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SESSION 1:
DIAGNOSTIC GUIDELINES in MUSCULOSKELETAL ONCOLOGY
CHAIRS: Andreas Leithner (Austria), Maciej Jackowiak (Poland)

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Bone cancer in Ancient Egypt. The largest series

Aim of the study: Evolving malignant disease

The antiquity of Cancer has always been one of the most interesting points in the Evolutionary Medicine. Why the skeletons diagnosed of cancer are so scarce in ancient times? Absence of pollutants, the lack of fire domestication, the diet (low fat and sugars) and, mainly, the shorter life span have been inferred to explain this absence. Ancient Egypt is, a work field in which this research could be better assessed. The presence of a civilization that spans near 4000 years in the same geographical area is a very useful tool to infer the evolution of malignant disease in humankind. Since 1905, Douglas Derry, diagnosed a malignant tumor in the skull of the 5th dynasty from then onwards only a handful of bone cancer had been described until 50's decade. The majority of the cases of cancer in old times were tentative diagnosis of a case report along with the revision of literature. Following a precise criteria and after an accurate differential diagnosis including field x-ray examination, we present the worldwide largest series of malignant disease in individual belongs to 5 different Spanish Archaeological Missions from Egypt. The series includes 14 cases: 2 cases from Middle Egypt (1 from Oxirhynchus, 1 from Sharuna); 12 cases from Upper Egypt (9 from West Thebes and 3 from Qubbet el-Hawa). It is noteworthy that 7 correspond to metastasis, 1 to nasopharyngeal carcinoma, 1 a probable Ewing sarcoma, 2 multiple myeloma, 1 acute lymphoblastic leukemia and 1 soft tissue sarcoma.

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Concordance between the initial and final histopathological diagnosis of soft tissue sarcomas in the reference center

Aim of the study: The aim of this study was to assess the differences in diagnosis with pathomorphological reassessment by experienced pathologists in a reference center of specimens diagnosed with soft tissue sarcoma (STS) from outside our center

Material/methods: Data of all consecutive patients diagnosed pathologically with STS (GIST excluded) referred to center within 2 years were analyzed retrospectively. The concordance of diagnosis was divided into three groups: 1-full disagreement (misdiagnosis of STS, final diagnosis of benign lesion or significant impact on treatment choice), 2-change in diagnosis within STS subtypes (without significant impact on final treatment), 3-full agreement in diagnosis.

Results: 83 patients (37women, 46 men; median age 51 years) were included in final analysis. 39 patients had previously been operated outside our center, 44 had only a biopsy. In 21 patients metastatic disease was diagnosed at consultation. Most often, the primary focus was located on the lower limb (38%). In 10% of patients, the diagnosis

of STS was described without any specification of the subtype. Additional molecular analysis was performed in 67 patients (80%) in our center. Full discordance (Group 1) was observed in 20 patients (24%), of which in 9 patients the final diagnosis was carcinoma or melanoma. In 28 (33%) patients the diagnosis of STS was confirmed, but in the final diagnosis was another subtype of STS (Group 2). Only in 35 patients (43%) the diagnosis was fully consistent with original report (Group 3).

Conclusions: Diagnosis of STS requires a specialized pathologic assessment. In the analyzed group 57% of patients had improper diagnosis which needed a correction after consultation at the referral center, and in 24% of patients this diagnosis was completely changed, with a large impact on the treatment and patients prognosis.

Min Wook Joo, Yoon Joo Cho, Yong-Suk Lee

The Catholic University of Korea

Is it appropriate to perform imaging evaluation of a soft-tissue mass before referral to a specialized center? A systematic review

Aim of the study: We questioned whether it is acceptable to perform ultrasonography and magnetic resonance imaging investigations for a soft-tissue mass before referral to a musculoskeletal tumor center.

Introduction: Although frontline physicians often encounter a soft-tissue mass, the initial approach is challenging. Thus, some countries use clinical practice guidelines. Recently, ultrasonography (USG) and magnetic resonance imaging (MRI) have been widely used. But there is some controversy over whether it is appropriate to perform pre-referral evaluation in non-specialized centers. Therefore, we questioned whether it is acceptable to perform USG and MRI investigations for a soft-tissue mass before referral to a musculoskeletal tumor center.

Methods: The study protocol was registered in the International Prospective Register of Systematic Reviews. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist. We performed a database search of the MEDLINE, Embase, and Cochrane Library for studies discussing pre-referral USG and MRI for evaluation of a soft-tissue mass until September 2023. Then, two authors independently reviewed the studies. A total of nine studies were included.

Results: Investigations performed in non-specialized centers before referral are generally considered inappropriate in terms of indications, technical fidelity of the imaging protocol, faithfulness of reporting, diagnostic precision, referral interval, and cost-effectiveness.

Conclusions: Frontline physicians should not forget the recommendations on the classical alarm symptom of a soft-tissue mass as an indication for advanced imaging evaluation. Education and certification are required so that referrers can understand the limitations of USG. MRI should be performed and interpreted in a specialized center or by a radiologist with relevant expertise. Guidance on the use of advanced imaging may help reduce inappropriate imaging.

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Diagnostic yield of percutaneous intra-osseous bone tumor biopsies

Aim of the study: To evaluate percutaneous drill biopsies of intra-osseous bone tumors in terms of diagnostic yield, feasibility rate in local anesthesia and rate of procedures done under X-ray guidance alone (without CT).

Introduction: Fetching tissue samples percutaneously from intraosseous bone tumors is sometime challenging. Our aim was to evaluate percutaneous drill biopsies of intraosseous bone tumors in terms of diagnostic yield, feasibility rate in local anesthesia and rate of procedures done under X-ray guidance alone (without CT).

Methods: The retrospective nation-wide observational cohort included all percutaneous intraosseous bone tumor biopsies performed 2019-2023 with Jamshidi-like needles or Arrow-OnControl® system at a single referral center (i.e. the only one in the Republic of Slovenia).

Results: In 205 consecutive percutaneous intraosseous drill biopsies (27 Jamshidi-like and 177 Arrow-OnControl® needles), 47% of diagnoses were malign. Most procedures were performed in local anesthesia (82.8%) and under X-ray guidance alone without CT (84.3%). As many as 34.8% of cases required tissue sampling with a special arthroscopic forceps used in addition to the original biopsy system. Diagnosis was established after the first biopsy for 83.8%. In 12 cases the biopsy was repeated because of aggressive radiological appearance and gave the same histopathological result – if these are also counted as successful, the diagnostic yield at the first attempt was 90.0%.

Conclusion: Drill biopsies of intraosseous benign or malign bone tumors have comparable success rates to open biopsies, most of them can be performed in local anesthesia under X-ray guidance alone without CT. Nevertheless, tissue sampling often requires a special arthroscopic forceps in addition to the original biopsy system.

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Clinical application of liquid biopsy in bone and soft tissue sarcoma patients. A systematic literature review

Aim of the study: This systematic literature review aimed at summarising current knowledge on clinical applicability of liquid biopsy in sarcomas.

Background: Liquid biopsy (LB) as a non-invasive method to investigate cancer biology and monitor residual disease has gained significance in clinical practice over the years. Whilst its applicability in carcinomas is well established, the low incidence and heterogeneity of bone and soft tissue sarcomas explains the less well-established knowledge considering LB in these highly malignant mesenchymal neoplasms.

Methods: A systematic literature review in PubMed was performed according to the PRISMA guidelines, including all original English and German articles (including case reports) published until 08.02.2023 and dealing with LB in sarcoma. From initially 920 studies, 466 duplicates were removed. The resulting 454 records were screened, and 206 of these excluded based on the title. Abstracts of the remaining 248 articles underwent in-depth screening, with 68 articles ultimately included in this systematic review.

Results: The 68 articles contained evidence on use of LB in 2636 sarcoma patients. The 5 most common histological subtypes analysed were osteosarcoma (n=602; 22.8%), Ewing sarcoma (n=384; 15.0%), gastrointestinal stromal tumour (n=203; 7.7%), rhabdomyosarcoma (n=193; 7.3%) and leiomyosarcoma (n=145; 5.5%). Of the 11 liquid biopsy analytes discussed, largest evidence was present for ctDNA (26 studies), cfDNA (18 studies), miRNA (9 studies), and circulating tumour cells (7 studies).

Conclusion: This systematic literature review provides an extensive up-to-date overview about the current and potential future uses of different liquid biopsy modalities as diagnostic, prognostic, and disease monitoring markers in sarcoma.

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Distinguishment between atypical lipomatous tumor and dedifferentiated liposarcoma using PET/MRI

Aim of the study: To investigate whether a standardized uptake value maximum (SUVmax) on 18F-FDG PET/MRI is useful in distinguishing ALT from DDLPS.

Introduction: Dedifferentiated liposarcoma (DDLPS) is an atypical lipomatous tumor (ALT) showing progression to non-lipogenic sarcoma of variable histological grade. DDLPS often demonstrates an abnormal accumulation of 18F-FDG on PET examination, but it is sometimes difficult to distinguish DDLPS from ALT.

Methods: Between January 2013 and June 2023, we measured SUVmax on preoperative PET/MRI examination in 48 patients. Twenty-eight patients (58.3%) were pathologically diagnosed with ALT, three patients (6.3%) with low-grade DDLPS (LG group), and seventeen patients (35.4%) with high-grade DDLPS (HG group). For multiple comparisons, the Kruskal-Wallis and Mann-Whitney's U tests were used in these three groups. We also examined whether the abnormal FDG accumulation and low-intensity lesions of the non-lipogenic sarcoma on T1-WI match in DDLPS.

Result: Average SUVmax was 2.0±0.9 in the ALT group, 3.4±0.7 in the LG group, and 11.4±5.6 in the HG group. There were no significant differences in SUVmax between the LG and ALT groups or between the LG and HG groups. The concordance rate between the abnormal FDG accumulation areas and T1-weighted low-intensity lesion was 100% in the HG group but 33% in the LG group.

Discussion: This study suggests that the presence or absence of FDG accumulation in T1-weighted low-intensity areas, in addition to SUVmax on PET/MRI, helps differentiate between ALT and HG-DDLPS.

Conclusion: PET/MRI may help differentiate ALT from HG-DDLPS.

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Clinical symptoms associated with malignant peripheral nerve sheath tumors: A study of 154 patients in a regional sarcoma database

Aim of the study: Aim of this study was to describe the clinical symptoms of patients with peripheral nerve sheath tumors and assess the association of MPNST diagnoses with these clinical findings.

Introduction: Aim of this study was to describe the distribution of clinical symptoms – (1) loss of neurological function, (2) presence of a rapid enlarging mass or (3) new, worsening or persistent pain - amongst patients with peripheral nerve sheath tumors, and assess the association with MPNST diagnoses.

Methods: We utilized a retrospective descriptive epidemiological study design and recruited patients from a regional sarcoma database. A multivariable logistic regression was performed to evaluate the odds of an eventual MPNST diagnosis with the three relevant clinical symptoms.

Results: Hundred and fifty-four patients were identified between 2010 and 2018. A multivariable logistic regression analysis showed that loss of neurological function was associated with a 25.7-fold increased odds of an MPNST diagnosis (adjusted OR = 25.70; 95% CI = 2.21 - 298.74). Patients who presented with a rapidly enlarging mass were also found to have higher odds of MPNST, albeit not statistically significant (adjusted OR = 2.24; 95% CI = 0.18 - 27.50). Patients with a history of neurofibromatosis were also found to be at 52.9-fold increased odds of an MPNST diagnosis (adjusted OR = 52.86; 95% CI = 7.24 – 385.86). A goodness-of-fit test using a Pearson's Chi-squared test showed that the regression model fits the dataset well. Area under the ROC curve of 0.91 has been demonstrated.

Conclusions: Neurological deficit and presence of an enlarging mass and history of neurofibromatosis should be heavily considered as predictive clinical factors of MPNST.

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Fusion imaging of preoperative in-situ magnetic resonance imaging and postoperative computed tomography of the specimen to improve pretherapeutic grading of soft tissue sarcoma

Aim of the study: Pilot study to correlate histopathological and radiological characteristics of soft tissue sarcomas

Treatment and prognosis of soft tissue sarcoma (STS) are based on histological subtype and grading. However, due to tumor size and intratumoral heterogeneity, pretherapeutic biopsies are often not dependable. By correlating functional imaging and histopathological features, pretreatment grading might be improved. For twelve patients with STS a diffusion weighted MRI was performed preoperatively. After tumor resection, core needle biopsies (CNBs) from distinct tumor sites from the specimen were collected and a radiopaque marker was left at each biopsy site. Afterwards a CT of the specimen visualized the markers. To evaluate the imaging features of the exact sampling regions, fusion imaging of preoperative in situ MRI and postoperative CT was performed. The ADC on MRI and histopathological Grading according to FNCLCC were determined for all specimens and CNBs. Fusion imaging was feasible in 7/12 cases without relevant contour discrepancies. Histological workup resulted in correct grading in 9/11 cases (81,8 %, in n=2: G1 instead of G2). Functional evaluation showed the tendency for high-grade regions (G2/G3; 1.13 (0.78–1.70) ± 0.23 [× 10−3 mm2/s]) to have lower ADC values than low-grade regions (G1; 1.43 (0.64–2.03) ± 0.46). Our pilot study demonstrates the technical feasibility of correlating imaging features of in situ MRI and CT of the specimen by fusion imaging. In this regard, ADC appears to correlate with the FNCLCC grading criteria. Further studies are needed to clarify the potential of functional imaging to supplement histopathological grading.

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Does preoperative imaging determine the necessity of tissue biopsy in lipomatous tumors?

Aim of the study: To determine the effectiveness of radiological evaluation without biopsy in lipomatous tumors.

Introduction: Most soft-tissue masses need a biopsy to identify these lesions. However, a provisional diagnosis of lipomatous tumors can be made by imaging studies.

Method: A retrospective study collected all data from 2015 to 2023, including all lipomatous tumor patients who underwent definite surgery with a minimum of 1-year follow-up. Sixty-two patients with 64 lesions were included, consisting of 51 lipomas, eight atypical lipomatous tumors (ALT), and five high-grade liposarcomas. Provisional diagnoses of lipomas and ALTs were marginally resected, while high-grade liposarcomas were managed with wide resection.

Results: Preoperative tissue biopsy was performed when imaging suggested high-grade liposarcoma in 4/5 (80%) lesions and 1/8 (12,5%) in ALTs. Definitive surgery was performed without biopsy on all superficial lesions between the fascia and the skin, and 45/46 (98%) lesions containing more than 75% fat. One out of 5 (25%) biopsy resulted as an ALT.

Conclusions: When the preliminary diagnosis is certain, imaging methods can guide treatment when a biopsy does not give accurate results, even in malignant lipomatous tumors. The most important reason for this may be that although the biopsy's success in the sampled tissue is very high, it cannot evaluate the entire lesion. On the contrary, imaging methods evaluate the entire lesion. Moreover, in superficial lesions and lesions with high-fat content, definitive surgery can be performed without biopsy with correct interpretation of the images.

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Adjunct diagnostic strategies in improving diagnostic yields in image-guided biopsies – a cost-effectiveness analysis

Aim of the study: This study aimed to ascertain the most cost-effective adjunctive diagnostic test for image guided biopsies of musculoskeletal neoplasms.

Background: Routine use of adjunct intra-procedural fresh frozen biopsy (FFP) or point of care (POC) cytology at the time of image-guided biopsy can improve diagnostic tissue yields. These strategies are associated with increased cost.

Materials and Methods: This expected value cost-effectiveness microsimulation compared the payoffs of cost (2020 United States dollars) and effectiveness (quality adjusted life, QAL, in days) on each of the competing strategies. A literature review, in addition to our institutional data, was used to ascertain the probabilities, diagnostic yields, utility values, and direct medical costs associated with each strategy. Payer and societal perspectives are presented. A willingness to pay threshold of $100,000 per quality adjusted life year (QALY) was utilized.

Results: The total cost and effectiveness for each of the strategies were $1,248.98, $1414.09, $1980.53 and 80.31, 79.74, 79.69 days for the use of adjunct frozen pathology, permanent pathology only, and adjunct POC cytology, respectively. The use of adjunct frozen pathology dominated, thereby indicating that this adjunct was less expensive and more effective than the competing alternatives. One- and two-way sensitivity analyses indicate this remains the most cost-effective strategy across all clinically plausible values.

Conclusion and Relevance: The use of frozen pathology is the most cost-effective strategy in improving diagnostic yields of image guided biopsies. Routine use of this adjunct could improve diagnostic yields, decrease need for repeat procedures, and expedite diagnosis and initiation of treatment for these neoplasms at marginal incremental cost.

Min Wook Joo, Yoon Joo Cho, Yong-Suk Lee

The Catholic University of Korea

Quality assessments in the technical requirement and report of the magnetic resonance imaging from referring hospitals

Aim of the study: The purpose of this study was to assess the quality in the technical requirements and reports of MRIs from referring hospitals using ESSR guidelines.

Introduction: Soft tissue sarcomas are rare malignancies. Inappropriate imaging studies can lead to misdiagnosis and referral delays for patients who should be treated in sarcoma centers. Magnetic resonance imaging (MRI) is the essential modality for differentiating soft tissue sarcomas. In 2015, guidelines for appropriate imaging and reporting of MRI in diagnosing soft tissue tumors were proposed from European Society for Musculoskeletal Radiology (ESSR). The purpose of this study was to assess the quality in the technical requirements and reports of MRIs from referring hospitals using ESSR guidelines.

Methods: We planned a prospective study. Patients who visit our institution with both MRI and report from referring hospitals were considered eligible for this study. Criteria for assessment based on ESSR guidelines were used. Percentage-based evaluation was used to present the current situation.

Results: One hundred and ten patients were enrolled as subjects from May 2022 to January 2024. None of the MRIs met all the criteria of ESSR guidelines. In the technical requirement, criteria of field strength were met in all patients (100%). While the number of planes (96%), external bony landmark (92%) and adequate field of view (76%) were relatively met, description reports (50%), protocols (50%), slice thickness (46%), enhancement (40%) and cutaneous marker (1%) were poorly met.

Conclusions: Technical requirement and report of the MRI from referring hospitals showed significant deviations from criteria of ESSR guidelines. Networks between referring hospitals and certified sarcoma centers with excellence in multidisciplinary approach should be established for education and supervision of referring hospitals.

SESSION 2:

CONSERVATIVE THERAPIES VS SURGERY WHEN AND WHY?

CHAIRS: Oleg Vyrva (Ukraine), Minna Katariina Laitinen (Finland)

Andreas Leithner

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Atypical cartilaginous tumour: an Enigma

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Preliminary results of the EMSOS study on grade 2 chondrosarcoma treated by intralesional curettage: follow-up vs resection

Aim of the study: Observe grade 2 CS primarily treated with curettage and to compare the outcome of a secondary treatment with resection and a wait and see approach with active follow-up.

Curettage is a safe and effective treatment option in case of low-grade chondrosarcoma (CS), whereas en-bloc resection is recommended for grade 2-3 CS. However, pre-operative assessments do not always give an accurate prediction of grade. Thus, it is still debated on what to do in case of a high-grade CS that have been curetted because of wrong preoperative estimation of grade. This multicentric EMSOS study aimed to observe grade 2 CS primarily treated with curettage and to compare the outcome of a secondary treatment with resection and a wait and see approach with active follow-up. Inclusion criteria included a diagnosis of grade 2 CS in the definitive specimen in patients treated with intralesional curettage. Patients were divided into two groups (wide margin resection and follow-up). Local recurrence (LR) and distant metastases rate were recorded for both groups. 53 patients enrolled at 16 different institutions have been included (mean age 45 years); after histological confirmation of G2 diagnosis, 17 underwent radical resection, 34 were monitored with a close follow-up, and 2 had a new curettage procedure. LR rate was significantly higher in the follow-up group compared to resection group (51.9% vs 12.2% at 5 years, p=0.033). Conclusions This study is ongoing and further data are welcome for a complete analysis. The results of this study will provide evidence to support clinicians in deciding the safest and most appropriate approach to grade 2 CS after accidental curettage.

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Should we curette chondrosarcomas? Which ones and what are the implications? An evidenced based treatment algorithm

Aim of the study: The aim of the study was to identify the oncological outcomes of chondrosarcoma treated with intralesional margins either intended or accidentally and to develop an evidence-based algorithm for the management of conventional central chondrosarcomas.

Central cartilage tumors (CCT) present a diagnostic challenge for clinicians, requiring differentiation between benign enchondromas, atypical cartilaginous tumors (ACT), and malignant chondrosarcomas. Biopsy, the primary diagnostic method, is deemed inaccurate in distinguishing between benign and malignant CCTs or guiding treatment decisions. Controversies surround the surgical approach. Many surgeons favour intralesional curettage for low-grade chondrosarcomas to reduce the morbidity of a wide resection, which often requires a reconstruction with associated complications and reduced function. The study aimed to assess the oncological outcomes of chondrosarcoma treated with intralesional margins and develop an evidence-based algorithm for managing conventional central chondrosarcomas. The study included 456 patients diagnosed and surgically treated for central chondrosarcoma. Intralesional margins for intraosseous chondrosarcoma led to a high rate of local recurrence (LR), mainly high-grade, with no significant impact on disease-specific survival (DSS). Margins less than 3 mm in extraosseous chondrosarcoma correlated with high rates of LR and decreased DSS. The patients were classified by anatomical location, whether purely interosseous or extraosseous with a soft tissue component observed in preoperative MRI, the surgical intention to treat, achieved margin and oncological outcomes. Intralesional margins for intraosseous chondrosarcoma lead to a high rate of locally recurrent disease, with the majority of LR being high-grade, though this does not appear to impact DSS. Margins less than 3 mm in extraosseous chondrosarcoma have high rates of LRs and significantly decreases patients' DSS. The study provides valuable insights for clinicians facing with the complexities of treating these bone tumors.

Ahmad Shehadeh

King Hussein Cancer Center

The outcome of Cryosurgical ablation of bone tumor, a comparative study between open and closed systems

Aim of the study: A comparative study between Open and closed cryoablation systems for bone tumors

Open system and closed system cryoablation have been known to be effective as adjuvant for bone tumors surgical treatment. At KHCC, 102 patients with benign aggressive and low grade malignant bone tumors were treated with curettage, high speed burring and adjuvant cryoablation, 62 patients received the open system cryoablation (liquid nitrogen pouring) and 40 patients received the Argon –based closed cryoprobes system. In the open group diagnosis was (ABC=23 patients, GCT= 13, Fibrous Dysplasia = 6, Chondroblastoma = 5, Chondrosarcoma = 4, and others = 11), anatomical location was DF=14, PT=14, PF=9, PH= 7, pelvis = 3 and others = 15. In the closed group, diagnosis was (ABC = 17, GCT= 7, chondroblastoma = 6, chondrosarcoma= 3, Osteoblastoma= 3, and others = 4), anatomical location was (PH=11, PT= 11, DF=6, pelvis = 3, DT=3 and others = 8. In the open system group, recurrence occurred in 3 patients (5%), skin necrosis and superficial wound infection 5 pats (8%), bone non-union/fractures in 6 patients (10%), deep infection in 4 patients (6%), one of them ended up with amputation, neuropraxia 3 patients (5%). In the closed system group, recurrence was in 2 patients (5%), and deep infection in 1 patient (2%), neropraxia one patient (2%), no skin necrosis or superficial wound infection.

Conclusion: Both open system and closed system cyroablation, have similarly a low recurrence rate (5%), when compared to historical outcome of no cryoablation, however, the complication rate on bone and soft tissue when the closed system was used were observed to be less.

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Impact of local treatment modalities and tumor characteristics on Survival Outcomes in Ewing Family tumors: insights from the Latin-American Ewing II study

Aim of the study: Objective: To assess the impact of surgery, radiotherapy, and their combination on oncological outcomes in patients with Ewing Family Tumors (EFT).

Introduction: The aim of this study was to assess the impact of surgery, radiotherapy, and their combination on event-free survival (EFS), overall survival (OS), and local recurrence-free survival (LRFS) in patients with Ewing Family Tumors treated with chemotherapy. In addition, we assessed the relationship between tumor characteristics and local treatment efficacy.

Methods: We analyzed outcomes for 366 patients with localized bone and soft tissue EFT from the Latin-American Ewing II study. The local treatments evaluated included surgery, radiotherapy, and combined Sg and RT. Analysis was conducted using Cox proportional hazards regression and propensity score weighting.

Results: The study found a 5-year EFS hazard ratio (HR) of 0.64 (95% CI: 0.43 - 0.97) and an OS HR of 0.65 (95% CI: 0.41 - 1.05) for Sg versus Sg+RT. The LRFS HR was 0.68 (95% CI: 0.79 - 2.21) and 0.45 (95% CI: 0.99 - 2.41) for Sg versus RT and Sg versus Sg+RT, respectively. Tumors ≤8cm were significantly associated with improved EFS ($p<0.01$), as was positive chemotherapy response ($p<0.01$). No notable differences in outcomes were observed for larger tumors across treatment modalities or based on tumor location.

Conclusion: Our findings suggest that optimal local treatment outcomes are associated with positive chemotherapy responses and smaller tumor sizes. Surgery alone improved EFS for smaller and appendicular tumors. Despite study limitations, these results highlight the significance of tailoring treatment strategies to tumor size and chemotherapy response.

Bhim Bahadur Shreemal, Giusseppe Papalia, Guy Morris, Scott Evans, **Michael Parry**, **Vaiyapuri Sumathi**, **Vineet Kurisunkal**

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Is marginal excision following preoperative radiotherapy for extremity myxoid liposarcoma acceptable?

With pre-operative radiotherapy (RT), marginal excision has been an acceptable practice in Myxoid liposarcoma (MLS). This study aimed to assess the association between margins and local recurrence (LR) and, distant metastasis in these patients. Patients with limb salvage surgery for non-metastatic MLS of the extremities pre-operative RT between 2012-2022, with at least a year of follow-up were evaluated. Patient and treatment characteristics, radiological and histological responses, and clinical surveillance were recorded. Sixty-three patients were included. Margins were involved in 6 (9.5%), and 0.05). The rate of metastasis was 17.5% (11/63) with mean time for metastases 3 ± 2 years. The rate of metastasis was 27% for involved or < 1mm margins (10/37), and 3.8% for ≥1mm margins (1/26) ($p = 0.002$). Three patients had pulmonary metastases, 2 chest walls, 5 spinal, and 5 visceral and mediastinal. LR-free survival was 95.2%, and metastasis-free survival was 84.1%. Marginal margins following preoperative radiotherapy were not associated with a higher incidence of local recurrence when compared to wide margins. However, marginal margins and tumor size were associated with a higher incidence of distant metastasis.

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Surgical results in cases of osteoid osteoma: A single-center retrospective study

Aim of the study: The main treatment goal is complete nidus removal and the operation should be planned by determining the lesion localisation preoperatively.

Introduction: Osteoid osteoma is a benign bone tumor originating from osteoblasts, cells responsible for bone formation. The hallmark features of osteoid osteomas include a small central region called the nidus, typically measuring less than 2 cm in diameter, surrounded by sclerotic bone. This study describes the clinical management and surgical treatment of osteoid osteomas.

Material and Methods: The study included 38 patients with clinical, radiological, pathological findings consistent with osteoid osteoma who were operated on between January 2010 and January 2023 in the institute. The patients were evaluated regarding age, gender, localization of the lesion, complaints on presentation, duration of complaints,response to oral salicylates and NSAIDs.

Results: The analysis encompassed 38 individuals who underwent surgery for osteoid osteoma, with a gender distribution of 20 males (52.6%) and 18 females (47.4%). The average age of the cohort was 12.5 years, ranging from 3 to 36 years. Predominantly, the femur was the most frequently affected site, accounting for 14 cases (36.8%). The surgical intervention for the 38 patients involved the excision of the nidus using either the en-bloc resection method or burr-down-assisted intralesional curettage.Two cases were reported due to insufficient excision of the tumor. In this study, no recuurence was observed during the follow-up.

Conclusion: En-bloc resection and burr-down assisted intralesional curettage both have similar clinical results in the treatment of osteoid osteoma. Open procedures reduces the risk of the recurrence on these types of tumor.

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Minimally invasive techniques as an alternative to surgery in treatment of bone tumors

Aim of the study: To present a case-based discussion of minimally invasive percutaneous procedures as an alternative approach to surgery in treatment of bone tumors

Starting from the early 2000s minimally invasive percutaneous treatment techniques have been increasingly employed in the treatment of bone and soft tissue tumors. Several techniques of thermal ablation have been developed. Accepted indications include painful benign bone tumors, small primary malignant bone tumors in non-surgical candidates, secondary bone tumors (oligometastatic disease) and soft tissue tumors (especially desmoid tumors and endometriosis). The technique of percutaneous ablation relies on introducing a needle/needles into the tumor, either under CT or MRI guidance and increasing (as in radio-frequency ablation) or decreasing (as in cryoablation) tissue temperature, which leads to tumor necrosis/apoptosis. Thus, a resection of bone tissue may be avoided. Benefits of minimally invasive techniques include precise destruction of tumor tissue, shorter hospital stay as compared to surgery and a low rate of complications. The authors will present cases of bone tumors qualified for minimally invasive treatment (cryoablation) in order to avoid bone resection.

Fatih Özel, Mehmet Bürke, İpek Işik, Emre Ünal, Türkmen Turan Çĭftçĭ, Devrim Akinci, Mehmet Ayvaz

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Long term results of radiofrequency ablation treatment guided by computed tomography in osteoid osteoma patients

Aim of the study: This study aims to provide a comprehensive perspective on treatment outcomes and rare complications seen during the follow-up period of OO.

A hospital database search was performed between Jan 2005 and Dec 2022. Patients with OO treated with CT-guided RFA were retrospectively analyzed. Patients with a history of surgery before RFA treatment, patients who underwent RFA treatment at another institution, and patients who underwent surgery after RFA treatment at another institution were excluded from the study. In 210 symptomatic OO patients (male/female ratio: 141/69, mean age 16.6 years (min: 2 years; max: 58 years)), the number of procedures was 223. All patients had preop CT imaging. Post-procedure clinical follow-up of the patients was evaluated. Technical and clinical success as well as complications of RFA treatment were recorded. Rapid relief of the pain symptom characteristic of OO, low long-term recurrence rate and low complication rates confirm the efficacy and safety of RFA treatment. There are many articles in the literature on the short-term outcomes of patients treated with RFA. However, this article points to an increase in recurrence rates in RFA patients in the long term and suggests that the follow-up period should be kept longer. Nevertheless, when long-term results are analyzed, RFA can be safely considered as a preferred treatment modality in the treatment of OO due to its 95.2% efficacy and low complication rates.

SESSION 3:

MANAGEMENT AFTER MISDIAGNOSIS & INAPPROPRIATE TREATMENT

CHAIRS: Emanuela Palmerini (Italy), Philipp Theodor Funovics (Austria)

Harzem Özger

Department of Orthopaedics and Trauma, Medical University of Istambul, Turkey

Complications of limb salvage in children and management strategies

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Delay in the diagnosis of bone sarcomas – what do we currently know and does it really have such a significant impact on the overall survival of patients?

Aim of the study: Narrative review in topic of delay in diagnosis of bone sarcoma

Management of patients with bone sarcoma is often a demanding task, and at the same time, is belived that prolonged diagnosis may worsen patients' prognosis. In the studies included in the review (34 manuscripts), the average delay in diagnosis ranged from 7 weeks to even 28 months. Differences in the length of the delay depend on the type of bone sarcoma, patients' age, gender, tumor location, first symtops and even type of health professional initially consulted of patient. There are many reasons for the delay, the most common being: lack of oncological vigilance among doctors and misdiagnosis. A total of 13 studies included in the review tried to answer the question whether a longer period of delay in diagnosis significantly affects the survival of patients. Eleven of them did not show a significant relationship between longer delay and overall survival.

Emanuela Palmerini[1], Vanina Ramacci[2], Giorgio Frega[1], Richard Evenhuis[3], Jay Wunder[4], Eduardo Cruz Ortiz[5], Eduardo Cruz Ortiz[5], Nicola Ratto[6], Sebastien Raux[7], Mata Fernandez Cristina[8], Biau David[9], Giannis Trikoupis[10], Leithner Andreas1[1], Coccoli Luca[12], Simone De Meo[6], Alessandra Longhi[1], Marilena Cesari[1], Laura Campanacci2[·] Anna Paioli[1], Rossella Hakim[1], Andrea Marrari[1], Davide Maria Donati[2], Michiel A.J. van de Sande[3], Eric L. Staals[2], Toni Ibrahim[1]

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Local Relapse in patients with high-grade osteosarcoma: a European retrospective study

Background: Local recurrence (LR) rate for high-grade osteosarcoma ranges from 4% to 10%. Limited data on LR are available This study aims to analyze patterns of LR, treatment and outcome for high-grade osteosarcoma.

Methods: Multicenter, European, retrospective study. Inclusion criteria was LR as first event, ± distant metastases (DM). Diagnostic modality, treatments, and post-LR survival (PLRS) were assessed.

Results: 176 patients, 70 (40%) females; median age 22 years (range, 6-87). 19 patients were excluded because no disease-free status obtained after first surgery, 157 included. Patterns of relapse: LR only 98/157 (62.4 %), LR + distant metastases (DM) 59/157 (38%) patients. 113/157 (72%) of patients relapsed within 24 months, and LR was detected by clinical symptoms in 78/157 (50%). LR treatment: surgery in 64 (41%), chemotherapy in 22 (14%), chemotherapy + surgery in 52 (33%), other in 19 (12%). Surgical complete remission after LR (CR2) was achieved in 75/116 (65%). 5-year PLRS was 34% (27-43%), significantly better for patients with longer LR-free interval (LRFI; ≤24 months 28% vs > 24 months 47%; HR 0.55, 95%CI 0.34-0.88, P = 0.01), absence of DM (no DM 50% vs DM 11%, HR 0.26, 95%CI 0.17-0.39 P = 0.001), and achievement of CR2 (no CR2 5% vs CR2 58%, HR 4.74, 95%CI 2.95-7.59 P = 0.001). No survival difference was found according to the use of chemotherapy in patients with LR only.

Conclusions: LR is detected by symptoms in about half of the cases. Achievement of CR2 and longer LR-free interval, not the use of chemotherapy, are crucial for survival.

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Specificity of oncological management in the treatment of peripheral nervous system tumors, iatrogenic complications and secondary reconstructions

Aim of the study: Presentation of the biology and the nature of tumors of the peripheral nervous system and the method of surgical treatment enabling the preservation of nerve and limb function.

Introduction. Malignant peripheral nervous system tumors account for less than 5 % of nervous system tumors. Other tumors and perineural tumor-like lesions are benign. The benign tumors can be removed while preserving the function of the nerve.

Methods. In the period 2020 – 2023, the authors treated 14 patients with tumors of the peripheral nervous system in the distribution of: 3 brachial plexus schwannomas, 2 schwannomas in the nerves of the upper limb, 5 schwannomas in the nerves of the lower limb, 2 neurofibromas, 1 liposarcoma, 1 intraplexus lipoma. 13 tumors were completely removed while preserving the function of the nerves from which they came out or surrounded. One case required removal of the tumor along with a resection of the damaged nerve, with simultaneous reconstruction with a neuroautograft. One case required further oncological management. 4 patients with iatrogenic peripheral nerve lesions were treated after primary treatment of benign tumors at other centers. In reconstructive treatment neuroautografts were used, in 1 case triple nerve transfer, in 1 case secondary techniques.

Results. In 13 cases, removal of the tumor was not associated with the occurrence of defective symptoms. Postoperatively, preserved nerve function and resolution of preoperative complaints associated with tumor mass were observed. In 1 case, requiring resection - reconstruction with good regeneration in follow up.

Conclusions. Imaging diagnostics allowing for precise determination of the nature of the lesion, in the case of benign lesions, a procedure should be performed simultaneously to completely remove the tumor while maintaining the function of the nerve.

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A Novel Multidisciplinary Surgical Approach To Peripheral Nerve Sheath Tumors

Aim of the study: Share our experience and discuss the surgical treatment of soft tissue lesions involving peripheral nerves including soft tissue sarcomas.

Background: Peripheral Nerve Sheath Tumors, constituting a mere 5% of tumors, pose a rare but impactful threat. Particularly perilous are those that afflict peripheral nerves, causing significant pain and compromising patients' daily function and life quality. This retrospective study unfolds a pioneering multidisciplinary strategy for neurolysis, addressing the entrapment of peripheral nerves by soft tissue lesions. The innovation lies in the collaboration between an orthopedic oncology surgeon and a microsurgery team.

Material and Methods: Examining 247 patients with peripheral nerve-involved soft tissue masses through gadolinium-enhanced MRI, the study, spanning 2013-2023, boasts a consistent approach. A unified team, featuring an orthopedic oncologist and a peripheral nerve neurosurgeon, meticulously executed surgeries utilizing microscope-assisted techniques. The goal was precise dissection, ensuring tumor-free margins.

Results: Encompassed 160 females and 87 males, averaging 42 years, across various pathologies. The team operated on diverse cases, including 70 soft tissue sarcomas, 30 malignant peripheral nerve sheath tumors (MPNST), 50 neurofibromas, 40 schwannomas, and 57 atypical lipomas. Post-surgery, all patients reported immediate pain relief. With a 7-year average follow-up, recurrence occurred in 20 patients.

Conclusion: This groundbreaking surgical approach intertwines the proficiency of neurosurgery and orthopedic oncology, achieving unparalleled success in soft tissue tumor management around peripheral nerves. The fusion of extensive orthopedic oncology techniques with precise microsurgery resulted in effective tumor-free neurolysis, offering a promising avenue for future interventions.

SESSION 4:

INFECTION AND THE ROLE OF PLASTIC SURGERY

CHAIRS: Andrea Angelini (Italy), Burkhard Lehner (Germany)

Philipp Theodor Funovics

Department of Orthopaedics, Musculoskeletal Oncology Division, Medical University of Vienna, Austria

Prognostic factors for periprosthetic joint infection in musculoskeletal oncology

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Two stage revision for late prosthetic joint infection in megaprosthesis following bone sarcomas

Aim of the study: Identify predicting factors for the outcome of MPJI treated with a staged approach and to compare different reconstructions among different anatomical sites.

Treatments for megaprosthesis joint infections (MPJI) are similar to those for standard prosthesis (PJI), including debridement and implant retention, one and two-stage revision. This multicentric EMSOS study aimed to identify predicting factors for the outcome of MPJI treated with a staged approach and compare different reconstructions among different anatomical sites. Inclusion criteria included a late MPJI diagnosis (>6 weeks) and treatment with two-stage revision surgery. Patients with a follow-up <12 months and reconstructions other than megaprosthesis were excluded. Re-infection rate was recorded, along with patient characteristics, MPJI site, infection characteristics and time-related parameters.

177 cases were included from 15 different centers. The mean patient age was 38.6 years. Most represented sites were distal femur (89 cases), proximal tibia (47 cases) and proximal femur (24 cases). 34% of MPJI were polymicrobial, with most of monomicrobial infections from gram-positive pathogens (S. Epidermidis 26.6%, S. Aureus 20.3%). However, in 13% of the cases microbiological exams were positive for Enterobacteriaceae, and this series also included high-virulence bacteria and fungi. Moreover, no pathogen was isolated in 16.9% of the cases, despite clinical confirmation of PJI diagnosis. Infection recurrence was observed in 40.7% of cases after a median of 20 months.

MPJI has a higher prevalence of high-virulence bacteria such as S. aureus and Enterobacteriaceae compared with series involving standard PJI.

Even though a staged approach is the gold standard to treat chronic MPJI, its success rate is inferior compared to standard prosthesis.

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Orthoplastic approach is crucial

Aim of the study: In the Aim of this study is to analyze patients treated by a multidisciplinary team to evaluate indications and surgical approaches, complications and therapeutic/functional outcomes

Purpose. Obtain wide margins after resection of sarcomas is the main factor. The role of plastic surgeon in crucial for tissue coverage, prevent side effects or wound complications, restore function and morphology. We analyzed patients treated by a multidisciplinary team to evaluate indications and surgical approaches, complications and therapeutic/functional outcomes.

Methods. Overall, 161 patients were treated from 2006 to 2017. Patients were treated for their primary tumor (75.5%) or after unplanned excision/recurrence (25.5%). Sites included lower limbs (36.6%), upper limbs (19.2%), head/neck (21.1%), trunk (14.9%) and pelvis (8.1%). Flaps included: 84% local/regional flaps and 16% Microvascular free flaps.

Results. At a mean follow-up of 5.3 years, 130 patients were continuously disease free, 10 patients alive with disease and 21 were dead with disease. Overall, 62 patients (38.5%) developed a complication: 90.3% minor wound related problems while flap loss occurred only in 5/48 patients (10.4%). We observed a significant improvement in functional result in both pedicled and free flaps with no influence in major complications between these two types of flaps. The mean Musculoskeletal Tumor Society (MSTS) and Toronto Extremity Salvage Score (TESS) was 74.8 ± 14 and 79.1 ± 13, respectively.

Conclusions. A multidisciplinary approach is crucial in management of sarcoma patients. Free or pedicle flaps are successful in most of the cases. One-stage reconstructions are technically feasible and not related with increased risk of complications and should be the gold standard.

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Centro Hospitalar Universitário de Santo António

Risk Factors for Periprosthetic Infection Following Limb Salvage Surgery in Bone Sarcomas

Aim of the study: The authors aim to identify risk factors for periprosthetic joint infection (PJI), while also clarifying site and kind of tumor implications for PJI, as well as the responsible pathogens.

Background. Multimodal treatment of bone sarcomas has improved survival and allowed limb salvage surgery in the majority of these patients. Periprosthetic joint infection (PJI) constitutes a challenging complication. Controversy remains about risk factors for PJI. Here, we aim to identify them. We also discuss pathogens and treatments.

Methods. The authors reviewed the institutional database to retrieve endoprostheses implanted after bone sarcoma resection, from 2014 to 2021. 66 eligible patients were identified.

Results. A total of 14 (21.21%) periprosthetic infections were diagnosed. 10 occurred in men (71.43%, $p = 0.143$). Mean BMI, age at the time of surgery, ASA score and site were significantly higher among patients who developed PJI ($p = 0.003$, 0.044, 0.033, 0.029, respectively). Number of comorbidities and Charlson Comorbidity Index were also higher among these patients ($p = 0.264$, 0.060, respectively). Histology didn't play a role in PJI ($p = 0.385$).

Conclusion. Our data allows surgeons to better understand and control risk factors for PJI. We identified BMI, age, ASA score, site and Charlson Comorbidity Index as the main risk factors. Polymicrobial infections and Staphylococcus aureus are associated with recurrent infections. A multicentric study with a larger cohort is needed.

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Periprosthetic Infection of megaprostheses after limb-salvage surgery

Aim of the study: The study aims to assess the effectiveness of managing periprosthetic infections in patients who have undergone limb salvage surgery with megaprostheses. It seeks to evaluate the success rates of infection eradication and implant survival post-surgery.

Introduction: Periprosthetic joint infection (PJI) after endoprosthetic reconstruction in limb salvage surgery (LSS) is a challenging complication. The treatment may require multiple reoperations and prolonged administration of intravenous antibiotics, while it is associated with high rates of failure and amputation.

Methods: We retrospectively analyzed the outcomes of 35 patients who were diagnosed with PJI after endoprosthetic reconstruction with megaprostheses for oncologic indications. Eighteen patients were treated with two-stage revision surgery, 13 with DAIR and 2 patients with one-stage exchange. Resection arthroplasty was performed in 2 patients. We evaluated success rate, implant survival and recurrence time of infection. Minimum follow-up period was 24 months.

Results: Our cohort included 18 male and 17 female patients with a mean age of 51.7 ± 21.2 years. The average infection-free implant survival was 23.7 months. The most common microorganism isolated was Staphylococcus spp. (5 MSSA, 1 MRSA, 7 CoNS, 1 Staph. Capitis) and polymicrobial infection was present in 19 patients. Concerning outcomes of surgical management of infection, 10/18 patients with two-stage revision were successfully treated, 4/13 with DAIR, 1/2 with resection arthroplasty. One out of the two patients managed with one-stage revision remained infection-free. Seven patients (20%) underwent amputation, while 9 (25.7%) died due to systemic complications or septicemia.

Conclusions: The two-stage revision approach remains a standardized and effective method for treatment PJI after LSS, whereas surgical management with DAIR yields less favorable outcomes. Successful treatment requires a comprehensive multidisciplinary approach.

Michele Boffano[1], Pietro Pellegrino[1], Nicola Ratto[1], Martina Rezzoagli[1], Stefano Marone[1], Andrea Ferro[1], Elena Boux[1], Ugo Albertini[1], Chiara Beltramo[2], Raimondo Piana[1]

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How to deal with EPR/megaprosthesis revision in long survival patients if the implant is out of market or the company has closed?

Aim of the study: To deal with revision of old or out of market implants

Introduction: Long term surviving patients after bone sarcomas are increasing because of the improvement of oncologic treatments. Prosthesis are improving in quality but a revision of the implant can always occur and can be challenging if the prosthesis is out of market or the company has closed.

Methods: Seven patients with megaprosthesis (5 to 25 years since first surgery) from different companies required partial revision for aseptic loosening, bushes wear, breakage, lenghtening but for several reasons the implant is no longer available. Possible solutions and complications are evaluated.

Results. Custom-made components have been realized in 5 cases, in 2 cases a partial conversion from the old to the new implant was necessary, 2 cases of tibial fractures, 2 cases of superficial infection needing wound re-excision and long term antibiotic therapy, 1 case of persistent limb length discrepancy.

Conclusions: If long term survival is a good news on one side, on the other side orthopaedic surgeons will deal more and more with challenging revisions. Some national regulations forbid to use and produce components of a "out-of-the-market" prosthesis. The production of a custom-made component is difficult if the technical sheets and the implant design are unavailable because the producing company has closed or the prosthesis even if old and "out-of-market" is still covered by a patent.

Luisa Kriens, Jendrik Hardes, Wiebke Guder, Nina Myline Engel, Arne Steitbürger

Universitätsklinikum Essen

Identification of risk factors in the development of post-operational wound healing complication in soft tissue sarcoma patients

Aim of the study: Surgical improvemont in soft tissue sarcoma.

Wound healing complications (WHC) are a known challenge in soft tissue sarcoma surgery. Aim of this study was to evaluate positive and negative predictive values influencing WHC in order to reduce future numbers of cases and improve patients' recovery. The study was performed as a single-institutional, retrospective study at a supranational tumor center over a three-year time-period from April 2019 to June 2021. 588 patients were included, out of these 54,3% were initially treated at our center, 45,7% were later referred after insufficient primary surgery. 41 different factors were observed, including general patient information regarding gender and age, as well as general clinical information regarding diagnostics, number of operations, (neo)adjuvant treatment, wound closure, and follow up. Univariate and Multivariate analysis showed no correlation to neither neoadjuvant nor adjuvant radiotherapy (p= .453, p= .553). Main identified negative predictive values were age (p= .002), gender (p= .048), size (p= .002), localization (p= .010), grading (p= .013), bone tissue involvement (p= <.001), number of revision procedures (p=<.001), and presence of metastasis (p=<.001) or other oncologic diseases (p= .039). Interestingly, neoadjuvant Chemotherapy presented as main positive predictive value, reducing the event of WHC (p = .029) and number of overall revision procedures (p = <.001). Leading into our conclusion to screen patients for identified risk factors and when detected to reevaluate planned surgical procedures in terms of two-stage wound closure and free muscle flap.

Dipak B. Ramkumar

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Silver-coated prostheses in the mitigation of periprosthetic joint infection – a cost effectiveness analysis

Aim of the study: We aimed to ascertain the cost-effectiveness of silver-coated megaprostheses in mitigating PJI and related complications in patients undergoing limb salvage.

M**aterials and Methods:** An expected-value cost-effectiveness model was developed utilizing the payoffs of cost and effectiveness (in quality-adjusted life expectancy in days, QALE). A review of the medical literature was used to ascertain various complications, their probabilities, utility values, and direct medical costs associated with various health states. One- and two-way sensitivity analyses were then completed to identify the model parameters that were most influential on the preferred implant.

Results: The total cost and effectiveness for the silver-coated and standard megaprostheses were $45,466.83 and 11,824.45 days and $64,254.45 and 11,989.25 days, respectively. This resulted in an incremental cost-effectiveness ratio of $114.12 per day for use of the silver-coated implant. The use of silver coated megaprosthesis is cost-effective in minimizing the incidence and associated complications of PJI in the modeled patient population. These results remain dominant across a range of model parameters.

Conclusion: The use of silver-coated megaprostheses in reconstruction after wide resection of lower extremity osteosarcomas remains a cost-effective strategy at mitigation of post-operative prosthetic joint infections and associated healthcare costs. The upfront incremental cost increase of the silver-coated prosthesis is minimal in comparison to the determinantal quality of life conferred and the associated medical costs of the PJI health state. With increasing fiscal austerity in healthcare and society, the routine use of silver-coated megaprostheses should be considered in prosthetic reconstructions after wide resection of lower extremity osteosarcomas.

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Exploring the interdisciplinary collaboration between resection and reconstruction in multimodal sarcoma treatment

Aim of the study: Infection Management in Musculoskeletal Oncology

Introduction: Resections of locally advanced soft tissue sarcomas, treated within a multimodal setting, are associated with a high complication rate. A crucial aspect of a Sarcoma Center is the effective collaboration between resecting and reconstructive surgeons. In the current cohort, a collaboration exists between the Sarcoma Center Mannheim (Resection) and BGU Ludwigshafen (Reconstruction) at two separate locations. The tumor resection and the application of a vacuum dressing take place at one site, while the reconstruction occurs several days later at the second location following confirmation of the R0 status. This study investigates the incidence of planned and unplanned plastic reconstructions, examining their correlation with the postoperative complication rate.

Methods In the period from 2022 to 2023, a total of 178 sarcoma resections were conducted, encompassing 107 procedures on the extremities and trunk.

Results Ninety-six of 107 patients underwent tumor resection with planned primary wound closure, and eleven patients underwent planned, two-stage plastic reconstruction. Wound healing disorders requiring re-intervention (n=1), revision surgery (n=10) or secondary plastic reconstruction (n=3) was necessary in 14 of 96 patients with planned primary wound closure (14%). Planned two-stage plastic reconstructions were performed in eleven patients (10%). The average time between resection and reconstruction was 6.3 days, with all cases securing an R0 status before reconstruction.

Conclusions: The interdisciplinary surgical collaboration with Two-stage resection and reconstruction at two different locations in planned two-stage procedures is proved to be oncologically safe, time-efficient, and associated with low complications.

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Thirty-year follow-up: evaluating quality of life after rotationplasty

June 12, Wednesday | Baltic Hall

SESSION 1:
ABC & GIANT CELL TUMOR of BONE (GCTB)
CHAIRS: Emanuela Palmerini (Bologna), Tomasz Byrski (Szczecin)

Emanuela Palmerini

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Denosumab in clinical practice

Bartłomiej Szostakowski

Maria Sklodowska-Curie National Research Institute of Oncology, Department of Surgical Oncology, Warsaw, Poland

Current surgical approach

Ricardo Gehrke Becker[1], Eduardo da Silva Rodrigues[1], Michelle Ghert[2], Bruno Pereira Antunes[1], Julie Francine Cerutti Pestilho[3]

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Exploring 30 years of giant cell tumor of bone in the knee: a Brazilian perspective

Aim of the study: How have patient/tumor characteristics and treatments evolved in Brazil over the past 30 years? (2) What are the local recurrence rates and their changes over time?

Background: Giant cell tumor of bone (GCTB) is a benign, locally aggressive tumor that commonly affects the bones around the knees of young adults. Local recurrence leads to further interventions. Questions/Purposes: (1) How have patient/tumor characteristics and treatments evolved in Brazil over the past 30 years? (2) What are the local recurrence rates and their changes over time?

Methods: This was a retrospective study of 335 patients with GCTB in the knee (1989-2021) from 16 Brazilian centers. Patient/tumor data, local recurrence, metastases, and treatment over three decades were analyzed.

Results: Campanacci grade 3 tumors, pulmonary metastasis, and local recurrence rates were 56.7%, 5.3%, and 15.8%, respectively. Curettage and resection resulted in a 21.4% and 9% local recurrence rate, respectively. Descriptive analysis showed a 23.8% recurrence with denosumab and curettage, versus 21% with curettage alone. Local recurrence reduced from 22.9% (1989-2005) to 15.1% (2006-2021). Recurrence post-en bloc resection decreased from 23% to 7.8% but remained stable after curettage (23.8% in 1989-2005 and 21.2% in 2006-2021).

Conclusions: This multicenter study showed a recent increase in severe Campanacci grade 3 tumors in Brazil but a decreased overall local recurrence rate of 15.8%, especially after en bloc resection. This highlights the challenges of treating rare diseases in emerging economies.

Amber Lamoré[1], Mylène Duivenvoorden[2], Mario Maas[1], Floortje Verspoor[2], Robert Hemke[1]

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Diving deeper: Using radiomics to predict the recurrence of giant cell tumours of the bone

Aim of the study: The aim of this study was to evaluate tumoral characteristics that can be used to pre-operatively differentiate between recurrent and non-recurrent GCTB, based on radiomics features on MRI.

