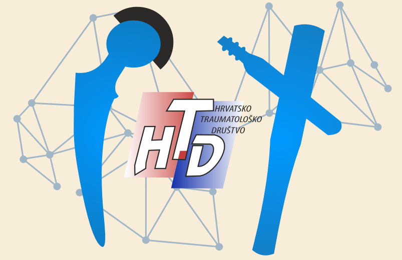

7HTD

7th Congress of the Croatian Trauma Society
with international participation

Opatija, April 17–18, 2026

Book of Abstracts

Dear colleagues,

It is our great pleasure to invite you to the **7th Congress of the Croatian Trauma Society** with international participation, which will be held in Opatija from **April 17 to 18,** 2026.

The Congress will bring together leading national and international experts in the fields of orthopedics and traumatology, as well as professionals from other disciplines involved in the diagnosis, treatment, and rehabilitation of trauma patients. The goal of the Congress is to exchange knowledge, experiences, and the latest advancements in the multidisciplinary approach to patient care.

The scientific and professional program will include plenary lectures by distinguished national and international speakers, thematic symposia, and panel discussions, along with presentations of new technologies and scientific research.

The Congress is intended primarily for **orthopedic surgeons and traumatologists,** but also for **anesthesiologists, radiologists, nurses and technicians, specialists in occupational and sports medicine, physiatrists, physiotherapists,** and other healthcare professionals involved in the diagnosis and treatment of trauma patients.

We look forward to your participation and to meeting you in Opatija!

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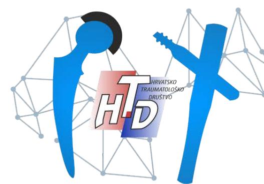

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Basic Science

Innovations in Fracture Care – Treatment, Monitoring, and Prognosis of Fracture Healing

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Although being the current gold standard for clinical assessment of fracture healing progression, conventional X-rays are limited to single-time-point measurements with highly subjective interpretation. To address these shortcomings, an implantable sensor system – AO Fracture Monitor – was developed and is currently in the first-in-human trials for plated distal femoral fractures. Continuously measuring the implant load, the system provides objective quantitative, X-ray-free data for remote monitoring of the healing progression and patient activity, allowing a more personalized and efficient rehabilitation for advancement of fracture aftercare. By implementing the ground-truth implantable sensor data throughout the healing process, validated prognostic mechanoregulatory models are being applied to predict patient-specific secondary fracture healing in terms of callus formation, mineralization patterns, and clinical outcomes such as union, delayed union, or nonunion – via computer simulations with post-operative data. The biphasic plating concept is an alternative approach that provides favourable mechanical conditions at the fracture site and avoids complications independently from patient loading activities. Featuring a bi-linear stiffness response with adequate flexibility and increased implant strength, this concept with its first implementation for plating of distal femoral fracture – Biphasic Plate DF – provides timely, robust healing by creating a beneficial mechanical environment for confident weight bearing. The clinical use of this CE-certified implant with more than 100 cases demonstrates its potential. On the other hand, regarding surgical training and education, fracture fixation complications not only occur due to the use of suboptimal implants and instruments but can also be caused by incorrect surgical techniques. That is why it is of utmost importance to not only know the guidelines but also to understand the underlying biomechanical principles and gain practical skills. To foster the understanding of the biomechanical principles of fracture fixation and healing, a virtual and freely accessible interactive osteosynthesis learning platform with unique possibilities of animating and displaying biomechanical simulations – OSapp – was developed and incorporated in other existing offerings for education. In addition, a novel technology facilitating the development of practical haptic skills for orthopaedic trauma surgery by incorporating an accessible and modular education device comprised of an intraoperative image intensifier with an engine that simulates radiation-free X-ray imaging – Digitally Enhanced Hands-on Surgical Training (DEHST) – was developed and validated as an education tool.

Time-Specific Modulation of Fracture Mechanics Using External Locked Plating: A Novel Approach Based on Selective Screw Locking

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Introduction: External locked plating represents an alternative to conventional external fixation, offering improved patient comfort and simplified application. Beyond these advantages, this technique enables non-invasive modulation of construct stiffness during fracture healing. We conducted a biomechanical pilot study to evaluate stiffness adaptation under cyclic loading and present a clinical case in which this concept was applied using staged stiffness modulation.

Methods: In a biomechanical model (Synbone tube model, Ø25 mm) simulating tibial fixation with a 9-hole 4.5 LCP distal femur plate, four configurations were tested under cyclic axial loading (5,000 cycles; 10–100 N). Stiffness and interfragmentary motion were measured using an Instron testing machine and optical tracking system. Construct stiffness was modified by adding, locking, and removing a screw adjacent to the fracture gap. A 53-year-old male sustained a right multifragmentary tibial and fibular shaft fracture after a fall from height. Initial stabilization was performed using a conventional external fixator on the day of injury. Twelve days post-injury, conversion to external locked plating was performed using a contralateral distal femur locking plate. Fixation consisted of three locked and one initially unlocked screw per main fragment. Three weeks after plate application, the previously unlocked screws were locked to increase construct stiffness (reverse dynamization concept).

Results: Biomechanically, locking an additional screw increased axial stiffness by 11–12% and reduced interfragmentary shear by 94.1–94.5%. Removal of the screw restored baseline stiffness, confirming reversible modulation of working length. Clinically, the patient tolerated full weight-bearing 10 weeks after plate application. Radiographic consolidation was evident at 18 weeks. Implant removal was performed in an outpatient setting 7 months postoperatively. At one-year follow-up, complete tibial and fibular union with satisfactory functional outcome was confirmed.

Conclusion: External locked plating allows controlled, time-specific modulation of construct stiffness without additional surgical trauma. The biomechanical findings demonstrate substantial reduction in interfragmentary shear and increased axial stiffness through simple

screw locking. The presented clinical case illustrates the feasibility of staged stiffness adaptation (reverse dynamization) during tibial fracture healing, suggesting promising translational potential. Further clinical studies are warranted to determine optimal timing for stiffness modulation to enhance fracture healing.

Artificial Intelligence in Biomechanical Gait Analysis After Traumatic Injuries of the Lower Extremities

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In traumatology practice, the assessment of functional recovery after lower extremity injuries is most often based on clinical examination and subjective evaluation of gait, which may result in an insufficiently precise insight into the presence of asymmetries, compensatory patterns, and uneven load distribution during movement. Such limitations may lead to premature progression of loading or prolonged functional recovery. The development of artificial intelligence and markerless biomechanical systems has enabled objective, quantitative gait analysis without the need for complex laboratory equipment, thereby opening the possibility of application in clinical, rehabilitation, and outpatient settings.

Based on the above, an analysis of the available scientific literature (n = 47) was conducted with the aim of presenting the potential of artificial intelligence and markerless biomechanical systems in gait analysis after traumatic lower extremity injuries. Particular emphasis was placed on the application of markerless systems in the analysis of kinematic and spatiotemporal gait parameters after fractures, ligament injuries, and surgical procedures. The results of the included studies show that systems based on computer vision and machine learning can reliably detect gait asymmetries, changes in step length and duration, movement speed, and lower extremity loading patterns, with deviations from reference laboratory systems most commonly within 2–7° for angular parameters.

The particular clinical value of these systems is reflected in the possibility of longitudinal monitoring of recovery outside the laboratory, which enables objective assessment of rehabilitation progress and early identification of inadequate compensations. In the elderly population, such systems have additional potential in assessing the risk of falls and functional independence, while in the active population they may contribute to a safer return to daily and sports activities. The integration of artificial intelligence into biomechanical gait analysis represents a significant step toward a more personalized, objective, and efficient approach in modern traumatology.

Keywords: gait, biomechanics, artificial intelligence, traumatology, functional recovery

Morphological Patterns of Posterior Tibial Slope and Their Association With CPAK Knee Phenotypes: A Machine-Learning Analysis

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Introduction: The Coronal Plane Alignment of the Knee (CPAK) classification defines nine knee phenotypes based on hip-knee angle (aHKA) and joint line obliquity (JLO). The posterior tibial slope (PTS) has gained clinical importance in total knee arthroplasty (TKA) planning. Excessive PTS may lead to instability. Given the rise of personalized TKA techniques, we investigated the relationship between PTS clusters and CPAK phenotypes.

Aims & objectives: We aimed to identify possible PTS clusters and examine their correlation with CPAK phenotypes. We also analysed variations in coronal limb alignment and PTS based on age, sex, and BMI.

Study design & methods: Radiographs of patients undergoing TKA (2010–2023) were analysed, excluding posttraumatic arthritis, prior corrective osteotomies, neoplasms, or poor- quality images. Five examiners independently measured MPTA, LDFA, and PTS with high interobserver reliability (ICC >0.80). Knees were classified by CPAK, and PTS clusters were determined using k-means clustering. Statistical comparisons were conducted using χ^2 tests, correspondence analysis, and Spearman's ρ.

Results: A total of 2,328 knees (35.5% male, 64.5% female) were assessed. Four PTS clusters were identified, with a significant distribution difference among CPAK groups ($p<0.001$). Valgus knee types (CPAK II, III, VI, IX) had steeper PTS, while varus types (CPAK IV, V, VII, VIII) had lower PTS ($p<0,001$). CPAK I had uniform PTS distribution. Male patients had more varus knees, while females had more valgus knees.

Conclusion: Certain PTS clusters are more frequently associated with specific CPAK knee types. Analysis of the association of PTS and CPAK can aid in preoperative planning to enhance TKA outcomes.

Successful Validation of a Decontamination and Rinsing Protocol for Contaminated Autologous Bone Grafts

Marina Bujić Mihica[1], Marija Zekušić[1], Maja Ledinski[1], Ivanka Batarilo[1], Marija Skoko[1], Snježana Ramić[2], Patricija Sesar[2], Tiha Vučemilo[1], Slaven Babić[1,3], Srećko Sabalić[1,4], Dejan Blažević[1,3,5], Dinko Vidović[1,6,7]

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Background: Severe musculoskeletal injuries caused by high-energy trauma frequently result in extensive bone defects requiring complex reconstructive procedures to preserve limb function and prevent amputation. In open fractures, contamination of large autologous bone segments represents an additional major clinical challenge, significantly complicating their reimplantation. The aim of this study was to develop and validate a standardized decontamination protocol for autologous bone grafts while preserving their biological integrity.

Methods: Protocol validation was performed using femoral head fragments experimentally inoculated with selected bacterial strains (Bacillus subtilis, Clostridium sporogenes, Staphylococcus epidermidis, Staphylococcus aureus, and Cutibacterium acnes) at a concentration of 10^6 CFU/mL. Six femoral heads were divided into five equal segments, resulting in a total of 30 samples. Four fragments from each femoral head were intentionally contaminated, while one fragment served as a negative control. Three contaminated fragments underwent decontamination in BASE 128 medium for 6 hours at 37 °C, followed by prolonged rinsing in BASE medium at 4 °C to eliminate residual antibiotics. Positive controls did not undergo the decontamination procedure. BASE 128 contains a broad-spectrum antibiotic combination (vancomycin, gentamicin, cefotaxime, and amphotericin B) commonly used for tissue processing intended for transplantation.

Results: The decontamination and rinsing protocol achieved complete elimination of all tested Gram-positive microorganisms. Microbiological analysis confirmed the absence of residual contamination, and no inhibitory concentrations of antibiotics were detected after rinsing. Histological evaluation of deep-frozen samples demonstrated preservation of viable osteoblasts, osteocytes, and chondrocytes following the decontamination and rinsing procedure.

Conclusions: The proposed protocol proved to be safe and effective for the decontamination of autologous bone grafts contaminated with Gram-positive bacteria, the most common pathogens in musculoskeletal surgery. Future studies should extend validation to Gram-negative microorganisms to further confirm the broader applicability of the method.

Frozen But Functional: Osteoblast Viability and Osteogenic Capacity After Deep-Freezing

Maja Ledinski[1], Marija Zekušić[1], Marija Skoko1, Marina Bujić Mihica[1], Zlata A. Sošić, Ivana Vrgoč Zimić[1], Snježana Ramić[2], Inga Urlić[1], Slaven Babić[1,3], Dejan Blažević[1,3,4], Srećko Sabalić[1,5], Tiha Vučemilo[1], Dinko Vidović[1,6,7]

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Introduction: The preservation of viable osteoblasts in frozen bone is of considerable importance for maintaining the biological and regenerative properties of bone tissue during storage. Ensuring that osteoblasts retain their functional capacity after cryopreservation is essential for potential clinical and research applications. This study aimed to evaluate the viability and regenerative potential of osteoblasts isolated from frozen bone, with particular attention to the effects of deep freezing and the use of the cryoprotectant dimethyl sulfoxide (DMSO).

Methods: To investigate the effects of low-temperature storage (15 and 30 days, with or without DMSO at − 80 °C) on osteoblast function, cells were isolated from fresh and frozen bone samples. A combination of cellular and molecular techniques was employed, including light microscopy of cell cultures, immunocytochemical assessment of Ki-67 as well as time-lapse imaging. Also, after osteogenic induction, gene expression analysis of osteogenic markers *ALPL* and *COL1A1* was performed.

Results: Osteoblasts isolated from frozen samples maintained proliferative activity and differentiation capacity similar to those isolated from fresh bone. Deep-freezing in DMSO-supplemented media was associated with a modest increase in population doubling time. Expression levels of osteogenic markers *ALPL* and *COL1A1* were significantly upregulated after 14 days of osteogenic induction. Time-lapse imaging demonstrated active cell migration and proliferation, while the presence of extracellular vesicles and nanotubes indicated preserved intercellular communication. Overall, the results support the maintenance of osteoblast viability and functional competence following freezing.

Conclusion: These findings suggest that deep freezing can preserve osteoblast viability and functional properties, supporting the potential biological value of deep-frozen bone.

Periprosthetic Fractures

Internal Fixation for Hip Femoral Periprosthetic Fracture

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Periprosthetic femoral fractures (PPF) following total hip arthroplasty represent a challenging clinical entity, particularly in elderly patients with compromised bone quality. This presentation reviews five representative cases of hip PPF managed with internal fixation, highlighting decision-making principles, surgical techniques, and clinical outcomes.

Patients ranged from 67 to 92 years of age and sustained fractures predominantly after low-energy falls, with one high-energy sports injury. Fracture patterns were classified according to implant stability and fracture location. In all cases presented, intraoperative assessment confirmed a stable femoral stem (Vancouver type B1 or C), emphasizing the critical importance of determining stem stability during surgery and maintaining readiness to convert to revision arthroplasty if instability is detected.

Management consisted of plate osteosynthesis using long reconstruction plates with adequate working length. Fixation strategies combined locking and non-locking screws, unicortical screws, and cerclage wires to optimize stability while preserving periosteal blood supply. Particular attention was given to biological fixation principles, including respect for soft tissues and avoidance of excessive stripping. Plates were selected to span the fracture adequately, often extending proximally to include the greater trochanter when required.

Follow-up up to one year demonstrated satisfactory fracture healing and functional recovery across cases. No early mechanical failures were reported. The cases underline that plate fixation for Vancouver B1 and selected type C fractures is a safe and effective treatment option when performed with meticulous technique.

Key considerations include thorough exclusion of low-grade infection, careful intraoperative evaluation of implant stability, anticipation of poor bone quality, and preparedness with a contingency plan. Although technically demanding, properly executed long-plate fixation with appropriate working length and biological principles can achieve reliable outcomes in periprosthetic femoral fractures around stable hip implants.

Revision for Hip Femoral Periprosthetic Fractures

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Periprosthetic femoral fractures (PPFs) after total hip arthroplasty are complex injuries in which treatment is primarily guided by stem stability and bone stock quality. Accurate differentiation between Vancouver B1, B2, and B3 fractures is critical, as misclassification may lead to mechanical failure.

In B2 fractures, characterized by a loose stem with adequate bone stock, stem revision is the gold standard. A long revision stem bypassing the fracture by at least two cortical diameters, achieving distal fixation in healthy diaphyseal bone, combined with cerclage wire stabilization, provides reliable mechanical support. Attention is required in transverse or short oblique fractures at the stem tip, where stress concentration may result in failure if treated with short, rigid plate constructs. In selected cases with an intact cement mantle, a cement-in-cement revision technique can be considered, ensuring proper cement handling and supplemental fixation.

B3 fractures involve stem loosening with severe bone loss and compromised bone quality. Management typically requires long modular uncemented stems with distal fixation, often supplemented by cerclage wires or trochanteric fixation. The acetabular component must also be evaluated and revised if unstable or worn. In elderly patients or in cases of extensive comminution, long cemented stems may offer a viable alternative. Structural allografts can be used selectively but are limited by availability, cost, and infection risk.

Comprehensive imaging, careful preoperative planning, and intraoperative reassessment are essential. Stem stability remains the key determinant of treatment. Long revision stems with secure distal fixation and adjunctive cerclage wiring provide the most consistent outcomes, while surgeons must remain prepared to modify the surgical plan based on intraoperative findings.

Management of Periprosthetic Acetabulum Fractures: a Systematic Review

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Introduction: Traumatic periprosthetic acetabular fractures (PAF) in patients with total hip arthroplasty (THA) are rare but severe injuries associated with significant morbidity. This systematic review aims to evaluate treatment strategies and assess the treatment and outcome of these patients.

Methods: A literature search was performed according to the PRISMA guidelines across multiple databases, including PubMed, EMBASE, Cochrane, Web of Science, and Scopus. Studies focusing on traumatic periprosthetic acetabular fractures in THA patients were included. Data on patient demographics, fracture characteristics, treatment modalities, and outcomes were extracted and analysed.

Results: 28 studies involving 106 patients were reviewed. 72% were female, with a mean age of 70 years. Treatment modalities varied, including open reduction and internal fixation (ORIF) (47%), acetabular revision (4%), reconstruction (14%), and conservative management (19%). Bone grafting was utilized in 47% of cases. ORIF with plate fixation was the most common approach, given the small amount of studies, no predictive factors for impaired outcome have been identified yet.

Conclusion: Guidelines on the management of traumatic PAF differs among centers. Due to the lack of data, no clear treatment recommendations can be made yet. More prospective, multicenter, studies are to establish evidence-based guidelines and predict treatment outcomes more reliably.

Management of Periprosthetic Fractures of the Femur Following Total Hip Arthroplasty: Review Analysis

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Background: Periprosthetic femoral fractures (PFFs) represent one of the most challenging complications following total hip arthroplasty (THA). Their incidence continues to rise globally in parallel with increasing life expectancy, expanding indications and growing number of performed THA. Data analyses from national arthroplasty registries (the Swedish Arthroplasty Register and the UK National Joint Registry) show that PFFs are among the leading causes for revision surgeries after THA, particularly beyond the first postoperative year. The reported cumulative risk ranges from approximately 0.4% to 3.5% after primary THA and increases significantly after further revision procedures. Intraoperative fractures occur more frequently in uncemented implants and during revision surgery, whereas postoperative fractures predominantly result from low-energy trauma in the geriatric population especially among osteoporotic patients. The clinical burden of PFFs is merely the tip of the iceberg which extends well beyond technical surgical complexity, including high morbidity and mortality, prolonged hospitalization, and significant healthcare expenses. The etiopathogenesis is multifactorial in origin, involving advanced age (patients older than 65 years), female sex, osteoporosis, rheumatoid arthritis, Paget's disease, increased time since implantation, implant design, stem fixation method, stem malalignment, history and number of previous surgeries at the same region, osteolysis and aseptic loosening. Contemporary treatment strategies require restoration of femoral anatomical alignment with a stable implant, bone stock sufficiency, promote fracture union, minimize complications, enable early mobilization and joint movement. Classification systems, especially the Vancouver classification and the novel Unified Classification System (UCS), are essential tools guiding treatment decisions and mitigating communication between surgeons.

Objective: The objective of this review is to provide a comprehensive, evidence-based review of current concepts in the assessment and management of PFFs following THA with an emphasis on diagnostic approaches, classification-guided treatment strategies, surgical decision-making, and clinical outcomes.

Materials and methods: A narrative evidence-based review methodology was employed using publications indexed in PubMed and MEDLINE from January 2000 to December 2025, including systematic reviews, key expert consensus papers, meta-analyses, registry-based studies, prospective and retrospective cohort analyses. Studies focused on epidemiology, risk factors, diagnostic evaluation, classification systems, surgical and conservative management, and postoperative outcomes were prioritized. Registry datasets, including

national arthroplasty databases, were used to assess epidemiological trends and treatment distribution based on the Vancouver classification system.

Results: Most PFFs occur following low-energy trauma among the geriatric population burdened with multiple comorbidities. Precise diagnosis relies on detailed history taking, including pre-injury pain suggestive of component loosening, comprehensive physical examination, and high-quality imaging studies. Standard radiographs of the entire femur and pelvis remain mandatory, while computed tomography specifies fracture morphology, cement mantle integrity, and bone stock. Despite advanced imaging techniques, a mismatch between preoperative and intraoperative assessment of stem stability remains significant, with studies showing up to 20% misclassification rates (Corten et al., 2009). The Vancouver classification remains the most widely used decision-making framework. Type A fractures, localized to the trochanteric region, are frequently stable and commonly managed conservatively with protected weight bearing, although displaced or symptomatic nonunions may require ORIF using cables, wires, or specialized plates. Type B fractures represent the most complex category with 3 subtypes. Registry data indicate predominance of B1 and B2 subtypes. B1 fractures (stable stem) are generally treated by ORIF using locking bridging plates and adjunctive cerclage wiring or cortical strut allografts. B2 fractures (unstable stem with good bone stock) necessitate revision arthroplasty with long, distally fixed stems, often combined with supplemental internal fixation. B3 fractures (unstable stem with poor bone stock) require advanced reconstructive strategies, including modular revision stems, structural allografts, or proximal femoral replacement. Type C fractures (distal to the stem) are managed according to conventional fracture fixation principles, typically with bridge plating, and rarely with retrograde nailing, while accounting for stress risers. Across studies, conservative treatment is associated with inferior outcomes, including higher rates of malunion, nonunion, medical complications, and is generally reserved for non-ambulatory or medically unfit patients. Complications such as infection, construct failure, and implant loosening remain common. Mortality rates are comparable to those observed after fragility hip fractures, with one-year mortality approaching 10% in several cohorts (Bhattacharyya et al., 2007; Boylan et al., 2018). Functional outcomes are frequently compromised, with a substantial proportion of patients failing to regain pre-injury mobility. Studies using validated scores such as the Oxford Hip Score and Harris Hip Score consistently demonstrate lower postoperative function compared to revision THA for aseptic loosening. B3 fractures show the poorest prognosis, reflecting severe biological and mechanical challenges.

Discussion: Management of PFFs demands a multidisciplinary approach that integrates trauma principles with revision arthroplasty techniques. The main challenge remains to accurately differente between stable and loose implants, since inappropriate classification directly affects surgical treatment approach and outcome. Literature consistently highlights the limited reliability of radiographic assessment alone, thus emphasising the need for intraoperative evaluation. Locking plates and biological fracture fixation have improved union rates, while modern modular revision stems allow restoration of stability in complex B2 and B3 fractures. Treatment decisions must extend beyond radiological classification and include patient's medical history, bone quality, and functional expectations. Minimization of surgical delay and early mobilization are critical determinants of outcome, as prolonged immobilization contributes to complications and mortality. Radiographic healing does not

necessarily translate into patient's restoration of pre-fracture independence which is why functional recovery still remains a major issue. Furthermore, the high prevalence of frailty and cognitive impairment among the geriatric population highlights the need for geriatric co-management. Recent studies also explore adjunctive biological therapies, including anabolic agents such as teriparatide, particularly in selected minimally displaced fractures or in patients with poor bone quality, although evidence remains limited and requires further investigation. Future directions include improved preoperative diagnostic tools for implant stability, registry-based outcome standardization, and optimized treatment algorithms tailored to patient-specific risk profiles.

Conclusion: Periprosthetic femoral fractures following THA represent an increasingly prevalent and mutifaceted clinical challenge characterized by high morbidity, significant mortality, and demanding highly specialized surgical management. Evidence from contemporary literature supports a classification-driven yet individualized treatment approach focused on accurate assessment of implant stability, restoration of mechanical alignment, preservation or reconstruction of bone stock, and early mobilization. Surgical treatment remains the standard of care for most fracture types, with ORIF strategies for stable implants and revision arthroplasty with or without ORIF for loose components. Despite advances in surgical techniques, functional recovery remains limited for many patients, especially among the geriatric population and those with compromised bone stock. Continued refinement of diagnostic accuracy, multidisciplinary perioperative care, and evidence-based surgical strategies is essential to improve long-term outcomes in this expanding patient population.

Keywords: Periprosthetic femur fracture, fragility hip fracture, total hip artrhoplasty, Vancouver classification, Unified Classification System, implant stability, ORIF, CRIF, geriatric co-management, multidisciplinary approach, biological therapies, anabolic agents, teriparatide

Distal Bypass Length Does Not Predict Stability in Vancouver B2/B3 Periprosthetic Fractures Treated with a Modular Tapered Revision Stem

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Background: Conventional surgical principles recommend distal stem bypass of at least two cortical diameters to ensure mechanical stability in Vancouver B2/B3 periprosthetic femoral fractures. However, this recommendation is largely based on experience with non-modular cylindrical revision stems rather than contemporary modular tapered designs. The purpose of this study was to evaluate radiographic outcomes using the Revitan® Modular Revision Hip System and to assess whether the extent of distal stem bypass predicts postoperative stability.

Materials and methods: A retrospective analysis of 49 patients treated for Vancouver B2/B3 fractures over a three-year period (single surgeon) was performed. All cases were managed using the Zimmer Biomet Revitan® Modular Revision Hip System, a modular tapered, fluted, distally fixed stem designed for diaphyseal fixation. Minimum follow-up was 12 months. Radiographic assessment included stem subsidence (average, measured three times by orthopedic surgeon and radiologist) and fracture union. Distal bypass was quantified relative to the commonly cited two-cortical-diameter threshold by comparing the length of the stem extending beyond the most distal fracture line with the femoral diameter at that level. Its relationship with subsidence and fracture healing was analysed.

Results: Mean distal bypass was 70.6 mm compared with a mean two-cortical-diameter threshold of 64.2 mm, corresponding to approximately 10% greater distal extension. The ≥2 cortical diameter criterion was achieved in 54% of cases, while 82% demonstrated bypass ≥1.5 diameters. Median stem subsidence was 2 mm, and 46% of patients showed no subsidence. No statistically significant association was found between distal bypass length and subsidence. Radiographic fracture nonunion was present in 6% patients and showed no correlation with distal bypass length or subsidence.

Conclusion: Distal bypass length did not predict stem subsidence or fracture healing. Design-specific biomechanics may outweigh absolute bypass length in contemporary modular revision systems.

Keywords: Periprosthetic femoral fracture; Vancouver B2/B3; Modular tapered revision stem; Distal bypass; Stem subsidence

Femoral Periprosthetic Fractures

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Periprosthetic fractures represent a major challenge in modern orthopedics and traumatology due to the continuous increase in the number of implanted endoprostheses and the prolonged life expectancy of the population. The main challenges in treatment are bone quality and the general condition of the patient, since most patients are of advanced age with numerous comorbidities and osteoporosis, which complicates implant fixation. Assessment of prosthesis stability is also very important: whether the existing prosthesis has remained stable or whether loosening has occurred, which directly dictates the type of surgery. The operations are lengthy and require specific revision implants as well as a high level of surgical expertise. The goal of treatment is to enable early weight-bearing in order to avoid complications of prolonged immobilization, which is often difficult to achieve in fragile bones. This article provides an overview of the techniques used in our institution in the treatment of these challenging fractures, with reference to contemporary perspectives from recent literature.

Internal Fixation in Periprosthetic Distal Femoral Fractures After Total Knee Arthroplasty – Indications, Surgical Strategy and Outcomes

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Background: Periprosthetic fractures around the knee following total knee arthroplasty (TKA) occur in 0.2–2.5% of cases and represent a complex surgical challenge. Osteoporosis, comminution, limited bone stock, and very distal fracture extension complicate management. Reported nonunion rates range from 9–15%, and fixation failure remains a significant concern. Optimal treatment depends on fracture pattern, implant stability, and bone quality.

Purpose: To analyze treatment decision-making and compare single versus double locking plate fixation in periprosthetic distal femoral fractures (PPF) after TKA, with particular emphasis on fracture type (Su classification), bone quality, and implant stability.

Methods: Preoperative assessment included evaluation of pre-fracture pain, standard radiographs, and CT imaging to assess osteolysis and occult fractures, which are frequently underestimated preoperatively. Treatment strategy was guided by fracture morphology, bone stock, medial comminution, and implant fixation status.

Single lateral locking plate fixation was used in patients with good bone stock and Su type I–II fractures. Double locking plate fixation was indicated in cases of poor bone quality, comminution, medial column deficiency, and Su type III fractures.

Surgical approaches included midline incision (allowing future revision TKA), or combined minimally invasive lateral and open medial approaches, emphasizing preservation of blood supply and minimizing infection risk.

Results: Single locking plating provides satisfactory outcomes in selected cases but demonstrates limitations in very distal fractures and in the presence of medial comminution. Reported nonunion rates reach 12% with high failure rates in Su type III fractures. Double locking plate fixation demonstrated reliable stability, with union rates up to 95% and good functional outcomes. It provides improved mechanical stability, particularly in osteoporotic bone and fractures with compromised medial support, allowing early mobilization and rehabilitation. Reported complications include delayed union (7.4%), nonunion (3.7%), and fixation failure (26%) in selected series.

Conclusion: Treatment of periprosthetic distal femoral fractures after TKA must be individualized based on implant stability, fracture configuration, and bone quality. While

single lateral locking plating remains appropriate for Su I–II fractures with good bone stock, double locking plate fixation offers superior stability and reliable healing in osteoporotic, comminuted, and very distal (Su III) fractures. Careful preoperative planning and appropriate surgical strategy are essential to optimize outcomes in this challenging patient population.

Complex Revision for the Unreconstructable Knee Femoral Periprosthetic Fracture – A Case-Based Presentation

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Background: Although periprosthetic fractures around the knee remain relatively rare, their incidence is steadily increasing due to the growing number of primary and revision knee arthroplasties. The majority of femoral periprosthetic fractures can be successfully managed with osteosynthesis, most commonly using intramedullary fixation or extramedullary fixation with locking plates. In complex fracture patterns, particularly very distal fractures, dual plating techniques have demonstrated favorable outcomes.

Purpose: This presentation aims to address the challenging subgroup of unreconstructable femoral periprosthetic fractures around the knee, where standard osteosynthesis techniques are not feasible or have failed.

