



# ONLINE ABSTRACT BOOK



Nordic Orthopaedic Federation (NOF) Congress

[www.nof2022.org](http://www.nof2022.org)

ISBN 978-609-96167-6-6

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2022

**Nordic Orthopaedic Federation  
(NOF) Congress**

7–9 September 2022, Vilnius, Lithuania

**ONLINE  
ABSTRACT BOOK**

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# ORAL PRESENTATION ABSTRACTS

The content of the abstracts presented is the responsibility of their authors  
and co-authors.

The abstracts are arranged according to the congress programme.

## **1. PLENARY SESSION**

### **1.1. Outcomes with surgery vs functional bracing for patients with closed, displaced humeral shaft fractures and the need for secondary surgery. A prespecified secondary analysis of the FISH randomized clinical trial**

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#### **Importance**

Existing evidence indicates that surgery fails to provide superior functional outcome over nonoperative care in patients with a closed humeral shaft fracture. However, up to one-third of patients treated nonoperatively may require secondary surgery.

#### **Objective**

To compare the 2-year outcomes of patients who required secondary surgery with the outcomes of patients with successful initial treatment.

#### **Design, Setting, and Participants**

This 2-year follow-up of the Finnish Shaft of the Humerus (FISH) randomized clinical trial comparing surgery with nonoperative treatment (functional brace) was completed in January 2020. Enrollment in the original trial was between November 2012 and January 2018 at 2 university hospital trauma centers in Finland. A total of 321 adult patients with closed, displaced humeral shaft fracture were assessed for eligibility. After excluding patients with cognitive disabilities, multimorbidity, or multiple trauma and those refusing randomization, 82 patients were randomized.

## Main outcomes and measures

The primary outcome was Disabilities of Arm, Shoulder and Hand (DASH) score at 2 years (range, 0 to 100 points; 0 denotes no disability, 100 extreme disability; minimal clinically important difference, 10 points).

## Results

Of 82 randomized patients, 38 (46 %) were female. The mean (SD) age was 48.9 (17.1) years. A total of 74 patients (90 %) completed the 2-year follow-up. At 2 years, the mean DASH score was 6.8 (95 % CI, 2.3 to 11.4) in the initial surgery group, 6.0 (95 % CI, 1.0 to 11.0) in the bracing group, and 17.5 (95 % CI, 10.5 to 24.5) in the secondary surgery group.

The between-group difference was -10.7 points (95 % CI, -19.1 to -2.3; P = .01) between the initial and secondary surgery groups and -11.5 points (95 % CI, -20.1 to -2.9; P = .009) between the bracing group and secondary surgery group.

## Conclusions and relevance

Patients contemplating treatment for closed humeral shaft fracture should be informed that two-thirds of patients treated with functional bracing may heal successfully while one-third may experience fracture healing problems that require secondary surgery and lead to inferior functional outcomes 2 years after the injury.

## Interventions

Interventions were surgery with plate fixation (n = 38; initial surgery group) or functional bracing (n = 44); the latter group was divided into the successful fracture healing group (n = 30; bracing group) and the secondary surgery group (n = 14) with fracture healing problems.

## 2. INFECTION SYMPOSIUM

### 2.1. Evaluating inter-rater reliability of the Modified Gordon Score for pin site infection

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## Introduction

There is no consensus on how to evaluate and grade pin site infections which is the most common complication in external fixation (EF). Pin site infection is diagnosed from clinical symptoms (erythema, swelling, pain, drainage, pus) but there is no international consensus on how to grade infection. A precise, objective, and reliable pin site infectious score is warranted to improve post-surgical care. The literature was reviewed for previously used pin site infection classification systems. The Modified Gordon Score (MGS) was chosen as it is based on objective clinical signs: 0 = clean; 1 = Serous drainage no erythema; 2 = Erythema, no drainage; 3 = Erythema and serous drainage; 4 = Erythema and purulent drainage; 5 = Erythema, purulent drainage, radiographic osteolysis; 6 = Ring sequestrum or osteomyelitis. To differentiate between grade 4 and 5 radiographs are needed to identify osteomyelitis.

## Aims and Objectives

The aim was to test the reliability of the Modified Gordon Infection Score. The observed agreement and inter-rater reliability were investigated between nurse and doctors.

## Materials and methods

MGS score was performed in the outpatient clinic at Aalborg University Hospital, Denmark on 1 472 pin sites in 119 patients by one nurse and one of three orthopaedic surgeons blinded to each other's judgement. The data was stored in a Red Cap Database for further statistical analysis. The observed agreement between the nurse and the 3 orthopaedic surgeons was evaluated with a one-way random-effect model with interclass correlation with absolute agreement. Furthermore, the observed agreement for each of the 3 surgeons with the nurse was calculated.

## Results

The distribution of MGS infection grade in the 1 472 pin sites was: Grade 0; n = 1372, Grade 1; n = 32, Grade 2; n = 39, Grade 3; n = 24, Grade 4; n = 5, Grade 5; n = 0, Grade 6; n = 0.

The observed agreement between the nurse and the surgeons was calculated as 98 %. The ICC estimated between nurse and the surgeons was 0,8943 (ICC > 0,85 = reliable). The grading was done by three different doctors with

an agreement with the nurse as follows. Rater1 (n = 416) = 99,5 %, Rater2 (n = 1440) = 97,4 %, Rater3 (n = 1440) = 96,6 %.

## Conclusions

A limitation to this study is that the dataset represents mostly clean pin sites with MGS 0. Only 100 pin sites had signs of superficial infection MGS 1-4 and no sites with severe deep infection score were observed. We found that the MGS infection score is highly reliable for low grade infections but cannot conclude on reliability in severe infections.

## Key words

Pin site infection; external fixation; classification system; orthopaedics; modified Gordon score.

## **2.2. Host factors and risk of pin site infection in external fixation: a review examining age, body mass index, smoking, comorbidities including diabetes**

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## Introduction

External fixation is a widely used treatment of complex fractures as well as for limb lengthening and reconstruction of bone deformities including infection with good and reliable results. The incidence of pin site infection varies widely in the literature from 0–100 % and depends on its classification and severity, and if expressed as the number of pin sites or the number of patients. Most pin site infections are superficial, but it can cause losing of fixation or development of osteomyelitis. By a modified Delphi approach an international Pin Site Consensus Group has identified the topic of host factors affecting pin site infection to be one of the top 10 priorities in pin site management.

## Aims and Objectives

The aim was to report the frequency of studies reporting the specific host factor as a significant association with pin site infection. The host factors to be assessed were: age, smoking, BMI and any comorbidity, diabetes, in particular. The intention was an ethological review, determining the

association between specific host factors: age, BMI, smoking, comorbidities, in particular diabetes, and the outcome pin site infection. Data was extracted if feasible, however no meta-analysis was performed.

## Materials and methods

We conducted a systematic literature search on the host factors affecting pin site infection. This systematic literature search was performed according to the Preferred Reporting Items for Systematic reviews and Meta-Analysis Protocols (PRISMA) guidelines 2020. The protocol was registered before data extraction in the International Register of Systematic Reviews, PROSPERO (ID: CRD42021273305). The search string was based on the PICO (Population, Intervention or Exposure of interest, Comparison, Outcomes) criteria. A logic grid with key concept, key words and index terms was made, and from that a search string was built with the help from a librarian. The literature search strategy was developed using terms related to external fixator constructs, pin site infection and the host factors of interest. The host factors to be assessed were: age, smoking, BMI and any comorbidity, diabetes in particular. The literature search was executed in three electronic bibliographic databases, including Embase MEDLINE (1111 hits) and CINAHL (2066 hits) via Ovid and Cochrane Library CENTRAL (387 hits) at its own website. Studies were included if they meet the following criteria: Patients treated with external fixation, more than one patient developed pin site infection, description of at least one host factor, Peer-reviewed journal. Studies were excluded if they meet the following exclusion criteria: not written in English, German, Danish, Swedish, or Norwegian; animal or cadaveric studies; external fixation in the head, neck, spine, cranial, or thorax; editorials or conference abstract. The title-abstract and full text screening process was done using the platform – Covidence.

## Results

A total of 3 564 titles was found. 3 162 records were excluded by title and abstract screening. 140 studies were assessed for full text eligibility. 11 studies were included for data extraction. The included studies were all designed retrospective. Three of the studies were case-control studies. The studies were generally assessed to have a high risk of bias. Individual retrospective studies reported significant associations between pin site infection for following host factors: a) increased HbA1C level in diabetic

patients; b) congestive heart failure in diabetic patients; c) less co-morbidity; d) preoperative osteomyelitis.

## Conclusions

This systematic literature search identified a surprisingly low number of studies examining for risk of pin site infection and host factors. Thus, this review most of all serves to demonstrate a gap of evidence about correlation between host factors and risk of pin site infection, and further studies are warranted.

## Key words

Pin site infection; host factors; external fixation.

### **2.3. Preparing an automatic pin site infection detection tool with machine learning for homebased surveillance**

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## Introduction

External fixation is widely used and during treatment infection at the pin sites are common. To detect early signs of infection infrared thermography has been suggested to provide quantitative information.

## Aims and Objectives

Our vision is to invent a pin site infection thermographic surveillance tool for patients at home. A preliminary step to this goal is to automate the process of locating the pin and detecting the pin sites in thermal images efficiently, exactly, and reliably for extracting pin site temperature.

## Materials and methods

Images (digital conventional and thermographic) were obtained in a controlled clinical setting and in an uncontrolled home setting. The total number of images available for developing the machine learning algorithm (images of pin sites) before augmentation was 1708, included was 1) FLIR C3, Hospital, n = 1042 2) FLIR C3, Home, n = 197 good-quality 3) FLIR

C3, Home, n = 429 low-quality 4) FLIR Pro One, n = 25 No infection 5) FLIR T540, n = 15. The images was augmented by 9 different methods in to totally 10.409 images and randomly divided into a training set (n = 8325), a validation set (n = 1040), and a test set (n = 1044) of images. The Pin Detection Model (PDM) was developed as follows: A You Only Look Once (YOLOv5) based object detection model with a Complete Detection Intersection over Union (CDIoU) was pre-trained by the hospital dataset and finetuned by the patient dataset through transfer learning. The basic performance of the YOLOv5 with CDIoU model was compared with other conventional models (FCOS and YOLOv4) for deep and transition learning to improve performance and precision. Maximum Temperature Extraction (MTE) Based on Region of Interest (ROI) for all pin sites was generated by the model. Inference of MTE using PDM with infected and un-infected datasets was investigated.

## Results

An automatic tool that can identify and annotate pin sites on conventional images using bounding boxes was established. An obstacle was shifting between the infrared and the conventional digital images, captured by two physically separated cameras on the same device with different spatial locations. It was solved by calibration and image registration with a transformation matrix that converted every pixel on the visible images from the coordinate system of the visible camera to the coordinate system of the thermal camera. The PDM algorithm enabled temperature information extraction at an automatically detected ROI on the skin surface. The PMD algorithm was built on YOLOv5 with CDIoU and has a precision of 0.976. The model offers the pin site detection in 1.8 milliseconds. The thermal data from the pin site could be automatically extracted.

## Conclusions

These results enable automatic pin site annotation on thermography. The model tracks the correlation between temperature and infection from the detected pin sites and demonstrates it is a promising tool for automatic pin site detection and maximum temperature extraction for further infection studies. Our work for automatic pin site annotation on thermography paves the way for future research on infection assessment using thermography.

## Key words

Object detection; machine learning; image analysis; infection; thermography; bone; pin site; orthopaedics.

## **2.4. Hip joint periprosthetic infection treatment with temporary cemented endoprosthesis – 10 year single institution experience**

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### Introduction

Periprosthetic joint infection is one of the most devastating complication in total hip replacement surgery. Standard world-wide approved treatment strategy is two-stage revision. In first surgery meticulous debridement and all implant removal is performed. After an average 6 weeks, second stage surgery is done – repeated debridement and endoprosthesis implantation.