Introduction: Giant cell tumour of the bone (GCTB) is a rare and intermediate malignant tumour, that affects most patients in the third decade of their life. Grading the tumour is currently done based on conventional radiographs, followed by MRI. The current method of grading is suboptimal in predicting the recurrence of a tumour, and therefore raises the question if there is no better way to be able to predict the recurrence of the tumour for an individual. Radiomics has been starting to play a role in predicting tumoral behaviour in several fields but has not yet been used to predict the recurrence of GCTB.

Methods: This retrospective cohort study included 36 patients with GCTB. Each tumour went through the process of segmentation and feature extraction on both T1 and T2-weighted MRI series. Features were then tested for relevance and converted into a heatmap.

Results: The T2-weighted images showed five relevant features, that were converted into a heatmap. The T1-weighted images only showed one single relevant feature. The clusters of the heatmap did not correlate with the recurrence and non-recurrence group of the patients. It also did not correlate with any of the other clinical categories.

Conclusion: Even though this study was able to detect five relevant radiomics features, these features did not correlate with any of the clinical information of the included patients and could therefore not be used to differentiate between recurrent and non-recurrent GCTB on MRI.

Yi Luo, Fan Tang, Li Min, Chongqi Tu

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Safety and efficacy of denosumab in treatment of pulmonary metastatic giant cell tumor of bone

Aim of the study: This study aims to evaluate the safety and efficacy of denosumab for these patients with pulmonary metastatic giant cell tumor

Background: Giant cell tumor of bone is usually a benign, locally aggressive tumor with metastatic potential. We report interim safety and efficacy results from denosumab in patients with pulmonary metastatic giant cell tumor.

Methods: We retrospectively reviewed 7 pulmonary metastatic giant cell tumor patients who received denosumab treatment from January 2014 to July 2018. Safety and efficacy analyses included all patients who received at least 60 months of denosumab treatment. Serial chest computerized tomography scan was used to monitor response to denosumab and RECIST 1.1 standard was used to evaluate to therapeutic efficiency.

Results: All patients experienced pain relief in the first month of treatment. Three patients demonstrated a positive radiographic response with reduced and decreased tumor nodules within three months. And this three patients were partial response according to RECIST 1.1. All patients were safety except 1 hypocalcaemia and 2 fevers. No treatment-related deaths were reported. No patient in tumor progression was found in an average of 78.6 months follow-up.

Conclusion: We describe our series experience in the treatment use of denosumab and offer suggestions for long term applicationfuture. It was efficacy and safety that represents a new treatment option for pulmonary metastatic patients with giant cell tumor.

Ron Batash, Andrea Angelini, MariaChiara Cerchiaro, Giulia Trovarelli, Pietro Ruggieri

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Aneurysmal Bone Cyst – must we operate?

Aim of the study: Discussion of non surgical approach to ABC - can we replace surgical treatment?

Introduction: Aneurysmal Bone Cyst is considered a benign aggressive lesion and curettage with bone graft being the standard of care. Due to operative complications and the usual young age of the patients lead to several non-surgical modalities to emerge in the past decades. Hypothesis Non-surgical modalities can address the condition with low recurrence rates.

Material and Methods: A systematic search of the literature using the PRISMA guidelines for all non-surgical treatments only including Sclerotherapy, Selective Angiographic Embolization, Radiofrequency ablation, Cryotherapy, Systemic therapy off label denosumab and bisphosphonates.

Results: Thirty-nine studies were included in the present review. Total 964 primary ABC were included in this study with an average recurrence rate of 19%: In the sclerotherapy group 16.6% (CI 10.9%-22.3%) recurrence rate; systemic therapy 19.25% (CI 19.25%-41.2%) recurrence rate; SEA 9.7% (CI 9.7-32%) recurrence rate; Radiofrequency ablation 0% recurrence rate.

Conclusions: A minimally invasive non-surgical approach can be considered a durable treatment for Aneurysmal Bone Cyst. We believe that in case of young patients, pediatric cases, and challenging inoperable scenarios, a non-invasive/minimally invasive modality should be considered over open curettage. Due to the low volume of published studies, further series should be conducted in SEA, cryosurgery, radiofrequency ablation in order to evaluate these modalities better.

Osman Emre Aycan, Sercan Bahadir, Berk Kiran, Muhammet Coşkun Arslan

Baltalimani Bone Diseases Training and Research Hospital, Istanbul, Türkiye

Recurrent Giant Cell Tumors of the extremities: Is curettage and cementation still safe?

Aim of the study: The aim of our study is whether intralesional treatment sufficient for recurrent GCT and to determine the factors influencing the risk of recurrence in patients operated for recurrent GCT.

Patients and Methods: A retrospective evaluation was conducted on 45 patients who underwent surgery for recurrent GCT between 2005 and 2021. Thirteen patients with follow-up periods of less than 24 months and insufficient data were excluded from the study, remaining 32 patients were included in the study. The use of denosumab and applied surgical method were evaluated. Recurrence risk factors and recurrence-free survival were calculated regarding Kaplan-Meier statistical analyses.

Results: Among the 32 patients operated for recurrent GCT, the mean age was 32.1 ± 9.7, and mean follow-up was 87.5 months. Of the 183 primary GCTs treated in our institute, 11.4% developed recurrence (n=21). Intralesional curettage with burr, phenol, cauterization and cement application respectively, were the most commonly used treatment method in this study. We found that this approach prevented RE-recurrences in recurrent GCT cases (p=0.004). Among the 12 recurrent GCT patients RE-recurrences encountered in mean 23.8 months. Seven patients underwent wide resection with neoadjuvant denosumab, of them RE-recurrence was encountered in two patients. There was significant relation with extracompartmental spread of the tumor was determined (p=0.017). Mean MSTS was 85.3%. RE-recurrence-free survival within 2 years was 0.84% and 5 years was 0.72%.

Conclusion: The use of denosumab did not prevent the development of RE-recurrences in this study. Phenol, PMMA and cauterization can prevent RE-recurrences in GCT unless the primary treatment is performed by the same surgeon.

Xin Hu, Minxun Lu, Li Min, Chongqi Tu, Yong Zhou, Yi Luo

Department of Orthopaedic Surgery and Orthopaedic Research Institute, West China Hospital, Sichuan University, Chengdu, China

A biomechanical comparison between cement packing combined with extra fixation and three-dimensional printed strut-type prosthetic reconstruction for giant cell tumor of bone in the distal femur

Aim of the study: The goal of this study is to comparatively analyze the biomechanical performance of reconstruction methods aimed at the identification of better operative strategy.

Background: Giant cell tumors of bone (GCTB) often result in bone defects requiring reconstruction. The conventional approach involves cement packing with subchondral bone grafting and extra fixation, but this has limitations affecting prognosis and joint function. Our institution developed a 3D-printed strut-type prosthesis with superior biocompatibility and osseointegration for GCTB-related bone defects.

Methods: Four 3D finite element models were created: Model #1 – Normal femur; Model #2 – Femur with tumorous cavity bone defect; Model #3 – Defect reconstructed with cement packing, bone grafting, and extra fixation; Model #4 – Defect reconstructed with 3D-printed strut-type prosthesis and bone grafting. Finite element analysis assessed mechanical differences using applied femoral muscle forces.

Results: The normal femur exhibited optimal stress and displacement distribution. Both reconstruction methods provided initial stability and support. Stress distribution in the femur reconstructed with cement packing, bone grafting, and extra fixation was uneven, with notable concentration around the articular surface. Conversely, the femur reconstructed with the 3D-printed strut-type prosthesis showed superior performance in displacement and stress distribution, especially in protecting the articular surface and subchondral bone.

Conclusions: The 3D-printed strut-type prosthesis excels in precise shape matching and superior osseointegration. Compared to cement packing and extra fixation, it offers similar support and fixation stiffness but demonstrates enhanced biomechanical performance, safeguarding subchondral bone and articular cartilage. Therefore, combining 3D-printed strut-type prosthetic reconstruction with subchondral bone grafting emerges as a viable alternative for treating GCTBs in the distal femur.

Mylene JC Duivenvoorden, Vineet Kurisunkal, Gerjon Hannink, Micheal Parry, Lee Jeys, Floortje GM Verspoor

UMC Amsterdam, The Netherlands

Long-term Denosumab giant cell tumor of bone patients

Introduction: Giant Cell Tumors of Bone (GCTB) are intermediate malignant tumors and occur in all bones. For over a decade systemic Denosumab was added as neo-adjuvance to surgery, however higher local recurrence rates were found. No data is available on long-term Denosumab use. This study, retrospectively evaluated long-term Denosumab for GCTB with regards to effect, doses, frequency and adverse events to provide a treatment algorithm.

Methods: All GCTB patients treated with Denosumab between 2010-2023, at the Royal Orthopaedic Hospital in Birmingham, were retrospectively evaluated. Patients treated less than 14 weeks were excluded for further statistical analysis (determined as neo-adjuvant).

Results: Overall 112 patients, median age 35(IQR 25-51) years, were found. GCTB was located in the extremities (n=71) and axial skeleton (n=41). Median time of Denosumab treatment was 87 (IQR 29-153) weeks. Patients with axial skeletal GCTB were treated significantly longer (p=0.001). The Denosumab interval was successfully reduced to 2 monthly after 64 (IQR 52-80) weeks (n=52), and to 3 monthly after 106 (IQR 98-183) weeks (n= 26). Adverse events (n=24) including skin irritation (n=5), osteonecrosis of the jaw (n=5) and a stress fracture (n=4) occurred. Denosumab was discontinued (n= 63) for subsequent surgery (n=38), adverse events (n=8), disease progression (n=8), pregnancy (wish) (n=4), worsening of pain (n=4) and movement abroad (n=1).

Conclusion: This large, retrospective cohort, confirms long-term Denosumab is indicated for selected GCTB cases. It can stabilize and reduce disease burden. The dose and frequency can be safely reduced under adequate surveillance. However, adverse events do occur. A treatment algorithm to assist physicians in making individual treatment decisions was developed.

SESSION 2:

PATHOLOGY HOT TOPICS IN DIAGNOSIS OF BONE & STS

CHAIRS: Bernadette Liegl-Atzwanger (Austria), Eva Wardelmann (Germany)

Konrad Ptaszyński

Department of Pathology and Forensic Medicine, University of Warmia and Mazury, Olsztyn, Poland

Precision in orthopedic pathology: the role of immunohistochemistry and molecular techniques in a multidyscyplinary approach

Bernadette Liegl-Atzwanger

Research Institute of Molecular Pathology, Medical University of Graz, Austria

Molecular testing for soft tissue tumors – benefits and caveats

Iva Brcic

Research Institute of Molecular Pathology. Medical University of Graz, Austria

Molecular testing for primary bone tumors – benefits and caveats

Eva Wardelmann

Department of Pathology, University of Muenster, German

Soft tissue tumors – new kids on the block

Ramses Forsyth

Department of Pathology, University of Brussels, Belgium

Bone tumors – new kids on the block

Xin Hu, Minxun Lu, Yitian Wang, Yong Zhou, Yi Luo, Li Min, Chongqi Tu

Department of Orthopaedic Surgery and Orthopaedic Research Institute, West China Hospital, Sichuan University, Chengdu, China

Exosomal Long Non-Coding RNA ANCR Mediates Drug Resistance in Osteosarcoma

Aim of the study: This study unveils ANCR's crucial role in therapy resistance mechanisms in osteosarcoma, suggesting its potential as a therapeutic target to enhance treatment outcomes for this rare malignancy.

Background: Osteosarcoma (OS), a rare malignancy with a bimodal age distribution, requires neoadjuvant therapy, surgical excision, and postoperative chemotherapy. However, the current therapeutic strategy's efficacy, marked by suboptimal disease prognosis and drug resistance, necessitates a deeper understanding of resistance mechanisms.

Methods: Investigating Doxycycline (Dox)-sensitive and resistant OS cell lines (KHOS and U2OS), we observed increased proliferation in resistant variants (KHOS-DR and U2OS-DR). Treating Dox-sensitive cells with exosomes from resistant variants induced Dox resistance in vitro and in vivo, promoting tumor growth and reducing overall survival. Notably, the long non-coding RNA (lncRNA) ANCR was upregulated in KHOS-DR and U2OS-DR.

Results: Silencing ANCR through siRNA knockdown reduced proliferation and increased Dox sensitivity in KHOS-DR/U2OS-DR cells. Exosomal lncRNA ANCR emerged as a key determinant of drug resistance and OS progression in xenografts, correlating with Adriamycin resistance and overall survival in OS patients.

Conclusion: These findings pinpoint lncRNA ANCR as a pivotal mediator of therapy resistance in OS, suggesting its potential as a therapeutic target in OS treatment.

Ayano Aso[1,2], Hisaki Aiba[1,2], Matteo Traversari[1], Alberto Righi[3], Marco Gambarotti[3], Ahmed Orlando Atherley O'Meally[1,4], Konstantina Solou[1], Silvia Cammelli[5,6], Barbara Bordini[7], Monica Cosentino[7], Federica Zuccheri[1], Barbara Dozza[8], Giorgio Frega[9], Toni Ibrahim[9], Marco Manfrini[1], Davide Maria Donati[1], Costantino Errani

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A reduction in tumor volume greater than 65% can predict a good histological response to neoadjuvant chemotherapy in patients with Ewing sarcoma

Aim of the study: To determine an optimal threshold for tumor volume reduction that predicts a good histological response in Ewing sarcoma patients following neoadjuvant chemotherapy

Introduction. Consensus on tumor volume response criteria in Ewing sarcoma is lacking. This study aimed to identify an optimal cutoff for predicting good histological response by analyzing tumor volume changes and tumor necrosis after neoadjuvant chemotherapy.

Methods. We reviewed 184 Ewing sarcoma patients treated with neoadjuvant chemotherapy and surgery from 2003 to 2020, examining tumor volume changes before and after neoadjuvant chemotherapy. Patients were divided

based on histological response into good (necrosis ≥95%) and poor (<95%) groups. The ROC AUC method was used to determine the optimal threshold for predicting the histological response, and its prognostic value for relapse-free survival was assessed.

Results. Of 184 patients, 83 (45%) had tumor necrosis ≥95%, while 101 (55%) had tumor necrosis <95%. ROC analysis identified the optimal cutoff for a good histological response as over 65% tumor volume reduction (AUC=0.69; p<0.001). Patients with volume reduction of ≥65% had a higher likelihood of a good histological response than those with lesser reductions (odds ratio=2.61; p=0.004). Multivariable analysis indicated a correlation between poor histological response and reduced relapse-free survival (hazard ratio=2.17; p=0.01), while tumor volume reduction itself did not impact survival.

Conclusions. A reduction in tumor volume of ≥65% predicted a good histological response in Ewing sarcoma patients. We recommend the integration of preoperative tumor volume assessment into treatment planning, potentially guiding intensified chemotherapy or additional radiotherapy for patients at risk of poor histological response.

SESSION 3:

BONE SARCOMA DIAGNOSTIC AND TREATMENT PATTERN

CHAIRS: Dimosthenis Andreou (Austria), Lars Lindner (Germany)

Piotr Rutkowski

Department of Bone, Soft Tissue Sarcoma and Melanoma, National Institute of Oncology, Warsaw, Poland

Chondrosarcoma – genetic and immunological profile

Dimosthenis Andreou

Department of Orthopaedics. Medical University of Graz, Austria

Should patients with osteosarcoma and Ewing sarcoma only be treated in large-volume specialized centers?

SPAGN: Kathleen Kane

Bone Cancer Research Trust, UK

From a patient´s point of view

Pramod Chinder

Department of Orthopaedic Oncology, Bangalore, India

Normalizing and streamlining the use of 3-dimensional preoperative surgicalplanning and 3d printing in orthopaedic oncology. Where boon where bane? A collective study and analysis of 60 cases from a single institution in India

Lorenzo Andreani[1], Raffaele Gaeta[2], Mariangela Morelli[3], Francesca Lessi[3], Maria Chiara Mazzantini[3], Michele Menicagli[3], Edoardo Ipponi[1], Rodolfo Capanna[1], Luca Coccoli[4], Paolo Aretini[3], Alessandro Franchi[2]

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Identification of new potential prognostic and predictive markers in high-grade osteosarcoma using whole exome sequencing

Aim of the study: Use whole exome sequencing (WES) to identify new potential prognostic biomarkers and therapeutic targets in osteosarcoma

Introduction: Conventional high-grade osteosarcoma (OS) is the most common primary cancer of bone and it typically affects the extremities of adolescents. OS has a complex karyotype, and molecular mechanisms related to carcinogenesis, progression and resistance to therapy are still largely unknown. For this reason, the current standard of care is associated with considerable adverse effects.

Methods: In this study, our aim was to identify gene alterations in OS patients using whole exome sequencing (WES) to find new potential prognostic biomarkers and therapeutic targets. We performed WES on formalin-fixed paraffin-embedded (FFPE) biopsy materials collected from 19 patients affected by conventional high-grade OS. The clinical and genetic data were analyzed according to response to therapy, presence of metastasis and disease status.

Results: By comparing good and poor responders to neoadjuvant therapy, we detected a clear prevalence of mutations in the ARID1A, CREBBP, BRCA2 and RAD50 genes in poor responders that negatively influence the progression-free survival time. Moreover, higher tumor mutational burden values correlated with worse prognosis. The identification of mutations in ARID1A, CREBBP, BRCA2 and RAD50 may support the use of a more specific therapy for tumors harboring these alterations.

Conclusion: Among the others, BRCA2 and RAD50 are involved in homologous recombination repair, and could thus be used as specific therapy targets of inhibitors of the enzyme Poly ADP Ribose Polymerase (PARP). Finally, tumor mutational burden is found to be a potential prognostic marker for OS.

SESSION 4:

TREATMENT STRATEGIES FOR (OLIGO) METASTATIC DISEASE IN SARCOMA PATIENTS

CHAIRS: Joanna Szkandera (Austria), Bartłomiej Szostakowski (Poland)

Lars Lindner

Ludwig-Maximilians-University of Munich, Germany

An oncologist´s perspective

Piotr Rutkowski

Department of Bone, Soft Tissue Sarcoma and Melanoma, National Institute of Oncology, Warsaw, Poland

A surgeon's perspective

Mateusz Spałek

Department of Radiotherapy, National Institute of Oncology, Warsaw, Poland

A radiation oncologist´s perspective

Valentina Kottmann[1], Ulrike Ritz[2], Ansgar Bokel[3], Franz Paul Armbruster[3]

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[2] Department of Orthopaedics and Traumatology University Medical Center of the Johannes Gutenberg University Mainz, Germany
[3] Immundiagnostik AG, Bensheim, Germany

Bone sialoprotein stimulates cancer cell migration in vitro

Aim of the study: Basic cancer research employing in vitro assays to gain a better understanding of skeletal metastases

Introduction: Bone sialoprotein (BSP) is expressed in tumour sections of cancer patients (Waltregny et al., 2000) and has been proposed to be a driver of tumour progression, particularly the development of bone metastases. For instance, BSP stimulates cancer cell adhesion (Sung et al., 1998), invasion (Karadag et al., 2004) and angiogenesis (Bellahcène et al., 2000). However, less is known about the role of BSP in cancer cell migration. This study aimed to investigate the migration of cancer cell lines to BSP using a transwell cell migration assay. We hypothesised that breast adenocarcinoma and prostate adenocarcinoma cells would migrate towards BSP.

Methods: Human breast MDA-MB-231 and human prostate PC-3 cancer cell lines were used in three independent transwell cell migration assays, which were carried out in triplicate. Cells migrated towards 30 µg/ml BSP for 24 hours. The percentage of migrated cells was calculated using a standard curve of absorbance of crystal violet.

Results: BSP significantly enhanced the migration of breast cancer and prostate cancer cells compared to negative control (1% FCS) (One-way ANOVA, $p<0.0001$).

Conclusions: We have demonstrated that BSP promotes the migration of breast adenocarcinoma and prostate adenocarcinoma cells. Further investigations are needed to elucidate the underlying mechanism of cancer cell migration towards BSP. Targeting specific receptors with antibodies or using RGD-containing peptides could potentially

inhibit tumour cell binding to BSP, thereby suppressing cancer cell migration to bone and inhibiting skeletal metastasis development.

Acknowledgements: Research sponsored by Immundiagnostik AG, Bensheim.

Anthony Bozzo[1], Alex Hollingsworth[2], Subrata Chatterjee[2], Aditya Apte[2], Jiawen Deng[3], Simon Sun[2], Ahmed Aoude[1], Sahir Bhatnagar[1], John Healey[2]

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A multimodal neural network model with gradient blending improves predictions of overall survival and risk of distant metastases in soft tissue sarcoma

Aim of the study: The objective of this study is to develop a multimodal neural network model (MMNN) that analyzes clinical variables as well as MRI images of a sarcoma, to predict an STS patient's overall survival and risk of distant metastases.

Background: The survival of sarcoma patients has not improved over the past 3 decades. New innovations in matching patients to optimal treatments are needed to improve outcomes. The objective of this study is to develop a multimodal neural network model (MMNN) that analyzes clinical variables as well as MRI images of a sarcoma, to predict an STS patient's overall survival and risk of distant metastases.

Methods: All patients aged 18 or older with biopsy-confirmed STS who underwent primary resection at MSKCC between 2005-2020 were reviewed. We included all patients with a pre-treatment MRI with both a T1 post-contrast sequence and a T2 fat-sat sequence available. A total of 9380 MRI slices containing sarcomas are available for analysis. Our MMNN accepts the T1 and T2 MRIs which are fed through an image subnetwork consisting of a 2-channel DenseNet-121. The T1 and T2 sequences are masked and cropped to contain only the tumor volume. Visualization of the image features using heat maps was obtained using the Grad-CAM methodology.

Results: Our MMNN outperformed all other models in predicting overall survival and the risk of distant metastases . The C-Index of our MMNN for overall survival is 0.769, an absolute increase of 11.4% in AUC compared to the next best performing model. The heat maps demonstrate the areas of the sarcomas deemed most salient for the predictions .

Conclusion: This is the first multimodal neural network in sarcoma.

Rita Carrilho Pichel[1], João Queirós Coelho[1], Hugo Miranda[1], Cristina Soares[2], Ridhi Ranchor[1], Raquel Romão[1], Eugénia Rosendo[1], Alexandra Araújo[1], Manuel Magalhães[1], António Araújo[1]

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First-line trabectedin for soft tissue sarcomas in patients unfit for doxorubicin – real world data

Aim of the study: Describe our centre experience with first-line trabectedin

Anthracyclines are the first-line (1L) standard treatment for advanced soft tissue sarcomas (STS). Trabectedin is indicated after doxorubicin and ifosfamide, or if ineligible for these. We aim to evaluate our centre experience with trabectedin for STS in 1L palliative setting. We performed a retrospective analysis of all patients treated with trabectedin at our institution, from 2015 to 2023. Here we present the subanalysis of patients with recurrent/metastatic STS who had not received any prior chemotherapy. We assessed trabectedin indications, efficacy and tolerance. Eight patients, 62.5% of them male, with a mean age of 73yo (range 48-88), received 1L palliative treatment with trabec-

tedin. The most frequent histology was leiomyosarcoma (37.5%), with 75.0% "L-sarcomas", and the primary tumors were mostly retroperitoneal (37.5%). Reasons for choosing trabectedin in 1L were: age >75yo, ECOG PS 2, cardiac comorbidities and refusal of alopecia. The median progression-free survival (PFS) and overall survival (OS) were 6.0m (95%CI: 0.1-11.9) and 14.4m (0.0-32.8), respectively. Grade 3-5 adverse events were mainly hematological, with the exception of a case of severe mucositis. STS patients treated with 1L trabectedin had older age yet efficacy outcomes resemble those reported for doxorubicin (Judson I et al 2014) without additional safety issues. These findings support that trabectedin should be considered in 1L palliative treatment of STS in patients who were considered unfit to receive the current standard.

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Osteosarcoma Immune Prognostic Index can indicate the nature of indeterminate pulmonary nodules and predict the metachronous metastasis in osteosarcoma patients

Aim of the study: This study aims to create an osteosarcoma immune prognostic index (OIPI) using hematological markers for predicting metachronous metastasis. It also explores OIPI's combined predictive ability with indeterminate pulmonary nodules (IPNs).

Introduction: Investigating the link between indeterminate pulmonary nodules (IPNs) and metastasis poses challenges. We aim to develop a predictive model elucidating IPN nature and forecasting metachronous metastasis probability in osteosarcoma patients.

Methods: A retrospective study encompassing 184 osteosarcoma patients from January 2016 to January 2021 was conducted, analyzing hematological markers and clinical features.

Results: An osteosarcoma immune prognostic index (OIPI), derived from the lung immune prognostic index (LIPI), outperformed other markers and features in metastasis prediction. OIPI categorized 184 patients into four groups, demonstrating consistent predictive efficacy in both no-nodule and IPN groups, correlating with metastatic site occurrence. High OIPI groups with IPNs exhibited increased metastasis risk. Combining OIPI with IPNs enhanced metastasis identification accuracy. Additionally, an OIPI-based nomogram was constructed for predicting 3-year and 5-year metastasis rates.

Conclusion: This study introduces OIPI as a valuable tool for diagnosing IPN nature alongside chest CT and surpasses other hematological markers. OIPI serves as an auxiliary tool for assessing the malignant transformation tendency of IPNs, and its combination with IPNs improves metastatic prediction in osteosarcoma patients.

Marco Focaccia[1], Eleonora Pesce[1], Martina Modeo[1], Alberto Righi[2], Luca Cevolani[1], Giuseppe Bianchi[1], Benedetta Spazzoli[1], Davide Maria Donati[1]

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Myxosarcoma lymph nodal metastasis: prognosis impact and treatment

Aim of the study: To study the overall survival of lymph nodal metastatic mixofibrosarcoma

Introduction: Myxofibrosarcoma is one of the most frequent soft tissue sarcomas. Metastatic diffusion mainly involves lungs; lymph nodal metastasis are rare, the meaning on prognosis is uncertain and the treatment is debatable.

Materials and methods: This retrospective study investigated the oncologic outcomes of patients with histological diagnosis of lymph nodal metastasis of myxofibrosarcoma (LMOM) treated in our center. Patients > 18 years were identified from prospective databases. Tumor, treatment and oncologic outcomes were evaluated. Median follow-up was 12 months (median 11, range 2-31 months).

Results: On a total of 440 patients treated in our center for myxofibrosarcoma, there were 11 patients (2,5%) with LMOM diagnosis with a median age 79 years (range 63-91 years). Mean onset time from diagnosis was 6 months (range 0-22), with 5 patients with metastasis at diagnosis. Mean overall survival was 32 months (median 26, range 8-106), mean overall survival after LMOM diagnosis was 25 months (median 17, range 8-101).

Conclusions: LMOM diagnosis is rare and could mean a systemic diffusion of the disease, therefore onset time it can affect prognosis. In this case series the mean overall survival after LMOM was 25 months, with noticeable differences regarding the onset time. The treatment remains uncertain: poor overall survival in patients with lymph nodal metastatic disease at diagnosis put a question mark on a radical treatment in this population. Otherwise, if LMOM are asynchronous long-term survival without evidence of disease is achievable and could justify an early and radical treatment.

June 12, Wednesday | Pomerania Hall

SESSION 1:
PERIOPERATIVE CARE AND COMPLICATIONS IN MUSCULOSKELETAL ONCOLOGY

CHAIRS: Laura Campanacci (Italy), Peter Bekkering (The Netherlands)

Agata Andrzejewska

Department of Anaesthesiology and Intensive Care, Pomeranian Medical University, Szczecin, Poland

Prepare for the worst, hope for the best – Multimodal monitoring in anaesthesiology

Nicola Ratto[1], Dimosthenis Andreou[2], Jendrik Hardes[3], Sebastien Raux[4], Michiel van de Sande[5], Michele Boffano[6], Craig Gerrand[7], Eric Staals[8], Pan Pantziarka[9]

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[3] University Hospital of Essen
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Perioperative strategies may influence long-term survival: a multicentric survey on patients treated for osteosarcoma

Aim of the study: The purpose is to obtain information and results that will help to improve clinical practice in the perioperative period.

Introduction: Surgical treatment of most bone and soft tissue sarcomas is a prerequisite for the long-term survival of oncological patients. However, the body's response to the trauma of major surgical intervention causes the secretion of growth factors and cytokines for tissue repair and angiogenesis and also causes immunosuppression. Together, these factors create a potentially favourable host environment for tumour growth. Many short-term interventions, collectively termed as 'perioperative therapies', are reported to influence the development of local recurrences and distant metastases in several tumours, including osteosarcoma.

Methods: A survey of 27 questions on various perioperative interventions was compiled, including data on the choice of anesthetic technique and anesthetic agents, pain management, antithromboembolic and antibiotic prophylaxis and other non-pharmacological interventions such as perioperative nutrition. The responses were collected from 9 Orthopedic Oncology Department of 6 different European countries treating adult and pediatric patients with Osteosarcoma.

Results: Locoregional anesthesia is widely used today, while there is no agreement on the type of general anesthesia, between propofol-based total intravenous and inhalational anesthesia. Some differences were also found in the choice of pain medication, the age at which heparin is started, the presence of protocols for preoperative detection of colonizing bacteria or the use of nutritional programs.

Conclusions: Interestingly, there is significant variation in perioperative practice between centers. The sharing of information and knowledge helps to improve the clinical practice. It is essential to focus on all the aspects related to surgery to impact on the survival of Osteosarcoma patients.

Michiyuki Hakozaki

Higashi-Shirakawa Orthopaedic Academy and Department of Orthopaedic Surgery, Fukushima Medical University School of Medicine, Fukushima, Japan

Severe oropharyngeal mucosal injury caused by high-dose methotrexate therapy for osteosarcoma

Aim of the study: We retrospectively analyzed high-dose methotrexate therapy-induced severe oropharyngeal mucosal injury following treatment for osteosarcoma in our institute.

Introduction: Although high-dose methotrexate therapy (HD-MTX) is a primary chemotherapeutic agent for osteosarcoma, it may lead to severe adverse events. We retrospectively analyzed severe oropharyngeal mucosal injury (OPMI) following HD-MTX. Methods Between January 2007 and December 2020, 29 patients with osteosarcoma underwent 113 courses of HD-MTX; five patients with a mean age of 26.8 years experienced a severe OPMI of grade 3-4 (CTCAE).

Results. The standard doses of MTX of 10 g/m2 and 8 g/m2 for patients < 20 and those ≥ 20 years old were applied, respectively. The severe OPMI occurred after the first course in three cases and after the second course in two cases. In all cases, plasma MTX concentration 72 h from the administration was significantly high at a mean concentration of 0.46 μM (0.34-0.58), but additional folic acid administration had not done. Severe OPMI occurred 5-12 days after MTX administration and lasted 6-21 days. One case was managed by tracheal intubation because of pharyngeal bleeding, and another case complicated the pudendal ulcer. Delayed fever over 38 °C was observed in all cases, along with severe myelosuppression that required erythrocyte transfusion. Four patients experienced neutropenia (grade 3-4), and thrombocytopenia (grade 4). After their recovery, two patients continued HD-MTX, and severe OPMI had not recurred.

Conclusions. Our findings revealed that complicated myelosuppression might occur in severe OPMI cases, which requires multidisciplinary care. Additional folic acid administration seems to be essential for preventing severe OPMI.

Hans Roland Dürr[1], Maria Hett[1], Alexander Klein[1], Stefan Rakete[2], Boris Michael Holzapfel[1], Christoph Lahr[1]

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Raised metal-ion concentrations after tumor resections and reconstruction with megaprotheses around the knee joint

Aim of the study: Aim of this study was therefore to evaluate the incidence of raised cobalt and chromium ions in a consecutive series of tumor patients with megaprosthesis around the knee.

In arthroplasty serum ions as cobalt or chromium have been shown to be raised. Megaprostheses have an elevated risk of raised ion concentrations as shown in small series or case reports. Adverse effects as heart failure might develop. Patients >From 1992 to 2023 42 patients with a distal femur or a proximal tibia tumorprothesis were included. Till now in 35 patients, analysis could be completed (median 88 months, 15-372 months). A MUTARS-type prothesis was used in 32, a HMRS prothesis in 3 patients. Mean age in 18 male was 40.2 years in 17 female 31.1 years. The distal femur was resected in 22 patients, the distal tibia in 13 patients. Results Cobalt and chromium concentrations should not exceed 7 µg/l. 77% of patients showed concentrations above the limits. Mean chromium concentration was 10.1 µg/l, maximum 22.3 µg/l. Mean cobalt concentration was 16.5 µg/l, maximum 91.5 µg/l. Both showed a significant correlation. Distal femur implants had higher levels as compared to proximal tibia prostheses. As larger the resection was, as higher levels were seen. Highest levels of both ions were observed in the first 3 years. Conclusion Raised levels of cobalt or chromium ions even to more than tenfold are common. This was seen especially in the first 3 years. After that, the level was also raised but not more than 3-5 fold. The impact of such long-term moderately raised ion-levels has to be evaluated.

Megan Rose Donnelly, Ekenedilichukwu Nwakoby, Garrett W. Esper, Michelle Richardson, Karim Masrouha

NYU Langone Health, Department of Orthopedic Surgery

The risk of venous Thromboembolism (VTE) in orthopedic oncology patients extends far beyond the index operative hospital admission necessitating long-term surveillance

Aim of the study: The purpose of this study was to determine for how long after orthopedic oncologic surgery patients are at risk for venous thromboembolism (VTE)

Many studies have investigated the risk of VTE in patients with cardiovascular conditions or in patients who have sustained trauma. But there is a paucity of literature regarding VTE in patients with orthopedic oncologic conditions, including metastatic bone disease and malignant primary bone/soft tissue tumors. This is despite the fact that the incidence of VTE in this population has been found to be around 10.7%. Additionally, little is known about the postoperative time period within which these patients are at a higher risk for VTE. This study analyzed institutional data for patients who underwent a lower extremity orthopedic oncology procedure (2012-2023). The primary outcomes were VTE diagnosed during the index admission as well as VTE diagnosed after discharge. 211 patients were identified, and descriptive statistics were performed and multivariate stepwise regression was used to develop a model for VTE risk. 7 (3.3%) patients were diagnosed with VTE during the index hospital admission and 24 (11.4%) were diagnosed with future VTE. On average, time from surgery to deep vein thrombosis was 106 days and time from surgery to pulmonary embolism was 180 days. At greatest risk were patients with metastatic lung cancer and those with higher preoperative Caprini scores. Being on preoperative VTE prophylaxis as well as administration of enoxaparin both immediately postoperatively and after discharge did not help mitigate this increased risk for VTE. It is our recommendation that patients should be surveilled for VTEs for at least 6 months after any orthopedic oncologic procedure.

José M Lamo-Espinosa, Jorge Gómez Álvarez, Mikel San-Julián

University Clinic of Navarra

Fertility in long-term survivors of pediatric and young adults high grade osteosarcoma

Aim of the study: To assess long-term fertility in patients treated for osteosarcoma, describing any potential issues they may have encountered

Introduction: Chemotherapy in osteosarcoma has significantly improved survival rates. Concerns persist regarding long-term impairment of fertility. Despite the systematic application of many fertility preservation techniques, few studies specifically address fertility in survivors. Our goal is to assess fertility in patients treated for pediatric and young adult osteosarcoma.

Methods: Retrospective analysis of osteosarcoma survivors treated at our center from 1982 to 2005. All followed a standardized chemotherapy protocol. Telephone interviews were conducted in cases where contact could not be established at the time of the follow-up for their osteosarcoma, querying about pregnancy desires and difficulties. In case of difficulties, we further investigated the possible reasons behind them.

Results: Of 116 patients, 104 were contacted, and 66 (26 women, 40 men) desired pregnancy. Mean age at diagnosis was 16.4 (SD: 6.2) years, and at follow-up end, 44.7 (SD: 9.4) years, with an average of 339.8 (SD: 92.2) months of follow-up. Among the 26 women desiring pregnancy, only 1 (3.8%) faced fertility challenges due to chemotherapy. Of the 40 men, 4 experienced difficulties due to azoospermia and in 2 cases, the cause is unknown as no fertility studies were conducted for the couple. No discernible chemotherapy dosage differences were found between patients with fertility issues and those without.

Conclusions: Survivors of pediatric and young adult osteosarcoma exhibit a high success rate in achieving normal conception and childbirth, aligning with the general population. These findings underscore the ongoing importance of fertility preservation strategies.

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A nutritional metabolism related prognostic scoring system for patients with newly diagnosed osteosarcoma

Aim of the study: Osteosarcoma, a highly metastatic bone tumor, challenges long-term survival. Limited and conflicting studies exist on the prognostic value of hematological markers related to cancer metabolism and nutrition.

Introduction: Osteosarcoma, a highly metastatic bone tumor, poses challenges for achieving prolonged patient survival. The emerging hallmark of cancer, metabolic reprogramming, is crucial in osteosarcoma. However, research on the prognostic significance of hematological markers linked to nutritional and metabolic aspects in cancer patients is limited and conflicting.

Methods: In this retrospective study, we collected data on 16 hematological markers related to nutrition and metabolism in 223 osteosarcoma patients. Using least absolute contraction and selection operator (LASSO) cox regression analysis, we constructed a Nutritional Metabolism-Related Prognostic Scoring System (NMRS) for osteosarcoma patients.

Results: NMRS demonstrated superior predictive power compared to individual hematological indicators (training set: 0.811 vs. 0.362-2.638; validation set: 0.767 vs. 0.333-0.595). It emerged as an independent prognostic factor for osteosarcoma patient survival [HR: 1.957 (1.375-2.786) in the training set; HR: 3.146 (1.574-6.266) in the validation set]. NMRS-based nomograms exhibited robust and consistent predictive capabilities.

Conclusions: NMRS enables refined risk stratification among patients sharing similar clinical characteristics.

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Assessing the prognostic role of skeletal muscle index for sarcopenia in soft tissue sarcoma

Aim of the study: To further assess the role of radiological diagnosis of sarcopenia in predicting the outcome of patients with soft tissue sarcoma.

Introduction: Conflicting results have been observed in the relationship of survival post soft tissue sarcoma resection in the presence of sarcopenia. Improving prognostication in the management of sarcoma patients is desired to allow optimal individual treatment plans. We aimed to further assess the role of radiological diagnosis of sarcopenia in predicting the outcome of patients with soft tissue sarcoma.

Methods: In a single centre retrospective study 99 patients were identified. Pre-operative staging CT scans were used to the assess the presence of sarcopenia by the skeletal muscle index method, with a value of $<55cm^2/m^2$ and $<39cm^2/m^2$ used to diagnose sarcopenia in male and female patients respectively. Disease free survival outcomes at 2 and 5 years were assessed with correlation analysis performed.

Results: Of the 99 patients, the median age at time of surgery was 56 years. Median tumour size was 8.5 cm. Median body mass index was 27. Limb salvage surgery was performed in 84%, (84/99) and 61% (61/99) received neo-adjuvant or adjuvant radiotherapy. Sex was observed to differ significantly between the sarcopenic (female 39%, male 61%) and non-sarcopenic groups (female 54%, male 46%) $p = 0.03$. Sarcopenia was not observed to correlate with disease free outcome at 2 or 5 year follow up.

Conclusion: Used in isolation a radiological diagnosis of sarcopenia does not predict a negative outcome for disease free survival in soft tissue sarcoma patients. Further research into its prognostic value when used in combination with other parameters is required.

Megan Rose Donnelly, Garrett W. Esper, Michelle Richardson, Ekenedilichukwu Nwakoby, Karim Masrouha

NYU Langone Health, Department of Orthopedic Surgery

Venous Thromboembolism (VTE) in patients with metastatic bone disease versus malignant primary bone or soft tissue tumors

Aim of the study: The purpose of this study was to define rates of venous thromboembolism (VTE) in patients with metastatic bone disease versus malignant primary bone/soft tissue tumors

Venous thromboembolism (VTE) occurs in the setting of Virchow's triad. There are theories that malignancy affects all three aspects of this triad. However, not all cancers behave the same. The purpose of this study is to evaluate how rates of postoperative VTE differ in patients with metastatic bone disease versus malignant primary bone/soft tissue tumors. Utilizing institutional data for patients who underwent a lower extremity orthopedic oncology procedure (2012-2023), we created cohorts of metastatic bone disease (n=121) and primary bone/soft tissue tumor patients (n=90). Statistics were performed to compare demographic, past medical history, surgical data, and outcomes data, including rates of VTE, between cohorts. We found that, despite surgeons having a higher clinical suspicion for deep venous thrombosis (a greater number of screening duplex ultrasounds obtained) in patients with metastatic bone disease (p=0.040), particularly during the index operative admission, there were no differences in the rates of VTE events at any time point between groups. This is despite metastatic bone disease patients having a greater preoperative Caprini score (9.4 vs. 8.3, p=0.013). This may be secondary to increased use of prophylactic enoxaparin in the immediate postoperative period (67.8% vs. 47.1%, p=0.015). Future research should attempt to determine how metastatic bone disease and malignant primary bone/soft tissue tumors affect the different aspects of Virchow's triad, which may pave the way for improved risk stratification and prophylaxis in these medically complex patients.

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Venous tumoral thrombosis in osteosarcoma of the limbs

Aim of the study: Venous tumoral thrombosis (VTV) is a rare complication of osteosarcoma, mainly described in pelvic tumors. Specific features should allow to diagnose it before surgery and treat patient in a curative purpose

Eight patients aged 10 to 22 were treated from 1997 to 2023 for a chondroblastic osteosarcoma with a VTV. There were 4 proximal femur, 3 distal femur, and one proximal humerus tumors. Four patients were treated by anticoagulation for an embolism in a pulmonary artery. Five patients had lung metastases. The thrombosis was diagnosed during resection of the tumor in 6 cases or during an amputation in 2. Treatment consisted in resection of the veins in continuity with the tumor up to the proximal extremity of the thrombus as assessed by palpation and visualization through the vascular wall. In five cases margins were R0 margins and R1 in 3. In 3 out 4 proximal femur tumors resection of the external iliac vein was performed. In distal femur the deep femoral vein and/or superficial femoral vein was resected. In proximal humerus the sub clavian vein was resected. Lung metastases and pulmonary artery embolism were resected. After 4m. to 25y. FU, 4 patients had NED, one had an evolutive rhabdosarcoma and 3 were deceased. Two patients in whom the vein was not completely removed with the tumor had local recurrences. VTV is a very rare in osteosarcoma, mainly seen in proximal and chondroblastic tumors. It should be systematically sought after in case of so-called pulmonary embolism. In some instance the calcified thrombus may be visible on plain Xray or CT scan. Large resection of the invaded vein en-bloc with the tumor, is mandatory to be curative.

Tanya Fernández-Fernández, Sergio Ruiz Blanco, Lourdes Prats-Peinado, Jose Antonio Matas, Pablo Sanz-Ruiz

Hospital General Universitario Gregorio Marañón

Massive chronic expansive haematoma: a very rare osteolytic lesion and soft tissue mass around total hip arthroplasty. A case report and review of the literature

Aim of the study: To present an unusual case of chronic expanding haematoma after total hip arthroplasty and to review the current literature on the subject.

Introduction: Following total hip arthroplasty (THA), patients may present with a painful periprosthetic lytic lesion surrounded by a soft tissue mass. Pseudotumours should be considered in the differential diagnosis of sarcomas and metastatic lesions, arising classically from granulomatous reaction to particulate debris, a periprosthetic infection or, rarely, a chronic expanding haematoma (CEH).

Methods: We present the extraordinary case of an 81-year-old man who presented with a suspected pseudotumour after 20 years of metal-on-polyethylene THA. Intraoperative findings and pathological examination confirmed the CEH. A descriptive analysis of the 9 published cases of confirmed CEH after THA was performed along with ours. All pathological examinations revealed fibrin and clotted blood without lymphocytic infiltration, metallosis or polyethylene debris.

Results: Ten cases were included, with a median age of 69.9. CEH was diagnosed on average 19.2 years after THA (range: 4 - 35). No correlation with a specific bearing pair was found: MoP (3), CoP (3), MoM (1), CoM (1), and unspecified (2). Treatment strategies were not standardised: one-stage revision (60%), two-stage revision (10%) and palliative resection surgery (30%). At a mean follow-up of 21 months, all patients were pain-free and able to walk, with varying degrees of technical assistance.

Conclusions: CEH should not be overlooked in the differential diagnosis of periprosthetic THA lytic lesions. Long-term follow-up is recommended for early detection. Albeit not malignant, early surgical resection and THA revision may be advisable due to its aggressive nature and potentially fatal consequences.

SESSION 2:

PROGNOSTIC FACTORS IN STS

CHAIRS: Axel Horsch (Germany), Anna Raciborska (Poland)

Burkhard Lehner

Heidelberg University Hospital, Orthopaedic and Sarcoma Department, Germany

Pathologic fracture in the treatment of soft tissue sarcomas. When and why?

Ahmad Shehadeh

King Hussein Cancer Center

Soft Tissue Sarcoma Abutting/Invading The Bone, a proposed guideline for surgical management

Aim of the study: To formulate a guideline for surgical management of soft tissue sarcoma abutting the bone.

Background: The incidence, surgical treatment and effect on overall survival and recurrence of bone invading/ abutting soft tissue sarcoma, still poorly described in the literature. bone.

Material / Methods: From 2006, 252 patients treated with wide local/compartment resection, at KHCC. Fifty five patients (20%) the tumor were attached to the bone. Patients divided into 3 groups: Group 1: bone abutment only (n=30) Group 2: cortical invasion (n=13) Group 3: either medullary canal invasion or total encasement of bone (n=12) Patients in group 1 received tumor subperiosteal resection , group 2 received hemicortical resection, and group 3 received segmental bone resection.

Results: At mean follow up of 56 month (16-78mo),8 patients died of disease metastasis,4 patients developed local recurrence at the soft tissue, all of them the pathology of the resection show negative margin, 2 from group 1, and 2 from group 2.Two patients had radiation related femur fracture.Six out of the 13 patients with bone invasion on MRI , found to have bone invasion in histopathology exam.5 yr. EFS = 53% and 5 yr. OS = 76%

Conclusion: This is a small group retrospective pilot study; the results show that STS abutting bone probably do not lead to worse outcome. Our proposed guideline for surgical management of different scenarios of soft tissue tumor with adjacent bone abutment/invasion can be the basis for objective mean to plan the management of this subtype of soft tissue sarcoma. Larger size study is needed to expand this guideline.

Edoardo Ipponi, Martina Cordoni, Elena Bechini, Fabrizia Gentili, Rodolfo Capanna, Lorenzo Andreani

University of Pisa – Department of Orthopedics and Trauma Surgery

Myxoid liposarcomas of the thigh: prognostic factors, oncological outcomes and functional results In a single institution experience

Aim of the study: Evaluation of resecion margins and lesion's size as prognostic factors

Introduction: Myxoid liposarcomas are malignant soft tissue tumors. Orthopedic surgeons must remove lesions with the widest margins possible while preserving all the noble vascular and nervous structures in the area to preserve the thigh's postoperative functionality.

Methods: We evaluated all the myxoid liposarcomas of the tight we treated between 2015 and 2021. Resection margins, complications, local recurrences, and metastases were recorded. We evaluated the oncological outcomes of each case. The Functionality was assessed with MSTS scores before and after surgery.

Results: Thirty cases were included in our study: 20 low-grade and 10 high-gade myxoid. The mean larger diameter was 11.8cm. Resection margins were wide 24 cases (80%) and marginal in 6 cases (20%). The mean follow-up was 47.5 months. Six cases (20%) had post-operative complications (seromas, superficial infections, wound dehiscence, dysesthesia). Five cases, 1 high-grade and 4 low-grades, were diagnosed with a local recurrence (17%). Marginal resections were associated with a higher risk of local recurrences (p=0.041). Four cases (13%) developed metastases. At their latest follow-up, 20 cases (67%) were CDF. CDF patients had a significantly shorter lesions compared to other patients (p=0.048). At the patients' latest follow-up, their mean MSTS score had risen from 22.9 to 27.3.

Conclusions: When approaching myxoid liposarcomas, the size of the neoplasm should be evaluated as a prognostic factor. Wide margins of resection also represent a pivotal factor in determining the local success of surgical treatment.

Kumaran Rasappan, William Beedham, Micheal Parry, Guy Morris, Lee Jeys, Rajesh Botchu, Vineet Kurisunkal

Royal Orthopaedic Hospital, Birmingham, UK

Does local recurrence of soft tissue sarcomas occur at the site with the closest primary surgical resection margin?

Aim of the study: To find out whether re-resection of cases with involved or close margins in soft tissue sarcomas makes any difference in oncological outcomes.

Introduction: Surgeons are often left with a difficult decision whether to re-resect soft tissue sarcomas (STS) with a involved or close margin post primary resection. However, not much evidence exists if it makes any difference in outcomes by doing so. In this study, we hypothesize that location of the narrowest margin in STS resection specimens does not influence location of future local recurrence (LR) and thus re-resecting wound beds with narrow or involved margins in not required.

Methods: This retrospective study evaluated patients with STS who were surgically treated at a single institution over the last 22 years, with at least two years of follow-up. Data such as post-operative margins and location of narrowest margin, tumor type/grade, neoadjuvant / adjuvant therapy, LR, LR-free survival, and metastasis will be collected and analyzed.

Results and Conclusions: Eighty four patients with STS with local recurrence are being included in our study. We have completed the systematic search and are now in the process of analyzing our data. The preliminary results so far have been interesting but our final results and conclusion will be available and presented during the conference. This paper will give an answer whether re-resection of cases with involved or close margins in STS makes any difference in oncological outcomes.

Hao Wang, Yi Luo, Yong Zhou, Li Min, Chongqi Tu

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Prognostic value of the lung immune prognostic index in soft tissue sarcoma patients treated with immunotherapy: a retrospective study

Aim of the study: The purpose of this study is to assess the efficacy of the Lung Immune Prognostic Index (LIPI) as a clinical prognostic tool for predicting survival rates in STS patients undergoing immunotherapy

Background: Soft tissue sarcoma (STS) presents challenges with limited therapeutic advancements and bleak prognoses, especially in cases of metastasis or recurrence. The Lung Immune Prognostic Index (LIPI), combining pretreatment derived neutrophil-to-lymphocyte ratio (dNLR) and lactate dehydrogenase (LDH), has shown potential in predicting outcomes across cancers but remains underexplored in STS.

Methods: A retrospective study was conducted on 50 STS patients undergoing immunotherapy at Sichuan University's West China Hospital. Clinical parameters including dNLR, LDH, LIPI, and combined positive score (CPS) for PD-L1 expression were examined. Prognostic significance was assessed using predetermined cutoffs: 3 for dNLR, 165 for LDH, and 1 for CPS. Patients were categorized into three LIPI groups: good (dNLR < 3 and LDH < 165), moderate (dNLR ≥ 3 or LDH ≥ 165), and poor (dNLR ≥ 3 and LDH ≥ 165).

Results: The study involved 50 STS patients (mean age 43 years ± 12, with 23 male and 27 female participants). Before immunotherapy, all patients had a biopsy confirming diagnosis, with undifferentiated sarcoma (40%), synovial sarcoma (28%), dedifferentiated liposarcoma (14%), and epithelioid sarcoma (8%) being the most common types. LIPI emerged as an independent prognostic indicator, outperforming dNLR and LDH in predicting 1.5-year and longer survival. LIPI exhibited strong prognostic value in synovial sarcoma. A nomogram integrating clinical features with LIPI predicted overall survival with a C-index of 0.797.

Conclusion: LIPI, as a composite index, outperforms individual biomarkers in predicting survival in STS patients undergoing immunotherapy, suggesting its potential as a clinical prognostic tool in this cohort.

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Indications and clinical outcome in patients with soft-tissue sarcoma receiving prosthetic replacement after tumor resection

Aim of the study: The aim of this study was to analyze the indications and results of bone resection and endoprosthetic reconstruction in soft tissue sarcomas.

Methods: Twelve patients (5 women, median age 49 years) who underwent endoprosthetic reconstruction due to soft tissue sarcoma between 2010 and 2021 were analyzed retrospectively. While the most common localization was the thigh (66%), the most common diagnosis was myxofibrosarcoma (33%). The most common indication in patients undergoing bone resection was close relationship of the tumor with the bone (n = 6). A total of 3 patients had a history of R1 resection. The most common proximal femoral endoprosthesis (33%) was applied. Two patients were amputated during follow-up.

Results: Eight patients (66%) had no evidence of disease at the last follow-up examination (median 62 months), while 4 patients died in an average of 14 months. The fact that the tumor was located in the thigh, the presence of metastasis at the time of diagnosis, a history of R1 resection, the diagnosis being myxofibrosarcoma, the presence of bone infiltration, CT (Chemotherapy)+ILP(Isolated limb Perfusion) treatment and in-domo biopsy did not significantly affect the recurrence and survival of the patient. A history of R1 resection was significantly negative prognostic in terms of prosthesis survival ($p<0.045$).

Conclusions: In bone-associated soft tissue sarcomas, wide resection and endoprosthetic reconstruction is a recommendable option with good oncological results and acceptale complication rate. The most common indication is close relationship of the tumor to the bone. The presence of bone infiltration does not increase the risk of local recurrence. Unplanned intralesional interventions significantly reduce limb survival.

Osman Emre Aycan, Abdülbaki Kurt, Muhammet Coşkun Arslan, Avni Murat Sobayapan

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Atypical lipomas of the extremity: How consistent are they radiologically and histopathologically? Is the surgical margin crucial?