Methods: Through a series of selected case presentations, combined with a review of the recent literature, we analyse different surgical strategies for the management of unreconstructable femoral periprosthetic fractures. The cases illustrate various indications for complex revision procedures, including severe comminution, poor bone stock, implant loosening, and previous failed fixation.

Results: The presented cases demonstrate that complex revision solutions can provide satisfactory clinical and functional outcomes when appropriately indicated. However, these procedures are associated with a higher rate of complications, including infection, mechanical failure, and soft tissue-related problems, which require careful perioperative planning and meticulous surgical technique.

Conclusion: Unreconstructable femoral periprosthetic fractures around the knee represent a rare but increasingly encountered clinical problem. Case-based analysis supported by current literature suggests that complex revision procedures offer viable treatment options in selected patients. Awareness of potential complications and their management is essential to optimize outcomes in this demanding patient population.

Periprosthetic and Peri-implant Fractures

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With increasing of living age, increased number and percentage of elderly people in population and therefore more and more patients undergoing osteosynthesis and arthroplasty due to fractures and degenerative changes, there has been an increase in periimplant and periprosthetic fractures involving more and more body regions.

Due to specific entities of these injuries and patients' situation they are faced with, orthopaedic trauma surgeons need to recognize these distinct condition and patterns, understand the importance of fixation allowing for early range of motion and be familiar with surgical concepts in treatment, many times with combining principles of fracture fixation, endoprosthetic replacement and exchange, augmented mechanical fixation and biological enhancement of healing potential. Frailty and sarcopenia add to other comorbidities to make these patients acutely susceptible to blood loss anemia. Many of these patients are on anticoagulation, which predisposes them to increased blood loss at the time of injury and together with some other medication impact on delaying fracture repair. Surgical and medical co-management should therefore be considered for reversal of anticoagulation. Fracture stabilization usually helps to prevent ongoing blood loss, and these patients therefore benefit from timely surgery. Unnecessarily delaying surgery in frail patients has a negative impact on mortality and outcomes. There are several classifications and algorithms about these fractures. One of the simplest and clinically very practical for the periprosthetic fractures is Baba classification – it helps very much in clinical decision about treatment and distinguish among cemented versus noncemented type and stable versus unstable prosthetic components. In periimplant fractures crucial points are whether the past fractures are healed or not and the biologic potential (vitality and soft tissue condition). CT with addition of specific protocols (3D reconstruction, angiography, segmentation-deduction etc.) and not seldom MRI are of crucial help in strategic decision about treatment, together with patient's condition and compliance, particularly regarding frailty, dementia, osteoporosis, sarcopenia and prior or current periprosthetic/implant infection and decubital ulcers. In the presentation, typical ways of treatment with the unstable and non-healed situations together with repetitive fractures and tips and tricks for implant removal and exchange are presented. As the concept of "keep elderly mobile" is of utmost importance in reducing the mortality and improving the clinical outcome, augmented fixation with temporary or permanent help of cement and the use of metal and bony enhancement (struts) might be of additional benefits in solving periimplant and periprosthetic fractures and avoiding possible further complications. With increasing of endoprosthetic and implant inserting operations, numbers of not only revision procedures due to loosening or infections, but also combinations of all the possible biologic and mechanical complications is rising, too. Effective solving of these problems could be achieved only with a teamwork of not only orthopaedic trauma surgeons, but also many other specialists like emergency doctors,

anesthesiologists, cardiologists, endocrinologists, specialists in blood disorders, orthogeriatricians, nutritionists, infectious diseases doctors etc. as well as effective rehabilitation and nursing teams. We have to be aware but also about the more and more need of palliative care.

Orthogeriatric Surgery

Management of Periprosthetic Fractures of the Femur Following Total Hip Arthroplasty: Review Analysis

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Background: Periprosthetic femoral fractures (PFFs) represent one of the most challenging complications following total hip arthroplasty (THA). Their incidence continues to rise globally in parallel with increasing life expectancy, expanding indications and growing number of performed THA.

Data analyses from national arthroplasty registries (the Swedish Arthroplasty Register and the UK National Joint Registry) show that PFFs are among the leading causes for revision surgeries after THA, particularly beyond the first postoperative year. The reported cumulative risk ranges from approximately 0.4% to 3.5% after primary THA and increases significantly after further revision procedures. Intraoperative fractures occur more frequently in uncemented implants and during revision surgery, whereas postoperative fractures predominantly result from low-energy trauma in the geriatric population especially among osteoporotic patients.

The clinical burden of PFFs is merely the tip of the iceberg which extends well beyond technical surgical complexity, including high morbidity and mortality, prolonged hospitalization, and significant healthcare expenses. The etiopathogenesis is multifactorial in origin, involving advanced age (patients older than 65 years), female sex, osteoporosis, rheumatoid arthritis, Paget's disease, increased time since implantation, implant design, stem fixation method, stem malalignment, history and number of previous surgeries at the same region, osteolysis and aseptic loosening.

Contemporary treatment strategies require restoration of femoral anatomical alignment with a stable implant, bone stock sufficiency, promote fracture union, minimize complications, enable early mobilization and joint movement. Classification systems, especially the Vancouver classification and the novel Unified Classification System (UCS), are essential tools guiding treatment decisions and mitigating communication between surgeons.

Objective: The objective of this review is to provide a comprehensive, evidence-based review of current concepts in the assessment and management of PFFs following THA with an emphasis on diagnostic approaches, classification-guided treatment strategies, surgical decision-making, and clinical outcomes.

Materials and methods: A narrative evidence-based review methodology was employed using publications indexed in PubMed and MEDLINE from January 2000 to December 2025, including systematic reviews, key expert consensus papers, meta-analyses, registry-based studies, prospective and retrospective cohort analyses. Studies focused on epidemiology, risk

factors, diagnostic evaluation, classification systems, surgical and conservative management, and postoperative outcomes were prioritized. Registry datasets, including national arthroplasty databases, were used to assess epidemiological trends and treatment distribution based on the Vancouver classification system.

Results: Most PFFs occur following low-energy trauma among the geriatric population burdened with multiple comorbidities. Precise diagnosis relies on detailed history taking, including pre-injury pain suggestive of component loosening, comprehensive physical examination, and high-quality imaging studies. Standard radiographs of the entire femur and pelvis remain mandatory, while computed tomography specifies fracture morphology, cement mantle integrity, and bone stock. Despite advanced imaging techniques, a mismatch between preoperative and intraoperative assessment of stem stability remains significant, with studies showing up to 20% misclassification rates (Corten et al., 2009).

The Vancouver classification remains the most widely used decision-making framework. Type A fractures, localized to the trochanteric region, are frequently stable and commonly managed conservatively with protected weight bearing, although displaced or symptomatic nonunions may require ORIF using cables, wires, or specialized plates. Type B fractures represent the most complex category with 3 subtypes. Registry data indicate predominance of B1 and B2 subtypes. B1 fractures (stable stem) are generally treated by ORIF using locking bridging plates and adjunctive cerclage wiring or cortical strut allografts. B2 fractures (unstable stem with good bone stock) necessitate revision arthroplasty with long, distally fixed stems, often combined with supplemental internal fixation. B3 fractures (unstable stem with poor bone stock) require advanced reconstructive strategies, including modular revision stems, structural allografts, or proximal femoral replacement. Type C fractures (distal to the stem) are managed according to conventional fracture fixation principles, typically with bridge plating, and rarely with retrograde nailing, while accounting for stress risers.

Across studies, conservative treatment is associated with inferior outcomes, including higher rates of malunion, nonunion, medical complications, and is generally reserved for non-ambulatory or medically unfit patients. Complications such as infection, construct failure, and implant loosening remain common. Mortality rates are comparable to those observed after fragility hip fractures, with one-year mortality approaching 10% in several cohorts (Bhattacharyya et al., 2007; Boylan et al., 2018). Functional outcomes are frequently compromised, with a substantial proportion of patients failing to regain pre-injury mobility. Studies using validated scores such as the Oxford Hip Score and Harris Hip Score consistently demonstrate lower postoperative function compared to revision THA for aseptic loosening. B3 fractures show the poorest prognosis, reflecting severe biological and mechanical challenges.

Conclusion: Periprosthetic femoral fractures following THA represent an increasingly prevalent and mutifaceted clinical challenge characterized by high morbidity, significant mortality, and demanding highly specialized surgical management. Evidence from contemporary literature supports a classification-driven yet individualized treatment approach focused on accurate assessment of implant stability, restoration of mechanical alignment, preservation or reconstruction of bone stock, and early mobilization. Surgical treatment remains the standard of care for most fracture types, with ORIF strategies for

stable implants and revision arthroplasty with or without ORIF for loose components. Despite advances in surgical techniques, functional recovery remains limited for many patients, especially among the geriatric population and those with compromised bone stock. Continued refinement of diagnostic accuracy, multidisciplinary perioperative care, and evidence-based surgical strategies is essential to improve long-term outcomes in this expanding patient population.

Direct Anterior Approach Total Hip Arthroplasty: A Single-Center Experience From University Hospital Merkur

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Aim: To present the surgical technique of direct anterior approach THA and to analyse our institutional experience during its adoption, with particular focus on complications and the learning curve.

Methods: A retrospective review was performed of consecutive primary THAs carried out using the DAA at our institution. Perioperative parameters and complications were analysed. Evaluated parameters included operative time, intraoperative complications, early postoperative complications, and length of hospital stay.

Results: A total of 650 patients underwent primary THA using the DAA between March 2020 until February 2026. During the early adoption phase, longer operative times and a higher incidence of approach-related complications were observed. With increasing surgical experience, operative time decreased significantly, complication rates declined, and postoperative recovery parameters improved. No increase in major complications was observed following completion of the learning curve.

Conclusion: Direct anterior approach THA is a reproducible muscle-sparing technique that can be safely implemented in routine clinical practice. Although a distinct learning curve exists, structured adoption leads to improved efficiency and reduced complications. Our experience supports the role of DAA THA as a minimally invasive approach within modern fast-track hip arthroplasty protocols.

Extended Direct Anterior Approach in Revision Hip Arthroplasty

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Aim: Revision total hip arthroplasty (THA) remains technically demanding due to altered anatomy, bone loss, and prior surgical scarring. The extended direct anterior approach (eDAA) has gained interest as an alternative extensile exposure for selected revision cases. This abstract evaluates its safety profile and appropriate indications in hip joint revision arthroplasty.

Methods: A review of contemporary literature and institutional experience with revision THA performed via the eDAA was conducted. Indications included aseptic loosening of acetabular and/or femoral components, instability, adverse local tissue reaction, selected periprosthetic fractures, and second-stage reimplantation for infection. Technical adaptations—such as proximal and distal femoral extension, capsular release, and stepwise soft-tissue mobilization—were analyzed. Perioperative metrics and complication profiles were assessed to determine procedural safety.

Results: The eDAA provided adequate exposure for acetabular reconstruction and modular femoral revision in appropriately selected patients. Supine positioning allowed fluoroscopic guidance to optimize component positioning and leg length restoration. Reported complication rates were comparable to established revision approaches, with no significant increase in neurovascular injury when meticulous technique and familiarity with anterior anatomy were maintained. While operative time may increase during the learning curve, blood loss, postoperative stability, and early functional recovery were acceptable and consistent with published revision benchmarks.

Conclusion: The extended direct anterior approach is a safe and reproducible option for revision THA in selected indications, particularly isolated acetabular revision, modular femoral revision, instability, and staged reimplantation. Appropriate patient selection and surgeon experience are critical to maintaining acceptable safety outcomes.

"Orthogeriatric Co-Management" – A Multidisciplinary Approach to the Treatment of Elderly Patients With Fractures

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"Orthogeriatric Co-Management" represents an integrated, multidisciplinary approach to patients with fractures in the elderly. By introducing "Orthogeriatric Co-Management" into everyday practice, early mortality (30-day), complications are significantly reduced, the functional status of the patient is improved, and the hospital stay is shortened without increasing the total cost of treatment.

Hip fracture in the elderly is a major public health problem in the world. Mortality within a month and in the first year after injury is almost 25%, and only a third of patients achieve the functional result as before the fracture. Given the poor results, the traditional clinical approach (focus on anesthetic preparation of the patient for surgery and fixation of the fracture by the surgeon) is not adequate. As a result of the above, it is evident that patients with hip fractures in older age need a multidisciplinary treatment approach that, in addition to treatment by an orthopedist/traumatologist, anesthesiologist, physiotherapist and nurse, also requires a geriatrician/internal medicine specialist, nutritionist, social worker, psychiatrist in order to make their recovery as successful as possible and to reduce mortality in the first year. Considering that hip fractures in older age burden health systems around the world with 1.5% of the health budget, introducing "Orthogeriatric Co-Management" into everyday practice would relieve the financial burden on the health system.

Impact of Direct Oral Anticoagulants (NOACs/DOACs) on Emergency Surgical Treatment of Pertrochanteric Fractures

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Introduction: Since the EU approved new direct oral anticoagulants (NOAC, DOAC, direct thrombin inhibitors and factor Xa inhibitors) in 2010, the proportion of patients who are urgently hospitalized for proximal femoral fractures, and in whom NOAC was previously introduced into chronic therapy, has been increasing year by year. Since all of the mentioned new anticoagulants (NOAC) do not have an antidote, and those that do have one are not available in everyday practice due to their high cost, we often find ourselves in a situation where it is difficult to condition patients for the upcoming emergency surgical treatment.

Material and methods: This is a retrospective analysis, data were collected from the BIS IT system of the Karlovac General Hospital and "Medical History" from 2021-2025. The analysis was performed using standard statistical methods.

The following parameters were examined for each cohort:

1. time to surgery, 2. type of anesthesia, 3. chosen osteosynthesis method, 4. amount of transfusion, 5. early surgical complications, 6. comparison of comorbidities of both groups according to the Charlson index. 7. length of hospital stay, 8. intrahospital mortality.

Results: A total of 460 patients were analyzed, of which 12.6% (n= 58) patients were on NOAC at the time of fracture while 402 (87.4%) patients were not on NOAC anticoagulant therapy. Intrahospital mortality was 11 (2.4%). During the study, the following results were obtained: The time to surgery in patients on NOAC therapy was significantly longer than in those not on anticoagulant therapy, the number of transfusion doses was higher in patients with NOAC therapy. We did not find significant differences in early postoperative surgical complications as well as in-hospital mortality, and an increase in the number of days of hospitalization was also observed in the group of patients on NOAC therapy.

Conclusion: A significant increase in the time to emergency surgery has been observed. Since this is a very important predictive factor that affects mortality and morbidity in these patients, the justification for increasing, or deciding to defiantly reduce the time window to osteosynthesis is still under expert interdisciplinary consideration. The use of drugs with antidotes and urgent determination of NOAK plasma concentrations are considered in emergency patient preparation.

Towards National Guidelines for the Management of Trauma in the Geriatric Population

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In the world, as well as in the Republic of Croatia, there is a pronounced trend of population aging. In parallel, the number of traumatic injuries in the elderly is increasing, most often caused by low-energy falls, with a high incidence of comorbidities, polypharmacy and cognitive disorders. The treatment of such patients goes beyond the framework of standard surgical treatment of fractures and requires an organized, multidisciplinary approach.

Contemporary orthogeriatric models are based on rapid diagnostics, adequate preoperative preparation in collaboration with other specialists, surgical treatment in the optimal time frame and early postoperative initiation and planning of rehabilitation, in order to reduce complications and return the patient to their previous level of independence.

With the increase in the number of such patients, there is a need for clear organizational models and the development of national guidelines that can standardize practice and enable the transfer of experience between institutions.

Through many years of clinical, educational and scientific work, the Zagreb Hospital Center has developed a system of care that includes continuous improvement of prevention, diagnostics, surgical procedures and rehabilitation of geriatric trauma patients. Accumulated experience, developed protocols and cooperation with numerous domestic and foreign institutions have created the prerequisites for formal recognition of this role at the national level.

Based on fulfilling the prescribed professional, scientific, personnel and technical criteria, the Ministry of Health of the Republic of Croatia awarded the Institute the title of reference center for geriatric traumatology. These criteria include many years of experience in improving care, proven international cooperation, continuous scientific production in indexed journals, participation in scientific projects, application of new treatment methods, as well as appropriate professional and educational capacities, space and modern medical and technical equipment.

The status of a reference center thus represents a confirmation of the work done so far, but also an obligation to further development, education and the creation of recommendations that will contribute to the quality of care for elderly trauma patients throughout Croatia.

DAIR Without Borders: A New Multimodal Approach in the Treatment of Acute Periprosthetic Hip Infections

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Introduction: Debridement, antibiotic therapy, and implant retention (DAIR) is now the accepted treatment for acute periprosthetic hip infection. Compared with revision surgery, this approach allows for less surgical trauma, faster patient recovery, and lower treatment costs. However, the success of the DAIR method in practice varies significantly, especially in patients who have undergone surgery for fractures, have revision prostheses, have numerous associated comorbidities, or infections caused by resistant and polymicrobial pathogens.

In such high-risk groups, standard DAIR protocols are often insufficient to completely eliminate the infection, primarily due to the difficulty in controlling the bacterial biofilm on the implant surface and the limited effect of systemic antibiotic therapy at the local level. Therefore, we have developed a structured, multimodal DAIR protocol that combines thorough surgical debridement, targeted application of antiseptics and antibiotics, and postoperative local irrigation of the joint cavity.

Materials and methods: We present experiences with the application of the new protocol in 16 consecutive patients treated for acute hip infection in the period from 2022 to 2026. The majority of patients belonged to the high-risk group, with pronounced comorbidities and complex surgical procedures.

Results: Successful infection control with retention of the implant was achieved in 15 of 16 cases, with no significant treatment-related complications.

Conclusion: The obtained results indicate that by applying a structured and extended DAIR approach, very good results can be achieved even in demanding clinical situations. This multimodal approach represents a safe and effective way of treatment and opens up new possibilities for the preservation of implants in patients with acute periprosthetic infection of the hip. Further prospective studies are needed to confirm these results and further improve existing therapeutic protocols.

Angiosarcoma Localized Around a Total Hip Arthroplasty Mimicking Periprosthetic Osteolysis: A Case Report

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Introduction: Malignant tumors around endoprostheses are extremely rare, and angiosarcoma is a particularly aggressive and diagnostically deceptive entity. The aim is to present a case of angiosarcoma around a total hip arthroplasty (TEP), which presented clinically and radiologically as repeated hematoma and rapidly progressing periprosthetic osteolysis.

Case report: Male, 78 years old, TEP of the left hip in 2006. After falling on the left side (03/2018), he developed progressive pain and swelling of the upper leg. CT describes the periprosthetic collection; evacuation of the "hematoma" was performed without cytological evidence of infection or malignancy. During the following months, a rapid progression of osteolysis around the femoral component was noted along with recurrent hematomas, multiple surgical evacuations and repeated biopsies with initially negative findings. MSCT angiography shows preserved patency of blood vessels without clear neovascularization; due to suspicion of bleeding, selective embolization was performed. Despite the measures, clinical deterioration occurs (anemization, mass growth, progression of osteolysis). In severe destabilization of the patient, explantation of the endoprosthesis and extensive necrectomy were performed; high-grade angiosarcoma of the periprosthetic tissue was confirmed histopathologically. The patient died due to multiorgan failure in 12/2018.

Discussion: This case highlights the "red flags" for a rare malignant etiology after TEP: recurrent hematomas without a clear cause, rapidly progressing osteolysis, and unexplained persistence of the mass with negative microbiological findings. Metal artifacts significantly limit imaging methods, and sampling can be falsely negative, contributing to delay in diagnosis. Sporadic cases of angiosarcoma in the vicinity of TEP with a poor prognosis are described in the literature.

Conclusion: Although extremely rare, angiosarcoma should be included in the differential diagnosis of atypical periprosthetic osteolysis and recurrent hematomas after TEP. Early multidisciplinary workup and repeated, targeted histopathological sampling (from vital lesion margins) are crucial for timely diagnosis.

Sports Traumatology

A Structured Approach to the Treatment of KD3 Knee Dislocations: Advantages of Early Repair Compared With Delayed Reconstruction

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Introduction: Knee dislocations of the KD3 type (injuries of both cruciate ligaments and one collateral ligament) represent critical events with a high risk of permanent disability. Traditional delays of surgical intervention to allow soft tissue recovery often result in fibrosis and loss of proprioception. This paper analyzes the contemporary shift toward early surgical repair and biological augmentation in comparison with conventional delayed reconstruction.

Early repair vs. delayed reconstruction: The main focus of the paper is on the advantages of early intervention (within 10 to 14 days after injury). The early approach enables primary repair of avulsions and peripheral structures, thereby preserving native ligament tissue and mechanoreceptors. In contrast, delayed reconstruction (after 6 or more weeks) often requires more extensive use of allografts or multiple autografts due to the inability to reposition retracted ligament remnants, which increases surgical trauma and prolongs biological integration.

Surgical protocol and biological optimization: In the early phase, we apply the All-Inside technique with cortical fixation, along with specific biological modifications:

- Augmentation, not just replacement: The use of InternalBrace technology to protect the fresh repair allows more aggressive rehabilitation without the risk of tissue elongation.
- Fertilization of the biological environment: Application of autologous bone slurry and PRP at insertion sites to accelerate healing of native structures, along with additional techniques to biologically enhance tendon-to-bone integration (“Candy Stripe” graft).

Outcome objectification: Comparison of the two approaches is performed through quantitative MRI diagnostics—T2 mapping, which in the early repair group demonstrates better ligamentization and more preserved collagen architecture. Clinical outcomes are monitored via a digital platform, enabling precise analytics of return to function (PROMs, VAS) and early detection of potential delays in rehabilitation.

Conclusion: An early structured approach to the treatment of KD3 knee dislocations, focused on repair and biological augmentation, offers superior stability and better functional outcomes compared to delayed reconstruction. The key to success lies in early recognition of the injury, precise surgical technique, and digitally guided postoperative rehabilitation.

Keywords: KD3 knee dislocation, early repair, delayed reconstruction, InternalBrace, biological augmentation.

Arthroscopically Treated Tibial Spine Fracture with Anterior Cruciate Ligament Avulsion of the Right Knee and Tibial Spine Fracture with Posterior Cruciate Ligament Avulsion of the Left Knee in the Same Patient – A Case Report

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Background: Tibial spine fractures are uncommon injuries in adults and are typically associated with anterior cruciate ligament (ACL) avulsion. Posterior cruciate ligament (PCL) tibial avulsion fractures are considerably rarer. The simultaneous occurrence of ACL tibial spine avulsion in one knee and PCL tibial spine avulsion in the contralateral knee in the same patient is exceptionally rare and sparsely described in the literature.

Case presentation: A 34-year-old male sustained multiple injuries following a motorcycle accident. Clinical and radiological assessment revealed a tibial spine fracture with anterior cruciate ligament avulsion of the right knee and a tibial spine fracture with posterior cruciate ligament avulsion of the left knee. Additionally, bilateral fibular head fractures and a distal radius fracture of the right wrist were diagnosed.

Fourteen days after the injury, arthroscopic fixation was performed. The right knee ACL tibial spine avulsion and the left knee PCL tibial spine avulsion were treated using suture fixation with button stabilization. Bilateral fibular head fractures were managed non-operatively. The distal radius fracture was treated conservatively.

Results: At 7-month follow-up, the patient demonstrated full range of motion in both knees, stable ligamentous examination, and excellent functional outcome without subjective instability. Radiographic evaluation confirmed fracture union.

Conclusion: This case highlights the rare presentation of contralateral tibial spine avulsion fractures involving the ACL in one knee and the PCL in the other knee in the same patient. Arthroscopic suture and button fixation provided stable fixation and enabled excellent functional recovery. Early recognition and minimally invasive arthroscopic management can result in favorable outcomes even in complex bilateral knee injuries.

Arthroscopy-Assisted Percutaneous Osteosynthesis of Knee Joint Fractures

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Introduction: Intra-articular fractures of the knee joint include fractures of the tibial plateau, distal femur, and patella, and represent a surgical challenge due to the need for anatomical reduction and preservation of soft tissue integrity. Certain types of fractures of the mentioned structures can be treated arthroscopically. Arthroscopically assisted minimally invasive osteosynthesis has emerged as a technique that enables direct visualization of the joint with a significant reduction in soft tissue trauma, as well as additional possibilities for addressing intra-articular knee pathology. The aim of this paper is to present the results and modern principles of treating patients with this technique, along with a literature review and case presentations.

Methods: A retrospective review was conducted of patients who underwent arthroscopically assisted minimally invasive osteosynthesis of intra-articular knee fractures in 2024 and 2025. Indications included Schatzker type I–III tibial plateau fractures, femoral condyle (Hoffa) fractures, and tibial eminence avulsions.

The surgical technique included arthroscopic assessment of the joint, evacuation of hematoma, direct visualization of the fracture, use of specific techniques for fracture reduction, and percutaneous fixation using cannulated screws with fluoroscopic control. Other intra-articular soft tissue pathology was treated during the same procedure. Clinical follow-up included radiological assessment of healing, range of motion (ROM), and perioperative complications.

Results: A total of 16 patients with different types of fractures were operated on. Anatomical reduction was achieved in all patients without the need for conversion to an open procedure. All fractures healed properly without secondary displacement within the expected time period. Functional and aesthetic outcomes were excellent, with no complications. Concomitant intra-articular lesions were identified in a significant proportion of patients.

Conclusion: This technique enables excellent functional and aesthetic outcomes in properly selected patients, with an exceptionally rapid functional recovery, and provides the possibility of intraoperative assessment of the entire knee joint and treatment of concomitant pathology.

Arthroscopic FHL Transfer as Biological Augmentation with Percutaneous Repair of the Achilles Tendon in Chronic Missed Rupture

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The treatment of chronic or unrecognized Achilles tendon rupture remains a subject of debate. The Achilles tendon is the largest and strongest tendon in the human body, the one most frequently injured, and accounts for approximately 20% of all tendon ruptures. The treatment of acute ruptures is controversial, ranging from conservative treatment with various protocols to mini-open or open surgical procedures. Chronic, unrecognized ruptures are no simpler. Numerous surgical methods have been proposed, achieving good postoperative clinical results. These techniques include direct tendon suture, V-Y plasty, turndown flap, the use of tendons in reconstruction such as the peroneus brevis, flexor digitorum longus, flexor hallucis longus (FHL), semitendinosus, gracilis tendon, or the use of synthetic material.

In this paper, I present the technique of percutaneous Achilles tendon suturing with biological augmentation by arthroscopic FHL transfer. This is a minimally invasive concept that meets the principles of minimal surgical aggressiveness, minimal postoperative complications, and almost complete functional recovery.

Arthroscopy-Assisted Surgical Stabilization of the Acromioclavicular Joint in Acute, Chronic, and Revision Settings

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Injuries of the acromioclavicular (AC) joint represent a significant proportion of traumatic injuries of the shoulder girdle, particularly in a younger and physically active population and in athletes participating in contact and high-energy sports. The most common mechanism of injury involves a direct blow to the lateral aspect of the shoulder with the arm in adduction, resulting in rupture of the acromioclavicular (AC) and/or coracoclavicular (CC) ligaments, with consequent disturbance of vertical and horizontal joint stability. The Rockwood classification is most commonly used for grading these injuries, whereby type I and II injuries are considered stable and are generally treated conservatively. In contrast, types IV, V, and VI imply pronounced instability and dislocation of the distal clavicle and are generally an indication for surgical treatment. Injuries of types III and V remain a matter of debate, especially in young, working, and athletic patients, in whom functional demands are high. In the last decade, there has been a significant increase in the use of arthroscopically assisted techniques for AC joint stabilization. Such an approach enables minimally invasive surgery, precise visualization of the coracoid base, better control of implant positioning, and simultaneous management of associated intra-articular lesions of the glenohumeral joint. In addition to the biomechanical advantages of anatomical reconstruction of the CC complex, increasing emphasis is being placed on restoring horizontal and rotational stability, which has proven crucial for long-term functional outcomes. The aim of this paper is to present contemporary indications, operative principles, and technical aspects of arthroscopically assisted operative treatment of AC joint stabilization in the acute, chronic, and revision setting, with a review of current scientific evidence on functional and radiological outcomes and complications. An acute injury is defined as one occurring within three weeks from the initial trauma. In this period, the biological healing potential of the ligamentous complex is preserved, which allows the application of reparative and reconstructive procedures aimed at anatomical reduction and stabilization. In high-grade injuries, particularly Rockwood types IV to VI, surgical treatment is considered the standard, whereas in type III injuries the decision is made individually, depending on the functional demands of the patient, the presence of horizontal instability, and persistent pain and functional limitation. Arthroscopically assisted stabilization in the acute phase most commonly includes anatomical reduction of the distal clavicle and stabilization of the coracoclavicular complex using suspensory systems. Advantages of the arthroscopic approach include reduced surgical trauma, lower risk of soft tissue infection, precise implant placement under direct visualization, and the possibility of diagnosing and treating associated lesions, such as SLAP lesions or rotator cuff lesions. Recent meta-analyses comparing operative and conservative treatment of high-grade injuries (Rockwood III–V) show that operative treatment results in statistically significantly better functional outcomes in the period from 24 to 48 months.