### Aims and Objectives

The aim of the study was to evaluate 10-year experience of our treatment method – single stage revision using temporary cemented prosthesis in first-stage revision.

### Materials and methods

203 patients were enrolled in the study from years 2010 to 2019. Analyses were performed based on medical records, radiological and microbiological findings.

### Results

203 patients with hip joint periprosthetic infection were treated from 2010 to 2019 by 15 surgeons. Surgical approaches for 12 surgeons were anterolateral, for 3 surgeons lateral and posterior. No preferences regarding surgeons tactics were taken in account. 80 % (N=163) of all patients were treated using temporary prosthesis in first stage revision, 20 % (n=40) were treated with implant removal in first stage and reimplantation of cement spacer or no-spacer. Infection treatment success-rate in endoprosthetic group was 90 % (N=139), in no-endoprosthetic group 72 % (N=28). Fistula, what as historically known is contraindication for one-stage revision, was present in 37% (N=60) of patients undergoing temporary prosthesis implantation and

50 % (N20) no-implant group, it was not negative factor for infection eradication. 56 % (N91) from patients with temporary prosthesis no second stage revision was necessary. Most-common reasons for second stage revision was pain- 17 % (N28) and instability 14 % (N23). Microbiological findings in whole cohort was similar to other authors publications- St. Aureus 34 %, St. Epidermidis 19 %, Gram- 10 %, Streptococcus 7 %, others 15 %, unknown 15 %, in both groups no significant differences were found. In cases of severe acetabulum bone defects, more likely method of no-implant usage was chosen. Femur periprosthetic fracture was indicator for more-likely secondary revision surgery. BMI > 40, immunosuppression (HIV, oncological disease), radiation-therapy are associated with worse prognosis regarding one-stage infection eradication. Treatment method preference was determined by surgeon.

### Conclusions

Temporary cemented endoprosthesis is good method of choice for hip-joint periprosthetic infection treatment with good success rate regarding infection eradication, good functional results, in 56 % of cases secondary revision surgery was not necessary.

### Key words

Periprosthetic hip joint infection; articulating hip joint spacer.

## **2.5. Intramedullary nail versus dynamic hip screw with stabilising trochanteric plate in the treatment of unstable intertrochanteric fractures**

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### Introduction

Intertrochanteric fractures are typically treated with internal fixation. However, despite extensive research, the best choice of implant for intertrochanteric fractures remains controversial, especially for unstable

intertrochanteric fractures. Intramedullary nails (IMNs) have shown better results than dynamic hip screws (DHS), which lead to the development of the trochanteric stabilising plate (TSP). The TSP should stabilise the greater trochanter and lateral femoral wall, however, few have compared it to IMNs.

### Aims and Objectives

The study aimed to compare IMN and dynamic hip screw with a trochanteric stabilising plate (DHS-TSP) in the treatment of unstable intertrochanteric fractures in terms of both short- and long-term clinical outcomes.

### Materials and methods

A prospective cohort study included 156 patients treated for an unstable intertrochanteric fracture with IMN or DHS-TSP. The primary outcome was reoperation within three years. Secondary outcomes were measured during the hospital stay (operation time, total blood loss, blood transfusions, mobilisation, and length of stay) and at a one-year postoperative follow-up (pain, patient-reported outcome measures (PROM) and regaining pre-fracture function). Differences between the two groups were analysed using the chi-squared test or Fisher exact test.

### Results

The two groups were similar concerning baseline characteristics, except for IMN being used more frequently than DHS-TSP in osteosynthesis of AO/OTA type 31.3 fractures ( $p < 0.01$ ). The IMN group had a higher total blood loss ( $p < 0.01$ ) and a lower frequency of mobilisation within 24 hours ( $p = 0.02$ ). However, this was not reflected in the number of blood transfusions ( $p = 0.73$ ) or a decreased walking ability at the one-year follow-up ( $p = 0.09$ ). After one year, the IMN group had less pain ( $p = 0.04$ ) but similar results in terms of all other outcomes, including regaining pre-fracture function ( $p = 0.86$ ), PROM ( $p = 0.35$ ) and reoperation rates ( $p = 0.61$ ).

### Conclusions

The findings suggest that both IMN and DHS-TSP may be used to treat unstable intertrochanteric fractures with similar results regarding regaining function, PROM and reoperation rates.

## **Key words**

Hip fracture; intramedullary nail; dynamic hip screw; trochanteric stabilizing plate; intertrochanteric fracture; reoperation; PROM.

## **3. REGISTRY SYMPOSIUM**

### **3.1. Inadequate evaluation and management of suspected-infections after TKA surgery in Lithuania: a retrospective study of 2 769 patients with 2-year follow-up**

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#### **Introduction**

The evidence-based algorithms for treatment of periprosthetic joint infection (PJI) recommends surgical intervention in combination with use of systemic antibiotics. However, still it is not unusual to treat total knee arthroplasty (TKA) patients with suspected infection only using antibiotics.

#### **Aims and Objectives**

We evaluated how suspected infection after TKA was treated in “real life” in Lithuania, with respect adherence to guidelines and investigated the outcome of antibiotic treatment without surgical intervention.

#### **Materials and methods**

Of the 4 069 TKA patients (4 269 knees) registered in the Lithuanian Arthroplasty Register (2013–2015) 2 769 patients (2 825 knees), were interviewed 2 years after the surgery. The patients were inquired if they had been subject to antibiotics treatment after the TKA surgery and/or if any additional surgical interventions on the operated knee had been performed. The number of patients treated with antibiotics due to problems in the

operated knee was identified and cumulative revision rates (CRR) were calculated.

## Results

180 (7 %) patients out of the 2 769 reported that they had been prescribed antibiotics after the primary TKA, 132 of these patients (70 %) said they had received antibiotics due to problems with the operated knee. The 2-year CRR after TKA in patients not treated with antibiotics was 0.7 % (95 % CI 0.4–1), as compared to 24 % (95 % CI 17–32) in those who had used antibiotics due to the problems in operated knee for more than 1 week.

## Conclusions

In Lithuania there seems to be a lack of adherence to evidence based treatment guidelines when infection is suspected after primary TKA.

## Key words

Knee; arthroplasty; infection; antibiotics.

### **3.2. Femoral head size and surgical approach are associated with risk of revision after total hip arthroplasty. Updated results of 269 280 procedures in the Dutch Arthroplasty Register (LROI)**

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## Introduction

In 2017 we found based on Dutch Arthroplasty Register (LROI) data that the 6-year overall revision rates between surgical approach groups were comparable. However, anterior and anterolateral approach were associated with a reduced risk for revision for dislocation, compared to the posterolateral approach. This was at the cost of a higher revision rate for non-dislocation.

## Aims and Objectives

We re-examined the association of femoral head size and surgical approach on revision rate for dislocation or non-dislocation after THA using LROI data, now with more data and longer follow-up.

## Materials and methods

We analyzed data on 269 280 primary THA's registered in the LROI between 2007 and 2019. Crude revision rates for dislocation and non-dislocation were calculated by competing risk analyses and stratified by femoral head size and surgical approach. Multivariable Cox regression was used to analyze time to revision due to dislocation and non-dislocation adjusted for age at surgery, gender, ASA score, fixation, femoral head size, and period of surgery.

## Results

Revisions for dislocation were rare, but at 9-year follow-up more frequent after the posterolateral approach (1.4 % (95 % CI: 1.3-1.5)) compared to the straight lateral (0.6 % (95 % CI: 0.5-0.7)), anterolateral (0.6 % (95 % CI: 0.5-0.7)) and anterior (0.4 % (95 % CI: 0.3-0.5)) approach. A larger femoral head size was associated with decreased revision risk for dislocation (1.4 % (95 % CI: 1.3-1.5) for 22-28 mm heads; 0.9 (95 % CI: 0.8-1.0) for 32 mm heads; 0.6 % (95 % CI: 0.6-0.7) for 36 mm heads) for all approaches. Multivariable Cox regression analyses showed that for the anterior approach the hazard ratios (HR) for both revision for dislocation (0.3, 95 % CI: 0.3-0.4) and non-dislocation (0.8, 95 % CI: 0.8-0.9) were lowest compared to other approaches including posterolateral (HR 1). Non-dislocation revision risk was highest with the anterolateral (HR 1.3 (95 % CI: 1.2-1.4)) and straight lateral approach (1.1 (95 % CI: 1.0-1.2)).

## Conclusions

The anterior approach had the lowest revision rates for both dislocation and non-dislocation. Increasing head size to 32 or 36 mm reduced dislocation and overall revision rates for all approaches.

## Key words

Total hip arthroplasty; revision; dislocation; surgical approach; anterior approach; femoral head size.

### **3.3. Impact of COVID-19 on arthroplasty surgeries in 2020 in the Netherlands**

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#### **Introduction**

Due to the COVID-19 pandemic and the admittance of COVID-19 patients, elective hip, knee and shoulder arthroplasty surgeries were severely reduced in the Netherlands in 2020. Subsequently, COVID-19 resulted in a substantially lower number of performed arthroplasty procedures. As a result, patients did not receive the care they needed. Furthermore, a COVID-19 infection will affect patients differently. For that matter, several COVID guidelines recommended to operate the healthy younger patients first.

#### **Aims and Objectives**

We estimated the change in primary arthroplasty surgery rate in the Netherlands in 2020, because of COVID-19. Additionally, we evaluated whether differences in patient and hospital characteristics between the pre-COVID period and during the COVID-19 outbreak in 2020 were present.

#### **Materials and methods**

All patients with a primary hip, knee or shoulder arthroplasty between 2014–2020 were extracted from the Dutch Arthroplasty Register (LROI). We calculated observed/expected (O/E) ratios to determine the change in arthroplasty rates during the COVID-19 outbreak. We used Poisson regression to estimate the expected number of surgeries per month in 2020, taking into account changes in age and sex composition of the general Dutch population over time (using data from Statistics Netherlands (CBS)). We analyzed 4 consecutive time periods to compare differences in patient mix and hospital characteristics (age, sex, body mass index (BMI), indication (OA or non OA), ASA Physical Status Classification System, and type of hospital (University / General / Orthopedic Focus Clinics). Independent-Samples T (if continuous) and Chi-Square (if categorical) tests were used to

assess differences in patient and hospital characteristics in these four periods: pre-COVID (2014–March 15, 2020), 1<sup>st</sup> wave (March 16–May 24, 2020), summer period (May 25–September 20, 2020) and 2<sup>nd</sup> wave (September 21–December 31, 2020).

## Results

Between March 15, 2020 and December 31, 2020 a total of 60 914 primary hip, knee and shoulder arthroplasties were performed, while 76 371 surgeries were expected. Hence, 15 457 (20 %) fewer surgeries were performed in 2020. The O/E ratio during the COVID-19 outbreak was 0.83 in hip arthroplasties, 0.77 in knee arthroplasties, and 0.78 shoulder arthroplasties. The largest drop in the observed/expected ratio of all arthroplasties was seen in April 2020 (O/E ratios; Hip: 0.25, Knee: 0.03, Shoulder: 0.23), during the 1<sup>st</sup> COVID-19 wave. Compared to the pre-COVID period, the proportion of patients undergoing surgery in focus clinics during the intermediate period and 2<sup>nd</sup> wave increased from 9 % to 15 % and 20 %, respectively, while the proportion of patients in general hospitals decreased from 88 % to 83 % and 79 %, respectively. The proportion of patients undergoing surgery due to OA only decreased during the 1<sup>st</sup> wave (Hip: 74 % vs 34 %; Shoulder: 44 % vs 20 %), compared to the pre-COVID period. Relatively more patients with a more urgent indication for arthroplasty, such as fractures or cancer underwent surgery. These findings did not apply to the knee population, in which the majority of performed surgeries was due to OA (>90 %) in all periods.