Aim of the study: The aim of our study is to determine the radiological and histopathological concordance and evaluate the outcome of our treatment in atypical lipomas of the extremities based on the results.

Patients and Methods: A retrospective evaluation of 42 patients who underwent surgery for a primary diagnosis of atypical lipoma at our clinic between 2011 and 2021. Patients with less than 2-year follow-up and insufficient radiological and histopathological data were excluded. 37 patients were evaluated. Lesion depth, tumor size, the

number of septa observed on MRI, neurovascular proximity, and stage were assessed. Surgical margin, subtype, MDM2 and CDK4 were also evaluated. Follow-up and MSTS were assessed. In recurrent lesions time to recurrence, risk factors and average recurrence-free-survival were calculated

Results: The mean age was 55.5 (20-80), and the median follow-up was 28 months. The mean tumor size was 579.6cc (28.8-2483.3), and the most commonly affected region was the thigh (n=20). Resection diagnosis confirmed atypical lipoma in 20 patients with >5 septations observed on MRI. Nineteen lesions had proximity to neurovascular bundle. According to AJCC classification, 35 lesions were type 2a, and 2 were type 2b. The 10-year LRFS rate was 82%. Residual tumor after resection was found in 46% of cases. MDM-2(+) was identified as a negative prognostic factor. Positive surgical margins were found in 4 patients however no recurrence was observed. The mean MSTS was 25.3 (22-30).

Conclusions: The absence of septae on MRI does not always represent lipoma. Neurovascular bundle sacrifications and extensive muscle resections are not necessary in atypical lipomas. Re-excision after unplanned surgery is not always mandatory.

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Angiosarcoma: Overall survival and prognostic factors. A long-term population based follow-up study

Aim of the study: To make a long-term population-based evaluation of overall survival, risk of local recurrence, risk of metastasis, and defining prognostic factors in patients with newly diagnosed angiosarcoma.

Introduction: Angiosarcoma (AS) is a soft tissue sarcoma with low awareness and lack of evidence-based recommendations.

Purpose: To identify AS prognostic factors in a nationwide cohort of in order to support treatment guidelines

Methods: By National Registries, all patients with newly diagnosed angiosarcoma in Denmark between Januar 1, 2000 and December 31, 2017 were included. Kaplan-Meier survival analysis was used for evaluation of overall survival (OS). Competing risk analysis was used to assess cumulative incidence of recurrence and metastasis. Cox models were created to identify factors associated with OS. Patients were followed until death or end of study (January 1, 2023) resulting in a minimum follow-up of 6 years.

Results: We included n=173 patients with a mean age of 66 (22-95) years (F/M=109/64). Overall 5-year survival was 26% (95%CI: 19%-33%). Cumulative incidence of local recurrence and metastasis at 5 year was 28% (95%CI: 21%-35%) metastasis was 42%(95%CI: 35%-50%) after 5 respectively. Age>60, metastasis, deep seated soft tissue tumors were independent associated with worse OS. Cutaneous tumors, surgery and negative resection margin were independent associated with improved OS. Our long-term results from a population-based cohort with complete follow-up, confirmed severe aggressive behavior of AS. No difference in OS between primary and secondary AS was found. The risk of metastasis was higher than recurrence. Cutaneous tumors without subcutaneous invasion was independent associated with improved OS. Adjuvant oncological treatment did not improve OS.

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Impact of anatomic presentation on prognosis of myxoid liposarcoma

Aim of the study: The prognosis of myxoid liposarcoma (MLS) according to anatomical presentation is not well understood. This study aimed to evaluate the association of anatomical presentation with oncologic outcomes in MLS.

We retrospectively reviewed data from 112 patients who underwent resection of localized MLS. Anatomic presentations were classified according to the tumor location on MRI; compartmental status based on Surgical Staging System and tumor location with regard to the muscle of origin. Anatomic presentations were superficial (n=14), intramuscular (n=23), intracompartmental intermuscular (n=33) and extracompartmental (n=23). Radiation therapy was administered in 52 patients, with large and high grade tumors. Median follow-up was 63 months. Local recurrence free survival (LRFS) were 85% at 5 years and 83% at 10 years. Intramuscular MLS had the lowest local recurrence rate (0%), followed by superficial (7.1%), intermuscular (9.1%) and extracompartmental MLS (44%). Metastasis free survival (MFS) were 83% at 5 years and decreased to 78% at 10 years. Intramuscular MLS had the lowest metastasis rate (4.4%), followed by superficial (14%), intermuscular (24%), and extracompartmental MLS (30%). Disease specific survival (DSS) were 94% at 5 years and 89% at 10 years. Factors influencing LRFS included microscopic margin, radiation therapy, and anatomic presentation. Factors influencing MFS and DSS included tumor size and FNCLCC grade. Anatomic presentation of MLS is associated with local control, with intramuscular MLS demonstrating excellent local control. Despite the recognized sensitivity of MLS to radiotherapy, our findings suggest size.

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Outcomes of extremity soft tissue and bone sarcomas with or without vascular intervention

Aim of the study: To assess amputation-free limb survival and overall patient survival, comparing patients with limb salvage procedures with vascular intervention, those without, and those who underwent limb amputations.

Background: The use of vascular reconstruction repair in treating extremity sarcomas is on the rise. However, the results of these procedures have seldom been documented.

Method: In a retrospective analysis conducted between 2012 and 2023 at two leading oncology centers in Riyadh, Saudi Arabia, we reviewed the medical records of 245 patients from an initial cohort of 306, selecting those who fulfilled our study's criteria. The focus was on assessing patient outcomes based on the type of treatment received: 200 patients underwent limb salvage without vascular intervention (LS group), 14 received limb salvage with vascular intervention (LSVR group), and 31 underwent primary amputations. The primary metrics evaluated in our study included limb survival, mortality rates, duration of hospital stay, and the frequency of re-operations.

Results: The mean follow-up times were 38.1 months (LSVR group), 25.3 months (LA group), and 27.5 months (LS group) in our study involving 245 participants. Osteosarcoma, Ewing sarcoma, Pleomorphic sarcoma, and other sarcomas constituted 38.7%, 13.5%, 10.2%, and 38.8%, respectively. Limb outcomes did not significantly differ between the groups ($p = 0.827$, log-rank test). The 5-year survival rates were 90% (LA group), 82.8% (LS group), and slightly lower at 78.6% (LSVR group), with no statistically significant variation ($P = 0.792$, log-rank test). Notably, 8 of the 14 LSVR patients required additional interventions, a notably higher rate than the LS group, where only 30 out of 200 (15%) needed further surgeries.

Viola Laghi[1], Paolo Spinnato[2], Erika Galietta[1], Costanza Maria Donati[1], Letizia Cavallini[1], Giuseppe Bianchi[3], Alberto Righi[4], Massimiliano De Paolis[5], Andrea Sambri[5], Annalisa Cortesi[6], Claudio Malizia[7], Davide Maria Donati[3], Alessio Giuseppe Morganti[1], Silvia Cammellli[1]

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Assessing the predictive role of volumetric changes in soft tissue sarcomas of the extremities following neoadjuvant radiotherapy

Introduction: To evaluate the radiological response of localized, high-grade, primary soft tissue sarcomas (STS) of the extremities treated with neoadjuvant radio(chemo)therapy, using RECIST, Choi criteria, and volumetric changes.

Methods: Fifty-nine patients with STS underwent pre-operative external beam radiotherapy (RT), receiving a median dose of 50 Gy. MRI scans of the affected region and chest TC +/- PET were performed before RT and after RT (before surgery), and during follow-up (FU). All MRIs were reviewed by a single radiologist specializing in musculoskeletal oncology, using semi-automatic software (Carestream Vue PACS c 12.2.6.2000019) for volume measurements.

Results: MRI scans were conducted at a median of 5.71 weeks before and 4.43 weeks after RT. The median percentage change in maximal tumor diameter was -12.50% (range -74.63% to +92.78%). According to RECIST and Choi criteria, partial response was seen in 20.34% and 55.93% of cases, stable disease in 71.90% and 27.12%, and progressive disease in 8.47% and 16.95%, respectively. Tumor volume decreased in 43 out of 59 patients, with a median change of -32.00% (range from +415% to -99.00%). The log-rank test revealed that radiological responses evaluated by RECIST, Choi criteria, and volume changes did not significantly impact 5-year local control, distant metastasis-free survival, disease-free survival, or overall survival.

Conclusions: Our analysis indicates that neither RECIST and Choi criteria nor volumetric changes effectively predict oncological outcomes. This suggests the necessity for exploring additional parameters or predictive models that could more accurately forecast treatment response and patient prognosis in soft tissue sarcomas of the extremities following neoadjuvant radio(chemo)therapy.

SESSION 3:

REHABILITATION IN MUSCULOSKELETAL ONCOLOGY

CHAIRS: Lorenzo Andreani (Italy), Lauris Repsa (Latvia)

Lorenzo Andreani, Edoardo Ipponi, Federico Falcinelli, Sara Barderi, Francesco Rosario Campo, Antonio D'Arienzo, Paolo Domenico Parchi

University of Pisa – Department of Orthopedics and Trauma Surgery

Distal femur megaprostheses in orthopedic oncology: A single-institution experience with a standardized rehabilitation protocol

Aim of the study: Evaluate the effectiveness of a standardized post-operative protocol in terms of rehabilitation milestones and final functionality in oncologic cases treated with distal femur megaprosthesis

Introduction: Megaprostheses are the most used reconstructive approach for patients who have undergone massive resection of their distal femurs due to bone tumors. Although the literature about their outcomes has flourished in recent decades, to date, a consensus on rehabilitative treatment is yet to be established. In this study, we report on our experience with our latest standardized rehabilitation program, evaluating our results in a mid-to-long-term scenario.

Methods: We evaluated the functional results of all our oncologic patients treated between 2016 and 2022 who could follow our standardized post-operative rehabilitative approach, consisting of progressive knee mobilization and early weight-bearing.

Results: Sixteen cases were included in our study. The average duration of the patients' hospitalization was 12.2 days. A standing position was reached on average 4.1 days after surgery, while assisted walking was started 4.5 days after surgery. After a mean post-operative follow-up of 46.7 months, our patients' mean MSTS score was 23.2 (10-30). Our data suggest that the sooner patients could achieve a standing position ($p = 0.012$) and start walking ($p = 0.010$), the better their final functional outcomes regarding their MSTS scores.

Conclusions: Rehabilitation should be considered a pivotal factor in decreeing the success of distal femur megaprosthetic implants in long-surviving oncologic patients. Correct rehabilitation, focused on early mobilization and progressive weight-bearing, is crucial to maximizing the post-operative functional outcomes of these patients. We have no conflict of interest to declare.

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Proximal femur reconstructions after primary bone tumor resections: analysis of failures and functional outcomes of megaprosthesis and allograft prosthesis composites

Aim of the study: To analyse outcomes after proximal femur reconstructions with megaprosthesis or allograft prosthesis composite

Introduction: Proximal femur reconstruction after primary bone tumour resection is challenging and usually performed using titanium mega prosthesis. In young patients, an Allograft prosthesis composite (APC) can be used in place of metal. The aim of this study was to evaluate complications and functional outcomes following reconstructing proximal femur.

Methods: Patients with a proximal femur reconstruction from 1994 to 2022 were included in the study when a minimum 12-month follow-up was available. Outcomes were evaluated using Henderson Classification to define reconstruction failures and Musculoskeletal Tumour Society score (MSTS score) and Harris Hip Score (HHS) for

functional results. Many predictive factors were included in the analysis including type of reconstruction, diagnosis, previous pathological fracture, use of cement and joint coupling.

Results: 80 patients fulfilled the inclusion criteria. APC and megaprosthesis groups were comparable. HHS and MSTS scores were satisfactory for both groups, with no statistically significant differences (80/100 and 22/30 respectively). Implants survival was 77% at 5 years, 59% and 42% at 10 and 15 years. No differences in survival rates were found on Kaplan meier univariate analysis considering the studied predictive factors. Surprisingly, in multivariate analysis, Megaprosthesis were found to have an increased risk of failure compared to APC (HR: 3,4 CI 95%: 1,3-9,4). Prosthesis dislocation was the main reason for failure, with a 10% incidence.

Conclusions: In very young patients, APC are still an important option to consider when reconstructing proximal femur.

Edoardo Ipponi, Federico Falcinelli, Martina Cordoni, Elena Bechini, Fabrizia Gentili, Lorenzo Andreani

Univeristy of Pisa – Department of Orthopedics and Trauma Surgery

Proximal femur megaprostheses in orthopedic oncology: Evaluation of a standardized post-operative rehabilitation protocol

Aim of the study: The evaluation of rehabilitation milestones and post-operative overall functionality in oncologic patients treated with proximal femur megaprosthesis.

Introduction: The reconstructions of the proximal femur after massive resections represent one of the main challenges in orthopedic oncology. Among the possible treatments, megaprostheses represent one of the most used and reliable reconstructive approaches. Although literature about their outcomes has flourished through the last decades, a consensus on rehabilitative treatment still needs to be established.

Materials: We evaluated the functional results of all our oncologic cases treated between 2016 and 2022 that could follow our standardized post-operative rehabilitative approach, consisting of progressive hip mobilization and early weight bearing.

Reults: Twenty-two cases were included in our study. On average, their hospitalization lasted 15.1 days. The seated position was achieved on average within 3.7 days after surgery, the standing position reached 5.4 after surgery and assisted walking started 6.4 days after surgery. After a mean post-operative follow-up of 44.0 months, our patients' mean MSTS score was 23.2 (10-30). Our data suggested a statistically significant inverse linear correlation between post-operative functionality and patients' age, resection length, and the start walking.

Conclusions: A a correct rehabilitation focused on early mobilization and progressive weight bearing is crucial to maximize patients' post-operative functional outcomes. We have no conflict of interest to declare.

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Explaining needs for rehabilitation in patients with bone sarcoma and a megaprosthesis: a qualitative, grounded theory study

Aim of the study: To explain the needs for rehabilitation of patients with bone sarcoma before and after surgical resection and reconstruction with megaprosthesis.

Background: Patients with bone sarcoma who underwent surgical resection and reconstruction with megaprosthesis usually receive rehabilitation services for optimal recovery. Rehabilitation can be very complex due to the physical impact of the medical treatment and heterogeneity in patients. What patients need in this rehabilitation pro-

cess is unknown. Understanding needs regarding rehabilitation can help healthcare professionals to provide personalized care.

Methods: We performed a qualitative study following constructivist grounded theory principles. Data were collected using semi-structured interviews and analyzed with grounded theory data-analysis. Ultimately, a conceptual model was created.

Results: Thirteen participants were interviewed between March and May 2023. Patients were treated for osteosarcoma, chondrosarcoma, angiosarcoma, and metastasis. The locations of the tumor were either in the proximal humerus, pelvis, proximal femur, distal femur or proximal tibia and all patients received a megaprosthesis after resection of the tumor. Seven theoretical codes were found. The first is the need to achieve a new normal; being able to function with their medical history and megaprosthesis in a new normal life. Two key values patients needed were being understood and being prepared. Four important conditions that patients needed were: optimal conditions for rehabilitation, a trustworthy physical therapist, a clear closure from rehabilitation, and access to expertise in the hospital. The core concept was achieving a new normal.

Conclusions: Patients with bone sarcoma need rehabilitation to achieve a new normal life. With the understanding of needs regarding rehabilitation now gained, the care for patients with bone sarcoma should be better tailored.

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Changes in Health-Related Quality of life following surgery in patients with high-grade extremity soft-tissue sarcoma: a prospective longitudinal study

Aim of the study: This study assesses HRQoL from time of diagnosis to one year thereafter among adults and elderly with eSTS.

Changes in health-related quality of life (HRQoL) during the diagnostic and treatment trajectory of high-grade extremity soft-tissue sarcoma (eSTS) has been rarely investigated for adults (18-65y) and elderly (aged≥65y), despite potential variation in challenges from diverse levels of physical, social, or work-related activities. This study assesses HRQoL from time of diagnosis to one year thereafter among adults and elderly with eSTS.

Methods: HRQoL of participants from the VALUE-PERSARC trial (n=97) was assessed at diagnosis and 3, 6 and 12 months thereafter, utilizing the PROMIS Global Health (GH), PROMIS Physical Function (PF) and EQ-5D-5L.

Results: Over time, similar patterns were observed in all HRQoL measures, i.e., lower HRQoL scores than the Dutch population at baseline (PROMIS-PF: 46.8, PROMIS GH-Mental: 47.3, GH-Physical: 46.2, EQ-5D-5L: 0.76, EQ-VAS: 72.6), decrease at 3 months, followed by an upward trend to reach similar scores as the general population at 12 months (PROMIS-PF: 49.9, PROMIS GH-Physical: 50.1, EQ-5D-5L: 0.84, EQ-VAS: 81.5) except for the PROMIS GH-Mental (47.5), where scores remained lower than the general population (T=50), although not clinically relevant. Except for the PROMIS-PF, no age-related differences were observed.

Conclusion: On average, eSTS patients recover physically well from surgery, yet the mental component showed no progression, irrespective of age. These results underscore the importance of comprehensive care also addressing mental health.

SESSION 4:

LIMB SALVAGE IN CHILDREN AND ADOLESCENTS

CHAIRS: Domenico Campanacci (Italy), Bartosz Pachuta (Poland)

Bartłomiej Kowalczyk

University Children's Hospital of Kraków, Poland

Local control of limb malignancies in the paediatric population – the art of doubts

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Proximal femur reconstruction in young children: a critical look at vascularised fibular graft outcomes

Aim of the study: To evaluate the long-term results of using composite vascularized fibula grafts for proximal femur reconstruction in children under six years old.

Introduction: Reconstructing lower-limb periarticular defects in skeletally immature patients after malignant tumor resection presents a unique challenge, particularly in the youngest group due to their small anatomy and the need to restore joint function while preserving growth potential. We provide a detailed analysis of composite vascularized fibula grafts (CVFG) for proximal femur reconstruction in pediatric patients focusing on the long-term outcome.

Methods Five patients aged 4-6 years, who underwent proximal femur resection for malignant bone tumors, were retrospectively studied. They received a treatment combining ipsilateral vascularized fibular head autograft and massive bone allograft, following Manfrini's 2003 technique. Demographics, outcomes, and complications were analyzed, alongside comparative data from similar successful cases.

Results: The first case, following a 22-year follow-up, demonstrated favorable clinical and radiographic evolution with growth and remodeling of the fibula. However, with a minimum follow-up of 15 years, the other four cases encountered complications leading to failure of the primary reconstruction. These include fibular head necrosis, hip septic arthritis, and a stiff hip leading to early secondary osteoarthritis. The mean CVFG survival was 18 months. Despite graft failures, oncological local control remained excellent in all five cases.

Conclusions: Reconstructing the proximal femur in children younger than six using CVFG is a delicate and complex procedure. It carries the potential for complications and graft failures. This study brings attention to the careful consideration required before embracing this procedure broadly, given its technical complexity and the intensive rehabilitation that follows.

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Management of complications and secondary deformities after proximal femur replacement in skeletally immature patients

Aim of the study: We report the incidence, probable cause and management of pediatric complications and deformities after proximal femur replacement.

Retrospective analysis of 14 patients who underwent primary or revision operation with a proximal femur replacement between 2018 and 2022. Mean patient age was 9.1 years (range 4-17 years) and mean resection length 176mm. Eighteen revision operations were performed. Hip dislocation occurred most frequently (n=9/18; 50%). Four dislocations occurred without an underlying deformity. Secondary hip dysplasia was identified in 58.3% (n=7/12) of intraarticular resections, leading to dislocation in 71.4% (n=5/7). Attachment tubes were used in 50% (n=7/14) patients and 42.9% (n=3/7) with secondary hip dysplasia. A genu valgum deformity was observed in 41.6% (n=5/12). The incidence of combined hip dysplasia and genu valgum was 42.9% (n=3/7). Triple pelvic osteotomy led to rebound hip dysplasia in two cases (patients aged <10 years), whereas acetabular socket replacement led to stable hip joints over the course of follow-up. Temporary hemiepiphyseodesis was performed to address secondary genu valgum. One case each of periprosthetic fracture and torn power cord in a motorized growing prosthesis were reported. Stress shielding was observed in 71.4%.

Patients aged <10 years were prone to develop secondary hip dysplasia and genu valgum following proximal femur replacement in this cohort. Management of secondary deformities should depend on remaining skeletal growth. Stress shielding was observed in almost all skeletally immature patients.

Bartosz Pachuta, Iwona Malesza, Krzysztof Bronowicki, Tomasz Walenta, Wojciech Jasica, Agnieszka Szymborska, Anna Raciborska

Mother and Child Institute

Reconstruction techniques after resection of musculoskeletal tumors in children under 5 years of age

Aim of the study: In the Department of Surgical Oncology, between 2015 and 2023, we operated on 326 children with primary malignant bone tumors. In this group, 24 children were under 5 years of age. Ewing's sarcoma was diagnosed in 21 patients, and osteosarcoma in 3.

Primary malignant bone tumors (PMBT) and soft tissue sarcomas (STS) often pose a great challenge both in the context of radical resection and reconstruction particularly in young children. Currently, reconstruction techniques are divided into two large groups. The first is post-resection implants, divided into numerous subtypes. The second is a reconstruction using grafts, including vascularized ones. Both techniques are not competitive procedures, and the indications for their applications are precisely defined. While surgical decisions in older patients are not questionable, in the youngest patients are a subject of discussion. Between 2015 and 2023, we operated on 326 children with primary malignant bone tumors. In this group, 24 children were under 5 years of age. Ewing's sarcoma was diagnosed in 21 patients, and osteosarcoma in 3. All patients received neoadjuvant and adjuvant chemotherapy. 6 of 24 had an axial tumor. One patient had radiation therapy only due to the many bone metastases. Conservation procedures were performed using post-resection endoprostheses in 16 pts. Only one patient was reconstructed with a vascularized bone graft. There were no surgical complications that could lead to amputation. All patients continued adjuvant CHT post-surgery. 18 patients are alive, and 6 patients died due to the progression of the disease. 17 of 18 alive patients are ambulatory without crutches. Modern methods of reconstructive treatment enable the achievement of excellent functional results. Patients after extensive resections using optimal surgical and rehabilitation treatment methods can achieve good functional outcomes, which is documented in the video material.

Iwona Malesza, Katarzyna Bilska, Krzysztof Bronowicki, Anna Raciborska

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Challenges in the management of childhood malignant chest tumors.

Aim of the study: This study aimed to evaluate clinical outcomes for patients with chest wall sarcomas.

The paper discusses experiences regarding the resection and reconstruction of malignant lesions of the chest wall in pediatric patients treated at IMID. Between 2010-2023 46 patients with malignant lesions of the chest wall were treated in the Department of Oncology and Surgical Oncology for Children and Youth. The chest wall lesions were assessed as primary tumors in 39 patients. Seven patients had metastases to the chest wall. .Among the treated patients the diagnosis was: Ewing sarcoma 31, Osteosarcoma 6, Chondrosarcoma 1, Rhabdomyosarcoma 3, Malignant Peripheral Nerve Sheath Tumor 1, and other sarcomas 4. Age at diagnosis was 2 months to 18 years of age. The mean age at the beginning of the treatment was 12.35 years. Surgical treatment was conducted in 44 cases. In 45 cases oncological treatment was performed (chemotherapy, radiotherapy, or both of them).27 pts alive, 9 patients no data and 10 patients died from the disease. Crucial surgical complications were not obsereved. Conclusion: Radical resection is important component of treatment. Initial treatment with chemotherapy, may facilitate resection by decreasing the size of the tumor and its vascularity.

Zhuangzhuang Li, Minxun Lu, Yitian Wang, Yi Luo, Yong Zhou, Li Min, Chongqi Tu

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Three-dimensional printed customized uncemented unipolar prosthesis combined with ligament reconstruction for tumorous defect of the distal emur in children

Aim of the study: This study aimed to describe uncemented unipolar prosthesis design and assess the short-term outcomes of this refined prosthetic hemiarthroplasty.

Introduction: Hemiarthroplasty following tumor resection of the distal femur in children provides a chance to preserve the proximal tibial physis for limb elongation. Based on 3D printing technology, the uncemented unipolar prosthesis with joint stability reinforced structure (JSRS) was custom-designed for our cases. This study was to describe the design and assess the short-term outcomes of this refined prosthetic hemiarthroplasty.

Methods: Seven patients (four females and three males) received 3D-printed customized uncemented unipolar prosthesis for hemiarthroplasty after removal of the distal femur, from September 2019 to October 2020 at our Orthopedics department. The limb function, growth of the preserved proximal tibial physis, joint stability, and limb length discrepancy (LLD) were assessed. Complications were recorded.

Results: Six patients survived with no evidence of metastasis or local recurrence at the last follow-up, and one patient died of lung metastasis at 19 months postoperatively. Elongation of the tibia was observed in all cases. At the last follow-up, four patients exhibited equal growth length compared with the healthy contralateral tibia. LLD ranged from 0.8 to 1.6 cm with a mean of 1.3 cm. All patients achieved satisfactory postoperative limb function with a mean MSTS score of 25.8.

Conclusions: 3D-printed customized uncemented unipolar prosthesis with JSRS would be a good choice for reconstructing tumorous defect in the distal femur in children.

Rebecca O'Keeffe

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Juvenile Tumour Systems: A modified Delphi study to develop best practice guidelines

Non-invasive growing (NIG) implants have been used for paediatric sarcoma patients for approximately 20 years and have been shown to have reduced post-operative complications compared to the previously used minimally invasive growing implants. The predominant NIG implant in use in the UK is the Onkos Surgical Juvenile Tumour Systems implant. Despite its extensive use across the UK there are no best practice guidelines for clinicians. Earlier benchmarking demonstrated that all services in the UK are offering a different service. A modified-delphi study has been designed to gain consensus on best practice across the UK. Professionals have been identified through existing sarcoma networks and invited to participate via email. The consensus will be completed in 4 phases including consensus questionnaires and web conferences. Consensus will be achieved if >70% of responses are marked 'Agree' or 'Strongly Agree', items that do not meet consensus will be discussed further in web conferences before being rescored in future questionnaires. Areas to be discussed within the consensus include: – Long leg X-ray frequency – Appointment frequency – Maximum length per session - Managing a difficult motor The study is ongoing and predicted to be completed in February 2024. By developing the consensus guidelines this will improve equity of service, the patient pathway and monitoring for paediatric patients with NIG implants. It will also provide standards that services can be audited against to allow for future service development. A secondary outcome will be improved networking between sarcoma centres in the UK treating paediatric patients.

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Outcomes of non-invasive expandable endoprostheses for malignant bone tumors in skeletally-immature patients: Can dummy-prosthesis be a good surgical alternative?

Aim of the study: In this study, it was planned to investigate the effect of using a placeholder "dummy" of the same size as the motor in the first surgery in expandable prostheses on the management of these cases.

Methods: The data of a total of 30 patients, with an average age of 9.7 years, who underwent reconstruction with expandable prosthesis between 2010 and 2023, were analyzed retrospectively. While the prosthesis was applied with a motor in 9 patients (group I), a dummy-prosthesis was used in the first surgery in 21 patients. A motor was implanted in 8 of these cases at an average of 52 months (group II). In 4 of these surgeries, motor implantation was during complication surgery. Thirteen cases are still under follow-up with dummy (group III).

Results: The mean follow-up periods of groups were 45, 104 and 27 months, respectively. A total of 7 and 5 cases in groups 1 and 2 had an average lengthening of 3 and 6 cm, respectively. Surgery was performed due to 3 (33%) (mechanical), 6 (%75) (3 mechanical, 3 infection) and 4 (31%) (mechanical) complications in the groups, respectively.

Conclusions: The addition of motors to some of the complicated dummy cases during revision and the much longer follow-up period of Group 2 seem to have made the complication rate of this group relatively high. The use of dummy at index surgery seems to have similar extension success as the use of a direct motor, and it has the advantage of ensuring that an expensive motor can be used only when needed.

Axel Horsch, Burkhard Lehner

Heidelberg University Hospital

Systematic review of extraosseous Ewing sarcoma in pediatric patients

Introduction: This study aims to comprehensively analyze the prevalence, clinical characteristics, and outcomes of young patients with extraosseous Ewing sarcoma (EES). The hypothesis tests the detailed aspects of EES in a pediatric and adolescent population.

Methods: We reviewed literature from PubMed, Scopus, Web of Science, and Google Scholar, focusing on EES in individuals under 21 years. Our primary objective was to assess the incidence of EES in this age group. Secondary objectives included examining demographic and tumor characteristics, and clinical outcomes. Data were quantified as effect size (ES) with 95% confidence intervals (CI).

Results: From 29 studies, childhood EES occurrence was noted in 24 studies [ES = 30%; 95%CI: 29–31%], with five studies reporting extraosseous manifestations [ES = 22%; 95%CI: 13–31%]. The thorax emerged as the most frequent site [33%; 95%CI: 20–46%], followed by extremities [31%; 95%CI: 22–40%]. Treatment commonly involved concurrent chemotherapy and radiotherapy [57%; 95%CI: 25–84%]. The rate of no evidence of disease and 5-year survival stood at 69%, while mortality was observed in 29% of cases. Recurrence and secondary metastasis were reported in 35% and 16% of cases, respectively.

Conclusions: The study highlights significant insights into the clinical presentation and prognosis of EES in children and adolescents, emphasizing the need for focused clinical management and research in this demographic.

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Revision of expandable prostheses

SESSION 5:

SURGERY OF THE UPPER LIMB – PROXIMAL AND PERIPHERAL TUMORS

CHAIRS: Arne Streitbürger (Germany), Pietro Ruggieri (Italy)

Giulia Trovarelli, Elisa Pala, Mariachiara Cerchiaro, Alberto Crimi, Andrea Angelini, Pietro Ruggieri

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Modular Reverse Total Shoulder Arthroplasty (RTSA) after tumor resection: results of 54 patients treated in a single Centre

Aim of the study: The study aimed to evaluate results after proximal humerus resection and reconstruction with the HRP system (Exactech) compared to Mutars prosthesis.

Introduction. Modular RTSA after proximal humerus resection provides excellent functional results with a low incidence of complications. The most frequent complication is dislocation, occurring in over 25% of cases. Since April 2022, the HRP system (Exactech) has been available in Europe. The study aimed to evaluate results after proximal humerus resection and reconstruction with the HRP system (Exactech) compared to Mutars prosthesis.

Methods. From January 2011 to December 2023, we treated 54 patients with modular RTSA: 41 silver-coated MUTARS® prostheses (20 press-fit, 21 cemented) and 13 cemented HRP Exactech prostheses. There were 30 women and 24 men with a mean age of 58 (12-77 yrs). RTSA was implanted after proximal humerus resection for sarcomas or metastases (48) or as revision procedures (6). Navigation was used for the glenoid component implant in 7 cases. Complications and functional results were evaluated.

Results. 19 complications occurred in 15 patients. The most frequent was dislocation, occurring in 32% (13) of MUTARS and 16% (2) of Exactech prostheses. There were also poly wear and disconnection (Type I), 1 aseptic loosening (Type II), 2 periprosthetic fractures (Type III), and 1 infection (Type IV). The mean MSTS score was 26.

Conclusions. Reconstruction with modular RTSA after tumor resection achieved reasonable shoulder function. HRP system has 3 significant advantages: choosing the deltoid wrap with different proximal bodies, reattaching the deltoid muscle, and a distal ring component to reduce torsional forces applied to the stem. Moreover, navigation significantly improves glenoid implants, reducing the risk of dislocation.

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Proximal humeral endoprosthetic reconstruction: results from the MUTARS Orthopedic Registry Europe study (MORE)

Aim of the study: This study evaluates clinical outcomes of patients with MUTARS proximal humerus endoprostheses using data from MUTARS Orthopedic Registry Europe (MORE).

Introduction Tumor defects around the shoulder often need reconstruction with endoprostheses; either hemiarthroplasty(hemi), reversed(RSA) or anatomic total shoulder arthroplasty(TSA). This study evaluates clinical outcomes of patients with MUTARS proximal humerus endoprostheses using data from MUTARS Orthopedic Registry Europe (MORE).

Methods: We evaluated 84 proximal humeral reconstructions;49(58%) hemiarthroplasties, 30(36%) RSA and five(6%) TSAs. Median follow-up was 5.7 years(95%CI 4.2-7.2).

Results: Compared with hemiarthroplasty, (part of) the axillary nerve needed to be sacrificed more often inRSA (22% vs 4%), while rotator cuff refixation was less frequently possible (41 vs 77%) and median age was lower (43 vs 56 years). Main complications were dislocation (n=7,8%) and infection (n=12,14%) and were comparable between RSA and hemiarthroplasty. Eleven implants (13%) were revised, for mechanical complications (dislocation n=3, peri-prosthetic fracture n=2), and infection (n=6). The cumulative incidence of revision for mechanical complications at 2, 5, and 10 years was 4%, 7%, and 7%. For infection, these were 5%, 7%, and 10%. Compared with hemiarthroplasty, RSA offered superior anteflexion (78°[IQR56-90] vs 40°[25-50]) and abduction (72°[45-90] vs 33°[20-50]), while external rotation (16°[0-20] versus hemi 10°[0-30]) was comparable.

Conclusions: Proximal humerus reconstruction outcomes are satisfying, particularly in terms of mechanical failure. RSA seems to offer superior functional outcomes compared to hemi, despite more frequent sacrifices of the axillary nerve and rotator cuff in RSA.

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Salvage of the elbow using a custom-made component for complex revision of humerus prosthesis in orthopedic oncology: clinical outcome at 5 years mean follow-up

Aim of the study: The aim of our study was to review clinical outcome of humerus prosthesis with custom-made component to preserve the native elbow in case of minimal residual portion of the distal humerus.

Introduction: Revision of proximal humerus prosthesis may sometimes require conversion to a total humerus in case of insufficient residual bone stock of the distal humerus. Custom-made stems can preserve the native elbow avoiding total humerus replacement.

Methods: Three patients underwent proximal humerus reconstruction with a custom made stem from 2018 to 2020 for revision after failure for local recurrence in megaprosthesis in 2 cases and fracture of osteoarticular allograft

in 1 case. The custom-made implant was designed with a short intramedullary stem and two epicondylar flanges to obtain a combined intra and extramedullary fixation.

Results: Mean follow up was 61 months (min-max). Two patients developed a local recurrence. In one patient, the recurrence involved only the soft tissues, in the other, the extension pieces of the prosthesis had to be replaced to remove the recurrence. Mean functional score according to MSTS was 19, Mayo Elbow Score was excellent in all patients.

Conclusion: The use of a custom-made stem avoided the use of a total humerus prosthesis in these patients, with excellent functional elbow outcomes at the last follow-up. This technical solution can improve the quality of life in these patients in whom upper limb function is already compromised by poor shoulder active motion.

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Lipomatous tumors of the hand: A review and 15 patient case series

Aim of the study: This study aimed to review 15 cases of lipomatous tumors of the hand according to the clinical, radiological and therapeutic characteristics and surgical treatment's clinical and functional outcomes.

Methods: All cases of surgically treated lipomatous tumors of the hand between 2016 and 2022 were retrospectively reviewed. Data were collected on demographic characteristics and the diagnostic, immunohistochemical, therapeutic and postoperative clinical findings.

Results: The patients comprised 73% (n=4) females and 27% (n=11) males, with a median age of 54 at the time of surgery. The most common compartments where the tumor was located in the hand were thenar (n=5) and central (n=5). All patients were presented with a single, painless and enlarging mass in their hands. Magnetic resonance imaging showed the tumors to be hyperintense on T1- and hypointense on T2-weighted images. All patients had marginal excision of the tumor. Histologically, there were 14 lipomas, one angiolipoma and one spindle cell lipoma. The mean follow-up was 57 months (range, 29-96 months). There was no recurrence or need for secondary surgical intervention in any patient in this study.

Conclusions Lipomas rarely occur on the hand. Typically, they present as slow-growing masses that may develop symptoms. If the widest diameter of the tumor exceeds the widest diameter of the compartment in which it is measured on the same axis, it is more likely to cause cosmetic, functional and compression symptoms. Imaging techniques alone aid in pre-diagnosis, but the final diagnosis is made histopathologically. The main treatment is surgical excision.

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Tenosinovial giant cell tumor in the hand: Evaluation of recurrence risk factors in 45 cases

Aim of the study: This study investigated the clinical and epidemiological features of 45 patients who had localized giant cell tumors of tendon sheath excised, focusing on recurrence rates and the relationship between surgical margins.

Introduction: Tenosynovial giant cell tumor is a rare, benign neoplasm affecting synovium-lined joints, tendon sheaths, or bursae. The pathogenesis of giant cell tumors of tendon sheath (GCTTS) still remains unclear. Following ganglion cysts, GCTTS are the second most common soft tissue tumors in the hand region. This study aimed to investigate the clinical and epidemiological features of 45 patients who underwent excision of localized GCTTS, the recurrence rates, and reasons for recurrence.

Material and Methods: A retrospective assessment was conducted on 45 patients who underwent treatment for giant cell tumors of the tendon sheath in the hand. All procedures were performed by the same surgeon. The study involved a review of patient records, considering preoperative magnetic resonance imaging findings, physical examinations, patients' demographical features, tumor anatomical site, the association between neurovascular structures and bone, post-surgery recurrence, and complications.

Results: The study consists of 45 patients. Postoperatively, no complications were observed. In 37 of 45 patients with GCTTS, the mass was seen in the metacarpal region, and the volar region was the most frequently affected site. The recurrence rate and possible causes of recurrence were evaluated statistically. Recurrence was found to be higher in volarly located masses.

Conclusion: Effective outcomes in treating tenosynovial giant cell tumors, particularly with clear margins, are achieved through surgical excision. The crucial issue is the possibility of recurrence. When the recurrence has obtained, re-excision should be advised.

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Reconstruction of the proximal radius with 3D-printed personalized prosthesis after tumor resection

Aim of the study: We present the patients who underwent reconstruction of the proximal radius with 3D-printed personalized prosthesis after tumor resection, aiming to describe the prosthesis design and surgical technique and evaluate the clinical outcomes of this method.

Introduction: Giant cell tumor of bone (GCTB) (Campanacci III) or malignant tumors often necessitate intra-articular resection in the epiphyseal region of the proximal radius, presenting a challenging bone defect reconstruction. This study evaluates clinical outcomes following proximal radial resection through implantation of a 3D-printed personalized prosthesis.

Methods: From November 2018 to January 2021, nine patients underwent radial hemiarthroplasty with 3D-printed personalized prostheses post-tumor resection. Elbow flexion/extension and forearm supination/pronation range of motion (ROM) and strength were assessed. Pain was gauged using the visual analog scale (VAS). Functional outcomes were measured using the Mayo Elbow Performance Score (MEPS) and the Musculoskeletal Tumor Society (MSTS) scoring system.

Results: Patients were followed for 24 to 51 months, with a median of 35 months. No local recurrence or metastasis occurred during follow-up. The VAS score improved from a preoperative median of 5 points (range 4 to 7) to

1 point (range 0 to 2) at the last follow-up. MEPS averaged 88.5% (83 to 93), and MSTS scored 25.3 (24 to 27) at the last follow-up. No complications, including infection and aseptic loosening, were detected.

Conclusions: Implanting a 3D-printed personalized prosthesis after proximal radial resection demonstrated excellent short-term oncologic outcomes and postoperative function, offering a viable alternative for reconstructing proximal radial bone defects post-tumor resection.

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A pedicled latissimus dorsi flap: An example of limb salvage following chondrosarcoma recurrence around the shoulder

Aim of the study: The study aimed to describe a case of using a pedicled flap of the latissimus dorsi muscle to salvage a limb due to recurrence of chondrosarcoma around the shoulder

An 80-year-old patient underwent surgery in 2022 for resection of a tumor near the left end of the humerus bone and reverse post-resection endoprosthetic replacement of the left shoulder joint. After several months, there was a recurrence of the tumor with destruction of the soft tissues on the anterior surface of the shoulder. The aim of the study was to demonstrate one of the applications of this flap and the benefits of this method in patients with numerous comorbidities and eligible for palliative treatment. A skin incision was made along the lateral border of the latissimus dorsi muscle. The fascia was incised, and the muscle was elevated. Then, the muscle was cut from its attachments. In the second the tumor was resected with a margin of surrounding tissues. The flap was passed through and sutured into the surrounding tissues. The flap was covered with a split-thickness skin graft. The LD flap has broad applications in reconstructive surgery, both as a pedicled flap and as a free flap. In the described case, this method allowed for limb preservation, implant coverage, and wound healing. Moreover, the procedure was associated with fewer perioperative burdens than free flap reconstruction. The presented method is a viable alternative to amputation or limb disarticulation in patients eligible for palliative treatment. It enables limb preservation, significantly improving the patient's quality of life, while being less burdensome and carrying lower risks of complications than free flap reconstruction.

SESSION 6:

SURGERY OF THE LOWER LIMB – PROXIMAL AND PERIPHERAL TUMORS

CHAIRS: Richard E Evenhuis (The Netherlands), Radomir Czajka (Poland)

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Joint-sparing resection in lower limb salvage. How much to push the boundaries?

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Could a modular uncemented hollow stem that can be designed according to the remaining bone stock be a good opportunity to protect the adjacent joint?

Aim of the study: This study aimed to analyze the follow-up results of cases in which the adjacent joint was preserved using a custom-made short stem design in megaprosthesis applications due to bone sarcomas.

Methods: In this study, a total of 13 patients, with an average age of 9.6 years, who underwent endoprosthetic reconstruction with a custom-made unsemented, modular hollow stem component between 2017 and 2023, were retrospectively analyzed in terms of reconstruction survival, and complications. The most common diagnosis was Ewing‘s sarcoma (n=7), and the most common reconstruction was proximal femoral tumor prosthesis (n=6). Results: The hollow body was used distally in 10 of the megaprotheses, proximally in 1, and both proximally and distally in 2 of them. Two patients died within an average of 22 months. One patient underwent hip revision due to chronic joint subluxation. One patient underwent temporary hemiepiepiphysiodesis due to genu valgum. Two patients were operated on due to wound healing problems in the early postoperative period. The prosthesis of all patients who were followed up for an average of 34 months was preserved without any aseptic loosening or infection. However, tibial bowing and irregular gait along with partial consolidation were observed in 1 patient, and revision will be planned when growth prosess of patient completed. Eleven of 12 lower extremity cases could bear full weight without pain. Conclusions: In cases where the remaining bone stock after bone resection is insufficient, reconstruction with a patient-specific short hollow stem design appears to be a good alternative with high prosthesis survival and low revision rates in the short term follow-up.

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Subchondral bone defects after curettage and reconstruction of aggressive bone tumours: increased risk of osteoarthritis?

Aim of the study: Evaluation of the development of knee cartilage after the surgical treatment of subchondral bone tumors.

Introduction: Subchondral bone defects affect frequently also the subchondral bone lamella. The surgery could lead to focal degeneration of the cartilage. The aim of this study is to evaluate the development of the cartilage in the affected section of the knee joint.

Methods: Patients with local aggressive primary bone tumors involving the epiphysis of the distal femur or proximal tibia were included. The patients were followed up at regular intervals using MRI after surgery. The preoperative and postoperative imaging was used for evaluation.

Results: Of 26 patients, 21 (80.8%) had a giant cell tumor of bone, 3 a chondroblastoma (11.5%). The median follow-up time was 48 months (36 - 221 months) for all patients. In 17 cases (65.4%) the bone defect was reconstructed with bone cement, in 9 cases with allogenic cancellous bone. During the follow-up period, osteoarthritis developed in the affected compartment of the knee joint in 3 cases (11.5%) and focal chondropathy in 6 cases (23.1%). The thickness of the cartilage layer was comparable between the cement and spongiosa augmentation groups, however a greater reduction was observed in the cement augmentation group after 36 months (p=0.082). All cases of chondropathy occurred in in the cement group (p=0.008).

Conclusions: Bone tumors in the subchondral region of the knee joint influence the postoperative development of the articular cartilage. A decrease in cartilage thickness was observed postoperatively. Augmentation with cement led more frequently to the development of at least focal chondropathy.

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Cementless curved endoprosthesis stem for distal femoral reconstruction in a Chinese population: a combined anatomical & biomechanical study

Aim of the study: This study analyzed the biomechanical performance of the newly designed stem aimed at the identification of better operative strategy.

Background: Existing universal femoral stem designs may not suit anatomical variations in the Chinese population. To address this, we measured femurs from 96 healthy Chinese volunteers, proposing a cementless, curved, short endoprosthesis stem for distal femur reconstruction.

Methods: CT-scanning data from volunteers were used in Mimics software for segmental measurements of the femoral medullary cavity's radius of curvature (ROC). Four endoprosthetic models were created: A - distal tumor-resected femora + straight stem; B - distal tumor-resected femora + curved stem; C - distal tumor-resected femora + curved stem; D - distal tumor-resected femora + curved stem. Finite element analysis compared mechanical differences among models.

Results: Mean femoral ROC for Segments 1 to 5 was 724.5mm, 747.5mm, 1016.5mm, 1286.5mm, and 1128mm. Curved stems B, C, and D were designed with ROCs of 475mm, 700mm, and 1300mm, respectively. All models exhibited normal-like stress distribution on femurs. The biomimetic curved stem showed superior biomechanical performance, reducing femoral stress shielding and implant stress distribution compared to the straight stem.

Conclusions: The uncemented, curved, short stem with an appropriate ROC aligns with Chinese femoral canal morphology, offering better mechanical properties. Pending experimental support, this newly designed femoral stem holds promise for treating malignant femoral tumors in Chinese populations.

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Hip reconstruction using a customized intercalary prosthesis with the rhino horn-designed uncemented stem for ultrashort proximal femur segments following tumor resection: A combined biomechanical and clinical study

Aim of the study: The purpose of this study was to address the challenges associated with hip-preserved reconstruction in patients with ultrashort proximal femur segments following extensive femoral diaphyseal tumor resection.

Background: Ultrashort proximal femur reconstruction after extensive femoral diaphyseal tumor resection poses significant challenges. We developed a customized intercalary prosthesis with a rhino horn-designed uncemented stem for reconstructing these extensive skeletal defects (Fig.1).

Methods: This study aimed to analyze and compare biomechanical differences between normal femurs and femurs with diaphyseal defects reconstructed by intercalary prostheses with different stems. Using a healthy femur as a reference, five three-dimensional finite element models were developed, including a clinical follow-up of 12 patients undergoing intercalary femoral replacement (Fig.2).

Results: Biomechanical analysis revealed normal-like stress and displacement distribution in proximal femur segments after reconstruction with rhino horn-designed uncemented stems, compared to the straight stem. Stem A exhibited superior biomechanical performance, while Stem B's fixation system was relatively unstable. Clinical outcomes aligned with finite element results (Fig.3). After a mean 32.33±9.12 months follow-up, all patients showed osteointegration and satisfactory clinical outcomes. Asymptomatic aseptic loosening occurred in one patient reconstructed by Stem B; no other postoperative complications were reported in the remaining 11 patients.

Conclusion: The rhino horn-designed uncemented stem excels in precise shape matching and osseointegration. This novel prosthesis design, particularly with Stem A, may reduce the risk of mechanical failure and aseptic loosening. Therefore, the customized intercalary prosthesis with this rhino horn-designed uncemented stem presents a reasonable alternative for reconstructing ultrashort proximal femur segments after extensive tumor resection.

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Survivorship, complications, and functional outcomes of uncemented distal femoral endoprosthesis with short, curved stem for patients with bone tumors

Aim of the study: This study assesses the 9-year survivorship, complications, and functional outcomes post distal femur tumor resection with uncemented endoprosthetic reconstruction using a curved, short ste. We also evaluate osseointegration with the HA-coated stem.

Introduction: Endoprosthetic reconstruction following distal femur tumor resection has been widely advocated. This study presents the design of an uncemented endoprosthesis system featuring a short, curved stem, with the goal of enhancing long-term survivorship and functional outcomes.

Methods: This study involved patients who underwent implantation of an uncemented distal femoral endoprosthesis with a short and curved stem between 2014 and 2019. We clinically assessed functional outcomes using the

1993 version of the Musculoskeletal Tumor Society (MSTS-93) score. Additionally, we quantified five types of complications and assessed osseointegration radiographically. The survivorship of the endoprosthesis was evaluated according to two endpoints.

Results: 134 patients with a median age of 26 years (range, 5 to 78 years) were finally included in our study. The median follow-up time was 61 months (range, 25–101 months). The median functional MSTS-93 was 25 (range, 18–30) postoperatively. 21 patients (15.7%) encountered complications. The rate of aseptic loosening was 6.7% (9/134). The survival rates up to 8.5 years was 93.3% for aseptic loosening as the end point and 88.4% for any reason as the end point, retrospectively.

Conclusion: The utilization of an uncemented distal femoral endoprosthesis with a short, curved stem demonstrated a low incidence of aseptic loosening and achieved long-term survivorship of up to 9 years. Meanwhile, aseptic loosening typically occurs in the early stage postoperatively.

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Locking-mechanism failure and complications in MUTARS distal femur and proximal tibia endoprostheses: are there differences between PE, PEEK and MoM?

Aim of the study: In this study, we aimed to estimate the cumulative incidence of mechanical failure per type of locking-mechanism, and the associated risk factors.

Background: Wear or breakage of the locking-mechanism may cause symptomatic instability of MUTARS endoprosthetic knee replacements. Over the years, the locking-mechanism of MUTARS knee replacements changed from polyethylene(PE) to PEEK-Optima(PEEK) and metal-on-metal(MoM) in an attempt to reduce the risk of mechanical failure. In this study, we aimed to estimate the cumulative incidence of mechanical failure per type of locking-mechanism, and the associated risk factors.

Methods: 237 patients with a MUTARS knee replacement after tumor resection were included. Median age was 46 years (IQR23-64). Median follow-up was 8.3 years (95%CI 7.1-9.5).

Results: Symptomatic instability due to wear(n=17) or breakage(n=10) occurred in 27(11%) patients:6/47(13%) in PE, 4/32(13%) in PEEK, and 17/158(11%) in MoM locking-mechanisms. The cumulative incidence of revision for instability due to wear or implant breakage at 2, 5, and 10 years was 0%, 7%, and 7% for PE, 0, 7%, and 7% for PEEK, and 0, 4%, and 11% for MoM. Median time to locking-mechanism failure was 7.5 years (IQR 3.9-10.3), and did not differ between PE, PEEK, and MoM. Resection length, BMI or age were not significantly associated with the risk of revision.

Conclusion: Symptomatic instability due to wear or locking-mechanism breakage impose a substantial implant revision risk. Design and material modifications have not yet resulted in a significant decrease of the revision risk.

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The role of patellar height In knee function after distal femur endoprosthesis

Aim of the study: To evaluate patellar height after distal femur (DF) EPR and its association with knee function.

The patellar height can influence the extensor mechanism and the knee function after knee replacement. However, it is still unknown about the effects of patella height in endoprosthesis reconstruction (EPR). The aim of this study was to evaluate patellar height after distal femur (DF) EPR and its association with knee function. This retrospective analysis included 166 patients who underwent DF EPR at three Centers. Patellar height was calculated using modified Insall-Salvati ratio (MISR), Blackburne-Peel Index (BPI) and Caton-Deschamps Index (CDI), preoperatively and at one-year follow-up. These were associated to anterior knee pain (AKP), range of motion (ROM), and Knee Society Score (KSS). A reduction in patellar height was observed at 1-year follow-up (mean MISR: 1,61 vs 1.49, p2) was also correlated to higher KSS functional scores (p=0.038). Nevertheless, patella alta was associated to AKP more frequently than patella baja (p=0.047). Despite an increase in knee ROM and functional scores, patella alta was associated to higher rates of anterior knee pain. Thus, it is recommended to maintain the patella height in the normal range even after DF EPR.

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The Clinical Outcomes in Total Femur Prosthesis in Patients with Musculoskeletal Tumors

Aim of the study: Explore the oncological diagnostic process, including tumor radiological characteristics, preoperative procedures, postoperative monitoring, and specific conditions like recurrence and metastasis during patient follow-up.

Introduction: Following extensive removal of bone and soft tissue sarcoma in the thigh, total femoral replacement can reinstate femoral integrity, enabling patients to regain the ability to walk. The literature has a heterogeneous mix of retrospective case series. This study aims to outline the oncological diagnosis process, encompassing tumor radiological characteristics, presurgical procedures, postsurgical follow-up, and specific conditions like recurrence and metastasis during patient monitoring.

Material and Methods: Six consecutive patients were treated with total femur resection and reconstruction with total femur replacement. Six patients' demographic data, pathological and clinical outcomes, metastasis status during diagnosis, surgical margins and adjuvant chemo/radiotherapy protocol, and Huvos degrees of resection material were recorded. Results Six patients underwent total resection of the femur with modular endoprosthetic replacement. Four of these patients were diagnosed with osteosarcoma,one of these four patients operated due to recurrence after distal femur resection. A patient diagnosed with angiosarcoma, with a history of multiple surgeries, underwent an external hemipelvectomy on the 20th day after total femur resection due to acute massive recurrence.A patient was operated on due to chondrosarcoma, and proximal femur resection was applied. During the follow-up process, total femoral resection was applied because of recurrence. The longest follow-up time was 23 years,and the patient is still alive.

Conclusion: Total femoral replacement is a salvage surgical procedure mainly for oncologic indication to prevent limb amputation. Patients should be managed by a multidisciplinary team specializing in orthopedic oncology.