Better radiological reduction has also been observed, with a smaller AC joint width and a lower incidence of residual dislocation or subluxation. Nevertheless, rates of return to sport and work in most studies remain comparable between operatively and non-operatively treated groups, which emphasizes the need for an individualized approach when making decisions regarding surgical treatment. A chronic injury is defined as a condition lasting longer than three to six weeks from the initial trauma, particularly in patients in whom conservative treatment has not led to satisfactory clinical improvement. After three weeks, the healing potential of the AC and CC ligaments is significantly reduced, which makes primary reparative techniques less effective. Chronic AC joint instability clinically presents with persistent pain, a feeling of instability, reduced strength and endurance, scapular dyskinesis, and aesthetic deformity. In the chronic phase, anatomical reconstruction of the coracoclavicular ligaments with biological augmentation using a graft is recommended. Hybrid techniques, which combine suspensory systems with a tendon graft, have shown more favorable biomechanical properties and better control of anterior and superior clavicular translation. Special emphasis in chronic cases is placed on reconstruction of the acromioclavicular capsule and restoration of horizontal and rotational stability. According to biomechanical studies, approximately 80% of horizontal stability is provided by the superior-posterior capsuloligamentous complex, which explains why isolated vertical stabilization is often insufficient for long-term success. The success of surgery in the chronic phase therefore depends on restoration of the overall stability of the AC joint, including the structures of the deltotrapezoidal fascia. Revision surgery of the AC joint is indicated in cases of loss of reduction, mechanical failure of the implant, persistent horizontal instability, fractures of the coracoid or clavicle, and chronic pain with significant functional limitation. Revision procedures require a thorough preoperative analysis of the causes of failure, including radiological assessment of implant position, bone tunnel width, and integrity of the coracoid. In revision procedures, it is recommended to minimize the number and diameter of new bone tunnels and to use alternative anchoring techniques in the case of compromised existing tunnels. In many cases, it is necessary to consider the use of tendon grafts and ensure reconstruction of the horizontal component of stability. Due to the increased risk of complications, revision procedures require a high level of surgical experience and an individualized therapeutic approach. Despite the large number of described surgical techniques, there is no single superior method for all cases. The evolution of operative strategies shows a clear shift toward anatomical reconstruction with a minimally invasive approach and an increasing emphasis on horizontal stability. Arthroscopically assisted techniques today represent the standard in many centers due to better control of the coracoid base, less surgical trauma, the possibility of combined procedures, and potentially faster recovery. The key to a successful outcome is not only achieving vertical stability, but restoring the overall biomechanics of the AC joint, including capsular structures and dynamic scapular stability. In conclusion, arthroscopically assisted AC joint stabilization represents an effective and biomechanically sound method for the treatment of high-grade injuries in the acute phase. In chronic cases, anatomical reconstruction with biological augmentation and mandatory addressing of horizontal instability is indicated. Revision procedures require an individualized approach with particular caution due to the increased risk of complications. The choice of therapeutic strategy must be individualized, taking into account the degree of injury, patient functional demands, time elapsed since injury, and the experience of the

surgeon. Long-term success depends on precise anatomical reconstruction, stable fixation, and a structured rehabilitation program.

Surgical Repair of Acute Distal Biceps Tendon Rupture

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Introduction: Distal biceps tendon (DBT) ruptures are relatively rare injuries, mostly among middle aged men, during sports activities or manual labor. In acute DBT rupture with high demanding patients, surgery is a method of choice. Two most represented surgical methods are one incision and two incision technique, combined with various bone-tendon fixation techniques. We did retrospective study of operated patients with acute DBT rupture in our institution during last four years using single incision and endobutton method for fixing tendon to the bone.

Methods: During period from January 2022 to December 2025, we surgically treated 29 patients with acute DBT rupture. In all of these cases we used one incision technique with reinsertion of tendon using cortical button and interference screw (BicepsButton, Arthrex). All patients had postoperatively hinged elbow brace during 6 weeks with 2 weeks only passive movements, and next 4 weeks active flexion with restrictions. We observed injury mechanism, time to operation, functional outcomes, complications and return to work or sports activities after surgery.

Results: We treated 29 male patients average age 44 years (min. 30, max. 61). Only 10 % of our patients had sport related injury while other 90 % were injuries related to lifting heavy load. Non dominant hand was injured in 70% of cases. Rupture of DBT was diagnosed mostly with ultrasound (65%), some had MRI (20%) and some were operated based on clinical findings (15%). Average time from injury to operation was 16 days (min. 2, max. 77). Average time of hospitalization for our patients was 3 days (min 2 days, max. 8 days). ROM and strength were satisfactory for 28 patients. We observed one patient with limited extension (12°). We didn't observe any wound infections, reruptures or sinostosis. We observed 1 heterotopic ossification without functional impairment, and four transitory neural praxia (LACN). All operated patients returned to daily activities after 2 months. Return to work and sports was after 3-4 months period. We used isokinetic testing for five of our patients and have determined that they have the same flexion and supination strength in both hands, operated and non-operated one.

Discussion: In high demanding patients, our choice of early surgery, single incision surgical technique, tendon fixation methods and postoperative rehabilitation protocol with hinged elbow brace, provided us functional outcomes, complication rates and time to return to preinjury activities similar as in other studies of this type.

Conclusions: In high demanding patients, early diagnosis of DTB rupture combined with early surgery, provides good functional outcomes with low complications incidence.

Keywords: distal biceps tendon, tendon injury, biceps button, single incision

From Primary Reconstruction to Revision: Radial Collateral Ligament Reconstruction of the Thumb in an Adolescent Athlete

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Introduction: The radial collateral ligament (RCL) is increasingly recognized as a key stabilizer of the thumb metacarpophalangeal (MCP) joint, accounting for approximately 10% of thumb ligament injuries. RCL disruption results in unopposed adductor and flexor muscle forces, leading to pain, instability, and recurrent active subluxation. While conservative management has historically been the standard of care, surgical repair and reconstruction using tendon grafts are now more frequently employed in symptomatic cases. However, data regarding revision RCL reconstruction remain extremely limited, with only isolated cases reported in the literature.

Case presentation: A 17-year-old male competitive handball player presented with progressive pain and instability of the thumb MCP joint over three months following an acute sports injury. Ultrasound demonstrated a complete RCL rupture. Initial treatment consisted of cast immobilization for four weeks. Despite the initial treatment, his symptoms worsened over six months, prompting surgical RCL reconstruction using a palmaris longus autograft with suture augmentation and Arthrex SwiveLock fixation. Return to sport was permitted at three months after surgery. One year postoperatively, the patient sustained a reinjury and reported recurrent pain and instability. MRI revealed graft rupture and early degenerative joint changes. Revision reconstruction was performed using a partial flexor carpi radialis tendon with suture augmentation. Postoperative recovery was uneventful, and the patient is currently pain-free and undergoing rehabilitation.

Conclusion: Although uncommon, RCL injuries can lead to pronounced lateral instability and functional impairment if inadequately treated, particularly in high-demand athletes. Revision thumb ligament reconstruction is technically demanding due to limited bone stock, altered anatomy, and constraints on graft selection. Moreover, it remains a largely unexplored field, with scarce clinical guidance available.

Injuries in a Professional Football Club: The Impact of Organisational and Personnel Changes

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In professional football, injuries represent one of the most significant challenges. They directly affect player's health as well as team's success and finances. Injury occurrence is influenced by numerous internal and external risk factors that interact in a complex manner.

Internal risk factors are player-related and include previous injuries, age, sex, anthropometric characteristics, and aerobic fitness levels. External risk factors are related to the environment and the organisational system in which players perform, including training load, match congestion, climatic conditions, travel-related fatigue, sports equipment, and variability in pitch quality.

While many studies aim to quantify load-dependent variables, very few focus on how organizational oscillations like changes in team personnel, especially head coach, can affect injury occurrence.

From the 2016/2017 to the 2023/2024 season, we conducted a longitudinal observational study collecting data on injury occurrence in an elite senior professional football team competing in the Croatian national top tier. Among external injury risk factors related to personnel changes, we specifically examined the association between coaching turnovers and changes in injury incidence.

During study the team experienced 16 coaching changes, averaging 2 per season. All injuries were continuously monitored, regularly recorded and saved in the club's database. They were analysed over three-time frames: for each season, 2 and 4 weeks after the coaching change.

Paired-sample *t*-tests were conducted separately for overall injuries and muscle injuries across the observed time frames. Total injury incidence increased by 27.7% and 35.4% in the two- and four-week periods following coaching turnovers, respectively. In contrast, muscle injuries showed smaller increases of 5.5% and 8.1% over the same periods. There were no statistically significant changes, but a medium effect size was reported when comparing overall injuries in 4 weeks and the season in general.

In the context of professional sport, it is important to emphasise that even modest trends may have meaningful practical implications. Accordingly, coaching and medical staff should exercise particular caution in managing training load and recovery strategies during periods of coaching transition.

Upper Extremity

Functional Non-operative Treatment of Humerus Fractures

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Upper extremity fractures offer a great opportunity for successive results with the non-operative treatment, but despite this more and more patients are operated on every year, with important number of complications.

Several cases with basic principles of non-operative functional treatment with pendular exercises and simple traction, together with functional bracing of humeral fractures are presented.

This type of treatment offers attractive, low demanding and effective way of care with low number of complications, it needs but respecting of basic principles, patient compliance and several check-ups in the clinics with active rehabilitation that can be managed by patients themselves.

Peri-implant Fractures in Upper Extremity

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Upper extremity fractures occur mainly in young, sportsly active population and in senior persons with increasing frailty and osteoporotic changes. Despite upper extremity offers a great opportunity for successive results with the non-operative treatment of fractures in this region, there are more and more patients undergoing upper extremity osteosynthesis (and arthroplasties). There are several reasons for that, probably mainly due to the increased living age and percentage of elderly people in population and due to the higher demands with the function of the upper extremity even in them. Consequently, there has been an increase in peri implant fractures involving particularly shoulder, humerus and elbow region, too. Despite osteosynthesis of the distal radius fractures is the most commonly performed procedure in the upper extremity, peri implant fracture in this region is not a common situation.

Patients co-morbidities, medication, functional and ASA status, together with CT and addition of specific protocols (3D reconstruction, angiography, arthrography, segmentation-deduction etc.) crucially affect strategic decision about treatment.

Solving peri implant fractures are not seldom demanding procedures. Surgeons need to be familiar with knowledge of osteosynthesis, as well as prosthetic insertion (in trauma mainly reverse arthroplasties are used). Removal of implants (particularly broken nails and screws) might be also demanding with the need of several tips and tricks. As forces and weightbearing are lower in comparison to the lower extremity, rehabilitation might look easier, but demands at least early pendular and assisted ROM exercises.

However, with a team approach in specialized centers, respecting principles and algorithms, these fractures can be successfully treated, being aware that patients' medical status and compliance significantly affect the final outcome.

Humeral Shaft Fractures with Radial Nerve Palsy – Treatment Options

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Purpose: To present radial nerve palsy associated with humerus fractures and to foster the decision making in treating such injuries.

Materials, methods and results: An up-to-date international literature review together with personal clinical experience

Conclusion: Radial nerve palsy associated with humeral fractures present a common problem with an incident range up to 32% especially in distal third of the upper arm. Knowing the anatomy of the radial nerve, understanding nature of soft tissues, having good surgical skills as well as continuous and clear communication with the patient may help us solve the situation to achieve a favourable outcome.

Scapulothoracic Dissociation with Acromioclavicular Separation – Case Report and Literature Review

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Scapulothoracic dissociation is a term used to describe a high-energy traumatic disruption of the scapulothoracic joint accompanied by injuries to the clavicle, scapula, acromioclavicular and sternoclavicular joints, and is often associated with serious neurovascular injuries. This injury is rare, but can lead to devastating consequences for the patient, including complete or functional loss of the arm, and in the most severe cases, death, and therefore early recognition and treatment are of critical importance. For cases in which scapulothoracic dissociation is accompanied by acromioclavicular separation (and not a clavicle fracture), there is no standardized treatment or customized implants, and therefore treatment requires a certain degree of improvisation and adaptation.

We will present a review of the literature with published surgical solutions, and then our case of a 29-year-old patient who suffered a scapulothoracic dissociation with acromioclavicular separation in a work accident - we describe the diagnostic procedure, the surgical treatment performed, and the final functional result.

When a Low-Energy Fall Results in Bilateral Scapular Fracture – A Rare Clinical Scenario

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Introduction: Scapular fractures are rare injuries that are generally associated with high-energy trauma. Simultaneous bilateral scapular fractures are even rarer and most commonly occur in the context of traffic accidents, convulsions, or electrical injuries. Their occurrence after a low-energy mechanism of injury has rarely been described and may lead to diagnostic oversight.

Case report: A case is presented of a 43-year-old previously healthy man who sustained bilateral scapular fractures after a ground-level fall during recreational sports activity. The clinical presentation was dominated by severe pain in the shoulder girdle region with inability to actively elevate the upper extremities. Radiological evaluation demonstrated simultaneous bilateral extra-articular fractures of the scapular body without associated intrathoracic injuries. The patient was treated conservatively with immobilization and structured rehabilitation, with complete functional recovery.

Discussion: A brief review of the available literature shows that most reported cases of bilateral scapular fractures are associated with high-energy or neuromuscular mechanisms, whereas low-energy causes are exceptionally rare. The presented case confirms that even an apparently benign mechanism of injury may result in a severe shoulder girdle injury.

Conclusion: In patients with marked shoulder girdle pain and restricted range of motion, the possibility of a scapular fracture should be considered even after a low-energy fall. Timely radiological diagnosis is essential for appropriate treatment planning and a favorable functional outcome.

Proximal Humerus Fractures – Controversies and Challenges

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Although proximal humerus fractures are very common (the third most frequent osteoporotic fracture), particularly in women older than 65 years, there is no consensus on the optimal treatment method for these injuries. Despite advances in surgical techniques and the development of modern implants, treatment outcomes often fail to meet the expectations of either clinicians or patients. The advantages of operative management have been called into question, and the role of surgery in the treatment of proximal humerus fractures remains the subject of considerable controversy. These controversies primarily concern the indications for surgery, as well as the decision between fixation techniques and arthroplasty in the management of these fractures, particularly in elderly patients. The introduction and widespread use of reverse total shoulder arthroplasty for three-part and four-part proximal humerus fractures has represented a paradigm shift in the operative treatment options. Ongoing debates include the surgical indications, the role of intramedullary fixation with or without additional augmentation, plate osteosynthesis with augmentation, and the role of reverse total shoulder arthroplasty. When choosing the treatment strategy, evidence-based methods should be applied, including the findings of recent randomized controlled trials that evaluate outcomes after proximal humerus fractures. Studies such as the PROFHER trial suggest that surgery often does not provide superior outcomes, while it carries a higher risk of complications. Before deciding on the treatment modality, it is crucial to thoroughly assess the patient's activity level, expected functional demands and range-of-motion requirements, comorbidities, bone quality, and perioperative risk. For a good surgical outcome, the surgeon's awareness of their own skill level and experience is also of key importance.

Reverse Arthroplasty in the Treatment of Proximal Humerus Fractures – Ten Years of Experience at the Department of Traumatology, University Hospital Centre Zagreb

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The trend toward increased life expectancy in the geriatric population confronts everyday clinical practice with the challenge of surgically treating comminuted fractures. Proximal humerus fractures in which reconstruction with osteosynthesis is not feasible require arthroplasty as the definitive treatment option. The aim of this presentation is to outline the complete treatment algorithm for proximal humerus fractures managed with reverse shoulder arthroplasty, together with an analysis of the results from the Department of Traumatology, University Hospital Centre Zagreb. The analysis of patients treated with reverse shoulder arthroplasty demonstrates a low rate of revision procedures, reduced postoperative pain, shorter periods of immobilization, and earlier initiation of rehabilitation. Prerequisites for a good functional outcome include appropriate patient selection, accurate radiological assessment of the fracture pattern and the patient's rehabilitation potential, as well as thorough familiarity with the surgical technique. In conclusion, reverse total shoulder arthroplasty represents a significant step forward in the management of comminuted proximal humerus fractures in the geriatric population.

Massive Reverse Hill-Sachs Lesion Treated with Femoral Head Allograft Reconstruction – A Case Report

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Introduction: Posterior glenohumeral dislocations are often underdiagnosed, potentially resulting in the formation of a massive reverse Hill-Sachs defect and ongoing functional impairment. Timely identification and appropriate surgical intervention are essential to restore shoulder stability and function.

Case report: A patient experienced a right shoulder injury following a fall. Initial assessment at a regional hospital led to a diagnosis of adhesive capsulitis, and referral to physical therapy was made. After two months without clinical improvement, the patient presented to our institution. Plain radiographs indicated a humeral head defect with a suspected bony Bankart lesion. Clinical examination demonstrated a severely restricted range of motion: abduction 40°, forward flexion 40°, external rotation 0°, internal rotation 5°. ASES score was 22/100. MSCT confirmed a massive reverse Hill-Sachs defect of the humeral head.

Surgical intervention was indicated and performed, consisting of open reduction of the right glenohumeral joint, reconstruction of the humeral head with a structural allograft secured using two Acutrak Mini screws, refixation of the subscapularis tendon, and tenotomy of the long head of the biceps tendon.

A femoral head allograft from the bone bank was contoured intraoperatively to match the dimensions and shape of the humeral head defect.

At the six-month follow-up, radiographs demonstrated a congruent glenohumeral joint without evidence of graft resorption or collapse. Clinical examination revealed improved range of motion: abduction 70°, forward flexion 100°, external rotation 0°, and internal rotation to the S5 vertebral level. The ASES score improved to 72/100, accompanied by substantial pain reduction and functional improvement.

Conclusion: For chronic posterior shoulder dislocation with a massive reverse Hill-Sachs lesion, reconstruction with a structural femoral head allograft represents an effective joint-preserving approach. This method restores articular congruency and stability, providing a valuable alternative to arthroplasty, especially for younger and active patients.

Complex Elbow Injuries – A Case Series of Four Surgically Treated Patients

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Introduction: Complex elbow injuries include dislocations with associated fractures and ruptures of the collateral ligaments and represent a significant surgical challenge. Inadequate treatment may result in chronic instability and loss of function. Contemporary literature emphasizes the importance of timely surgical management of all components of the injury combined with early mobilization. The aim of this study is to present four cases of complex elbow instability treated with collateral ligament reconstruction using suture anchors.

Case report: We present four patients with complex elbow injuries. The first patient sustained a dislocation with rupture of the UCL and RCL and avulsion of the radial epicondyle. The second patient sustained a sports-related injury with a multifragmentary fracture of the humeral trochlea, intra-articular fragments, and complete rupture of the UCL with contusion of the ulnar nerve. The third patient presented with a dislocation associated with a radial head fracture and rupture of both collateral ligament complexes. The fourth patient presented one month after a dislocation with fracture of the coronoid process and radial head and rupture of the UCL and RCL, having initially been treated at another institution. All patients underwent collateral ligament reconstruction using suture anchors, with osteosynthesis or fragment removal performed as indicated.

Results: After surgery and rehabilitation, all patients achieved a full range of motion in the elbow without residual instability. One patient initially developed a contracture, which resolved with physical therapy.

Conclusion: Reconstruction of the elbow collateral ligaments with suture anchors after complex injuries provides favorable functional outcomes. Our results are consistent with recent literature showing excellent and good outcomes in more than 90% of patients treated with this technique. Early surgical intervention combined with stable fixation and a protocol-based rehabilitation program is crucial for achieving recovery.

Dislocations and Fractures of the Elbow Joint

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Objective: To present the surgical methods of treating elbow injuries at General Hospital Pula in the period 2020–2025.

Method: Retrospective analysis of surgically treated elbow injuries over a five-year period. The indications for surgical treatment were elbow instability after reduction, fracture of the radial head and/or ulnar coronoid process, and intra-articular fracture of the distal part of the humerus. In the given period, we surgically treated 37 patients.

Materials: For osteosynthesis of articular humeral fractures we used precontoured LC plates in two planes, headless compression screws (Herbert screws), the radial head was fixed with 1.7 mm or 2.3 mm screws and appropriate plates or replaced with a prosthesis, and the ligamentous apparatus and joint capsule were reconstructed using suture anchors, transosseous sutures, and a buttress screw in larger coronoid fragments of Mason type III.

Results: Postoperatively, satisfactory stability of the elbow joint was achieved, with good functional outcomes after completed physical therapy and rehabilitation.

Conclusion: Stable fixation of bony fragments, achieved by using appropriate osteosynthesis materials and good surgical technique, together with reconstruction of the ligamentous apparatus and joint capsule, allows mobilization of the joint immediately after the procedure and attainment of a greater final range of motion with a better and faster course of recovery.

Keywords: elbow, dislocation and fracture, radial head fracture

Refracture and Peri-Implant Forearm Fracture Treated With Reosteosynthesis via the Thompson Approach: A Case Report

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Introduction: Refracture and periplate fracture of the forearm after osteosynthesis in the early phase of healing is not a frequent occurrence. Taking this into account, and bearing in mind that a diaphyseal forearm fracture requires anatomic reduction, re-osteosynthesis is risky in terms of healing and the final functional outcome. In addition, approaches to the forearm are diverse, and the literature mostly states that for fractures of the middle third of the radius the preferred approach is the anterior (Henry) approach.

Case report: After a ground-level fall, a 40-year-old female patient sustained a fracture of the mid-diaphysis of the radius and ulna. Primary osteosynthesis was performed with plates and screws using the Thompson approach for the radius and an approach through the muscle interval between flexor and extensor carpi ulnaris for the ulna. After initial uneventful healing and functional recovery, three months later the patient sustained another fall, resulting in a periplate fracture of the radius and a refracture of the ulna.

Treatment and outcome: We decided on re-osteosynthesis using the same surgical approaches as in the primary osteosynthesis. In the proximal diaphyseal region of the radius, we reused the same, previously drilled screw holes. The motor branch of the radial nerve within the supinator muscle was not exposed. The patient was followed for one year and six months. At the end of treatment, forearm function and range of motion were complete. All fracture lines healed primarily except for one, which healed by delayed primary union.

Conclusion: With careful technique, the plate can be safely positioned on the proximal third of the radius using the Thompson approach. Furthermore, in anatomical regions with limited bone stock, the drilled screw holes from the primary osteosynthesis can be reused.

Keywords: periplate fracture, forearm refracture, motor branch of the radial nerve

Management of Severe Hand Injuries

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Objective: The aim of this paper is to demonstrate how hand injuries can lead to functional incapacity of the hand and, consequently, to a reduction in the patient's everyday practical, creative, and social abilities. Perhaps because they are so common, or because they involve small bones and are therefore often considered minor injuries, these fractures are frequently left to less experienced members of the medical team. Unfortunately, the outcomes of hand fracture treatment are not universally good, and the incidence of stiffness, malunion, prolonged functional disability, and economic loss is rather alarming. Nowhere else in the locomotor system is function so closely linked to anatomical structure as in the hand. Therefore, proper initial assessment and clearly defined treatment principles are of crucial importance. The initial assessment and primary care of an injured hand are key, as this is when the surgeon has the best opportunity to accurately determine the extent of damage and to plan restoration of the disturbed anatomy, that is, re-establishment of its original state. Many authors emphasize that the fate of the hand largely depends on the judgment of the physician who first examines the patient. Maximizing functional recovery should be the goal of treatment for every hand injury, and this can only be achieved if the injury is assessed in the context of the patient's individual needs and lifestyle. Crush injuries of the hand and fingers require special attention. It is necessary to assess the severity of soft-tissue damage and its viability, as well as any associated injuries to bone, tendons, joints, blood vessels, and nerves. Assessment of finger viability is of paramount importance, whereas reconstruction of vessels, nerves, and tendons may, in selected cases, be performed in a delayed fashion, depending on the condition of the tissues and the general condition of the patient. In crush injuries, reduction and stable fixation of the phalanges must be performed. In the emergency setting, reduction and fixation with Kirschner wires is most commonly used. Adequate coverage and reconstruction of the skin envelope is of vital importance. When dealing with a defect on a single digit or amputation of the distal phalanx of the thumb, the method of choice is often a neurovascular island flap, which enables high-quality soft-tissue reconstruction while preserving sensibility.

Case report: We present two cases of severe hand injuries that confirm the importance of thorough initial assessment and appropriate selection of therapeutic strategy with the aim of achieving maximal functional recovery of the injured hand. In the first case, there was a crush injury of the second and third fingers of the left, dominant hand. After initial management in the emergency department and continuation of treatment in another institution, amputation was proposed because of the severity of the injury to the second finger. The patient refused the proposed procedure, and in a third institution a surgical revision was performed, the osteosynthesis material was removed, and the soft-tissue defect was covered with a neurovascular island flap, which allowed preservation of the finger and hand function. In the second case, the patient injured the left hand with a circular saw, with

amputation at the level of the base of the distal phalanx of the thumb and of the distal phalanx of the third finger. Instead of re-amputation, reconstruction of the thumb stump was performed with a neurovascular flap, while the defect of the third finger was treated with a V–Y plasty. This reconstructive approach achieved preservation of functional finger length and a satisfactory functional and aesthetic result.

Conclusion: In patients with severe hand injuries, age, involvement of the dominant hand, occupation, and a detailed initial medical history are key factors in treatment planning. Functional demands differ significantly depending on whether the patient is, for example, an office worker, a broker, a professional or amateur musician, a surgeon, or a carpenter. It is essential to obtain precise information about the injury itself: how it occurred and the mechanism of injury—whether it is a crush, tear, avulsion, or a clean, sharp injury. Particular attention is required in the case of human bites, which are notoriously dangerous injuries. It is important to determine where the injury occurred (clean environment, industrial facility, stable, garage), whether it happened in the workplace, how much time elapsed before medical care, and what was done in the meantime. The clinical examination must be systematic and detailed. The area of tenderness must be precisely defined in order to assess the extent of soft-tissue damage. Both open and closed injuries require careful evaluation of potential tendon, nerve, and vessel injury, the presence of foreign bodies, the degree of crushing, lacerations or skin defects, and any exposure of deeper structures. Wound assessment must include its location, relation to skin creases, viability of skin flaps, the extent of true tissue loss, and the degree of contamination. These factors decisively influence the choice of therapeutic strategy and reconstructive procedure and ultimately determine the aesthetic and functional outcome of treatment.

Keywords: hand injuries, initial assessment, reconstruction, neurovascular flap, functional recovery

Complex Bony Injuries of the Hand – A Case Series of Three Surgically Treated Patients

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Introduction: Complex bony injuries of the hand and wrist, including perilunate dislocations and dislocations of the carpometacarpal (CMC) joints, represent rare but serious injuries with a risk of permanent loss of function. Studies indicate the importance of timely diagnosis and surgical fixation combined with early mobilization to achieve a favorable functional outcome. The aim of this paper is to present three cases of complex bony injuries of the hand and wrist.

Case report: The first patient sustained a scaphoid fracture with lunate dislocation after a bicycle fall. He was operated on on the fifth day after injury by reduction and fixation of the lunate with three Kirschner wires and osteosynthesis of the scaphoid with a compression screw. The Kirschner wires were removed after eight weeks, with no secondary displacement and a satisfactory range of motion. The second patient presented with a trans-scaphoid perilunate dislocation with an intra-articular fracture of the distal radius. Reduction of the lunate with triquetrolunate fixation using two Kirschner wires and osteosynthesis of the scaphoid with a screw was performed, with wire removal after two months and good functional recovery. The third patient, a polytrauma victim, had dislocation of the 2nd–5th CMC joints, a fracture of the fifth metacarpal, and multifragmentary fractures of the carpal bones; he was treated with reduction and fixation using Kirschner wires and wrist arthrodesis, with hardware removal after two months and a positive response to rehabilitation.

Results: In all three cases, stable reconstruction of the bony and articular structures was achieved, with a satisfactory functional outcome after rehabilitation.

Conclusion: Timely surgical management of perilunate injuries and multiple CMC dislocations with stable fixation enables preservation of hand function. Our results are consistent with the literature, which reports mean Mayo wrist scores of 85 to 88 points in surgically treated perilunate injuries and complete functional recovery in CMC dislocations fixed with Kirschner wires.

Perilunate Dislocations – A Case Series from a Regional Trauma Center

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Background: Perilunate dislocations are rare but severe wrist injuries, typically resulting from high-energy trauma. Delayed diagnosis and inadequate treatment may lead to chronic instability, median nerve neuropathy, and post-traumatic arthritis. Early recognition and operative management are essential for optimal functional recovery.

Methods: We present a case series of three patients with perilunate dislocation treated operatively at General Hospital Dubrovnik. The mean patient age was 44 years. All injuries resulted from highenergy mechanisms. Open reduction and internal fixation with ligament repair were performed in all cases. In one patient, carpal tunnel release was performed secondarily due to evolving median nerve symptoms, while in the remaining two patients carpal tunnel release was performed during the primary surgical procedure.

Results: All patients achieved good functional outcomes, with satisfactory wrist range of motion and grip strength at follow-up. No cases of persistent median neuropathy, recurrent instability, or early degenerative changes were observed.

Conclusion: Prompt surgical treatment of perilunate dislocations provides favorable functional outcomes. Concomitant or staged carpal tunnel release should be considered depending on the presence and progression of median nerve symptoms. Keywords: perilunate dislocation; wrist trauma; carpal tunnel release; median nerve; open reduction; ligament repair.

Anabolic Steroids as a Hidden Risk Factor for Radial Head Avascular Necrosis after Monteggia Injury

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We present the case of a 46-year-old woman with a neglected Monteggia fracture–dislocation resulting in non-union, occurring in the setting of long-term corticosteroid misuse and secondary osteoporosis. The patient was admitted through the emergency department with severe functional impairment and was found to have multiple concomitant skeletal injuries, including vertebral compression fractures, rib fractures, an old pubic fracture, and bilateral hip osteoarthritis. The initial forearm injury had occurred two months prior to presentation and remained untreated.

Clinical examination revealed forearm deformity, persistent pain, and limited range of motion, while imaging confirmed fracture non-union and extensive osteoporotic changes. Surgical management included vertebroplasty and open reduction with internal fixation of the forearm. Postoperative care involved analgesic therapy, gradual tapering of corticosteroids, antiplatelet therapy with gastroprotection, and structured rehabilitation.

This case highlights the significant impact of chronic corticosteroid abuse on bone integrity and emphasizes the importance of early diagnosis and timely fracture management to prevent long-term disability.

External Fixation of a Radial Fracture – RLT With 1 + 1 Schanz Screws and a K-Wire

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Closed reduction under fluoroscopic guidance and FE external fixation of a radial fracture were performed – RLT percutaneously with 1 + 1 Schanz screw plus a K-wire through the styloid. Early mobilization of the fingers and pronation–supination, together with MIPO and minimal disruption of the circulation, resulted in rapid healing and removal of the external fixator in the day surgery unit after 5 weeks, comparable to the duration of cast immobilization in conservative treatment. The method has been applied in more than 20 patients.

External Fixation of a Humeral Fracture With 1 + 1 Schanz Screws and TENS or K-Wires

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Closed reduction under fluoroscopic guidance and FE external fixation of humeral fractures are presented, performed percutaneously with 2 Schanz screws plus intramedullary TENS for diaphyseal fractures, or transfixation to the scapula with K-wires for subcapital fractures. Early mobilization and MIPO with minimal disruption of the circulation result in rapid healing and removal of the external fixator after 4–6 weeks, comparable to the duration of immobilization in conservative treatment, and removal of the TENS after 3 months in the day surgery unit. The method has been applied in more than 20 patients.

Complex Elbow Injury with Multiple Posttraumatic Complications – A Case Report

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Complex elbow injuries with intra-articular fractures and ligamentous instability require early surgical stabilization combined with appropriate rehabilitation to achieve optimal functional recovery. Such injuries often pose a rehabilitation challenge because of post-traumatic complications, and the simultaneous occurrence of multiple complications is strongly associated with poorer functional outcomes.