## Conclusions

The COVID-19 pandemic had a huge impact on patients in need of hip, knee or shoulder arthroplasty, as 20 % fewer surgeries were performed, with the largest impact in April 2020. In contrast, relatively more surgeries were performed in focus clinics. During the 1<sup>st</sup> wave, relatively more patients with more urgent indications underwent hip and shoulder surgery.

## Key words

COVID-19; impact; hip; knee; shoulder; arthroplasty; surgery; National Registry; Dutch.

### **3.4. Mortality and revision rates of patients 80 years and older in primary total hip arthroplasty for osteoarthritis. Report of 43 053 cases of the Dutch Arthroplasty Register (LROI)**

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#### **Introduction**

Mortality and revision risks are important issues during shared decision making for total hip arthroplasty (THA) especially in elderly patients. We examined mortality and revision rates as well as associated patient and prosthesis factors in primary THA for osteoarthritis (OA) in patients  $\geq 80$  years in the Netherlands.

#### **Materials and methods**

We included all primary THAs for OA in patients  $\geq 80$  years in the period 2007–2019. Patient mortality was calculated using Kaplan-Meier survival analyses. Competing risk analyses were performed with revision of the primary THA as the end point and death as a competing event. Risk factors for patient mortality and prosthesis revision were analyzed using multivariable Cox regression analysis adjusted for sex, age, ASA class, fixation method, head size and approach.

#### **Results**

Mortality was 0.2 % at 7 days, 0.4 % at 30 days, 2.7 % at 1 year, and 20 % at 5 years. Mortality was higher in males and higher ASA class but did not differ between fixation methods. Crude cumulative incidence of revision was 1.6 % (95 % CI 1.5–1.7) at 1 year and 2.5 % (CI 2.4–2.7) after 5 years follow-up. Multivariable Cox regression analysis showed a higher risk of revision for uncemented (HR1.6 (CI1.4–1.8) and reverse hybrid THAs (HR2.9 (CI 2.1–3.8) compared to cemented THA's. Periprosthetic fracture was the most frequently registered reason for revision in uncemented THAs.

#### **Conclusion**

Increasing age, male sex and high ASA class were risk factors for mortality. The risk of revision in patients  $\geq 80$  years was higher for uncemented and

reverse hybrid THA's. Cemented THA's might be a safer option in this patient group.

### **3.5. Total knee arthroplasty and bariatric surgery: change in BMI and risk of revision depending on sequence of surgery**

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#### **Background and purpose**

Obesity has been shown to have a negative impact on outcomes after total knee arthroplasty (TKA). Furthermore, it is recommended to lose weight prior to bariatric surgery (BS), to improve per- and postoperative outcomes. We investigated the change in body mass index (BMI), and the risk of revision, depending on the sequence of surgery in patients having both TKA and BS.

#### **Patients and methods**

Data was extracted from Scandinavian Obesity Surgery Registry and the Swedish Knee Arthroplasty Register. Patients who underwent TKA between the years 2009–2019, and BS within 2 years of their TKA, were eligible for the study. The cohort was divided into two groups: patients with TKA before BS (TKA-BS) and patients with BS before TKA (BS-TKA). The BMI change was presented with descriptive statistics, while Cox proportional hazards model, adjusting for sex, age, BMI and sequence of TKA and BS respectively, was performed to analyze the risk of revision.

#### **Results**

A total of 119 patients were included in the TKA-BS group and 465 patients in the BS-TKA group. The mean gain in BMI in the TKA-BS group was +2.7 while, the mean reduction of BMI was – 11.8 in the BS-TKA group. We

found no association between the sequence of surgery and the risk of revision.

### Interpretation

These results do not indicate a beneficial effect on BMI reduction in patients undergoing TKA prior to BS. Patients undergoing BS prior to TKA had a significant reduction in BMI, but we found no difference in risk of revision.

### **3.6. Pain, function and satisfaction after total knee arthroplasty, with or without bariatric surgery**

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### Background and purpose

The impact of obesity on patients reported outcome (PRO) after total knee arthroplasty (TKA) surgery have demonstrated varying results. We evaluated knee pain, activity in daily life function (ADL), and satisfaction after TKA surgery in patients with and without prior bariatric surgery (BS).

### Patients and methods

Scandinavian Obesity Surgery Registry (SOReg) and the Swedish Knee Arthroplasty Register (SKAR) was used to identify patients operated on with primary TKA for osteoarthritis (OA) between 2009–2019 that had a BS within two years before the TKA (BS group). These patients were compared to patients with TKA without prior BS (no BS group). The patients filled in the Knee injury and Osteoarthritis Outcome Score (KOOS) preoperatively and one year postoperatively as well as satisfaction with the surgery one year postoperatively. Multiple linear regression analysis was used to evaluate one-year postoperative KOOS pain and ADL function between the 2 groups. Adjustments were made for sex, age and preoperative KOOS pain and ADL function respectively.

## Results

Forty-four patients were included in the BS group and 3 524 patients in the no BS group. We found no statistically or clinically significant difference in one-year postoperative KOOS pain and ADL function between the BS group and the no BS group. The majority of the patients in both groups were classified as satisfied or very satisfied one year postoperatively to the TKA.

## Interpretation

Our results indicate that patients without BS prior to the TKA gain similar one-year outcome in pain, ADL function and satisfaction as patients with prior BS.

## 4. PAEDIATRICS ORTHOPAEDICS

### 4.1. Complications of orthopedic treatment in children diagnosed with X-linked Hypophosphatemic Rickets. Is FGF 23 antibody treatment justified?

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#### Introduction

X-linked Hypophosphatemic Rickets (XLHR) in children with a Rickets Severity Score  $\geq 2$  can now be treated with the new fibroblast growth factor 23 (FGF23) antibody drug which prevents bone deformities and increases gait endurance. This study illustrates the extend and complications in the traditional orthopedic treatment of XLHR patients. The impact of surgery and severity of complications in this patient population has not been systematically assessed before. These data are needed to justify the very expensive antibody treatment.

#### Aims and Objectives

This study reviews systematically the complications of orthopedic treatment in XLHR patients and illustrates the extend of surgical treatment through selected patient cases.

#### Materials and methods

The search strategy resulted in 215 studies in which data were collected from 19 eligible studies and complications were categorized. Five patients with

XLHR were identified from Aalborg University Hospital and complications and extend of surgeries were evaluated based on patient charts.

## Results

XLHR patients without FGF23 antibody treatment undergo multiple surgeries. 168 complications were reported in 172 patient in the published literature. The 168 reported complications were categorized as follows: Type I (n = 79): Complications with minimal intervention required and treatment goal still achieved, Type II (n = 41): Complications with substantial change in treatment plan and treatment goal still achieved, Type IIIA (n = 23): Complications with failure to achieve treatment goal and no new pathology or permanent sequelae, Type IIIB (n = 25): Complications with failure to achieve treatment goal and/or new pathology or permanent sequelae. In the five studied patient records at Aalborg University Hospital, Denmark we found a mean of 5.2 complications per procedure in comparison to 1 complication per procedure in the reviewed literature.

## Conclusions

In average one complication occurred per surgery in the included literature and the severity of complications was remarkable. The treatment goal was not achieved in 28 % of surgeries whereof half of these resulted in permanent sequelae or new pathology. Complications were possibly underreported in current literature and complications of surgery in XLHR may therefore be underestimated. Our findings support the use of FGF23 antibody for treatment of the skeletal changes in XLHR instead of surgery as the reported side effects of antibody treatment is negligible compared to the impact of surgeries and related complications.

## Key words

X-linked hypophosphatemic rickets; FGF23 antibody; complications; osteotomy.

## **4.2. Modified Dorgan's technique for pinning supracondylar humeral fracture percutaneously**

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## **Introduction**

Fractures of the bones, involved in elbow joint, especially distal humerus, are diagnosed commonly in children. They compose to 10 % of all paediatric fractures. Distal supracondylar humeral fractures (DSCHF) (type IIB and type III according to Wilkins-Gartland classification) are treated by closed reduction and percutaneous pinning with K-wires (PPKW) (cross pinning) – K-wires are crossed through both humeral condyles. However, this surgical technique often results iatrogenic injuries of ulnar nerve. Also, other percutaneous pinning methods are used – 2, 3 or 4 K-wires may be spiked through lateral humeral condyle only, but such kind of fixation reduce biomechanical stability of fragments even to 58 %. We suggest to apply the modification of Dorgan technique (cross-lateral pinning) – primarily a K-wire is introduced through lateral condyle, then the second K-wire is introduced through medial condyle.

## **Aims and Objectives**

To optimize the tactics of the treatment in children with displaced supracondylar humeral fracture (DSCHF).

To evaluate incidence of iatrogenic ulnar nerve injury using modified Dorgan technique.

## **Materials and methods**

From 2012-01-01 to 2021-12-31 75 patients, which included all inclusion criteria were treated at Orthopaedics Surgery division of Clinic of Paediatrics Surgery using modified Dorgan technique (cross-lateral pinning) – primarily a K-wire is introduced through lateral condyle, then the second K-wire is introduced through medial condyle.

This technique of cross pinning of K-wire enables easy-to-perform traditional PPKW (cross pinning) technique to be easily converted to the safest Dorgan technique. We suggest to name it modified Dorgan technique or Kaunas technique.

## **Results**

Using modified Dorgan technique for children with DSCHF provides stable fixation and no iatrogenic neurological complications were detected.

## Conclusions

After evaluation of study results and publications' analysis we suppose that our recommended modified Dorgan technique of percutaneous pinning for the treatment of the children with distal supracondylar humeral fracture is not more complicated technically than traditional PPKW (cross pinning), but safety of it do not yield to Dorgan technique (lateral-cross), biomechanical stability of fragments is not reduced. We expect, that applying of this technique (modified Dorgan technique – cross-lateral pinning) in daily practice of paediatric orthopaedic surgeon will lead to significant reduction of complete prevention of iatrogenic complications of ulnar nerve.

## Key words

Distal supracondylar humeral fracture; modified Dorgan technique.

### **4.3. Health related quality of life of children with flexible flatfoot**

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## Introduction

Pediatric flexible flatfoot usually is described as a foot posture with deficiency or insufficiency of the longitudinal arch in the midfoot. The debate between treatment and observation of asymptomatic flexible flat feet is still on top.

## Aims and Objectives

The aim of this study was to investigate the child and parent perceptions of health-related quality of life associated with flexible flatfeet.

## Materials and methods

In the study 176 boys and 175 girls were enrolled in the study with pediatric flexible flatfeet and normal feet between the pre-school and school age completed the Pediatric Quality of Life Inventory (PedsQLTM 4.0). Proxy questionnaires were also completed. Objective parameters were also included and compared with life quality.

## Results

Parents' assessment of the quality of life of children with asymptomatic mobile flatfoot is more higher than children. Reliability between patient and

proxy questionnaires was assessed using the absolute agreement intraclass correlation coefficient and comparing mean absolute differences with a paired two-tailed t test as per recommendations. Questionnaire domain scores were compared between subject groups using an unpaired two-tailed Student's t test. Pearson's R was used to assess the correlation between PedsQLTM 4.0 domain scores. Alpha was set at 0.05 to define significance.

### Conclusions

This suggests that a non-symptomatic mobile flatfoot is not always a reflection of a normal foot and that the child's health-related quality of life complaints should be considered more closely in the identification and development of a treatment.

### Key words

Foot posture index; paediatric flexible flatfoot; footprints; Health-related quality of life.

## **4.4. ACL reconstruction in adolescent athletes. Hamstring vs quadriceps tendon tendon autografts. Early outcomes of a prospective study**

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### Introduction

Recently increased numbers of anterior cruciate ligament (ACL) injuries are seen in adolescent population. Mostly that is due to better diagnostic abilities and constant rise of involvement in specialized sports activities. There is no more discussion whether ACL in young patient should be reconstructed. It is proven that ACL reconstruction (ACLR) prevents further meniscus and cartilage damage. Graft choice for ACLR is an important debate. Traditionally hamstring (HS) tendons are more commonly used for ACLR. Another option trending is quadriceps tendon (QT) autograft. Some data claims that QT autograft is excellent and robust tissue which is relatively easy to harvest and provides great knee stability.