SESSION 7:
SURGERY OF PELVIC TUMORS 1
CHAIRS: Lee Jeys (UK), Hazem Wafa (Belgium)

Arne Streitbürger

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Pelvic tumour resection: the Essen experience

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Three-dimensional printing-based custom reconstructions for limb salvage in patients with bone tumors: a retrospective case series of 105 patients in two referral centers

Aim of the study: Aims were 1) indications and designs of 3D-printed prostheses for complex reconstructions; 2) complications rate considering site (3) oncologic and functional outcomes

Background: Three-dimensional (3D) printing is an emerging technology for reconstruction of large bone defects after tumor resections or complex revision surgeries, especially in specific sites where modular prostheses are not available.

Methods: This is a two-institutional retrospective case series. We analyzed 105 patients (males 38%, mean age 45 years/range 10-78 years), in whom a custom-made 3D printed prosthesis was used from 2009 to 2022. Sixty-seven primary tumors (63%), 11 metastatic lesions and 27 non-oncologic patients. Pelvis was the most frequent site (87, 83%). Reconstruction included articular replacement (72% of the cases).

Results: The 5 year-survival rate was 86% (sarcoma group) whereas mean survival in metastatic group was 2 years. Among 78 oncologic patients, 57 were NED (6 after treatment of relapses), 8 AWD and 13 DWD. Overall complication rate was 29.5% (40 complications in 31/105 patients), mainly wound related problems and infection. Recurrence occurred in 9 patients. None of the follow factors (site, pathologic fracture, adjuvant treatments, primary/revision implants) significantly affect survival to complication. Survival was related to tumor histotypes, range of resection, recurrence and time of diagnosis ($p<0.05$). Mean MSTS score at final follow-up was 73% (range, 23%-100%) and 85.6% reported good or excellent results.

Conclusions: Custom-made 3D printed prostheses represent a good reconstructive technique, maintaining however the correct indications for their use. Complication rate is acceptable, with infection and wound healing problems. Osseointegration is necessary to reduce loosening.

Li Min, Xin Hu, Minxun Lu, Chongqi Tu

Department of Orthopaedic Surgery and Orthopaedic Research Institute, West China Hospital, Sichuan University, Chengdu, China

Combined and Modified Gibson and Ilioinguinal Approaches in Type II + III Internal Hemipelvectomy for Periacetabular Tumors

Aim of the study: This study assesses the modified MGMII surgical approach versus the standard iliofemoral approach for type II + III periacetabular tumor resection, using 3D printed endoprostheses.

Background: Standard iliofemoral approaches for type II+III periacetabular tumor resections involve extensive skin incisions and substantial muscle detachment, resulting in prolonged hospital stays, increased complications, and impaired lower limb function. Utilizing an enhanced recovery after surgery (ERAS) protocol, we employed a combined and modified Gibson and ilioinguinal (MGMII) approach (Fig.1-3) to minimize soft tissue trauma during tumor resection, facilitating patients' faster return to normal life.

Methods: This study included 25 patients with type II + III periacetabular tumors, undergoing reconstruction with 3D printed customized endoprostheses at our center between January 2017 and March 2019. Thirteen cases used the MGMII approach, while 12 employed the iliofemoral approach. Operation duration, blood loss, surgical margin, reconstruction accuracy, abductor muscle strength, Musculoskeletal Tumor Society (MSTS-93) scores, Harris Hip scores (HHS), and limp scores were evaluated. Complications were recorded through patient records.

Results: The MGMII group exhibited shorter operative durations and lower blood loss than the iliofemoral group, with slightly higher postoperative hemoglobin levels. The MGMII group demonstrated stronger postoperative hip abductors, better functional restoration, and fewer patients with higher limp scores. No complications were observed in the MGMII group, while the iliofemoral group experienced three cases of wound healing delay and one deep infection.

Conclusions: The MGMII approach enhances exposure of the posterior acetabulum, especially the ischial tuberosity, reducing the risk of tumor rupture during resection. Additionally, the MGMII approach helps preserve residual muscle function, such as the gluteus medius origin, while ensuring effective tumor resection.

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Outcomes of Dedifferentiated chondrosarcoma of pelvis: A retrospective study of 8 cases

Aim of the study: To describe the outcomes of 8 patients with dedifferentiated chondrosarcoma of pelvis

Introduction: The purpose of this study was to describe the outcomes of 8 patients with dedifferentiated chondrosarcoma of pelvis.

Methods: This was a retrospective study of 8 patients with non-metastatic dedifferentiated chondrosarcoma of pelvis diagnosed between 2005 to 2021. Data including treatment details and oncologic outcomes were analysed.

Results. Of these 8 cases, 5 were primary and 3 were recurrent cases. The median age was 41.5 years (26-61 ±9.87). Only 1 case had diagnosis on biopsy; rest were diagnosed on post-operative histopathology report. 3 underwent external hemipelvectomy while 5 underwent limb sparing surgery. Of these 5 limb salvage surgeries, 3 had positive margins. Of 3 amputations, 1 had positive margin. 2 patients with positive margins received post operative radiotherapy. 1 patient developed local recurrence, 3 had distant recurrence and 2 patients had combined recurrence. One of the patients with combined recurrence was lost to follow up after the diagnosis of the same. One patient was lost to follow up 3 years after surgery for local recurrence. The median follow-up time was 47 months (7 days – 188 months). The 3- year overall survival was 33% with the probability remaining same at 5 years. At study conclusion, only one patient was alive with no evidence of disease.

Conclusion: Our findings confirm poor prognosis of pelvic dedifferentiated chondrosarcoma with 5-year overall survival of only 33% making it an unsolved clinical challenge needing new avenues for optimal management.

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Three-Dimensional Multimodality Image Reconstruction as Teaching Tool for Case-based learning among medical postgraduates: a focus on primary pelvic bone Tumour Education

Aim of the study: This study aimed to assess the feasibility and effectiveness of incorporating 3DMMI in combination with a Case-Based Learning (CBL) approach for postgraduate education.

Background: Postgraduate oncology orthopedics education faces challenges in teaching pelvic tumors due to intricate anatomy and limitations of conventional methods. This study explores the feasibility and effectiveness of integrating Three-dimensional multimodality imaging (3DMMI) with a Case-Based Learning (CBL) approach in a 10-week course for 90 surgical postgraduates focusing on pelvic tumors.

Methods: Students, divided into traditional CBL and 3DMMI-CBL groups, created PowerPoint presentations on assigned clinical cases. Content covered pelvic anatomy, clinical presentations, radiological features, and treatment principles of common pelvic tumors. Evaluations included image interpretation, theoretical knowledge, and questionnaires.

Result: The 3DMMI-CBL group excelled in imaging diagnosis and theoretical knowledge compared to the CBL group. Teacher questionnaires indicated enhanced clinical knowledge, improved instruction, and increased satisfaction with teaching using 3DMMI.

Conclusion: Incorporating 3DMMI into the traditional CBL model for postgraduate pelvic bone tumor education is feasible, demonstrating potential effectiveness and acceptability.

Daniel Kotrych

Department of Children Orthopaedics and Musculoskeletal Oncology, Pomeranian Medical University of Szczecin, Poland

3D printing for pelvic ring reconstruction – a chance or a disaster?

Ahmet Salduz, Serkan Bayram, **Turgut Akgül**

Istanbul University, Faculty of Medicine, Department of Orthopedics and Traumatology

Management of the vein invasion in the pelvic osteosarcoma surgeries

Aim of the study: In this study we aimed to present two pelvic osteosarcoma cases who has iliac vein invasion and surgical management of vein involvement.

Case 1: A 17-year-old male who has right iliac osteosarcoma extending posteriorly and superiorly invading iliac vein and lumbar vein. Notably, distant metastasis was absent on both chest CT and PET CT scans. Following three cycles of chemotherapy, the tumor was deemed resectable, allowing for limb salvage. The surgical procedure involved a meticulous wide resection and lumbopelvic fixation. Lumber vein invasion extending iliac vein lumen was excised by longitudinal incision of lumbar vein and pulling the tail from the iliac vein lumen. Internal iliac vein involvement was managed similarly but partially excised during the surgery. Acetabulum and sciatic nerve were preserved. Patient is alive and mobilize without any support at 3rd month follow-up. He is doing well.

Case 2: A 22-year-old female patients with right pelvic osteosarcoma originating sacroiliac joint and disseminating bladder, uterus and pouch of Douglas including iliac vein. No metastasis was observed at the initial presentation, but the local tumor progression was observed during the chemotherapy. Internal hemipelvectomy was performed with partial bladder and uterus excision. The vein extension was removed by the longitudinal incision of the internal

iliac vein and pulling of the tumor tail from the lumen. Patient was survived 6 months and died due to lung metastasis. These two cases are good example of how the osteosarcoma metastases via vein invasion. Exsicion of the intravenous tumor extension could make the patients tumor free in selected patients. Vena cava filter is also recommended in the literature.

SESSION 8:
SURGERY OF PELVIC TUMORS 2
CHAIRS: Daniel Kotrych (Poland), Rob Pollock (UK)

Lee Jeys

The Royal Orthopaedic Hospital, Birmingham, UK

Modern hemipelvectomy: Are we getting better?

Davide Donati

Rizzoli Orthopaedic Institute, University of Bologna, Italy

Pelvic and sacral tumors – treatment recommendations

Minna K Laitinen[1], Michael C Parry[2], Guy V Morris[2], Vineet Kurisunkal[2], Jonathan D Stevenson[2], Lee M Jeys[2]

[1] Helsinki University Hospital Helsinki Finland
[2] Royal Orthopaedic Hospital Birmingham United Kingdom

Enhanced survival outcomes in pelvic chondrosarcoma surgery: Impact of research progress

Aim of the study: To compare local-recurrence free survival (LRFS) and disease-specific survival (DSS) between older and modern treatment groups.

The surgical management of pelvic chondrosarcoma poses a challenge due to its anatomy and proximity to vital structures. This study aimed to compare LRFS and DSS between older and modern treatment groups We retrospectively analysed pelvic chondrosarcoma cases treated at the Royal Orthopaedic Hospital between 2003 and 2022. Among 185 patients, 81 were treated from 2003 to 2012 (old group), and 104 were treated from 2013 to 2022 (modern group). We used Kaplan-Meier analysis to compare surgical methods, DSS, and LRFS between these groups. In the old group, treatments included hindquarter amputation for 15/81 patients, resection for 64/81, and curettage for 2/81. In the modern group, the numbers were 9/104, 95/104 and 0/104 respectively. Tumour grades were 1, 2 and 3, with equal distribution in both groups. LRFS rates at 1, 3 and 5 years were 87%, 67%, and 57% in the old group and 93%, 82% , and 79% in the modern group (p=0.004). DSS rates 1, 3, and 5 years were 90%, 80%, and 70% in the old group, and 97%, 91%, and 89% in the modern group (p=0.004). Pelvic chondrosarcomas are treated surgically more often with resection in the modern group. Utilizing advanced techniques such as enhanced imaging and navigation has led to reduced local recurrence rates, consequently enhancing DSS. Increasing knowledge and modern techniques like new imaging and navigation help us treat pelvic chondrosarcomas by decreasing the rate of local recurrences, thereby increasing disease-specific survival.

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Is autogenous tibia a feasible choice of pelvic reconstruction in hindquarter amputation: A retrospectively case-control study

Aim of the study: To evaluate the feasibility of pelvic reconstruction with autogenous tibia in hindquarter amputation patients.

Introduction: Pelvic malignancy always induces terrible prognosis. For the advanced disease, limb salvage is impossible and hindquarter amputation (HQA) could be an alternative choice. Pelvic reconstruction in HQA was reported necessary and feasibility of reconstruction with autologous tibia was seldomly reported before.

Method: We retrospectivel reviewed the patients who underwent hindquarter amputation from April 2013 to June 2019. Total sixteen patients were included and divided into two groups. Patients' characters, perioperative management details and complications were recorded. The limb function was evaluated through the Musculoskeletal Tumor society Rating Scale (MSTS) and the quality of life was through the World Health Organization quality of life questionnaire – brief version. Chi-square test and Mann-Whitney U test was used to compare the categorical variable parameters and count variable parameters, respectively.

Results: The mean follow-up was 28.1 months in group A and 26 months in group B (P>0.05). No significant difference in the blood loss, surgical time, transfusion and hospitalization days between group A and group B (P>0.05). Median MSTS score was higher in group A with 18.00 than that in group B with 14.00 (P0.05). Complications were comparable between two groups (P>0.05).

Conclusion: Autogenous tibia can be a feasible material in reconstructing the pelvic ring after hindquarter amputation, especially in the case that a suitable autologous femur is unavailable.

Oleg Vyrva, Roman Malik

Sytenko Institute of Spine and Joint Pathology, Kharkiv, Ukraine

Concept strategy for pelvic resections in tumor patients: single institution review

Introduction: Pelvic resection, historically termed internal hemipelvectomy, is crucial for managing primary malignant pelvic tumors. This study reviews the outcomes of pelvic tumor patients treated at Sytenko Institute from 1963 to 2021, focusing on surgical techniques and reconstruction strategies.

Methods: A retrospective review of 239 pelvic tumor patients was conducted, with 186 patients treated during the modern era (2004-2021). Selection criteria included primary malignant pelvic tumors, metastatic lesions, infection, or trauma. Surgical techniques and reconstruction methods were tailored based on tumor histology, lesion location, and extent of resection. A multidisciplinary approach was adopted, and patients underwent preoperative counseling regarding potentional morbidity and mortality, rehabilitation, and life expectancy.

Results: Among the 186 patients treated in the modern era, diverse surgical techniques and reconstruction strategies were employed based on tumor characteristics and resection extent. The overall survival rate was 81,2%, with a median follow-up of 2 years to 15 years. Surgical complications included 41,6% incidence of wound complications, 38,7% of infections. Local reccurence – 51,4%. Functionality outcomes revealed 56% of patients achieving satisfactory mobility and 76% experiencing improved QOL post-surgery.

Conclusions: Pelvic resections in tumor patients demand careful consideration of surgical techniques and reconstruction methods tailored to individual tumor characteristics and patient needs. The multidisciplinary approach and preoperative counseling are crucial for optimizing patient outcomes and managing expectations regarding morbidity, mortality, and rehabilitation. This review underscores the importance of ongoing refinement of surgical strategies and emphasizes the need for further research to enhance the effectiveness and safety of pelvic resections in tumor patients.

Safak Aydin Simsek[1], Tolgahan Cengiz[2], Bedirhan Albayrak[1], Alparslan Yurtbay[3], Ismail Buyukceran[1], Hüseyin Sina Coskun[1], Nevzat Dabak[1]

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The Clinical Management and Outcomes of Pelvic Resections in Ewing's Sarcoma

Aim of the study: The objective of this study is to highlight the surgical treatment strategies, processes of biological reconstruction, and rehabilitation procedures in 8 patients diagnosed with Ewing's sarcoma.

Introduction: Pelvic resection is a challenging surgical technique primarily used for treating primary malignant pelvic tumors, and in rare instances, it may be indicated for metastatic lesions, infection, or trauma. The extent of resection and remaining structures guide the reconstruction, with surgical techniques tailored to tumor histology and lesion location. In this study, we aim to emphasize surgical treatment approaches and processes, biological reconstruction, and rehabilitation processes of 8 patients diagnosed with Ewing's sarcoma, a malignant tumor of primitive neuroendocrine origin.

Material and Methods: This retrospective review consists of eight patients who underwent pelvic resection due to Ewing's sarcoma between 2004 and 2023. The clinical outcomes (complications and radiologic outcomes) and oncological and functional outcomes, mean survival rate were recorded. Results Eight patients were included in the study, with the most extended follow-up period being 22 years. Different types of pelvic resection were applied to patients based on the tumor's location. Resection types according to Enneking classification were recorded. The treatment and follow-up of all our patients were conducted in collaboration with oncology.

Conclusion: Pelvic resection surgeries have potential morbidity and mortality, an extensive rehabilitation process, and life expectancy. A multidisciplinary team is essential; preoperative counseling for patients and their families is necessary to discuss all processes. Key Words: Pelvic resection; pelvic tumors; Ewing's sarcoma; biologic reconstruction.

Osman Emre Aycan, Ümit Burak Alparslan, Meryem Gülendam Çolban, Niyazi İğde

Baltalimanı Bone Diseases Training and Research Hospital, Istanbul, Türkiye

Operative treatment of aneurysmal bone cysts (ABC) in pelvis

Aim of the study: We sought to evaluate the management and results of primary aneurysmal bone cysts (ABC) of pelvic involvement.

Method: We retrospectively reviewed 26 patients, treated due to primary ABC's in pelvis between 2000-2016. Four patients with less than 2 years follow-up and two patients who received treatment with the arterial embolism were excluded. Total of 20 patients were evaluated in terms of demographic data, treatment methods, complications and outcomes. En bloc resection, cementation, grafting and curettage methods were also noted. Cyst volumes were measured according to MRI.

Results: The mean age was 22.55 (9-56) and median follow-up time was 64.5 months. All patients had pain at presentation and swelling was most common second complaint. Mean cyst volume was 4361.16 mm^3 (400-14400). Most common involvements were ilium (n=7) and pubis (n=7), 4 sacrum (n=4) and acetabulum (n=2). Preop arterial embolism was performed in 4 patients. Resection was the most common treatment (n=7). In 6 patiens curettage-grafting, in 5 patients curettage-cementation and in 2 patients only curettage were performed. High speed burr was used in all patients. In six patients phenol, in five patients bone cement was also used. Recurrence (n=2), Hip arthritis (n=1) and obturatory nerve palsy (n=1) were complications.

Conclusion: ABC's are rarely seen in pelvis with commonly local pain. Intralesional curettage was performed by using local adjuvants with good outcomes. Acetabular lesions should be treated meticulously. En bloc resections can be performed in patients with large cysts at pubis or ilium involvements.

Adam Chrobok[1], Patryk Tomasik[1], Daniel Kotrych[2]

[1] Regional Trauma Hospital in Piekary Śląskie, Poland
[2] Department of Children Orthopaedics and Musculoskeletal Oncology, Pomeranian Medical University of Szczecin, Poland

Custom 3d printed implants for pelvic periacetabular and long bone tumors – early follow up and clinical outcome

Aim of the study: Follow up and clinical outcome of patients after 3d implants for bone tumors

The new 3d printed titanium implants changed the approach and possibilities of treatment in many fields and became more and more popular in oncological orthopaedics. We started applying them for pelvic tumors in 2018

Patients and methods: Between 2018 and 2023 we operated 6 patients with 3 d implants for pelvic periacetabuar tumors. 3 of them had primary lessions, 2 developed mets and 1 large pseudotumor within acetabulum and femur after primary hip prosthesis. Additionaly 2 patients suffered from lower limb pathology were operated in 2023 by the same technique. The implants were positioned by templates. No computed navigation was used

Discussion and Results: The 3d implanants for reconstruction of pelvic bone tumors within acetabulum changed the whole philosophy of surgical treatment in this area. After complex solutions such as various common revision system or ice cups like Lumic used previously we find 3 d implants best to resolve. Thanks to them the pelvic ring could be reconstructed and spared. We find also that new implants have larger and high porous surface, so the revison rate could be lower. We observed no infections and no losening within our material and local recurrence in one case which is now under control after radio and chemotherapy. In one case an osteoporotic fracture occured close to implant surface. As the follow up time and the numer of patients is low – we cannot apply any big statistics on them, however the results up till now are promising.

June 13, Thursday | Baltic Hall

SESSION 5:
GLOBAL SARCOMA REGISTRY INITIATIVES AND PROGNOSTIC TOOLS

CHAIRS: Dario Callegaro (Italy), Joanna Szkandera (Austria), Benjamin Miller (USA)

Benjamin Miller

Department of Orthopaedics, University of Iowa, Iowa, USA

Musculoskeletal Tumor Registry (MsTR) in the US

Paolo Lasalvia

Department of Oncology, National Cancer Institute, Milan, Italy

EURACAN registry on sarcomas – current and future perspectives

Gijs Geleijnse

IKNL Netherlands Comprehensive Cancer Organisation, Eindhoven, Netherlands

Implementing an impactful, federated international sarcoma registry: technology and governance

Joanna Szkandera

Department of Oncology, Medical University of Graz, Austria

Clinical impact of the registry results

Lee Jeys

The Royal Orthopaedic Hospital, Brimingham, UK

BOOM or Bust: Is consensus worth it?

Dario Callegaro

National Cancer Institute, Milan, Italy

Update on prognostic tools in STS

Philipp Theodor Funovics[1], Dimo Andreou[2], Krzysztof Bronowicki[3], Isidro Gracia[4], Lizz van der Heijden[5], Michael Mørk Petersen[6], Thomas Schubert[7], Olga Zaikova[8], Jendrik Hardes[9]

[1] Medical University of Vienna
[2] Medical University of Graz
[3] Wroclaw Medical University
[4] Autonomous University of Barcelona
[5] Leiden and Princess Máxima Center for Pediatric Oncology
[6] University of Copenhagen
[7] Cliniques universitaires Saint-Luc Brussels
[8] Oslo University Hospital
[9] Universitätsklinikum Essen

Results of a questionnaire by the Euro Ewing Consortium Surgical Subgroup regarding SOPs for the surgical treatment of Ewing Sarcoma in different centers across Europe

Aim of the study: On behalf of the Euro Ewing Consortium Surgical Subgroup

Introduction: Ewing Sarcoma is an orphan disease, therefore the evidence for standardised treatments and the development of SOPs (standard operating procedures) is difficult to establish, while this may be regarded helpful in the optimisation in patient outcomes. The Euro Ewing Consortium is an international partnership of specialists from 15 European countries consisting of different thematic subgroups working together to improve survival of patients with Ewing Sarcoma.

Methods: An on-line questionnaire consisting of 82 questions was designed by the members of the surgical subgroup covering the topics of general medical background, diagnosis and therapy related to Ewing Sarcoma and is sent out to major medical units specialising in the treatment of bone and soft tissue sarcoma.

Results: At the time of abstract submission for this meeting the survey is still on-going, but will finish on time for statistical evaluation of results to be presented at EMSOS 2024. In order to obtain a timely impression of treatment standards across Europe in order to pursue the ongoing scientific discussion, the authors felt it be helpful to present results within a pan-European forum, since the survey was exclusively focussing on European treatment standards of Ewing Sarcoma..

Conclusion: The results of a still on-going on-line survey about European treatment standards in the surgical therapy of Ewing Sarcoma will be presented and discussed as a potential basis for the definition of SOPs in Ewing Sarcoma care in Europe.

Maria Anna Smolle[1,2], Joanna Szkandera[3], Fabrice André Scheurer[1], Daniel Müller[1], Andreas Leithner[2]

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Outcome analysis in soft tissue sarcoma. Parameters associated with local recurrence, distant metastasis, and overall survival in 746 STS patients from a multicentre, multinational registry-based study

Aim of the study: The aims of this multicenter, registry-based study were to 1) assess LR and DM risk, and OS in a cohort of STS patients from Austria and Switzerland, and to 2) investigate established and eventually identify novel prognostic factors for LR, DM and OS.

Introduction: Oncological outcome parameters in soft tissue sarcoma (STS) patients include risk for local recurrence (LR) and distant metastasis (DM), as well as overall survival (OS). Over the past years, risk prediction tools

have been developed to estimate patients' outcome, incorporating established prognostic factors (e.g. tumour size, histological subtype).

Methods: 746 patients with STS (mean age: 62.5±16.3 years; 49.9% males) were retrospectively included. Multivariate (including age, gender, size, grading, depth, histology, location) Fine&Gray and Cox-regression models were carried out to analyse the potential impact of variables on LR, DM, and OS.

Results: Median follow-up was 24.2 (IQR 11.8-71.7) months. During follow-up, 117/596 and 211/619 patients, respectively, developed LR and DM, and 202/676 patients died. High-grade STS were per tendency independently associated with increased LR-risk (SHR 3.13, p=0.069). High-grade STS (SHR 3.63, p=0.031) and leiomyosarcoma (SHR 3.20, p=0.027) showed an independent association with increased DM-risk. Advanced patient age (HR 1.06, p<0.001), large tumour size (HR 1.05, p=0.001), and histologies UPS (HR 1.86, p=0.045) and "other" (HR 2.29, p=0.016) were independently associated with reduced OS.

Conclusion: Our preliminary findings identified similar prognostic factors as previously reported for oncological outcome in STS patients. Future steps include refinement of the models to further enhance prognostication in patients with STS.

Megan Rose Donnelly, Garret W. Esper, Michelle Richardson, Ekenedilichukwu Nwakoby, Karim Masrouha

NYU Langone Health, Department of Orthopedic Surgery

Disseminated cancer patients incur a three-times greater risk of venous thromboembolism diagnosis following orthopedic surgery

Aim of the study: The purpose of this study was to determine the correlation between a disseminated cancer diagnosis and the risk of venous thromboembolism (VTE) in a large, national dataset

The rate of symptomatic VTE after surgery for long bone metastases is very high. Recent studies report that as many as 10% of all orthopedic oncology patients are diagnosed with a VTE postoperatively. To date, there remains a paucity of literature investigating the impact of metastatic disease on likelihood for VTE diagnosis compared to patients without a cancer history, particularly in a large, diverse patient population. By utilizing the ACS National Surgical Quality Improvement Program (NSQIP) database (2017-2020), we identified 987,459 patients who underwent orthopedic surgery in the United States. Of these, 7,763 patients had a disseminated cancer diagnosis. The remainder (n=979,696) served as controls. The rate of VTE diagnosis in the disseminated cancer patients was 3.3% compared to 0.8% in controls (p<0.001). Through the use of nearest neighbor propensity score matching to control for all confounding variables reported in the dataset, including demographics, past medical history and surgical characteristics, we found that disseminated cancer diagnosis alone conferred a 3.6x greater risk of pulmonary embolism, a 3x greater risk of deep venous thrombosis, and a 3.2x greater risk of any VTE event within 90-days postoperatively (disseminated cancer patients, n=5,367 and controls, n=5,367) (all p<0.001). Given the significant risk for morbidity and mortality that this complication poses to orthopedic oncology patients, these findings emphasize the need for defined protocols for prevention and appropriate prophylaxis in the perioperative setting for these high-risk individuals.

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Can sarcopenia represent a negative prognostic factor in localized extremities/ trunk wall soft tissue sarcomas?

Aim of the study: To evaluate sarcopenia impact on survival outcomes of patients with soft tissue sarcomas

Introduction: The aim is to evaluate sarcopenia impact on survival outcomes of patients affected by extremities and trunk wall soft tissue sarcomas (ESTS).

Methods: SliceOMatic software was used on a basal CT to select the cross-sectional skeletal muscle area(SMA), the subcutaneous fat area(SFA) and the visceral fat area(VFA), along with the muscle density(MD) computed in Hounsfield units(HU). SMA was normalized by patient's height and skeletal mass index(SMI). We explored the correlation of the different parameters with post-surgical complications and survival outcomes (Kaplan-Meier method). Hazard ratios (HR) were estimated by Cox regression.

Results: 268 patients treated in 10 years, median age 63 (IQR 48-74). Sarcopenia rate did not differ in elderly patients according to baseline Sarculator predicted outcomes. 229 patients were included in survival analysis. With a median follow-up of 49.5 months, overall survival (OS) was significantly worse for sarcopenic patients: median OS of 111.7 months (95%CI 72.8- 150.6) vs not reached (NR - HR=1.55 (95%CI:1.00-2.41, p=0.049) if stratified for SMI; median OS 79.6 months (38.6-120.6) vs NR (HR 2.11, 1.34-3.34, p=0.001) if stratified for MD. No difference was observed for SFA and VFA. Sarcopenic patients showed increased postoperative complications (30.5%vs17.0%, p=0.073).

Conclusion: Even if retrospective, our study suggests sarcopenia as a negative prognostic factor in ESTS patients.

SESSION 6:

DESMOID TUMORS

CHAIRS: Silvia Stacchiotti (Italy), Andreas Leithner (Austria)

Maartje C. Lourens[1], Floortje G.M. Verspoor[2], Mario Maas[1], Jacqueline M. Tromp[3], Robert Hemke[1]

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[3] Department of Oncology, Amsterdam UMC, Amsterdam, the Netherlands

Desmoid fibromatosis: assessment of MRI texture features correlating with radiological and/or clinical outcome

Aim of the study: To evaluate if MRI based image texture analysis can effectively differentiate between treatment responsive and non-responsive desmoid-type fibromatosis patients.

Introduction: The aim was to evaluate if MRI based image texture analysis can effectively differentiate between treatment responsive and non-responsive desmoid-type fibromatosis patients.

Methods: This retrospective cohort study included patients who received treatment and underwent a pretreatment MRI scan. Group allocation was performed at 3, 6, 9, and 12 months after treatment started. Desmoids on T1W contrast-enhanced and T2W fat suppressed MRI scans were segmented and texture features were extracted. Heatmaps were constructed to explore features that showed a relevant difference between response groups (p0.79. One out of six T2W features had an AUC>0.9. T1W contrast-enhanced MRI texture features were able to differentiate between clinically and/or radiologically responsive and non-responsive patients.

Andreas Leithner

Department of Orthopaedics, Medical University of Graz, Austria

Is there still a role for surgery?

Silvia Stacchiotti

Department of Oncology, National Cancer Institute, Milan, Italy

Update on medical treatment of desmoid tumors

Eva Wardelmann

Department of Pathology, University of Muenster, Germany

Diagnostic standards

Yong-Suk Lee, Sungan Hong

Department of Orthopaedic Surgery, Incheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea

Current treatment concepts for extra-abdominal desmoid-type fibromatosis: a narrative review

Aim of the study: To assess the current treatment concepts for extra-abdominal desmoid-type fibromatosis

Introduction: Extra-abdominal desmoid-type fibromatosis (EADTF) is a rare neoplastic condition of monoclonal fibroblastic proliferation characterized by local aggressiveness. The aim of this review was to assess the current treatment concepts.

Methods: A search of articles published in the databases between January 2008 and November 2023 was conducted in December 2023.

Results: Until the early 2000s, surgical resection had been the mainstay of treatment. However, local recurrence rates at 5–10 years have been reported up to 60%. Initial active surveillance is considered the first-line approach based on accumulated evidence. The latest two guidelines support active surveillance as the preferred initial treatment. Radiation therapy is considered as treatment following surgery or systemic therapies. The reported local control rates range from 55 to 92.3%. Recently, percutaneous ablation has been revealed to be effective for both first-line treatment and disease recurrence. Chemotherapy combining low doses of methotrexate and vinblastine is generally administered and associated with disease control rates of 64–100%. Recent guideline declared that current evidence demonstrated a significant therapeutic advantage of TKIs in the treatment of EADTF.A selective GSI, nirogacestat, has been shown to impede cell growth causing cell cycle arrest, suggesting the possible application of GSIs in EADTF.

Conclusions: Active surveillance should be considered the first-line management approach for EADTF. Surgeries remain relevant for symptomatic patients or when the tumor endangers critical anatomy. Systemic therapies, particularly TKIs and GSIs, are emerging as effective treatments for progressive and symptomatic EADTF.

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Extraabdominal desmoid tumor; a single center retrospective observation

Aim of the study: The purpose of the study is to analyze the clinical and demographic features of extremity located EDT, and determine the risk factors of recurrence.

Background: Extraabdominal Desmoid Tumor (EDT) is locally aggressive tumor derived from fibroblastic cells and is one of the most challenging issues in extremity surgery. It arises most commonly in the shoulder region folllowed by trunk and thigh. The purpose of the study is to analyze the clinical and demographic features of extremity located EDT, and determine the risk factors of recurrence.

Methods: 36 patients were identified out of 61 desmoid tumor patients, who were undergone wide resection surgery with or without adjuvant radiotherapy. 11 patients had additional bony involvement, where either endoprosthetic reconstruction or reconstruction with biologic methods became mandatory.

Results: After wide resection, 40% of these patients had clear margins, whereas 22% had R1 and %38 had R2 involvement respectively. Adjuvant therapy was scheculed for all R1 and R2 patients except one patient, whereas two R0 patients also received radiation therapy due to very large tumor volume. At the end of the first year, there was a total of 37% recurrence. The majority of these recurrence patinets did not undergo a further surgical procedure.

Conclusion: EDT is a benign, but locally aggressive lesion with irregular margins. Due to the spicular pattern of invasion, the probability of recurrence is high even when the principles of wide surgical resection are used. It's still not clear, whether adjuvant measures are useful in particulary patients with a positive surgical margin. Factors like large tumor size,bony involvement and location might also contribute to recurrence.

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Desmoid fibromatosis: assessment of MRI texture features correlating with radiological and/or clinical outcome

Aim of the study: To evaluate if MRI based image texture analysis can effectively differentiate between treatment responsive and non-responsive desmoid-type fibromatosis patients.

Introduction: The aim was to evaluate if MRI based image texture analysis can effectively differentiate between treatment responsive and non-responsive desmoid-type fibromatosis patients.

Methods: This retrospective cohort study included patients who received treatment and underwent a pretreatment MRI scan. Group allocation was performed at 3, 6, 9, and 12 months after treatment started. Desmoids on T1W contrast-enhanced and T2W fat suppressed MRI scans were segmented and texture features were extracted. Heatmaps were constructed to explore features that showed a relevant difference between response groups (p0.79. One out of six T2W features had an AUC>0.9. T1W contrast-enhanced MRI texture features were able to differentiate between clinically and/or radiologically responsive and non-responsive patients.

SPAGN: Kathrin Schuster

Sarcoma Patient Advocacy Global Network

From a patient´s point of view

SESSION 7:

UPDATE IN MEDICAL TREATMENT OF STS

CHAIRS: Sebastian Bauer (Germany), Robin Jones (UK)

Joanna Szkandera

Department of Oncology. Medical University of Graz, Austria

Update on current studies in STS

Silvia Stacchiotti

Department of Oncology, National Cancer Institute, Milan, Italy

Treatment options in ultrarare sarcomas

Lars Lindner

Ludwig-Maximilians-University of Munich, Germany

Perioperative chemotherapy plus regional hyperthermia in STS patients

Pawel Sobczuk[1,2], Izabela Agnieszczak[1,2], Szymon Lipiec[1,2], Piotr Malinowski[1,2], Katarzyna Kozak[1], Paweł Teterycz[1], Paweł Rogala[1], Tomasz Świtaj[1], Hanna Koseła-Paterczyk[1], Sławomir Falkowski[1], Piotr Rutkowski[1]

[1] Maria Sklodowska-Curie National Research Institute of Oncology, Department of Soft Tissue/Bone Sarcoma and Melanoma, Warsaw, Poland
[2] Medical University of Warsaw

Systemic treatment of advanced synovial sarcoma – analysis of real-world data from a reference center

Introduction: Chemotherapy (ctht) remains the standard of systemic therapy for patients with synovial sarcoma (SS), and little progress has been made in recent years. In this study, we aimed to describe the pattern of care and outcomes for patients with advanced SS.

Methods: This is a retrospective analysis of patients with advanced or metastatic SS treated with systemic therapies.

Results: 134 patients were included, 88.1% underwent curative surgery for primary disease, and 84.7% received perioperative chth. Median time from diagnosis to palliative therapy was 18 months. Median PFS and OS in 1st line were 7.8 and 22.3 months. The most common chth in 1st line were ifosfamide (65.7%) and doxorubicin-based regimens (29.9%), but no differences in PFS were observed (8.7 vs 7.0 months, p=0.735). 52.2% of patients underwent surgery in 1st line, which resulted in improved PFS (19.9 vs. 4.2 months, p1st line is very limited, with some activity of pazopanib and rechallenge with ifosfamide.

Tomohiro Fujiwara[1], Toshiyuki Kunisada[1], Eiji Nakata[1], Toshifumi Ozaki[1], Akira Kawai[2]
[1] Okayama University Hospital
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Alveolar soft part sarcoma: progress toward improvement in survival? A nationwide database study

Aim of the study: We aimed to characterize alveolar soft part sarcoma (ASPS), an ultra-rare soft-tissue sarcoma, and investigate whether the oncological outcome has improved over the past decade using a nation-wide database.

A total of 120 patients with newly diagnosed ASPS from 2006 to 2017 were studied. The study cohort comprised 34 (28%) patients with localized ASPS and 86 (72%) with metastatic disease at presentation. The 5-year DSS was 68% for all patients and 86% and 62% for localized and metastatic disease, respectively (p=0.019). Metastasis at presentation was the only adverse prognostic factor for DSS (HR: 7.65; p=0.048). Patients who were >25 years (80%; p=0.023), had deep-seated tumours (75%; p=0.002), and tumours>5 cm (5–10 cm, 81%; >10 cm, 81%; p<0.001) were more likely to have metastases at presentation. In patients with localized ASPS, adjuvant chemotherapy or radiotherapy did not affect survival, and 13 patients (45%) developed distant metastases in the lung (92%) and brain (15%). In patients with metastatic ASPS (lung, n=85 [99%]; bone, n=12 [14%]; and brain n=9 [11%]), surgery for the primary or metastatic site did not affect survival. Prolonged survival was seen in patients who received pazopanib treatment (p=0.045), but not in those who received doxorubicin-based cytotoxic chemotherapy. Overall, improved DSS for metastatic ASPS has been observed since 2012 (5-year DSS, from 58 to 65%) when pazopanib was approved for advanced diseases. In conclusion, the national study confirmed an overall trend toward prolonged survival after the introduction of targeted therapy, which encourages continuous efforts to develop novel therapeutic options for this therapeutically resistant soft-tissue sarcoma.

Paulina Chmiel

Department of Soft Tissue/Bone Sarcoma and Melanoma, Maria Sklodowska-Curie National Research Institute of Oncology, Warsaw, Poland

Long-term outcomes of multiple lines of chemotherapy in epithelioid sarcoma

SESSION 8:

RADIOTHERAPY

CHAIRS: Lisette Wiltink (The Netherlands), Beatrice Seddon (UK)

Beatrice Seddon

The Sarcoma Unit at University College Hospitals NHS Foundation Trust, London, UK

Proton beam and carbon particles

Lisette Wiltink

Radiation Oncology Department, Leiden University Medical Center, The Netherlands

New approaches in radiation therapy of STS

Mateusz Spałek, Aneta Borkowska, Michał Wągrodzki, Patricia Castaneda-Wysocka, Piotr Rutkowski

Maria Skłodowska-Curie National Research Institute of Oncology, Warsaw, Poland

Preoperative radiotherapy with hyperthermia in recurrent and radiation-associated sarcomas: results of a phase 2 clinical trial

Aim of the study: To investigate if preoperative or definitive radiotherapy combined with regional hyperthermia would not lead to significant late toxicity in patients with radiation-associated or in-field recurrent sarcomas

Introduction: The role of perioperative treatment in radiation-associated sarcomas (RAS) and sarcoma recurrence in a previously irradiated volume (IRS) remains uncertain. We hypothesized that the combination of preoperative or definitive radiotherapy (RT) of 12x 3 Gy with or without boost, combined with regional hyperthermia (HT) twice weekly, would not lead to significant late toxicity in RAS/IRS patients.

Methods: We conducted a prospective, single-arm phase 2 clinical trial. We included patients with locally advanced or oligometastatic RAS/IRS. The treatment consisted of three weeks of RT, 3 or 3.5 Gy per fraction, combined with HT, followed by surgery or observation. Boost or no-boost regimen was based on resectability. The regimen would be considered safe, significant late RT-related toxicity (CTCAE 5.0 grade 3+) occurred in less than 20% of patients 18 months after RT.

Results: We included 20 patients (RIS n=8, IFRS n=12). The median follow-up was 28 months. Late toxicity included limited limb mobility in two patients (grades 1 and 2), grade 1 skin fibrosis in four patients, and chronic skin ulceration (grade 2) in two patients. No patient developed late-grade 3+ toxicity. Seven patients who received the no-boost regimen experienced local failure. No patients receiving the boost regimen experienced local progression. Eight patients had distant metastases. Four patients died.

Conclusions: Our study suggests that combining moderately hypofractionated RT with HT is safe for RAS/IRS patients. Additionally, the boost may be important for acceptable local control.

Carolina De la Calva Ceinos, Elena Sáez Padilla, Paula González Rojo, Manuel Angulo Sánchez, José Vicente Amaya Valero, Francisco Celada Álvarez, Francisco Baixauli García

The University and Polytechnic La Fe Hospital of Valencia, Spain

Analysis of the role of intraoperative radiation therapy in the treatment of soft-tissue sarcomas. case-control study

Aim of the study: The purpose of this study is to analyse the impact of intraoperative radiation therapy (IORT) in the treatment of soft tissue sarcomas in a Musculoskeletal Tumor Reference Unit.

Introduction: Currently, there is no clear evidence of greater overall effectiveness of intraoperative radiation therapy (IORT) in the treatment of soft-tissue sarcomas compared with other procedures.

Methodology: A retrospective case-control study was carried out comparing the rate of complications of the surgical wound and local recurrence in patients treated with preoperative radiotherapy and IORT using as a control group, patients who have only received preoperative radiotherapy. The variables age, gender, location, histological subtype, staging according to AJCC or surgical margins have been studied; and a survival analysis has been performed to study local and systemic recurrence and overall survival.

Results: A total of 39 patients were analyzed, 18 cases and 21 controls. 5 (27.78%) patients experienced surgical wound complications in the case group and 6 (28.57%) in the control group. There are no significant differences between both groups ($p = 0.372$). The survival rate free of local recurrence was 85.71% in the cases and 76.92% in the controls, without significant differences ($p = 0.2268$). The overall survival rate was 92.86% in cases and 76.92% in controls, with no significant differences ($p = 0.5756$). The mean follow-up was of 21.35 ± 10.47 months in cases and 32 ± 29.71 months in controls.

Conclusion: The use of IORT in soft-tissue sarcomas does not lead to an increase in wound complications. However, more studies with larger number of participants are needed to establish its influence on local and systemic recurrence.

Lukáš Pazourek[1], Tomáš Tomáš[1], Michal Mahdal[1], Vasileios Apostolopoulos[1], Iva Staniczková Zambo[2], Jiří Komínek[3], Dagmar Adámková Krákorová[4]

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Soft tissue sarcoma resection after neoadjuvant radiotherapy or chemoradiotherapy

Aim of the study: Evaluation of our expirience with neoadjuvant radiotherapy or chemoradiotherapy in the treatment of extremity soft tissue sarcomas

Introduction: The use of neoadjuvant radiotherapy in soft tissue sarcomas is associated with a low risk of local recurrence even with R1 or close R0 resections.The essence of the technique is the precise targeting of radiotherapy to the volume of the tumor itself and the adjacent reactive zone, which is associated with a smaller irradiated field and a lower dose compared to adjuvant radiotherapy. The combination with neoadjuvant chemotherapy can, in indicated cases, improve overall survival and reduce the risk of metastatic spread until the tumor is removed.

Methods: The authors retrospectively evaluate a set of 33 patients who underwent resection of extremity soft tissue sarcoma between 2019 and 2023 at a single institution after previous neoadjuvant radiotherapy. The average follow-up was 26 months, the average age was 63.3 years, the most common site was the thigh (63%), the average tumor size was 13.4 cm, the most common diagnosis was myxoid liposarcoma and undifferentiated pleomorphic sarcoma, in 14 patients neoadjuvant radiotherapy and chemotherapy was combined.

Results: After neoadjuvant treatment, no statistically significant reduction in tumor size was noted (p0.756), however an average of 67% tumor necrosis was achieved. Local recurrence was noted in only one patient. Treatment-related complications such as wound dehiscence, extensit hematoma or infection occurred in 7 patients (21%).

Conclusions: The use of neoadjuvant radiotherapy or chemoradiotherapy in the treatment of large extremity soft tissue sarcomas enables limb-preserving resection with a low risk of local recurrence and an acceptable complications rate.

Viola Laghi[1], Paolo Spinnato[2], Erika Galietta[1], Costanza Maria Donati[1], Letizia Cavallini[1], Giuseppe Bianchi[3], Alberto Righi[4], Massimiliano De Paolis[5], Andrea Sambri[5], Annalisa Cortesi[6], Claudio Malizia[7], Davide Maria Donati[3], Alessio Giuseppe Morganti[1], Silvia Cammellli[1]

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Results of Neoadjuvant Radiotherapy in High-Grade Soft Tissue Sarcomas of the Extremities: Insights from an Italian Reference Centre

Introduction: To assess the outcomes of high-grade soft tissue sarcomas (STS) of the extremities treated with neoadjuvant radio(chemo)therapy in a single-institution series.

Methods: This study involved 102 patients with localized, high-grade STS of the extremities. All cases underwent a multidisciplinary review involving radiation oncologists, orthopaedic surgeons, medical oncologists, radiologists, and pathologists. The median radiation dose was 50 Gy. Conservative surgery followed a median of 5 weeks post-radiotherapy.

Results: Over a median follow-up of 65 months, 40 patients (39.22%) experienced relapse: 2 (1.96%) locally, 36 (35.29%) with distant metastases (median onset 17.08 months, range 2.86-147.25), and 2 (1.96%) with both. The 5-year actuarial rates were: local control (LC) 95.00%, metastasis-free survival (MFS) 70.00%, disease-free survival (DFS) 69.00%, and overall survival (OS) 94.40%. Surgical margins were wide in 74.76% of patients, marginal in 19, and intralesional in 7. Histologic evaluation showed a median tumor necrosis of 80%. Log-rank tests indicated better 5-year DMFS and DFS in patients with spindle cell histology (p=0.016, p=0.012) and lower median dose (p=0.047, p=0.021), better 5-year LC with wide resection margins (p=0.004) and improved 5-year OS with chemotherapy (p=0.008). None of the significant differences recorded in the univariate analysis were confirmed in the multivariate analysis.

Conclusions: Neoadjuvant radiotherapy, combined with conservative radical surgery, achieves excellent LC and OS. This underscores the importance of thorough, multidisciplinary evaluation. The extended follow-up period is crucial for timely detection of metastases, which can occur long after treatment.

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Safety and textbook outcomes of preoperative chemotherapy with hypofractionated radiotherapy in borderline resectable soft tissue sarcomas

Aim of the study: Analysis of safety and definition of textbook outcomes for preoperative treatment with doxorubicin-ifosfamide (AI) chemotherapy and hypofractionated 5x5Gy radiotherapy after 1st cycle of chemotherapy in marginally resectable soft tissue sarcomas.

Limb salvage surgery is still a challenge in patients with T3/T4 soft tissue sarcomas(STS). Based on our phase II clinical trial (NCT03651375) we have implemented preoperative treatment with doxorubicin/ifosfamide(AI) and 5x5Gy radiotherapy after 1st cycle of chemotherapy; in marginally resectable STS(UNRESARC). 82 patients were enrolled. 73(89%) patients received 3 AI cycles, all received radiotherapy with a preplanned dose and schedule and were referred to surgery. Textbook outcomes (TO) for therapy were: 1) Negative margins, 2) No amputation, 3) No Clavien-Dindo ≥3a/≥2 grade complications, 4) No 30-day readmission, 5) No 30-day mortality, 6) Hospitalization <90 percentile, 7) No vascular reconstruction, 8) No need for VAC treatment, 9) No postoperative blood transfusion, and 10) No significant limb function impairment. 43% of patients achieved TO, while poor 5/10-year OS estimated by sarculator, hypoproteinemia G3, amenia G2/3 before surgery correlated with not achieving TO. Hypoalbuminemia correlated with tumor volume, and GTV ($p<0.01$). Nevertheless, the achievement of TO did not impact either RFS or OS. Limb amputation was performed only in 3 patients. The majority of AEs were related to chemotherapy. Postoperative wound complications included infection (12.2%), wound drainage(9.8%), wound dehiscence(5.9%), hematoma(4,9%), and wound packing (3.7%). Despite preoperative treatment only 7 patients required reoperation. 5-year OS rate was 50.1% (95% CI: 37.8%-66.5%). Treatment with the UNRESARC protocol has acceptable safety and enables limb-sparing surgeries in STS.

SESSION 9:

ONCOLOGICAL BATTLES

CHAIRS: Javier Martin Broto (Spain), Peter Reichardt (Germany)

Peter Reichardt (Berlin), Robin Jones (London)

Do we really need preoperative chemotherapy in STS?

Javier Martin Broto (Madrid), Hanna Kosela-Paterczyk (Warsaw)

Is there a future for immunotherapy in sarcoma?

June 13, Thursday | Pomerania Hall

SESSION 5:

PRINCIPLES OF BIOLOGICAL RECONSTRUCTIONS AND SURGICAL TREATMENT OF BONE SARCOMA

CHAIRS: Maurizio Scorianz (Italy), Felix Shumelinsky (Belgium)

Miguel San Julian Aranguren

Universidad de Navarra, Pamplona, Spain

Biological reconstructions in bone sarcomas

David Martinčič, Rok Vojković, Aljaž Merčun, Blaž Mavčič

University Medical Centre Ljubljana, Slovenia University of Ljubljana, Slovenia

Pelvic chondrosarcoma resection with fibula graft reconstruction

Aim of the study: Case presentation – Pelvic chondrosarcoma resection with fibula graft reconstruction

A 40-year-old male underwent surgical treatment after two-month of abdominal and thigh pain. Imaging showed a large mesenchymal tumor arising from the left pubic bone (12x10x11 cm), eroding the cortex of the right pubic bone, compressing the bladder and infiltrating the lower abdominal wall just above symphysis. Core needle biopsy results gave the diagnosis of grade 1 chondrosarcoma. An en-bloc tumor resection was performed with removal of both pubic bones and symphysis. The osteotomy sites were guided by an intraoperative navigation system, crossing the pubic rami just medial to the acetabulum, thus preserving the hip joints. The infiltrated lower abdominal wall was resected together with the tumor and a rectus abdominis tissue flap was used to cover the defect. The tumor was carefully dissected from the anterior surface of the bladder. A 14-cm free fibula graft was harvested, implanted transversely across the bony defect between both pubic bone osteotomy sites and fixed with cortical screws, thus restoring the continuity of the pelvic ring. Graft had to be removed two weeks later due to infection and bladder perforation. Temporary bilateral nephrostomes were inserted and urinary complications resolved without major urological interventions. After one yearof follow-up, the patient walks without any aids and has no signs of pelvic instability. This case shows pelvic ring reconstruction is not necessary even with major symphysis defects. Inserting grafts/implants deep into the pelvic cavity may result in impingement and subsequent perforation when bladder is distended with physiological amounts of urine.

Oleg Vyrva, Yanina Golovina, Igor Shevchenko, Roman Malik

Sytenko Institute of Spine and Joint Pathology, Kharkiv, Ukraine

Long-term outcomes of allograft bone tumor reconstructions: single institution historical review

Introduction: Limb salvage surgery for musculoskeletal sarcomas aims to remove tumors and restore limb function and appearance. While complications with allografts are reported, unique anatomical conditions often necessitate their use. This study reviews the 70+ years of experience at Sytenko Institute to access the efficacy of structural allografts in limb salvage surgeries.

Methods: The first allograft tumor reconstruction in Ukraine occurred in 1946. Over 3,400 limb salvage surgeries were performed from 1950 to the end of 1990, predominantly utilizing hemiarthroplasty and intercalary resections with massive cortical structural allografts. Historical records were reviewed to assess outcomes in terms of joint preservation, reoperations, revisions, and amputations.

Results: Infection complications occurred in 28% of cases, with allograft fractures and nonunions in 16%. These complications often led to revision surgeries and an amputation rate of 39% due to infection, local tumor relapse, and nonunion. However, the majority of patients (54%) experienced satisfactory limb function restoration, improved joint range of motion, and enhanced QOL.

Conclusions: Intercalary bone allograft reconstruction demonstrated better functional outcomes and lower complication rates compared to allograft hemiarthroplasty. The long-term success rate of over 50% with structural allograft limb salvage confirms its viability in select cases. Additionally, the biological healing of bone and robust soft tissue attachment further highlight the benefits of allograft usage in limb salvage surgeries. These findings underscore the importance of careful patient selection and surgical technique in optimizing outcomes in bone tumor reconstructions.

Anjana Reddy, Manish Pruthi, Prakash Nayak, Ajay Puri

Tata Memorial Hospital, Mumbai

Prognostic factors and outcomes in periosteal osteosarcoma – single institute study of 31 cases

Aim of the study: To evaluate the prognostic factors and outcomes in periosteal osteosarcoma treated at a single institute over 21 years.

Methods: Retrospective analysis of 31 periosteal osteosarcoma cases (2001-2022). Mean age was 19 years. Intramedullary disease was present in 16 patients, absent in 14, data was unavailable in one. 28 of 31 patients received chemotherapy. Twenty-nine had limb salvage surgery (LSS), one amputation, one rotationplasty. Of the 29 LSS, 21 were wide excision, 8 hemicortical excision.

Results: 29 of 31 patients were available for follow up. Median follow up was 85 months (1-209 months). Surgical margins were free in all. 28 patients received chemotherapy. Response was assessed in 14 cases as other 14 patients underwent resterilization and reimplantation of tumor bone, hence response assessment was not possible. Good response to chemotherapy was seen in 6/14 cases while poor in 8/14 cases. There was 1 local, 2 distant and 3 combined relapses. Four of 5 with distant recurrence had intramedullary disease. There was no statistically significant difference in disease recurrence based on chemotherapy response. Six patients died of disease. Twenty-three patients are currently alive and remain continuously disease-free. 5-year OS was 77.7%. Tumour size was associated with distant recurrence when analysed as continuous variable ($p=0.04$). Hazard of death in patients with medullary involvement was 3.8 times higher ($p=0.19$).