We present a patient with elbow dislocation and a multifragmentary fracture of the ulnar coronoid process who was treated surgically in two stages. After the first procedure, residual elbow instability persisted, and therefore additional stabilization with collateral ligament reconstruction was performed in the second stage. During the postoperative period, the patient developed heterotopic ossifications around the elbow and complex regional pain syndrome with multiregional involvement of the shoulder, elbow, and hand, along with axonotmesis of the ulnar nerve. These complications markedly complicated the rehabilitation process. The clinical course was characterized by severe pain, edema, limited range of motion of the elbow, shoulder, wrist, and hand, clinical signs of ulnar nerve injury, autonomic nervous system–mediated changes, and poor tolerance of rehabilitation procedures.

The patient underwent a prolonged, individualized rehabilitation program that included pharmacologic pain management, various modalities of physical therapy, and continuous, carefully dosed kinesiotherapy. Despite the complex postoperative course and the concurrent presence of multiple complications, a satisfactory functional recovery was achieved, with preservation of the patient's independence in activities of daily living and subjective satisfaction with the treatment outcome.

This case highlights the importance of timely surgical stabilization, early recognition and management of post-traumatic complications, and prompt initiation of an individually tailored rehabilitation program in the treatment of complex elbow injuries.

Suprascapular Nerve Block as a Therapeutic Bridge in the Rehabilitation of Post-Traumatic Brachial Plexus Injury – A Case Report

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Chronic neuropathic pain following cervical radiculopathy and traumatic brachial plexus injury can significantly limit functional recovery. Intense pain often prevents adequate participation in physical therapy, thereby further impairing motor restoration. A suprascapular nerve block may serve as a “rehabilitative window,” reducing pain and enabling effective therapy.

A 46-year-old truck driver developed sharp neck pain radiating to the right arm after a fall (NRS 9, PainDETECT 24). His medical history included prior C6–C7 anterior cervical surgery. Neurological examination revealed shoulder abduction 0/5, elbow flexion and extension 0/5, and hand grip strength 2/5. Electromyoneurography (EMNG) demonstrated a severe C5–C6 radicular lesion, while C6–C7 showed signs of reinnervation. MRI and ultrasound of the brachial plexus revealed a postganglionic traction lesion at C6–C7 with preserved trunk and fascicular continuity.

An ultrasound-guided suprascapular nerve block was performed, resulting in pain reduction from NRS 9 to NRS 1 and enabling intensive physical therapy.

Following rehabilitation, motor function improved, with shoulder abduction 1/5, elbow flexion 3/5, and hand grip strength 5/5. EMNG demonstrated improvement in chronic neurogenic findings. The analgesic effect lasted approximately six weeks. Pain during folow-up was managed with tramadol/paracetamol and pregabalin with NRS scores of 2 at one month and 6 at three months.

In this case, the suprascapular nerve block acted as a therapeutic bridge, facilitating rehabilitation and functional recovery despite chronic neurogenic injury. In complex post-traumatic cervicobrachial syndromes, this block may have both diagnostic and therapeutic value and may represent an important component of a multimodal management strategy.

Lower Extremity

The Feasibility Of Navigation-Assisted Fracture Surgery For Foot Trauma: A Systematic Review

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Intoduction: Minimally invasive surgery became the standard of care for foot fractures, but complex cases remain challenging. The introduction of intra-operative CT imaging has improved outcomes, and navigation-assisted surgery may offer additional benefits. This study aims to assess the feasibility of navigation-assisted surgery for foot trauma.

Methods: Following the PRISMA-guidelines, the PubMed database was searched for clinical studies on computer-assisted/navigated foot and ankle fracture surgery by the utilization of MeSH-terms. Patient and fracture characteristics as well as surgical techniques and outcome were analyzed. No language restrictions were applied.

Results: 37 studies on navigated fracture care for foot injuries were identified, with 4 selected for analysis. A total of 53 fractures were described, including calcaneal (n=33), talar (n=10), and 5th metatarsal (n=10). Patient age ranged from 20 to 51 years, and 75% of studies used 3D navigation. Reference guides were attached to the calcaneus. Mean operation time ranged from 13 to 61 minutes, none of the navigated screws was misplaced and no conversion to open surgery was required. Moreover no complications or infections have been reported.

Conclusion: Navigation-assisted fracture treatment of foot injuries is a promising technique that allows for more precise screw placement, less soft tissue injury, and improved outcomes with fewer complications. Fractures of the calcaneus, talus and metatarsals can be treated in isolation or in combination. Prospective comparative studies are needed to further explore the feasibility of this technique in trauma cases.

Navicular Bone Fractures of the Foot: Influence of Patient and Trauma Factors on Treatment and Outcomes

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Introduction: Navicular bone fractures of the foot are significant injuries that can lead to long-term disability. Treatment approaches vary between institutions, ranging from open reduction and plate fixation to non-operative management (NOM). This study aims to assess outcomes after operative and non-operative treatment and the impact of patient and trauma-related factors.

Methods: Patients hospitalized and treated for navicular bone fractures at a level-I trauma center in central Europe over a 3-year period were identified from a prospective foot & ankle trauma registry. Patient characteristics, treatment strategies, and outcomes were analyzed and compared between those treated operatively and with NOM.

Results: A total of 42 patients with a mean age of 49 years were identified. Ten patients underwent operative management (K-wire fixation, n=4; plate/screws, n=4; external fixator, n=2). Two patients required compartment release on admission. Most patients were polytraumatized, injured from falls, and had multiple foot fractures/luxations. Seven patients were operated within 24 hours; the others after 4 days. No differences were found between open and minimally invasive treatments. Six patients required multiple surgeries. Patients had an average hospital stay of 19.9 days, with 30 patients transferred to a rehabilitation clinic.

Conclusions: Navicular bone fractures of the foot often result from high-impact trauma. Operative management is necessary for about 25% of patients, with many requiring multiple interventions and intensive rehabilitation. Further prospective multicenter studies are needed to determine optimal treatment of these fractures with focus on timing and extent of surgery (e.g. minimal invasive vs. open).

Outcome After Femoral Neck Osteosynthesis Is Driven by Fracture Morphology and Reduction Quality Rather Than Implant Choice: A Single-Center Experience

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Introduction: The optimal fixation strategy for femoral neck fractures remains controversial, particularly in younger and biologically active patients where preservation of the native hip joint is preferred. Despite the availability of multiple fixation techniques, treatment outcomes remain variable and are likely influenced by several interacting factors. The objective of this study was to determine the relative impact of implant choice, fracture morphology and fracture reduction quality on clinical outcomes following femoral neck osteosynthesis.

Materials and methods: A retrospective single-center analysis of all surgically treated femoral neck fractures over a five-year period was performed with minimum one - year follow – up. Arthroplasty procedures were analyzed descriptively, while osteosynthesis cases treated with multiple cannulated screws, dynamic hip screw (DHS / DHS + screw) or a fixed-angle gliding device were evaluated in detail. Fractures were classified according to Pauwels classification. Fracture reduction quality was recorded (adequate vs suboptimal). Complications included implant failure, pseudoarthrosis, femoral head osteonecrosis (FHON), and femoral neck shortening. A composite complication endpoint was analysed.

Results: Osteosynthesis represented 5.9% of all surgically treated femoral neck fractures and was mainly performed in younger patients (mean age 55.8 years), whereas arthroplasty predominated in older individuals (mean age 79.5 years). The fixed-angle gliding device was the most frequently used implant (58%). Overall complication rates were lower in the fixed-angle gliding device group compared with other fixation methods (41.9% vs 68.4%). Pauwels III fractures demonstrated markedly higher implant failure and FHON rates compared with Pauwels I–II fractures (27.8% vs 3.1%), resulting in higher overall complication rates (66.7% vs 43.8%). Suboptimal postoperative fracture reduction was associated with substantially increased complications (87.5% vs 45.2%, p=0.07). Multivariable analysis identified fracture comminution as an independent predictor of adverse outcomes (p=0.012). In unstable Pauwels III fractures, the fixed-angle gliding device showed a strong trend toward fewer complications (p=0.06).

Conclusion: Clinical outcomes after femoral neck osteosynthesis appear to be largely influenced by fracture morphology and structural stability with fracture reduction representing a relevant modifiable surgical factor, while implant choice plays a secondary role. Fixed-angle gliding fixation demonstrates favorable trends in biomechanically unstable fracture patterns and may provide clinical benefit in selected cases.

Complex Knee Reconstruction with Extruded Shaft and Distal Femur – A Case Report

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Background: Severe lower limb trauma with extensive bone loss and soft tissue compromise represents a rare but highly challenging clinical scenario. Management of extruded, devascularized femoral segments remains controversial, particularly in the presence of contamination and neurovascular injury.

Case presentation: We present the case of a 24-year-old female patient who sustained severe injuries to the right lower limb following a motor vehicle accident. Initial assessment revealed open fractures of the femur, patella, and tibia, managed with external fixation. The injury was complicated by peroneal nerve palsy and extrusion of approximately two-thirds of the distal femur with complete periosteal stripping and absence of blood supply. The extruded bone segment was heavily contaminated with dust, plastic, and glass particles. Microbiological cultures identified coagulase-negative *Staphylococcus*, *Bacillus* spp., and *Streptococcus mitis*. The extruded femoral segment, measuring 28 cm, was stored at -80 °C for 14 days. After thorough removal of connective tissue and impurities, the bone was decontaminated and disinfected using BASE 128 medium containing vancomycin, gentamicin, cefotaxime, and amphotericin B deoxycholate. Subsequent sterile cultures confirmed successful decontamination.

Surgical technique: A free vascularized fibular graft (21 cm) was inserted into a prepared intramedullary slot of the femur to restore biological continuity. Surgery was performed through an anterolateral approach, respecting the stellate scar and protecting the sciatic nerve. Popliteal vessels were isolated, and microvascular anastomosis was performed. A periprosthetic locking plate was used to stabilize the femur and protect the fibular graft. A complex distal pole patellar fracture was treated with a basket plate, while the tibial fracture was managed using a minimally invasive plate osteosynthesis (MIPO) technique. The posterior cruciate ligament stump was sutured, the medial collateral ligament was repaired, and the posterolateral corner was repaired and augmented using an iliotibial band flap.

Postoperative course: Postoperatively, the patient was immobilized in a brace for six weeks with progressive partial weight bearing. Initial recovery was complicated by mild pain and knee contracture with a range of motion (ROM) of 0–40°. Arthroscopic arthrolysis and manipulation under anesthesia were performed, revealing preserved articular cartilage. Subsequent rehabilitation resulted in improved ROM to 0–87°. One year after surgery, the patient reported knee instability. Clinical examination showed a negative posterior drawer

test, marked valgus instability (+++), and mild varus instability (+), necessitating revision surgery with posterolateral and posteromedial corner reconstruction.

Outcome: All fractures healed successfully, and the vascularized fibular graft demonstrated complete remodeling at three-year follow-up. The patient ambulated without crutches, reported no pain, and achieved a stable knee with a final ROM of 0–90°.

Conclusion: This case illustrates that limb salvage with reimplantation of an extruded femoral segment combined with a free vascularized fibular graft is feasible, even in the setting of severe contamination and complex soft tissue injury. Careful multidisciplinary planning, staged reconstruction, and management of ligamentous instability are crucial for achieving satisfactory long-term outcomes.

Comparison of Intramedullary Nailing and Dynamic Compression Plate Fixation in the Treatment of Diaphyseal Tibial Fractures

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Introduction: Diaphyseal fractures of the lower leg represent one of the most common long bone injuries in adult trauma practice. Due to the anatomical characteristics of the tibia, its subcutaneous location, and relatively limited vascular supply, the choice of the optimal osteosynthesis method plays a crucial role in achieving favorable functional and radiological outcomes. The most commonly used surgical techniques include intramedullary nailing and open reduction with internal fixation using a dynamic compression (DC) plate. Although both methods are widely accepted, previous studies have reported differences in healing dynamics, callus formation, rehabilitation time, and functional recovery. The aim of this study was to compare the clinical and radiological outcomes of these two methods in a cohort of 40 patients and to evaluate them in the context of available literature data.

Material and methods: A total of 40 patients with diaphyseal tibial fractures treated surgically at the same clinical center were analyzed. Patients were divided into two groups according to the type of osteosynthesis: the first group consisted of patients treated with intramedullary nailing (n=20), while the second group underwent osteosynthesis using a DC plate (n=20). The choice of treatment method depended on the fracture type, soft tissue condition, and surgeon's assessment. Radiological evaluation was performed using standard anteroposterior and lateral radiographs at regular follow-up intervals. Particular attention was given to the timing and quality of callus formation. Functional outcomes were assessed based on clinical examination, weight-bearing status, and return to daily activities. The obtained results were compared with findings from previous clinical studies and meta-analyses addressing the comparison of these two methods.

Results: The analysis demonstrated clear differences between the two groups. Patients treated with intramedullary nailing showed earlier radiological callus formation and more favorable healing dynamics compared to those treated with DC plate fixation. Callus formation was more pronounced and uniform on follow-up radiographs, indicating a biologically favorable healing process. Functional recovery was faster in the intramedullary nailing group, with earlier initiation of partial and full weight-bearing. In contrast, patients treated with DC plates required a longer period of protected weight-bearing and demonstrated a slower return to full function. These findings are consistent with previous studies reporting that intramedullary fixation preserves periosteal blood supply and provides a favorable biomechanical distribution of forces, contributing to faster callus formation and more stable healing. Plate fixation, although allowing precise anatomical reduction, is often associated with greater surgical invasiveness and potential disruption of local bone biology.

Discussion: The results of this study support conclusions from earlier research favoring intramedullary nailing as the method of choice for most diaphyseal tibial fractures. The biomechanical advantages of intramedullary nailing, including elastic stability and controlled micromotion at the fracture site, explain the earlier callus formation and improved functional outcomes. DC plate fixation retains its role in the management of specific fracture patterns, particularly when intramedullary fixation is technically or clinically contraindicated. However, compared to intramedullary nailing, it is associated with slower radiological consolidation and prolonged rehabilitation.

Conclusion: Based on the analysis of 40 patients and comparison with available literature, intramedullary nailing demonstrates superior functional and radiological outcomes compared to DC plate fixation in the treatment of diaphyseal tibial fractures. Earlier callus formation and faster functional recovery make this method a reliable and effective treatment option. Further studies with larger patient populations and longer follow-up periods are warranted to confirm these findings.

Orthoplastic Management of Exposed Osteosynthetic Material in The Lower Leg Using Gastrocnemius Flap Coverage and Hybrid External Fixation – A Case Report

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Background: Soft-tissue complications following internal fixation in the lower leg remain a major challenge and may threaten both limb function and fracture healing. Infection with exposure of osteosynthetic material requires coordinated management addressing both skeletal stability and soft-tissue reconstruction. The orthoplastic approach, integrating principles of orthopedic stabilization and reconstructive surgery, has emerged as the standard for complex lower extremity trauma and postoperative complications. Muscle flap coverage combined with appropriate definitive fixation can enable infection control, protect vital structures, and support bone healing.

Methods: We present a case of a 60-year-old patient who sustained a tibial plateau fracture following a fall. Initial management consisted of temporary stabilization using an external fixator, later converted to internal fixation with minimally invasive plate osteosynthesis (MIPO). The postoperative course was complicated by wound infection leading to soft-tissue breakdown on the lateral aspect of the proximal lower leg, with exposure of the osteosynthetic material. Microbiological analysis demonstrated colonization with Pseudomonas aeruginosa. Following multidisciplinary discussion, an orthoplastic strategy was adopted. Removal of the infected implant was performed, and soft-tissue reconstruction was achieved using a lateral gastrocnemius muscle flap to provide vascularized coverage of the exposed bone and control infection. Definitive skeletal stability was restored using a hybrid external fixator, allowing maintenance of fracture alignment while minimizing further soft-tissue compromise. The muscle flap was covered with split-thickness skin grafting.

Results: The postoperative course was uneventful, with successful flap integration and complete skin graft take. Infection control was achieved without recurrent wound breakdown. The hybrid external fixator provided stable fixation throughout healing, allowing protection of the reconstruction and progressive recovery. The wound healed with durable coverage and satisfactory limb function. At latest follow-up, the external fixator remains in place pending final radiologic confirmation of complete bone healing. Conclusion: This case illustrates the value of the orthoplastic principle in managing complex complications after internal fixation in the lower leg. Coordinated treatment combining removal of infected hardware, vascularized muscle flap coverage, and definitive external fixation enabled infection control, soft-tissue restoration, and preservation of limb stability. Early collaboration between orthopedic and reconstructive teams is essential for successful outcomes in complex lower extremity reconstruction.

Reconstruction of a Severe Lower Leg Décollement Injury Using a Free Gracilis Muscle Flap – A Case Report

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Background: Décollement injuries of the lower extremity represent severe soft-tissue trauma caused by high-energy mechanisms, frequently associated with extensive skin and subcutaneous tissue avulsion and exposure of underlying bone. These injuries pose a significant reconstructive challenge due to contamination, compromised vascularity, and the risk of infection or osteomyelitis. Timely debridement and staged reconstruction are essential to achieve limb salvage and restore function. Free tissue transfer remains a reliable option for coverage of exposed tibial bone when local reconstructive solutions are insufficient. Methods: We present the case of a 24-year-old male patient who sustained a severe anterior lower leg décollement injury following a motorcycle accident. The injury resulted in extensive soft-tissue loss in the entire anterior lower leg with exposed tibial bone in the upper and middle thirds of the leg. Initial management consisted of serial surgical debridements to remove devitalized tissue and reduce bioburden, followed by negative pressure wound therapy (NPWT) to promote granulation tissue formation and optimize wound bed preparation. A dermal substitute (Matriderm) was applied as part of staged wound conditioning. Definitive reconstruction was performed using a free gracilis muscle flap for coverage of the exposed tibia. Microvascular anastomosis was established to the anterior tibial vessels, with arterial anastomosis performed end-to-side and venous anastomosis end-to-end. The remaining soft-tissue defect and the muscle flap were subsequently covered with split-thickness skin grafts. Results: Postoperatively, the flap developed partial necrosis, likely related to prolonged ischemia time. Surgical debridement followed by secondary split-thickness skin grafting resulted in successful preservation of vascularized coverage over the exposed tibia. Complete wound healing was achieved without chronic infection or osteomyelitis. At follow-up, the patient demonstrated stable soft-tissue coverage, a durable and stable scar, preserved limb function, and return to normal daily activity with a satisfactory aesthetic outcome.

Conclusion: Staged management combining serial debridement, NPWT, dermal substitute application, and free muscle flap transfer provides an effective strategy for complex lower leg décollement injuries with exposed tibia. The free gracilis flap offers reliable vascularized tissue coverage with minimal donor site morbidity and enables successful limb salvage and functional recovery in young trauma patients.

Morel-Lavallée Lesions of the Lower Leg

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Objective: The aim of this paper is to present a case of treatment of a Morel-Lavallée lesion of the lower leg following a motorcycle accident in a 23-year-old patient. A Morel-Lavallée lesion is a rare but clinically significant closed degloving injury of the soft tissues caused by shearing forces, resulting in separation of the subcutaneous tissue from the underlying fascia, with subsequent formation of a cavity filled with blood, lymph, and inflammatory exudate. In most cases, it occurs in high-energy trauma, and recognition may initially be delayed due to nonspecific clinical presentation. It most commonly occurs in the hip, pelvis, and lumbar regions, but can also be found in other locations such as the knee and lower leg. The method of treatment depends on the size and duration of symptoms. It is most often treated conservatively with aspiration, compression, and instillation of sclerosing agents, but sometimes requires surgical treatment, as in this case.

Case report: A 23-year-old patient, while riding a motorcycle, struck the bumper of a truck with his left leg, sustaining an abrasion on the lateral side of the left lower leg. Several days after the injury, swelling and a hematoma developed at the site, which the patient initially treated with rest and cold compresses. Four months after the injury, the patient presented to a trauma clinic, where the cavity contents were aspirated multiple times. MRI of the left lower leg confirmed a Morel-Lavallée lesion with a formed fibrous capsule. After each aspiration, the cavity refilled with fluid, and due to unsuccessful conservative treatment, a surgical approach was undertaken.

Treatment and outcome: We opted for surgical treatment of the lesion. An incision was made above the lesion site, revealing a capsulated collection. Complete debridement of the fibrous capsule was performed and the lesion contents were removed, followed by extensive irrigation of the cavity. The subcutaneous tissue was then fixed to the underlying fascia with sutures to eliminate the dead space. The postoperative course was uneventful, and at the final follow-up, one year after surgery, there was no recurrence of the collection.

Conclusion: This case highlights the importance of timely recognition and appropriate treatment of a Morel-Lavallée lesion of the lower leg, which represents a rare location of this injury. Although conservative approaches are often used as initial therapy, in chronic and encapsulated lesions, surgical treatment proves to be an effective and definitive solution. Complete excision of the capsule and elimination of dead space are crucial in preventing recurrence and ensuring successful functional recovery of the patient.

Keywords: Morel-Lavallée lesion, lower leg, closed degloving injury, magnetic resonance imaging (MRI), surgical treatment

Complex Management of Fracture-Related Infection After an Open Tibial Pilon Fracture – A Case Report With a Review of Current Recommendations

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Introduction: Fracture-related infection (FRI) represents one of the most severe complications in traumatology, particularly in open fractures of the lower leg with associated soft tissue damage. Contemporary international guidelines emphasize the importance of early recognition of infection, a multidisciplinary approach, stable osteosynthesis, thorough debridement, adequate soft tissue management, and individualized antimicrobial therapy. We present the case of a young patient with an exceptionally complex course of treatment following an open pilon fracture complicated by the development of FRI.

Case report: A male patient, born in 1997, sustained an injury at work when a tree fell onto his right lower leg. An open pilon fracture of the tibia (Gustilo–Anderson type IIa) was diagnosed. Initial management included surgical wound debridement and temporary stabilization with an external fixator. During further treatment, wound dehiscence developed, requiring multiple repeated debridements, local soft tissue reconstruction, and systemic antibiotic therapy.

Due to persistence of the problem and suspicion of deep infection, the osteosynthesis material was removed, an external fixator was reapplied, negative pressure wound therapy (NPWT) was introduced, and prolonged antibiotic therapy was administered, without significant clinical improvement. This was followed by necrosectomy of the infected bone, initiation of the Masquelet procedure, and soft tissue reconstruction using a reverse sural flap.

After eight weeks, cancellous bone grafting (spongioplasty) was performed along with arthrodesis of the ankle and subtalar joints using a hindfoot nail. Due to failure of the distal part of the flap, additional microvascular reconstruction was required.

Conclusion: The presented case highlights the complexity and prolonged nature of treating fracture-related infection following open pilon fractures. Successful management requires an individualized, multidisciplinary approach, stable fracture fixation, repeated debridements, and adequate soft tissue management. The entire course of treatment confirms that FRI is a long-term and complex process, often requiring staged treatment, with realistic expectations and continuous evaluation of therapeutic goals.

Crush Injuries and Traumatic Limb Amputations – Three Patients, Three Treatment Strategies

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Introduction: Severe crush injuries and traumatic amputations of the extremities represent one of the greatest challenges in trauma surgery. The decision between limb salvage and primary amputation must be made rapidly, often in life-threatening conditions, taking into account the extent of soft tissue injury, vascular status, the patient's overall condition, and the potential for functional recovery.

Case report: Three patients with extreme extremity injuries of different etiologies and therapeutic approaches are presented.

The first patient sustained a traumatic forearm amputation at the level of the elbow; due to extensive soft tissue destruction and contamination, primary stump formation was performed immediately.

The second patient had severe bilateral lower extremity injuries; on one leg, a primary femoral amputation was performed, followed by hip disarticulation due to progression of infection and necrosis. On the contralateral leg, sequential treatment was carried out with multiple necrosectomies, VAC therapy, and ultimately split-thickness skin grafting (Thiersch graft).

The third patient sustained a severe crush injury of the lower leg with traumatic knee dislocation and injury to the popliteal artery; urgent vascular reconstruction was performed, along with external fixation of the knee, repeated debridements, and definitive defect coverage using a Thiersch skin graft, resulting in limb preservation.

Discussion: The presented cases illustrate that therapeutic strategies in severe extremity trauma must be individualized and dynamic. Primary amputation in certain situations represents the optimal therapeutic decision, whereas in selected cases timely revascularization and a staged approach enable limb salvage. Predictive scoring systems have limited value and cannot replace clinical judgment and team experience.

Conclusion: Management of severe crush injuries and traumatic amputations requires rapid decision-making, clearly defined therapeutic priorities, and a multidisciplinary approach. The goal of treatment is not only anatomical limb preservation, but optimal functional outcome and patient survival.

Delayed Below-Ankle Replantation After Traumatic Rope Amputation: A Multidisciplinary Limb Salvage Case

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A 44-year-old male sustained an injury while sailing when a boat rope wrapped around his right lower leg, suddenly tightened, and caused an amputation just above the ankle. Neither the patient nor the amputated segment was in contact with seawater. He was initially managed at a regional hospital and urgently transferred by ground ambulance, as helicopter transport was not possible due to adverse weather conditions.

The patient was admitted to our tertiary center more than 6 hours after the injury. The amputated part had been wrapped in saline-soaked gauze and placed directly on ice. An Esmarch tourniquet had been applied to the stump for over 6 hours, approximately 10 cm proximal to the amputation level. On admission, he was hemodynamically stable.

Emergency replantation was undertaken by a combined orthopedic trauma and plastic surgery team. The amputated segment was prepared on a separate sterile table and repeatedly irrigated with octenidine and saline. Radical debridement of nonviable skin, muscle, and bone was performed on both the stump and amputate until viable bleeding tissue was obtained. The posterior tibial artery was identified, catheterized, and flushed with heparinized saline. After bone shortening and preparation, retrograde intramedullary fixation of the tibia was performed with planned subtalar and tibiotalar arthrodesis to ensure stability. Microsurgical end-to-end anastomosis of the posterior tibial artery was completed first, achieving immediate restoration of inflow and distal bleeding. Concomitant venous anastomosis of the tibial veins was then performed to secure adequate outflow, followed by epineural repair of the tibial nerve. Layered soft-tissue reconstruction was completed without tension.

Postoperatively, the foot remained viable, warm, and well perfused, with no signs of infection. Daily physiotherapy was initiated. After three weeks, the patient was transferred to a hospital in Slovakia for further rehabilitation with a viable replanted limb.

Primary Hindfoot Arthrodesis in Trauma: A Two Case Report

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Hindfoot arthrodesis is a procedure used to achieve fusion of the hindfoot joints, including the subtalar, talonavicular, calcaneocuboid, and occasionally tibiotalar joints, through removal of articular cartilage and rigid internal fixation, aimed at achieving pain relief, mechanical stability, deformity correction, and a plantigrade foot in cases of severe joint pathology or non-reconstructible trauma.

This study presents two cases M (37) and F (46), both admitted to the emergency department after a fall from a height after a suicide attempt. Both of the patients had previous mental illness and expressed low compliance during treatment. Both of these patients were polytraumatized and had undergone urgent surgeries and early aftercare in the Intensive care unit. X-ray images, besides other injuries, showed complex intraarticular multifragmentary fractures of distal tibia and fibula. Initially, ankle fractures in both patients were treated by placing an external fixator. In both of these patients as a definitive treatment modality for the ankle fractures we decided to perform arthrodesis using a Expert Hindfoot Arthrodesis Nail (HAN). Both patients showed satisfactory early recovery considering associated injuries.

In conclusion, when reconstruction is unlikely to succeed due to severe articular destruction, soft-tissue compromise, or patient-related factors, primary arthrodesis is a valid treatment option.

Calcaneal fractures – minimally invasive approach for promising results

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Introduction: Calcaneal fractures are complex and disabling injuries, usually a result of high-energy trauma like a fall from height or a motor vehicle accident. The annual incidence is approximately 11.5 cases per 100,000 people. Treatment can be conservative (cast immobilisation) or surgical. Indications for surgical treatment are poor heel position and shape, displaced articular involvement and open fractures. Surgical treatment, particularly open reduction and internal fixation (ORIF), carries a substantial risk of complications, up to 40%, with wound healing issues, infection and chronic pain.

Materials and methods: In our research, we covered 56 cases of calcaneal fractures treated surgically in our clinic between 2021 and 2025. Initial diagnosis was made upon examination in the emergency department after initial physical exam and X-ray. For preoperative planning, CT scans were used in all 56 cases. Including factors were calcaneal fracture and age above 18. To reduce complications, percutaneous/closed reduction and internal fixation (PRIF/CRIF) was the preferred method of treatment.

Results: Our research has shown that the majority of patients were work-active males, and only 10,7% of patients were females. The average age among all patients was 54 years. The favored method of osteosynthesis was cannulated screw fixation after indirect reduction with the help of the temporarily placed Steinmann pin and K-wires, which was used in 94,6% of patients, and plate and screws were used in only 3 patients, or 5,35%. Hardware extraction was performed in 10 patients, or in 17,85%. We achieved good to excellent functional outcomes in 42 patients, fair in 9 and poor results in 5 patients.

Conclusion: Minimally invasive approach (PRIF/CRIF) with cannulated screws fixation, represents a method of treatment with satisfactory results in patients with complex calcaneal fractures reducing soft tissue damage and avoiding major complications.

External fixation of calcaneal fractures using K-wires + MMA

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This paper presents a method of external fixation (EF) for calcaneal fractures using percutaneous transfixation with K-wires anchored to the talus, cuboid, and navicular bones. Fracture reduction is achieved under fluoroscopic guidance using Schanz screws in combination with external fixation, which are subsequently removed after definitive stabilization with K-wires connected externally using polymethylmethacrylate (MMA) bone cement.

This technique allows for early mobilization and weight-bearing while minimizing soft tissue and vascular compromise, consistent with MIPO (minimally invasive plate osteosynthesis) principles. The result is faster healing and removal of K-wires/PMMA at approximately 6 weeks, comparable to the duration of immobilization with casting in conservative treatment.

The method has been applied in more than 10 patients.

Surgical Management of Distal Femur and Ipsilateral Proximal Tibia Fractures With Early Fixation and Temporary Reconstruction of the Bone Defect Using Bone Cement (PMMA)

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Introduction: Open comminuted fractures of the proximal tibia with associated bone and soft tissue defects are linked to a high risk of infection and nonunion. Stable osteosynthesis combined with reconstruction of both bone and soft tissue defects is a key step in the management of such injuries.

Case report: A male polytrauma patient injured in a traffic accident on September 11, 2024, was admitted with an open multifragmentary fracture of the left proximal tibia and fibula with a significant metaphyseal bone defect (Gustilo–Anderson type IIIB), along with an ipsilateral comminuted metaphyseal and intercondylar fracture of the distal femur with a Hoffa fracture component of the lateral condyle.