### Aims and Objectives

To evaluate and compare knee stability (side-to-side anterior tibial translation) after ACLR using HS versus QT autograft in adolescents.

## Materials and methods

A prospective randomised study of 50 (29 male, 21 female) patients from 13 to 17 years old who suffered ACL tear and were treated at Hospital of LUHS Kaunas Clinics. Diagnosis of ACL tear must have been confirmed clinically and on MRI. Treatment method was randomly chosen. For group I ( $n = 27$ ) HS graft and for group II ( $n = 23$ ) QT graft was used for ACLR. Before the surgery IKDC questionnaire and Tegner Lysholm knee scoring scale were filled by the patients. During the surgery data of meniscal damage and graft diameter were collected. Genourob (GNRB) knee arthrometer was used 3, 6 and 12 months postoperatively to evaluate side-to-side anterior tibial translation. At the moment GNRB data of 3 (GNRB1) and 6 (GNRB2) months postoperatively were compared. Force of 134N was used in GNRB1 testing and forces of 134N, 150N and 200N were used in GNRB2 testing. Data analysis was performed by IBM SPSS 27 software. Data is presented using descriptive statistics. For data comparison between methods Mann-Whitney U test was used.

## Results

Mean age of the patient at the time of the surgery was 15.96 (SD 1.26). Average IKDC score before the surgery was 54.42 (SD 18.01), average Lysholm score was 68.59 (SD 21.03) and Tegner activity level score averaged at 7.51 (median 9). Associated meniscal lesion was found in 37 patients (74 %). 18 patients (36 %) suffered medial, 12 (24 %) had lateral and 7 (14 %) had both ruptured meniscus. Depending on graft choice 27 patients (54 %) formed HS group and 23 (46 %) formed QT group. GNRB1 was performed on 34 patients (68 %) and GNRB2 on 30 patients (60 %). There was no significant difference in graft diameter between HS group 9.19 mm (SD 1.01) and QT group 9.44 mm (SD 0.46) ( $U = 217$ ,  $p = 0.064$ ). Smaller but not significantly different side-to-side anterior tibial translation was seen in QT group vs HS group during GNRB1 and GNRB2 testing at 134N force: QT group GNRB1 0.97 mm (SD 0.79) vs HS group GNRB1 1.67 mm (SD 1.52) ( $U = 60.5$ ,  $p = 0.092$ ); QT group GNRB2 1.21 mm (SD 0.96) vs HS group GNRB2 1.59 mm (SD 1.38) ( $U = 105$ ,  $p = 0.79$ ). Comparing QT and HS group during GNRB2 testing at 150N and 200N force also no significant difference was seen: QT group GNRB2 150N 1.23 mm (SD 0.96) vs HS group GNRB2 150N 1.66 mm (SD 1.34) ( $U = 97.5$ ,  $p =$

0.55); QT group GNRB2 200N 1.21 mm (SD 0.95) vs HS group GNRB2 200N 1.32 mm (SD 1.05) ( $U = 95$ ,  $p = 0.98$ ).

## Conclusions

Although there is no significant difference in knee stability postoperatively after ACLR whether HS or QT autograft was used but tendency can be seen that QT graft has slight advantage. These results are primary but also promising that with increased sample size they could be more reliable and QT as great autograft option more frequently would be used for ACLR in adolescents.

## Key words

ACL reconstruction in adolescents; quadriceps tendon autograft.

## **4.5. Pediatric foot's longitudinal arch assessment by different indicators.**

### **A cross sectional study**

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## Introduction

The foot posture is age-dependent. The purpose of this study was to investigate the relationship between the 6-item version of the foot posture index and other clinical, foot anthropometric, radiological measurements for foot position in 5–8 years children.

## Aims and Objectives

The purpose of this study was to investigate the relationship between the 6-item version of the foot posture index and other clinical, foot anthropometric, radiological measurements for foot position in 5–8 years children.

## Materials and methods

A total of 301 participants with a mean age of  $6.4 \pm 1.14$  years were enrolled in the study. Children were examined physically, clinically, radiologically to measure foot posture index and navicular drop test, resting calcaneal stance position angle, Chippaux-Smirak index, Staheli index, calcaneal pitch angle, talocalcaneal angle, lateral first metatarsal angle. Tibial torsions, internal rotation of hip as an indirect method of femoral anteversion and Beighton scale were analyzed for factors associated with flat foot prevalence.

## Results

The study included children with normal and flexible flat feet. Statistical analysis showed a significant FPI score correlation with other parameters (SI, CSI, RCSP, ND, CP, TMA, TCA) showed strong and moderate correlations,  $p < 0.001$ . Overall, the strongest associates are Chippaux-Smirak index ( $\beta = 0.34$ ) and ND ( $\beta = 0.28$ ). Other indicators having relatively small relationships with the foot posture index.

## Conclusions

There is a strong correlation between FPI-6 and navicular drop test, Chippaux-Smirak index in 5–8 years children. All three prominent foot posture indicators (FPI-6, ND, CSI) might be used as a primary or preferred tool in clinical practice.

## Key words

Foot posture index; foot assessment; pediatric flat foot; footprints; Chippaux-Smirak index

### **4.6. In search of optimal conservative treatment method for lateral ankle sprains in adolescents**

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## Introduction

A lateral ankle sprain (LAS) is one of the most common injury, which occurs in children. Despite large number of studies, diversity of treatment strategies persists. Over 20 years acronym PRICE (protection, rest, ice, compression, elevation) and anti-inflammatory drugs (NSAIDs) is first option, despite its lack of high-quality evidence. Lately acronym PEACE and LOVE (protection, elevation, avoid anti-inflammatory drugs and icing, compression, education, load, optimism, vascularisation, exercise) was announced, which involves immediate care and rehabilitation of soft tissue damage. It is thought that phases of inflammation help tissue to heal and NSAID's combined with icing interferes it, so new strategy excludes this combination.

## Aims and Objectives

To compare PRICE vs PEACE and LOVE for LAS treatment and to evaluate injury severity outcomes in adolescents.

## Materials and methods

A prospective randomised study of 33 (18 male, 15 female) patients from 12 to 17 years old who admitted LUHS Paediatric emergency department in year 2022 after LAS was executed. Inclusion criteria were first time LAS, acute period of 1 to 4 days after injury, exclusion of chronic pain and any fracture, except avulsion. Patients were randomly allocated to classic (A) PRICE (n = 16, male 61.1 %, female 38.9 %) or new (B) PEACE and LOVE (n = 17, male 50 %, female 50 %) treatment method. Patient diagnose was confirmed by x-rays and ultrasound system MyLab 9 eXP 20071, Esaote S.p.A., CE 0123. Ankle function was tested by Biomed isokinetic dynamometer to compare range of motion (ROM) and peak torque to body weight (PEAK TQ/BW) of inversion (IN) and eversion (EV), Y balance test composite scores (YBT CS) were counted to evaluate proprioception between involved (I) and unininvolved (U) legs 1 to 2 and 5 to 7 weeks after injury comparing two methods. Depending on radiologic findings patients were divided into two groups: I – diagnosed with sprains (grade I) or partial tears (grade II) of lateral ankle ligaments; II – diagnosed with complete tears (grade III) and/or avulsions of lateral malleolus.

Data analysis was performed by IBM SPSS 22 software. Two independent samples were compared by Mann-Whitney U test.

## Results

Mean patient age was 15.19 (SD 1.54). Depending on injury severity 15 patients (46.9 %) formed group I and 17 patients (53.1 %) group II. There was no significant difference measuring deficiencies between U and I legs in group I and II in both testing: YBT-1 CS group I 15.46 % vs group II 17.41 % ( $U = 112$ ,  $p = 0.558$ ); YBT-2 CS group I 12.30 % vs 15 % ( $U = 68$ ,  $p = 0.393$ ); 1 PEAK TQ/BW IN group I 15.17 % vs group II 17.68 % ( $U = 108$ ,  $p = 0.450$ ); 1 PEAK TQ/BW EV group I 14.60 % vs group II 18.18 % ( $U = 99$ ,  $p = 0.282$ ); 2 PEAK TQ/BW IN group I 15.90 % vs group II 12.88 % ( $U = 66$ ,  $p = 0.340$ ); 2 PEAK TQ/BW EV group I 12.85 % vs group II 14.68 % ( $U = 73.5$ ,  $p = 0.564$ ); 1 ROM group I  $13.47^\circ$  vs group II  $19.18^\circ$  ( $U = 82$ ,  $p = 0.086$ ); 2 ROM group I  $11.35^\circ$  vs  $15.56^\circ$  ( $U = 58.5$ ,  $p = 0.183$ ). There was no significant difference comparing efficiency of two treatment strategies

after 5 to 7 weeks also: I leg YBT CS A 10.92 % vs B 15.71 % ( $U = 53$ ,  $p = 0,111$ ); I leg PEAK TQ/BW IN A 13.83 % vs B 13.21 %; I leg PEAK TQ/BW EV A 14.04 % vs B 13.04 %, I leg ROM A 11.46° vs B 15.25° ( $U = 59,5$ ,  $0,208$ ).

### Conclusions

There is no significant difference in ankle function 1 to 2 and 5 to 7 weeks after LAS regardless it is just a sprain or complete ligament tear. Despite a paucity of high-quality evidence classic PRICE does not concede to a new PEACE and LOVE strategy.

### Key words

Lateral ankle sprain; peace and love; price; YBT; biodex.

## 5. ARTHROPLASTY SYMPOSIUM

### 5.1. Hip resurfacing – where do we go from now?

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#### Introduction

First attempts to perform hip resurfacing were made in early 20th century. Results of procedure were poor, until year 1997, when modern MOM hip resurfacing was introduced by D. McMinn. Since then, resurfacing was in its golden age. Development of new implants gave an unexpected results. Variety of modifications led to catastrophic implant failure. In 2010 – voluntary withdrawal of one of the resurfacing systems due to new data from the UK register (frequency of revisions in the first 5 years – 13 %), after which came other systems. Today, hip resurfacing is one of the most controversial topics in orthopaedics. It had its ups and downs. Should it be abandoned or on the contrary – encouraged?

#### Aims and Objectives

Evaluate results of modern metal on metal hip resurfacing and define factors that affect clinical outcomes.

## Materials and methods

Literature review of hip resurfacing and its results – indications, survivorship, functional outcomes, adverse events. Compare outcomes between resurfacing and conventional total hip arthroplasty. Define factors for successful hip resurfacing.

Present Lithuanian experience in hip resurfacing – analysis of hip resurfacing outcomes using Lithuanian joint registry.

## Results

Resurfacing should be considered for younger male patients, who require superb functional outcomes – such as high-performance athletes. But this option should only be considered when strict selection criteria are met, appropriate implants used and surgery performed by most skilled surgeon in high volume centre. Otherwise – this type of surgery cannot be justified and it can lead to disastrous results.

## Conclusions

Hip resurfacing still has its place in joint replacement surgery – and it shouldn't be forgotten. It's not a routine procedure which is suitable for vast majority of patients. But in selected cases it outperforms conventional total hip arthroplasty.

## Key words

Hip; arthroplasty; resurfacing; metal on metal; athletes.

## **5.2. Pre-operative 3D planning and clinical use of custom-made acetabular implants. A report of 3 clinical cases and short-term results**

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## Introduction

In the last decade clinical use of custom-made 3D-printed acetabular implants has significantly risen. One of the main indications for choosing 3D-printed acetabular implants over the standard implants is large acetabular bone loss (with a W. G. Paprosky type IIC-IIIB defects). Even though there are still many disagreements and unsolved questions regarding complex

acetabular revisions - first studies show promising future for this novel technology.