Conclusion: Intramedullary involvement and increasing tumor size may lead to increased recurrence risk. Distant recurrence has an impact on survival, hence a poor prognostic factor. Effect of chemotherapy is debatable as judged by survival data in good and poor responders.

Ajay Puri, Manish Pruthi, Anjana Reddy, Ashish Gulia

Tata Memorial Centre, Mumbai, India

What factors affect outcomes in parosteal osteosarcoma (PO)?

Aim of the study: PO is a low-grade surface osteosarcoma conventionally treated with surgery alone. We evaluated the impact of medullary invasion and margins on Local Recurrence Free Survival (LRFS) and Overall Survival (OS).

Methods: 42 patients (34 primary, 8 recurrent) with mean age 34 years analysed.Thirty-nine had limb salvage surgery (LSS) (32 osteoarticular ,7 hemicortical excision), 3 had amputations. Nine patients needed vascular reconstruction.

Results: Three of 42 cases were dedifferentiated PO, excluded from subsequent analysis. One patient died immediately post-operatively, one was lost to follow-up. Remaining 37 patients had a median follow-up of 107 months (range 1-273). 31 are alive and disease free. 10 LR (range 3-124) and 2 distant failures (median 23 months). 5-year OS was 89.6% (95% CI 0.80-0.99), 10-year OS was 74.4% (95% CI 0.60-0.92). A margin width of < 5mm predicted worse LRFS, 5-year and 10-year LRFS was 75% (95% CI 0.54-1) and 62% (95% CI 0.38-1) respectively. In margin > 5mm, 5-year and 10-year LRFS was 100% (95% CI 1-1) and 90% (95% CI 0.73-1) respectively (p=0.038). Medullary invasion did not impact on outcomes (5-year and 10-year LRFS was 84.6% and 74% respectively, p=0.74; 5-year and 10-year OS was 84.6% and 72.5% respectively, p=0.46).

Conclusion: Surgery in PO has a high incidence of vascular reconstruction. Intramedullary involvement does not impact on prognosis. Resection margins > 5 mm improve survival and late LR can occur.

Papalia Giuseppe Francesco, Kumaran Rasappan, Micheal Parry, Guy Morris, Lee Jeys, Vineet John Kurisunkal

Royal Orthopaedic Hospital, Birmingham, UK

What is the ideal surgical resection margin that gives the best outcomes in patients with parosteal osteosarcomas?

Aim of the study: This study aims at analyzing POS occurring at various body sites and determines if there were any differences in local recurrence (LR) and metastasis rates based on resection margins.

Introduction: This study aims at analyzing parosteal osteosarcomas (POS) and determines if there were any differences in local recurrence (LR) and metastasis rates based on resection margins.

Method: This retrospective study looked at a single institution's sarcoma database over the last 22 years for patients with POS who underwent surgery with at least two years of follow-up. Data such as site, post-operative margins, tumor grade, LR and metastasis were collected and analyzed.

Results: Forty four patients were included. There were 27 distal femur POS (61.4%), 6 humerus (13.6%), 5 proximal tibias (11.4%), 3 metatarsals/metacarpals (6.8%), 2 fibulas (4.5%) and 1 radius (2.3%). The rate of LR was 22.7% (10/44): 50% with involved margins (4/8), 31.3% with margins <1mm (5/16), 5% with ≥1mm margins (1/20). Metastasis rate was 18.2% (8/44): 25% with involved margins (2/8), 31.25% in <1mm (5/16), 5% in ≥1mm (1/20). The only case with LR and metastasis with margins ≥1mm was in a proximal tibia POS where final resection histology came back as dedifferentiated POS and the patient was too old for adjuvant chemotherapy. Excluding this single case from analysis, there was a significant difference between margins vs LR and margins vs metastasis rates (p= 0.005 and p=0.032 respectively).

Conclusion: A minimum of 1 mm resection margin should be attained to achieve best patient outcomes with regards to LR and metastasis rates.

Kumaran Rasappan, Giuseppe Francesco Papalia, Lee Jeys, Guy Morris, Micheal Parry, Vineet John Kurisunkal

Oncology and Complex Arthroplasty, Royal Orthopaedic Hospital, Birmingham, United Kingdom

Can we quantify a safe margin to reduce local recurrence in paraosteal osteosarcomas around the distal femur?

Aim of the study: To evaluate the rate of local recurrence and metastasis in paraosteal osteosarcomas around the distal femur, in order to quantify a safe margin for surgery.

Introduction: Parosteal Osteosarcomas of the distal femur (POSDF) usually presents with posteriorly outgrowing tumors that lie close to the popliteal neurovascular bundle which is difficult to resect with a wide margin. The aim of this study is to evaluate the rate of LR and metastasis in POSDF, based on several parameters, in order to quantify a safe margin for surgery.

Methods: This retrospective study evaluated patients with POSDF who were surgically treated at a single institution between 2003 and 2020, with at least two years of follow-up. Data such as post-operative margins, tumor grade, chemotherapy, LR, LR-free survival, and metastasis were collected and analyzed.

Results: Twenty-seven patients with POSDF were included. Margins were involved in 4 (14.8%) patients, 2mm in 6 (22.2%). LR occurred in 8 patients (29.6%), of which three had involved margins and 5 had margins <1mm; no patients with margins ≥1mm had LR (p=0.015). Five-year LR-free survival was 25% for patients with involved margins, 64.3% for <1mm margins and 100% for ≥1mm margins (p=0.026). Metastasis-free survival was 75% for patients with involved margins, 64.3% for <1mm margins and 100% for ≥1mm margins (p=0.2).

Conclusion: Obtaining wide margins in patients with POSDF remains challenging. In light of our findings, we conclude that it is necessary to achieve at least a 1 mm margin for optimal oncological outcomes.

Francesco Muratori[1], Paolofrancesco Malfi[2], Roberto Scanferla[1], Serena Puccini[1], Federico Sacchetti[1], Elisabetta Neri[1], Guido Scoccianti[1], Domenico Andrea Campanacci[1]

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Allograft Prosthetic Composite after proximal humerus tumor resection: a retrospective analysis of a single institution

Aim of the study: To analyze type of implant, functional and oncologial outcomes of Allograft Prosthetic Composite reconstruction following proximal humerus tumor resection.

Background: The Authors report their experience on a series of 40 allograft prosthetic composite of the proximal humerus implanted in a period between 1996 and 2016 with at least 2 years follow-up, analyzing type of implant, functional and oncological outcomes and complications.

Material and method: A retrospective analysis was conducted on 40 patients (22 males, 18 females) who underwent proximal humerus resection and reconstruction in the Orthopedic Oncology department of Careggi in Florence. The reconstruction procedures included 26 anatomical, 2 resurfacing, and 12 reverse allograft prosthetic composite. Out of these, 2 prostheses were implanted for benign tumors, 32 for primary malignant tumors, 4 for metastatic disease, and 2 for the failure of previous surgery. Oncological and functional assessments were conducted using the MSTS score, and complications were categorized following the Henderson classification.

Result: In 40 patients, the average follow-up was 83 months (range 12-336 months), with 10 alive with disease, 22 no evidence of disease, 5 dead with disease, and 3 dead for other reasons. Overall Survival was 79% at 5 years and 73% at 10 years. Implant survival was 73% at 5 years and 52% at 10 years. Complications included 4 Type 1, 3 Type 2, 3 Type 3, 0 Type 4, and 5 Type 5. Higher MSTS score was noted for resections shorter than 10 cm (MSTS 88% vs. 77%)

Conclusions: Allograft prosthetic composite is a suitable option for young patients with primitive lesions, higher life expectancy, anticipating a possible future revision scenario.

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Is 3D-printed mesh scaffold an alternative to reconstruct cavity bone defects near joint?

Aim of the study: This study aims to design a 3D-printed mesh scaffold as an alternative to repair cavity bone defect, and evaluated its treatment outcomes, osteoconductivity to facilitate bone grafts healing and integration, and related complications.

Introduction: Reconstruction of cavity bone defects after curettage of benign bone tumors around joint remains challenging. We designed a novel 3D-printed mesh scaffold as a substitute for bone cement, aiming to support the articular surface, protect the subchondral bone and reduce complications rates.

Methods: We retrospectively analyzed seven patients who received curettage and reconstruction using a 3D-printed mesh scaffold between January 2020 and June 2021. Pain and function were evaluated using the 10-cm Visual Analogue Scale (VAS) score and the 1993 version of the Musculoskeletal Tumor Society (MSTS-93) score. Radiographs were used to evaluate articular surface supporting, subchondral bone protection and complications.

Results: The median functional MSTS-93 and VAS scores were both improved after surgery. Articular surface supporting, subchondral bone preservation and osteogenesis were observed postoperatively. No related complications were observed at the last follow-up.

Conclusions: The 3D-printed mesh scaffold provided sufficient mechanical support for the articular surface and protected the subchondral bone. We recommended the 3D-printed mesh structure as an alternative to repair cavity bone defect around joints.

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Use of arterial homografts for vascular reconstruction in oncological limb salvage surgery

Aim of the study: Demonstrate the feasibility, safety and efficiency of arterial homografts in oncological vascular reconstructions compared to standard techniques using artificial conduits or autologous veins

Introduction. In extremity sarcomas, major vessel encasing usually leads to amputation. Salvage surgery may be performed using a vascular reconstruction. Most surgeons use artificial conduits/saphenous autografts with significant complication rates. Considering our large experience in using arterial homografts for vascular salvage procedures (e.g. infected artificial conduits), we have been using such homografts for vascular reconstruction in extremity sarcoma surgery. We describe our experience for patients who benefitted from vascular reconstruction by homografts for tumors encasing the superficial femoral vascular bundle.

Methods. We analysed the files of 11 patients who required a vascular reconstruction using arterial homografts. We are currently evaluating their hemodynamics by ultrasonography.

Results. We operated on 8 women and 3 men of a mean age of 46.7±30.0y (range 13-84y) and mean follow-up of 2.6±2.2y. Two patients died from their disease respectively at 3 months and 2 years with a remaining viable limb. There was no immediate vascular complication. We had one prolonged lymphatic leakage and one local infection both treated conservatively. At mid-term (7 months), one patient required a revision of the vascular graft for an acute rupture by friction against the collar of a Zimmer Biomet Compress distal femur megaprosthesis. One patient was amputated at 2 years for an infected osteosynthesis in the irradiated area.

Conclusion. Vascular reconstruction of large vessels using arterial homografts is feasible, safe and effective with no significant vascular complication. We are currently assessing the grafts adequate blood flow dynamics by ultrasonography.

Manu Paul, Guruprasad C.S, Aswin Kumar, Deepthi Boddu, Prasanth V R, Manjusha Nair, Binitha R, Jayasree K, Preethi Sara George, Paul Augustine, Bhaskar Subin Sugath, Priyakumari T

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Surgical outcome of reconstruction with sterilised tumour bone using extra corporeal irradiation in paediatric malignant bone tumours

Aim of the study: To assess the surgical outcome of reconstruction with irradiated tumour bone in paediatric patients.

Introduction: Reconstruction after wide excision of a pediatric bone tumor is challenging. Autologous sterilized tumor bone provides a perfect fit, avoids problems of prosthesis wear and holds a promise for long term bone longevity. Here we present our experience with wide excision and reconstruction with irradiated tumor bone at our institution which is a high volume pediatric sarcoma care centre.

Methods: This is a retrospective analysis of 53 paediatric patients who were operated and underwent reconstruction with irradiated tumor bone between 01/01/2011 to 31/12/2021.

Results: The median follow up period was 64 months (6-112 months) and 83.3% of patients had a minimum of 3 year follow up. There were 44 diaphyseal osteotomies and 42 metaphyseal osteotomies. Short-term complications were seen in 10 patients (18.9%). The long-term complications were high, but 65% of cases were successfully managed and at the time of analysis only 15 patients had morbidity related to long term complications. A total of seven patients (13.2%) had persistent nonunion even after additional procedures like bone grafting and refixation. There were four isolated local recurrences in our series (7.5%) and all were in soft tissue. The five-year overall survival was 75.7% and five-year disease free survival was 63%.

Conclusion: Reconstruction with irradiated tumour bone is an oncologically safe procedure with acceptable morbidity. Although reconstruction with irradiated tumor bone is not a procedure without complication, it is an excellent option for reconstruction in pediatric bone tumors.

Manish Pruthi, Kumayl Nathani, Ajay Puri, Ashish Gulia, Prakash Nayak, Anjana Reddy

Tata Memorial Hospital

Limb salvage using liquid nitrogen treated autogenous tumor bone graft in malignant bone tumors – A single institution experience of 35 cases

Aim of the study: Establish outcomes of using liquid nitrogen treated autografts in primary high grade extremity tumours.

Materials and Methods: Over a period of 3 years (April 2019 to March 2022), 35 patients with primary malignant tumours of bone underwent tumor excision and reconstruction with liquid nitrogen treated autografts. 20 patients had intercalary resections while 15 had pedicle freezing technique.

Results: At median follow-up of 30 months, 29 patients were alive, 4 had died of disease and 2 were lost to follow up (LFU). Osteotomy union was assessed separately for metaphyseal and diaphysial sites. In total, we had 16 diaphyseal and 28 metaphyseal osteotomies for evaluation. All except 1 metaphyseal osteotomies united at a mean duration of 7 months. Non union was seen in 2/16 diaphyseal osteotomies. Mean time to union was 12 months. Major complications requiring intervention included deep infection in 7, bone lysis in 6 and cryotherapy bone fracture in 3 patients. Out of 35 cases, 7 patients developed distant metastasis. Two out of 7 had soft tissue local recurrence. At last follow up, of 18 intercalary resections cases available for follow-up, 14 had recycled graft in situ, 2 had partial graft in situ while 2 had complete removal. While out of 15 pedicle reconstructions, 9 had recycled graft in situ, 2 had graft in situ with infection while 4 had complete removal.

Conclusions: Graft removal in intercalary frozen autografts bone were mainly due to lysis and stress fractures whereas deep infection was the leading cause of graft elimination in pedicle cryotherapy cases.

SESSION 6:

TECHNICAL AND BIOLOGICAL ASPECTS OF BONE GRAFTING

CHAIRS: Fabrice Fiorenza (Italy), Pramod Chinder (India)

Thomas Schubert

Cliniques Universitaires Saint-Luc Department of Orthopedic Surgery and Traumatology, Brussels, Belgium

The improvement of future biological reconstructions

Maxendre Feyens[1], Robin Evrard[2], Julie Manon[2], Benoit Lengelé[2], Olivier Cartiaux[1], Thomas Schubert[2]

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Modification of mechanical properties of perfusion-decellularized structural allografts

Aim of the study: Characterization of a new generation of massive bone allografts.

Introduction: To mitigate the post-operative complication rates associated with massive allografts, tissue engineering techniques have been employed to decellularize entire bones through perfusion with a sequence of solvents. Mechanical assessment was performed to compare conventional massive allografts and perfusion/decellularized massive allografts.

Methods: Ten porcine femurs were included. Five were decellularized by perfusion. The remaining 5 were left untreated as the "control" group. Biomechanical testing was conducted on each bone, encompassing five different assessments: screw pull-out, 3-points bending, torsion, compression and Vickers indentation.

Results: four variables showed a slight, yet significant, superiority in the control group: maximum force until screw pull-out (p-value=0.028), maximum elongation until screw pull-out (p-value=0.049), energy to pull out the screw (p-value=0.028) and fracture resistance in flexion (p-value=0.028). The eight other variables showed no mechanical superiority in favor of the control group. They are listed as: Young's modulus in flexion, Young's modulus in shear stress, Young's modulus in compression, elastic conventional limit in compression, maximum constrain in compression, lengthening to rupture in compression, resilience in compression and Vickers Hardness.

Discussion and Conclusion: descriptive statistical results suggest that the biomechanical characteristics of decellularized bone decrease compared with the control group. Statistical inferences demonstrated a weak superiority of the control group. However, the mechanical properties differences were most apparent with mechanical stresses far exceeding physiological range. These tests demonstrate the safety of our decellularization protocol.

Robin Evrard[1], Julie Manon[1], Alexandre Englebert[1], Lies Fieve[2], Daela Xhema[2], Olivier Cornu[1], Benoit Lengelé[1], Thomas Schubert[1]

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Creating a living massive bone allograft: Final data of our pilot study

Aim of the study: Enhancing the biological integration of bone allografts.

Introduction: The high complication rate of massive allografts jeopardizes their use in limb salvage surgery, despite the biological quality that this type of implant should provide. Tissue engineering techniques could be the solution for improving the biological quality of these grafts.

Methods: Three porcine humerus – decellularized by perfusion according to a previously described protocol – were subjected to a recellularization protocol. This protocol, developed and refined by our teams, involves two injections of GFP (Green Fluorescent Protein) mutated adipose mesenchymal stem cells (AMSC-GFP) into the vascular network of total bone kept sterile and under cell culture conditions using a custom-made bioreactor. This recellularization protocol takes at least one month to complete and allows the introduction of cell differentiation factors. Nano-CT acquisitions are ongoing. Differentiation immunohistochemistry's are ongoing.

Results: A qualitative histological study of each bone in its entirety was carried out. The presence of cells in the medullary cavity was clearly identified. These cells appeared in clusters, firmly attached to the extra-cellular matrix and producing their own collagenous matrix, a sign of their vitality. In the cortex, we observed a large number of stem cells in the vascular network. Moreover, it would appear that diffusion of these cells has enabled them to occupy the decellularized osteoplasts.

Conclusion: The refinement of our protocol enables us to create recellularized porcine massive bone allografts.

Fatih Özel, Mehmet Bürke, İpek Işik, Emre Ünal, Türkmen Turan Çĭftçĭ, Devrim Akinci, Mehmet Ayvaz

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Long Term Results Of Radiofrequency Ablation Treatment Guided By Computed Tomography In Osteoid Osteoma Patients

Aim of the study: This study aims to provide a comprehensive perspective on treatment outcomes and rare complications seen during the follow-up period of OO.

A hospital database search was performed between Jan 2005 and Dec 2022. Patients with OO treated with CT-guided RFA were retrospectively analyzed. Patients with a history of surgery before RFA treatment, patients who underwent RFA treatment at another institution, and patients who underwent surgery after RFA treatment at another institution were excluded from the study. In 210 symptomatic OO patients (male/female ratio: 141/69, mean age 16.6 years (min: 2 years; max: 58 years)), the number of procedures was 223. All patients had preop CT imaging. Post-procedure clinical follow-up of the patients was evaluated. Technical and clinical success as well as complications of RFA treatment were recorded. Rapid relief of the pain symptom characteristic of OO, low long-term recurrence rate and low complication rates confirm the efficacy and safety of RFA treatment. There are many articles in the literature on the short-term outcomes of patients treated with RFA. However, this article points to an increase in recurrence rates in RFA patients in the long term and suggests that the follow-up period should be kept longer. Nevertheless, when long-term results are analyzed, RFA can be safely considered as a preferred treatment modality in the treatment of OO due to its 95.2% efficacy and low complication rates.

Michelle Ghert, Lauren Gyemi, Tricia Schneider, Asher Selznick, Hadia Farrukh, Bradley Petrisor

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A calcium sulfate-calcium phosphate bone substitute as a bone void filler in the treatment of primary benign bone tumours – a case series

Aim of the study: To describe the use and medium- to long-term outcomes of a calcium-sulfate-calcium phosphate bone substitute (CaSO4/CaPO4) as a bone void filler option in the treatment of primary benign bone tumours following intralesional curettage.

Methods: Retrospective review of patients identified from surgeon-specific orthopaedic oncology database, who underwent intralesional curettage of benign bone tumours and subsequent bone void filling with CaSO4/CaPO4. Of 39 patients (20 males, 19 females) meeting inclusion criteria, the average age was 31 years (range: 13 to 62 years) with a median follow-up of 3 years and a maximum follow-up of 11 years.

Results: The most common tumour diagnosis was giant cell tumour of bone (GCT) (n = 19), and the most common location was the proximal tibia (n = 9). The mean volume of tumour excised was 74.1cm3 including extraosse-

ous bone expansion due to tumor growth, with a mean volume of 21.4ml of CaSO4/CaPO4 used to fill the intraosseous cavitary defects to restore normal bone anatomy. None of the lesions required additional internal fixation. The primary outcome measure, average time to full weight-bearing/full range of motion, was 11 weeks and 6 weeks for upper and lower extremity lesions respectively. Complications included tumour recurrence requiring reoperation in 6 patients and infection requiring reoperation in 2 patients.

Conclusion: This study demonstrates that CaSO4/CaPO4 is a viable option as a bone void filler in the reconstruction of cavitary defects following removal of primary benign bone tumours. CaSO4/CaPO4 provides sufficient bone regeneration early in the post-operative period to allow progression to full weight bearing within weeks without the need for internal fixation. There were no graft-specific complications noted.

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Clinical evaluation of the three-dimensional printed strut-type prosthesis combined with autograft reconstruction for giant cell tumor of the distal femur

Aim of the study: This study aimed to describe the design and surgical techniques of a three-dimensional (3D) printed strut-type prosthesis with a porous titanium surface for distal femur giant cell tumors of bone (GCTB) and evaluate the short-term clinical outcomes.

This study presents a 3D-printed strut-type prosthesis for giant cell tumors of bone (GCTB) in the distal femur, offering a novel solution to complications associated with traditional treatments. The porous titanium prosthesis aims to preserve knee functionality and subchondral bone, with short-term clinical outcomes showing promise.

Methods: The study outlines the design and surgical techniques of the 3D-printed strut-type prosthesis for distal femur GCTB, with short-term clinical outcomes evaluated after a mean follow-up of 30.8 ± 7.5 months.

Results: Patients (n=__) displayed positive outcomes at the final follow-up, with no local recurrence or complications. Pre-surgery, the mean affected subchondral bone percentage was 31.8% ± 9.6%, and thickness was 2.2 ± 0.8 mm. Postoperatively, significant improvements were noted in the MSTS-93 score (26.7 ± 2.4 vs. 18.8 ± 3.7, $P < 0.05$) and range of motion (122.8° ± 9.1° vs. 108.3° ± 6.1°, $P < 0.05$). Subchondral bone thickness increased to 10.9 ± 1.3 mm.

Conclusions: The 3D-printed strut-type prosthesis, combined with autograft reconstruction, demonstrates acceptable early outcomes for grade I or II GCTB in the distal femur. Advantages include biocompatibility, osseointegration capacity, and subchondral bone protection. Further validation in larger studies with extended follow-up may establish it as an alternative for GCTB treatment in the distal femur.

Levent Eralp, Buğra Alpan, Hakan Özbay, Natig Veli, Harzem Özger

Acibadem Maslak Hospital Dept. of Orthopaedics And Traumatology Istanbul, Türkïye

Extraarticular resections: indications, prognostic factors and outcomes

Aim of the study: To investigate the prognostic significance of radiologic criteria used in decision-making for extraarticular resections and oncological outcomes of these procedures.

Forty-two patients (M/F:28/14), who underwent extraarticular resection between 1998-2023, were retrospectively analyzed. Most common site was knee with 24 (57.1%) patients. Mean age was 36.7 (5-77) years, and mean follow-up was 44.7 (1-295) months. Most common pathology was osteosarcoma (18 pts, 42.9%) and 33 (78.6%) were operated for bone tumors. Tumor size was larger than 10 centimeters in 25 (59.5%). Pathological (intraarticular) fractures were detected in 3 (7.1%). Thirty-nine (92.9%) patients had a positive imaging finding of articular involvement. Site-independent imaging findings were as follows: effusion in 22 (52.4%), transarticular skip metastasis 2 (4.8%), articular cartilage destruction 15 (35.7%), capsular insertion destruction 3 (7.1%), synovial contrast enhancement 6 (14.3%) and bone marrow edema 17 (40.5%). Intraarticular tumor involvement was confirmed in pathology in only

29 (69.0%). Local recurrence was observed in 7 (16.7%) and metastasis developed in 15 (35.7%). While significant correlations were determined among certain parameters, results mainly suggest articular cartilage destruction, synovial contrast enhancement, and pathological (intraarticular) fracture as the universal indicators for extraarticular resections for all anatomical sites. Further studies with larger cohorts are needed to investigate the actual impact of histology, neoadjuvant treatment, imaging findings and resection technique on outcomes. Retrospective multidisciplinary assessment of radiological and histopathological findings is essential to evaluate the accuracy of surgical decision-making.

Guido Scoccianti, Serena Puccini, Elonora Mellace, Caterino Martina, Francesco Muratori, Domenico Andrea Campanacci

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Distal radius allografts after resection for tumor: survival and functional results at 10 to 24 years follow-up

Aim of the study: Purpose of the study was to ascertain long-term results of reconstructions with osteoarticular allografts after distal radius resections for tumor.

Introduction: Different reconstructions of the distal radius after resection for tumor were proposed. Osteoarticular allografts can restore a functional joint but long-term durability of this reconstruction was questioned. To ascertain long-term results we decided to review our series of patients with a minimum follow-up of 10 years.

Methods: From 1999 to 2013 we performed 23 reconstructions with osteoarticular allografts after distal radius resection. Age of patients: 14 to 69. 17 patients were affected by giant cell tumor, 3 by Ewing sarcoma, 2 osteosarcoma, 1 osteoblastoma. All patients were evaluated for survival of the allograft and functional result (MSTS and DASH scores).

Results: One patient was lost at follow-up after 53 months. One patient died for concomitant diseases at 44 months. Among the remaining 21 patients, just one underwent a revision to an arthrodesis at 48 months after two failures. Twenty allografts, out of twenty-one with a minimum follow-up of ten years, remained in situ at latest follow-up, ranging from 122 to 293 months (mean 211, median 223). MSTS (18 pts) ranged from 20 to 30 (mean 26.8), DASH from 0 to 30% (mean 9,4).

Conclusions: In our experience, osteoarticular allografts in distal radius reconstruction can be a long-lasting procedure, with long-term satisfaction of the patient, if avoidance of heavy activities is accepted since the beginning. Few and conflicting results are reported in Literature; a comparison between series would be interesting to understand factors which could explain differences in results.

SESSION 7:

BIOLOGICAL SOLUTIONS IN NOVEL ONCOLOGICAL IMPLANTS

CHAIRS: Thomas Schubert (Belgium), Minna Katariina Laitinen (Finland)

Jendrik Hardes

Essen, Germany

Joint and physis sparing surgical techniques in the era of 3D-printing

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Joint-sparing resection of juxta-articular primary tumors of the knee using titanium alloy 3D printed cutting guides and reconstruction using custom shaped allograft

Aim of the study: The aim of our study was to develop 3D-printed cutting guides made of titanium alloy that allow precise tumor resection and allograft shaping allowing biological reconstruction in joint-sparing resection of the knee.

Introduction: Treatment of juxta-articular knee tumors is challenging. The development of 3d printing technology has made it possible to develop cutting guides allowing accurate tumor resection and allograft shaping to achieve a biological reconstruction.

Methods: Between December 2017 and June 2021, 10 patients underwent multiplanar juxta-articular resection for a primary bone tumor at our institution. Resection was performed using a custom-made 3D-printed titanium alloy cutting guide. Reconstruction was performed using a custom shaped allograft. The mean follow-up was 50 months.

Results: The study of cutting accuracy was performed by computerized examination of CT images of the resection piece. It was possible to evaluate the accuracy of the cuts on the resection piece of 6 patients; the average cutting error was 2.9 mm. Surgical margins were wide in all patients. Two patients developed postoperative complications that resulted in the removal of the allograft in one. The median Muscoloskeletal Tumor Society Score was 26, the median Oxford Knee Score was 44.

Conclusions: Our results are promising and demonstrate the possibility of achieving precise cuts leading to wide margins. Complications can be managed in most cases preserving the allograft. This research project is funded by Tuscany Region.

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Dual-crosslinked magnetic hydrogel with programmed release of PTH promotes bone healing

Aim of the study: This study aimed to develop a stimulus-responsive hydrogel to provide on-demand pulsatile and sustained release of PTH with the simultaneous effect of magnetic actuation to enhance osteogenesis in critical-sized defects.

Introduction: Intermittent delivery of parathyroid hormone (PTH) could effectively promote bone regeneration. Exposure to magnetic stimulation could regulate cell fate to promote osteogenesis.

Method: A magnetised scaffold was developed to provide programmed PTH release and simultaneously magnetic actuation to promote osteogenic commitment. A dual-crosslinked hydrogel was formulated as GelMA-PVA (GP) biphasic reservoir with magnetic nanoparticles (GPM) and PTH (GPMP). Macroscopic and microscopic characterisations were performed to optimise the formulations.

Results: In vitro release assessment verified the programmable release of PTH with a pulsatile profile primed by magnetisation in the first four days and a sustained release controlled by the optimised GP matrix over one month. Stimulated magnetisation, the scaffolds displayed a zigzag-shaped pulsatile release profile and the cumulative release was enhanced by 8%, 28%, and 18% in In40, Ab40 and In20Ab20 formulations respectively. In vitro test shows that all formulations were biocompatible and PTH addition significantly promoted the proliferation of MC3T3-E1 pre-osteoblasts. In vivo studies presented enhanced new bone regeneration with bone volume and bone mineral density significantly improved in GPM and GPMP groups (increased 120% and 251% compared with Blank), confirming its osteogenic effects and accelerated bone healing.

Conclusion: This newly developed GPMP system supported the future clinical application with simultaneous effects from the programmed release of PTH and magnetic activation, holding promise to enhance osteogenesis and treat various conditions of delayed/non-unions without the burden of daily injection.

Lee Zuckerman

Keck School of Medicine of the University of Southern California

All internal distraction osteogenesis after tumor resection with magnetic intramedullary nails

Aim of the study: This purpose of this study is to evaluate the outcomes of multiple all internal distraction osteogenesis techniques using magnetic intramedullary nails.

Introduction: All internal distraction osteogenesis (AIDO) can reconstruct defects and correct limb-length discrepancies (LLDs) with or without deformities. This study evaluates the outcomes of multiple AIDO techniques using magnetic intramedullary nails.

Methods: A retrospective review of all patients undergoing AIDO using magnetic nails was performed. Age, follow-up, reconstruction length, location, number of surgeries, and complications were evaluated.

Results: Twenty patients underwent AIDO. Thirteen had a primary bone sarcoma and seven had metastatic disease. The average age was 32 years (9-70), defect was 10 cm (3-23) and follow-up was 36 months (9-101). Eight underwent intramedullary lengthening, two with simultaneous deformity correction, averaging 1.25 surgeries (1-2) and 6 cm of lengthening (3-11) with no complications. Five underwent plate-assisted bone segment transport (PABST), averaging 2.6 surgeries (1-5) and a 14 cm defect (10-23) with one debridement for infection. Five had a bone transport nail (BTN), averaging 4.4 surgeries (2-8) and a defect of 12 cm (4-18). Three had hardware failures, two had a nonunion, two had regenerate issues requiring surgery and two had residual LLDs. Two underwent extramedullary AIDO, averaging 5.5

surgeries (3-8) and a defect of 13 cm (5-21). Both had hardware failures, with one requiring two revisions and one requiring one revision.

Conclusions: AIDO successfully treated intercalary defects and LLDs. Further research is needed to determine the optimal technique for defect reconstruction. An author is a paid consultant for the implant company.

Lee Zuckerman

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Reconstruction of bony defects with intercalary allografts using magnetic intramedullary nails in compression

Aim of the study: The purpose of this study is to evaluate union rates and complications of allograft reconstruction using magnetic growing intramedullary nails in compression.

Introduction: Intercalary allografts have high nonunion rates, particularly when fixed with intramedullary nails alone. The purpose of this study is to evaluate union rates and complications of allograft reconstruction using magnetic growing intramedullary nails in compression.

Methods: A retrospective review was performed of patients reconstructed with an intercalary allograft and magnetic nail and a minimum follow-up of 6-months. 15 patients with 31 osteotomies were identified. The average age was 36 years (9-71) and follow-up was 49 months (11-102). 8 patients had primary bone sarcomas, 6 had metastatic disease and 1 had chronic recurrent multifocal osteomyelitis. 14 received chemotherapy and 2 had radiation. 28 osteotomies were for primary resections, 1 for a nonunion, and 2 for an acute allograft fracture. An intercalary allograft with an average length of 15 cm (5.5-29) was placed with a magnetic nail in compression. Union rates, time to union from the initial procedure and complications were evaluated.

Results: 27 of 31 (87%) osteotomies healed after 9 months on average (2-21). Complications included 1 postoperative allograft fracture, 1 wound dehiscence, failure of 7 screws and 3 failed nails. 2 sites healed after a single revision surgery. No allograft reabsorption, recurrence, or infections occurred.

Conclusions: There was an 87% union rate at final follow-up and 80% after a single surgery. Although hardware failure was common, the use of magnetic nails in compression resulted in a high rate of union. An author is a paid consultant for the implant used.

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Fabrication and characterization of a bioactive polymethylmethacrylate-based porous cement loaded with strontium/calcium apatite nanoparticles

Aim of the study: Stroncium Nanoparticles loaded PMMA cement enhances bone integration.

One possible solution for bone replacement in cavities resulting from bone tumor curettage is the use of polymethylmethacrylate (PMMA)-based orthopedic cement. However, challenges arise, such as frequent bone resorption and loosening of the cement block, attributed to the lack of pores and a distinct elastic modulus compared to natural

bone. In addressing these issues, we have developed a novel approach by incorporating Sr2+-substituted hydroxyapatite nanoparticles (NPs) and a porogenic compound into the cement formulations. This modification creates a microenvironment conducive to osteoblast proliferation. The NPs, mimicking bone apatite structure, facilitate the controlled release of Sr2+. X-ray patterns and infrared spectra analysis confirmed the successful substitution of Sr2+ for Ca2+ across the entire NP composition range. The addition of an effervescent additive lowered the polymerization temperature, resulting in a highly porous cement with mechanical properties comparable to trabecular bone. This open and interconnected matrix allowed osteoblast penetration, while gas formation confined the NPs to the pore surfaces, ensuring controlled Sr2+ delivery at concentrations supporting osteoblast viability. Furthermore, the cement exhibited apatite formation when immersed in simulated body fluids, enhancing its bioactivity. In summary, our PMMA cement formulation, enriched with Sr2+-substituted hydroxyapatite NPs and featuring an interconnected porous structure, demonstrates improved in vitro performance. This innovation holds promise for enhanced bone repair guided by PMMA cements, offering increased osteoblast viability and deposition of a mineralized matrix.

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In-house 3D printed porous implants: in-vivo study of osseointegration

Aim of the study: Study the osseointegration of our 3dprinted implants to establish a baseline for future in-house production.

Introduction: A collaboration between a 3DP centre in Aarhus University Hospital (AUH) and the Danish Technological Institute (DTI), allow us to manufacture custom-made 3D metal implant in-house. Aim of this study was to assess the osseointegration of 3D-printed titanium implants through a validated randomised animal study.

Methods: 20 stable, non-weight-loaded, 6*10 mm cylindrical implants were 3D printed by DTI: 10 with a rough and 10 with a smooth surface. Implants were randomised and implanted into the left humerus of 20 skeletally mature sheep. After 4 weeks of observation all sheep were euthanised. The specimens were collected and cut into blokes, each containing an implant and surrounding tissue. Each block was then cut into a 3 mm block for mechanical test, closest to the surgical entry site, and a 6 mm block for future histomorphometrical evaluation. Biomechanical testing was performed as failure by push-out test on an Instron Universal Test Machine.

Results: Implants with a smooth surface demonstrate complete absence of osseointegration, as they fall out of the bone during sample preparation. Testing was therefore not possible. Porous implants showed macroscopic integration and breaking point at implant´s surface. We measured a median Ultimate Shear Strength of 0,06 MPa (IQR:1,14), a median Apparent Shear Stiffness of 0,16 MPa/mm (IQR:0,48) and a median Energy Absorption of 19,98 kJ/m2 (IQR:25,80).

Conclusion: Our study shows superior osseointegration in 3DP implants with a porous surface.

SESSION 8:

THE ASSESSMENT AND THERAPY OF SPINAL TUMORS

CHAIRS: Lee Zuckerman (USA), Will Aston (UK)

Andrea Angelini

Department of Orthopedics and Orthopedic Oncology, University of Padova, Padova, Italy

Surgical treatment for spinal metastases: an update on clinical practice

Maria Anna Smolle[1,2], Lukas Leitner[2], Dimosthenis Andreou[2], Susanne Scheipl[2], Peter Ferlic[2], Andreas Leithner[2]

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External validation of 9 prognostic scoring models in 526 patients with spine and extremity metastases undergoing surgery.

Aim of the study: This retrospective single-centre study aimed at comparing the predictive accuracy of 9 published prognostic scoring models (death as endpoint) in patients with surgically treated spine and extremity bone metastases.

Background: Treatment decision making in patients with impending or pathological fractures of spine and extremity bone metastases is aided by prognostic scoring models.

Methods: 526 patients (271 males; median age: 67.0 years) undergoing surgery for spine and extremity bone metastases were retrospectively included. Median follow-up was 267 days. During the observation period, 457 patients died of their disease (86.9%). Validation of the 9 scoring models (spine: Bollen, Modified Bauer, Tomita, van der Linden; extremity: Ratasvouri, Janssen, Sorensen, OPTImodel; both: Katagiri) was performed on the entire cohort (n=526), and separately for patients with spine (n=224) or extremity (n=302) metastases using Cox-regression and logistic regression models. Harrell's c-statistic and AUC ROC were used as validation metrics.

Results: Upon validation on the entire cohort, highest performance was found for Janssen (c-index=0.711) and Katagiri models (c-index=0.698). Likewise, both models achieved highest accuracy when validated on spine patients (Janssen: c-index=0.723; Katagiri: c-index=0.718), although the Janssen model had been developed on extremity metastasis patients only. Performance of all models was slightly lower when validated on the extremity cohort. Again, the Janssen (c-index=0.697) and Katagiri (c-index=0.681) models achieved highest accuracy, followed by Modified Bauer score (c-index=0.675).

Conclusion: Our results point towards a uniform applicability of prognostic models to both extremity and spine bone metastasis patients owing to comparable impact of certain variables on overall outcome.

Andrea Angelini, Anika Penko, Diego Babolin, Lisa Agostini, Pietro Ruggieri

Department of Orthopedics and Orthopedic Oncology, University of Padova

Prone position nursing protocol for the prevention of intraoperative complications in spine surgery for oncologic and degenerative diseases

Aim of the study: The purpose of the study was to review clinical studies reporting complications that arose from positioning of adult patients during dorsal exposures of the spine. Secondary aim was to realize an operative protocol from a nursing point of view.

Introduction. There are a variety of surgical positions that provide optimal exposure of the dorsal lumbar spine. These include the prone, knee-chest and lateral decubitus positions. Patients undergoing spinal surgery in the prone

position may be at risk for postoperative complications that result from excessive pressure applied to the torso, head or extremities.

Materials and methods. We identified 456 patients treated with between 2018 and 2022. Literature search was performed to find clinical studies reporting complications associated with positioning during spine surgery. The following information was obtained: study design, sample size, age, operative time, type of surgery, surgical position, complications associated with positioning and outcomes.

Results. Excluding surgery not in prone positioning, biopsy, Halo-vest, anesthetic procedures and wound revision, we analyzed 228 patients (106 females, 122 males) with a mean age of 56 years (12-89 years). About time of surgery, in 93 (41%) was over 240 minutes, 89 (39%) between 121-240 minutes and 46 (20%) less than 120 minutes. The incidence of all complications positioning-related was 8.3% (19/228), all minor complications, and none in patients with surgical time lower than 2 hours. There was a relationship between increased operation time and position complications.

Conclusions. This work presents a review of positioning-related complications in spine surgery and specific details on evidence-based recommendations for avoidance of these potentially severe complications. A detailed operative protocol may serve as a framework to educate the surgical team and decrease rates of intraoperative positioning complications.

Fuguo Kuang

Department of Orthopedics, People's Fourth Hospital of Sichuan Province, Sichuan, People's Republic of China

Clinical analysis of microwave ablation combined with decompression and pedicle screw fixation in the treatment of spinal metastases

Aim of the study: This study aims to clinically analyze the effectiveness of microwave ablation along with decompression and pedicle screw fixation in the palliative management of spinal metastases with pathological fracture.

Methods: A retrospective study was conducted on 82 patients with spinal metastases and pathological fractures, with 44 patients undergoing pedicle screw fixation along with laminectomy (Group A), and the remaining 38 patients receiving microwave ablation in addition to the treatment provided to Group A (Group B). Before surgery, all patients underwent pain assessment using a Visual analog scale (VAS) and evaluation of spinal cord injury using the Frankel classification. After surgery, patient prognosis was assessed using the Tomita score, the modified Tokuhashi score system, and progression-free survival time.

Results: All patients were followed up for a median duration of 18 and 20 months in Groups A and B, respectively. Statistically significant reductions in postoperative VAS scores were observed in all patients compared to their preoperative scores. Group B exhibited lower blood loss, lower VAS scores at the 1-month and 3-month follow-up points, and longer progression-free survival compared to Group A. Although the operation times in Group B were longer than those in Group A, this difference was not statistically significant. No statistically significant differences were found in the improvements in spinal cord function between the two groups.

Conclusion: When compared with decompression and pedicle screw fixation in terms of treating spinal metastasis with pathological fracture, microwave ablation combined with decompression and pedicle screw fixation showed better outcomes in pain control, longer progress-free survival, and lower blood loss without increasing operative time, which has favorable clinical application value.

Yawei Gou[1], Nengyuan Weng[1], Fuguo Kuang[1], Hong Duan[2]

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Preliminary efficacy analysis of decompression separation and microwave ablation for thoracolumbar metastases

Aim of the study: To compare the clinical effects of pedicle screw fixation decompression with or without microwave ablation in the treatment of thoracolumbar metastases.

Methods: The clinical data of 45 cases of pathological fractures of thoracic and lumbar metastatic tumor patients treated in the Fourth People's Hospital of Sichuan Province from January 2017 to may 2021 were retrospectively analyzed. 25 patients were treated with pedicle screw internal fixation combined with posterior decompression (group A). 20 were treated with microwave ablation combined with laminectomy and pedicle screw fixation (group B). All patients underwent Tokuhashi Score,Tomita Score, spinal instability neoplastic score (SINS), and epidural spinal cord compression (ESCC) score system before operation. VAS scores of pain and SF-36 scores of quality of life were recorded before and after operation. Overall survival was assessed by the Kaplan Meier evaluation system.

Results: All the 45 patients were followed up for 5-41 months. Before operation, there was no significant difference in Tomita score, modified Tokuhashi score, SINS score and ESCC score between the two groups (P>0.05). The SF-36 quality of life score and VAS score of the two groups were significantly improved during postoperative follow-up. The spinal cord function was improved in both groups, but the difference was not statistically significant (P>0.05). There was no significant difference in overall survival between the two groups (P>0.05).

Conclusion: In the treatment of thoracolumbar metastatic tumors, compared with the traditional single pedicle screw and lamina decompression, microwave ablation and inactivation will not increase the operation risk or trauma, and has certain advantages in relieving pain and improving life.

Lech Grzelak

Department of Neurosurgery, University Specialized Hospital of Nicolaus Copernicus, Toruń, Poland

The role of multidiscylinary cooperation in the treatment of spinal metastases

Bedirhan Albayrak[1], Safak Aydin Simsek[1], Tolgahan Cengiz[2], Ismail Buyukceran[1], Huseyin Sina Coskun[1], Nevzat Dabak[1]

[1] Ondokuz Mayıs University, Department of Orthopaedics and Traumatology
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Vertebral height restoration and bleeding amount results in multiple myeloma patients who had kyphoplasty procedure

Aim of the study: This study aims to show the results and effectiveness of the kyphoplasty procedure in patients with multiple myeloma.

Introduction: Multiple myeloma(MM) is a clonal plasma cell disorder characterized by increased plasma cells in the bone marrow. Vertebral compression fractures occur secondary to vertebral lytic lesions in up to 70% MM of patients. Minimally invasive techniques for vertebral augmentation, such as vertebroplasty and kyphoplasty, prevent the collapse of the vertebra in patients with vertebral involvement of multiple myeloma.

Material And Methods: Kyphoplasty procedure was performed on 20 multiple myeloma patients with a histopathological diagnosis. Preoperative,postoperative local kyphosis angle, anterior and middle vertebral height restoration, VAS score, Oswestry Disability Index(ODI), functional values, Back Pain Scale were compared.

Results: Vertebral augmentation with percutaneous balloon kyphoplasty(PBK) was performed on 20 multiple myeloma patients. Local kyphosis angles improved except for two patients. While the anterior vertebral height of 6 patients did not change compared to the preoperative period, a decrease was observed in the anterior vertebral height of 1 patient. An increase in the middle vertebral body height was observed in all patients.While variable intraoperative bleeding amounts were observed, ranging from approximately 10 to 500cc, preoperative and postoperative mean Hb values were 10.8-10.1.

Conclusion: PBK method is a minimally invasive method and can be applied by experienced surgeons in multiple myeloma patients with vertebral compression fractures. Although bleeding is not expected in percutaneous procedures, it must be kept in mind that bleeding up to 500 cc may occur. Furthermore, middle column height restoration was associated with improved clinical results.

Ioannis Trikoupis, George Kakouratos,Stavros Goumenos, Pavlos Gerasimidis, Nikolaos Stavropoulos, Vasileios Vasileios Kontogeorgakos, Panayiotis Papagelopoulos

Department of Orthopedic Surgery, Athens University Medical School, Greece

Sacrectomy for malignant bone tumors. A single center experience

Grzegorz Guzik

Department of Orthopaedic Oncology, Subcarpathian Oncology Center, Brzozów, Poland

Spine metastases surgical treatment – indications and results

Introduction: Spinal metastases are particularly common in breast, thyroid, kidney, lung cancers and myeloma. Surgical treatment improves patients quality of life and reduces incidence of neurological complications and pain.

Methods: We made a retrospective analysis of 1340 patients, who underwent surgical treatment for metastatic spine tumours in the Podkarpacki Oncology Centre in Brzozow. The most common cancers were breast (57%), myeloma (20%), kidney (12%), lung (10%), and thyroid (6%).

Results: The majority of metastases were located in the lumbosacral (62%), thoracic (28%) and cervical (10%) spine. Surgical spine stabilisation with or without decompresion was made in 84% of cases. Radical tumors resection with vertebral body prosthesis implantation was performed in 16% of cases. Quality of life was assessed using the Karnofsky scale, neurological status in Frankel scale, and the pain in (VAS) scale. The number of surgical complications and local tumor recurrence were assessed.

Conclusions: The results of surgical treatment of spinal metastases are favorable. Most of patients reported significant pain reduction and functional status improvement. The number of complications was low

June 14, Friday | Amber Hall

SESSION 9:
SURGERY IN METASTATIC BONE DISEASE
CHAIRS: Panayotis Papagelopoulos (Greece), Andrea Angelini (Italy)

Mohamed Omar

Department of Musculoskeletal Oncology, University of Hanover, Germany

Application of 3D printing in the treatment of bone tumors and metastases

Michelle Ghert

McMaster University and the University of Maryland

The Proximal Femur Resection or Internal Fixation for Metastases (PERFORM) multicenter randomized controlled trial

Aim of the study: The PERFORM randomized controlled trial will aim to determine if resection and endoprosthetic reconstruction improves patient-important outcomes compared to internal fixation in patients with metastatic bone disease of the proximal femur.

Background: Stabilization of an impending or actual fracture of the proximal femur resulting from skeletal metastases has historically been achieved with internal fixation using intramedullary nails, plates, and screws. However, many patients with metastatic cancer are experiencing longer life spans due to advances in systemic treatment options. Therefore, the traditional methods of stabilizing bones in the setting of skeletal metastases may no longer be meeting the standard of outcomes required for patients who can now live for years with their cancer. Complete resection of the affected bone followed by reconstruction with an endoprosthesis, although more invasive and conferring higher surgical risks than an internal fixation procedure, reduces the risk of cancer recurrence at the surgical site and associated hardware failure. However, the evidence supporting the use of resection and endoprosthetic reconstruction of the proximal femur, although promising, is retrospective and methodologically weak, resulting in a gap in the necessary evidence to change practice.

Methods: International multi-center randomized controlled trial.
Population: Patients with skeletal metastases of the proximal femur.
Intervention: Resection and endoprosthetic reconstruction.
Comparator: Internal fixation.
Outcome: Hierarchal composite outcome.
Time: One year.
Status: Funding received, finalizing protocol, recruiting sites.

Danique van Broekhoven[1], Lisa Dootjes[2], Gerco van der Wal[1], Julie Willeumier[1], P. van der Zwaal[3], A. Leithner[4], M. Fiocco[5], Yvette van der Linden[6]

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Solitary and oligometastatic bone metastases in renal cell carcinoma patients are associated with favourable survival, modification of the OPTIModel

Aim of the study: This study aims to assess survival in renal cell carcinoma (RCC) patients with symptomatic solitary, oligometastatic (max 4 lesions) or diffuse metastases of the long bones, and to modify the OPTIModel survival estimation tool accordingly.

Patients and Methods: In total 178 RCC patients with long bone metastases were included, respectively 156 RCC patients from a large retrospective multicentre cohort and 22 patients from a prospective cohort. 53 had solitary metastases (SBM) (29.8%), 60 oligo metastases (OBM) (33.7%) and 65 diffuse metastases (DBM) (36.5%). Survival was estimated using the Kaplan-Meier method. The effect of risk factors on survival were assessed by estimating a multivariate Cox proportional hazard regression model.

Results: Median overall survival was 12.1 months (95%CI: 8.8-15.3). Median survival for the SBM, OBM and DBM was 19.5 months (95%CI: 6.8-32.4), 14.8 months (95%CI: 7.6-21.9) and 6.1 months (95% CI: 2.7-9.5), respectively. Because SBM and OBM did not differ in survival, they were combined into a single category (≤4 BM) comprising of 113 patients (63.5%) with a median survival of 16.3 months (95% CI: 10.6-22.0). Compared to this combined category, the hazard ratio for overall survival for DBM patients was 2.1 (95%CI: 1.5-3.1). Including the number of bone metastases into the OPTIModel improved the C-statistic for RCC patients from 0.585 (se=0.027) to 0.622. (se = 0.024).

Conclusion: RCC patients with <4 long bone metastases had a better survival than patients with diffuse long bone metastases. This finding aids in decision-making in order to make appropriate treatment decisions.

Megan Rose Donnelly, Michelle Richardson, Ekenedilichukwu Nwakoby, Garrett W. Esper, Karim Masrouha

NYU Langone Health, Department of Orthopedic Surgery

Pilot Study: Does the Use of Bisphosphonates in Metastatic Bone Disease Improve Outcomes Following Orthopedic Oncology Surgery?

Aim of the study: The purpose of this study was to preliminarily evaluate the relationship between bisphosphonate use and postoperative outcomes in patients with metastatic bone disease at our institution

Bisphosphonates are known to decrease skeletal-related events in patients with metastatic bone disease. Their role in long-term outcomes have been well-studied. However, their short-term benefits in the perioperative period have not been well reported. As such, we used institutional data for all patients with metastatic bone disease who underwent a lower extremity orthopedic oncology procedure (adult, hospital stay >23 hours, procedure other than simple biopsy) in the years 2012 to 2023 and identified preoperative use of bisphosphonate therapy. Multivariate regressions were then performed to see the correlation between bisphosphonate use and fracture through the metastatic bone lesion with discharge home, 90-day mortality, hospital length of stay and number of subsequent orthopedic procedures. One-hundred and thirty-five patients with metastatic bone disease to the extremities were identified and 17 of these patients were found to be taking bisphosphonates just prior to the time of surgery. Given the limited sample size, our data could only show trends in bisphosphonate use leading to increased rates of being discharged to home (as opposed to rehab, hospice of skilled nursing facility) as well as decreased hospital stay after index orthopedic

operation (all p>0.05). With prospective data collection for additional metastatic bone disease patients undergoing orthopedic surgery at our institution, we hope to increase the sample size and support the use of bisphosphonates for short-term benefit in the perioperative orthopedic oncology patient.

Michele Boffano[1], Nicola Ratto[1], Pietro Pellegrino[1], Stefano Marone[1], Elena Boux[1], Martina Rezzoagli[1], Andrea Ferro[1], Ugo Albertini[1], Chiara Beltramo[2], Raimondo Piana[1]

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[2] University of Turin

Which patients with bone metastasis have the best survival rate? A retrospective study on 259 patients in 5 years time

Aim of the study: To combine different risk factors for survival in bone metastatic patients

Introduction: The estimation of survival is challenging in oncologic patients but mostly in patients with bone metastasis when the decision for surgery and the choice of the surgical intervention is critical. Several algorithms were developed to foresee the survival and drive the orthopedic decision.

Methods: In the period 2018-2023, 259 patients (age range 25-90) surgically treated for bone metastases were retrospectively studied. Overall survival rate was 31.7% (range 6-72 months). Indications for surgery: impending fractures, pathologic fractures, painful metastatic lesion with low risk for fracture. Survival rate according to primary tumor and indication for surgery was evaluated.