On the day of admission, surgical debridement of the lower leg wound was performed, followed by temporary stabilization using an external fixator. Definitive fixation was carried out the following day: osteosynthesis of the proximal tibia using a locking compression plate (LCP) with locking screws, and fixation of the distal femur fracture using lag screws and a supracondylar intramedullary nail. The metaphyseal tibial defect was temporarily reconstructed using PMMA granules, providing initial mechanical support and enabling local antibiotic delivery.

In the same procedure, soft tissue reconstruction was performed using a medial gastrocnemius flap and split-thickness skin graft (Thiersch graft), along with negative pressure wound therapy (VAC). After four months, the PMMA was removed and the bone defect was reconstructed with autologous cancellous bone graft harvested from the ipsilateral iliac crest.

Outcome: The postoperative course was uneventful, with no signs of infection. Follow-up radiographs demonstrated restoration of bone continuity. Functionally, a knee range of motion from 0° to 120° of flexion was achieved. Fourteen months after the initial injury, the patient reports good subjective outcomes, minimal pain, and independent ambulation.

Conclusion: In complex Gustilo–Anderson type IIIB proximal tibial injuries, early stabilization combined with temporary reconstruction of the bone defect using PMMA cement and soft tissue reconstruction represents a reliable limb-salvage strategy, creating optimal conditions for bone healing and functional recovery.

Osteosynthesis of a Pilon Fracture Complicated by Critical Foot Ischemiaand Subacute Infection – A Case Report

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Objective: The aim of this paper is to present the management of complications following osteosynthesis of a pilon fracture.

Methods: In this case report, we present a 71-year-old patient (D.I.) who was admitted through the emergency department of Dubrava University Hospital due to an intra-articular fracture of the distal left tibia (AO 43C2.3) sustained after a fall from standing height.

Results: The patient was hospitalized on November 16, 2024, due to a pilon fracture of the left lower leg. He had no prior comorbidities and was not on chronic therapy. Clinical examination revealed moderate edema, no neurological deficit, and preserved capillary perfusion of the foot. The local condition was initially managed with external fixation, followed by definitive internal fixation using a minimally invasive technique after 10 days. The early perioperative period was uneventful. The patient was readmitted on December 9 due to clinically evident critical limb ischemia. Digital subtraction angiography (DSA) revealed occlusion of the distal third of the anterior tibial and posterior tibial arteries, most likely due to subacute thrombosis on an atherosclerotic background triggered by trauma. Percutaneous recanalization of the distal lower leg arteries was attempted twice (December 13 and 17) without success. There was progression of ischemic changes, including epidermolysis of the dorsum of the foot and dry gangrene of the fourth toe. On December 19, urgent revascularization of the foot was performed using a venous tibio-pedal bypass. On January 1, 2025, additional necrosectomy and amputation of the fourth toe of the left foot were performed. The subsequent course was uneventful, with regular outpatient wound care. The patient was readmitted on March 13, 2025, due to infected tibial osteosynthesis with wound discharge. Radiological evaluation showed nonunion, and microbiological cultures isolated MRSA and *Pseudomonas aeruginosa*. On March 25, 2025, the osteosynthesis material was removed, intramedullary debridement was performed using reamers, and external fixation according to the Ilizarov method was applied, along with targeted antibiotic therapy. The further course was without complications, with regular wound care until soft tissue healing. After six months, the external fixator was removed due to radiological fracture union and satisfactory functional status.

Conclusion: This case highlights the importance of thorough vascular assessment in elderly patients with lower leg fractures. Although the initial clinical findings and history may appear unremarkable, severe complications with a high risk of amputation may develop. Therefore, in cases with suspected arterial insufficiency, we recommend performing angiography as part of the initial MSCT evaluation of fractures as a standard protocol.

From Defect to Function: AutoCart in Talar Cartilage Repair – A Case Report

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Chondral lesions of the talus are a common cause of chronic ankle pain, instability, and functional impairment, particularly in young and physically active patients, and their management remains a clinical challenge. Standard surgical techniques, including microfracture and abrasion chondroplasty, often result in the formation of fibrocartilage with limited mechanical strength and long-term durability. We present a case of a patient with a symptomatic chondral lesion of the anteromedial talar dome treated using the AutoCart technique.

Diagnostic anterior ankle arthroscopy using the NanoNeedle Scope 2.0 Operative Arthroscopy System revealed a large anteromedial shoulder-type chondral flap lesion with intact subchondral bone. This was followed by an open medial malleolar osteotomy to allow adequate exposure of the defect. After preparation of the lesion bed and harvesting of fragmented cartilage tissue, the defect was filled and stabilized using a minced cartilage graft fixed with autologous fibrin and thrombin derived from the patient's blood. Postoperatively, the ankle was immobilized and non-weight-bearing for six weeks, followed by progressive physiotherapy and gradual return to weight-bearing according to patient tolerance. During follow-up, the patient demonstrated significant pain relief, improvement in functional outcomes, and return to daily and sporting activities without signs of instability or progressive degenerative changes. This case report highlights the potential value of the AutoCart technique as an effective and biologically compatible option for the treatment of talar chondral lesions, particularly in patients who do not achieve satisfactory long-term outcomes with conventional procedures. Further clinical studies are warranted to confirm its long-term efficacy and durability.

Femoral Neck Fractures – Success Rate of Preservation Attempts

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Introduction: Femoral neck fracture is a significant medical and social problem because it usually requires surgical treatment, which can lead to reduced physical abilities, chronic pain, need for revision surgeries, etc., resulting in high cost and reduced life quality. Incidence of femoral neck fracture in the US in 2021 was 146 per 100,000 adults. In some patients there is a chance for the preservation of the hip joint, and if attempt is unsuccessful, then revision surgery is advised and conversion to the total hip arthroplasty.

Materials and methods: In our research we covered 1728 proximal femur fractures treated between Aug-1-2019 and Dec-31-2025, and among them we found 50 patients on who preservation attemps were performed (fracture reduction and stabilisation with 3 cannulated screws, dynamic hip screw (DHS) or cephalomedullary osteosynthesis(CMO)), while the remaining underwent primary partial or total hip arthroplasty (THA). Including factors were femoral neck fracture, age above 18. Eliminating factors were pathological fracture and age below 18.

Results: Hip joint preservation was attempted in 50 out of 1728 patients (2,89%), and it was successful in 40 out of 50 patients (80%). The average age of patients was 52,06 years, 54% were females, 46% were males. Fracture reduction with 3-point screw fixation was performed in 82% of patients, CMO in 12% of patients, and with DHS 6%. Revision surgery and conversion to THA were performed in 20%, and the average time between initial and revision surgery was 9,78 months.

Conclusion: Even though femoral neck fractures often lead to avascular necrosis, the hip joint can be preserved with prompt intervention in suitable patients. Factors to consider when choosing the treatment are patient age, degree of comminution and dislocation, time between injury and surgery, and patient-related factors as general health and condition, level of activity, and radiological signs of degenerative changes of the joint.

Keywords: Avascular necrosis, Femoral neck, Fracture, Internal fixation

Open Medial Subtalar Dislocation – A Case Report

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Introduction: Subtalar or peritalar dislocations are conditions characterized by complete loss of congruence of the talocalcaneal and talonavicular joints. They are rare injuries, accounting for 1–2% of all dislocations and approximately 1% of traumatic foot injuries. These are emergency conditions requiring prompt reduction to minimize the harmful effects of bony pressure on surrounding soft tissue and neurovascular structures. They may be further complicated by associated fractures, avascular necrosis, and, in open dislocations, external contamination.

Case report: We present the case of a 79-year-old female patient admitted after a fall from standing height with a mechanism of forced inversion during plantar flexion of the foot. Clinical examination revealed a wound on the anterolateral side of the right ankle with protrusion of a rounded articular bone surface, while the neurovascular status of the foot was preserved. Radiography demonstrated a subtalar dislocation.The ankle was manually reduced under intravenous analgesia and appeared stable. Primary wound sutures were placed, immobilization applied, tetanus prophylaxis administered, and dual antibiotic therapy initiated. MSCT imaging demonstrated the status after complete dislocation of the right talocrural joint, with a minimally displaced fracture of the medial malleolus of the tibia, a medial talar head fracture, and a marginal fracture of the navicular bone. On the same day, surgical debridement and stabilization using two Kirschner wires were performed. The patient was discharged on the third postoperative day with immobilization in a plaster splint and instructions for complete non-weight-bearing. At 14 days post-discharge, swelling, pain, and minor wound necrosis were noted, and immobilization was removed. At 28 days, the Kirschner wires were removed and physical therapy was initiated. At 4-month follow-up, persistent swelling and partial limitation of range of motion were present.

Conclusion: Postoperative management includes a period of immobilization followed by gradual rehabilitation, with earlier mobilization associated with improved range of motion and functional recovery. Careful patient follow-up is essential for early detection of complications such as infection, avascular necrosis of the talus, post-traumatic arthritis, and persistent joint stiffness. Functional outcomes are generally poorer in open injuries, cases with associated fractures, and in patients requiring prolonged immobilization. Due to the low incidence of subtalar dislocations, current treatment strategies are based on limited evidence, and standardized guidelines are still lacking. Further research is needed to establish optimal treatment protocols.

Spine, Pelvis and Polytrauma

Acetabular Superior Wall Fractures – A Special Acetabular Fracture Entity

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Introduction: A grey-zone exists between classical trapezoideal anterior and large fragment posterior wall fractures. Acetabular dome involvement is a common acetabular fracture pathology, especially in geriatric fractures.

Methods: All acetabular fractures with superior dome involvement were analyzed and isolated superior articular fractures represent the basis for further evaluation. Overall, seven patients were identified. These patients were analyzed in terms of initial clinical course (demographic data, mechanism of injury (MOI) and clinical course) and radiological files for fracture classification, associated fracture modifiers (e.g. type of dislocation, comminution, marginal impactions, intraarticular fragments, femoral head injuries), concomitant pelvic ring injuries and definitive treatment.

Results: All patients, except two, sustained high-energy trauma. The mean age was 48 years and 4 patients were male. An associated hip dislocation was observed four cases (anterior-superior or pure superior). Except on case, surgery was performed by anterior approaches (mainly iliofemoral) in six cases with screw fixation. The overall surgical results were worse, with all having relevant joint discomfort or degeneration probably due to relevant articular injury.

Conclusion: Special superior wall acetabular fractures exist, similar to classical anterior and posterior wall fractures. In contrast, isolated superior wall fragments are unusual. Typically, severely displaced, multiple fragments with associated articular damage, both involving the acetabular and femoral head articular surface were observed. Overall, results are worse.

Ilio-femoral External Transfixation as a Rare Damage-Control Treatment Option in Acetabular Fracture Dislocations

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Introduction: Acetabular fracture dislocations are prognostic relevant injuries. Immediate closed reduction is the standard of car. In rare cases, especially in polytraumatized patients, initial reduction attempts fail.

Methods: A database analysis was performed in two university centers for patients with unreducabel acetabular fracture dislocations. In these cases ilio-femoral transfixation (IFT) was performed. These patients were analyzed in terms of initial clinical course (demographic data, mechanism of injury (MOI) and clinical course) and radiological files for fracture classification, associated fracture modifiers (e.g. type of dislocation, comminution, marginal impactions, intraarticular fragments, femoral head injuries), concomitant pelvic ring injuries and definitive treatment.

Results: 13 patients were identified. 10 patients were male and three were female. The average age was 27.2 years (range 13-66 years). All patients sustained high energy trauma. All patients were polytraumatized with an average Injury Severity Score of 46.8 points (range: 27-57 points). All patients had associated injuries. Seven patients had additional pelvic ring injuries: 4x unilateral type C injuries, 2x open-book type B-injuries and one patients with a spino-pelvic dissociation injury.

Immediate IFT was performed during the damage-control phase and associated unstable pelvic ring injury had at least external fixation. In two patients, emergency fixation was performed using the pelvic c-clamp. Nine patients sustained an acetabular fracture with a transverse fracture component. Three patients presented with posterior acetabular fracture types. Central/medial hip dislocation was observed in 6 patients, posterior-superior in five and posterior-medial in one patient. The overall mortality rate was 23.1%. Of the 10 survivors, nine patients had secondary open reduction and internal fixation of their acetabular fracture.

Conclusion: IFT is a rare but suitable initial treatment method for unreducable acetabular fracture dislocations in the polytrauma setting.

Acetabular Roof Fractures – Third Column Fractures

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Introduction: A new classification system for acetabular fractures proposed by Zhang at al. in 2019. which is called the 3-column classification, consisting of an anterior and posterior column and integrating a roof column. This led us to analyse a database of acetabular fractures to 1) determine the incidence of fracture roof types, 2) describeits radiological characteristics, 3) attempt to set out a specific treatment strategy.

Methods: Two surgeons in each of seven hospitals independently analysed a set of complex acetabular fractures that occured between 1st January 2021 and 31st December 2025. The dijagnosis was made using 2D and 3D CT reconstructions. A retrospective analysis was done of the reduction and fixation of the roof fragment relative to the chosen surgical approach.

Results: The study comprised 95 acetabular fractures we operated in seven hospitals, of which we have selected two groups: first group 7 (7,4%) was roof column fractures, second group 34 (35,8%) was both column fractures with an independent roof fragment. Roof column fractures has no involvement on iliopectineal and ilioischial line, nor on anterior and posterior rim, and in new classification system they represents A3.2 type or third column fractures. Both column fractures with an independent roof fragment, in new classification system are classified as C2 or C3 type or three column fractures.

Conclusion: The acetabular roof, as a weith bearing base and critical structure for maintaing the stability of the hip joint, is defined as the roof wall and roof column in new 3-column classification system. In our case series acetabular roof fractures have a high incidence. We conclude that the importance of acetabular roof was highlighted in the 3-column classification, and that this new classification is logical and makes sense.

Unclassified Acetabular Fractures

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Introduction: The surgical treatment of acetabular fractures relies on the understanding of fractures architecture and their classification. Recently, there has been growing evidence of dicrepancies and incompleteness in the Judet and Letournel classification, adversely affecting its clinical use. The aim of this case series is to report the incidence and description of unclassified acetabular fractures and special surgical approaches and fixation methods of these unique patterns, only in group of complex acetabular fractures.

Methods: This is a retrospective consecutive case series. In the period between 1st January 2021 and 31st December 2025, we operated in 7 hospitals 95 patients with complex acetabular fractures. Elementary patterns were not taken into consideration. Classification of acetabular fractures according to Letournel was done for all cases by two surgeons.

Results: Out of all 95 patients with complex acetabular fractures 58 (61,1%) did not fit into any of the fracture types according to Letournel classification as follows: 27 cases (46,6%) BC+PW; 8 cases (13,8%) T-shape+PW; 8 cases (13,8%) Roof; 6 cases (10,3%) BC+PW+AW; 2 cases (3,4%) Tr+AW+PW; 2 cases (3,4%) AC+PW; 2 cases (3,4%) AC+PHT+PW; 1 case (1,7%) pure QLS; 1 case (1,7%) AC+AW+PHT; 1 case (1,7%) Tr+QLS.

Conclusion: In our specific case series of complex acetabular fractures a large number of acetabular fractures (61,1%) could be considered unclassified fractures, as we expected. The main reason for the high incidence is our decision to analyze only complex fracture types in all seven hospitals. These unique patterns may require special approaches or special fixation methods. Letournel classification is still the gold stone for classifing acetabular fractures, but modification can do the job.

Pelvic and Acetabular Fractures – Patients Hospitalized at University Hospital of Split During 2025

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In this presentation, we retrospectively analyze patients older then 18 years old admitted to University hospital of Split for acetabular or pelvic ring fractures during 2025.

The total number of treated patients was 134, of which 4 cases were transfers from other hospitals. Based on this, we estimate that the annual incidence of these injuries in Split-Dalmatia County is approx. 29/100,000. In further analysis, we divided the patients according to the intensity of the injury that led to the fracture: 53 patients suffered injuries from high-energy trauma, 80 patients from low-energy trauma, while one case was a stress fracture.

In the group of patients with fragility fractures, the age distribution was 59-98 years with a median of 85, with a predominance of women (78%). In this group, we recorded 4 patients with combined injury (acetabulum and pelvic ring), 7 patients with acetabular fracture, 63 patients with injury to the anterior pelvic ring, 7 patients with injury to both the anterior and posterior pelvic ring, and one patient with an isolated sacral fracture. In the group of patients with fractures due to high-energy trauma, the age distribution was 19-90 years with a median of 53, with a predominance of men (68%). In this group, we recorded 11 patients with combined injury, 9 patients with acetabular fracture, 14 patients with injury to only the anterior pelvic ring, and 17 patients with injury to both the anterior and posterior pelvic ring.

We performed a total of 24 surgical procedures, in another four cases we set an indication for surgery, but the surgery was not performed due to patient refusal or medical complications. One operation was performed as an emergency, while the others were performed delayed. Regarding the type of fracture: in 2 cases it was a combined injury, in 8 patients the indication for surgery was an acetabular fracture, while in 14 patients the indication for surgery was a pelvic ring fracture.

Pelvic Ring Injuries in Polytraumatized Patients: Implications for Emergency Surgery, Length of Hospital Stay, Outcomes, and Treatment Costs

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Introduction: Pelvic ring fractures in polytrauma are associated with hemodynamic instability and a higher risk of poor outcomes. The aim of the study is to describe the frequency and patterns of pelvic fractures in polytrauma and to examine the association of fracture stability with emergency surgery, mortality, length of hospital stay and cost.

Methods: A retrospective cohort study conducted in a tertiary center between 2015 and 2020 identified 335 polytraumatized patients according to the Berlin criteria. Pelvic fractures were classified according to the Young–Burgess (Y-B) classification and by stability. Comparisons were performed using non-parametric and Fisher tests. Multivariate models were used for mortality and emergency surgery.

Results: In the total sample, the median age was 45 years, ISS (Injury Severity Score) was 34, length of hospital stay was 10 days, and cost was €1603. Pelvic fractures were reported in 65/335 (19.5%). In the pelvic cohort (n=65), traffic was the most common mechanism of injury (66.2%). Stable fractures accounted for 42/65 (64.6%), unstable 23/65 (35.4%). Unstable fractures had a higher ISS (57 vs 41; P<0.001), higher cost (5732 vs 3738 €; P=0.035), more frequent emergency surgery (90.9% vs 67.4%; P=0.033; OR 4.83) and higher in-hospital mortality (36.4% vs 9.3%; P=0.015; OR 5.57), without a significant difference in length of hospitalization (23 vs 17 days; P=0.273). There was no significant difference in mortality or emergency surgery between the Y–B groups, while the difference in ISS and length of hospital stay was statistically significant (P=0.003). In the multivariate mortality model, impaired consciousness was independently associated with mortality (OR 20.3; P=0.014), while other factors had no significant effect. For emergency surgery, the only independent predictor was ISS (OR ~1.08 per point; P<0.05).

Conclusion: Unstable pelvic fractures are associated with greater physiologic decompensation, injury severity, cost, and mortality, but after adjustment, ISS and impaired consciousness remain key predictors of outcome.

Management of the Pelvic Floor in Open Pelvic Fractures: The Role of the Digestive Surgeon

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Introduction: Open pelvic fractures are life-threatening injuries often associated with complex injuries of the pelvic floor and anorectal region. In addition to initial life-saving, long-term functional outcome, especially continence, is crucial for the patient's quality of life. The literature emphasizes the importance of an early and experience-guided reconstructive approach.

Aim of the paper: To present the role of the digestive surgeon in the management of pelvic floor injuries in open pelvic fractures through a literature review and a presentation of our own complex cases with an emphasis on functional outcomes.

Materials and methods: A review of the relevant literature and an analysis of selected complex cases treated at the Rijeka University Hospital Center are presented. Surgical strategies in the acute and delayed phases of treatment are described, including reconstruction of the anorectal complex, over-lapping sphincteroplasty and reconstruction of the pelvic diaphragm. Options for later treatment of fecal incontinence, including sacral neuromodulation, were also discussed.

Results: In the presented cases, the timely involvement of a digestive surgeon and the application of reconstructive techniques resulted in satisfactory functional outcomes with preserved or significantly improved continence. The literature confirms that early, planned pelvic floor reconstruction reduces the risk of infections and improves long-term results.

Conclusion: A digestive surgeon with experience in pelvic floor reconstructive surgery plays a key role in the multidisciplinary management of open pelvic fractures. Focus on functional outcome, timely reconstruction and consideration of advanced therapeutic options, including sacral neuromodulation, should be an integral part of modern treatment of these patients.

Keywords: open pelvic fracture, pelvic floor, reconstruction, continence, digestive surgeon

Dual versus Single Sacroiliac Screw Fixation in Lateral Compression Pelvic Ring Injuries: Does It Take Two to Tango?

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Introduction: Lateral compression (LC) pelvic ring fractures represent the most common pelvic injury pattern and frequently require surgical stabilization. While sacroiliac (SI) screw fixation is the standard treatment, the optimal number of screws remains a topic of debate. This study tested the hypothesis that dual unilateral SI-screw fixation (S1+S2) leads to superior functional outcome compared to single S1 fixation.

Methods: In this prospective real-world auto-randomized study, adult patients with LC-type fractures undergoing operative posterior ring fixation were included. Allocation to single S1 screw or dual S1+S2 screw fixation was determined by sacral anatomy. Clinical outcomes, radiographic complications, and PROMs including postoperative pain (VAS), independent mobilization, walking aid requirement, and discharge destination were analyzed.

Results: Ninety-three patients (45 male, 48 female) were included; 19 received single S1 fixation and 74 dual screws. Groups were similar regarding age, ISS, fracture distribution, and trauma severity. No differences were observed in complication rates, screw malpositioning, ICU stay, hospital length of stay, or reoperation rates. Radiographic loosening occurred in four dual-screw cases without clinical relevance. At discharge, significantly fewer patients in the dual group required walking aids (74.6% vs. 94.4%), and discharge home was more frequent (28% vs. 5%, $p=0.002$). Pain scores and static functional parameters were comparable.

Conclusion: Dual SI-screw fixation does not increase complication rates but is associated with improved early ambulation and higher autonomy at discharge. These findings suggest that enhanced rotational stability translates into meaningful functional benefits, indicating that, for LC fractures, it may indeed take two screws to tango.

Modification of the Existing Iliosacral Screw Placement Technique as a Potential Solution for Bilateral Sacroiliac Joint Injuries

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Introduction: Fractures and ligamentous injuries in the sacroiliac (SI) joint area are rare and most often associated with high-energy trauma. In the case of bilateral injuries, the risk of complications such as hemodynamic instability and neurological damage is higher and surgical management is more demanding. Diagnosis is made radiologically, and definitive treatment depends on the stability of the pelvic ring.

Objective: The aim of the study is to present a modified technique for placing 2 bilateral iliosacral screws (the "kissing screw" method) in bilateral injuries in the SI joint area.

Methods: A polytraumatized patient was transferred from an external institution for definitive surgical management of a pelvic injury. The patient was injured in a traffic accident and was initially treated according to the rules of "damage control" surgery, during which a splenectomy was performed, the mesentery and sigmoid colon injuries were treated, and an external fixator was placed on the lower leg. In our institution, bilateral iliosacral fixation with 2 7.0mm cannulated screws with partial thread was performed under X-ray control. Both tightening cannulated screws were placed over the same guide, which reduces exposure to X-ray radiation and the duration of the surgical procedure. Since both screws follow the same trajectory given by the guide, the final result gives the impression that the tips of the screws are kissing. Furthermore, bilateral lumbopelvic L IV-V fixation and osteosynthesis of the tibial fracture were performed. The procedures were performed in an orderly manner and the patient was discharged for home treatment, after which inpatient rehabilitation was performed.

Results: After 1 year, the patient subjectively feels well and is without any complaints, verticalized with an aid.

Conclusion: The modified technique of placing iliosacral screws represents a possible solution for certain cases of bilateral injuries in the SI joint area.

Indications for Lumbopelvic Fixation in the Treatment of Vertically Unstable Pelvic Ring Fractures

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Introduction: Lumbopelvic fixation (LPF) and its variant, triangular osteosynthesis (TOS), are key techniques for the treatment of highly unstable pelvic ring injuries, such as spinopelvic dissociation (SPD) and sacral comminuted fractures. These injuries are usually high-energy, associated with injuries to other organ systems, and are often associated with significant neurological deficits. Major classification systems, such as Denis, Roy-Camille, and Isler, are used to characterize fracture morphology and the degree of lumbosacral junction instability to guide surgical intervention.

Methods: This paper presents a narrative review of the literature, along with a case series from a first-degree trauma center.

Results: The primary biomechanical goal of LPF is to bridge the injured sacrum by transferring vertical axial loads from the lumbar spine directly to the ilium. TOS further improves this construct by combining a vertical LPF with transverse iliosacral or transsacral screws, providing multiplanar stability that is particularly effective in comminuted or highly unstable fractures. Although traditional open LPF allows for direct reduction and decompression, it has historically been associated with high rates of infection (16–26%) and wound healing complications. Current surgical trends favor minimally invasive techniques (MIS), which have been shown to significantly reduce blood loss, operative time, and soft tissue complications. Clinical outcomes generally demonstrate reliable stabilization and the potential for earlier weightbearing compared with standard fixation with iliosacral screws or ilioiliac plate. However, implant-related complications remain common, including rod fracture and symptomatic implant prominence, often requiring secondary removal surgery.

Conclusion: Despite the risks noted, LPF/TOS is the gold standard for stabilization of complex posterior pelvic ring injuries.

Spinal Injuries in Polytraumatized Patients: Incidence, Classification, and Impact on Clinical Outcomes

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Introduction: Spinal fractures in polytrauma are a common and clinically challenging entity, often associated with multiple injuries and significant systemic sequelae. The aim of the study was to describe the incidence and patterns of spinal fractures and to examine their association with emergency surgery, mortality, length of hospital stay and cost of treatment.

Methods: A retrospective cohort study conducted in a tertiary care center from 2015 to 2020 identified 335 polytraumatized patients according to the Berlin criteria. Spinal fractures were classified according to the AO-S CCF system and anatomical region. Analyses were performed using nonparametric and Fisher tests, as well as multivariate linear and logistic regression models.

Results: Spinal injury was recorded in 155 patients (76% male). Emergency surgery was performed in 56% of cases, and in-hospital mortality was 11.5%. The most common mechanism of injury was traffic (60%), followed by falls (37%). In linear regression, the only independent predictor of length of hospital stay was ISS ($\beta = 0.48$; $p < 0.001$). Hospital costs were primarily determined by length of stay (≈ €253 per day; $p < 0.001$) and severity of trauma, with no independent effect of spinal cord injury. AO-S CCF classification was not associated with emergency surgery, mortality, or mechanism of injury. In logistic models, higher ISS predicted emergency surgery (OR 1.12; $p < 0.001$). For mortality, older age, ISS, head and neck injury, and pelvic injury were independent predictors, while spinal cord injury was not an independent risk factor.

Conclusion: Clinical outcomes, length of treatment, and costs were primarily determined by total trauma severity (TIS), rather than isolated spinal cord injury, emphasizing the importance of a holistic approach to the assessment of the polytraumatized patient.

When Things Go Wrong. Patient With Disection of Thoracic Aorta and Burst Fracture of Lumbar Vertebra

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Blunt aortic injury in patient with spine fracture is relative common injury with incidence 7 to 10% according to literature.

We present a case of management of multitrauma patient with dissection of thoracic aorta and burst fracture of lumbarspine with neurological impairment and present our results of management spine fractures associated with injury of aorta.

We find that prophylactic TEVAR in patients with spine fracture is safe tool for preventing aortic rupture during spine surgery.

Polytrauma at University Hospital Centre Zagreb – A Decade Review

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The approach to a polytraumatized patient, from initial care to definitive treatment and final rehabilitation, involves complex procedures and algorithms and multidisciplinary cooperation of surgical and non-surgical branches of medicine. Despite advances in medical care, subspecialization of experts, as well as social efforts to encourage prevention; injuries, including polytrauma, continue to represent a global health burden, ranking third on the list of causes of death, dominating morbidity and mortality in the younger adult population. In order to effectively treat polytraumatized patients and improve their final quality of life, we must have epidemiological data such as the number and type of injuries, the method of their care, mortality, duration of hospitalizations and even the final financial burden.

In the absence of a national trauma registry, we conducted an overview of polytraumatized patients treated in our institution over a ten-year period (from 2014 to 2024). Among other things, we focused on injuries to individual organ systems, the need for urgent surgical care, the length of hospitalization, in-hospital mortality and the financial costs of treatment. We will present the relationship between the number of patients in whom treatment according to polytrauma protocols is indicated and the final number of patients who fit into today's definitions of polytrauma.

Vertebral Artery Dissection in a Polytraumatized Patient With Hypoplasia of the Contralateral Vertebral Artery: A Case Report

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Despite the increasing incidence of vertebral artery injury (VAI), it is often overlooked in the management of polytraumatized patients. Due to its specific anatomical location, the vertebral artery is particularly susceptible to traumatic and spontaneous injuries. Traumatic VAI can occur due to blunt or penetrating injuries and is often associated with cervical spine injuries.

An 18-year-old male was admitted to the emergency department after a motor vehicle collision. On admission, he was unconscious, normotensive, and tachypneic, with no visible head or neck injuries, but with multiple chest and abdominal contusions. Radiological examination revealed a fracture of the transverse process of the seventh cervical vertebra, with dissection, thrombosis, and occlusion of the V1 segment of the left vertebral artery. Hypoplasia of the contralateral vertebral artery was also noted (Figs. 1, 2). Due to ultrasound-confirmed free fluid in the abdominal cavity and newly developed hemodynamic instability, the patient underwent emergency surgery. Intraoperatively, a grade III liver laceration was determined, and hemostasis was achieved with direct sutures.

After regaining consciousness, the patient developed right-sided homonymous hemianopsia with signs of cerebral ischemia. After stabilization, anticoagulant and antiplatelet therapy were initiated. At discharge and during follow-up, the neurological deficit in the visual field persisted (Fig. 3, 4).

This case report emphasizes the importance of timely recognition and treatment of vertebral artery injury in polytraumatized patients. The rare combination of hypoplasia of the contralateral vertebral artery and traumatic OVA significantly influenced the development of neurological deficits.