### Aims and Objectives

To analyse and share short-term results of the first complex acetabular revisions made with custom-made 3D printed acetabular implants on patients with a W.G. Paprosky type IIC-IIIB defects in Republican Vilnius University Hospital.

### Materials and methods

This is a single-centre observational descriptive study. The inclusion criteria were: patients, regardless of age, with Paprosky type IIC-IIIB defects undergoing revision surgery using custom-made 3D printed acetabular implants. Preoperative preparation was done using MICE, Mimics Medical and Geomagic FreeForm Plus software. 3D implants were synthesized by direct metal laser sintering and later were sterilised for clinical use. Due to large bone defects present in these patients, few other surgical options were available. In total 3 patients underwent the surgery with one patient undergoing the surgery twice – on both sides. The clinical postoperative results and radiological imaging were compared with the preoperative status. Pain scores, functionality, stability, mobility, impact on daily life and implant positioning were recorded. Special notice of possible short-term complications was taken.

### Results

Out of 3 clinical cases that were analysed all 3 (100 %) achieved satisfactory short-term hip joint and acetabular implant mobility and stability. Radiological imaging showed adequate implant positioning. In the short-term no complications were recorded. The median operating time was 175 minutes.

### Conclusions

The use of custom-made 3D-printed acetabular implants enables reconstruction of large acetabular defects while ensuring easy surgery preparation for the surgeon, probably less common complications and similar if not better functionality and pain scores than other alternatives. Further long-term follow-ups are needed to draw additional conclusions in regard to clinical use.

## **Key words**

Individual acetabular implant; surgical drilling guides; surgical instruments; guides; custom-made; fixation; virtual planning; 3D printing.

### **5.3. Being active with a total hip or knee prosthesis: a systematic review into physical activity and sports recommendations and interventions to improve physical activity behaviour**

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#### **Introduction**

Regular physical activity is considered important after total hip / knee arthroplasty (THA/TKA).

#### **Aims and Objectives**

Objective was to systematically assess literature on recommendations given by healthcare professionals to persons after THA and TKA and to provide an overview of existing interventions to stimulate physical activity and sports participation. Regular physical activity is considered to be one of the most important lifestyle behaviors affecting health. Regular physical activity it is proven to help prevent and treat noncommunicable diseases. Being physically active on a regular basis also enhances fitness. Fitness is positively associated with functional autonomy in older adults.

#### **Materials and methods**

A systematic review with a narrative synthesis including articles published between January 1995 and January 2021 reporting on recommendations and interventions. The PubMed, Embase, CINAHL and PsycInfo databases were systematically searched for 1) original articles reporting on physical activity and sports recommendations given by healthcare professionals to persons after THA and TKA, and 2) articles reporting on interventions / programs to stimulate a physically active lifestyle after rehabilitation or explicitly defined as part of the rehabilitation. Methodological quality was assessed with the Mixed Methods Appraisal Tool (MMAT).

## Results

Twenty-one articles reported on recommendations. Low-impact activities are allowed. Contact sports, most ball sports, and martial arts are not recommended. One study informed on whether health-enhancing physical activity recommendations were used to stimulate persons to become physically active. No studies included recommendations on sedentary behavior. Eleven studies reported on interventions. Interventions used guidance from a coach/physiotherapist, feedback on physical activity behavior from technology, face-to-face, education, goal-setting, financial incentives and coaching/financial incentives combined, of which feedback and education seem to be most effective. For methodological quality 18 out of 21 (86 %) articles about recommendations and 7 out of 11 (64 %) articles about interventions scored yes on more than half of the MMAT questions (0-5 score).

## Conclusions

There is general agreement on what kind of sports activities can be recommended by health care professionals like orthopaedic surgeons and physiotherapists. No attention is given to amount of physical activity. The same is true for limiting sedentary behavior. The number of interventions is limited and diverse, so no solid conclusions can be drawn. Interventions including provision of feedback about physical activity seem to be effective and feasible.

## Key words

Total hip arthroplasty; total knee arthroplasty; sports; physical activity.

### **5.4. Effectiveness of rehabilitation for working-age patients after primary total hip arthroplasty: a comparison of usual care in the Netherlands versus Germany**

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## Introduction

Primary Total Hip Arthroplasty (THA) postoperative rehabilitation differs between Germany and the Netherlands. In the Netherlands, patients undergo fast-track surgery following quickly discharge into their home environment. Postoperative physiotherapy reimbursement depends on the patient's health insurance coverage. In Germany, patients stay in hospital for about 6–10 days before being transferred to a (inpatient) rehabilitation center for a 3-week period.

## Aims and Objectives

The primary aim of this study is to compare the medical effectiveness of the Dutch versus German usual care after THA. A secondary aim is to get a first insight in the cost effectiveness between the two policies.

## Materials and methods

This transnational prospective controlled observational trial assessed the medical effectiveness by means of standardized patient self-reported questionnaires and functional tests. Measurements were taken preoperatively, and postoperatively at 4 weeks, 12 weeks and 6 months. For a first cost-effectiveness impression, economic aspects were assessed (6 months postoperatively) from a societal perspective.

## Results

In both countries complete data for 62 patients are available. The German policy leads to a significant larger patient proportion (65.6 % vs. 47.5 %) that is satisfied 12 weeks postoperative. The German cohort scored significantly better regarding subjective and selected objective THA function. Concerning

the costs, the German policy is almost twice (45 %) as expensive as the Dutch. Comparing only patients who are still participating in the workforce, costs in Germany are only 20 % higher. If, in a scenario analysis, weekly working hours and productivity costs in Germany are brought into line with those in the Netherlands, the cost difference falls to 8 %.

## Conclusions

Based on the results it can be concluded that the more intense postoperative rehabilitation following THA as handled in Germany is medically advantageous. From a cost-effectiveness perspective, comparisons are less straightforward as the socio-economic context differs between both countries. However, the results still give food for thought whether aspects of the German approach could be beneficial for the growing group of working-age patients in the Netherlands.

## Key words

Osteoarthritis; orthopedics; physiotherapy; patient satisfaction; economic evaluation; cost comparison.

### **5.5. Implementing lifestyle interventions in hip and knee osteoarthritis: experiences of healthcare professionals**

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## Introduction

For hip and knee osteoarthritis (OA), substantial evidence has demonstrated the positive effects of lifestyle modifications (e.g. increasing physical activity levels and weight reduction) on OA symptoms. However, lifestyle interventions (LIs) are currently underutilized in the conservative treatment of hip and knee OA. Up to now, limited research has been conducted

focusing on the experiences of healthcare professionals (HCPs) with LIs in their daily practice.

### Aims and Objectives

The aim of this qualitative study was to identify factors affecting the implementation of LIs from the perspective of different HCPs involved in hip and knee OA care.

### Materials and methods

Four multidisciplinary focus groups were conducted. In total, 38 primary and secondary HCPs participated, including orthopedic surgeons (or in-training), general practitioners (or in-training), dieticians, lifestyle counsellors, nurse practitioners, physiotherapists and a general practice assistant. Data analysis was performed following thematic analysis, in which the Tailored Implementation for Chronic Diseases checklist was used to organize the findings in themes.

### Results

Nine main themes of influencing factors were identified during the analysis: (1) intervention factors (e.g. effectiveness); (2) individual HCP factors (e.g. knowledge); (3) patient factors (e.g. treatment preferences); (4) professional interactions (e.g. coordination of OA treatment); (5) incentives and resources (e.g. time); (6) capacity for organizational change (e.g. support within the organization); (7) social, political and legal factors (e.g. healthcare system); (8) patient and HCP interactions (e.g. therapeutic alliance); and (9) disease factors (e.g. image of OA).

### Conclusions

This multidisciplinary focus group study revealed a wide variety of factors that affect the implementation of LIs in hip and knee OA by HCPs. In particular, the importance of effective interdisciplinary collaboration was highlighted in the focus group discussions. The thorough analysis of influencing factors, as was performed in this study, is an important first step toward improving the implementation of LIs within OA care. The next step is to prioritize these factors to determine the most significant opportunities for change within daily practice.

## Key words

Clinicians; health promotion; implementation; nutrition; physical activity; qualitative research.

### **5.6. No difference in clinical outcome or migration but greater loss of proximal bone mineral density with the CFP compared to the Corail stem. Randomized controlled trial with 5 years follow up**

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#### Introduction:

The Collum Femoris Preserving (CFP) stem was first introduced in the 1980's. It has had its current design since the 1990's. The design aims to preserve proximal bone in order to facilitate future revision surgery. Few studies have been performed where it is compared to a stem of standard length.

#### Aims and Objectives

The aim of this study was to compare the mid-term patient-reported outcome, bone remodelling and migration of a short stem (CFP) with a standard uncemented stem (Corail).

#### Materials and methods

71 of 81 primarily included patients were available at the five years follow up. The primary outcome was the clinical result measured with Oxford Hip Score (OHS). Secondary outcomes were stem migration measured with Radiostereometric Analysis (RSA), change of bone mineral density around the stem, development of radiolucent lines on conventional radiographs and additional PROM data.

#### Results

There were no statistically significant differences between groups regarding patient reported outcomes, median OHS (CFP stem 45, range 11-48; Corail stem 45, range 26–48,  $p = 0.7$ ). RSA showed stable stems in both groups, with little or no further subsidence between two and five years. Neck resorption was evident in nine patients in the CFP group and in none of the

15 Corail stems with collar that could be studied. DXA showed a significantly higher loss of BMD in the proximal Gruen regions in the CFP group. (Mean changes in BMD, 95 % CI, Gruen region 1; CFP -9.5, -14.8– -4.2, Corail 1.0, -3.4- 5.4, Gruen region 7; CFP -23.0, -29.4– -16.6, Corail -7.2, -15.9- 1.4). Two CFP stems were revised before the two year follow up due to loosening, and one Corail was revised after the two year follow up due to chronic infection.

### Conclusions

The CFP stem has equal clinical outcome and subsidence pattern when compared to the Corail stem. More pronounced proximal stress shielding was observed with use of the CFP stem. This suggests a diaphyseal anchorage of the CFP stem questioning its neck sparing properties in the long term.

### Key words

Total hip arthroplasty; Radiostereometric analysis; short stems.

## 6. SHOULDER, ELBOW AND WRIST SYMPOSIUM

### 6.1. Association between distal radius fracture malunion and patient-reported disability: a systematic review with a meta-analysis

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### Introduction

Malunion is a known complication to distal radius fracture. There is controversy regarding whether malunited distal radius fracture is associated with greater activity limitation and pain compared to fractures that heal with a near anatomical alignment. This issue is important because it may have a direct impact on the choice of treatment. If malunion after distal radius fracture is associated with worse outcome, then treatment methods resulting in healing in a near anatomical position should be used (providing that the complication rate does not exceed the treatment benefit).

## Aims and Objectives

To assess whether adult patients with malunion after distal radius fracture have greater patient-reported disability than patients without malunion.

## Materials and methods

A systematic literature search in PubMed, EMBASE, and Cochrane databases was performed. Eligible studies for inclusion were cohort studies and randomized controlled trials reporting on patient-reported outcome after malunited distal radius fractures in adults. The outcome measures were the 30-item Disabilities of the Arm, Shoulder and Hand (DASH), the 11-item QuickDASH, and the Patient Reported Wrist Evaluation (PRWE) scales, completed at least 12 months after fracture. Malunion must have been confirmed with radiographs at least 3 months after the fracture. The risk of bias of the included studies was assessed according to the Quality In Prognosis Studies (QUIPS) tool. Studies with high risk of bias were subsequently excluded. For the meta-analysis the overall effect size was used to express the effect of malunion on the outcome. We assessed the included studies regarding heterogeneity and publications bias.

## Results

Our search strategy yielded 5 917 records after removal of duplicates and 380 reports were included in the full text review. Finally, 11 articles met the inclusion criteria. One study was subsequently excluded because it presented the same patient population as in another included study. Four other studies were subsequently excluded because they had high risk of bias on the QUIPS tool. Thus, 6 studies (734 patients) [556 (76 %) females] were included in this systematic review and meta-analysis. The overall effect size of malunion on patients-reported outcome was 0.58 (95 % CI, 0.39-0.77;  $p < 0,001$ ). There was no significant heterogeneity and no publication bias in the included studies.