Results: The worst survival rate was for lung carcinoma, while the best for thyroid carcinoma. Kidney and breast carcinoma metastatic patients are increasing survival along the studied period of time. Eight patients were treated for painful lesions. Among the groups impending vs pathological fractures no differences were observed in death rate but survival was longer after treatment of impending fractures (average survival 13vs8 months). The survival was mainly related to the primary tumor with best survival rates for breast, kidney, multiple myeloma, lymphoma and the worst for lung, gastrointestinal, bladder.

Conclusions: Our research confirms that survival depends on the primary tumor. The difference between prophylactic and fracture surgery does not affect long term but can improve short term survival. Even if it is better to prevent a pathologic fracture, the combination of indication for surgery and primary tumor can help in survival preoperative evaluation and decision making surgical process.

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[2] Department of Orthopaedics and Traumatology, Bone Tumour Unit, HUS, Helsinki University Hospital, Finland

Routine oncological biomarkers provide no benefit in diagnostics of primary malignancy underlying skeletal metastasis

Aim of the study: To better understand the role of oncological biomarkers CEA, CA12-5, Ca15-3, Ca19-9, PSA and myeloma biomarkers in the diagnostics of primary disease underlying skeletal metastasis.

In the context of skeletal metastasis accurate identification of the primary disease is essential for correct treatment. Oncological biomarkers CEA, Ca12-5, Ca19-9, Ca15-3, PSA and myeloma light chains, are commonly used for diagnostics despite uncertainties about their role. A retrospective study on 193 patients undergoing oncologic biomarker examinations between 1.1.2019-31.12.2021 revealed a general elevation in biomarker levels across all patient groups, indicating a lack of specificity. Patients with increased CEA mostly had breast (29%, NS) or lung (24%, p=<0.001) cancer, patients with increased Ca15-3 63% had breast cancer (p=<0.001) and 16% lung cancer (p=0.042), 13% of patients with increased Ca12-5 gynecological carcinomas (p=0.025), and 36% of patients with increased Ca19-9 gastrointestinal cancer (p=0.012). In multivariate analysis only Ca12-5 reached significance in lung cancer (p=0.008). PSA was significantly increased in patients with prostate cancer (p=0.015), but of patients with increased

PSA only 74% had prostate cancer. Myeloma parameters S-Prot (p=<0.001), and S-K/L-s-V (p=0.004) were significant for myeloma. Increased myeloma parameters, however, were found up to 70% of patients, including patients with benign lesions.

Oncologic biomarkers are unspecific and based on this data their routine examination cannot be recommended. PSA and myeloma parameters may be useful in selected cases, but especially increases of myeloma parameters are found in all patient groups, and these therefore are not diagnostic.

Abdurrahman Yilmaz, Omur Caglar, Mehmet Ayvaz, Bulent Atilla, Ahmet Mazhar Tokgozoglu, Ali Okan Gazeloglu

Hacettepe University

Success and reliability of combined treatment with RF ablation and cementoplasty in the management of pelvic ring malignant bone metastases

Aim of the study: The main aim is to demonstrate that combined percutaneous radiofrequency ablation (RFA) and cementoplasty is an effective treatment for pain palliation and enhancement of functional capacity in malignant pelvic and sacral metastases.

Introduction: Pelvic and sacral bone metastases cause significant morbidity. Our objective was to find out the impact of the combined percutaneous radiofrequency (RF) ablation and cementoplasty on pain relief and functional ability in patients with malignant pelvic and sacral bone metastases.

Methods: 20 patients who underwent RF ablation and cementoplasty for malign pelvic bone and sacrum metastases between January 2014 and December 2021 were retrospectively identified. The inclusion criteria were having a life expectancy of more than 1 month, being >18 years old, and having at least one month of follow-up. The Visual Anlouge Scale (VAS) pain, Karnofsky Performance Status (KP), and Musculoskelatal Tumor Society (MSTS) scores were calculated.

Results: VAS pain values decreased and KP values increased postoperatively. (p = 0.006 and p = 0,013) There was no statistically significant increase in MSTS (p> 0.05). Correlation relationships between lesion filling ratio and VAS pain, KP, and MSTS scores were not statistically significant (p> 0.05). Cement leakage was observed in 5 patients (25.0%), and no symptoms related to this leakage were observed.

Conclusion: Combined RF ablation and percutaneous cementoplasty in malignant pelvic bone and sacrum metastases is an effective treatment for pain and functionality.

Oleg Vyrva, Igor Shevchenko, Dmitro Mikhanovsky

Sytenko Institute of Spine and Joint Pathology, Kharkiv, Ukraine

Surgical strategies for diaphyseal bone metastases: predictive factors and outcomes

Introduction: Surgical intervention for diaphyseal bone metastases aims to stabilize fractures and enhance functional outcomes, thereby improving the quality of life for patients. This study investigates predictive factors for patient survival to guide appropriate surgical decision-making.

Methods: A prospective surgical database was reviewed to identify 188 patients undergoing surgery for diaphyseal metastases. Of these, 124 underwent limb salvage surgery, while 54 did not due to poor general condition. Surgical procedures included modular endoprosthesis replacement (58), plate or nail osteosynthesis with bone cementation (48), and palliative intramedullary fixation without segmental bone resection (28). Discriminant analysis was employed to predict patient survival rates based on various factors.

Results: Patients were stratified into three groups based on survival duration. Patients with an ASA stage of 4 and pathologic fractures, indicative of survival up to 6 months, did not undergo surgery (54 cases). Those with an ASA

stage of 3 and pathologic fractures underwent internal fixation without resection (28 cases). Patients with survival ranging from 6 to 24 months or longer than 2 years underwent intercalary resection with plate or nail osteosynthesis plus bone cementation (48 cases) or endoprosthesis replacement (58 cases). All patients who maintained their limbs experienced restored function and pain relief.

Conclusions: Surgical decision-making for diaphyseal bone metastases relies on predicting patient survival rates, facilitated by our developed predictive model and ASA staging. Tailored surgical approaches based on predicted survival rates yield low morbidity and immediate functional restoration, pain relief, stability, and enhanced quality of life. These findings emphasize the importance of individualized surgical planning to optimize outcomes and improve patient well-being in the management of diaphyseal bone metastases.

Megan Rose Donnelly, Michelle Richardson, Ekenedilichukwu Nwakoby, Garrett W. Esper, Karim Masrouha

NYU Langone Health, Department of Orthopedic Surgery

Have rates of Venous Thromboembolism (VTE) in patients with metastatic femoral lesions undergoing prophylactic versus fracture fixation improved in recent years?

Aim of the study: The purpose of this study was to determine the relative rates of VTE in patients with metastatic femoral lesions undergoing either prophylactic or fracture fixation in recent years.

A previous study by Aneja et al. using 10 years of data (2002-2011) from the Nationwide Inpatient Sample (NIS) database concluded that patients undergoing prophylactic treatment of metastatic femoral lesions had higher rates of VTE compared to pathologic femur fracture patients undergoing fixation. This was despite the fact that prophylactic fixation patients tended to be younger and healthier. As such, it was proposed that prophylactic nailing patients should have optimized VTE prophylaxis and careful perioperative monitoring. Although the ACS National Surgical Quality Improvement Program (NSQIP) database does not document the type of VTE prophylaxis used, we sought to leverage this database to investigate whether rates of VTE in the aforementioned patient populations have followed certain trends overtime. As such, we used data from 2017 to 2020, identifying 867 prophylactic fixation patients and 1,341 pathologic fracture fixation patients across the country. While bivariate analysis showed a greater rate of VTE in pathologic fracture patients (4.0% with VTE vs. 2.2% with VTE) compared to prophylactic fixation patients, in a multivariate model controlling for demographics, past medical history and operative time, there were no differences in the rates of VTE between the cohorts. It is possible, then, that our healthcare system has made great strides in caring for patients with metastatic femoral lesions undergoing orthopedic surgery. However, there still remain relatively high rates of VTE in both of these groups compared to orthopedic patients without a cancer diagnosis, providing an opportunity for further research and evolving prophylaxis protocols.

César Vázquez García

César Vázquez García, Albert Isidro Llorens, Miguel I. Yáñez Lallana, Aamer Malik, Teresa Serra Porta, Martyn Turner Mateo.

Beyond expectations: exploring the interplay between synovial metastasis and infections in periprosthetic tumors

Aim of the study: Clinical Insights and Diagnostic Challenges.

Periprosthetic metastases (MTT) are uncommon clinical conditions which are usually misdiagnosed. We present a case of a 82 years old male patient who had undertaken a THR 3 years earlier, presenting hip pain and clinical manifestations suggesting on acute haematogenous prosthetic infection and whose final diagnosis was synovial metastasis of a carcinoma of the bladder. Radiological studies didn't reveal signs of hip prosthetic loosening. The diagnosis was confirmed by intraoperative histopathology. Samples were taken during the surgical procedure turning out to be posi-

tive for Streptococcus anginosus. Periprosthetic bone metastases are medical conditions well described in literature and usually involve loosening of prosthetic components. Periprosthetic soft tissue metastases are bizarre and usually mimic periprosthetic infection. The take home of this case is the inclusion of synovial metastases in the diagnostic algorithm of painful prosthetic articulations, especially in the case of oncology patients. Furthermore it is important to highlight the clinical similarity and the coexistence with low level periprosthetic infections with the aim of integrating them systematically in normal practice. We present the clinical particularities and revise the existing literature.

SESSION 10:

SACRAL TUMORS AND NOVEL TREATMENT METHODS IN MUSCULOSKELETAL ONCOLOGY

CHAIRS: Michele Boffano (Italy), Jendrik Hardes (Germany)

Burkhard Lehner

Heidelberg University Hospital, Orthopaedic and Sarcoma Department, Germany

Proton and carbon ion beam radiotherapy for sacrococcygeal chordoma, the Heidelberg experience

Jakub Pawlik

Department of Orthopaedics, Traumatology and Musculoskeletal Oncology, Pomeranian Medical University, Szczecin, Poland

Treatment of malignant sacral tumors with en-bloc resection and 3D-printed custom-made implants – a review of 27 patients in a single institution

Panayiotis Gavriil, Stavros Goumenos, Ioannis Trikoupis, Vasileios Karampikas, Konstantinos Soultanis, Vasileios Kontogeorgakos, Panayiotis Papagelopoulos

First Department of Orthopaedics, Attikon Hospital, University of Athens, Athens, Greece

Surgical treatment of sacroiliac tumors: clinical and functional results

Aim of the study: The aim of this study is to present the clinical and functional short-term and mid-term results after surgical treatment of bone tumors involving the sacroiliac joint in our institution.

The treatment of malignant musculoskeletal tumors located around the sacroiliac joint is challenging for the orthopedic surgeon and requires wide en block resection in combination with chemotherapy or radiotherapy in selected patients. In this study 15 patients were retrospectively reviewed. The mean age of the patients at the time of surgery was 33 years. Five patients were diagnosed with osteosarcoma, four patients with chondrosarcoma, four patients with Ewing sarcoma and 2 patients with giant cell tumor of bone. The patients were operated from the same team of orthopedic surgeons. Nine patients underwent type 1-4 internal hemipelvectomy, two patients type 1-2-4, two patients type 4, one patient type 1 combined with total sacrectomy and another one underwent type 1-2-4 internal hemipelvectomy with hemisacrectomy. In nine cases the reconstruction of the pelvis defect included single or double rod spinopelvic fixation. In four cases, a fibula autograft was used, vascularized or not. In two cases the reconstruction was performed with iliac bone graft transport and one patient was revised using iliac autograft due to fibula graft resorption and aseptic loosening of the screws. The median Follow-up duration was 26 months. Three cases were complicated with wound dehiscence problems, four cases with neurological defects, one with nonunion of the autograft and two patients died of the systematic disease. The surgical treatment of bone tumors involving the sacroiliac region necessitates the use of specialized and advanced surgical techniques which are associated with high risk of complications.

Frank Traub[1], George Farah[1], Beatrice Jung[1], Saskia Sachsenmaier[2]

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What is the clinical outcome and prosthetic survival after resection and intercalary endoprosthetic reconstruction of humeral and femoral diaphyseal metastases?

Aim of the study: Metastatic lesions of the diaphysis can cause significant pain and complex surgical challenges. This study analyzed the outcome of intercalary endoprostheses in treating bone metastases, focusing on implant survival, functional scores, and complications.

Twenty-five patients who underwent surgical treatment between 2012 and 2023, with a mean follow-up time of 27.6 months, were retrospectively analyzed. Functional outcomes using the Musculoskeletal Tumor Society (MSTS) scoring system and complications using the Henderson classification were evaluated. In 25 diaphyseal implants (14 femur, 11 humerus, 24 %), six complications were observed. Three types of failure were identified: Type II, i.e., aseptic loosening (1 patient, 4%); type III, i.e., structural failure (3 cases, 12%); and local recurrence was noted in two patients (8%). The risk of failure was significantly higher in the femur than in the humerus (odds ratio 12.19, 95% confidence interval 1.22-131.05, $p = 0.0297$). The average MSTS score was 87 %. The MSTS score was significantly lower ($p = 0.008$) for the humerus (77.6 %) compared to the femur (85.2 %). The results showed that resection of bone metastases and replacement with intercalary endoprostheses yields excellent immediate functional results with acceptable complications in prognostically favorable patients. The overall cumulative implant survival rates were 92% one year after surgery and 60% five years after surgery, indicating that these implants are reliable options for patients with bone metastases. In conclusion, this study underscores the importance of individualized treatment plans for patients with bone metastases, especially concerning the increased prognosis for patients. It highlights the potential benefits and risks of using intercalary endoprostheses.

Massimiliano De Paolis[1], Michele Fiore[1], Marta Bortoli[1], Riccardo Zucchini[1], Laura Cercenelli[2], Andrea Sambri[1], Emanuela Marcelli[2]

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Augmented reality as a navigation tool in orthopaedic oncology surgery

Aim of the study: Evaluate the efficacy of combined 3D-printed cutting-guides and AR on 8 cases of primary bone cancer surgery to assess the possible future role of AR as an independent navigation system.

Image-based 3D-technologies such as Augmented Reality (AR) are transforming orthopaedic oncology surgical practice. AR overlays virtual information on real space, improving visual comprehension and exploration. Our study aims to evaluate the efficacy of combined 3D-printed cutting-guides and AR on 8 cases of primary bone cancer surgery to assess the future role of AR as an independent navigation system. 3D-anatomic models were obtained by 2D-imaging, segmented using D2PTMsoftware (3DSystems). 3D-models were used to plan resection planes and create 3D-printed cutting guides, then uploaded on the AR visor to visualize the virtual imaging superimposed on the patient's anatomy. The accuracy of overlay between AR and 3D-printed PSI was measured as reciprocal dimensional deviation. Post-operative CT-scans were matched and compared with pre-operative planning. Results were compared with a similar cohort of 10 patients who underwent 3D cutting-guided resection without AR. Histological margin assessment was conducted in both groups. The overlay was precise in all cases, with a medium deviation of 2 ± 0.4 mm. The planned and obtained resection compared on pre- and post-operative imaging were comparable. Wide surgical margins were obtained in both groups. AR represents an added value to PSI use in orthopaedic oncology, potentially increasing surgical safety and enabling the consciousness of surgeons' decisions. Moreover, AR could be a valid, user-friendly tool to accelerate learning curves. However, more studies are needed before assuming that AR could be an independent intra-operative navigation instrument.

Zbigniew Żęgota, Konrad Żęgota

Clinical Hospital MSWiA in Olsztyn

Simple solutions for complicated problems. Our experiences with Patient Specific Implants

Aim of the study: Case study analysis of treatments using Patient Matched Implants (PSI).

The presentation introduces three case studies of patients presenting with bone loss in the pelvis, who were successfully treated using Patient Specific Implants (PSI) in the Orthopaedic department at Clinical MSWiA Hospital in Olsztyn. Two of the patients were complications post revision surgeries of total hip arthroplasty. The third patient suffered from prostatic cancer with metastatic changes, which caused bone loss in the pelvis. Analysis of types of bone deficits and their treatment using PSI was performed, considering the reconstruction of the continuity of the pelvic girdle and methods of stabilization.

Minxun Lu, Zhuangzhuang Li, Yi Luo, Yong Zhou, Li Min, Chongqi Tu

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Outcome of three-dimensional-printed custom-made short stem with porous structure for fixation of massive endoprosthesis after tumor resection

Aim of the study: This study examines outcomes and complications of using 3D-printed porous short stems in massive endoprosthesis replacement, suggesting it as a short-segment fixation alternative.

Introduction: This study evaluates outcomes using a 3D-printed porous short stem in massive endoprosthesis replacement, addressing challenges posed by large malignant bone tumors and revision limb salvage procedures leading to substantial bone loss.

Methods: From July 2018 to February 2021, 12 patients with significant bone loss underwent reconstruction with custom-made short-stemmed endoprostheses. Procedures targeted the proximal femur (n=4), distal femur (n=1), proximal humerus (n=4), distal humerus (n=1), and proximal radius (n=2).

Results: On average, 72.4% of the bone length was resected (range: 58.4% to 88.5%). The 3D-printed porous short stems had a mean length of 6.3 cm. Median follow-up was 38 months (range: 22 to 58 months). The mean MSTS score was 89% (range: 77% to 93%). Radiographically, 11 patients exhibited bone in-growth into the porous structure, indicating successful osseointegration. Intraoperative breakage of the short stem occurred in one patient, necessitating revision with a plate for fixation due to aseptic loosening four months post-surgery. Implant survivorship at 2 years was 91.7%. No other complications, such as deep infection or local tumor recurrence, were observed.

Conclusions: 3D-printed custom-made short stems with porous structures prove effective for fixing massive endoprostheses in short bone segments post-tumor resection. This approach demonstrates satisfactory limb function, excellent endoprosthetic stability, and low complication rates.

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Nanosilicate-reinforced GelMA-PEGDA hydrogel promotes angiogenesis for bone regeneration

Aim of the study: The present work aims to develop GelMA-PEGDA (GP) scaffolds reinforced with SN (GPS) for promoting vascular formation and bone regeneration.

Introduction: Bone tissue engineering has emerged as a pivotal field addressing the critical clinical needs of bone fractures. Replicating the intricate tissue architecture with multi-tiered vasculature networks remains a challenge in tissue engineering endeavours. The complex structure of bone, characterized by calcified regions intertwined with vascular networks, demands specialized environments supporting both vasculogenesis and osteogenesis.

Method: A multi-composited hydrogel was developed by synergising biocompatible GelMA macromolecules with synthetic PEGDA and then reinforcing with nanosilicates (SN). The incorporation of SN introduces crucial trace elements such as silicon, magnesium, and lithium, fostering the promotion of both angiogenesis and osteogenesis.

Results: Characterisations showed that incorporating PEGDA emerged as a substantial factor, significantly reinforcing the composite hydrogels' stability. The addition of SN further elevated the mechanical integrity of the GelMA-PEGDA-SN (GPS) hydrogels. Cell studies designated that GPS improved cell proliferation and migration, angiogenic VEGF/eNOS expression and osteogenic differentiation. In vivo experiments provided valuable insights into the practical efficacy of GPS hydrogels in enhancing calvarial healing. Notably, the GPS-2 formulation (2% SN) displayed superior bone coverage and heightened vascular formation. This was validated through assessments of osteogenic formation and the angiogenic marker CD31, emphasizing the comprehensive bone regeneration potential of GPS hydrogels.

Conclusion: Hydrogels reinforced with SN show promise as potent biomimetic and osteogenic materials in tissue engineering, significantly boosting bone regeneration. These results further underscore the potential of GPS hydrogels in promoting bone healing and growth.

Liam Sabot, Bilal Kapanci, Félix Shumelinsky, Vincent Donckier De Donceel

Jules Bordet Institute

Artificial intelligence-based large language model as a source of information for patients with sarcoma: evaluation of the quality of ChatGPT4's answers by an expert consortium

Aim of the study: We aim to evaluate ChatGPT4's performances by assessing the level of agreement among specialists regarding responses to questions about sarcoma.

Objective: Sarcoma is a rare type of cancer. Information can be elusive, and patients often seek information through artificial intelligence (AI) tools. Chat Generative Pre- trained transformer (ChatGPT) is a large language model (LLM) increasingly used by patients. We aim to evaluate ChatGPT4's performances by assessing the level of agreement among specialists regarding responses to questions about sarcoma.

Methods: We collected ChatGPT4 responses to 32 questions (20 mandatory + 12 optional) about sarcoma extracted from the FAQ section of 6 cancer information websites. Using an online questionnaire, the quality of AI's responses was independently graded by sarcoma specialists using a visual slider and specifying the type of error that was made. Roughly 350 specialists were contacted. Descriptive and exploratory data analysis will be used to assess the quality of LLM on different topics and assess evaluation variability based on evaluator profiles.

Results: 47 specialists responded to all mandatory questions, of whom 20 responded to both mandatory and optional questions. There are 37 surgeons and 10 non-surgeon participants. We observed an overall consensus of 63,64% (IC 95%: 20,97% - 100%) for non-surgical specialists and 65,03% (IC 95%: 20,47% - 100%) for surgeons. The most reported type of error in ChatGPT4's responses is a lack of exhaustivity.

Conclusion: ChatGPT is a potentially helpful tool to inform patients about sarcoma, but it has limitations. The moderate level of agreement among specialists with ChatGPT4 answers is mostly related to lack of exhaustivity rather than erroneous content.

Chongqi Tu, Longqing Li, Yi Luo, Yong Zhou, Li Min

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Signature based on tumor essential gene pairs identifies osteosarcoma patients with different survival outcomes

Aim of the study: This paper aims to examine the outcomes of three-dimensional (3D) design custom-made uncemented stems for revision.

Purpose: Osteosarcoma is a malignant tumor originating in children and adolescents. Recent advances suggest the necessity of developing new therapies to improve patient prognosis rather than intensifying anti-tumor chemotherapy. Some genes are essential for tumor growth and predicting poor prognosis in patients; however, their roles in osteosarcoma remain unclear.

Methods: Three osteosarcoma datasets with sufficient clinical information were obtained from public databases. Essential genes for osteosarcoma were identified through genome-scale CRISPR screening of the datasets. A tumor essential gene pair (CRGP) signature was constructed using minimum absolute shrinkage and selection operator regression based on prognosis-related CRGPs. Differences in immunity, metabolism, and ferroptosis among CRGP signature groups of patients were evaluated. Finally, SubMap analysis was used to assess patient response to immunotherapy in the CRGP signature groups.

Results: The CRGP signature reliably predicts overall survival of osteosarcoma patients. CRGP features are also associated with the metastatic status of osteosarcoma patients and can be used for further risk stratification of metastatic patients. Immunotherapy is more likely to benefit patients in the low-risk CRGP group.

Conclusions: The signature based on tumor essential gene pairs can assess the prognosis of osteosarcoma patients.

June 14, Friday | Baltic Hall

SESSION 10: SARCOMA RESEARCH

CHAIRS: Anna M. Czarnecka (Poland), Beate Rinner (Austria)

Sebastian Bauer

Sarcoma Center University of Essen, Germany

Targeting signalling pathways in sarcomas

Anna M. Czarnecka

Department of Soft Tissue/Bone Sarcoma and Melanoma, Maria Sklodowska-Curie National Research Institute of Oncology, Warsaw, Poland

Biomarkers in sarcomas

Beate Rinner

Research Institute of Molecular Pathology, Medical University of Graz, Austria

Differences between primary and metastatic clear cell sarcoma cell lines lead to tailored, improved therapy

Min Wook Joo, Yoon Joo Cho, Yong-Suk Lee

The Catholic University of Korea

Sex differences in the association of alcohol consumption with the risk of soft-tissue sarcoma

Aim of the study: We conducted a population-based study using the nationwide claims data to explore the association between alcohol consumption and soft tissue sarcoma risk, and its differences between sexes, focusing on the consumption amount per occasion and drinking.

Introduction: The incidence of Soft-tissue sarcoma (STS) increases with accelerating population aging, which may be associated with demographic, environmental, or lifestyle factors. As alcohol consumption stands as a leading risk factor for oncogenesis and related death worldwide, we hypothesized that it might be a risk factor for STS. We conducted a population-based study using the nationwide claims data to explore the association between alcohol consumption and STS risk.

Methods: We analyzed the association between alcohol consumption and the risk of sarcoma among 3,937,745 eligible participants from the Korean National Health Insurance Service database (2009-2020). Alcohol consumption was stratified into three levels; nondrinker, mild drinker (30< g/d of ethanol), and heavy drinker (30≥ g/d of ethanol).

Results: We identified 969 incident sarcoma cases during the follow-up period of 10.1±1.3 years. In the female group, mild and heavy drinkers showed an increased risk of sarcoma compared to nondrinkers (aHR, 1.51 [95% CI, 1.20 to 1.90], and aHR 2.49 [95% CI, 1.17 to 5.27] respectively). However, alcohol consumption was not a risk factor

for males. The dose-response association between the amount of alcohol consumption per occasion and the risk of sarcoma was significant.

Conclusions: This study demonstrated a statistically significant dose-response relationship between the level of alcohol consumption and the risk of STS among women. Thus, we need proactive strategies to discourage alcohol consumption, which should be considered as a screening factor for STS.

Gomez-Mascard Anne

Sofia Galanou, Natacha Roussel, Ronan Guillemin, Christophe Bontoux, Gaelle Perot, Lucile Delespaul, Frédéric Chibon, Anne Gomez-Mascard

Tumor microenvironment analysis in osteosarcoma predicts therapeutic response to chemotherapy

Aim of the study: Osteosarcoma, chemoresistance, RNAseq.

We aim to understand chemotherapy response mechanisms in osteosarcoma by identifying new response and prognostic signatures after surgery. The chemotherapy response assessment, based on the average percentage of viable cells, is limited as some patients, despite a good response, experience early metastatic recurrence, highlighting the inadequacy of current tools for quantifying treatment response.

We hypothesize that a reason could be that it overlooks spatial heterogeneity and immune microenvironment. We performed immunohistochemistry and RNA-seq on a unique collection of surgical resections, focusing on the interactions between tumor cells/immune cells in territories of good/poor response (GRT/PRT). GRT/PRT were defined by the percentage of viable tumor cells (<10% and ≥10%, respectively). Deconvolution signatures from single-cell RNA-seq data were applied to bulk RNA-seq data to characterize microenvironment populations within response territories. Data were correlated with overall survival.

The results revealed distinct gene expression profiles in PRTs compared to GRTs. PRTs were associated with genes and pathways related to calcium metabolism and the extracellular matrix. Deconvolution signatures indicated enrichment of mesenchymal stem cells (MSC) and endothelial cells in PRTs while GRTs showed enrichment in CD163/CD206-positive macrophages, and CD68-positive osteoclasts. CD8-positive lymphocytes were evenly distributed in both GRTs and PRTs. Notably, metastatic patients were associated with higher rates of MSC in specific territories.

We propose integrating the analysis of tumor micro-environment, including immune cell signatures, extracellular matrix and calcium metabolism, into a new adjuvant therapeutic stratification algorithm, for earlier and more effective management.

Dimitra Melissaridou[1], Angelos Kaspiris[2], Olga Savvidou[1], Penelope Korkolopoulou[3], Panayiotis Papagelopoulos[1]

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Effects of β-blockers on the development of osteosarcoma metastases based on imaging techniques: an experimental study

Aim of the study: Aim of our study was to examine if the administration of β-blockers converts the osteosarcoma growth and metastases in vivo after the administration of highly metastatic 143B human osteosarcoma (OS) cells in SCID mice.

Introduction: β-Adrenergic receptors are Gs-protein-coupled receptors, that are expressed in various types of cancers. In vitro and in vivo studies demonstrated that β-blockers regulate cancer cellular processes such as proliferation, migration, apoptosis, MMPs/ cytokines activation, and angiogenesis. Recent studies reported that patients treated with neoadjuvant chemotherapy and b-blockers had low risk of recurrence and metastases.

Methods: 30 mice, 6-9 weeks old, were separated into 6 groups. On day 1, 143B cells were injected in the tail vein (subgroup 1) or tibia intramedullary (subgroup 2). The control (A1, A2) groups were composed of mice that didn't receive β-blockers, while in group B(B1,B2), mice were treated with propranolol for 30 days. Finally, in C1 (tibial application of OS) and C2 (tibial application of OS plus propranolol) groups, amputation of the affected joint was performed on the 5th day. On day 30, the mice were euthanized and radiographic, pQCT and whole-body scintigraphy scanning were performed.

Results: The survival rate was 95%. The amputation was successful without any complications. The size of the tumors was less than 2.00 cm X 2.00cm. Imaging examinations displayed altered number of local osseous and skeletal or lung metastatic potential in all groups receiving β-blockers.

Conclusions: Clinical significance of β-blockers in the management of primary cancers of bones has not been elucidated yet. Our protocol suggests that propranolol modifies the clinical expression of OS and metastatic potential. Further molecular, histological/immunopathological analyses are necessary.

Michelle Ghert[1], The SAFETY Investigators[2]

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[2] International

The Surveillance After Extremity Tumor Surgery (SAFETY) pilot international multi-center randomized controlled trial

Aim of the study: The SAFETY trial is an international multi-center randomized controlled trial that addresses the following question: Do the frequency and mode of pulmonary surveillance affect patient survival following extremity soft-tissue sarcoma surgery?

Background: Intensive post-operative surveillance of the lungs is routine clinical practice for patients with soft-tissue sarcoma. However, the adverse effects of intensive surveillance must also be considered, including healthcare costs, false-positive results, the financial/emotional burden on patients, and unnecessary radiation exposure.

Methods: Patients in the SAFETY trial are randomized into one of four surveillance groups for the first 2 years of follow-up: (1) CXR every 3 months, (2) CT chest every 3 months, (3) CXR every 6 months, or (4) CT chest every 6 months. The primary outcome is overall survival at 5 years. The secondary outcomes include patient anxiety, quality of life and healthcare costs. The pilot phase of the trial aimed to determine feasibility based on: (1) enrolment, (2) protocol adherence, and (3) data quality.

Results: The pilot phase enrolment of 232 patients was completed in 2023. Patients have been randomized across 31 clinical sites in 11 countries (Argentina, Australia, Austria, Brazil, Canada, Italy, Malaysia, Belgium, the Netherlands, Spain, and the USA). The most common protocol deviation was an unplanned clinic visit due to surgical wound complications. Thoracic imaging protocol adherence and data quality both met a priori criteria for feasibility. A total of 17 study participants have died. The SAFETY trial Data and Safety Monitoring Board recommended the trial continue as designed.

Conclusion: The pilot phase of the SAFETY trial met all a priori feasibility criteria and the pilot manuscript will be published in 2024. The SAFETY trial definitive phase is underway.

Anouk A Kruiswijk[1], Michiel A.J. van de Sande[1], Lisa A.E. Vlug[1], Ellen Engelhardt[2], Alessandro Gronchi[3], Dario Callegaor[3], Rick L Haas[2], Robert JP van der Wal[1], Leti van Bodegom-Vos[1]

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Risk-prediction models for clinical decision making in sarcoma care: an international questionnaire among soft-tissue sarcoma specialist

Aim of the study: This study aims to assess the extent to which, and the reason why RPM are used (both in multi-disciplinary tumor boards (MTB) and during consultation with the patient) by physicians.

Background: Risk prediction models (RPMs) are statistical tools which can predict the likelihood of a certain outcome or event for an individual based on their (clinical) characteristics. RPMs can support (shared) decision-making (SDM) by providing patients and clinicians with further insights into the diagnosis and prognosis of their disease. The number of RPMs to support choice of disease management in oncology has increased exponentially over the last decade driven by the move towards more personalized medicine. Also in the field of multimodality soft-tissue sarcoma care several RPMs are available. Despite their benefits, the extent to which RPM have been integrated into routine clinical decision-making for sarcoma care remains largely unknown. This study aims to assess the extent to which, and the reason why RPM are used (both in multidisciplinary tumor boards (MTB) and during consultation with the patient) by physicians. Additionally, as RPM have clear potential to influence SDM, we aimed to assess general attitudes of STS professionals towards SDM in sarcoma care.

Methods: An online survey will be disseminated to members of international sarcoma societies. The 29-item survey includes questions about the use of RPM (both in MTB and in consultation with the patient) by physicians for clinical decision-making in sarcoma care.

Discussion: The results of this study will be available in May 2024 and will provide insights in current use of RPMS in sarcoma care and what is needed to successfully implement the use of RPM for clinical decision-making in sarcoma care.

SESSION 11:

TENDON SHEATH GIANT CELL TUMOR (TGCT)

CHAIRS: Michiel Van de Sande (The Netherlands), Anne Gomez-Mascard (France)

Michiel Van de Sande

Department of Orthopedic Surgery, Leiden University Medical Center, The Netherlands

Surgical management: when and how?

Sebastian Bauer

West German Cancer Center (WTZ) University Hospital Essen, Germany

Systemic treatment: when and how long?

Anne Gomez-Mascard

University Cancer Research Institute, Toulouse, France

Challenges in the diagnosis of TGCT

Anne Gomez-Mascard

Christophe Bontoux, Hadrien Reboul, Marie Csanyi, Corinne Bouvier, Frédérique Larousserie, Hervé Sartelet, Frédéric Bibeau, Marie Paule Algros, G de Pinieux, Nathalie Van Acker, Solène Evrard and Anne Gomez-Mascard

FOS alterations in osteosarcoma support the hypothesis of malignant transformation of osteoblastoma: a multicentric and longitudinal study of five cases

Aim of the study: Osteosarcoma, osteoblastoma and molecular biology.

Etiology and pathogenesis of osteosarcoma (OS) remain poorly understood. Recent studies with conflincting resultats have suggested a potential link between osteoblastoma (OBL) and OS, supporting a malignant transformation process. Our objectives were to explore the hypothesis of malignant transformation of OBL to OS and to discuss the potential clinical implications of these findings. We conducted a multicentric restrospective case-series study by collecting clinical, radiological, histological and follow-up data of OS suspected to be linked with malignant transformation of OBL within the ResOs network (French National network specialized in pathology and care of bone sarcomas). Molecular analysis (fluorescence in situ hybridization- FISH and next-generation sequencing-NGS) were performed to characterize those tumors. Five cases were included (3 female and 2 male patients). The median age at diagnostic of OS was 35 years (range : 13-74). The tumor was located in axial skeleton for 4 patients. All cases were osteoblastoma-like OS. Two patients had a previous history of OBL diagnosed 11 and 17 years before the diagnosis of OS. Four OS harboured FOS rearrangement in FISH including two tumors with characterized uncommon fusions by NGS (FOS::VGLL4 and FOS::COL5A2). One patient had FOS polysomy. All patient were alive at last follow-up. Our results support the hypothesis of malignant progression of OBL towards OS through FOS alteration. This study emphasizes the need to recognize the malignant transformation potential of OBL and the indolent course of these tumors to improve the management of the patients.

SPAGN: Nadina Hood

Baltimore, USA

From a patient´s point of view

Johannes Neugebauer

Prof. Dr. Dammerer Prof. Dr. Bergovec Dr. Leone

False-positive radiological results in treatment of Tenosynovial giant cell tumor

Aim of the study: How often are the postoperative histopathological findings conclusive of the preoperative MR findings?

In a retrospective data analysis, we examined 137 patients in our department between 1991 and 2019 who had undergone radical synovectomy for suspected TGCT. Our inclusion criteria are: positive MRI findings in the hemosiderin sequences for TGCT, subsequent surgical synovectomy and completed histologic workup with inconsistency to the MRI findings. Due to the heterogeneity of the study group, we can only use descriptive statistics generated with Excell. Results: The mean age at diagnosis was 38 years (range: 9 - 73). Of 137 cases, 52 were included in the study with complete data sets. In 37 of 52 (71%), MR and histologic findings were conclusive. 15 of 52 (29%) had a false-positive MR finding for TGCT. Conclusion Due to the invasiveness of radical synovectomy, preoperative biopsy is a sensible option for confirming the diagnosis and should be used in cases of doubt. As we work closely with our specialist tumor radiologists within the University Hospital, we always have the opportunity to discuss cases individually and thus make the diagnosis according to the multiple-eye principle, but we still recommend a biopsy in cases of doubt.

Piotr Rutkowski[5], Nicholas M. Bernthal[6], Supraja Narasimhan[7], Maitreyi G. Sharma[7], Rodrigo Ruiz-Soto[7], Matthew L. Sherman[7], William D. Tap[8]

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Safety and efficacy updates from a phase 1 study of vimseltinib in patients with tenosynovial giant cell tumor

Aim of the study: To present updates in the assessment of safety and efficacy from a phase 1 study of vimseltinib in patients with tenosynovial giant cell tumor.

Introduction: Vimseltinib is an investigational, oral, switch-control tyrosine kinase inhibitor specifically designed to selectively and potently inhibit the colony-stimulating factor 1 (CSF1) receptor (CSF1R). We report updated data for patients with tenosynovial giant cell tumor (TGCT) from phase 1 (dose escalation) of a phase 1/2 study (NCT03069469).

Methods: Patients with TGCT not amenable to surgery were treated with vimseltinib (cohort 5, 30mg once daily [QD] loading dose [LD] for 5 days (d), then 30mg twice weekly; cohort 8, 30mg QD LD for 3d, then 10mg QD; cohort 9, 20mg QD LD for 3d, then 6mg QD). Objectives were to determine safety, tolerability, and recommended phase 2 dose.

Results: As of June 27, 2023, 32 patients enrolled; 16 remain on study (15 on treatment, having received vimseltinib for ≥2 years, and 1 in follow-up). The most common tumor location was knee (63%). Grade 3/4 treatment-emergent adverse events (>5% of patients) included increased creatine phosphokinase, aspartate aminotransferase, lipase, amylase, and hypertension. There was no evidence of cholestatic hepatotoxicity. Combined objective response rate by independent radiological review (IRR) using Response Evaluation Criteria in Solid Tumors version 1.1 was 72% (1 complete and 22 partial responses). Most responses (65%) were achieved within 6 months.

Conclusions: Vimseltinib continued to be well tolerated. At data cutoff, nearly 50% of patients were on treatment for ≥2 years. Efficacy further improved with continuation of treatment and no patients progressed on treatment, as assessed by IRR. Previously presented at CTOS 2023.

Michiel van de Sande[1], Jean-Yves Blay[2], Piotr Rutkowski[3], Hans Gelderblom[1], Silvia Stacchiotti[4], Alejandro Falcon Gonzalez[5], Jayesh Desai[6], Axel Le Cesne[7], César Serrano[8], Virginia Ferraresi[9], Emanuela Palmerini[10], Breelyn A. Wilky[11], Andrew J. Wagner[12], Nicholas M. Bernthal[13], Supraja Narasimhan[14], Brooke Harrow[14], Maitreyi G. Sharma[14], Rodrigo Ruiz-Soto[14], Matthew L. Sherman[14], William D. Tap[15]

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Safety, efficacy, and patient-reported outcomes with vimseltinib in patients with tenosynovial giant cell tumor who received no prior anti–colony-stimulating factor 1 therapy: ongoing phase 2 update

Aim of the study: To present a phase 2 update on the assessment of safety, efficacy, and patient-reported outcomes with vimseltinib in patients with tenosynovial giant cell tumor who received no prior anti–colony-stimulating factor 1 therapy.

Introduction: Vimseltinib is an investigational, oral switch-control tyrosine kinase inhibitor specifically designed to selectively and potently inhibit the colony-stimulating factor 1 (CSF1) receptor (CSF1R). We report updated data from cohort A of the phase 2 part (expansion) of an ongoing phase 1/2 study (NCT03069469) of vimseltinib in tenosynovial giant cell tumor (TGCT).

Methods: Patients with TGCT not amenable to surgery and no prior anti-CSF1/CSF1R therapy (previous treatment with imatinib or nilotinib allowed) received vimseltinib 30mg twice weekly (recommended phase 2 dose). The primary objectives were safety, tolerability, and antitumor activity (by independent radiological review using RECIST v1.1). Pain was assessed using the brief pain inventory (BPI) worst pain item (responder: ≥30% pain improvement without ≥30% increase in narcotic analgesic use).

Results: As of June 27, 2023, 46 patients with TGCT without prior anti-CSF1/CSF1R therapy were enrolled. Median age was 44 years, and the most common tumor location was knee (57%). Most nonlaboratory treatment-emergent adverse events (TEAEs) were grade 1/2; grade 3/4 TEAEs (>5% of patients) were elevated creatine phosphokinase and hypertension. There was no evidence of cholestatic hepatotoxicity. Best overall objective response rate was 64%. At week 25, 59% of patients with objective tumor response and 55% with stable disease were also BPI worst pain responders.

Conclusions: These results demonstrate that vimseltinib can provide antitumor activity and pain relief in patients with TGCT not amenable to surgery with no prior anti-CSF1/CSF1R therapy. Previously presented at CTOS 2023.

Abdullah Serin, Mehmet Ayvaz, Taha Aksoy, Melih Oral

Hacettepe University Department of Orthopaedic and Traumatology

Mid-term outcomes of surgically treated fibrous dysplasia

Aim of the study: This study aims to present the mid-term outcomes of fibrous dysplasia patients treated with surgically.

Fibrous Dysplasia (FD) is a benign condition in which the normal bony structure is replaced by fibro-osseous tissues. 34 patients with 35 limbs with FD of long bones treated surgically by a single surgeon were enrolled in this study. Union time, monostotic or polyostotic variants, spinal involvement, associated syndromes, malignant transformation, augmentation method, and complications were recorded. Functional outcomes were evaluated using Muskuloskeletal Tumor Society Score (MSTS), Toronto Extremity Salvage Score (TESS), and Short From - 12 (SF-12). The mean age at the index surgery was 24.3 (±13.8) years . Bone union time was 75.4 (±24,9) days. The main complaint for admission was pain in 23 (66%), fracture in 8 (23%) and deformity in 4 (11%) segments. The localization of lesions were femur (19), humerus (6), tibia (6), radius (3) and fibula (1). The augmentation methods used was cement in 2 (%6), cancellous allograft in 16 (%45), fibular strut allograft in 17 (%49), femoral strut allograft in 3 (%9) and fibular autograft in one (%3) segment. One patient underwent resection of the fibula. Complications occured in 3 (%9) segments. Patients were followed-up for 52.6 months (±32.6). At the final follow up the mean MSTS score was 94.9, the mean TESS score was 97.9 and the mean SF-12 was 49.64 The present study shows that combination of curettage, bone grafting and fixation with plate or intramedullary nailing is a convenient way to treate patients suffering from FD of long bones.

June 14, Friday | Pomerania Hall

SESSION 9:
PRINCIPLES OF TREATMENT IN FOOT AND ANKLE TUMORS
CHAIRS: Harzem Özger (Turkey), Ajay Puri (India)

Hazem Wafa

Orthopaedic Oncology, Leuven University Hospitals, Belgium

Principles of management of bone and soft tissue sarcomas of the foot and ankle

Chongqi Tu, Xuanhong He, Li Min

Department of Orthopedics, Orthopedic Research Institute, West China Hospital, Sichuan University, Chengdu, People's Republic of China

Three-dimensional printed custom-made modular talus prosthesis in patients with talus malignant tumor resection

Aim of the study: In this study, we designed a 3D printed modular talus prosthesis and applied it to patients with talus malignant tumor. We tend to explore the application of 3D printed custom-maded modular prosthesis in talus malignant tumor.

Introduction: Talar malignant tumor resection presents challenges, with options like below-knee amputation, tibio-calcaneal arthrodesis, and homogenous refrigerated bone transplant having limitations. Although three-dimensional (3D) printed total talus prostheses are increasingly utilized, mostly in case studies, their clinical efficacy remains unclear.

Method: We retrospectively analyzed patients treated for talus malignant tumors with custom-made 3D printed modular prostheses. Recorded parameters included oncology outcomes, operation time, blood loss, and postoperative complications. Limb function assessment employed the Musculoskeletal Tumor Society 93 (MSTS-93) and American Orthopedic Foot and Ankle Society (AOFAS) scores, ankle joint range of motion, and leg length difference. Prosthesis position and osseointegration were evaluated using plain radiography and Tomosynthesis-Shimadzu Metal Artefact Reduction Technology (T-SMART).

Results: Patients (average age: 31.5±13.1 years) were followed for an average of 54.8 months. Operation time averaged 2.4±0.5h, with a blood loss of 131.7±121.4ml. MSTS-93 and AOFAS scores averaged 26.8 and 88.5, respectively. Ankle range of motion measurements were 32.5 degrees (plantar flexion), 9.2 degrees (dorsiflexion), 10.8 degrees (varus), and 5.8 degrees (valgus). One patient experienced delayed wound healing postoperatively, while good osseointegration was observed at the bone-prosthesis interface.

Conclusion: 3D printed custom-made modular talus prostheses exhibit the potential to restore joint stability, integrity, and enhance limb function in patients with talus malignant tumors.

Ajay Puri, Ashish Gulia

Tata Memorial Centre, Mumbai, India

Is bony reconstroction necessary after excision of distal fubula tumors?

Aim of the study: Is minimal reconstruction using prolene mesh (meshplasty) adequate to restore ankle stability and function after distal fibula resection?

Methods: 9 patients [PNET = 5, osteosarcoma = 2, GCT = 1 and angiosarcoma = 1] with mean age of 25 years were operated for distal fibulectomy through standard lateral approach . Mean resection length was 13.3 cm. A prolene mesh was anchored to distal tibia and talus using screws or Ethibond sutures. Rehabilitation protocol included below knee cast for 6 weeks followed by gradual full weight bearing mobilization and ankle range of motion exercises.

Results: Of 7 patients available for final assessment at a median follow-up of 78 months (range: 34-161 months), 2 had local recurrence. One patient had a valgus deformity at 55 months follow up without any restriction of activity while the others had a stable ankle without any deformity. The mean MSTS score was 28 (24 - 29).

Conclusion: "Meshplasty" after distal fibulectomy is an easy, reproducible, cost effective reconstruction modality with minimal complications which adequately restores ankle function.

N. M. Engel, J. Hardes, R. Öztürk, L.-E. Podleska, M. Nottrott, W.K. Guder, A. Streitbürger

University Hospital Essen, Department of Orthopedic Oncology, Essen, Germany

Bone and soft tissue sarcoma of hand and foot: experiences and treatment strategies of a tertiary sarcoma center from 2018 to 2023

Aim of the study: Soft tissue and bone lesions of the hands and feet are mostly benign and rarely sarcomas. Oncological resection is difficult given the small anatomical situation. This study aims to demonstrate current treatment regimens in a tertiary sarcoma center.

Methods: Between 2018-2023, 1321 patients with sarcomas received surgical treatment in our tertiary sarcoma center. We identified patients with sarcomas of hands and feet and data were collected from patient's records retrospectively.

Results: Sarcoma of hands (hand group = HG) or feet (foot group = FG) were found in 38/1321 patients (<3%). Twenty-six patients presented with a sarcoma of the foot (bone n=5, soft tissue n= 21; median follow-up: 2.1 years (range 0.6-21.4)) and 12 patients with a sarcoma of the hand (bone n=5, soft tissue n=7; median follow-up: 2.4 years (range 0.2-19.7)). At external hospitals, unplanned R1/2-resection at benign tumor suspicion (whoops procedure) was performed in 23/38 patients with local relapse (LR) in 14 patients. Good margins were mostly achieved after (re-) resection in our center (R0: n=34; R1: n=1 (HG), R1: n=3 (FG)) with low rate of LR (n=4). Initially four patients presented with and at last follow-up 15 patients showed distant metastases. 5-year metastatic-free survival (MFS) was 52% (FG) and 70% (HG). Patients with primary resection in our center showed a better 5-year MFS in the FG (77% vs 39%, p= 0.74), though not significant.

Conclusion: Whoops procedure in sarcomas of hand and feet is frequently performed in non-expert hospitals. Patients with unclear bone and soft tissue lesions should be referred to sarcoma centers for diagnosis and treatment.

Marisa Valentini, Marko Bergovec, Robert Piber, Susanne Scheipl, Andreas Leithner, Dimosthenis Andreou

Department of Orthopaedics and Trauma, Medical University of Graz, Austria

Midfoot sarcomas: reconstruction or amputation? Case series and literature review

Aim of the study: The unique foot anatomy presents challenges in reconstructing a viable and functional limb after oncological resection of midfoot sarcomas. Outcomes of surgical treatment options were evaluated through a comprehensive literature review and case series.

Introduction: This study aims at evaluating surgical treatment options for midfoot sarcomas, analyzing complications, morbidity, and outcome.

Methods: A comprehensive literature search revealed 58 articles reporting 85 surgically treated midfoot sarcomas (bone, 57; soft tissue, 28). Additionally, 5 patients with midfoot sarcomas (bone, 3; soft tissue, 2), treated between 2004 and 2021 at our department, were retrospectively reviewed and analyzed, including patient-related outcome measures.

Results: Ray resections (2), resection and reconstruction through fibular autograft, wide soft tissue resection, and midfoot amputation (1) were performed in our 5 patients with midfoot sarcomas (60% female; median age, 46y, IQR, 41-51). No evidence of disease and no complications were detected (median follow-up, 120mo, IQR, 70-146). The outcome measures revealed good overall results, with lower scores for the subsections assessing the emotional distress and the return to sport activities. The 85 cases included in the literature review (56.5% male; median age, 29y, IQR, 17-52; median follow-up, 31mo, IQR, 15.7-60), received following surgical treatments: resection and reconstruction (25.9%), resection without reconstruction (8.2%; overall limb salvage rate, 34.1%), ray resection (23.5%), and amputation (42.4%; of which 7 secondary). No evidence of disease at last follow-up was reported in 72.9% of cases.

Discussion: When resecting midfoot sarcomas it is essential to consider both principles of oncological surgery and functional anatomy. Biological reconstruction techniques can offer an alternative to ablative surgery in carefully selected cases with functional restoration of the salvaged limb.

Osman Emre Aycan, Mehmet Baydar, Berksu Polat, Muhammet Coşkun Arslan

Baltalimani Bone Diseases Training and Research Hospital, Istanbul, Türkiye

Biological reconstruction options for the calcaneal benign aggressive and malignant tumors

Aim of the study: Our study aimed to evaluate the biological reconstruction options for benign aggressive and malignant tumors of the hindfoot.

Patients and Methods: The data of 10 patients who underwent wide resection and calcaneal reconstruction due to malignant or benign aggressive tumors in the calcaneus between 2020 and 2022 were retrospectively analyzed. Six patients with a follow-up of more than 2 years and undergoing biological reconstruction were identified. After evaluating patients based on epidemiological characteristics, they were classified according to preoperative chemotherapy and radiotherapy, resection type, reconstruction type, and surgery duration, as well as mean blood loss. Patients were reassessed in the postoperative period considering complications, time to full weight-bearing, and MSTS scores.

Results: The mean age was 20.6±11.3 (9-41) years. Our series comprised 2 Ewing sarcomas, 1 osteosarcoma, 1 recurrent chondroblastoma, 1 recurrent giant cell tumor, and 1 chondrosarcoma. Neoadjuvant chemotherapy was applied to 3 patients, with an additional neoadjuvant 40Gy radiotherapy in 2 patients. In particular, cryopreserved calcaneus was used in 3 patients, combined with vascularized autograft (2double barrel fibula,1 iliac) to complete the reconstruction. The average surgery duration was 116 minutes, with a mean blood loss of 437 cc.Full weight-bearing was possible at 14th week. The mean follow-up was 26 months, with mean MSTS score of 86.7%.

Conclusions: Preserving plantar sensation is crucial for maintaining the patient's communication with the ground. Although weight-bearing took a longer time in patients undergoing biological reconstruction methods, a higher strength reconstruction was observed. Better functional outcomes were achieved in young patients with the application of biological reconstruction methods.

Osman Emre Aycan, Selman Tuncer, Muhammet Coşkun Arslan, Berkay Doğan

Baltalimanı Bone Diseases Training and Research Hospital, Istanbul, Türkiye

Non-vascularized fibular autograft reconstruction in tumor related metatarsal resections

Aim of the study: This retrospective study evaluates the outcomes of resection and reconstruction using a non-vascularized fibula in benign agressive and malignant metatarsal tumors.

Patients and Methods: 23 patients diagnosed with primary benign aggressive and malignant bone tumors of the metatarsals between 2006 and 2023, were retrospectively evaluated. 15 metatarsal reconstructions of 12 patients with non-vascularized fibular autografts with minimum24 months FU were included. Length of fibular autograft taken, operation time, proximal and distal-end union times, fixation material withdrawal, weight-bearing time, average follow-up time, MSTS, FADI, AOFAS scores, pre- and post-operative VAS were evaluated.

Results: The mean follow-up was 46.3 months(29-157). Most commonly involved metatarsals were 2nd (n=4) and 3rd (n=4). Patients diagnosed as ABC (n=5), synovial sarcoma (n=2), Ewing's sarcoma (n=1), chondrosarcoma(n=1), soft-tissue chondroidtumor(n=1) and Nora's lesion(n=1).3 patients had preoperativeRT. Mean fibular autograft length was 61.4mm.Mean union at proximal end was 14.7weeks and 15.6weeks at distal end.K-wires removed at mean 13.1 weeks. Patients were encouraged to partial weight-bearing at mean 8.5weeks. Mean operationtime was 117.4min. Five complications required revisions; 2wound infection ,2soft tissue necrosis and 1skin necrosis. Mean MSTS was26.5, mean FADI was %65, Mean AOFAS score was 71% at last follow-up. Mean preop VAS was 6.4 and postop VAS was 3.5

Conclusion: Non-vascularized fibular autografts provide an easier surgical technique, shorter operation time and and good healing potential. Non-vascularized fibular autografts can be used as an optimal alternative reconstruction tool following metatarsal resections.