Pediatric Locomotor System Surgery

A Quest to Decrease the Metal Footstep in Pediatric Orthopaedics

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Resorbable implants in orthopedics, such as screws, plates, or pins made of polymers (e.g., PLGA, PLLA) or magnesium, dissolve on their own after bone healing. This avoids secondary surgeries for metal removal, reduces soft tissue irritation, and is particularly advantageous in pediatric traumatology and forefoot surgery in adults. However, it also presents challenges regarding long-term studies and mechanical strength. The presentation will include the newest research and case regarding magnesium in adults and kids with a special focus on the growth plate.

Elastic Stable Osteosynthesis of Clavicle Fractures in Adolescents

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The majority of clavicle fractures in adolescents are treated nonoperatively, with excellent functional and cosmetic outcomes. Poor outcomes of nonoperative treatment are occasionally observed after refracture, significant displacement with pronounced deformity, systemic diseases that impair healing, polytrauma, and in older children with lower remodeling potential. In such cases, open reduction and internal fixation with plate and screws is most commonly used. This method has excellent union and success rates; however, secondary surgery for implant removal is usually required.

The incidence of primary surgical fixation of clavicle fractures in the adolescent population is increasing, particularly among older adolescents seeking faster recovery, partly due to the preferences of both patients and their families. Currently, there is ongoing controversy regarding the treatment of midshaft clavicle fractures in adolescents. Advocates of operative fixation extrapolate findings from adult studies to the adolescent age group. Pediatric surgeons favoring nonoperative treatment emphasize the intrinsic differences of the adolescent population, including faster healing, lower nonunion rates, and greater remodeling potential.

It is also difficult to define the age at which pediatric or adolescent fractures transition into adult-type fractures, since most adult studies include patients younger than 16 years of age, while many pediatric studies include patients up to 18 years old.

Motivated by contemporary trends in the management of this issue, pediatric surgeons from University Hospital Centre Zagreb and University Hospital Centre Rijeka initiated a joint study monitoring the operative treatment of children using intramedullary osteosynthesis with a titanium elastic nail.

This paper discusses the indications for operative stabilization of midshaft clavicle fractures, as well as the advantages and technical aspects of this method, comparing the characteristics of osteosynthesis materials and instrumentation from two different manufacturers.

Clavicle Fractures in the Pediatric Population: Duration of Immobilization and Return to Activities

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Clavicle fractures are among the more common injuries in childhood; however, recommendations regarding the duration of immobilization and timing of return to activities are rarely objectively standardized in clinical practice. The aim of this study was to analyze factors associated with the duration of immobilization and time to return to unrestricted activities in pediatric patients with clavicle fractures, as well as to examine the relationship between demographic, radiological, and therapeutic parameters and treatment outcomes.

A retrospective study was conducted on patients treated at Children's Hospital Zagreb between January 1, 2020, and October 31, 2025. All patients registered in the hospital information system (BIS) with a diagnosis of clavicle fracture and treated in the pediatric institution were included. A total of 842 patients were analyzed (593 boys, 239 girls), with a mean age of 9.6 years (range 0.02–17.91 years). Data were collected regarding mechanism of injury, degree of shortening and ad latus displacement of fragments, multifragmentation, treatment modality (arm sling, Madsen bandage immobilization, operative treatment), duration of immobilization, time until discontinuation of activity restriction ("free activity regimen"), complications, and refractures.

Conservative treatment was applied in 803 patients (95.37%), while 39 patients (4.63%) underwent operative treatment. The average duration of immobilization was 20 days (range 0–66 days), while the mean time to return to unrestricted activities was 77 days (range 0–587 days). Longer recovery times were observed in patients with greater fracture displacement, multifragmentary fractures, and in surgically treated patients. Refractures were recorded in 5.94% of patients, and the most common complications were related to secondary shortening of fracture fragments.

The results indicate an association between radiological characteristics and the selected treatment modality with both the duration of immobilization and time to return to activities. These findings may contribute to the standardization of recommendations regarding immobilization duration and safe return to activities in children with clavicle fractures.

Surgical Treatment of Supracondylar Humerus Fractures in Children: A 15-Year Retrospective Cohort Study

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Introduction: Supracondylar humerus fractures are the most common elbow fractures in childhood and frequently require surgical treatment. Although the majority of patients achieve good outcomes, some children develop functional or cosmetic deformities resulting in unsatisfactory outcomes.

Methods: A retrospective cohort study was conducted including 196 children who underwent surgical treatment for supracondylar humerus fractures at a tertiary care center between 2010 and 2025. Demographic data, injury characteristics, perioperative factors, radiological parameters, and pre- and postoperative complications were analyzed. Functional and cosmetic outcomes were assessed at the final follow-up examination using the modified Flynn criteria and dichotomized into satisfactory and unsatisfactory outcomes. Independent predictors of unsatisfactory outcomes were identified using multivariate logistic regression analysis.

Results: The median age was 6 years (IQR = 3), with a slight male predominance (55.6%). The most common fracture type was Gartland III (69.4%). Preoperative complications were recorded in 12.8% of patients, most commonly presenting as a pink pulseless hand. Postoperative complications occurred in 11.7% of cases, most frequently neurapraxia and secondary fracture displacement. Multivariate analysis identified the type of surgical procedure (OR = 13.64) and postoperative complications (OR = 19.94) as the only independent predictors of unsatisfactory outcomes. Other analysed variables were not independently associated with treatment outcome.

Conclusion: Postoperative complications and the need for open reduction are the most significant predictors of unsatisfactory functional and cosmetic outcomes in surgically treated supracondylar humerus fractures in children. Optimization of surgical technique and postoperative care is crucial, particularly in complex fractures.

Treatment of Capitellum Fractures of the Humerus in Children and Adolescents Using Headless Compression Screws

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Capitellar fractures of the humerus are rare injuries in childhood, accounting for approximately 6% of all distal humerus fractures. They typically occur only in younger adolescents, as the capitellum remains largely cartilaginous in earlier childhood.

We present a series of seven patients treated between June 2020 and July 2024. The mean age of the patients was 11 years and 10 months, with the youngest patient aged 11 years and 8 months and the oldest 14 years and 3 months.

In all patients, a Kocher approach was used, followed by open reduction and fixation with two or three headless compression screws. The average duration of immobilization was 14 days, while the average duration of physical therapy was 3.3 months, after which all patients achieved full range of motion of the elbow joint.

Regarding complications, one patient developed radial nerve palsy, which resolved spontaneously within six months.

Predictors for the Necessity of Open Reduction in the Treatment of Pediatric Both Bone Forearm Fractures With Elastic Stable Intramedullary Nailing

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Background and study aims: Elastic stable intramedullary nailing (ESIN) enables stable osteosynthesis with a low rate of complications in pediatric both-bone forearm fractures. However, repeated unsuccessful attempts at closed reduction can cause unnecessary soft tissue trauma and increased radiation exposure. We conducted a retrospective study of pediatric forearm fracture patients to identify predictors for the need for open reduction when using ESIN.

Patients and methods: We included 65 pediatric patients who underwent ESIN osteosynthesis for both-bone forearm fractures. We analyzed gender, age at injury, fracture location, fracture type, radiological parameters (shortening, angulation, and translation), the order in which the bones were stabilized, and the type of reduction performed.

Results: Of the patients, 49 (75.4%) were male and 16 (24.6%) female, with a mean age of 11.5 years. Most fractures (87.7%) occurred in the middle third of the forearm; 4.6% were proximal, and 7.6% distal. Fifteen patients (23%) had an open fracture; the remaining 50 (77%) had closed fractures. Overall, 59.2% (77/130) of fractured bones were fixed after closed reduction, while 40.8% (53/130) required open reduction and fixation.

When the radius was the first bone stabilized, significantly greater translation and shortening were observed in cases requiring open reduction. The difference was most pronounced when translation exceeded 100%. When the ulna was the first bone stabilized, significantly greater shortening predicted the need for open reduction.

Conclusions: When the radius is stabilized first, significant shortening and translation — especially translation over 100% — strongly predict failed closed reduction. When the ulna is first, shortening remains a reliable predictor.

Treatment of Subacute Monteggia Fractures in Children – A Case Series

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Subacute Monteggia fractures are defined as missed or inadequately treated fractures presenting 2 to 6 weeks after injury, in which the radial head is dislocated and soft tissue contracture has already developed. In such cases, anatomical reduction alone is not sufficient to achieve reduction of the radial head.

We present three cases of subacute Monteggia fracture presentation in children aged 2 years and 5 months, 5 years, and 6 years. In all three cases, it was necessary to expose the radial head using a Kocher approach and excise the annular ligament, while in two cases an ulnar osteotomy was also required to achieve reduction of the radial head.

Postoperatively, immobilization was applied for 3 to 4 weeks. In all cases, full forearm pronation and supination were achieved after physical therapy. In one patient, a residual deficit of 20 degrees of wrist extension persisted after 2 years, with otherwise normal sensation in the distribution of the radial nerve.

Treatment of Fifth Metacarpal Fractures With Antegrade ESIN

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Introduction: Fifth metacarpal fractures represent ~20% of hand fractures in youth, predominantly males aged 10–18. Antegrade single elastic intramedullary nailing (ESIN) is a minimally invasive option also feasible in ambulatory settings.

Aim: To evaluate surgical technique and clinical outcomes of anterograde single ESIN for 5th metacarpal shaft and neck fractures in a pediatric surgery unit.

Methods: Retrospective review over five years.

Indications: shaft fractures with >30° angulation and neck fractures with >70° angulation, ± rotational deformity. Exclusions: comminution, presentation >2 weeks post-injury, local infection.

Technique: 3 mm incision at ulnar dorsal base, awl entry, antegrade insertion of pre-contoured elastic nail, closed reduction under imaging, nail advanced across fracture to restore axial alignment.

Results: 23 fractures (shaft and neck), mean age 16.3 years. Mean operative time 25 min. Nail diameters: 1.6 mm (n=4), 2.0 mm (n=19). Mean correction angles: shaft 42°, neck 83°. Complications: two cases of skin irritation; no superficial wound infections.

Conclusions: Antegrade single ESIN for 5th metacarpal fractures is a safe, minimally invasive technique that achieves effective correction, rapid recovery, low complication rates, and is suitable for day-case surgery.

Is Excessive Body Weight Related to Energy Level of Injury in Tibial Tubercle Fractures in Adolescents?

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To assess whether excessive body weight or obesity predisposes adolescents to tibial tubercle fractures from less energetic traumas, prolongs the period of rehabilitation from these injuries or leads to worse outcomes. A retrospective study of patients who underwent surgical treatment for fracture of the tibial tubercle in the period from March 2013 to March 2022. Patients were classified according to age, gender, fracture type, BMI, mechanism and energy levels of injury, time to complete painless range of motion was achieved and rate of complications. We have surgically treated 33 patients who have sustained 34 tibial tubercle fractures. Twenty of our patients had a BMI in the 'healthy weight' range while 13 were either overweight or obese. A significant difference in the distribution of injury types between the two groups has been statistically confirmed, whereby more severe injuries were recorded in the 'healthy weight' group of patients. A statistically significant higher proportion of patients who sustained a fracture after a blow to the knee or during light activity could have been confirmed in the 'overweight/obese' group while patients in the 'healthy weight' group more often sustained fractures after a powerful concentric or eccentric contraction of the quadriceps muscle. All of the patients achieved full painless range of motion and a radiologically confirmed osseous union. The healthy weight group had a significantly shorter period of rehabilitation. Two minor complications have been recorded. A higher BMI may lead to tibial tubercle fractures caused by less energetic injuries in adolescent patients. We may also conclude that blows to the knee or injuries sustained while running most often do not cause the most severe type of fractures. However, operative treatment provides a good outcome regardless of the type of injury or BMI.

Elevated Body Mass Index as a Risk Factor for Tibial Tuberosity Avulsion Fractures in Pediatric Athletes

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Introduction and objectives: Tibial tubercle avulsion fractures are rare injuries in pediatric athletes, and data regarding the potential role of increased body mass index (BMI) as a risk factor remain limited. Previous research has primarily focused on age, sex, and type of sport, while the association between BMI and these injuries—most commonly affecting adolescent males during sports involving powerful quadriceps contractions—remains insufficiently explored. The aim of this pilot study was to analyze epidemiological and anthropometric characteristics of patients with tibial tubercle avulsion fractures, including injury mechanisms and fracture types; to assess whether the prevalence of overweight and obesity in the study population exceeds national pediatric reference values; and to describe associated clinical outcomes.

Materials and methods: A retrospective review of medical records and radiological imaging was conducted for patients under 18 years of age treated for tibial tubercle avulsion fractures between 2017 and 2024. Collected data included demographic and anthropometric characteristics, injury mechanism, fracture classification, treatment modality, complications, and outcomes. Patients were categorized into a normal-weight group (<85th percentile) and an overweight/obese group (≥85th percentile). The primary outcome was to determine whether the prevalence of overweight and obesity in the study cohort exceeded national pediatric reference values. Formal sample size and power analyses were also performed to guide future research.

Results: A total of 21 patients met the inclusion criteria, with a mean age of 13.7 years; 95.2% were male. The most common mechanism of injury was football (52.4%), followed by athletics and running. The most frequent fracture type was Ogden type IVb (38.1%). Overweight or obesity was present in 52.4% of patients, significantly higher than national reference values. Open reduction and internal fixation were performed in 90.5% of cases, with a mean follow-up of 14.6 months (range 6–36 months). Complications were observed in 14.3% of patients, exclusively in the overweight/obese group (27.3%).

Conclusion: This pilot retrospective study suggests a potential association between increased BMI and tibial tubercle avulsion fractures, with overweight and obesity being significantly more prevalent among affected patients compared to the general pediatric

population. These preliminary findings warrant confirmation in larger, adequately powered studies and highlight the importance of weight control and tailored sports participation as potential preventive measures. Early diagnosis, timely surgical management, and appropriate rehabilitation are essential for achieving optimal functional recovery in children with this rare but clinically significant injury.

Transforming Pediatric Polytrauma Care: Implementation of Splenic Artery Embolization After Institutional Reorganization

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Introduction: Pediatric polytrauma management requires rapid coordination between surgical and non-surgical specialties. High-grade splenic injuries (AAST IV–V) traditionally required operative management or strict non-operative management (NOM) under intensive monitoring. Following relocation to a new hospital facility two years ago, our department gained immediate access to interventional radiology services, enabling expansion of minimally invasive treatment strategies.

Aim: To present the implementation of splenic artery embolization as a novel component of multidisciplinary management in pediatric polytrauma patients at our institution.

Methods: A retrospective review was conducted of pediatric polytrauma patients treated over a two-year period following relocation to the new hospital. Clinical presentation, injury severity, imaging findings, hemodynamic status, treatment modality, and outcomes were analyzed. Special focus was placed on patients with high-grade splenic injuries (AAST IV–V) managed with interventional radiology.

Results: During the observed period, several pediatric polytrauma patients were treated, including three with severe splenic injuries (AAST IV–V). In hemodynamically stable or stabilized patients, selective embolization of the splenic hilum was performed in collaboration with interventional radiologists. All three patients were successfully managed without splenectomy. No major procedure-related complications were observed. Hemodynamic stability was achieved, transfusion requirements were limited, and splenic preservation was accomplished in all cases. Compared to previous institutional practice—where operative management or strict NOM were the only options—the availability of immediate interventional radiology enabled organ-preserving treatment in high-grade injuries.

Conclusions: The integration of interventional radiology into the acute trauma workflow has significantly expanded treatment possibilities for pediatric polytrauma in our institution. Splenic artery embolization represents a safe and effective adjunct in selected high-grade splenic injuries, supporting organ preservation within a multidisciplinary trauma approach. Structural reorganization and proximity of subspecialties can directly influence treatment algorithms and improve patient outcomes.

A Rare Fracture of the Anterior Column of the Acetabulum and Iliac Fossa in a Sixteen-Year-Old Male: A Case Report

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Introduction: Acetabular fractures in pediatric and adolescent patients are uncommon and usually result from high-energy trauma. Management must account for the immature pelvis and triradiate cartilage to avoid growth disturbance, early osteoarthritis, and long-term functional impairment. We present a case of an anterior column acetabular fracture extending into the iliac fossa in a 16-year-old male treated with open reduction and internal fixation.

Case presentation: A 16-year-old male presented after a fall down a large staircase with right hip pain, hematoma, and limited range of motion. Additional injuries included a superficial facial laceration and a fracture at the base of the proximal phalanx of the right fourth finger. Neurological status was normal (GCS 15). Pelvic radiographs demonstrated an anterior column fracture extending into the iliac fossa. CT with 3D reconstructions delineated fracture lines, assessed intra-articular involvement, and confirmed an intact triradiate cartilage.

Surgical technique: Through a modified ilioinguinal approach, optimal exposure of the pelvic rim and iliac fossa was achieved. Reduction was obtained using a pelvic clamp and ball-spike pusher, temporized with pointed reduction forceps and intramedullary K-wires across the iliac crest. Definitive fixation of the anterior column was performed using three lag screws placed to restore anatomy and stability.

Outcome: The postoperative course was uneventful. The patient was discharged on postoperative day four and immediately commenced physiotherapy. Scheduled outpatient follow-up with serial radiographs demonstrated satisfactory healing and maintained reduction. The patient regained function without complications.

Conclusion: In this adolescent, anatomical reduction and rigid fixation of an anterior column acetabular fracture via a modified anterior approach enabled early mobilization and excellent functional recovery. Prompt surgical management and accurate reconstruction are essential in adolescents to preserve joint longevity and prevent secondary degenerative change.

Electric Scooter Trauma in Pediatric Surgery – Incidence and Related Injuries: Experience at University Hospital Center Rijeka in 2025

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Electric scooters are being used worldwide as a new means of transport. Multiple recent reports show incresing popularity among children and adolescents. E-scooters pose a significant risk to children and can be associated with severe musculoskeletal injuries. We performed a retrospective review of all orthopedic pediatric referrals relating to e-scooter use for the year 2025. Data included patient sex, age, type of injuries and treatment. The aim of this pape is to present our expirience with injuries caused by electric scooter in hospitalised children and their statistic review.

Keywords: electric scooter, injury, children, pediatric surgery

Residents Section

ERAS in Orthopedics and Traumatology - Screening Protocol

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Introduction: The ERAS protocol is an integrated multidisciplinary approach applied before, during, and after surgery aimed at faster and safer patient recovery. The goal of ERAS is to reduce surgical stress, complications, and hospitalization length while improving functional recovery.

Discussion: A screening was conducted at the Department of Orthopedics and Traumatology at KBC Rijeka, involving patients over 60 years old diagnosed with pertrochanteric femur fracture, subtrochanteric femur fracture, and femoral neck fracture from May 18, 2022, to December 15, 2022. Patients underwent surgery either by classical open surgical methods or minimally invasive techniques. Demographic data, length of hospitalization, complications, and laboratory findings (albumin, total proteins, CRP) were analyzed at admission, on the third postoperative day, at discharge, and during first and second follow-ups. The results showed less protein loss in patients treated with minimally invasive surgical methods compared to the classical surgical approach. Scientific evidence was presented on the effectiveness of HMB in preserving muscle mass, preventing sarcopenia, and improving muscle strength and functional recovery in elderly patients.

Conclusion: Enteral nutrition enriched with HMB, along with adequate protein intake, vitamin D, and physical therapy, represents a key part of perioperative care, rehabilitation, and prevention of complications in elderly trauma patients.

Keywords: geriatric traumatology, ERAS, proteins, sarcopenia, functional recovery

Thromboprophylaxis in Patients with Pelvic Ring and Acetabular Fractures

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Introduction: Pelvic ring and acetabulum fractures in younger populations are most often the result of high-energy trauma, while in older populations they are typically associated with low-energy trauma, often in the context of osteoporosis. These fractures are frequently accompanied by injuries to adjacent organs and soft tissues, as well as significant arterial and venous bleeding.

Methods: These fractures are associated with an increased incidence of venous thromboembolic events (VTE), including deep vein thrombosis and pulmonary embolism, with most thromboembolic complications developing within the first week post-injury.

Results: Identified risk factors for the development of VTE include older age, obesity, the need for angioembolization, the presence of associated injuries, delayed initiation of thromboprophylaxis, delayed surgical intervention, and prolonged hospitalization. Despite this, the optimal approach to thromboprophylaxis in patients with pelvic ring and acetabulum fractures remains a topic of debate and is insufficiently defined in the literature.

Conclusions: Understanding the risk factors and timely and adequate application of thromboprophylaxis are crucial for the optimal management of these complex trauma patients. The aim of this paper is to review the current literature with an emphasis on the timely application of thromboprophylaxis and its impact on reducing the incidence of thromboembolic events in patients with pelvic ring and acetabulum fractures, treated with both conservative and surgical approaches.

Association Between Perioperative Hemoglobin Drop and Length of Hospitalization Following Hip Hemiarthroplasty

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Background: Hip fracture incidence is rising rapidly, caused mostly by the aging population. Femoral neck fractures treated with hemiarthroplasty are frequently associated with perioperative blood loss and postoperative anemia, which may affect recovery and thus increase hospitalization time. Identifying hematologic predictors of length of stay could help optimize perioperative management and improve outcomes.

Objective: To evaluate whether postoperative hemoglobin changes are associated with length of hospital stay in patients undergoing hip hemiarthroplasty for acute femoral neck fracture. Methods: We conducted a retrospective cohort study including 40 patients treated with hemiarthroplasty for hip fracture at our hospital. Preoperative hemoglobin and hematocrit, postoperative hemoglobin and hematocrit values, and hemoglobin and hematocrit decline (ΔHb and ΔHct) were collected. Demographic and clinical variables including age, sex and ASA score were collected. The primary outcome was length of hospital stay. Associations between hematologic variables and length of stay were analyzed using Spearman correlation and linear regression models.

Results: We found that postoperative hemoglobin and hematocrit decline were both correlated with longer length of stay (LOS). Preoperative hemoglobin and hematocrit were not correlated with LOS. In regression analysis adjusted for age and ASA score, hemoglobin decline remained an independent predictor of length of stay.

Conclusion: Perioperative hemoglobin decline appears to be a predictor of hospital stay duration after hip hemiarthroplasty. Monitoring and minimizing postoperative anemia may represent a modifiable factor for improving recovery and reducing hospitalization in this patient population. translate this to english again the same format.

Outcomes of Treatment of Femoral Nonunions With Intramedullary Osteosynthesis and Spongioplasty – A Retrospective Analysis

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Introduction: The treatment of nonunion fractures, or pseudoarthrosis of the femoral diaphysis, still represents a significant challenge in traumatology. This is often due to mechanical instability and poor biological activity of the bone, or infection, which causes impaired healing. The aim of this study was to investigate the effectiveness of intramedullary osteosynthesis with autologous spongioplasty after reosteosynthesis for nonunion of the femoral diaphysis.

Methods: From January 2008 to March 2023, a retrospective analysis was conducted on 41 patients with nonunion of the femoral diaphysis. Primary osteosynthesis was performed with plates and screws in 25 patients, and with intramedullary nails in 16. All patients subsequently underwent reosteosynthesis with an intramedullary nail and autologous spongioplasty. Radiological and clinical healing, as well as time to bone consolidation of the nonunion fracture, were monitored. Inclusion criteria were nonunion of the femoral diaphysis, availability of radiological and medical documentation, and a minimum follow-up of 6 months. The radiological criterion for healing was bridging of three out of four cortices in two projections of radiographs, along with the disappearance of the fracture line.

Results: After reosteosynthesis, bone healing was achieved in 33 patients, resulting in a bone healing rate of 80.49%. In 4 patients, delayed healing occurred, and dynamization of the intramedullary nail was performed. The average time to bone healing was approximately 4.9 months (149.77 days). In 8 patients, pseudoarthrosis persisted. Outcomes did not depend on whether the initial osteosynthesis was performed with a plate or a nail, confirming that the method is applicable in various situations.

Conclusion: Intramedullary reosteosynthesis with autologous spongioplasty proves to be a reliable and practical method for treating femoral pseudoarthrosis. It provides stability and biological stimulation, and the high rate of bone healing in a relatively short time makes it a good treatment option.

Periprosthetic Distal Femur Fractures After Total Knee Arthroplasty – A Retrospective Analysis

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Introduction: The increase in the number of knee endoprostheses and the longer life expectancy of patients have led to an increasing incidence of periprosthetic fractures of the distal femur. Treatment is complicated by osteoporosis, limited bone attachment zone and configuration of the femoral component of the knee endoprosthesis, and the optimal fixation method is still a matter of debate.

Methods: Patients with periprosthetic fractures of the distal femur after implantation of a total or partial knee endoprosthesis, treated with retrograde intramedullary nail, angular stable plate or free titanium screws as the method of choice in the period from January 2014 to January 2026 were retrospectively analyzed. General demographic data, time of endoprosthesis implantation, type of endoprosthesis implanted, choice of osteosynthesis method, preoperative and postoperative radiological diagnostics were collected. Inclusion criteria were periprosthetic distal femur fracture after total or partial knee endoprosthesis implantation and availability of radiological and medical documentation.

Results: A total of 19 cases of periprosthetic distal femur fractures after total or partial knee endoprosthesis implantation were included in the study. The choice of osteosynthesis was retrograde intramedullary nail, angular stable locking plate for the distal femur or free titanium screws with a washer. Out of the total number, 5 fractures were treated with an intramedullary retrograde nail, 13 used an angular stable locking plate for the distal femur and 1 case used free titanium screws with a washer as the choice of osteosynthesis. Medical documentation and radiological diagnostics were analyzed preoperatively and postoperatively. Fracture healing was achieved in 79% (n=15) of cases. In 4 cases, adequate fracture healing did not occur, of which 1 was complicated by infection. In the remaining 3 cases, 1 underwent revision knee alloarthroplasty, and 2 underwent reosteosynthesis.

Conclusion: Osteosynthesis is an effective and reliable method of treating periprosthetic fractures of the distal femur after knee endoprosthesis with a stable femoral component. Our results show that the angularly stable locking plate and retrograde intramedullary nail are adequate methods of treating periprosthetic fractures of the distal femur. The basic prerequisites for successful treatment are the stability of the endoprosthesis, the selection of the appropriate osteosynthesis method according to the fracture geometry and bone quality, and careful surgical technique with minimal damage to the vascularization and soft tissues.

Comparison of Open and Mini-Open Techniques Using a Suspensory Fixation System in the Treatment of Acute Acromioclavicular Joint Dislocation – A Retrospective Cohort Study

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Introduction: Acromioclavicular (AC) joint dislocation is a common injury in the younger active population. It most often occurs as a result of a direct blow to the shoulder, especially in cyclists, football players and skiers. Clinically, it is manifested by elevation of the clavicle above the acromion due to rupture of the acromioclavicular and coracoclavicular (CC) ligaments. The Rockwood classification serves as a guide in the selection of treatment, with injuries of type III and higher most often requiring surgical treatment. The standard surgical method involves fixation with a suspension-fixation system, which is usually performed using a mini-open approach, in which a bone tunnel in the coracoid process is drilled without direct visualization. The aim of this study is to compare the clinical and radiological outcomes of treatment of AC joint dislocation in patients treated with an open method of fixation with a suspension-fixation system compared to patients treated with a mini-open method.

Materials and methods: A retrospective cohort study of patients operated on for AC joint dislocation type III or higher according to Rockwood in the period from 2015 to 2021 was conducted. Functional outcomes (Constant-Murley, ASES, DASH questionnaires), pain, range of motion, and radiographic parameter of CC distance immediately after surgery and at the last follow-up examination, as well as the percentage difference of CC distance compared to the contralateral side, were assessed. Reluxation as an outcome was defined as an increase in CC distance of ≥ 50% compared to the non-operated side. Complications such as "cut-out", reoperations, and coracoclavicular calcifications were recorded.

Results: A total of 57 subjects were included (mini-open n=32, open n=25; 52 men and 2 women). The mean age of the subjects was 38.1 ± 13 years, and the mean follow-up period was 6.7 ± 1.5 years. A significantly greater coracoclavicular distance was found in patients treated with the mini-open method (median (ICR) = 14.7 (11.4–17.4) mm) compared to patients treated with the open method 9.2 (7.8–11.1) mm. Reluxation was recorded in 15 (47%) patients treated with the mini-open method compared to 2 (8%) treated with the open method ($p<0.01$). No significant differences were found in terms of incidence of cut-outs, reoperations and CC calcifications during the follow-up period ($p>0.05$). No significant differences were found in the results of functional questionnaires or the occurrence of pain

between the open and mini-open groups ($p>0.05$). A difference was found in internal rotation of the operated arm between the mini-open and open groups ($p>0.05$).

Conclusion: In the treatment of acute Rockwood type III–VI acromioclavicular joint dislocation, the open method of fixation with a suspension-fixation system shows better long-term radiographic stability compared to the mini-open approach, with a significantly lower incidence of reluxation. Despite the pronounced differences in radiological outcomes, functional outcomes and pain incidence remain comparable between groups at long-term follow-up. The results obtained indicate that the open approach allows for more precise reconstruction of the coracoclavicular complex without a negative impact on clinical outcome and may represent a more reliable surgical option in the treatment of acute AC joint dislocation.

Case Report: Reverse Shoulder Arthroplasty With a 180-mm Long Humeral Stem in a Comminuted Proximal Humerus Fracture

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Abstract: Proximal humerus fractures account for approximately 5% of all fractures and represent the third most common fracture in the elderly population. These fractures are often highly comminuted and frequently associated with rotator cuff tears. The indication for reverse total shoulder arthroplasty (RTSA) has expanded beyond its traditional use in rotator cuff arthropathy, massive rotator cuff tears, and failed shoulder arthroplasties, to include the management of acute proximal humerus fractures.

In this case report, we present a 79-year-old patient with a four-part proximal humeral fracture extending into the humeral diaphysis, treated with RTSA using a 180-mm long humeral stem.

Case report: A 79-year-old female patient presented to the emergency department after a fall onto her outstretched right hand. Plain radiographs revealed a comminuted proximal humeral head fracture with extension into the humeral diaphysis. Given the four-part fracture pattern and the patient's age, reverse total shoulder arthroplasty (RTSA) was indicated.

Initially, the patient refused hospitalization and the proposed surgical treatment and was discharged with Dessault immobilization. At the first follow-up examination three days later, the same treatment recommendation was made and accepted by the patient. Due to the specific fracture pattern, with extension to the mid-diaphysis, a long revision humeral stem was ordered for the procedure.

Because of local skin complications (axillary skin ulcerations caused by Dessault immobilization), surgery was performed one month after the initial presentation.