## Conclusions

This systematic review and meta-analysis showed that patients with malunited distal radius fracture have significantly worse patient-reported outcomes than patients without malunion, with a moderate effect size.

## Key words

Distal radius fracture; malunion; patient-reported outcome measure.

## **6.2. Arthroscopic treatment of acute acromioclavicular dislocations. First clinical experiences and results at Republican Vilnius University Hospital**

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### **Introduction**

Acromioclavicular (AC) joint dislocation is an injury more common in younger male individuals. Most of these injuries, can be treated conservatively, however, some require surgical intervention. There are numerous open and arthroscopic surgical techniques for treating AC joint dislocations, however, there is no consensus on which type of surgery is the most suitable for this type of trauma.

### **Aims and Objectives**

To review the first clinical experiences and results of 30 arthroscopic treatments of AC joint dislocation cases at Republican Vilnius University Hospital.

To compare the arthroscopic treatment to open surgery of acute acromioclavicular dislocations, complications, operating time, rate of revision surgery.

### **Materials and methods**

From July 2021 to February 2022, 30 patients who have had acute AC joint dislocation have been treated arthroscopically using the "Zip tight" fixating system. The surgeries have been performed by the same Orthopedic surgeon at Republican Vilnius University Hospital. The average age was 35 years and all patients were male.

The first follow-up was at 6 weeks post-surgery. To evaluate post-surgery patient satisfactory a questionnaire and clinical assessment of the operated shoulder as well as pre- and post-operative x-ray comparison.

### **Results**

This study included 30 male patients which have had AC joint dislocation and have been treated arthroscopically using the "Zip tight" fixating system. Post-surgery questionnaire after arthroscopic treatment has shown a significant patient satisfaction rate. The average operating time was 55 minutes (from 40 minutes to 95 minutes), which does not differ from open

surgery. Another advantage of the arthroscopic approach was the identification and repair of additional injuries, e.g. tear of rotator cuff muscles or the shoulder labrum, and their immediate treatment. Comparing pre- and post-operative x-rays 27 (90 %) patients have had a successful AC joint reduction. However, in our patient group, 4 complications (13.3 %) have been observed that required revision surgery. 1 case of infection (3.3 %) and 3 (10 %) unsuccessful AC joint reductions.

### Conclusions

The first clinical experience of arthroscopic treatment of acute acromioclavicular dislocations has had a success rate of 87.6 % and 13.3 % rate of complications. Patients have expressed significant satisfaction and good clinical results post-surgery. As well as the arthroscopic approach has been shown to have its advantages when additional injuries are present.

### Key words

AC joint; Acute acromioclavicular dislocation; arthroscopic treatment.

## **6.3. Bursa Acromiale Reconstruction (BAR) arthroscopic technique – early results**

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### Introduction

Treatment of patients with massive, irreparable shoulder rotator cuff tears without pronounced glenohumeral arthritis or unsuitable for shoulder arthroplasty, remains a challenging endeavor for a shoulder surgeon. Such patients suffer shoulder pain and function deficit. Recent advancements in arthroscopic techniques include such as superior capsule reconstruction, tendon transposition, balloonplasty and others. Some reconstruction techniques can prove technically challenging and others such as balloonplasty may provide only temporary effect.

### Aims and Objectives

To present bursa acromiale reconstruction (BAR) technique and early clinical results.

## Materials and methods

Patients that underwent arthroscopic bursa acromiale reconstruction (BAR) procedure utilising a fascia lata autograft or an Achilles tendon allograft.

## Results

Postoperatively patients presented with decrease in shoulder pain scores and improvement in shoulder function scores.

## Conclusions

Arthroscopic bursa acromiale reconstruction (BAR) can be employed for shoulder pain treatment in patients with massive, irreparable rotator cuff tears without pronounced glenohumeral arthritis.

## Key words

Shoulder; arthroscopic; rotator; cuff; reconstruction.

### **6.4. Limited value of current shoulder registries in evidence-based shoulder surgery: a study of 7 national registries**

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## Introduction

National shoulder registries are currently used to assess incidence, indication, type of prosthesis and revision, but they seem to lack sufficient information to lead to evidence based decision-making in shoulder surgery. There appears to be a large difference in registered parameters and outcome measurement per country.

## Aims and Objectives

First we investigated whether existing registries have sufficient common datasets to enable pooling of data. Second, we determined whether known risk factors for prosthetic failure are being recorded.

## Materials and methods

Through a non-systematic literature review studies on registries were analyzed for included parameters. Seven national registries were scrutinized for the data collected and these were classified according to categories of risk factors for failure: patient, implant and surgeon related, and other parameters.

## Results

A large heterogeneity of registered parameters exists between countries. The majority of parameters shown to be relevant to outcome and failure of shoulder prostheses are not included in the studied registries.

## Conclusions

International agreement on parameters and outcome measurement for registries is paramount to enable pooling and comparison of data. If we intend to use the registries to provide us with evidence to improve prosthetic shoulder surgery, we need adjustment of the different parameters to be included.

## Key words

Arthroplast; registry; shoulder.

## **6.5. One simple question could simplify elbow arthroplasty patient reported outcome measurement**

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## Introduction

Gathering PROMs is an important aspect in orthopaedic research as they reflect the functional outcomes of an intervention. However, the acquisition

of PROMs poses a challenge because of possible low literacy, lengthiness and diversity of questionnaires, time burden and data collection issues. In previous literature, the SANE was proven to be well-correlated to the Oxford Elbow Scale during regular outpatient clinic visits for elbow-related problems. Therefore, this single question could be used in registries for simplicity and uniformity.

### Aims and Objectives

Aim of this pilot study is to establish whether the Single Assessment Numeric Evaluation (SANE) is correlated to the Patient Reported Outcome Measures (PROMs) of total elbow arthroplasty (TEA) patients, which could lead to a large simplification and reduction of questionnaires during follow-up. Besides, it could serve as a simple, uniform question for (inter)national elbow arthroplasty registries, which still lack PROMs as an outcome measure.

### Materials and methods

From October 2020 to October 2021 the SANE question was added to the regular questionnaires (Mayo Elbow Performance Index (MEPI), Oxford Elbow Scale (OES), EuroQoL-5D (EQ5D), visual analogue scales for pain in rest and during activity). Correlation was calculated with Pearson's r between the individual questionnaires.

### Results

65 patients completed the questionnaires at different moments during the follow-up. The SANE correlated significant with the EQ5D ( $r = 0.608$ ,  $p < 0.001$ ) and the OES ( $r = 0.533$ ,  $p < 0.001$ ). More moderate yet significant the SANE correlated with pain during activities ( $r = -0.503$ ,  $p < 0.001$ ) and pain in rest ( $r = -0.397$ ,  $p = 0.001$ ). Insignificant and poor correlations was present for the MEPI ( $r = 0.109$ ,  $p = 0.658$ ).

### Conclusions

The SANE has a good correlation between the questionnaires for quality of life, the Oxford Elbow Score and pain. Therefore, it seems feasible to reduce the patients' burden of questionnaires during follow-up, or as a general assessment for these three questionnaires which do not require a physical visit. The MEPI requires a physical visit as range of motion has to be assessed and has a high ceiling effect. When more (international) data are

collected and more valid conclusions can be drawn, the SANE could be used for relatively simple PROMs collection for arthroplasty registries.

#### Key words

Patient reported outcomes; questionnaires; outcomes; registry studies.

### **6.6. Posterior bone block associated with posterior glenoid opening osteotomy in severe posterior instability with pathologic glenoid retroversion and dysplasia: case report**

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#### Introduction:

Posterior shoulder instability in patients with pathologic glenoid retroversion and dysplasia is an unsolved problem in shoulder surgery.

#### Aims and Objectives

In a preliminary study of a young patient case with posttraumatic posterior shoulder instability associated with glenoid retroversion 29° and glenoid dysplasia who underwent posterior bone block associated with posterior glenoid opening osteotomy and glenoid concavity reconstruction using an iliac crest bone graft, we asked: (1) Does the patient had persistent apprehension? (2) What were the improvements in patient pain and range of motions? (3) What were the radiographic findings at short-term follow-up?

#### Materials and methods

At the age of 19 years patient underwent posterior shoulder dislocation in car accident. After closed reposition patient was pain free for 1 year, but then got sudden pain attack and the shoulder became “pseudoparalytic”: posterior dislocation appeared even in very slight flection or abduction. No possibility for physiotherapy, because the shoulder was unstable even in minimal activity. In CT scan glenoid retroversion 29° and dysplasia of the posteroinferior glenoid. Age of 21 years was at surgery and follow-up was 2 years. Patient shoulder scores included the subjective shoulder value (and scored with 100 % representing a normal shoulder), and the Constant score. Radiographic measurements included glenohumeral arthropathy and posterior humeral head subluxation, bone graft union, correction of glenoid retroversion.

## Results

In our case posterior apprehension was negative, no reported resubluxation. The preoperative subjective shoulder value 15 % and Constant scale score 12 % were improved at latest follow-up subjective shoulder value 90 % and Constant scale score 88 %. Posterior glenoid cartilage erosion was not present. Humeral head subluxation index decreased from 80 % preoperatively to 50 % postoperatively, it was reversed to a centred humeral head. CT images showed union in all bone grafts. The preoperative retroversion was corrected from 29° to 0° postoperatively. No intraoperative or early postoperative complications were recorded. In 12 months after osteotomy the arthroscopic anterior capsulotomy was performed due to postoperative shoulder stiffness with no progression.

## Conclusions

Patient was treated by experienced shoulder surgeon with no earlier experience in glenoid osteotomy. Posterior bone block associated with posterior glenoid opening osteotomy was able to reconstruct posterior glenoid morphology, correct glenoid retroversion, and improve posterior shoulder instability associated with pathologic glenoid retroversion and dysplasia. The size and complexity of this procedure made it likely that patient experienced severe shoulder stiffness after surgery for 1 year, and it was corrected with arthroscopic anterior capsulotomy. We recommend that such surgery be done only by experienced shoulder surgeon. The early results in our case are encouraging despite of difficult surgery and postoperative stiffness.

## Key words

Shoulder; glenoid; osteotomy; posterior instability.

### **6.7. Arthroscopic treatment of Scaphoid nonunion: technique outcomes**

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## Introduction

Scaphoid is the most commonly fractured wrist bone. Occurring mainly in young males, counting up to 30/100'000 of the whole population. Although

even after timely and appropriate scaphoid fracture treatment nonunion events up to 12 % of cases. In this scenario a surgical approach is indicated, though with even worse outcomes. Depending on literature sources at least one fifth of scaphoid nonunions treated surgically fails and wrist degeneration progresses. There is a great need for advanced, alternative surgical techniques in treating scaphoid nonunions. One of the latest options is arthroscopic treatment of scaphoid nonunion with bone graft. Outcomes of arthroscopic nonunion treatment in Hospital of Lithuanian University of Health Sciences (LSMU), Kaunas Clinics will be presented.

### Aims and Objectives

The aim of the study is to evaluate the outcome of minimally invasive treatment technique of scaphoid nonunion depending on union rates, wrist pain and epidemiologic factors.

### Materials and methods

A group was formed of 9 patients that undergone surgery due to scaphoid nonunion. Initial treatment of the fracture, time after the first trauma, fracture morphology, age, gender and tobacco usage was documented. Standard wrist arthroscopy was performed, following debridement of the nonunion area and radius auto bone grafting. Up to half of the cases fibrin glue were applied on the graft, hereby two smaller study groups for expedience of fibrin glue usage were formed. Bone was fixed with two Kirschner wires and immobilised. After 3 months Kirshner wires were removed and radiographic evaluation using x-ray and CT scan performed. Bone union was evaluated by a radiologist on x-rays and CT scans. Additionally wrist pain evaluation was done 6–12 months after surgery.