Kaan Erler

Cyprus

Grade 2 chondrosarcoma of the toe, unusual location. What should be the treatment guideline. In unclear diagnosis?

Aim of the study: To establish the challenge in the treatment chondrosarcoma with.

Enchondroma is the most common benign cartilage bone tumor of the toes. In contrast, the foot is a rare region for chondrosarcoma, and the involvement of phalanges is extremely rare. In this article, we report an unusual case of intermediate chondrosar- coma involving the proximal phalanx of the great toe of a 52-year-old woman who was previously treated with curettage and bone grafting because of misinterpretation of enchondroma at a local hospital. She presented complaining of pain and swelling that she had experienced for a period of 1 year after the first operation. Radiography revealed a lytic lesion with a subtle punctuate calcification and endosteal scalloping in the proximal phalanx of the great toe. Gadolinium-enhanced magnetic resonance imaging confirmed soft-tissue involvement and cortical destruction. Staging evaluation with computed tomographic scan of the chest, abdomen, and pelvis was performed to ensure that there was no metastatic disease. Subsequently, a bone biopsy was performed, and the diagnosis was grade 2 chondrosarcoma. The patient was informed about the recurrence of the lesion and the clinical context on the basis of tumor biology of chondrosarcoma and was offered the option of either amputation or wide resection. She preferred the latter. The patient was treated with wide resection and underwent reconstruction with cement and Kirschner wire. She remains free of disease after 5 years follow up.

Eric Mascard[1], Stéphane Scharicky[2], Nathalie Gaspar[3]

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Conservative treatment of malignant or aggressive bone tumors of the distal tibia or fibula, with reconstruction by ankle arthrodesis in children and adolescents

Aim of the study: There is no consensus on treatment of malignant tumors of the distal tibia. Many favor amputation because of the excellent reported results from below knee amputation.

17 patients aged 8 to 18 (m.13.1) underwent a conservative surgery between 1983 and 2021 for tumors of the distal tibia or fibula. Patients had “en bloc” resection. The reconstruction was achieved in 13 cases, during the same procedure, with tibiotalar and fibula-talus arthrodesis done with tibial strut and iliac bone grafts. In 4 cases the initial reconstruction was achieved with cement + osteosynthesis and the arthrodesis was secondarily achieved after completion of chemotherapy according to the induced membrane technique. Results were evaluated retrospectively with an average 11.4 y. FU (1-27). 14 patients were DF and 3 were deceased. Two local recurrence were amputated. There were 4 infections. Four patients required additional bone grafting. Three patients required osteotomy for realignment. All arthrodesis healed at last FU. All patients were able to walk without pain or limping with an average functional score of 25.9/30 (23-28) MSTS 86%. Several reconstructive techniques are available : ankle custom-made prosthesis, osteoarticular allograft or reconstruction by arthrodesis with vascularized fibula, allograft or by autograft. All clinical series reported significant rates of infections, cutaneous necrosis and nonunion. Conservative treatment is a possible alternative to amputation for management of malignant tumors of the distal tibia. The induced membrane technique allowed assessment of margins, ending of chemotherapy, post-operative radiotherapy (without irradiation of the graft) before doing the definitive reconstruction by bone grafting. Survival results and functional outcome are not inferior to amputation avoiding life time need for and external prosthesis.

Harzem Ozger

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Limb salvage in foot and ankle tumors

SESSION 10:
COMPLICATIONS IN SARCOMA TREATMENT
CHAIRS: Paweł Łęgosz (Poland)

Ahmad Shehadeh

King Hussein Cancer Center, Amman, Jordan

Diagnosis and management of periprosthetic infection in limb salvage. What I have learned?

Maximilian Sagmeister[1], Gilg Magdalena[2], Scheipl Susanne[3], Smolle Maria[3], Leithner Andreas[3], Andreou Dimosthenis[3]

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Permanent fistulas in sarcoma patients with megaprostheses are associated with frequent hospital visits and high secondary revision rates

Aim of the study: One way of treatment after infection in patients with megaprostheses due to sarcoma is to establish a fistula. Our aim was to analyze the course of disease and the outcome of sarcoma-patients with megaprosthesis and permanent fistula.

Methods: We performed a retrospective analysis of 14 patients (12 men, 2 women) with a bone- (8) or soft tissue sarcoma (6), who underwent megaprosthetic replacement at a median age of 41 (interquartile range (IQR), 24-61) years between 2005-2023 and subsequently developed a planned (n=1) or unplanned (n=13) permanent fistula.

Results: Development of permanent fistula occurred at a median of 3 (IQR, 2-27) months after megaprosthesis. The maximum value of C-reactive protein (CRP) from the establishment of the fistula to last follow-up was 62 (IQR, 31-129) mg/L, the median number of exacerbations of infection was 1 (IQR, 1-3). In 8 patients, there was a multi-microbial and in two patients a monomicrobial colonization. 13 patients underwent suppressive antibiotic therapy. During treatment with permanent fistula, a median of 7 (IQR, 5-13) outpatient- visits within a period of 2 (IQR, 1- 8) months were registered. The median period from fistula to last registered follow-up was 16 (IQR, 7- 51) months. Ten patients underwent surgical treatment after a median time of 1 (IQR, 1- 3 months) after fistula development. 3 patients underwent amputation, 5 fistula revisions and 2 single-stage prosthesis exchanges. Of the 7 patients treated with limb-sparing surgery, 4 had a recurrent fistula at last follow-up.

Conclusion: Permanent fistulas in sarcoma patients with megaprostheses are associated with frequent hospital visits and high secondary revision rates, followed by reduction in the quality of life of the patients.

Jasprit Kaur[1], Hartej Sur[1], Dror Robinson[2], Jonathan Stevenson[1], Lee Jeys[1], Michael Parry[1]

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[2] Tel Aviv University Tel Aviv Israel

Periprosthetic fractures around Megaprostheses of the knee for oncological indications: A comparison of treatment modalities

Aim of the study: Comparison of outcomes of periprosthetic fractures around megaprostheses of the knee for oncological indications.

Introduction: There is a paucity of literature describing outcomes of periprosthetic fractures around megaprostheses of the knee for oncological indications. Our study compares outcomes of periprosthetic fractures treated by ORIF, revision EPR and non-operative intervention.

Methods: Patients from 2007-2023 with periprosthetic fractures around knee megaprostheses were identified from a single tertiary centre's oncology database (ONKOS). Fractures were classified according to the unified classification system (UCS). Mean follow up was 7.5 years (range 1-20 years). Estimated survival was calculated using Kaplan Meier analysis.

Results: 31 fractures were identified in 29 patients. Fractures undergoing ORIF were classified as B1 or C. All B2/3 fractures underwent revision EPR. There were 6/13 failures in the ORIF group compared to 4/10 failures in the revision EPR group. There was 1 failure out of 8 in the non-operative group. There was no significant difference in the incidence of failure for the EPR group and the ORIF group (Cox ph, p=0.57); after 5 years survival for both groups was 60% (95% CI: 36.2% - 99.5%) and 61.7% (95% CI: 37.4% - 100%). At 10 years, survival following septic failure was 70% in both operative groups.

Conclusion: There is no difference in survival between operative groups at 5 years or following septic failure at 10 years. Treating B1 or C fractures with ORIF and B2/3 fractures with a revision EPR achieves comparable results. Non-operative intervention remains for undisplaced fractures with well-fixed stems.

Dipak B. Ramkumar

Lahey Clinic Inc, Section of Orthopaedic Oncology, Division of Orthopaedic Surgery, Burlington, United States

Silver-Coated Prostheses in the Mitigation of Periprosthetic Joint Infection – A Cost Effectiveness Analysis

Aim of the study: We aimed to ascertain the cost-effectiveness of silver-coated megaprostheses in mitigating PJI and related complications in patients undergoing limb salvage.

M**aterials and Methods:** An expected-value cost-effectiveness model was developed utilizing the payoffs of cost and effectiveness (in quality-adjusted life expectancy in days, QALE). A review of the medical literature was used to ascertain various complications, their probabilities, utility values, and direct medical costs associated with various health states. One- and two-way sensitivity analyses were then completed to identify the model parameters that were most influential on the preferred implant.

Results: The total cost and effectiveness for the silver-coated and standard megaprostheses were $45,466.83 and 11,824.45 days and $64,254.45 and 11,989.25 days, respectively. This resulted in an incremental cost-effectiveness ratio of $114.12 per day for use of the silver-coated implant. The use of silver coated megaprosthesis is cost-effective in minimizing the incidence and associated complications of PJI in the modeled patient population. These results remain dominant across a range of model parameters.

Conclusion: The use of silver-coated megaprostheses in reconstruction after wide resection of lower extremity osteosarcomas remains a cost-effective strategy at mitigation of post-operative prosthetic joint infections and associated healthcare costs. The upfront incremental cost increase of the silver-coated prosthesis is minimal in comparison to the determinantal quality of life conferred and the associated medical costs of the PJI health state. With increasing fiscal austerity in healthcare and society, the routine use of silver-coated megaprostheses should be considered in prosthetic reconstructions after wide resection of lower extremity osteosarcomas.

Pietro Pellegrino[1], Michele Boffano[1], Nicola Ratto[1], Ugo Albertini[1], Andrea Ferro[1], Chiara Beltramo[2], Elena Boux[1], Stefano Marone[1], Martina Rezzoagli[1], Simone De Meo[3], Raimondo Piana[1]

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[2] University of Turin
[3] Piedmont Region MuscoloSkeletal and Rare Tumor Charity

Know your enemy in the PARITY era! The choice of antibiotic in the prophylaxis of orthopaedic oncology surgery

Aim of the study: To evaluate antibiotic prophylaxis in orthopaedic oncology.

Introduction: Infection is one of the most dreadful complications in orthopaedic oncology. PARITY trial showed the non superiority of extended prophylaxis but there is still no consensus on the best antibiotic and administration timing.

Methods: In a referenced Orthopaedic Oncology centre we started an internal survey in November 2016. We used prolonged regimen with ceftriaxone for minor surgery and vancomycin for prosthetic replacement, pelvic and spine surgery from 2016 to 2018. From November 2018 to May 2021 we shifted to a short term prophylaxis with a second intraoperative shot if surgery was longer than 4 hours. A third dose was administered in surgeries longer than 8 hours. Using the same timing scheme of the 2018-2021, from June 2021 to June 2022 cefazolin was used for all interventions. In July 2022 the internal protocol changed with cefazolin for minor surgery and vancomycin for megaprosthesis and for patient with hospitalization in the previous 2 months. The infection rate related to the different protocol was evaluated.

Results: A decrease in infection rates occurred in the period 2018-2021 in comparison with 2016-2018, with an increase in the period 2021-2022 especially in megaprosthetic replacement and with methicillin resistant coagulase negative Staphilococci (MRSE). A negative drop in overall and periprosthetic infection rates was detected in the period 2022-2023.

Conclusions: Short term prophylaxis seems a standard of care and our data confirm the PARITY results. Antibiotic choice shall be discussed on the local epidemiology and cephalosporins could not be the first option.

Minxun Lu, Zhuangzhuang Li, Yi Luo, Yong Zhou, Li Min, Chongqi Tu

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Three-dimensional design custom-made uncemented stem for revision of cemented distal femoral endoprosthesis due to aseptic loosening

Aim of the study: This paper aims to examine the outcomes of three-dimensional (3D) design custom-made uncemented stems for revision.

Introduction: Revision of cemented distal femoral replacement (DFR) due to aseptic loosening is challenging because of the resultant femoral bone loss. This paper aims to examine the outcomes of three-dimensional (3D) design custom-made uncemented stems for revision.

Methods: Between January 2014 and December 2020, 17 patients received 3D design uncemented stems for revision of loosed cemented DFR. The femoral bone loss was classified into four Grades, and four types of uncemented stems were designed correspondingly. The revision stems were custom-made for each patient by measuring the diameter of the medullary cavity and the anterior curvature of the femur.

Results: The patient counts with their corresponding Grades of femoral bone loss were as follows: Grade I, 8 patients; Grade II, 5 patients; Grade III, 3 patients; and Grade IV, 1 patient. During the mean follow-up of 80 months, no revision failure was detected. The postoperative radiographic showed that the stem matched the femoral anterior curvature well. The femoral bone defect was completely filled by the 3D design stem in 10 of the 17 cases postoperatively. In the remaining cases, the persistent peri-stem defect was filled or partially restored during the follow-up.

Conclusion: 3D design custom-made uncemented stem created precise, stable, and durable fixation and provided satisfactory clinical outcomes, which seems to be a viable method for cemented DFR revision.

Ahmad Shehadeh

King Hussein Cancer Center, Amman, Jordan

Salvage of limb salvage using 3-D printing technology

Stewart Morrison, Lucas Annabell, Leo Donnan

The Royal Children's Hospital Melbourne, Australia

Rotationplasty: Are we asking the right questions?

Aim of the study: To evaluate the success of rotationplasty when compared to other local control options in paediatric and adolscent patients with sarcoma

Introduction: Rotationplasty is a surgical option for sarcoma about the knee in paediatric and adolescent patients. The goal of this study was to evaluate the outcomes of rotationplasty reported in the literature and evaluate their contemporary validity, particularly with regard to comparison to alternative surgical strategies and body image.

Methods: A literature review (Medline® (1946 to present)) was performed, identifying all articles mentioning 'rotationplasty' or 'Van Nes' in title or abstract. Abstracts were screened and categorised based on study type. Data pertaining to number of participants, indication, follow up period, outcome measures, and complications were extracted.

Results: 250 studies were identified including 1 systematic review, 25 narrative reviews, 86 case series, 17 comparative series, and 54 case reports. Age at surgery ranged from 16 months to 80 years with average follow up of 7.6 years. Outcome measures included the MSTS, SF36, TESS, and QLQ-C30. 7 studies reported on gait analysis. Wound problems were the most common complication, with thrombosis, early amputation, and subsequent request for foot amputation also reported.

Conclusions: Rotationplasty literature highlights the dilemmas present comparing local control options, including the complex interplay between functional outcomes and the concept of 'post-traumatic growth' on quality-of-life measures in young adult sarcoma survivors. Unresolved technical questions pertain to to vessel management, incision, and comparison of Winkelman BI vs BIIIa techniques. Evaluation of data should inform future research and ultimately the development of a framework for enhancing family decision making with regard to local control options in sarcoma.

POSTER SESSION

Vanessa Etschmaier[1], Dietmar Glänzer[1], Nicole Eck[1], Ute Schäfer[2], Andreas Leithner[1], Dietmar Georg[3], Birgit Lohberger[1]

[1] Medizinische Universität Graz – Universitätsklinik für Orthopädie und Traumatologie
[2] Medizinische Universität Graz – FE Experimentelle Neurotraumatologie
[3] Medical University of Vienna – Department of Radiation Oncology, MedAustron Ion Therapy Center

Proton and carbon ion irradiation changes the process of en-dochondral ossification in an ex-vivo femur organotypic culture model

Aim of the study: The Purpose of this study was to examine the effect of particle therapy (PT) on growing bone

Introduction: Particle therapy (PT) that utilizes protons and carbon ions offers a promising way to reduce the side effects of radiation oncology, especially in paediatric patients.

Methods: To investigate the influence of PT on growing bone, we exposed an organotypic rat ex vivo femur culture model to PT. After irradiation, histological staining, immunohistochemical stainings, and gene expression analysis were conducted following one or 14 days of in vitro culture (DIV).

Results: Our data indicated a significant loss of proliferating chondrocytes at 1 DIV, which was followed by regeneration attempts through chondrocytic cluster formation at 14 DIV. Accelerated levels of mineralization was observed, which correlated with increased proteoglycan production and secretion into the pericellular matrix. Col2α1 expression, which increased during the cultivation period, was significantly inhibited by PT. Additionally, the decrease in ColX expression over time was more pronounced compared to the non-IR control. The chondrogenic markers BMP2, RUNX2, OPG, and the osteogenic marker ALPL, showed a significant reduction in the increase of expression after 14 DIV due to PT treatment. It was noted that carbon ions had a stronger influence than protons.

Conclusion: Our bone model demonstrated the occurrence of pathological and regenerative processes induced by PT, thus building on the current understanding of the biological mechanisms of bone.

Birgit Lohberger

Birgit Lohberger, Dietmar Glänzer, Nicole Eck, Andreas Leithner, Dietmar Georg

Suppression of DNA repair mechanisms and enhancement of radiosensitivity by ATR inhibition in human chondrosarcoma cells

Aim of the study: In order to overcome the resistance to radiotherapy in chondrosarcomas, the prevention from efficient DNA repair with an additional treatment was explored for particle beams as well as reference X-ray irradiation.

Introduction: Chondrosarcoma represents a heterogeneous group of locally aggressive and malignant entities. Poor vascularisation, a slow division rate and a hyaline cartilage matrix that prevents access to the cells are reasons for the existing therapy resistance. The therapy options are limited and complete surgical resection remains the gold standard. Particle therapy (PT) with protons or carbon ions provide enhanced local control and patients' survival rates compared to conventional photon beam therapy.

Methods: The impact of combined treatment with DNA repair inhibitors - with focus on ATRi VE-821 - and PT was investigated regarding cell viability, proliferation, cell cycle distribution, MAPK phosphorylation and the expression of key DNA repair genes in two human chondrosarcoma cell lines.

Results: A pre-treatment with the PARPi Olaparib or Veliparib, the ATMi Ku-55933, and the ATRi VE-821 resulted in a dose-dependent reduction in viability, whereas VE-821 has the most efficient response. Quantification of γH2AX phosphorylation and protein expression of the DNA repair pathways showed a reduced regenerative capacity after irradiation. Furthermore, combined treatment increased MAPK phosphorylation and the expression of apoptotic markers. At the relative gene expression as well as at the protein expression and phosphorylation levels, we were able to demonstrate the preservation of DNA damage after combined treatment.

Conclusion: The present data show that the combined treatment with ATMi VE-821 increases the radiosensitivity of human chondrosarcoma cells in vitro and significantly suppresses efficient DNA repair mechanisms. This could be an important step towards improving the efficiency of radiotherapy.

Albert Isidro Llorens[1], Edgar Camaros[2], Tatiana Tondini[3]

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Ancient egyptian cancer far from Egypt

Aim of the study: Go deep in the cancer evolution.

Cancer is a widespread disease that affects all societies both ancient and actual. It is the second cause of death in modern Western populations, and its incidence has been doubling over the last thirty years. Its rapid increase and impact reinforce the belief that cancer is a modern disease, possibly related to increased exposure to environmental carcinogens or personal habits. However, palaeopathology, i.e., the study of ancient diseases, shows that oncological diseases were widespread in ancient populations. Ancient Egypt represents a unique opportunity to investigate cancer in antiquity as it offers well-preserved human samples as well as solid literature evidence. In fact, Egyptians were renowned throughout the ancient world for their medical texts and influenced many civilizations, such as the Greeks and Romans. In this context, weI present two ancient Egyptian skulls with clear evidence of cancer, which are held at the Duckworth Laboratory, University of Cambridge. The aim of the analysis consists of understanding, evaluating, and discussing how cancer affects bones by employing different techniques, such as anthropological approach, palaeopathological analysis, and micro-CT scanning. This analysis contributes to gaining a better understanding and characterisation of past neoplastic conditions that are present in archaeological skeletons. In addition, the above-mentioned analysis is incorporated into an evolutionary study, i.e., the two above-mentioned skulls come from ancient Egypt and date around 2500 BCE, and linking them with historical and geographical contexts may provide a glimpse into the understanding of how cancer has evolved through time.

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Bone cancer in Ancient Egypt. The largest series

The antiquity of Cancer has always been one of the most interesting points in the Evolutionary Medicine. Why the skeletons diagnosed of cancer are so scarce in ancient times? Absence of pollutants, the lack of fire domestication, the diet (low fat and sugars) and, mainly, the shorter life span have been inferred to explain this absence. Ancient Egypt is, a work field in which this research could be better assessed. The presence of a civilization that spans near 4000 years in the same geographical area is a very useful tool to infer the evolution of malignant disease in humankind. Since 1905, Douglas Derry, diagnosed a malignant tumor in the skull of the 5th dynasty from then onwards only a handful of bone cancer had been described until 50's decade. The majority of the cases of cancer in old times were tentative diagnosis of a case report along with the revision of literature. Following a precise criteria and after an accurate differential diagnosis including field x-ray examination, we present the worldwide largest series of malignant disease in individual belongs to 5 different Spanish Archaeological Missions from Egypt. The series includes 14 cases: 2 cases from Middle Egypt (1 from Oxirhynchus, 1 from Sharuna); 12 cases from Upper Egypt (9 from West Thebes and 3 from Qubbet el-Hawa). It is noteworthy that 7 correspond to metastasis, 1 to nasopharyngeal carcinoma, 1 a probable Ewing sarcoma, 2 multiple myeloma, 1 acute lymphoblastic leukemia and 1 soft tissue sarcoma.

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T1 mapping and reduced field-of-view DWI at 3.0 T MRI for differentiation of thyroid papillary carcinoma from nodular goiter

Aim of the study: To compare T1 mapping with rFOV-DWI in differentiating NG and PTC. Study Type: Prospective study.

Populations: Ninety-five hospitalized patients with thyroid nodules were included in the research. Sequence: All subjects underwent T1-weighted imaging, T2-weighted imaging, rFOV-DWI and T1-mapping sequences. Assessment: The apparent diffusion coefficient (ADC) and T1 values of each thyroid nodule were measured, respectively. According to pathological results, the thyroid nodules were divided into two groups: Group 1 (NG) and Group 2 (PTC). Statistical Tests: An independent sample t test was used to evaluate the differences of ADC and T1 between the two groups. The receiver operating characteristic (ROC) curve was used to analyze the diagnostic efficiency of T1, ADC, Thyroid Imaging Reporting and Data System (TI-RADS) and T1 and ADC.

Results: The T1 and ADC values of nodular goiter were both higher than those of PTC ($p < 0.05$). The area under the ROC curve (AUC) values of T1 and ADC were significantly higher than that of T1 or ADC alone ($p < 0.05$). The AUC value of T1 and ADC was as same as that of TI-RADS.

Conclusion: The combination of T1 mapping and rFOV-DWI could effectively differentiate NG from PTC. And it has at least the same diagnostic value as the ultrasound-based TI-RADS classification.

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Bovine grafting: an effective alternative after curettage of benign bone tumors

Aim of the study: To evaluate the rate of incorporation of the bovine graft into the host bone, as well as to describe the outcomes of bone healing.

Introduction: We retrospectively reviewed 28 patients (15 women and 13 men) with benign bone tumors or pseudotumors treated with curettage and filling with freeze-dried bovine bone graft Orthogen (Baumer S/A, São Paulo, Brazil). The aim of the study was to evaluate the rate of incorporation of Orthogen into the host bone, as well as to describe the outcomes of bone healing (quality, time, and complications).

Methods: General characteristics, tumor volume, size, site, complications, percent filled, and healing quality at 6 and 12 months were assessed through radiographs.

Results: Mean patient age was 20.5 (range 4.7–75.1) years. The most common lesion type was simple bone cyst (12/28), and the most common sites were the tibia (7/28) and humerus (7/28). There were no postoperative pathologic fractures. Two cases (7.1%) of serous fluid leakage through the wound occurred. Mean cavity volume was 20.1 (range 2.7–101.4) cm3. At 6 and 12 months, 75% and 77.8% of cavities, respectively, showed complete bone healing. At 12 months, 81% of cavities filled >90% with graft showed complete bone healing vs. only 19% of those filled <90%.

Conclusions: Filling with bovine bone graft resulted in few complications and excellent healing after curettage of benign bone tumors or pseudotumors. Complete healing occurred in most cases by 12 months. Cavities with a higher percentage of filling had a higher rate of complete radiographic incorporation.

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The role of adherence to multidisciplinary treatment guidelines in the treatment of patients with epithelioid sarcoma

Aim of the study: This study aimed to analyze the long-term survival outcomes of patients with ES treated with curative intent at and outside a referral sarcoma unit.

Introduction: Epithelioid sarcoma (ES) still represents diagnostic challenge as it 1% of soft tissue sarcomas and perioperative treatment if often not offered outside specialized oncology centers.

Methods: Long-term survival outcomes of patients treated at sarcoma unit for ES were retrospectively analyzed. Relapse-free survival (RFS) and overall survival (OS) were estimated using the Kaplan-Meier method.

Results: Out of 82 patients treated for ES between 1998 and 2023 in NIO-PIB, 77 underwent curative-intent resection of the primary tumor and were included in the analysis. Median follow-up was 55.5 months. Primary tumor (PT) was resected in sarcoma unit in 29 patients (38%). 24 (83%) of them received any perioperative treatment (radiotherapy and/or chemotherapy), the most common was neoadjuvant radiotherapy – administered in 9 cases (31%). R0 resections were achieved in 14 cases (48%). Contrary, in 48 patients (62%) who underwent PT resection in regional hospital, 11 patients (23%) received perioperative treatment and only 2 had R0 margins. If PT was resected in sarcoma unit, median RFS was 38.5 months, but if resection took place in regional hospital – 5.4 months (HR=0.55, 95% CI: 0.32 – 0.95, p=0.03). No significant difference in OS was observed between patients undergoing PT resection in sarcoma unit or regional hospital. Median OS was 75.4 months.

Conclusion: The adherence to multidisciplinary treatment guidelines at referral centers yields more favorable RFS for ES patients. Any patient with a suspected ES should be referred to multidisciplinary team.

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Long-term outcomes of multiple lines of chemotherapy in epithelioid sarcoma

Aim of the study: This analysis aimed to clarify the efficacy of multiline palliative chemotherapy in epithelioid sarcoma (ES), by assessing response rates, progression-free survival (PFS), and overall survival (OS) at a referral center.

A retrospective analysis examined palliative treatment outcomes for ES patients treated at the sarcoma unit from 1998 to 2023. Responses were assessed using RECIST, and Kaplan-Meier was used to calculate PFS and OS. 34 ES patients treated with chemotherapy were included, with 13 (59%) men. 5 were referred to our center at M1 disease, 8 received perioperative chemotherapy and progressed during follow-up. Median age at palliative treatment was 35 years (20-68). The median follow-up was 22.1 months. In first-line, 13 patients (59%) received anthracycline-based regimen, 6 (27%) high-dose ifosfamide, and 3 other regimens, including gemcitabine/docetaxel, etoposide/cisplatin, and paclitaxel (14%). 1 patient (4.5%) achieved PR, 15 (68%) SD, and 6 (32%) PD as best response. Median PFS in first-line was 6.36 months (95% CI: 3.02 – 12.9), but 9.66 months (95% CI: 4.37 – NR) for anthracycline-based therapy, indicating more favorable PFS (p=0.027). 18 (82%) and 9 patients received second- and third-line chemothe-

rapy. The median OS from first-line palliative chemotherapy was 22.1 months (95% CI: 10.5 – 41.4), and 14.7 from second-line. Perioperatively anthracycline-pretreated patients had median PFS of 2.92 months in M1 setting. Second-line long-time responses were sustained with pazopanib and vincristine with actinomycin D. Despite chemo-resistance, an advantage associated with anthracycline-based chemotherapy was confirmed. Poor responses underline need for further research. Second-line should be offered to eligible patients.

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Natural history of malignant humerus tumor

A 89-year-old woman with proximal humerus chondrosarcoma experienced significant disease progression during the COVID-19 pandemic. The patient presented with a 1-year history of pain and swelling in the right shoulder. Radiographs revealed a lesion of the proximal humerus. The patient was programmed for a contrast-enhanced MRI. Due to the COVID-19 pandemic, the patient's diagnosis and follow-up appointments were delayed by 20 months. During this time, the tumor progressed radically to total joint destruction. This case highlights the importance of early diagnosis and close follow-up for patients with chondrosarcoma. The patient's disease progressed rapidly during the pandemic, providing an opportunity to observe the natural history of the disease.

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Phosphaturic mesenchymal tumour in the fibular head causing paraneoplastic tumour-induced osteomalacia

Aim of the study: To show the importance of adequate imaging and laboratory work up in the setting of presumed osteomalacia

Introduction: Tumour-induced osteomalacia (TIO) is a rare paraneoplastic syndrome caused by a fibroblast-growth-factor-23 (FGF-23) due to phoshaturic mesenchymal tumour (PMT). TIO is characterized by hypophosphataemic osteomalacia, impaired tubular reabsorption of phosphat, supressed 1,25-dihydroxy-vitamin D synthesis and mostly elevated circulating FGF-23 concentrations.

Case presentation: We present the case of a 48-year-old female patient who was presented to our hospital with a history of idiopathic ataxia, progressively worsening diffuse thoracal and back pain for more than 2,5 years with pathological fractures of the ribs and vertebral bodys without trauma, causing referral for an osteological workup. This revealed generalised osteoporosis with increased alkaline phosphatase and FGF-23, decreased 1,25-hydroxy-colecalciferol and phosphate in the blood samples. To exclude a neuroendocrine tumour as the cause, a 68Ga DOTATATE PET/CT scan was performed, which showed a small lesion with increased tracer uptake in the left fibular head. In the MRI, this correlated with a T2-weighted hyperintense and a T1-weighted hypointense well-margined lesion. The tumour could then be adequately localised and thus resected. Postoperatively the laboratory parameters, the patient's generalised pain symptoms and mobilization improved rapidly. Bone density is nearly normal after 6 months.

Conclusion: The therapy of tumour-induced osteomalacia in phospaturic mesenchymal tumour is challenging and delayed. The match of MRI and 68Ga DOTATATE PET/CT is useful to specify the diagnosis. Resection of PMT ist the causal treatment.

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The role of 18F-FDG PET-CT in sarcomas

Aim of the study: The aim is to explore 18F-FDG PET-CT in sarcomas in terms of a difference in 18F-FDG uptake between soft tissue and bone sarcomas, the different subtypes and to investigate whether FDG uptake can aid in predicting the aggressiveness of sarcomas.

Introduction: In the diagnostic process of sarcomas, 18F-fluoro-deoxy-glucose (18F-FDG) Positron Emission Tomography-Computed Tomography (PET-CT) is used for staging sarcomas.

Method: A database from Sarcoma Team Amsterdam UMC was used. Inclusion criteria were: histology proven sarcoma diagnosis, an 18F-FDG PET-CT scan prior to treatment, convertible scans with HERMES, availability of information about metastases, histopathological grading and vital status. Quantitative information was retrieved by creating the Volume of Interest (VOI) and tumour-to-(unaffected)liver ratio.

Results: 257 patients were analysed with the Mann-Whitney-U and Kruskal-Wallis test. The soft tissue sarcomas have a significantly higher SUVmax ($p = 0,01$) uptake of 18F-FDG than bone sarcomas. Between the different subtypes of sarcomas, there is a significant difference in the tumour-to-liver uptake ($p<0,001$) as well as the SUVmax uptake ($p<0,001$). There is a significant higher SUVmax and tumour-to-liver ratio in patients with metastases ($p<0,001$), also when looking at the soft tissue sarcomas and bone sarcomas separately ($p<0,001$), a significant higher uptake of SUVmax and tumour-to-liver in high-grade sarcomas ($p<0,001$) and high-grade sarcomas and metastases had a significantly higher presence in the deceased patient group.

Conclusion: This study showed the potential of 18F-FDG PET-CT in the diagnostic process and evaluation of sarcomas. In clinical practice, it has the potential to aid in predicting the aggressiveness of the tumour.

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Aggressive multimodal treatment can lead to long-term survival in primary disseminated multifocal Ewing sarcoma patients

Aim of the study: Aggressive treatment is a prerequisite for long-term survival in multifocal Ewing sarcoma, but is also associated with significant morbidity. We aimed to evaluate the impact of aggressive treatment approaches on patient survival.

Introduction: Primary disseminated multifocal Ewing sarcoma (PDMES) is associated with a very poor prognosis. Our aim was to highlight the impact of aggressive treatment approaches on the survival of patients with PDMES.

Methods: We retrospectively evaluated the data of two patients (one female, one male, aged 6 and 18 years at initial diagnosis) who underwent aggressive multimodal treatment at our institution after diagnosis of PDMES in 1994 and 2009.

Results: The first patient had multiple lung and bone metastases at diagnosis. She underwent multi-agent chemotherapy, radiotherapy of the primary tumor, all bone manifestations, and whole lung irradiation, as well as two cycles of high-dose chemotherapy with stem-cell rescue. 4 years after diagnosis she developed recurrent pulmonary metastatic disease, which was treated again with multi-agent chemotherapy and surgery. 26 years later she is alive with no evidence of disease. The second patient presented with multiple bone and lymph node metastases. He received multi-agent chemotherapy, surgery, and postoperative radiotherapy of the primary tumor, as well as radiotherapy of all bony metastases, high-dose chemotherapy and resection of the lymph node metastases. 3 years later he developed the first of

six multifocal recurrences, which were all treated both systemically (including a second cycle of high-dose chemotherapy and several courses of maintenance chemotherapy) and locally. He is alive with disease 15 years after diagnosis.

Conclusion: Aggressive multimodal treatment concepts may be associated with significant toxicity, but they can also lead to long-term survival in patients with PDMES.

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Metaphyseal sclerotic bands in a 7 year old child post Denosumab treatment

Aim of the study: Identifying metaphyseal sclerotic bands in a 7 year old child post Denosumab treatment

Introduction: Denosumab has been used off label for targeted intervention in children with disorders affecting RANKL pathway- Osteogenesis imperfecta, Giant cell tumor of bone, Juvenile Paget's disease, Fibrous dysplasia and central giant cell granulomas despite concerns of rebound hypercalcemia.

Case report: We present a rare finding of asymptomatic metaphyseal scleroses across the skeleton without associated metabolic abnormality in a 7 year old girl with GCT of 2nd metacarpal bone of right hand, treated with 11 doses of neoadjuvant Denosumab (1.7 mg/kg), to facilitate surgical resection.

Results: Sclerotic bands are a manifestation of antiresorptive therapy in children before closure of the epiphyseal growth plates, and result from disruption in osteoclastic resorption of growth plate cartilage. The presence of subchondral sclerosis was an incidental finding on a 10 week response assessment radiograph.

Conclusion: Metaphyseal sclerosis with or without symptoms has uncertain medium to long term outcomes and is an addition to the safety concerns related to mineral homeostasis and bone turnover rebound hypercalcemia after the use of denosumab in children.

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Low-grade Fibromyxoid Sarcoma of the subscapularis muscle: a rare case

Aim of the study: To present a challenging diagnostic of a very uncommon subtype of sarcoma and its treatment

Low-grade Fibromyxoid Sarcomas (LGFMS) are rare soft tissue tumors that predominantly affect young adults. Trunk and proximal limbs are most commonly affected. Its clinical and morphological diagnosis can be challenging. Correspond to a slow growing, well-delimited and painless mass, with long preclinical stage; frequently found incidentally by imaging tests. Timely and correct identification of this malignant tumor is important due to a high rate of late recurrence and metastasis, frequently to lungs . Case report: Female patient, 47 years-old, with a previous pulmonary emphysema associated to sporadic pain in left chest wall that spread to breast and axillary area 5 years ago; presented recurrent pain after 3 years, with many emergency visits. Ultrasonography, mammography and chest X-ray: no changes. ThoracicC T scan revealed a well-defined lesion in the left subscapularis muscle, hypersignal on T2 ,peripheral uptake and surrounding adipose halo, and non-aggressive signs, in favor of intramuscular myxoma. Biopsy was compatible with myxoid sarcoma. After wide resection of the tumor, the pathological report revealed low-grade fibromyxoid sarcoma with negative surgical margins. Chemotherapy/ radiotherapy were not performed(limited efficacy due to low mitotic index of LGFMS) The patient is disease-free after 12-months follow-up, still undergoing periodic consultation. The diagnosis and access to the lesion while minimizing morbidity in this location was a great challenge; we performed a scapular osteotomy and minimized muscle dissection. This tumor requires prolonged clinical follow-up due to potential recurrence or secondary lesions, sometimes decades after initial identification.

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Surgical complications of curettage in atypical cartilaginous

Aim of the study: This study aims to evaluate the long-term outcomes of intralesional curettage in a tertiary referral center, focusing specifically on mortality, recurrence-free survival, surgical complications, and the need for secondary surgeries.

The prevalence of atypical cartilaginous tumors (ACT) has increased to 8.78 cases per million between 2005 and 2013, primarily due to the widespread use of MRI. In 2013, the World Health Organization reclassified grade I chondrosarcoma as ACT, acknowledging its local aggressiveness. Despite evolving management strategies, consensus on the preferred treatment remains elusive. Surgical interventions, fraught with complications, gain significance as the therapeutic paradigm shifts towards close observation with a wait-and-scan approach. This retrospective cohort study, conducted at a tertiary referral center for bone and soft tissue tumors from 2000 to 2019, investigated 388 ACT patients undergoing intralesional curettage. Comprehensive data included demographics, tumor characteristics, and follow-up details. Importantly, no ACT-related deaths occurred. Recurrence was observed in only 0.5% (N=2) after a mean of 18 ± 0.3 SD months. Residual disease affected 13.7% (N=53) of patients, of which 11 (21%) underwent growth. Post-curettage fractures were evident in 10% (N=37), and 16% (N=61) required secondary surgeries, primarily for pain, joint movement limitations, or fractures. In conclusion, curettage for ACTs presents a significant risk of postoperative complications with a limited risk of residual disease. The absence of malignant progression or distant metastasis, coupled with the substantial burden of complications, necessitates a critical evaluation of whether this approach is the most desirable. Further consideration within the overall treatment paradigm for ACT is warranted.

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Detecting malignant transformation of chondrosarcoma secondary to multiple osteochondromatosis using FDG-PET/MRI

Aim of the study: To evaluate effectiveness of FDG-PET/MRI in detecting malignant transformation in multiple osteochondromatosis

Background: Osteochondromas are chondrogenic tumors, accounting for 20-50% of benign bone tumors. While osteochondromas are generally benign, they rarely transform into malignant tumor. We herein report two cases of multiple osteochondromatosis with malignant transformation detected by FDG-PET/MRI.

Case presentation: 1. A 15-year-old male with non-hereditary MO was referred to our hospital due to the rapid enlargement of a hard mass in the left thigh. There is a osseous protrusion approximately 12 x 12 cm in size on the medial aspect of the left distal thigh. FDG-PET/MRI detected a cartilage cap thickness of approximately 3 cm, and there was increased FDG uptake in the same area with SUVmax 2.18. We performed wide excision. The lesion was diagnosed as chondrosarcoma, grade 1. 2. A 23-year-old male with hereditary MO was referred to our hospital due to the enlargement of a mass in the left thigh. FDG-PET/MRI detected a cartilage cap thickness of approximately 2 cm, and there was increased FDG uptake in the same area with SUVmax 2.5. We performed marginal excision and the patient was diagnosed with chondrosarcoma, grade 1.

Discussion/Conclusion: When conducting imaging assessments of rapidly enlarging osteochondromas, FDG-PET/MRI allows the evaluation of morphological changes through MRI and simultaneous assessment of metabolic activity through PET. Thus, FDG-PET/MRI has the potential to be effective in detecting malignant transformation beyond the assessment of morphological changes alone.

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Neoadjuvant trabectedin in patients with locally advanced myxoid liposarcoma – real world data

Aim of the study: Evaluate our centre experience with neoadjuvant trabectedin for myxoid liposarcoma

Introduction: Myxoid liposarcoma (MLPS) is a soft tissue sarcoma characterized by DDIT3(CHOP) translocation. A recent phase III trial proved non-inferior efficacy of neoadjuvant trabectedin, when compared to the standard chemotherapy with anthracycline. We aim to evaluate the experience of our institution with this strategy.

Methods: From the retrospective cohort of patients treated with trabectedin from 2015 until 2023, we selected cases of unresectable MLPS, who were treatment naive and received trabectedin with neoadjuvant intent.

Results: We report the results of five male patients with a median age of 47yo (range 35-63) with unresectable MPLS. All patients completed 6 cycles of trabectedin. We observed 100% stable disease by RECIST1.1 criteria, with 40% favorable subjective radiologic response. Except for one patient lost in follow-up to another institution, all patients underwent surgical resection with curative intent, with limb preservation. There were no complete pathological responses, but one patient achieved >90% pathological response. As previously described, maturation of cells into adipocytes occurred, interfering with objective response evaluation and resection. Two patients performed adjuvant RT due to R1 resection. With a median follow up time of 13m, no disease progression or death occurred. Trabectedin was generally well tolerated, without raising additional safety concerns.

Conclusions: Trabectedin emerges as a viable neoadjuvant therapeutic option for myxoid liposarcoma. Further studies with longer follow up and survival endpoints are necessary to recommend neoadjuvant trabectedin in MLPS, emphasizing the role of an experienced multidisciplinary team dedicated to the treatment of these rare tumors.

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Prognostic significance of histological subtype in soft tissue sarcoma with distant metastasis

Aim of the study: The present study aimed to examine the association of clinical outcomes with the histological subtypes and distant metastasis sites in patients with soft tissue sarcoma and distant metastasis.

Introduction: Soft tissue sarcoma (STS) is relatively rare and includes various histological subtypes, which results in small populations of patients with each histological type. There is consensus that distant metastasis has a strong influence on prognosis. However, the small sample sizes for each subtype prevent studies from identifying a relationship between subtype and prognosis. Therefore, we evaluated the relationship between the histological subtypes and clinical outcomes.

Methods: This retrospective study evaluated the histological subtypes of 105 patients with STS and distant metastasis treated at our two hospitals. Histological subtypes were considered relevant if we identified ≥ 5 cases per subtype. The patients' records were searched to collect information, and outcomes and clinical characteristics were compared according to the patients' histological subtypes.

Results: The histological diagnoses were dedifferentiated liposarcoma (13 cases), pleomorphic liposarcoma (5 cases), myxoid liposarcoma (10 cases), myxofibrosarcoma (11 cases), undifferentiated pleomorphic sarcoma (31 cases), synovial sarcoma (11 cases), malignant peripheral nerve sheath tumor (MPNST) (18 cases), and leiomyosarcoma (6 cases). The Kaplan-Meier curves for overall survival revealed that myxoid liposarcoma had a significantly better prognosis than MPNST ($p<0.05$). In the multivariate logistic regression analyses, the independent predictors of a poor prognosis were large size, advanced stage, and non-surgical treatment for metastasis ($p<0.05$).

Conclusions: Myxoid liposarcoma had a better prognosis than MPNST in STS patients with distant metastasis. Although the surgical removal of metastatic lesions may improve the patient's prognosis, the location of the distant metastasis was not a significant factor.

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Impact of primary tumor resection on metastasis to the lung in patients with bone and soft-tissue sarcoma

Aim of the study: This study aimed to examine the impact of primary tumor resection on lung metastasis and prognosis in patients with bone and soft-tissue sarcoma.

Introduction: The presence of distant metastases influences prognosis in patients with bone and soft-tissue sarcomas. However, if the primary tumor interferes with the patient's quality of life, resection may be required. Very few reports have investigated the effect of primary tumor resection on the prognosis of patients with metastases. Therefore, we evaluated the impact of primary tumor resection on lung metastasis and prognosis in patients with sarcoma.

Methods: We retrospectively identified 48 patients with bone and soft-tissue sarcoma with lung metastasis at the first visit treated at our hospitals. Patients with lung metastasis confirmed at the same time as local primary tumor recurrence were also included. Patients' records were searched to collect data. Clinical characteristics and outcomes were compared based on primary tumor resection status, and the factors affecting prognosis were examined.

Results: The multivariate analysis revealed that the maximum diameter of lung metastases and the average rate of increase in the size of lung metastases were significant prognostic predictors ($p=0.04$ and $p=0.0003$, respectively), yet primary tumor resection did not affect the outcome. In addition, the multivariate logistic regression analysis revealed that the rate of increase in the size of lung metastases was significantly associated with the maximum diameter of lung metastasis at the first visit ($p=0.0245$), and that surgical resection of the primary tumor did not affect it.

Conclusions: Primary tumor resection of bone and soft-tissue sarcoma in patients with lung metastasis was not shown to affect their prognosis.

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Development of fibrosarcoma after graft removal for cruciate ligament reconstruction

Aim of the study: Case report: A myxofibrosarcoma in contact to the patellar ligament after harvesting an autograft for ACL reconstruction as an extremely uncommon condition.

Case report: We present a case of a 47 years old woman suffering from such a tumor in the Hoffa´s fat pad after an ACL reconstruction 22 years ago. MRI showed 30x40 mm large, smoothly bordered tumor immediately posterior to a defect in the middle third of the patellar ligament. Due to her history of tumor and the unusual image morphology for a ganglion, incisional biopsy was performed. Histology confirmed a low-grade myxofibrosarcoma. The tumor was in close contact to the medial third of the patellar ligament. We performed a resection of the entire Hoffa`s fat

pad with, removal of the medial third and the tumor-near parts of the lateral third of the patellar ligament. The functionally insufficient part of the patellar ligament was reconstructed by a frame plasty with augmentation of the semitendinosus tendon. The large soft tissue defect with loss of anterior delimitation of the knee joint, was reconstructed by suturing in an Ethisorb® Durapatch (Ethicon).

Discussion: A variety of co-morbidities related to graft harvesting have been described following the anterior cruciate ligament reconstruction, but the development of a tumor at the donor site of a graft has not been mentioned so far. Fibrosarcomas in scars after burns have been reported in individual cases. Whether this is a coincidental encounter between a donor site defect after graft harvesting and a tumor, remains unclear. MRI images and findings must always be critically evaluated. In case of doubt, the biopsy clarifies the diagnosis.

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Evaluation of Youtube videos on soft tissue sarcomas: How reliable are Youtube shares?

Aim of the study: Social media platforms become much more important to patients' behavior about health, and health professionals should use the Internet to guide patients to accurate medical information.

Introduction: Soft tissue sarcoma is the general term for malignant tumors originating from the soft tissues, excluding the bones and other internal organs. These tumors can arise from various connective tissues, such as muscles, nerves, and blood vessels. The complexity of these tumors necessitates a multidisciplinary approach involving oncologists, surgeons, radiologists, and pathologists. Nowadays, social media channels may cause misinformation. In this article, for the first time in the literature, videos about soft tissue sarcomas shared on YouTube were examined, and their reliability was evaluated.

Material and Methods: A search for "Soft Tissue Sarcomas" was initiated by entering the term into the YouTube search bar. The first 50 videos whose titles have the term "soft tissue sarcoma" were evaluated.

Results: The research methodology entailed systematically classifying videos and grouping them based on various factors such as image type, uploaders, and content categories. Key metrics, including view count, upload date, comment count, like count, dislike count, and video length, were systematically recorded for each video.

Conclusion This study underscores patients' challenges in discerning potentially misleading medical information from reliable information on YouTube, specifically in soft tissue sarcomas. Future research in orthopedics and other medical domains will further enhance the quality and reliability of health-related video content. Keywords: social media, video recording, soft tissue sarcomas, sarcoma.

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Prognostic significance of modified Lung Immune Prognostic Index in osteosarcoma patients

Aim of the study: This study tends to investigate the prediction ability of Lung Immune Prognostic Index (LIPI) in metastasis and constructed a predictive model to evaluate the probability of distant metastasis.

Introduction: Osteosarcoma is the most common primary malignancy of bone with a dismal prognosis for patients with pulmonary metastases. Evaluation of osteosarcoma prognosis is meaningful. Lung Immune Prognostic Index (LIPI) is a novel prognostic factor in pulmonary cancers. Here, we explore the prognostic role of LIPI and further modify this predictive model in osteosarcoma.

Methods: A retrospectively study was conducted at West China Hospital between January 2016 and January 2021. Hematological factors and clinical features of osteosarcoma patients were collected and analyzed. The area under curve (AUC) and optimal cuff-off of each single hematological factor was calculated.

Results: LIPI was composed of Lactate dehydrogenase and derived neurtrophil to lymphocyte ratio and was further modified by combing the HBDH, forming the osteosarcoma immune prognostic index (OIPI). OIPI divided 223 osteosarcoma patients divided into four groups and it has a higher AUC value than LIPI and other hematological indexes in t-ROC curve. According to the univariate and multivariate analysis, pathological fracture, metastasis, NLR, platelet–lymphocyte ratio, and OIPI were associated with the prognosis; and metastasis and OIPI were independent prognostic factors of osteosarcoma patients. An OIPI-based nomogram was also established to predict the 3-year and 5-year overall survival.

Conclusion: This study first explore the prognostic significance of LIPI in osteosarcoma and developed the OIPI for osteosarcoma patients. In particular, OIPI may have the ability to identify some high-risk patients from clinically low-risk patients.

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Hematological prognostic scoring system can predict overall survival and can indicate response to immunotherapy in patients with osteosarcoma

Aim of the study: This paper aims to introduce a Hematological Prognostic Scoring System (HPSS) comprising 16 comprehensive hematological markers for assessing overall survival in osteosarcoma patients, enhancing risk stratification beyond clinical characteristics.

Introduction: Osteosarcoma is the most common primary malignant bone tumor with a high metastatic potential. Nowadays, there is a lack of new markers to identify prognosis of osteosarcoma patients with response to medical treatment. Recent studies have shown that hematological markers can reflect to some extent the microenvironment of an individual with the potential to predict patient prognosis. However, most of the previous studies have studied the prognostic value of a single hematological index, and it is difficult to comprehensively reflect the tumor microenvironment of patients.

Methods: Here, we comprehensively collected 16 hematological markers and constructed a hematological prognostic scoring system (HPSS) using LASSO cox regression analysis. HPSS contains many indicators such as immunity, inflammation, coagulation and nutrition.

Results: Our results suggest that HPSS is an independent prognostic factor for overall survival in osteosarcoma patients and is an optimal addition to clinical characteristics and well suited to further identify high-risk patients from clinically low-risk patients. HPSS-based nomograms have good predictive ability.

Conclusions: HPSS facilitates further risk stratification of patients with the same clinical characteristics.

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Relationship between bone sarcoma incidence and mortality rate and online interest – Google trends analysis

Aim of the study: The aim was to characterize the relationship between the occurrence of bone cancer and the number of Internet searches.

Internet searches reflect public awareness, which may be influenced by the cancer epidemiology. The epidemiology data of bone cancer in 2010-2020 were analyzed in relation to search volume index (SVI) in Google Trends.

Correlations between incidence rates and SVI for terms - osteosarcoma (r=0.17; p=0.035), chondrosarcoma (r= 0.36; p< 0.001) and Ewing sarcoma (r=0.21; p=0.008) and between mortality rate and SVI for terms: chondrosarcoma (r= 0.42; p < .001) and bone cancer (r= 0.20; p= 0.012) were noted. There was no increase in interest in the topic of bone cancer in July (Sarcoma Awareness Month). The incident and mortality rate of bone sarcomas is correlated with the number of online searches for individual phrases. Awareness campaigns do not significantly increase interest in the topic of bone sarcomas on the Internet.

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Effectiveness of angiosomal-based soft tissue defect reconstruction in oncoorthopaedics

Introduction: Soft tissue defects resulting from the removal of malignant tumors in the musculoskeletal system pose challenges due to the intricate anatomical and functional characteristics of the limbs. Conventional methods for wound closure often fall short in addressing combined defects involving both bone and soft tissues. The development of plastic surgery techniques based on the angiosomal theory offers a promising approach, ensuring adequate blood supply to the reconstructed tissues.

Purpose: This study aims to demonstrate the effectiveness of reconstructing combined soft tissue defects using angiosomal-based plastic surgery as part of comprehensive treatment for patients with malignant tumors of the musculoskeletal system.

Methods: The study evaluated the outcomes of plastic surgical techniques utilizing pedicled skin-fascial and muscle flaps based on the angiosomal concept. Clinical data from 38 patients with primary and secondary malignant tumors of the musculoskeletal system, treated at the Sytenko Institute, Kharkiv, Ukraine, from 2011 to 2021, were analyzed. Patients with necrotic soft tissue defects, resulting from tumor processes, prior surgeries, radiation therapy, or complications of modular tumor endoprostheses, were included.

Results: Our study demonstrated that angiosomal-based soft tissue reconstruction resulted in the highest percentage of positive outcomes in the treatment of musculoskeletal tumors and infection foci. Additionally, it contributed to the reduction of the recovery period for the affected skeletal segment.

Conclusions: The advancement of plastic surgery techniques based on the angiosomal theory, as pioneered by Taylor and Palmer, holds significant promise in the field of oncoorthopedics. Our clinical experience underscores the high effectiveness of angiosomal flaps in repairing infected soft tissue defects in both upper and lower limbs. Further research is warranted to explore the potential applications of angiosomal plastic surgery in addressing trophic lesions of distal lower limb segments associated with vascular and endocrine pathologies in the context of oncological pprocesses.

Oleg Vyrva, Yanina Golovina

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ACP replacement for long bone tumor defects

Introduction: Restoring the integrity of bone, adjacent joint, and soft tissue is crucial for optimizing limb function in patients with bone tumors. This study aims to analyze the clinical outcomes of using structural allografts for treating malignant bone tumors, evaluating various surgical methods and their afficacy.

Methods: Seventeen patients with malignant long bone tumors underwent surgery for en-bloc tumor removal and replacement of post-resection defects with bone structural allografts. Different fixation methods and allo-implant sterilization techniques were employed. Surgical procedures were categorized into three methods.