Under general anesthesia, an extended deltopectoral approach was used to access the proximal and middle portions of the humerus. A tenodesis of the long head of the biceps tendon was performed. The subscapularis and supraspinatus tendons, along with their bony attachments, were identified and tagged with FiberTape sutures for later reconstruction. The distal fracture fragments were stabilized using three cerclage wires. The comminuted humeral head was excised, the glenoid was prepared, and a 40mm polyethylene glenosphere component was implanted. Subsequently, a long humeral revision stem measuring 180 mm was inserted.

Intraoperative stability and range-of-motion testing demonstrated a stable prosthesis without signs of instability. The greater and lesser tuberosities were reattached using the previously placed FiberTape sutures. The postoperative course was uneventful, and the patient was discharged from the hospital five days after surgery.

At the first postoperative follow-up two weeks later, the patient was pain-free and without complications, and a structured physical therapy and rehabilitation program was initiated. At the two-month follow-up, she had regained 60 degrees of forward flexion, 60 degrees of abduction, and 15 degrees of external rotation. The patient reported high satisfaction, was pain-free, and independent in basic activities of daily living, including personal hygiene, cooking, dressing, and eating.

Outcomes of Treatment of Humeral Nonunions With Intramedullary Osteosynthesis and Spongioplasty

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Introduction: Nonunion of the humeral shaft fracture is a complication after treatment of a humeral shaft fracture. Nonunion is defined as a fracture that does not show radiological signs of union after 9 months of treatment. The incidence of humeral nonunion has been described in the literature as 2–20% with conservative treatment and functional immobilization with orthosome immobilization, and 6–10% with surgical treatment. The traditional classification of nonunion includes atrophic, oligotrophic and hypertrophic types. Symptoms of nonunion are pain and instability at the site of nonunion. The gold standard for treatment of nonunion of humeral fractures is plate osteosynthesis and autospongioplasty. The purpose of this study is to analyze the results of surgical treatment of nonunion of humeral shaft fractures with spongioplasty and intramedullary osteosynthesis with an antegrade nail.

Materials and methods: This retrospective study analyzed 26 patients with nonunion of humeral shaft fractures treated between April 2010 and January 2024. Inclusion criteria were nonunion of humeral shaft fractures, availability of radiological and medical documentation, and a minimum follow-up of 6 months.

Results: Of the 26 patients, 11 had their fractures initially treated with intramedullary osteosynthesis, 11 with plate and screw osteosynthesis, 3 with conservative treatment, and 1 patient with an external fixator. Preoperative and postoperative medical documentation and radiological work-up were analyzed. The radiological criterion for union was bridging of three of the four cortical bones in two X-ray projections with disappearance of the fracture crack. Nonunion was achieved in 88% of cases (n = 23), with a median (ICR) time to union of 137 days (85-177.5). Of the three cases without successful healing, two were initially treated conservatively, while one case was complicated by infection and previously treated with an external fixator.

Conclusion: This method of treating humeral shaft fractures has proven to be effective and reliable with a high rate of union. Intramedullary osteosynthesis in selected cases may have advantages, including a less invasive surgical approach, less soft tissue dissection, a lower risk of iatrogenic injury to the radial nerve, and satisfactory axial stability, especially in hypertrophic pseudoarthrosis or as a salvage method after failed plate osteosynthesis.

Should We ever Settle for Amputation when We Have Power to Rebuild? – The Masquelet Technique in Complex Thumb Trauma: A Case Report

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Abstract: Complex high-energy digital injuries involving extensive bone and soft tissue loss often lead to primary amputation. However, this case report presents the successful application of the Masquelet induced membrane technique for the reconstruction of a traumatic thumb injury in a young manual worker.

Case report: A 28-year-old male presented to the emergency department following a circular saw injury to his dominant right thumb. Clinical examination revealed a complex open fracture at the proximal phalanx level with dislocation of the phalangeal head and disruption of the extensor apparatus. Neurovascular structures remained intact. Radiographic imaging confirmed a comminuted fracture of the proximal phalanx with significant segmental bone loss. In collaboration with plastic surgeons, a stage reconstruction was initiated. During the first stage, after thorough debridement, the insertion of a polymethylmethacrylate (PMMA) spacer was performed in order to stabilize the defect and to encourage creation of the induced membrane. Anextensor tendorraphy was also performed. Six weeks later, the second stage was executed: the spacer was removed, revealing a well-vascularized induced membrane, which was subsequently packed with an autologous bone graft harvested from the iliac crest. Two months later at follow-up, complete radiographic union and full functional recovery was achieved, preserving both the aesthetic appearance and anatomical length of the thumb. This case highlights the Masquelet technique as a reliable and effective strategy for thumb salvage after high-energy trauma and significant bone loss. By utilizing the body's own biological capacity to create an induced membrane, we can provide an optimal environment for graft incorporation. This approach transforms life-altering workplace trauma into a success story of biological resilience, pushing the boundaries of reconstructive surgery and enabling manual laborers to return to their work obligations with full capacity.

Planning, Structuring and Delivering a Successful Lecture

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The aim of the lecture is to give to residents some important and practical guidelines for lecture preparation.

Lecture is valuable learning tool and should be structured according to the targeted audience, so the delivered information can be understandable and useful. The amount of information presented should always be limited, and it is impossible to deliver a complete knowledge of selected topics in one session. It is important to provide the audience with useful, clinically applicable, evidence based up-to date information and motivate the audience to learn more. Lecture should consist of catchy introduction, a body of the lecture with 3 to 5 major learning points and final conclusion.

When preparing a lecture, the title is usually defined, so you should then focus to learning outcomes. At the beginning you should define what do you want the learners to be, know, do or feel at the end of the lecture.

Next, define the conclusion or closure slide, where you will summarize the main messages from the lecture. Then, develop the body of the lecture, ensuring the story flows through 3 to 5 learning points that are easy to follow.

During preparation the body of the lecture is often too long; after initial editing slides should be removed based on the available time and the audience. Remember that "less is more". Rushing to squeeze in as many slides as possible will distract the audience and make it harder for them to remember the content.

For proper time management and to analyze the flow of information, it is important to rehearse as much as needed. Rehearse should be out loud with proper pronunciation, in front of the mirror or listener. More practice will give you more confidence, your body language will be more engaging, and learners will be able to retain more.

Today, technology gives us numerous possibilities, but whatever you use ask yourself "Is it useful and does it help?”. Too many graphics, busy slides, animations and videos can be distractive and lead to loss of attention.

Before the presentation it is important to check the venue and equipment, and always keep a backup folder.

Hypersensitivity to Orthopedic–Traumatologic Implants: A Literature Review and Case Report

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Hypersensitivity to orthopedic-traumatological implants is a rare complication after implantation of metal endoprostheses and occurs due to the release of metal ions of nickel, cobalt, and chromium into the periarticular space.

This paper presents a review of available systematic reviews and meta-analyses in the MEDLINE database, along with a case report from clinical practice. The clinical presentation of hypersensitivity is nonspecific, and described cases include persistent pain, effusion, synovitis, and joint stiffness, while skin manifestations such as atopic dermatitis occur in one-third of symptomatic patients. Diagnosis is based on exclusion of other causes, whereby patch testing and lymphocyte transformation tests have low sensitivity and specificity, with the possibility of false-positive findings in patients without clinical symptoms of implant allergy. Therefore, they are interpreted in the context of the clinical picture and only after exclusion of other causes.

The case describes a female patient who first underwent corrective proximal tibial osteotomy, after which prolonged pain developed and resolved following implant removal. Due to progression of osteoarthritis, total knee arthroplasty was implanted, after which knee pain intensified again. Infection was excluded by joint aspiration, microbiological analysis, and scintigraphy, while skin testing demonstrated hypersensitivity to titanium and chromium, due to which implantation of a hypoallergenic endoprosthesis was planned.

Treatment of implant hypersensitivity may be short-term in the form of symptomatic treatment with corticosteroids, anti-inflammatory drugs, or physical therapy. In more severe cases, revision implantation of hypoallergenic ceramic, titanium, zirconium oxide endoprostheses, or conventional prostheses coated with polytetrafluoroethylene that reduces release of metal ions is indicated.

The reviewed literature suggests patch testing in patients with a positive history of metal allergy and consideration of implantation of hypoallergenic prostheses in the case of a positive finding, while routine preoperative testing is not recommended. If signs of hypersensitivity develop postoperatively, after exclusion of all other possible causes, revision implantation of a hypoallergenic prosthesis is recommended only in patients with a positive patch test, as was the case in our patient.

Early Fracture-Related Infection After Intramedullary Osteosynthesis of a Femoral Fracture

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Introduction: Infection associated with fracture represents one of the most severe complications in traumatology surgery. It is associated with prolonged treatment, repeated operations, and an increased risk of osteosynthesis failure. It most commonly develops after open fractures and requires timely recognition and a clearly defined diagnostic and therapeutic strategy. The contemporary treatment approach is based on radical surgical debridement, removal of colonized implants, management of dead space, and targeted antimicrobial therapy aimed at eradication of biofilm.

Case presentation: A 23-year-old male patient sustained bilateral comminuted open subtrochanteric femoral fractures. Initial reduction and stabilization with external fixation were performed, followed by definitive osteosynthesis with intramedullary nails. Treatment was complicated by early infection of the right thigh within two weeks, with purulent discharge and wound dehiscence, thereby confirming the diagnosis of fracture-related infection. Microbiological analysis isolated Pseudomonas aeruginosa with an NDM resistance mechanism, Enterococcus faecalis, and methicillin-resistant Staphylococcus aureus. Due to persistence of infection and instability of osteosynthesis despite the use of negative pressure wound therapy, radical surgical debridement with implant removal and sonication was performed. The dead space was managed with local application of antibiotic cement containing gentamicin and meropenem. Systemic therapy included Vancomycin, Rifampicin, and Cefiderocol.

Conclusion: Successful treatment of fracture-related infection requires timely diagnosis, an aggressive surgical approach, removal of biofilm, and application of targeted antimicrobial therapy. In the presented case, infection control and secondary wound healing were achieved, with planned long-term follow-up.

Infections After Osteosynthesis of Tibial Fractures With LCP Plates – A Case Report

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The infection rate after osteosynthesis with LCP plates is 1–5% in closed fractures, 5–15% in open fractures, and more than 20% in severe open fractures. The risk depends on the localization, mechanism of injury, and general condition of the patient. Patient-related risk factors include diabetes mellitus, smoking, obesity, malnutrition, immunosuppression, and age. Injury-related factors include open fractures, soft-tissue damage, contamination, and poor vascularization. Surgical factors include prolonged and repeated operations, dead spaces, and inadequate antibiotic therapy. Infections are classified as early, delayed, and late.

A 70-year-old patient presented due to dehiscence of postoperative wounds on both lower legs. Seven months earlier, osteosynthesis of both tibiae with LCP plates had been performed following polytrauma. The treatment was complicated by numerous comorbidities. Diagnostic workup confirmed osteomyelitis. The contaminated osteosynthetic material was removed with sonication, and due to pathological mobility of the left tibia, an external fixator was applied. MRSA was isolated from the left leg, and MRSA and *E. Coli* from the right. Targeted antibiotic therapy was introduced, and antibiotic cement nails were placed in both tibiae. After resolution of the infection, the cement nails were removed, and definitive osteosynthesis with tibial nails was performed.

Infections associated with LCP osteosynthesis represent a serious complication. The risk is increased in cases of soft-tissue damage and poor vascularization. Diabetes mellitus and advanced age favor the development of chronic infections. Biofilm and microinstability of the implant make treatment more difficult. Early recognition, aggressive debridement, implant removal, and targeted antimicrobial therapy are key to a successful outcome.

Case Report: Posttraumatic Bilateral Hip Dislocation With a Pipkin I Fracture on the Right and a Pipkin II Fracture on the Left in a 30-Year-Old Patient

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The aim of this case report is to present the operative treatment and postoperative course of a 30-year-old patient who was injured in a traffic accident and presented to the Emergency Department of General Hospital Pula with bilateral hip dislocation, which was treated operatively, as well as a fracture of the right tibial plateau in the region of the intercondylar eminence, which was treated conservatively, together with a fracture of the inferior ramus of the right pubic bone.

In this case report, I will present the treatment process from the patient's admission to the emergency department, the radiological evaluation performed, followed by urgent reduction of both hips under general anesthesia, and the definitive surgical procedure. I will also address the incidence of post-traumatic bilateral hip dislocations and Pipkin fractures. Finally, I will present the postoperative course of treatment in this patient as well as the final treatment outcome.

Nurses and Technicians Section

Nursing Education – A Prerequisite for Safe and Quality Healthcare

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Nursing education has been marked by a series of changes related to the development of the nursing profession, changes in the education system, as well as changes in the healthcare system. The twenty-first century is characterized by the professionalization of nursing, the development of new nursing roles and expansion of competencies, the development of specialist education, outcome-based teaching, active learning, the application of transformational educational methods, as well as the accelerated development of medical sciences and diagnostic and therapeutic procedures.

Nursing education in the Republic of Croatia is aligned with the provisions of European Union Directives 2005/36/EC and 2013/55/EU, Delegated Directive 2024/782, recommendations of the World Health Organization, and the Bologna Process. It is expected that nurses acquire the necessary knowledge, skills, and attitudes, that is, competencies, during their education for the independent, responsible, and professional implementation of nursing care.

In accordance with the increasing demands placed upon nurses, the approach to teaching is also changing, and transformational educational methods are increasingly being used alongside traditional methods. Transformational learning is a student-centered process that actively engages students through critical reflection and discussion. In adult education, transformational learning is defined as a metacognitive process of reasoning that questions problematic assumptions and expectations, encouraging a more inclusive, reflective, and adaptive way of thinking (Mezirow, 2003). Education is therefore not focused solely on the acquisition of knowledge and skills, but also on profound changes in ways of thinking, attitudes, values, and professional identity. The development of critical thinking, individual and group work, experiential learning through simulations and real clinical practice, decision-making in clinical settings, as well as the development of empathy and cultural competence is encouraged.

In their everyday work, nurses make complex clinical decisions, face emotionally demanding situations and ethical dilemmas, and work in interdisciplinary teams; therefore, the inclusion of transformational teaching methods in education enables the preparation of future nurses for the labor market and the provision of safe and high-quality healthcare.

Achieving Functional Independence After Total Hip Arthroplasty

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Total hip arthroplasty is a major surgical procedure that requires intensive nursing care and early rehabilitation aimed at preventing complications and promoting patients' independence in daily activities. During hospitalization, the most common nursing diagnoses include impaired self-care, increased risk of infection, and increased risk of falls associated with the use of orthopedic walking aids.

Functional independence and autonomy are key determinants of quality of life and successful return to everyday activities after surgery. The hip joint plays a crucial role in maintaining stability, dynamic balance, and transferring body weight to the lower extremities during activities such as standing and walking. Therefore, early mobilization with appropriate orthopedic aids is an essential component of postoperative care.

This study aims to present strategies for achieving functional independence in the hospital setting through early postoperative nursing care and rehabilitation. Data on the number of total hip arthroplasties performed in 2021–2022, patients' age and sex, and nursing interventions during the perioperative period were analyzed, with particular focus on preparation for the first assisted mobilization in collaboration with a physiotherapist. The use of orthopedic walking aids to support early functional independence immediately after surgery is also described.

Observations indicated that older female patients more often required a walker at discharge, whereas younger, predominantly male patients more frequently used forearm crutches.

Keywords: Hip arthroplasty, rehabilitation, functional independence

Preoperative Preparation of the Patient for Total Knee Arthroplasty

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Total knee arthroplasty is one of the most common orthopedic procedures in modern surgery. It is performed in patients suffering from rheumatoid arthritis, severe osteoarthritis, and serious damage to the knee joint. The indication for surgery is established when conservative treatment methods no longer relieve pain and do not enable satisfactory joint function. The main goal of the operation is pain relief, improvement of mobility, and enhancement of the patient's quality of life in order to allow return to everyday activities.

Preoperative preparation has an important role in the success of the procedure. It begins with a detailed medical history and clinical examination, along with assessment of the degree of pain, mobility, and stability of the knee joint. The most commonly used diagnostic method is radiological evaluation – X-ray imaging in multiple projections, which enables assessment of the degree of joint damage and surgical planning. The patient's general health condition, presence of chronic diseases, and operative risk are also assessed. An important part of the preparation is patient education regarding the procedure itself, possible complications, and realistic expectations of treatment outcomes. Based on all findings, the type of endoprosthesis and surgical technique are planned.

The surgical procedure includes removal of the damaged joint surfaces of the distal femur, proximal tibia, and, if necessary, the patella, which are replaced with artificial components made of metal and polyethylene. Endoprostheses may be cemented, cementless, or hybrid, and their selection depends on the patient's age, quality of soft tissue structures (ligaments), and the extent of knee joint damage. Precise implant positioning is crucial for the longevity and functionality of the knee endoprosthesis.

The role of the operating room nurse – scrub nurse upon the patient's arrival in the operating room is to confirm the patient's identity (checklist), verify the surgical site (whether it has been properly prepared and marked), ensure patient safety from falls, properly position the neutral electrode, and maintain nursing documentation.

The operating room nurse ensures all necessary instruments for the procedure – verification of instrument sterility and verification of implant components.

Through their knowledge and skills, they ensure the successful and efficient performance of the surgical procedure.

Keywords: total knee arthroplasty, preoperative preparation, role of the operating room nurse

The Role of the Operating Room Nurse in the Management of the Polytraumatized Patient

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A polytraumatized patient is a person with multiple, often life-threatening injuries affecting several organ systems and requiring urgent and coordinated management. In such situations, the operating room nurse plays a key role as an integral part of the surgical team in the operating room. Her role begins already in the preparation phase, when she ensures the readiness of the operating room and prepares the necessary instruments, sterile materials, and medical equipment for emergency surgical procedures.

During the surgical procedure, the operating room nurse hands instruments in a timely manner, anticipates the surgeon's needs, maintains the sterile field, and participates in bleeding control and counting of instruments and consumable materials. Work with a polytraumatized patient often takes place under conditions of high stress, unpredictability, and time pressure, which is why the expertise, organization, and effective communication of the operating room nurse are of exceptional importance.

After the surgical procedure, the scrub nurse participates in final procedures, including instrument control, management of used materials, and preparation of the operating room for further procedures. Through her knowledge, skills, and professional approach, the operating room nurse significantly contributes to patient safety, the success of the surgical procedure, and the quality of healthcare in polytraumatized patients.

Keywords: operating room, operating room nurse, polytrauma.

Blast Injury as a Multisystem Trauma – A Case Report

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Introduction: Injuries caused by explosive devices represent a complex form of trauma that often includes a combination of visible and hidden injuries. Blast injuries require urgent and coordinated management by a multidisciplinary team.

Aim: The aim of this paper is to present the complexity of managing patients with blast injuries.

Methods: A case report of a 28-year-old patient with a blast injury following the explosion of a bomb in the hand is presented. Data were collected through review of medical and nursing documentation. A search of the PubMed and Hrčak databases was conducted.

Results: The patient sustained a severe destructive hand injury caused by a bomb explosion that required surgical amputation, as well as additional blast injuries: hearing impairment and lung injury. The patient was initially managed according to the ABCDE approach, followed by preparation for surgical treatment and further postoperative care. Although the patient was initially treated for external injuries, the pulmonary complication developed subsequently, one day after the explosive injury. Hand amputation significantly affected the patient's psychological state.

Conclusion: In the care of patients injured by explosive devices, continuous clinical monitoring is of exceptional importance, with special emphasis on timely recognition of additional injuries whose clinical manifestation may develop with a time delay. Equally important are effective communication within the multidisciplinary team and the provision of psychological support, especially considering the mechanism of injury and amputation in a young patient.

Keywords: blast injuries; multisystem trauma; nursing care; amputation; case report

Skin Integrity in Orthopedics and Traumatology: Challenges in the Prevention of Therapy-Related Injuries

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Disruption of skin integrity represents a significant clinical problem in the care of trauma and orthopedic patients. During diagnostic and therapeutic procedures – including immobilization, the application of orthoses, splints, extension devices, compression bandages, and medical adhesive products – there is an increased risk of the development of skin tears, medical adhesive-related skin injuries (MARSI), and pressure ulcers.

A review of contemporary literature indicates that skin tears are more frequent than pressure ulcers; nevertheless, they remain insufficiently systematically monitored and managed in clinical practice. These are superficial injuries caused by shear forces, friction, or mechanical trauma, most commonly on the extremities, especially in elderly and fragile patients. MARSI injuries additionally contribute to morbidity, prolongation of hospitalization, and increased treatment costs.

Although pressure ulcers are at the center of preventive strategies and standardized protocols, special attention is required for injuries that occur secondary to therapeutic procedures, especially on the heels and other predilection sites during the treatment of lower-extremity injuries. Insufficient risk assessment, inadequate skin protection, and non-uniform procedures further increase the incidence of complications.

The application of standard protocols, early identification of at-risk patients, the use of modern dressings and protective materials, and continuous education of nurses and technicians are key prerequisites for reducing the incidence of skin damage. A systematic approach to the prevention and management of these complications represents an important contribution to patient safety and the quality of trauma and orthopedic care.

Nursing Care of a Patient Undergoing VAC Therapy

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VAC therapy, or negative pressure therapy, is a modern method for the treatment of acute and chronic wounds that contributes to accelerated healing and reduction of complications. Through the action of negative pressure, angiogenesis is stimulated, wound moisture is regulated, and the number of microorganisms is reduced. In this way, optimal conditions are created for tissue granulation and epithelialization. In our institution, this therapeutic method is most commonly applied in operative wounds with a risk of infection, traumatic wounds, and postoperative infected wounds after debridement.

This paper describes nursing care in patients treated with VAC therapy, with emphasis on patient and wound preparation, maintenance of aseptic conditions, proper handling of the device, assessment of the wound and exudate, and timely recognition of possible complications. Proper implementation of nursing care enables effective functioning of VAC therapy, thereby improving the wound healing process.

Patient education includes informing the patient about the mechanism of action of VAC therapy, proper handling of the device, encouragement of active participation in treatment, and recognition of signs of infection or other adverse events.

An individualized approach, multidisciplinary collaboration, and continuous nursing care contribute to better quality of treatment, greater patient satisfaction, and successful outcomes of VAC therapy.

Keywords: VAC therapy, nursing care, wound healing, debridement, patient education

The Importance of Early Inpatient Rehabilitation and the Role of Nurses in Discharge Planning – Experience From the Department of Sports Traumatology

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Early inpatient rehabilitation represents a key segment in the recovery process of patients after acute injuries, surgical procedures, and sports trauma. Timely inclusion of rehabilitation procedures enables preservation of functional abilities, reduction of complications, accelerated recovery, and shorter duration of hospitalization. In the context of sports injuries, early rehabilitation has additional importance because it enables athletes to return to training and competitions more quickly and safely.

Successful implementation of the rehabilitation process requires multidisciplinary collaboration within the healthcare team, and the role of nurses is particularly emphasized. Ward nurses are responsible for daily patient care, monitoring of the patient’s condition, and implementation of therapeutic activities, while the discharge planning nurse coordinates the patient’s transition from hospital to home or outpatient care. Collaboration between these nurses ensures continuity of healthcare, timely recognition of patient needs, and an individualized approach in rehabilitation planning and education.

Preparation of the patient and family for discharge includes education by physicians and physiotherapists regarding exercises, weight-bearing, and safety in everyday activities, thereby reducing the risk of injury recurrence and rehospitalization. An integrated approach, combining early rehabilitation and coordinated nursing collaboration, contributes to higher quality care, greater patient satisfaction, and a more effective return to daily activities. The experience of the Institute for Sports Traumatology shows that an organized rehabilitation and discharge planning system significantly improves outcomes in patients with sports injuries.

Keywords: early recovery, inpatient rehabilitation, sports injuries, nurses, planned discharge

Characteristics and Hazards of Ionizing Radiation

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Operative methods of fracture treatment most commonly involve the use of perioperative and/or intraoperative ionizing radiation, namely X-rays, the so-called C-arm.

The use of the C-arm is even more common in MIPO methods, osteosynthesis with intramedullary nails, and similar procedures; that is, the use of minimally invasive procedures in operative fracture treatment increases the use of intraoperative radiation.

The aim of this paper is to present the basic characteristics, significance, and dangers of ionizing radiation for operating room personnel working during its use, as well as the methods of protection from the harmful effects of X-rays.

The emphasis will be on how to ensure safe work in the traumatology operating room during the use of X-rays.

Risk Management in the Operating Room

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The operating room is one of the most complex and high-risk environments in the healthcare system. Patient safety does not depend on an individual, but on a multidisciplinary team functioning as a safety system. Each team member has a clearly defined role, and effective communication is crucial for the prevention of errors.

Organizational failures such as an excessive number of people in the operating room, delays, working with insufficient staff, and skipping protocols increase stress and the risk of serious errors. Particularly dangerous are incorrect patient or procedure identification, which is why identity verification, marking of the surgical site, and safety checklists are the foundation of patient protection.

Surgical site infections occur due to disruption of the sterile chain and are prevented through consistent application of aseptic procedures, proper hand hygiene, and control of movement within the operating room. Technical errors and equipment problems are more common in conditions of urgency and staff shortages, especially with sensitive materials such as osteosynthesis instruments.

The human factor – fatigue, stress, and overload – additionally increases the likelihood of error. Therefore, continuous education, error analysis, and a culture of open communication are essential for safety. Patient safety requires the courage to stop the procedure and choose safety over speed.

Keywords: risk management, operating room, safety, education

The Most Common Comorbidities in Patients With Hip Fractures Hospitalized at the Department of Orthopedics and Traumatology, University Hospital Center Split, in 2024

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Aim: To determine the most common comorbidities in patients with hip fractures hospitalized at the Department of Orthopedics and Traumatology of the University Hospital Centre Split during 2024, and to examine differences in the occurrence of comorbidities with regard to fracture type, as well as to analyze their association with treatment outcomes.

Data sources and methods: The study was conducted as a retrospective observational study. All adult patients operated on for hip fracture during the observed period were included, totaling 374 patients. Data were collected from medical records, operative protocols, nursing documentation, consultation findings, and discharge letters. The participants were divided into two groups according to fracture type (femoral neck fractures and pertrochanteric and subtrochanteric fractures). Statistical analysis included descriptive and inferential methods.

Results: Female sex was represented in almost 70% of cases, and the mean age of participants was 81 years. The most common comorbidity was arterial hypertension, present in 61% of patients, while other comorbidities, such as diabetes, atrial fibrillation, dementia, and malignant diseases, had a significantly lower prevalence. Psychiatric exacerbation was more frequent in the group with pertrochanteric and subtrochanteric fractures, but without statistical significance. Urinary tract infection was the most common infectious complication during hospitalization. The majority of patients were successfully discharged from hospital, and in-hospital mortality was low.

Conclusion: The study confirms that hip fractures are most common in elderly women with multiple comorbidities, with arterial hypertension being by far the most prevalent. Urinary tract infection is the most common infectious complication, while differences in psychiatric complications according to fracture type were not shown to be statistically significant. The results emphasize the importance of a multidisciplinary approach, individualized care, and prevention of complications in this vulnerable population.

Keywords: comorbidities; patients with hip fractures; pertrochanteric fractures; subtrochanteric fractures; femoral neck fractures

Comparison of Treatment Costs and Length of Hospital Stay Between Patients With Femoral Fractures Operated Within and After 24 Hours of Hospital Admission

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Femoral fracture represents a serious medical condition that requires urgent and careful intervention. Femoral fractures are often the result of severe traumatic events such as falls from height, traffic accidents, or sports injuries, but they may also occur as a consequence of weakened bones due to conditions such as osteoporosis.

This research paper is based on the analysis of the incidence of femoral fractures according to age, sex, duration of hospitalization, and treatment costs, providing deeper insight into various aspects associated with these injuries and their consequences.

The aim of this research was to analyze the incidence of femoral fractures according to age and sex, and to compare the duration of hospitalization and treatment costs in patients operated on within and after twenty-four hours from hospital admission. This was a retrospective study, and data from the existing documentation of the hospital information system (IBIS) of University Hospital Centre Rijeka were used for patients with femoral fractures treated from January 1, 2022 to December 31, 2022.

The results of the study showed that the incidence of femoral fractures was higher in the female population and in persons older than 81 years. Furthermore, a statistically significant difference was demonstrated in the duration of hospitalization and treatment costs between groups of patients operated on within and after twenty-four hours from hospital admission.

In conclusion, the study confirmed that femoral fractures are more common in women, more frequent in the older age group, and that treatment costs and duration of hospitalization are shorter in patients who were operated on within twenty-four hours.

Nursing Care in the Physical Therapy of Chronic Pain – Contribution to Pain Reduction and Improvement of Quality of Life

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Nursing care in the physical therapy of chronic pain has a key role in alleviating symptoms, preserving functionality, and improving the quality of life of patients. Chronic pain, lasting longer than three months, affects not only physical health, but also psychological condition, work ability, and social relationships. Due to its complexity, it requires a comprehensive approach, in which the nurse occupies an important role.

The foundation of nursing care is high-quality pain assessment. The nurse assesses the intensity, localization, duration, and character of pain using validated scales and monitors changes during therapy. Through regular monitoring and documentation, adjustment of physical therapy procedures to the needs of the individual patient is enabled. In cooperation with physiotherapists and physicians, the nurse participates in the implementation of therapeutic methods such as kinesitherapy, electrotherapy, thermotherapy, cryotherapy, and massage, while ensuring safety and proper application.

An important part of nursing care is patient education. The nurse teaches proper performance of exercises, the importance of regular movement, correct body posture, and the application of non-pharmacological methods of pain relief. Through education, active patient participation in treatment is encouraged, thereby increasing the sense of control over the disease and reducing dependence on analgesics.

Psychological support is also an integral part of care. Chronic pain often leads to anxiety, depression, and social isolation. An empathetic approach, motivation, and continuous communication contribute to better coping with the disease and strengthening trust between the patient and the healthcare team.

Through comprehensive and continuous nursing care, reduction of pain intensity, improvement of mobility and functional ability, and significant enhancement of the quality of life of people living with chronic pain are achieved.

"Pain and Movement" – Challenges of Early Rehabilitation After Orthopedic-Traumatologic Surgical Procedures

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Orthopedic-traumatological surgical procedures are crucial for restoring patient functionality after traumatic injuries or degenerative changes, but the success itself depends on systematic and targeted rehabilitation. The goal of rehabilitation after surgical procedures on bones and joints is to restore all functions that existed before the injury or disease.

Early rehabilitation balances between the necessity of activating the patient as early as possible and the risk of complications. It begins on the first postoperative day, and numerous postoperative difficulties are usually present, which may result in prolonged inactivity in the patient. Postoperative difficulties are expected and transient, among which pain, swelling, nausea and vomiting, dizziness, and constipation predominate. Patients have limited mobility and instability and are therefore at high risk for falls and injuries, which requires additional supervision and education.