### Results

Study group consisted of 7/9 males and 2/9 ladies ranging from 19 to 39 years of age. Scaphoid proximal part fractures consisted 5/9 cases, while 4/9 were waist fractures. Less than half, 4/9, patients reported tobacco usage, which could impair bone healing. All patients were treated surgically, while fibrin glue was applied in 6/9 cases. After the treatment period most of the cases 8/9 achieved great results, union at 3 months and good pain scores. Good results were achieved independently on fracture morphology, tobacco usage, fibrin glue application or other epidemiological factors. One patient, 1/9, experienced delayed union at 7 months.

## Conclusions

Arthroscopic treatment of scaphoid nonunion with bone graft is able to achieve great outcomes and union rates. Results are not dependable on fracture morphology, tobacco usage, fibrin glue application and time after the initial trauma. Although modest in case number, our study supports the choice of arthroscopic scaphoid nonunion treatment and encourages additional research to append the technique and its relation to epidemiological and intraoperative factors.

## Key words

Scaphoid; nonunion; wrist; arthroscopic; bone graft.

## 7. TRAUMA SYMPOSIUM

### **7.1. Isolated greater trochanter fracture may impose a comparable risk on older patients' survival as a conventional hip fracture**

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## Introduction

High mortality after hip fracture (HF) has been reported by many studies; however, there are minimal reports on isolated greater trochanter fracture (IGT).

## Aims and Objectives

The aim of this study is to compare up to three-year mortality of elderly HF and IGT patients.

## Materials and methods

This retrospective cohort study used the Estonian Health Insurance Fund's validated administrative data. The study included patients aged  $\geq 50$  years with an index HF or IGT diagnosis between 2009–2017. Crude and adjusted mortality rates were compared using the Log-rank test and Bayesian survival modelling. The study was approved by the Research Ethics Committee of

the University of Tartu on 17 June 2013 and by the Estonian Data Protection Inspectorate for the use of personalised data on 1 December 2017.

## Results

The study included 11 541 patients, of whom 0.4 % (50) had an IGT. The baseline characteristics and the mortality rates of the fracture cohorts showed a close resemblance. The respective mortality rates for the IGT and the HF patients were: one-month, 4 %; 9 %; three-month, 14 %, 18 %; six-month, 20 %, 24 %; one-year, 28 %, 31 %; two-year, 38 %, 42 %; three-year, 46 %, 49 %. Crude and adjusted analyses suggested no difference in the three-year mortality of the patient populations, showing a p-value of 0.6 and a hazard ratio of 0.9 [0.6; 1.3] for the IGT patients, retrospectively.

## Conclusions

Despite IGT being a relatively minor injury, the evidence from this study suggests that it may impose a comparably detrimental effect on older patients' survival, as does HF. This may be explained by the close resemblance of the two fracture populations. Lastly, these results need to be interpreted cautiously since the research on rare diseases inevitably includes a small number of patients, increasing the possibility of underpowered statistical analyses.

## Key words

Hip fracture; isolated greater trochanter fracture; mortality.

## **7.2. Evaluation of initial diagnosis and treatment for minor trauma at a level II trauma center in Denmark: a retrospective cohort study**

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## Introduction

Images and charts from emergency departments are typically evaluated the following weekday at a radiographic conference, in some cases leading to re-contact of the patients: when there is a change of diagnosis and treatment plan or need for additional examinations. These necessary re-contacts should be few, and the reasons for re-contacts could inform focus areas of training, written instructions, or workflows.

## Aims and Objectives

To evaluate and improve the quality of trauma center service by retrospectively investigating the incidence and reasons for re-contact of patients after initial treatment for minor trauma in the emergency department at Horsens Regional Hospital, Denmark.

## Materials and methods

1000 patient has been treated from 1 October 2021 to 31 December 2021 and their medical charts from the trauma center were reviewed. Re-contacts were identified, and time of visit, diagnosis, treatment, and patient age and gender were compared to the cohort. Reasons for re-contacts were counted and explored qualitatively.

## Results

The overall incidence of re-contacts was 33 (3.3 %). Reasons for re-contact were missed injury 11 (1.1 %), need for additional examinations 6 (0.6 %), diagnostic error 5 (0.5 %), change of treatment plan without change of diagnosis 5 (0.5 %), uncertainty about treatment or diagnosis 5 (0.5 %), other 1 (0.1 %). The most common site for missed injury and diagnostic error was hand/wrist ( $n = 6$ ), followed by foot ( $n = 3$ ), shoulder ( $n = 2$ ) and elbow ( $n = 2$ ) cases. The re-contact rate varied throughout the day: day time 08:00–18:00: 2.1 %, evening 18:00–23:00: 4.6 %, and night 23:00–08:00: 5.4 %. This could be a reflection of the availability of a specialist orthopedic surgeon (08:00–18:00 on site, 18:00–08:00 on call), a newly graduated doctor (on site 08:00–23:00), and an orthopedic doctor in training (on call 08:00–18:00, on site 23:00–08:00).

## Conclusions

The incidence of re-contacts was 3,3 %, of which the missed injury rate was 1.1 %, which is relatively low compared with other studies (ranges from 1.39 to 14.5 %). The missed injury and diagnostic errors are mainly due to misinterpretation of radiological images, which can be improved by training. In the day time, when 60 % of patients visits the trauma center, we found a 50 % lower re-contact rate compared to evening and night. The working system at trauma center Horsens Denmark is well functional and can achieve a low missed injury rate.

## Key words

Trauma center; minor trauma; missed injury.

### **7.3. Peri-implant femoral fractures in hip fracture patients treated with osteosynthesis: a retrospective cohort study of 1 965 patients**

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## Introduction

Proximal femoral fractures are common in the elderly and projections suggest that numbers will increase, although there are reports that show a decrease in hip fracture incidence in many Western countries possibly due to preventive measures. As these patients are frail, recurrent falls might lead to subsequent femoral fractures encompassing the implant. Fractures in the proximity of a hip arthroplasty, periprosthetic femoral fracture, are associated with an increased mortality and their surgical treatment is technically demanding with a high complication rate and prolonged rehabilitation. Proximal peri-implant femoral fractures (PIFFs) in patients previously treated with osteosynthesis (sliding hip devices (SHD), cephalomedullary nails (CMN) or pins / screws), are less frequently described in the literature and with contradicting results. A lower rate of intra- and postoperative PIFF and reoperation after SHD compared to CMN was reported in a meta-analysis by Ma et al. 2017. An earlier meta-analysis found that CMN increased the risk of subsequent femoral shaft fracture by 4.5 times compared with SHD. However, among studies published between 2000 and 2005, CMN did not increase femoral shaft fracture risk. Parker and Handoll (2010) recommended SHD because of a lower intra- and postoperative PIFF risk together with comparable functional outcome and other postoperative complications compared with CMN.

## Aims and Objectives

There are few studies on incidence rates, treatment and outcomes for peri-implant femoral fractures (PIFF) in the proximity of osteosynthesis. The purpose of this study was to investigate the incidence of PIFF following osteosynthesis of proximal femoral fractures.

## Materials and methods

This retrospective cohort study comprised a consecutive series of hip fracture patients aged 50 years or older and operated with osteosynthesis between 2003 and 2015. Patients were followed-up until 2018, removal of implants or death, for a mean of 4 years (range 0–15). Data on age, sex, housing, hip complications, and reoperations were recorded. The risk of PIFFs was assessed using Cox proportional hazards regression analysis. In patients with two fractures during the study period, only the first fracture was included.

## Results

A total of 1965 osteosynthesis procedures were performed, of which 382 were cephalomedullary nails (CMN), 933 sliding hip devices (SHD) and 650 pins. Mean age was 80 years (range 50–104), 65 % of patients were women. A total of 41 PIFFs occurred during the study period. The cumulative incidence of peri-implant fractures was 0.8 % for CMN, 2.7 % (HR 2.995 % CI, 0.87-9.6,  $p = 0.08$ ) for SHD and 2.0 % (HR 2.3 95 % CI, 0.6-8.1,  $p = 0.2$ ) for pins. PIFFs occurred after a mean of 27 months (range 0–143). The 1-year mortality was 34 % following PIFF. The majority was treated surgically (66 %, 27/41) and the reoperation rate was 15 % (4/27).

## Conclusions

In this retrospective cohort study, in contrast to previous reports, we found a tendency to a higher cumulative incidence of PIFFs for SHD compared to modern CMN. Our results show cumulative incidences of PIFFs comparable to those described for periprosthetic femur fractures after hip arthroplasty for femoral neck fracture.

## Key words

Complication; hip fracture; internal fixation; peri-implant hip fracture; removal of hardware.

## **7.4 Risk factors of complications in externally controlled intramedullary bone lengthening nails**

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### **Introduction**

External fixation is a well-established method in bone lengthening by distraction osteogenesis despite its high complication rate. Externally controlled intramedullary lengthening nails have been introduced in an attempt to reduce complications and improve patient comfort. The FITBONE and PRECICE nails are the two most commonly used lengthening nails.

However, reports on the risk factors and complication rates are lacking on these internal lengthening nails.

### **Aims and Objectives**

The aim of this study was to investigate complications in patients treated with lower limb internal lengthening nails and examine the risk factors of complications. The objectives were to identify the number of complications in a cohort and assess if age, femur / tibia, increasing bone lengthening, retrograde / antegrade approach, acute deformity correction, nail type and etiology were risk factors.

### **Materials and methods**

A retrospective chart review of patients treated with externally controlled intramedullary lengthening nails was conducted at two limb lengthening hospitals (Nationwide Children's Hospital, Ohio, USA and Aalborg University Hospital, Denmark). FITBONE and PRECICE lower limb lengthening patients were included only if nail removal was completed. Bone transport nails, stump lengthening nails, compression nails, PRECICE STRYDE, nail insertion or removal at another hospital, lengthening nails in upper extremities, and extramedullary lengthening patients were excluded. Patient record data were obtained: nail information, patient demographics,

and complication yes/no. The Poisson regression model was used to assess the relative risk (RR) of complications for the selected risk factors in a crude model and in an adjusted model.

## Results

257 patients were identified comprising 314 lengthening segments. 80 % of lengthening was performed in the femur, and the FITBONE nail was the most frequently used (75 %). The median age was 19.5 years, with a range of 9.5–76.9. Complications were observed in 56 % of the segments with a median of 1 and a maximum of 5 complications per segment. The risk factor analysis showed a significantly increased relative risk in the adjusted model for: the four age groups above 20 years (RR: 1.91–2.21), tibia segment (RR: 1.59), and acute deformity correction combined with lengthening (RR: 1.26), FITBONE nail (RR: 1.38), etiology (Short stature) (RR: 1.99) and increasing bone lengthening (RR: 1.01 per. mm.). The retrograde / antegrade approach did not show increasing risk (RR: 0.99).

## Conclusions

Of the 314 included bone lengthening segments, 56 % had complications which is higher than previously reported. Six risk factors with increased relative risk of complication were identified. The risk factor might be used in further patient risk assessment and research aiming to reduce complication rates.

## Key words

Bone lengthening nail; risk factors of complication; precise nails; fitbone nail.

## **7.5. An inter- and intra-rater reliability study of a classification system to assess complications in bone lengthening nails**

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## Introduction

Distraction osteogenesis on the lower limb by externally controlled bone lengthening nails has been reported with fluctuating complication rates. This variability in complication rates might be due to the lack of a universal reporting system of complications. Limb lengthening affects numerous tissue types in a highly individualized manner. Thus, limb lengthening is exposed to various complication types and severities. Four different classification systems have to our knowledge been used. However, none of these systems account for the complication origin or has been tested for reliability.

## Aims and Objectives

The study aims to evaluate a severity and origin complications classification system for inter- and intra-rater agreement. The objective was to establish the reliability of the classification system in bone lengthening nail cases from cohort settings and from literature cases.