Results: Analysis of surgical outcomes revealed functional improvements assessed by the MSTS scale and complications evaluated using Henderson classification. Complications occurred in 58.8% of cases, including wound-related issues (5.9%), atrophic nonunion (23.5%), fixator integrity breaches (11.8%), infectious complications (5.9%), and local tumour reccurency (35.3%).

Conclusions: Bioreconstructive surgery utilizing bone allografts should be selectively employed to optimize outcomes. Implementation of the described techniques can mitigate risks associated with bone alloplasty. The combination of biological bone regeneration and rapid limb recovery via metal structures supports the widespread adoption of this approach in cancer patients.

Krzysztof Rak, Konrad Kudłacik

Specjalistyczny Szpital im. A.Sokołowskiego w Wałbrzychu, Polska

3D custom made endoprosthesis in the treatment of metastasis to the proximal tibia – case report

Aim of the study: Case presentation

Our presentation is a case report of the use of a 3D custom made implant in the treatment of kidney cancer metastasis to the proximal tibia, sparing the knee joint.

Sabrina Häusler

Helios Klinikum Berlin Buch

Giant cell-rich osteosarcoma – A rare case report

Aim of the study: Raising awareness in the event of an ambiguous diagnosis of a giant cell tumour.

We report the rare case of a 54-year-old female patient with metastatic giant cell-rich osteosarcoma of the distal femur. The diagnosis of giant cell-rich osteosarcoma is challenging from a radiologic and histologic perspective. Due to significant differences in therapy compared to the benign giant cell tumor- which should be considered for differential diagnosis- it is essential to obtain an accurate diagnosis. In our case report, a late periprosthetic infection after distal femoral replacement was detected as a complication in the 33-month follow-up after appropriate therapy using the EURO-B.O.S.S. protocol. However, a recurrence did not occur.

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Reconstruction of the knee extensor apparatus with a massive allograft in a case with patellar bone metastasis

Aim of the study: Evaluate the clinical and functional outcomes of massive allograft to reconstruct the patella and the extensor apparatus of the knee in a metastatic patient.

Introduction: The extensor apparatus of the knee can be thought of a chain that transmits the muscular strength developed by the quadriceps muscles to the proximal tibia. This complex is essential to allow the extension of the tibia over the femur, being essential to provide knee mobility and stability. In case of lesions which irreparably damage the patella, such as a locally aggressive bone tumor, it is necessary to restore both the apparatus' anatomical continuity and its strength.

Methods (case): A 39-years-old Caucasian man with a history of lung carcinoma developed atraumatic swelling and soreness in her left knee. Imaging evidence reported a degeneration of the left patella. Pre-operative needle-biopsy astablished a diagnosis of metastatic carcinoma. We performed an en bloc resection of the patella and the nearby soft tissues of the extensor apparatus. The resulting gap was fulfilled with a massive allograft consisting of a quadriceps tendon, a patella and a patellar ligament.

Results: No complication or local recurrences were observed. At the patient's latest follow-up, he did not have any extension lag and quadriceps strength was completely restored (MRC 5/5). The post-operative MSTS score was 30/30.

Conclusion: Massive allografts can represent a reliable alternative for the reconstruction of the patella and the knee extensor apparatus in orthopedic oncology.

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Distribution and characteristics of orthopaedically relevant bone metastases – a guide to efficient and fast diagnostics

Aim of the study: The aim of the study was to record the distribution and typical tumour entities in order to be able to recommend a diagnostic work-up that is simple and quick and can be applied in smaller hospitals.

Introduction: Metastatic bone disease (MBD) occurs when cancer spreads to bones, causing bone metastases and complications like fractures and pain. The prevalence is increasing. Challenges include early detection and efficient treatment especially in cases of impending or pathological fracture. The aim of this study was to determine the characteristics of MBD needing orthopaedic surgery to guide efficient and fast work-up.

Materials and Methods: We retrospectively reviewed the patient records of patients undergoing surgical treatment for MBD at our institution between 2005 and 2022. Factors like medical history, tumour type, metastatic status, surgical method, location and imaging were included in the analysis.

Results: The two most affected bone regions were proximal femur (32.4%) and proximal humerus (12%). Lesions of the proximal humerus were significantly more frequently characterized by pathological fractures ($p<0.001$). Patients with previously unknown disease were more likely to have a higher metastatic burden. Lung carcinomas, lymphomas and myelomas were found significantly more frequently in patients with previously unknown tumour disease. In patients with known malignancy, the latency between primary diagnosis and appearance of relevant bone metastasis was significantly longer in women with breast cancer and men with renal cell carcinoma.

Conclusion: CT protocols for staging for metastases should include the entire proximal third of the humerus and femur since these were the regions of major impact in our cohort. Current protocols often only show the epimetaphyseal region. Patients with newly diagnosed suspicious bone lesions should be evaluated early for lung cancer, lymphoma and myeloma.

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Is the treatment strategy for conventional femoral neck fractures inclusive for metastatic femoral fractures?

Aim of the study: The aim of this study was to determine whether the treatment strategy for conventional femoral neck fractures(FNF) is applicable for metastatic FNF.

Background: Although conventional and metastatic femoral neck fractures (FNF) constitute different patient groups in routine practice, treatment management proceeds similarly for these two groups. Although systematic approaches to FNF are currently used and supported by guidelines, patients with metastatic FNF are included in the treatment plan intended for conventional FNF.

Methods: This retrospective study included 185 patients diagnosed with a conventional FNF and 71 patients with metastatic FNF who underwent endoprosthetic reconstruction in our clinic between 2011-2021. Patient and hospital-related factors that could impact patient survival were identified and evaluated.

Results: The metastatic FNF patient group was determined to have significantly lower survival rates ($p=0.021$), more complications such as thrombotic events ($p=0.030$) and decubitus($p=0.029$), a longer operating time ($p<0.001$), more perioperative bleeding ($p<0.001$), and more transfusion requirement ($p<0.001$). The patients in the metastatic

group were determined to have longer preoperative and postoperative stays in hospital) and a longer time to mobilization postoperatively (p=0.017).

Conclusion: There are national data in the literature reporting mortality and complication rates similar to those of the current study findings for metastatic femoral neck fractures. Although treatment strategy for conventional FNF in orthopaedic practice has been standardized with certain algorithms, this standardized approach does not include metastatic FNF, which have higher rates of complications, and mortality.

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Endoprosthetic reconstruction of proximal femur after tumor resection

Aim of the study: Oncological and functional results after tumor rescection and proximal femur reconstruction

Introduction: Proximal femur is a very common anatomic site of primary and metastatic bone tumors. Endoprosthetic reconstruction is the gold standard treatment. This study evaluates the oncological, clinical, and functional outcome of patient with proximal femoral replacement.

Patients and Methods: One-hundred and four patients, 59 females (56,7%) and 45 (43,3%) males were retrospectively reviewed. Sixty-three patients (60,6%) diagnosed with primary bone tumor and 41 with metastatic disease. The mean age was 61 ±14,6 years. To assess the complications, Henderson classifications was used. For the evaluation of the functional outcome, we used MSTS score. The minimum follow-up period was 24 months.

Results: The average prosthesis survivorship was 49,7 months. The median resection length was 16 ± 4,3 cm. Thirty-six patients (34,6%) died of the disease. Type 1 complication was diagnosed in 10 patients (9,6%), aseptic loosening in 2 (1,9%), periprosthetic fracture in 2 patients (1,9%), periprosthetic infection (type 4) in 8 patients (7,7%) and local tumor progression in 1 patient (0,9%). Overall complication's rate was 22,1% and reoperation rate 16,3 and 17 patients underwent two or more reoperations. At the latest follow-up, median MSTS score was 76,6 ± 9,7%.

Conclusions: Endoprothetic proximal femur replacement is a very reliable reconstructive method, after tumor excision, in limb salvage surgery. Complications rate is relatively low, but very challenging to be treated. Functional outcome is satisfactory in most of the cases.

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Combining a custom made megaprosthesis with a total humerus megaprosthesis: A "Giga-Prosthesis"

Aim of the study: Evaluate the effectiveness of a combined 3D printed custom made scapular prosthesis and a total humerus implant in an oncologic patient

Introduction: Epithelioid hematangioendotheliomas are extremely rare tumors. Surgical resection represents their treatment of choice.

Methods: A 57-year-old male with a history of Epithelioid Hemangioendothelioma in the distal segment of his right humeral shaft, previously treated with a plate, screws, and intercalary cement, came to our attention due to pain in his right shoulder. Imaging evidence highlighted an osteolytic lesion localized in the glenoid region, which a needle biopsy confirmed to be a secondary lesion of Epithelioid Hemangioendothelioma. During the diagnosis process, the patient fell and had a peri-prosthetic fracture in his right distal humerus. Considering the patient's history and clinical condition, we decided to treat both the fracture and the neoplastic lesion with the same surgical approach. The affected limb was treated with a resection of the scapula and the whole humerus. A custom-made prosthesis was

used to replace the native scapula. The custom-made device was linked to a total humerus megaprosthesis and an elbow prosthesis, restoring the elbow region's anatomical continuity and functionality.

Results: No complications occurred. Twelve months after surgery, the patient still has a limitation in his shoulder abduction and flexion over 45 degrees. However, his elbow and wrist had complete and painless ROM. Ha was satisfied and his MSTS score was 22/30.

Conclusion: In selected oncologic cases with multifocal lesions, combining a custom-made scapular prosthesis and a total humerus megaprosthesis can allow sparing the upper limb and provide encouraging functional results.

Adam Chrobok

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Total femur replacement the selective and ultimate solution of treatment – 10 clinical cases – long term observation and complications

Aim of the study: Clinical outcome and study in patients after total femur replacement.

Total femur replacement (TFR) becomes more and more frequent due to increased number of reconstructive procedures following bone tumors resection. It is olso applied after vast and complicated hip and knee prosthesis revisons.

Material and methods: We assesed the clinical outcome, quality of life and complication rate of 10 patients (7 women and 3 males) who underwent TFR between 2007 and 2022 due to primary tumors (3 cases), secondary tomors (6 cases) and 1 after failed hip revison surgery.

Results: The group of assesed patients was heterogenic but 9 od 10 patients were operated due to primary of secondary tumors and one was non – oncological patient. We observed 7 good clinical outcomes according to MSTS score. Deep wound infection occured in 2 cases (2 hip disarticulation) in on case we observed persistent femoral and sciatic nerve palsy. Recurrent hip dislocation accured in one patient and was treated operatively. One patient died within one week after suregery.

Discussion and conclusions: TFR is a massive procedure, complitations are very common. We observed infectious, mechanical and nervous complitaions in many of our patients. In spite of this the decision to operate the patient should be made very carefully and selective. Obviously if uncomplicated the patients accept this method and are mostly satisfied.

Christian Lind Nielsen, Thomas Baad-Hansen

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Free vascularized fibular grafting for reconstruction after sarcoma resection in Denmark

Aim of the study: The purpose was to evaluate the rate of complications and survival following free vascularized fibular grafting for reconstruction after sarcoma resection in Denmark from 2009 to 2023.

We conducted a retrospective evaluation of the rate of complications and survival of patients who underwent reconstruction after sarcoma resection using free vascularized fibular grafting in Denmark from 2009 to 2023. Patients were treated in one of the two Danish Sarcoma Centers, Aarhus University Hospital and Rigshospitalet. Permission was granted by the Danish National Center for Ethics, the Central Denmark Region and the Capital Region of Denmark. Patients were identified from the Danish Sarcoma Database, which is a national database with a data completion of almost 100% since being established in 2009. Additional information about patient, tumor and surgical details were also obtained from the Danish Sarcoma Database. Medical records were reviewed for post-operative complications and survival while radiological material was reviewed for time to union and graft hypertrophy. Data is currently under evaluation. Final results are expected before June 2024.

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Distal tibia replacement for bone sarcoma in growing children: the use of allograft and lengthening sleeping nail

Aim of the study: To evaluate a new ankle reconstruction after bone sarcoma resection.

Introduction: Distal tibial resection and reconstruction in growing children is a challenging procedure, with an high risk of complications often requiring amputation.

Methods: An eight years old female with a left distal tibia osteosarcoma was treated with a distal tibial and partial fibular resection in 2020. The resection gap was filled with a massive structural tibial allograft and the fixation was obtained with a 215 mm Precice intramedullary tibial antegrade lengthening nail with tibio-tarsal arthrodesis. She underwent current pre-operative and post-operative chemotherapy protocol.

Results: The patient started walking with partial bearing at 2 months post operatively and left crutches at 4 months. After 3 years, the patient showed normal gait and good graft integration but a 4 cm left leg discrepancy. As previously planned, the patient underwent a second surgery with tibial osteotomy and magnetic lengthening of the left tibia until the discrepancy was resolved. The patient started walking with partial weight bearing 20 days after the end of the procedure with a progressive callus formation. No complications (such as infection, wound breakage, nerve palsy, or residual pain) occurred.

Conclusions: Lengthening devices could be associated to allograft with good functional results after bone tumor resection of children involving distal tibial growing plate.

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Multiple complications following the use of an acetabular implant after internal hemipelvectomy: A case report

Aim of the study: Highlighting numerous potential complications of hemipelvectomy based on a single case report.

Introduction: A 67-year-old patient underwent internal hemipelvectomy due to chondrosarcoma involving the right iliac, ischial, and pubic bones, with simultaneous post-resection endoprosthetic replacement of the right hip using a Lumic Implantcast implant. The patient experienced vascular and septic complications, as well as wound dehiscence. This study aimed to describe the occurrence of multiple complications following the use of an oncologic implant and various strategies for managing them.

Methods: Immediately after the surgery, the patient experienced compression on the iliac vessels, resulting in injury to the iliac vein. Emergency revision and repair of the damaged vessel were required. In the subsequent days, the patient developed sepsis, necessitating treatment in the Intensive Care Unit. Later on, extensive skin necrosis with wound dehiscence was observed. The patient was treated with negative pressure wound therapy; however, due to the lack of improvement, she was referred to the Plastic Surgery Department for flap reconstruction.

Results: The patient's hospitalization from the initial surgery to discharge from the Plastic Surgery Department lasted 5 months and required involvement of specialists from various fields, including Orthopedics, Anesthesiology and Intensive Care, Vascular Surgery, and Plastic Surgery. The patient was discharged home with healed wounds after initial rehabilitation.

Conclusion: Extensive resectional procedures such as hemipelvectomy carry a high risk of complications, especially in patients with multiple comorbidities. The occurrence of one complication increases the risk of subsequent ones, leading to a vicious cycle that may jeopardize reconstructive treatment. Managing multiple complications requires close collaboration among different specialties.

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Clinical Hospital MSWiA in Olsztyn

Pseudotumor of the hip bone due to aseptic loosening of a hip endoprosthesis – a case report

Aim of the study: A case study of a pseudotumor post aseptic loosening of a hip endoprosthesis.

A case study of a 73-year-old patient with a primary diagnosis of aseptic loosening of a hip endoprosthesis stem. The diagnosis was confirmed by CT and scintigraphy. The prosthetic acetabulum was not confirmed to be loose. The surgeon did not overlook the extensive defect in the hip bone. However, because of the extensive nature of the lesion and the lack of loosening of the prosthetic acetabulum, a revision of both components was not initially performed. In a short follow-up after the procedure, the patient reported complaints of pain involving the hip joint. A subsequent CT confirmed an extensive pseudotumor of the hip bone. Further analysis of the diagnostic and treatment was performed.

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Long-term follow-up of callus distraction for leg length discrepancy after surgery for malignant bone tumor of the knee in childhood. A case report

Aim of the study: To report a case of long-term follow-up of calls distraction for leg length discrepancy after surgery for malignant bone tumor of the knee in childhood.

Introduction: In limb-sparing surgery for malignant bone tumors around knee in children, leg length discrepancy due to knee prothesis is a large problem. We describe a case in which a patient who had maximum extension of her extended knee prosthesis and had residual leg length discrepancy underwent callus distraction of distal tibia.

Case: A 8-year-old female presented with left leg pain was diagnosed with a distal femoral osteosarcoma. She underwent wide resection of malignant bone tumor, and extended knee arthroplasty. After surgery, she developed leg length discrepancy due to growth and underwent lengthening of prosthesis three times, but five cm leg length discrepancy remained. Because of lumbar fatigue fracture associated with abnormal gait due to leg length discrepancy, she underwent callus distraction of tibia at 17 years old. Osteotomy was performed on the distal tibia with expandable external fixator. Extension was started two weeks after surgery, it was discontinued at three cm extension because of the appearance of talipes equinovarus. External fixator was removed one year after osteotomy. At 12 years after the start of leg extension with callus distraction, although two cm leg length discrepancy remains, she is able to walk with using complementary height shoe and has no difficulty with daily activities.

Discussion and Conclusion: We present a case of multiple staged procedure for osteosarcoma in childhood with long-term follow-up. This case suggests callus distraction using an external fixator is one of the options for leg length discrepancy due to limb-sparing surgery.

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Aggressive aneurysmal bone cyst of the proximal femur in a 1-year-old infant

Aim of the study: In infantile cases, the hip region's aneurysmal bone cysts may exhibit an aggressive course, emphasizing the importance of considering surgical treatment.

Introduction: Aneurysmal bone cysts are rare skeletal tumors often seen in the first two decades of life.These lesions typically occur in the metaphyses of long bones, posterior elements of the spine. In the differential diagnosis, telangiectatic osteosarcoma must be ruled out. Treatment is usually through curettage and grafting, similar to benign bone tumors, but adjuvant therapies are often used to prevent potential recurrences.

Case Presentation: This case presentation aims to provide an approach to rare, benign aggressive tumors affecting the skeletal system. The diagnosis, treatment, and one-year follow-up results of a 14-month-old male patient who presented with the complaint of inability to walk after falling will be shared.

Results: Due to increased lesion size between the clinical follow-up of the patient, the decision was made to apply surgical treatment. After curettage and grafting, a hip spica cast was applied, at the 6-week follow-up, the cast was removed.At the 6-month follow-up, it was observed that the patient could walk by fully bearing weight on the lower extremity.

Conclusion: Aneurysmal bone cysts reported in infantile cases exist in the literature. However, their localization is usually in the spheno-orbital region. In this case, an aneurysmal bone cyst was observed in the proximal femur region of a 14-month-old child.In infantile cases, it should be considered that aneurysmal bone cysts in the hip region can have an aggressive course, and the need for surgical treatment should be kept in mind.

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3D custom-made proximal tibia reconstruction in resection with short residual distal bone

Aim of the study: To evaluate a new custom-made implant for tibial reconstruction.

Introduction: Reconstruction of the proximal tibia is often challenging in cases of wide tumor resection. Advanced 3D printing technology has made important innovations in orthopedic surgery and seems to be a viable option for cases with a residual short segment. This case report evaluates surgical outcomes in two patients undergoing proximal tibia reconstruction with custom-made megaprosthesis with short distal stem fixed with two anatomical flanges.

Methods: Two patients underwent a wide resection of the proximal tibia after the failure of previous surgery for an osteosarcoma and an aggressive osteofibrous dysplasia. The residual distal bone was too short to accommodate a standard intramedullary stem. Thus, a custom-made megaprosthesis with short stem reinforced with two extra-articular flanges was manufactured by the same company.

Results: Last clinical evaluation and X-Ray were performed after 23 and 14 months. The two patients could walk with no pain or instability. Knee range of motion was 0-0-95 and 0-0-90, with an active extension lag of 5° and 15°, respectively. X-Rays showed no loosening or mechanical failure. MSTS functional scores was 25 and 29.

Conclusions: A custom-made reconstruction of the proximal tibia is a valuable alternative to amputation or total tibia reconstruction. The anchorage system proved reliable for tibial reconstruction with a short bone distal fragment, allowing good osseointegration and prosthesis stability. A good limb function and patient satisfaction were also obtained. This technique should become increasingly considered in revision surgery for failed proximal tibia reconstruction.

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Quantification of the biological superiority of perfusion-decellularized massive bone allografts: a preclinical in vivo study

Aim of the study: Preclinical analysis of a potential new generation of massive bone allograft.

Introduction: Currently, massive bone allografting is a solution for reconstructing large bone defects. Such a biological implant should have the ideal biomechanical qualities. However, their complication rate remains too high. Perfusion-decellularization of massive allografts could promote the biological integration of these grafts by removing their immunogenic component, thereby improving their vitality.

Material and methods: Three decellularized by perfusion massive bone allografts were compared to 3 fresh frozen massive bone allografts in a preclinical in vivo study. Three pigs each underwent two critical diaphyseal femoral defects and two allogeneic 2.5cm intercalary femoral grafts (one decellularized and one fresh frozen). The grafts were retrieved at 3 months postoperatively. Quantitative data were collected through Q-Path® software on histological and immunohistochemical acquisitions.

Results: Histology showed greater bone remodeling in the decellularized group, with greater numbers of osteoclasts around the graft ($p < 0.001$) and larger areas of osteoid matrix and newly formed bone. Immunohistochemistry showed greater vitality and remodeling in both the cortical and medullary cavities for Osteocalcin ($p < 0.001$), Ki67 ($p < 0.001$), CD3 ($p < 0.001$) and α-SMA ($p < 0.001$). Furthermore, the decellularized grafts proved to be biologically more active compared to control grafts. Fluoroscopic microscopy revealed more ossification fronts in the depth of the decellularized grafts ($p = 0.021$).

Conclusion: This pilot study provides the first in vivo information on the enhanced biological capacities of massive bone allograft decellularized by perfusion compared to conventional massive bone allografts.

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Spinal involvement of metastatic malignant triton tumour: unique location with uncertain management

Cel praca: To present the first reported case of metastatic malignant triton tumour in the spine and to review the current status of management of spinal involvement of malignant triton tumours.

Introduction: Malignant Triton Tumour (MTT) is a malignant peripheral nerve sheath tumour (MPNST) with rhabdomyoblastic differentiation. The development of metastases despite complete resection is common, with the lung being the most common site, followed by intra-abdominal visceral and osseous metastases. Cases of spinal involvement as a primary site of this tumour are rare. To the best of our knowledge, this is the first reported case of metastatic spinal involvement of MTT.

Methods: A 25-year-old man diagnosed with neurofibromatosis type 1 underwent complete wide resection for a large high-grade MTT in the right gluteal region (pT4 N0 M0). 5 months later, a follow-up CT scan revealed a solitary lung node and a lytic lesion in L4. Despite chemotherapy and radiotherapy as recommended by the multidisciplinary committee, the spinal lesion progressed over 2 months, causing acute cauda equina syndrome. He underwent an urgent L4 wide laminectomy followed by L2-S2 arthrodesis. An intralesional resection was performed. Metastatic origin was confirmed by pathological examination.

Results: Pain and neurological symptoms resolved during the early postoperative course and no vertebral collapse was observed. However, the current oncological prognosis remains unclear.

Conclusion: Metastatic involvement of the spine in MTT is extremely rare but may result in serious consequences. There is currently no standard management protocol for such cases. Early diagnosis and management are crucial to improve survival rates and reduce morbidity. Follow-up imaging of the whole spine and a high level of suspicion are advisable.

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Less invasive resections of spinal osteoid osteomas and osteoblastomas with intraoperative MRI

Aim of the study: Aim was to evaluate own results regarding residual tumour, recurrence rate, complications, pain and quality of life (QoL).

Introduction: Radiofrequency ablation (RFA) is treatment of choice for osteoid osteomas (OO) and osteoblastomas (OB). In anatomically complex localizations near to neurovascular structures, open procedures are indicated. Intraop. MRI with contrast medium (CM-iMRI) can increase safety of complete tumour removal, avoid re-interventions and reduce recurrence rate.

Methods: Between 2018 and 2022, patients were retrospectively analyzed. For CM-iMRI, 3.0 Tesla MR was used. Resection was evaluated regarding residual tumour, CM uptake as well as recurrence rate. Pain and QoL were assessed using visual analogue scales (VAS) and EuroQol. Results: 9 patients with spinal OO/OB (n=7/2) were included (cervical/thoracic/lumbar: n=1/6/2). Mean age was 26 yrs (8-48). In 8 no residual nidus was found in CM-iMRI, in 1 immediate re-curettage was performed after CM-iMRI with suspected residual tumour. Mean FU was 19mon. No patient had recurrence, no complications were observed. There was a significant reduction in pain (VAS preop./postop. 7.6/0.4 with high postop. QoL (EQ-5D 91). 8 were very satisfied, 1 rather satisfied.

Conclusion: In spine, especially areas near neurovascular structures, surgical resection is an alternative to RFA. CM-iMRT increases safety of complete resection through intraop. visualization of residual tumours, helps preventing re-interventions and reduces recurrence rate. With low complication rate, pain is significantly reduced and QoL is considerably improved. Prospective randomized studies should be performed to evaluate benefits of CM-iMRI in combination with RFA, possibly also using 3Dnavigation.

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Pediatric pelvic reconstructions for bone sarcoma: assessing femoral head osteonecrosis and other potential risks

Aim of the study: To evaluate the incidence of femoral head necrosis after pelvic resction and reconstruction with a massive allograft,in pediatric patient were the femoral head was preserved.

Introduction: Surgical management of pelvic bone sarcomas in pediatric patients presents unique challenges, particularly in accommodating potential growth. This study explores the use of extensive pelvic allografts for pelvic reconstruction in skeletally immature patients, focusing on preserving the femoral head to maintain natural anatomy and growth potential.

Material: From 1980 to 2022, the study analyzed records of patients under 14 years who underwent pelvic resection, including the P2 region, primarily for Ewing sarcoma, osteosarcoma, synovial sarcoma, and undifferentiated round cell sarcomas. The treatment included perioperative chemotherapy and, in 2 cases preoperative radiotherapy. A total of 29 patients, with an average age of 11 years, underwent pelvic resections and reconstructions using a massive allograft. The grafts were shaped during surgery to replicate the excised pelvic bone and acetabulum surface, fixed with plate and screws.

Results: After a mean follow-up of 120 months, 26 patients resulted free of disease. 48 complications were reported, with infection and hardware intolerance being the most frequent. 4 cases showed arthritis and 1 femoral head necrosis(all 5 treated total hip replacement). All cases showed partial graft resorption. 80% maintained the original allograft until the last follow-up. 19 patients had no final limb length discrepancy.

Conclusion: Massive allografts are a reliable method for pelvic reconstruction in pediatric patients. With 80% of patients maintaining the original implant after intermediate to long-term follow-up, and most experiencing only minimal limb length discrepancies, the technique proves its efficacy. Moreover, femoral head osteonecrosis occurred in only 1 case.

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Navigation-assisted tumour resection for primary malignant and benign bone tumours and solitary skeletal metastases

Aim of the study: Aim was to analyze own treatment results after navigated resection of musculoskeletal tumours regarding resection status, complications, survival, and radiation dose.

Purpose: Response to neoadjuvant chemotherapy and R0 resection are prognostic factors for local/systemic tumour control. Despite successful use of intraop. 3Dnavigation in arthroplasty/traumatology, there is limited experience in tumour surgery.

Methods: From 2016 to 2022, all navigated resections were retrospectively analyzed. Preoperative fused MRI/CT with navigation system Brainlab were used.

Results: 33 patients (mean age 44 (13-73) yrs, m/f: 15/18) with primary sarcoma (6 chondro-; 5 chordoma; 1 osteo-/ewing-/rhabdomyo-/pleomorphic each), solitary metastases (2 liposarcoma, colorectal/breast/anal/vaginal cancer: 7/2/1/1) and benign bone tumours (4 osteoid osteoma/osteoblastoma, 1 chondroblastoma) were included (sacrum/pelvis/spine/limb/sternum: 16/6/4/5/2). Mean operation and X-ray time was 240 (85-491) and 1.3 (0-5.4) min, respectively. R0 resection was achieved in 97%. Most common complications were wound healing disorders/infections (n=9). Mean FU was 28 mon. 88% of patients are alive (64% no evidence of disease). 4 patients died, 2 of them tumour-related. Mean overall survival was 75 mon., significantly worse in patients with Ca metastases compared to sarcomas. Distant metastases were detected in 39%, local recurrence in 12%. Mean intraop. radiation dose was 497.8 cGy*cm².

Conclusion: 3Dnavigation leads to optimal intraoperative orientation with low radiation exposure, high rate of save margins and low complications especially in anatomically complex regions. Prospective randomized studies are needed evaluating influence on R0 resection rate, local tumor control and reduction in extent of resection.

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Oncological outcome after partial pelvic resection of primary malignant bone tumors and solitary bone metastases

Aim of the study: The aim was to analyze the oncological outcome and complication profile after pelvic resection.

Introduction: Bone/soft tissue sarcomas or solitary carcinoma metastases (CA-MET) involving pelvis are indication for pelvic resection (PR). Depending on extent and type of PR, complex defect reconstructions of the hip or spinopelvic fixation are required.

Methods: Retrospective analysis of patients with PR due to sarcoma or solitary Ca-MET between 2010 and 2022 at the University Hospital Dresden or Vivantes Hospital Spandau was performed.

Results: 54 patients (m/f: 31/23, mean age 52 (6-93) yrs) with sarcoma and solitary CA-MET after PR (resection type according to Enneking I/Ia:11; II/IIa: 11; III:8; IV:7; hemipelvectomy int./ext.: 10/7) were included. Defect reconstruction was performed in 10 and spinopelvic fixation in 6 patients. Mean duration was 306 (55-674) min.

R0 resection was achieved in 82%. Complications occurred in 61%, mainly infection, hematoma and implant failure (n=16/7/5). 1/2year survival rate was 94%/87%. Mean disease-specific survival was 80 mon., significantly better in patients with type I resection. Patients with R0 resection had significantly better recurrence-free survival. Predictors for significantly worse disease-specific survival were R2 resection, distant metastases/local recurrence, and occurrence of complications.

Conclusions: PR are challenging due to complex anatomy and present with high complication profile. MET, local recurrence, and complications significantly influence survival. R0 resection significantly determines tumor control and makes wide resection the key factor for survival. Future studies must analyze quality of life and functionality depending on type/reconstruction of PR.

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Oncologic and functional outcome after hemipelvectomy in chondrosarcoma patients

Aim of the study: Showing the oncological and functional outcome after hemipelvectomy in chondrosarcoma patients

Oncologic and functional outcome after hemipelvectomy in chondrosarcoma patients Chondrosarcomas are among the most common primary bone tumors, with the pelvis being impacted in approximately 25% of cases. The complete tumor resection is necessary for a curative therapy. High rates (>35%) of local recurrence are described, particularly in pelvic chondrosarcomas, due to the low sensitivity to radiotherapy and chemotherapy. Because of the size of the bone and soft tissue defects, postoperative mobility is significantly impaired. In this study, we present the oncological and functional outcomes after surgical treatment of chondrosarcoma of the pelvis at a national sarcoma center. From 2019 to 2023, 26 patients with pelvic chondrosarcoma underwent surgery, incorporating various forms of reconstruction. Preservation of the hip joint was accomplished in four cases, with an R0 resection successfully achieved in 25 out of 26 cases. Local recurrence wasn´t observed during the observation period. After hemipelvectomy, 78% of patients were able to mobilize over longer distances with aids (78% forearm crutches, 39% active wheelchair). 50% of the cohort were able to mobilize for short distances without aids. 33% of the patients were able to work and were able to return to their occupation. Overall, the study showed a good oncological outcome and satisfactory functional outcome, although the mobility was perceived as a limitation by the patients.

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Treatment of early infected mega-prothesis of sacrum – case report

Introduction: According to the literature, infections after oncological reconstructions constitute 3.7-19% of complications, and in the case of pelvic reconstruction even 47%.

Description: The case describes a 21-year-old patient treated for giant cell tumor of the sacrum (GCTB). After a 3-year period of conservative treatment with denosumab, progression of clinical symptoms was observed as exacerbation of lower limbs neurological disorders and enlargement of the tumor mass. Qualified for surgical treatment, she underwent total sacrectomy below L5 with en block resection of the tumor, bilateral extra-articular partial resection of the iliac bones and resection of the S1-S5 nerve roots, as well as multi-tissue reconstruction of the pelvis and spine defect using 3D post-resection arthroplasty (MUTARS).

Before admission to the Department, the patient underwent a standard bacteriological screening (oral examination, sterile urine and nasal cultures were documented). Before the procedure itself, antibiotic prophylaxis was administered by administering Cefazolin 1.0 i.v.

Immediately after the procedure, the patient stayed in the Intensive Care Unit for 19 days, where the first signs of inflammation appeared in the postoperative wound. Bacteriological cultures of the wound were performed, detecting Enterococcus feacium, and Vancomycin 1.0 twice daily i.v. was administered.

On the 24th day after the procedure, the patient was transferred to our center. During admission, there were 2 communicating purulent wound fistulas locally. Bacteriological cultures were taken and Renasys GO Smith & Nephew vacuum drainage was used. Enterobacter cloacae (alert pathogen) and Staphylococcus haemolyticus were indentified. Meropenem 0.5 3 times a day i.v. was started and patient was sent into isolation.

During further treatment, on the 10th day of stay in the Department, debridement of necrotic tissues and local implantation of 20cc Stimulan Rapid Care with recrystallized calcium sulfate as a carrier (PG-CSH) were performed; off-label vancomycin 2.0 with meropenem 2.0 in 10cc was used as antibiotics. and tigecycline 0.2 in the next 10 cc. It was used to fill the space around the implant. Control bacteriological cultures taken intraoperatively confirmed the flora of Enterococcus feacium and Enterobacter cloacae (alert pathogen), treatment with Meropenem 0.5 three times daily i.v. was continued, and vacuum drainage (VAC) was continued.

Due to symptoms of irritation of the nerve roots running around the wound, which occurred on the 5th day after the revision, VAC vacuum therapy was used intermittent (4 times a day, 60 minutes each), alternating with absorbent dressings with active Ag (periodic difficulties in maintaining the tightness of the VAC).

During local and intravenous antibiotic treatment, gradually smaller growths of pathogens were achieved. However, an increase in Candida Albicans was observed. The patient underwent a gynecological consultation and targeted treatment using vaginal pessaries and probiotics was initiated.

On day 38, sterile bacteriological cultures were obtained. Treatment took a total of 78 days of continuous hospitalization. During follow-up visits, complete healing of the wounds, no fluid spaces, and the patient was able to move independently were observed.

10 months after healing, there are no signs of general or local infections.

Conclusions: In the treatment of periprosthetic infections (PJI), the key steps are early diagnosis, identification of the pathogen and coordinated general and local treatment. Early revision of the surgical site, removal of necrotic tissue (repeated if necessary depending on the local condition), local antibiotic therapy (PG-CSH) combined with targeted general antibiotic therapy, negative pressure wound therapy (NPWT/VAC) and a high-protein diet are the most important elements of the treatment plan. Cooperation in the therapeutic team of a surgeon and a microbiologist is also important, and in the case of long-term hospitalization, also the help of a psychotherapist or psychiatrist.

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The management of soft tissue sarcomas (STS) localized in the region of the foot in children – a single institution experience

Aim of the study: The aim of the study was to assess the actual therapeutic options for pediatric patients (pts) with STS localized in the region of the foot.

The treatment of STS of the foot especially in children seems to be difficult and unpredictable. From 2017-2023 a single-retrospective study was conducted in 12 pts- 8 had Ewing Sarcoma, 3-rhabdomyosarcoma, and 1-Small Round Cell Tumor. The use of all kinds of therapy-surgery, chemotherapy, and radiotherapy was analyzed and correlated with the outcome of treatment (CR-complete remission, P-progression, PR-partial regression, SD-stable disease). All 12 pts (mean f-up 2,57±1,79, mean age 10,48±4,17 years) were treated with CHT before surgery and achieved: 6CR, 3P, including 1 death, 2PR,1SD. Surgery was performed in 8 of 12 pts: 3 amputations (3R0:2CR,1P-death), 5 sparing surgeries (4R0-3CR,1SD;1R1-1P). 4/12pts had no surgery (1CR,2PR,1P). 8/12pts had metastases (3P,1PR,3CR,1SD), in 1/8pts metastases developed during treatment (1P). Radiotherapy of primary tumor was used in 6/12pts (2CR,2PR,2P), in this group 4/6 pts had no surgery (1CR,2PR,1P) and 2/6pts had sparing surgery (1R0-CR;1R1-P). Radiotherapy of metastases was used in 6/12pts (2CR,1PR,3P). 8/12pts with ES achieved 6CR, 1SD, 1P(death), 3/12pts with RMS achieved 1PR,2P, 1 pt with SRCT-1PR. Good response to chemotherapy and radiotherapy is the key to success in the treatment of STS localized in the region of the foot in children. Sparing surgery may also bring good results in these cases.

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Is there a need for reconstructive surgery after distal fibular resection due to bone tumors? Results from the PROSPERO international register of systematic reviews

Aim of the study: A question arises: is there a need for reconstructive surgery after distal fibular resection, and what reconstructive procedures are available?

Introduction: Primary bone tumors (PBTs) of the fibula are rare, around 20% of them being malignant. Historically, a below-knee amputation was the treatment of choice, but the advancement of chemo-radiotherapy allowed limb salvage surgery to become a feasible treatment option.

Materials and methods: The review is registered with the PROSPERO international register of systematic reviews (CRD42022336341). Inclusion criteria consisted of all levels of evidence, human studies, patients of all age and gender, English language of publication and resection of the distal portion of the fibula due to tumor pathology. The reviewers defined four different categories of interest by method of treatment and separated the cases from articles into adequate categories.

Results: The initial search resulted with a total of 2958 records. After title and abstract screening, a total of 2816 records were removed, leaving 142 articles for further full-text assessment. Of those 142, 42 were duplicates, while 6 were unavailable in full-text form online. Therefore, 94 articles went through full-text screening, resulting in 50 articles that were included in the study. Articles were divided into "No reconstruction", "Soft tissue reconstruction", "Bone and soft tissue reconstruction", and "Arthrodesis, arthroplasty or other reconstruction options" groups.

Conclusions: Limb salvage surgery should be followed by reconstruction in order to avoid complications. An ideal reconstruction technique is easily reproducible, gives a good functional outcome with no complications. A protocol of treatment is reported

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Osteosarcomas of the hand and foot: a single center case series

Aim of the study: Review and evaluation of treatment outcomes for osteosarcoma of the hand and foot.

Osteosarcoma is a mesenchymal tumor of the bones, mostly occurring in the long bones of the extremities. The incidence in the long bones of the extremities accounts for about 80-90%. On the contrary, one of the most rare sites is hand and foot representing approximately 1% of all diagnosed osteosarcomas. The rarity of osteosarcoma of the hand and foot has led to frequent misdiagnosis and delayed diagnosis or even to wrong treatment with fatal consequences. The literature has been contradictory about the prognosis and treatment of hand and foot osteosarcoma. Most of the studies indicate that is prognostic favorable, but the evidence remains low. Even in those sites, the limb salvage option is the treatment of choice, and with the use of chemotherapy, 60% to 65% of patients with osteosarcoma can be cured without amputation. The current knowledge is limited to case reports and very small retrospective studies. To expand the limited existing literature, we reviewed a series of 11 case reports of patients treated at our institution.

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Vascular port infection is an important risk factor for periprosthetic infection in patients with primary bone tumors treated with post-resection endoprostheses

Aim of the study: The aim of this study is to present the results of a study confirming the higher likelihood of periprosthetic infections in patients with vascular port infections.

One of the most frequently used surgical techniques in patients with primary malignant bone tumors (PMBT) is reconstruction with post-resection endoprostheses. Due to the complexity of these types of procedures, the number of early and long-term complications is high. Knowledge and elimination of all risk factors increase the safety of the patient and the operator. The analysis concerned 45 patients with PMBT of the distal femur treated in our clinic using a post-resection endoprosthesis with a minimum follow-up period of 2 years. In this group, 5 cases of periprosthetic infections were recorded. In 3 cases of periprosthetic infections, there was a previous infection of the vascular port. Statistical analysis confirmed a higher probability of periprosthetic infection in patients with vascular port infection (p=0,007). Vascular port infection is an important risk factor for periprosthetic infection. Due to the very serious consequences of periprosthetic infection, we recommend immediate removal of infected ports. There is no medical or financial justification for attempting to treat infected vascular ports. An additional conclusion of the study is the need to inform doctors of other specialties about the need for decisive action in the event of identifying this risk factor.

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Hydatid cysts in the musculoskeletal system: retrospective case analysis and overview of Austrian epidemiology

Aim of the study: To illustrate rare musculoskeletal manifestations of echinococcosis as differential diagnosis of soft tissue and bone tumours.

Background: Echinococcosis is a disease caused by E. granulosus and E. alveolaris. Cystic echinococcosis (CE), caused by E. granulosus, mainly involves the liver. Development of hydatid cysts in the musculoskeletal system is uncommon.

Methods: We analysed data of all reported cases of Echinococcosis obtained from the Austrian Agency for Health and Food Safety (AGES) (2011-2023). Furthermore, we searched our database for patients with musculoskeletal echinococcosis (CE, AE) treated at an Austrian tertiary orthopaedic centre (2002–2023).

Results: In total, n = 378 cases were reported to the AGES (CE n = 195; 55.8%, and AE n =183; 44.2%, respectively). Females were affected in 54.4% (CE), and 45.6% (AE). Most patients (n = 137, 40.5%) were Austrian citizens. Syria (8.3%) and Turkey (7.1%) was the origin of most patients with migratory background. Two patients with musculoskeletal hydatid cysts were treated at our hospital: A 34-year-old Syrian woman presented with a slow-growing mass in her thigh. The second patient, a 53-year-old Turkish woman, presented with a recurring cyst affecting both sacroiliac joints after surgery of a CE-cyst 16 years earlier. Both patients had no other organ manifestations.

Conclusion: Hydatid cyst is a differential diagnosis in cases of slow-growing tumour-like masses in which primary imaging and patient history are suspicious. If confined, surgical resection with removal of the intact cyst is curative. Systemic anthelmintic treatment is administered perioperatively, or as conservative treatment in cases where surgery is not feasible.

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Psychological distress during treatment in AYA patients with bone and soft tissue tumors

Aim of the study: To clarify factors that influence disease/treatment-related psychological distress and its changes over time in AYA patients with bone and soft tissue tumors.

Methods: Eligible Patients accessed by Distress Thermometer (DT) more than once during 2020-2023 were enrolled to analyze following: 1) the relationship between DT scores and patients' clinical background, and 2) changes in DT scores over the treatment course.

Results: Of 50 patients (male: 50%; malignancy: 78%, intermediate 10%, benign 12%), 27 patients (69%) underwent curative treatment, while 12 (31%) were treated with palliative management. The median number of times DT were applied for each patient was 4 (range 2-32). Median pre-interventional DT scores of patients with malignant/intermediate versus benign tumors were 5 and 2.5, respectively (p=0.08). Among patients with malignancy, median pre-interventional DT scores of the curative versus palliative treatment groups were 5 and 4.25, respectively (p=0.81). The median DT scores of the curative treatment group registered before the treatment course, after surgery, and at the end of the treatment course were 5, 1.5, and 0, respectively. Meanwhile, the scores of the palliative treatment group registered before and after intervention were 4.25 and 2.5. Both groups showed statistically significant trends of decreasing scores over time (p=0.008).

Discussion: The more malignant the disease was, the more intense psychological distress felt before intervention became in AYA patients suffering from bone and soft tissue tumors. In terms of patients with malignancy, there was no difference of pre-interventional psychological distress between curative and palliative treatment groups: instead, the scores decreased equally in both groups as treatment progressed.

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Multidisciplinary patient care after endoprosthesis implantation in children

Aim of the study: To investigate and evaluate the effectiveness of a multidisciplinary approach in postoperative care for children undergoing arthroplasty procedures for sarcomas.

Background: Currently, the treatment of sarcomas and combined with chemotherapy, surgery, and often radiotherapy. Children are a special group when it comes to treating tumors of the musculoskeletal system for several reasons. Firstly, their bodies are in a phase of dynamic growth and development, making the treatment of tumors more complex compared to adults. Necessary treatment procedures can be stressful for the patient and family. All makes the treatment process more delicate and requires a specialized, multidisciplinary approach.

Methods: Standard operating procedures (SOPs) for nursing and rehabilitation care used at the IMiD, requirements for pediatric oncology departments, and guidelines for caring for patients with bone cancer were analyzed for dedicated postsurgical care.

Results: Postoperative care was provided by the multidisciplinary team and parents. Multidisciplinary care included physical and emotional care (care nursing, psychology care, rehabilitation, and medical care). The basic tool for obtaining good treatment results was proper patient rehabilitation with the great cooperation of the nurse on duty in the postoperative room. Additionally, the active participation of the parent in this process and the strong will and motivation of the child-patient, supported by a psycho-oncologist, played an important role.

Conclusions: Postoperative care after arthroplasty procedures for children requires an interdisciplinary team with the support of parents. Described cooperation ensures the best functional results that affect long-term quality of life. It seems reasonable to argue that these factors in the post-operative recovery process become equivalently important to the doctor's role at this stage.

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Hand enchondromas treated with curettage, bone grafting, and early postoperative mobilization: Do pathological fractures affect the functional outcome?

Aim of the study: Evaluation of post-operative functioanlity in hand enchondromas with and without pre-operative pathological fractures

Introduction: Hand enchondromas are benign cartilage bone tumors. Curettage represents the actual gold standard for hand enchondromas. Little has been written about the effectiveness of curettage on hand functionality.

Methods: In this retrospective study, we evaluated the effectiveness of curettage, bone grafting and early post-operative mobilization and rehabilitation. For each case, we compared the pre-operative and post-operative QuickDASH of the treated limb. The final functional outcome was also evaluated by calculating the affected finger's Total Active Movement (TAM). Complications and local recurrences were recorded.

Results: Forty-five cases were included in our study. Fifteen of them had a pathological fracture. The mean pre-operative QuickDASH score was 48.4. No intraoperative complications occurred. After a mean follow-up of 38.1 months, the mean QuickDASH score had decreased to 4.4, and the TAM was optimal or sub-optimal. QuickDASH and TAM were significantly worse for those with pathologic fractures before surgery. Only 3 cases (7%) had post-operative complications, and 1 (2%) had a local recurrence.

Conclusion: Curettage and early postoperative rehabilitation can lead to good clinical and functional outcomes for hand enchondromas. Patients with pathologic fractures, although slightly exposed to a higher risk of sub-optimal outcomes, can also aim for good post-operative functionality.

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Osseointegration prosthetics limbs for amputees with sarcoma

Aim of the study: To introduce our experience in rehabilitation of sarcoma amputees using IPL system.

Introduction: Traditional socket prosthesis are associated with high incidence of problems: discomfort and pain at the residual limb, problems with fitting, and skin problems in the stump, all will result in negative impact at the quality of life and mobility of the patients.

Materials and Methods: At Khcc, we performed Osseo-integration surgery in 7 patients with above knee amputation for cancer, 3 patient with osteosarcoma, 3 patients with soft tissue sarcoma, and the one with germ cell tumor. In all 7 patients , surgery was done after 2-3 year history of fitting with traditional socket prosthesis, where the patient were extremely un comfortable, with persistent pain and high dose opioids pain medicine intake, 6 patients were transfemoral amputees and one was transtibial.

Results: Six out of the 7 patients did well and rehabilitated successfully and walked with no assistive aid at 1 year follow up period and stopped using all kinds of pain medicine, average MSTS score was 90%. The fourth patient, unfortunately developed metastatic lesion at the contralateral knee which mandates contralateral above knee amputation and her rehabilitation was complicated, then she developed systemic recurrences and passed away.

Conclusion: Our series, is small, we are the first center in the Middle East to use this technology, we obtained excellent results in 6/7 patients. One obstacle is the high cost of the implant, and difficulty to be afforded by financially uncovered patients.

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Integrating mind and body: a holistic approach to cancer treatment

Introduction: This presentation proposes a holistic approach to cancer treatment that considers the patient as a whole, addressing both physical and psychological aspects.

Utilizing a 2-voices narration, the presentation will offer insights from both doctors and patient family to provide a comprehensive understanding of the cancer journey. Mental interpretation will be backed with substantive analysis by psychologists. This fits well into the narrative of the 6th Polish Oncology Congress, which will take place with the participation of the Polish Minister of Health on October 17-19. The main topic of the conference will be interdisciplinary oncological care, which will be highlighted in this workshop by emphasizing the crucial role of cooperation in improving patients' well-being and, consequently, their lives.

Goals:

- To showcase the case study of
- To highlight the importance of holistic care in cancer treatment, emphasizing the integration of mind and body. Advocating towards interdisciplinary cooperation as a standard in oncological care.
- To showcase the challenges and triumphs experienced by patients and their families throughout the cancer timeline.
- To introduce strategies for treating traumatic experiences as a pathway to positive changes and resilience.

Scope:

- Introduction: Overview of the presentation's objectives and structure.
- Cancer Timeline:
  a. Doctor's Comment: Insights into medical diagnosis, treatment options, and recovery milestones.
  b. Patient Family's Comment: Emotional reflections on the impact of cancer diagnosis and treatment on family dynamics, incl. challenges they face on the journey
- Deep dive into psychology, incl. insights into the human mind's response to trauma and coping mechanism and showing recent studies on how trauma can be a catalyst for positive changes and resilience

Conclusion: This presentation aims to shed light on the significance of treating cancer patients as whole individuals, advocating for interdisciplinary cooperation. By providing a specialized case study combined with a deeper understanding of the challenges faced by patients and their families, the presentation offers a broad spectrum for further analysis. Authors, with their interdisciplinary perspective, offer strategies for resilience, showcasing a path to boost the quality of cancer treatment and improve patient outcomes.

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Treatment of conventional chondrosarcoma: an assessment of outcome

Aim of the study: The aim of this study was to evaluate the treatment results of 90 patients with conventional chondrosarcoma. The secondary goal was an attempt to identify prognostic factors.

Introduction: Primary malignant bone tumors are rare and constitute up to 0.5% of all primary malignant tumours. Approximately 20% of them are chondrosarcomas.

Methods: 90 patients, comprising 39 women and 51 men, aged 16-90 years, were treated in our hospital. Their general condition was measured according to the Zubrod performance scale. Tumor size, location, pathological fracture presence, distant metastases, and the presence of previous primary lesions which had undergone malignant transformation were taken into consideration.All patients were followed up after treatment. Again, their general condition was assessed. Disease-free survival (DFS), recurrence-free survival (RFS), metastasis-free survival (MFS) and overall survival (OS) were evaluated.

Results: Metastases occurred in 17 patients (17.2%), and recurrence in 26 patients (27.9%). 5-year overall survival was 59%. Gender correlated with RFS. Tumor size correlated with DFS and MFS. Patients with tumors smaller than 10 cm had significantly better OS. Treatment method was of importance to OS, DFS, RFS and MFS.

Conclusion: 1. Surgical treatment of chondrosarcoma is effective, especially for patients with tumors smaller than 10 cm. 2. Tumor size is a negative prognostic factor both for DFS and MFS, and tumors smaller than 10 cm a prognostic factor for OS. 3. Radical resection was identified as a positive predictive factor for OS, DFS, RFS and MFS.

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Possibilities of using custom-made 3D acetabular cups after resection of pseudotumors in complicated hip arthroplasty

Introduction: Implants made in 3D technology dedicated for the patient were many years reserved only for post-resection oncological arthroplasty, but they are becoming more and more widely used in the treatment of complications of primary arthroplasty.

Methods: We treated 4 patients with Paprosky IIIa and IIIb acetabular bone defects were qualified for surgery between 2020 and 2023 at the Department of Orthopedics, Traumatology and Oncology of the Musculoskeletal System, Medical University of Zielona Góra. The CT scan was sent to the manufacturer and, in consultation with the operating physician, an implant dedicated to the patient was designed. The removed tumor lesions were subjected to histopathological examination.

Results: All operated patients were able to walk with elbow crutches. In 1 case, the procedure was complicated by infection, debridment was performed, and in the next stage, dealloplasty.

Conclusions: The use of custom-made 3D acetabular cups brings good functional results, but is associated with a high risk of infection. The use of this type of implants in oncological orthopedics is relatively rare, therefore it is necessary to use the experience of orthopedic oncological doctors in order to obtain better clinical effects and reduce the huge risk of complications.

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A novel model for the direct referral of oncologic patients in a public health system

Background: The escalating global cancer burden strains public health systems and economies, necessitating effective strategies to mitigate prolonged waiting times for diagnosis and treatment. In Europe, waiting to consult an oncologist can span up to 7 months from initial symptoms, posing life-threatening risks. Despite ongoing efforts, protracted waiting periods persist as a critical issue in public healthcare.

Material and Methods: Over the past four years, Southern Israel and Northern Italy implemented an innovative direct referral model in the public health system. Emphasizing education and fostering direct communication between primary care physicians and orthopedic oncologists, the model aims to minimize delays for oncologic patients

seeking admission to specialized units. To assess its impact, a longitudinal mixed-methods approach evaluated effects on prognosis, overall survival, quality of life, and stressogenic factors in oncologic patients.

Results: Preliminary data from 700 patients indicate promising outcomes. The average waiting time for clinic access reduced to 2 days (range: 12 hours to 5 days), and referral-to-surgery time averaged 6 days (range: 1-14). Directly referred patients demonstrated improvements in function, overall survival, pain threshold, and quality of life.

Conclusion: This study sheds light on a novel direct referral model for oncologic care, anticipating a substantial reduction in waiting times, leading to enhanced overall survival rates and alleviating stress on patients and public health systems. The innovative approach presents a potential solution to the persistent challenge of extended waiting periods in cancer care, offering a more efficient and patient-centered approach to oncologic referrals.