In addition to physical difficulties, fear is often present in patients, which may reduce motivation and further complicate rehabilitation. In early rehabilitation, the emphasis is on systematic education and consistent implementation of preventive measures with the aim of reducing the risk of postoperative complications, including infection and dehiscence of the surgical wound, deep venous thrombosis, or endoprosthesis dislocation. Timely recognition of early signs of complications is equally important in order to enable rapid intervention and preserve functional recovery.

The entire process of early rehabilitation presents numerous challenges and highlights the irreplaceable role of the nurse as a key link between restoration of functionality and safe recovery.

Keywords: rehabilitation, orthopedics, surgical procedure

The Role of Nurses in Reducing Pain in Patients After Ankle Surgery

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Postoperative pain after ankle surgery represents a significant clinical problem that may slow recovery and negatively affect the patient's quality of life. The nurse/medical technician has a key role in the multidisciplinary team in the assessment and alleviation of pain through the application of professional interventions and patient education. During preoperative preparation, which also includes the psychological aspect, the nurse/medical technician informs the patient about the procedure and methods of pain control, thereby reducing anxiety and increasing cooperation. In the postoperative period, the intensity of pain is regularly assessed using validated scales, prescribed therapy is administered, and its effectiveness and side effects are monitored. Non-pharmacological methods such as proper positioning of the extremity, application of cold compresses, and encouragement of relaxation additionally contribute to pain reduction. Continuous monitoring of vital signs and the condition of the operated region enables timely recognition of complications.

The aim of this paper is to present the importance of the role of the nurse/medical technician in reducing postoperative pain after ankle surgery and to demonstrate that they have an irreplaceable role in improving treatment outcomes and accelerating patient recovery.

Keywords: analgesia, nurse/medical technician, ankle joint, postoperative pain

Nonoperative Treatment of Humeral Shaft Fractures With Sarmiento Functional Bracing – A Case Report

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Aim: The aim of this paper is to present the success of treatment of proximal third humeral shaft fractures with nonoperative treatment using Sarmiento functional bracing at the University Hospital Centre Split, and to compare it with the latest approaches and opinions in the treatment of this fracture through the most recently published papers.

Case presentation: Through this paper, we will present the case of an injured younger female person with a fracture of the proximal third of the humeral shaft that occurred during a recreational activity following a fall from standing height. After clinical examination and radiographic evaluation, due to the satisfactory position of the bone fragments with preserved neurological and vascular status, a medical decision was made for nonoperative (conservative) treatment with plaster immobilization, when an upper arm immobilization ("U" splint) was applied. At the first follow-up examination, review of the radiographic image concluded that the bone length was preserved without angulation or rotation, and continuation of nonoperative treatment with Sarmiento functional plaster immobilization was decided upon as the definitive treatment for this fracture, along with exercises aimed at preventing contracture of the shoulder, elbow, and hand joints over a period of 4 weeks. During fracture treatment, throughout the phases of treatment, two types of immobilization as well as two types of materials for fabrication of the immobilization were used: plaster bandage and synthetic material bandage with appropriate padding. In addition to clinical examination and radiological follow-up, the progress of treatment was also monitored through weekly completion of the DASH ("Disabilities of the Arm, Shoulder and Hand") questionnaire. After formation of a clear callus, the immobilization was removed, the person was referred to physical therapy which was successfully completed, and after the completed therapy she returned to everyday activities with a satisfactory DASH score.

Conclusion: Humeral shaft fractures occur in different forms and accordingly there are different treatment methods. The choice of treatment method depends on the degree of displacement of bone fragments, the location and stability of the fracture, as well as the age and comorbidities of the injured person. The final prognosis of the fracture depends on neurological status, vascular status, and the number of fragments. Nonoperative (conservative) treatment of humeral shaft fractures provides good results with regard to shortening, angulation, or rotation of the bone, which was recognized by Augusto Sarmiento, who proposed treatment of such fractures with functional immobilization, which has been accepted by many authors primarily because of treatment success and rapid recovery with minimal complications.

Keywords: immobilization, upper arm, fracture, Sarmiento

Early Mobilization After Surgical Management of Pelvic Fractures – The Role of Nurses

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Introduction: Surgical treatment of pelvic fractures represents only the first step in the management of these complex patients. Treatment outcomes largely depend on the quality of postoperative care and work organization. The contemporary traumatology approach abandons the concept of prolonged bed rest and introduces structured early mobilization as a standard of safety.

Aim: To present the organizational model of early mobilization at the Department of General Traumatology and Pelvic Fractures and to emphasize the leading role of nurses in the implementation of safety protocols.

Methods: A standardized postoperative algorithm is presented, including assessment of hemodynamic stability, pain control (NRS), laboratory monitoring, thromboprophylaxis, assessment of orthostatic tolerance, and coordination with the physiotherapist within the first 24 hours after surgery.

Results/discussion: Implementation of a structured nursing protocol achieved consistent and safe early verticalization of patients, with a reduction in complications associated with prolonged immobilization (DVT, respiratory complications, pressure ulcers, delirium). The nurse assumes an active role in clinical decision-making through continuous risk assessment, timely recognition of orthostatic instability, and an individualized approach to each patient. Early mobilization is viewed as a multidisciplinary process coordinated by the nursing team, thereby ensuring continuity of care and patient safety.

Conclusion: Early mobilization after surgical treatment of pelvic fractures is not only a rehabilitation intervention, but also a strategic element of the safety culture of our Department. Nursing leadership in the organization, supervision, and implementation of the mobilization protocol represents a key factor for successful treatment outcomes.

Keywords: nurses, pelvic fracture, early mobilization, prevention of complications

Specific Aspects of Nursing Care and the Complexity of Rehabilitation in a Patient After Osteosynthesis of a Periprosthetic Fracture of the Right Femur With Multiple Complications – A Case Report

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Introduction: Periprosthetic femoral fractures in elderly patients with implanted total hip arthroplasties and numerous comorbidities represent a challenge in rehabilitation. Early postoperative rehabilitation requires a multidisciplinary approach in which the nurse has a key role in the process of healthcare, control of vital parameters, early detection of complications, and implementation of specific nursing interventions.

Aim: To present the role of the nurse and the complexity of the rehabilitation process in a patient after osteosynthesis of a periprosthetic fracture, with special emphasis on the management of associated postoperative complications.

Case presentation: A female patient (born in 1938) was admitted for inpatient medical rehabilitation on the sixteenth postoperative day after osteosynthesis of a periprosthetic fracture of the right femur. The early postoperative course was complicated by iatrogenic bilateral pneumothorax and anemia. Upon admission, the patient was immobile and non-verticalized, with multiple comorbidities: osteoporosis, chronic renal failure, stenosis of the arteria carotis communis (bilaterally 30–40%), psycho-organic syndrome, and bilateral total hip arthroplasties. The clinical course of rehabilitation was additionally complicated by the occurrence of urinary tract infection and acute urinary retention, which required insertion of a permanent urinary catheter and targeted antibiotic therapy according to the antibiogram.

Nursing care: Specific aspects of nursing care included monitoring of vital functions and pain assessment, aseptic dressing changes of thoracic drain sites and the operative wound, prevention of complications of prolonged immobilization (pressure ulcers, thromboembolism, hypostatic pneumonia), and assistance in all segments of self-care. The focus of nursing interventions included management of urinary complications, achievement of optimal oxygenation through the application of the Fowler position and sitting, with continuous implementation of early mobilization together with physiotherapists. Systematic education of the patient and family was carried out regarding the benefits of early verticalization, fall prevention, proper use of orthopedic aids, and structured education of the patient and family regarding aseptic principles of manipulation with a permanent urinary catheter.

Results: Through timely recognition of complications and an individualized care plan, general condition and functional status improved. The patient was successfully verticalized and, upon discharge after 28 days of inpatient rehabilitation, was capable of transfers and independent walking with a walker over short distances, as well as active participation in all segments of self-care.

Conclusion: The complexity of rehabilitation of orthopedic-traumatological patients after postoperative complications and their prevention requires a high level of nursing competence. Through professional practice, the nurse directly contributes to the prevention of secondary complications, achievement of functional independence, and improvement of the patient's quality of life.

Keywords: complexity of care; nurse; osteosynthesis; periprosthetic fracture; rehabilitation

"When the Lights Go Out" – The Silent Burden of the Scrub Nurse in Traumatology

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Introduction: The traumatology operating room rarely knows peace. Patients with polytrauma, open fractures, massive bleeding, and intense fear arrive there. In this controlled chaos, the operating room nurse – scrub nurse must be a stable point: precise, composed, and professionally calm. Her hands must remain steady and her focus unwavering.

Reflection: While the surgical team acts synchronously, the scrub nurse simultaneously follows every step of the procedure, anticipates the next move, controls sterility, and assumes responsibility for the safety of implants and instruments. In situations of shortage of surgical technicians, she also takes over their tasks, which additionally increases the level of responsibility and workload. Every potential error carries serious consequences. Fatigue and emotional exhaustion, however, must not be visible. Emergency night operations, unpredictable intraoperative situations, severe outcomes, and emotionally demanding cases leave a long-lasting psychological impact. Without structured debriefing and systematic institutional support, chronic professional burden can lead to burnout syndrome, manifested through emotional exhaustion, depersonalization, and a reduced sense of professional effectiveness.

Clinical significance: Burnout in the operating room is not an individual problem, but an organizational and safety challenge. Systematic research shows that burnout among healthcare professionals is associated with a higher frequency of errors, reduced quality of team communication, and deterioration of safety culture. In the traumatology environment, where decisions are rapid, situations dynamic, and consequences immediate, the mental stability of operating team members is equally as important as technical competence. A system that does not recognize and address professional fatigue increases long-term risk to patient safety, reduces team resilience in crisis situations, and encourages staff turnover. Care for scrub nurses is therefore not a matter of comfort, but part of a risk management strategy and preservation of healthcare quality.

Conclusion: Care for operating room scrub nurses is not a luxury, but an integral part of the patient safety system. Recognition of emotional and professional burden, stable teams, a culture of mutual respect, and open communication are the foundation of quality traumatological care. Initiatives such as "Fighting Fatigue Together" by the Croatian Society of Nurses in Anesthesia, Resuscitation, Intensive Care and Transfusion represent an important step toward a sustainable, safe, and responsible healthcare system. Because when the lights in the operating room go out, someone still carries the weight of that day. The system must ensure that every team member can safely and steadily return to their professional and personal life.

Keywords: burnout syndrome, scrub nurse, on-call duty, culture of respect, open communication, "Fighting Fatigue Together"

The Scrub Nurse and Implantation of a Proximal Femur Megaprosthesis in Periprosthetic Infection

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Introduction: Implantation of a proximal femoral megaprosthesis in the context of periprosthetic joint infection (PJI) represents one of the most complex reconstructions in orthopedics and traumatology, whether performed as a single-stage or multi-stage procedure. The combination of extensive bone resection and the need for radical debridement of compromised soft tissues requires precise organization of the operating team and strict control of aseptic conditions.

Specific features of the procedure in PJI: Unlike primary or tumor reconstructions, procedures performed due to PJI include additional phases: removal of the previous implant, extensive preparation of the future megaprosthesis bed, collection of microbiological samples, and often changing the instrument set and gloves before the reimplantation phase. The scrub nurse must coordinate the transition from the "contaminated" to the "clean" phase of the procedure, with strict separation of instruments and control of the order of implant opening.

Challenges: During implantation of a megaprosthesis, it is necessary to provide multiple modular segments of different lengths, diameters, and offsets, as well as non-standard acetabular components. In situations of unexpected (or expected) loss of bony support or instability, readiness of additional reconstruction options (augments, antibiotic-loaded cement, different head types) reduces intraoperative delays. Since these are extensive operations in which serious intraoperative complications are possible (periprosthetic fractures, major vascular injuries), timely and coordinated reaction of the entire team is a prerequisite for successful management of complications. At the same time, rational management of sterile materials and control of implant exposure time are crucial for maintaining asepsis.

Conclusion: In prolonged and multi-stage procedures, the experience of the scrub nurse is crucial for the flow of the operation, safety of the patient and surgical team, and maintenance of organizational order in complex situations. During implantation of a proximal femoral megaprosthesis due to PJI, the scrub nurse team serves as coordinator and key support for the surgical team under conditions of high complexity. Clearly defined backup protocols and team stability are the foundation of a successful outcome.

Keywords: scrub nurse, infections, asepsis and antisepsis, open communication, megaprosthesis

Comprehensive Nursing Care for a Patient Undergoing Inpatient Medical Rehabilitation With Complex Traumatic Injuries and Chronic Wounds

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Introduction: Medical rehabilitation of a polytraumatized patient represents a challenge due to the need for simultaneous treatment of chronic wounds, pain control, and physical therapy. In the rehabilitation process, the nurse coordinates all aspects of care in order to ensure optimal conditions for recovery.

Aim: To present the importance of nursing care, treatment of chronic wounds, and an individualized and multidisciplinary approach to the patient after surgical treatment of confirmed bone fractures.

Case presentation: Patient (28) was admitted to the department as a transfer after a severe motorcycle accident from General Hospital Zadar. Diagnoses included fractures of the vertebrae (C5, L1, Th3–Th12), traumatic aortic lesion, paresis of the left radial and peroneal nerves, and multiple fractures of the extremity bones, for which surgical procedures were performed. Upon admission, the patient had severely impaired mobility and was dependent on assistance from others in the process of self-care and activities of daily living. Pressure ulcers (left and right heel and right gluteal region) and hypotrophy of the lower extremity musculature were present.

Key interventions included:

- Pain assessment and treatment.
- Wound care management: Daily dressing changes with monitoring of healing and use of modern dressings.
- Mobilization: Verticalization progressing from walking with a walker to independent walking with forearm crutches and stair climbing.
- Assistance in self-care and activities of daily living.

Conclusion: Continuous and professional nursing care in inpatient conditions was crucial for significant improvement of local wound status and rehabilitation outcomes. Through multidisciplinary work and patient education, the patient was enabled to live independently and maintain the achieved quality of life in accordance with his capabilities.

Keywords: nursing care, medical rehabilitation, multidisciplinary approach, pressure ulcers

Nutritional Assessment of Trauma Patients Older Than 65 Years

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The increase in the proportion of the elderly population leads to an increase in the number of hospitalizations due to trauma. In elderly patients, nutritional disorders are often present and may negatively affect the course of treatment, wound healing, functional recovery, and quality of life. The aim of this paper is to emphasize the importance of early nutritional assessment in traumatized patients older than 65 years and to highlight the role of the nurse/medical technician in recognizing the risk of malnutrition and timely introduction of nutritional support.

Nutritional status is assessed using the standardized Mini Nutritional Assessment (MNA) tool, which includes anthropometric measurements, assessment of functional and health status, as well as dietary habits and fluid intake. The nurse/medical technician has a key role in conducting the assessment upon patient admission, monitoring food and fluid intake, recognizing deviations in nutritional status, educating the patient and family, and collaborating with the physician and nutritionist in nutritional planning. In traumatized elderly patients, there is often a risk of malnutrition, although patients themselves may not subjectively perceive problems with nutritional status.

Timely nursing intervention, continuous monitoring, and an individualized approach to nutrition contribute to reduction of complications, faster recovery, and better quality of care. Nutritional assessment should be an integral part of the initial evaluation of traumatized elderly patients and an important segment of interdisciplinary work in traumatology.

Keywords: nutritional assessment, nurse/medical technician, malnutrition, elderly persons, trauma

Physiotherapists Section

The Role of Scientific Research in Physiotherapy

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Physiotherapy, as a healthcare profession focused on movement and function, is based on the application of scientifically proven methods aimed at improving treatment outcomes. Scientific research represents a key element in the development of modern physiotherapy practice, as it enables the evaluation of the effectiveness and safety of therapeutic procedures. The aim of this paper is to present the importance of scientific research in physiotherapy, its main types, and its application in clinical practice. Evidence-based practice integrates the best available scientific evidence, clinical expertise, and patient needs and preferences. Various types of research are used in physiotherapy, including quantitative and qualitative studies, randomized controlled trials, as well as systematic reviews and meta-analyses. Their application enables informed clinical decision-making and the individualization of therapeutic interventions. Despite its advantages, research in physiotherapy faces several challenges, such as limited access to scientific literature, lack of time and financial resources, and the need for well-developed critical thinking skills. Ethical principles also play a crucial role, including the protection of patient rights and safety, as well as transparency in reporting results. Technological advancements, including digital tools, telerehabilitation, and artificial intelligence, further enhance research and its implementation in clinical practice. The future of physiotherapy is oriented toward personalized treatment approaches and interdisciplinary collaboration. In conclusion, scientific research is the foundation of progress in physiotherapy and a key factor in ensuring high-quality and effective healthcare. Continuous education and staying up to date with new evidence are essential professional responsibilities for every physiotherapist.

Keywords: physiotherapy, scientific research, evidence-based practice, clinical practice, rehabilitation

Clinical Effects of Kinesiotherapy in the Rehabilitation of Low Back Pain

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Low back pain (LBP) is defined as pain, muscle tension, or stiffness localized between the lower rib margin and the gluteal fold, with or without radiation into the leg (sciatica). It represents one of the leading causes of functional disability in the working-age population. The aim of this study was to assess the effectiveness of adding kinesitherapy to standard physical rehabilitation in patients with LBP. A randomized, active-controlled interventional trial was conducted including 60 participants with LBP (mean age 58.3 ± 15.4 years; 37 women), randomly allocated (1:1) into two treatment groups. The first group was treated with standard physical therapy procedures (magnetotherapy, ultrasound, laser therapy, and electrotherapy), while the second group, in addition to the aforementioned procedures, also underwent targeted lumbosacral kinesitherapy focused on the spine and surrounding musculature. Effects were assessed at baseline and after completion of therapy using the Roland-Morris Disability Questionnaire and the Oswestry Disability Index. In both groups, statistically significant improvement after therapy was recorded. However, repeated measures analysis of variance (ANOVA) demonstrated a significantly greater reduction in symptoms and improvement in functional status in the group that underwent kinesitherapy ($p < 0.001$). Patients in group 2 experienced a 52.5% reduction in pain, whereas in group 1 this percentage was 25.4%. The results indicate that adding kinesitherapy to standard physical therapy leads to superior clinical outcomes in the treatment of low back pain.

Specific Aspects of Physiotherapy After Total Hip Arthroplasty: Lateral vs. Anterior Surgical Approach

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Total hip arthroplasty (THA) is one of the most common orthopedic and traumatological procedures, and the choice of surgical approach significantly affects the rehabilitation plan and course. The anterior approach enables preservation of the gluteal muscles and often results in faster initial recovery and fewer restrictions, while the lateral approach includes a surgical incision through the insertion of the gluteus medius muscle, which requires special emphasis on strengthening lateral stability. The aim of this lecture is to present how rehabilitation strategies differ depending on the operative approach and the clinical context – elective orthopedics versus emergency traumatology.

Through a review of relevant literature and our own clinical experience, we will compare the early and late phases of recovery in patients operated on due to degenerative hip diseases and those after femoral neck fractures. In elective orthopedics, in functionally fitter patients, the advantages of the anterior approach are most evident in the first weeks – faster mobilization, earlier transition to walking without aids, and fewer restrictions. In this population, the lateral approach may result in a slower start, but with targeted rehabilitation equal long-term outcomes are achieved. In traumatology, in elderly patients with comorbidities and poorer functional baseline, the pace of recovery is determined more by the general condition than by the type of surgical approach, and rehabilitation is focused on safe basic mobility, prevention of complications, and family education.

After the lecture, participants will be able to recognize how to adapt the rehabilitation plan according to the surgical approach and the patient's health status, and understand why individualization is crucial for success. The physiotherapist, as part of the multidisciplinary team, has a decisive role in the safe and effective restoration of function, regardless of the operative technique.

Keywords: traumatology, rehabilitation, total hip arthroplasty, anterior approach, lateral approach

Physiotherapy Process After Simultaneous Bilateral Total Knee Arthroplasty – A Case Report

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Background: Simultaneous bilateral total knee arthroplasty (TKA) is being increasingly performed in patients with advanced bilateral gonarthrosis. Although such a procedure enables a shorter overall rehabilitation period and faster return to function compared to two-stage operations, it represents a major challenge for postoperative physiotherapy due to more pronounced pain, muscle weakness, and reduced functional ability. High-quality planning and timely initiation of physiotherapy play a key role in achieving optimal functional recovery.

Aim: The aim of this lecture is to present the importance, specific characteristics, and effectiveness of a structured physiotherapeutic approach in the early and late postoperative period in patients after bilateral total knee arthroplasty, and to emphasize the importance of an individualized and progressive rehabilitation program.

Case presentation: An elderly female patient with a long-standing history of gonarthrosis who underwent simultaneous bilateral total knee arthroplasty is presented. Through this lecture, the basic principles of rehabilitation will be presented, along with additional manual therapy techniques including edema and pain control, improvement of range of motion, strengthening of lower extremity musculature, improvement of postural stability and balance during activities and standing, gait re-education, and education for return to activities of daily living. Patient progress was monitored through clinical and functional indicators, including range of motion, pain level, gait tests, and adaptation during activities of daily living.

Results: During rehabilitation, gradual reduction of pain, increased range of motion in both knees, and improvement in muscle strength and functional independence were recorded. At discharge, the patient was independent in transfers, walking with an assistive device on level ground, ascending and descending stairs, and performing basic daily activities.

Conclusion: The presented case confirms that timely initiated, individually tailored, and progressive physiotherapy has a central role in achieving functional recovery after bilateral total knee arthroplasty.

The Role of Early Physiotherapy Intervention in Anterior Cruciate Ligament (ACL) Rupture

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Rupture of the anterior cruciate ligament (ACL) is one of the most common and functionally most significant knee injuries, especially in the physically active and athletic population. The injury leads to joint instability, reduced functional ability, and an increased risk of developing secondary damage, including meniscal lesions and osteoarthritis. Early physiotherapy intervention plays a key role in overall treatment, regardless of whether a conservative or operative approach is applied. The goal of early physiotherapy is to reduce pain and swelling, restore full range of motion, especially extension, and prevent muscle atrophy. Intervention begins immediately after the injury or surgical procedure and includes the application of methods for inflammation control, patient education, manual techniques, quadriceps isometric exercises, cardiovascular endurance training, and the gradual introduction of active and functional exercises. Particular emphasis is placed on restoring neuromuscular control, proprioception, and balance, which are often impaired after ligament rupture. Diagnosis is established through a combination of patient history, clinical examination, and magnetic resonance imaging. After ACL rupture, the clinician and patient should jointly develop a treatment plan that includes treatment, rehabilitation, and return to sport. The three main factors in deciding readiness for participation in sport are physical readiness, psychological readiness, and biological healing. Current evidence suggests that average long-term outcomes are similar after treatment of ACL rupture with reconstruction and rehabilitation or rehabilitation alone. Subsequent knee injury after ACL injury is associated with poor long-term outcomes, and reducing the risk of subsequent knee injury should be a key priority in the treatment of individuals with ACL injury. Further research is needed to determine which patients will benefit most from treatment with or without an operative approach. In the preoperative phase, early physiotherapy contributes to better preparation for surgical intervention and faster postoperative recovery. In the postoperative period, safe and gradual progression of weight-bearing is enabled, along with an individually tailored rehabilitation program. Timely intervention reduces the risk of developing arthrofibrosis, muscle weakness, and chronic knee instability. Contemporary rehabilitation protocols are evidence-based and emphasize early mobilization, controlled loading, and criteria-based progression of exercises. A multidisciplinary approach, involving the orthopedic surgeon, physiotherapist, and patient, is essential for optimal treatment outcomes.

In conclusion, early physiotherapy intervention represents the foundation of successful rehabilitation after anterior cruciate ligament rupture. Timely planning, an individualized approach, and continuous evaluation of progress are key factors in achieving optimal functional knee stability, restoration of full functionality, and reduction of long-term complications.

Keywords: rupture, anterior cruciate ligament (ACL), rehabilitation, functional recovery, physiotherapy

Reduction of Arm, Shoulder and Hand Disability After Acromioclavicular Joint Stabilization Using the Tight Rope Technique and Subsequent Physiotherapy Intervention

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The acromioclavicular joint is a synovial joint formed by the medial border of the acromion and the lateral end of the clavicle. The acromioclavicular joint serves as the main articulation that suspends the upper extremity from the trunk and is the joint around which the scapula moves. Innervation of this joint is provided by the suprascapular nerve, lateral pectoral nerve, and axillary nerve. The acromioclavicular joint is generally considered a gliding joint with flat articular surfaces, although the surfaces are sometimes described as reciprocally concave and convex. Both joint surfaces are covered more by fibrous than hyaline cartilage. The joint is supported by a capsule reinforced superiorly and inferiorly by the acromioclavicular ligaments. The joint also contains an intra-articular meniscus, which is usually smaller than a complete disc and provides only minimal additional support. Another major support of the acromioclavicular joint is the extra-articular coracoclavicular ligament. This ligament represents critical support for the acromioclavicular joint, especially against major displacement and medial displacement. Dislocation of the acromioclavicular joint may be compared with rupture of the coracoclavicular ligament and fracture of the coracoid process. The coracoacromial ligament is another ligament associated with the acromioclavicular joint. Gliding joints allow only translational movements; however, many authors describe rotational movements. The described axes are vertical, anteroposterior (AP), and mediolateral (ML). The vertical axis enables scapular movements that bring the scapula closer to or farther from the clavicle in the transverse plane. Movements around the AP axis result in an increase or decrease of the angle formed between the clavicle and the scapular spine in the frontal plane. Movement around the ML axis tilts the superior border of the scapula toward or away from the clavicle.

Acromioclavicular joint dislocations are among the most common injuries seen in orthopedics and sports medicine and account for 9% of all shoulder girdle injuries. Surgical treatment of AC joint dislocation is indicated in cases of pronounced cranial, dorsal, and inferior displacement of the lateral part of the clavicle (Rockwood grades IV–VI). Postoperative rehabilitation must be adapted to the timeframes of tissue healing. The quality of patient care can be improved by introducing more practical, goal-oriented guidelines that encourage clinicians' critical thinking in order to address individual patient needs. This approach has been effectively termed "PASS" for AC joint rehabilitation. All patients use shoulder immobilization for 6 weeks. Protocols identified through searches of orthopedic surgery program websites in the United States, found through an interactive database access system, were reviewed. Twenty-one protocols were included in the review. It was concluded

that there was significant variability in publicly available acromioclavicular joint rehabilitation protocols. In postoperative physiotherapy of the acromioclavicular joint, patients are approached individually.

Keywords: acromioclavicular joint, coracoclavicular ligament, dislocation, sprain, PASS, rehabilitation

Rehabilitation in a Patient With Complex Regional Pain Syndrome Treated With Corticosteroid Therapy – A Case Report

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Complex regional pain syndrome (CRPS) is a condition characterized by vasomotor, sudomotor, and trophic changes that occur after injury, as well as allodynia and hyperalgesia.

The case report describes a 59-year-old shipyard worker who sustained a radioulnar fracture of the left wrist after a fall from a height of 2.5 meters. After immobilization lasting 4 weeks, edema and elevated temperature were present distally in the left forearm, hand, and fingers, along with limited range of motion in the wrist and finger joints, and weakened musculature of the forearm and hand. The patient reported pain during movement of the affected segments as well as at rest. After 2 rehabilitation cycles, the results were not in accordance with the expected progress, and the patient was therefore referred for comparative X-ray imaging of both hands for the purpose of diagnosing CRPS. A difference in bone density between the hands confirmed the syndrome, after which pharmacological treatment with corticosteroids and adjustment of kinesitherapy followed. After rehabilitation, the edema was completely reduced, the hand temperature corresponded to the contralateral side, range of motion increased, the affected musculature strengthened, and the pain was completely resolved. The patient returned to activities of daily living without limitations.

The obtained results suggest the great importance of including corticosteroid therapy, as well as adapting kinesitherapy and physical therapy, with the aim of restoring function and reducing pain in the segment affected by CRPS. It is necessary to emphasize the benefit of educating healthcare professionals regarding early recognition of clinical signs of CRPS, especially in the acute phase after injury or fracture of the distal parts of the extremities, and to apply a multidisciplinary approach including corticosteroid therapy, modified kinesitherapy, physical therapy, and occupational therapy of the affected segment.

Keywords: treatment monitoring, radioulnar fracture, complex regional pain syndrome, physiotherapy, corticosteroid therapy, multidisciplinary approach

Kinesiotape in Traumatology and Orthopedics

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Kinesio taping is a relatively new physiotherapy method based on kinesiology principles. It treats muscles, peripheral nerves, and organs. The technique stimulates the body's natural ability for self-healing by activating neurological and circulatory systems. Kinesio tape is thin and easily adheres to the skin. When maximally stretched, it reaches 130 to 140% of its original length. After application, the tape remains on the skin for 3 to 10 days. The procedure is repeated if necessary. The tape does not cause allergic reactions and does not contain pharmacological ingredients. The essence of treatment lies in the proper application of the tape to the desired part of the body. It should be emphasized that the method has nothing in common with the standard use of elastic bandages and wraps that are applied with the aim of limiting or completely preventing movement to a certain degree and are used in injuries, postoperatively, and as prevention for future injuries. Therefore, Kinesio tape does not have the task of immobilization. On the contrary, Kinesio tape enables movement. Muscles perform movement of certain body parts, but they also control venous and lymphatic flow, as well as body temperature. Precisely for this reason, disturbances in muscle function lead to numerous symptoms. An inflamed muscle swells and compresses circulation in the surrounding tissue. By using Kinesio tape, muscles and other tissues can be assisted through action from the surface of the body. The tape stimulates circulation and reduces congestion because it forms folds in the skin and subcutaneous tissue, creating the necessary space for fluid flow. The use of tape in rehabilitation after surgical procedures has proven to be a good method for faster recovery and return of the patient to activities of daily living. By applying kinesio tape immediately after surgery for the purpose of improving lymphatic circulation, edema in the operated body segment is reduced, and by reducing swelling the patient experiences less pain and range of motion in joints affected by edema is achieved earlier. Kinesio tape is a tool in physiotherapy that offers a range of benefits, from reducing pain and inflammation to improving muscle and joint functionality. Kinesiology tape has been widely researched, and its benefits in postoperative recovery have been demonstrated in numerous clinical studies. Its ability to increase circulation, stimulate lymphatic flow, and provide support without restricting movement makes it a valuable tool in the postoperative recovery process. However, it is important to consult with the surgeon to ensure its suitability for each individual case.

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