## Materials and methods

Complications were classified according to severity (I, II, IIIA, IIIB). I) Minimal intervention required; treatment goal still achieved. II) Substantial change in the treatment plan; treatment goal still achieved. IIIA) Failure to achieve treatment goal; no new pathology or permanent sequelae. IIIB) Failure to achieve treatment goal and / or new pathology or permanent sequelae. Complication origin were classified into eight main groups (soft tissue, joint, vascular, bone, neurological, infection, device-related, others) and 33 sub-groups. 48 complications retrieved from patient charts in a cohort study and 49 reported complications from published literature were assessed by four orthopedic surgeons. The cases were assessed with a least six weeks apart in a blinded independent set up. Cohen / Congers kappa estimated for inter-and intra-rater agreement. The kappa values were interpreted after Svanholm et al.

## Results

A kappa value of 0.68 (95 % CI: 0.56–0.79) and 0.62 (95 % CI: 0.53–0.73) were observed on severity and origin, respectively producing good agreement on the inter-rater assessment of the cohort cases. The literature retracted cases gave good agreement on the inter-rater agreement with a kappa value on the severity of 0.64 (95 % CI: 0.53–0.75) and origin of 0.74

(95 % CI: 0.65–0.83). Intra-rater agreement of cohort cases varied from poor to excellent.

## Conclusions

The presented complication classification system on bone lengthening nails is, to our knowledge, the first to incorporate both severity and origin and to be tested for reliability. Both the literature and cohort cases gave a good inter-rater agreement with the applied classification system. The intra-rater agreement differed among reviewers, which could imply that the classification system may merit from better reviewer rules and guidance.

## Key words

Agreement study; observer variation; bone lengthening nail.

## 8. ARTHROPLASTY SYMPOSIUM

### 8.1. Development of an internet-delivered cognitive behavioral therapy program for use in combination with exercise therapy and education by patients at increased risk of chronic pain following total knee arthroplasty

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## Introduction

Chronic pain after total knee arthroplasty (TKA) is reported in up to 20 % of patients. Catastrophic thinking, dysfunctional illness perception, poor mental health, anxiety and depression characterize these non-improvers, and indicate that these patients may need individualized treatment using a treatment approach based on the bio-psycho-social health model.

## Aims and Objectives

The present study developed an internet-delivered cognitive behavioral therapy (iCBT) program to be combined with exercise therapy and education for patients with knee osteoarthritis (OA) at increased risk of chronic pain after TKA.

## Materials and methods

The development process followed the first two phases of the UK Medical Research Council framework for complex interventions. In the development phase, the first prototype of the iCBT program was developed based on literature review, established iCBT programs and multidisciplinary workshops. The feasibility phase consisted of testing the program, interviewing users, condensing the program, and tailoring it to the patient group. A physiotherapist manual was developed and adapted to physiotherapists who serve as mentors.

## Results

The development process resulted in an iCBT program consisting of 10 modules with educational texts, videos and exercises related to relevant topics such as goalsetting, stress and pain, lifestyle, automatic thoughts, mindfulness, selective attention, worry and rumination. A physiotherapist manual was developed to guide the physiotherapists in supporting the patients through the program and to optimize adherence to the program.

## Conclusions

The iCBT program is tailored to patients at risk of chronic pain following TKA and may be useful in combination with exercise therapy alone or as a supplement to surgery. A multicentre RCT will evaluate the iCBT program in combination with an exercise therapy and education program. This intervention may be a valuable contribution to the treatment of OA patients at risk of chronic pain after TKA.

## Key words

Osteoarthritis; total knee arthroplasty; cognitive behavior therapy; physical exercise.

## **8.2. Factors associated with expectation fulfilment towards paid employment after total hip and knee arthroplasty**

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## *Aims and Objectives*

### **Introduction**

After surgery, patients of working-age undergoing total hip arthroplasty (THA) or total knee arthroplasty (TKA) tend to have high expectations towards returning to work, which are met in only 60–89 % of the patients.

### **Aims and Objectives**

To identify factors associated with 6 and 12 months postoperative fulfilment of patient expectations towards paid employment for THA and TKA patients, separately.

## Materials and methods

We included patients treated with THA or TKA, preoperatively employed, and aged 18–66 from the prospective multicentre cohort study Longitudinal Leiden Orthopaedics Outcomes of Osteoarthritis Study (LOAS). Questionnaires were filled out preoperatively, 6 and 12 months postoperatively, and included sociodemographic (i.e., age, sex), health-related (i.e., comorbidity, physical functioning), and work characteristics (i.e., work tasks, sick leave, difficulties at work). Physical functioning was measured with HOOS-PS/KOOS-PS. Preoperative expectations and fulfilment were assessed with the Hospital for Special Surgery expectations survey (back to normal = 1, much = 2 / moderate = 3 / slight = 4 improvement, or not applicable = 5). We computed fulfilment of expectations by subtracting preoperative from postoperative scores (score <0: unfulfilled; score ≥0: fulfilled / exceeded). Only the data of patients who preoperatively specified their expectation (score 1–4) were used for analysis of postoperative fulfilment. Multivariable logistic regression analyses using backward selection were conducted.

## Results

We included 1056 patients ( $n = 582$  THA,  $n = 474$  TKA). Preoperatively, 422 (73 %) of THA and 324 (68 %) of TKA patients expected a “back to normal” paid employment.

At 6 months postoperatively, the expectations of 64 % of THA and 65 % of TKA patients were fulfilled. Six months postoperatively, better postoperative physical functioning was associated with fulfilled expectations (HOOS-PS: OR 1.08, 95 % CI 1.05–1.11; KOOS-PS: OR 1.04, 95 % CI 1.01–1.06). Preoperative sick leave, present in 28 % of THA and 30 % of TKA patients, was negatively associated with fulfilled expectations (THA: OR 0.44, 95 % CI 0.20–0.95; TKA: OR 0.42, 95 % CI 0.22–0.79). Postoperative difficulties at work, reported in 52 % of THA and 66 % of TKA patients, were also negatively associated with fulfilled expectations (THA: OR 0.45, 95 % CI 0.21–0.96; TKA: OR 0.39, 95 % CI 0.17–0.91). Only after THA, mental work tasks were positively associated with fulfilled expectations (OR 4.01, 95 % CI 1.47–10.97). After TKA, higher age was associated with fulfilment (OR 1.09, 95 % CI 1.02–1.16).

At 12 months postoperatively, the expectations of 69 % of THA and 71 % of TKA patients were fulfilled. Our models yielded similar results to 6 months postoperatively. In addition, a combination of mental and physical work

tasks (OR 2.90, 95 % CI 1.36–6.23), and better preoperative physical functioning (OR 1.02, 95 %CI 1.00–1.04) were also positively associated with fulfilled expectations after TKA.

### Conclusions

The results of this study showed that for both working-age patient groups, the key factors for fulfilment of expectations regarding paid employment included both work characteristics and postoperative physical functioning. The important role of work characteristics is essential information for orthopaedic surgeons, occupational physicians, and employers.

### Key words

Knee replacement; hip replacement; work characteristics; expectation; work.

## **8.3. Osteoarthritis of the knee – the comparison of clinical, radiological and macroscopical evaluation**

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### Introduction

Knee osteoarthritis is one of the most common progressive degenerative disease of the joint cartilage among older people that can lead to joint deformity. Clinical symptoms are knee pain, joint dysfunction, rigidity, which can lead to difficulties doing every-day tasks. Around 15–20 % of people have asymptomatic form of osteoarthritis.

### Aims and Objectives

The aim of this study was to compare clinical, radiological and macroscopical evaluation of osteoarthritis of Lithuanian patient population presenting for knee arthroplasty in Republican Vilnius University Hospital (RVUL).

### Materials and methods

Patients, who had primary knee arthroplasty because of knee osteoarthritis were included in this study. All included patients were asked to fill WOMAC (the Western Ontario and McMaster Universities Osteoarthritis Index) questionnaire (on a scale of 0 to 96, where higher scores indicate worse pain, stiffness, and functional limitations). Anteroposterior and lateral X-rays of

affected knee were examined and classified before surgery using Ahlback and Kellgren-Lawrence classifications. During the knee replacement surgery, all knees were photographed in flexion to evaluate femoral joint, and after tibia plateau excision for macroscopical evaluation of joint lesions using ICRS (The International Cartilage Repair Society Cartilage Lesion) classification.

## Results

Twenty one patient from 57 to 84 years old with primary knee osteoarthritis were included in this study. The average VAS (visual analogue scale) score while walking was 5, average overall WOMAC score was 49, ranging from 28 to 76. More than 75 % of all cases were classified radiologically as high-grade osteoarthritis (III, IV, V grade on Ahlbäck and 3, 4 grade on Kellgren-Lawrence classification). Medial compartment was worse affected – 76 %, compared to lateral compartment (26 %). Macroscopically, using ICRS classification, all operated knees were classified as grade 3 or 4. Most commonly lesions were seen on medial femur condyle in antero-central area, and on medial tibia plateau in antero-central area in sagittal and centro-lateral area in frontal plane. The knee joint was classified as worse macroscopically compared to radiological evaluation – the disagreement between Ahlbäck and ICRS classification was 43 % and between Kellgren-Lawrence and ICRS classification was 29 %. The knee osteoarthritis was classified as low-grade on X-rays 4 times when macroscopically the lesions were classified as high-grade osteoarthritis. Neither overall WOMAC score, nor subgroup scores differed in different osteoarthritis radiological or macroscopical groups.

## Conclusions

In our study the knee osteoarthritis most often involves central part of medial compartment of the knee, causing moderate pain and dysfunction. Almost one-fifth on knee X-rays show the lower-grade picture of osteoarthritis compared to macroscopical lesions. The knee replacement operation should be based on overall patient examination.

## Key words

Knee osteoarthritis; WOMAC; Ahlback classification; Kellgren-Lawrence classification; ICRS classification.

## **8.4. The effectiveness of home-based e-health rehabilitation following primary total hip arthroplasty in comparison to usual care in Germany and the Netherlands: a pilot study**

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### **Introduction**

Both in Germany and in the Netherlands, it is advised to perform physiotherapeutic exercise following total hip arthroplasty (THA) to improve physical functioning either under supervision of a physiotherapist or in a rehabilitation center. An alternative could be the use of an innovative e-health home-based rehabilitation program using a tablet PC.

### **Aims and Objectives**

Aim was to get a first glimpse of the effectiveness of this home-based rehabilitation program following THA in comparison to usual care (UC) in the Netherlands and Germany.

### **Materials and methods**

A secondary analysis was conducted of data gathered in two studies. Self-reported questionnaires and objective functional tests were administered preoperatively (T0) and three times postoperatively (up to 6 months following THA: T3). Primary outcomes were the Five Times Sit-to-Stand Test (FTSST), the Hip disability and Osteoarthritis Outcome Score (HOOS) and the 3-level version of the EuroQol 5 Dimensions (EQ-5D-3L). Mean difference scores were calculated (T3 minus T0), which were corrected for differences in baseline characteristics among the groups using analyses of covariance.

### **Results**

In total, 102 participants were included (UC in Germany: n = 56; UC in the Netherlands: n = 23; home-based rehabilitation in the Netherlands: n = 23). Participants who followed the home-based rehabilitation program achieved the largest improvement on the FTSST and the subscales pain and function

in daily living of the HOOS. UC in Germany led to the largest improvement on the EQ Visual Analogue Scale. UC in the Netherlands led to the smallest amount of improvement for all primary outcome measures.

### Conclusions

Home-based rehabilitation was found to be an effective alternative to UC following THA. UC in the Netherlands was found to be the least effective, however the differences with UC in Germany were relatively small. More insight into personal, behavioral and environmental determinants is needed to enable patient-specific advice on the most optimal rehabilitation approach following THA.

### Key words

Total hip arthroplasty; rehabilitation; physiotherapy; exercise; e-health.

## **8.5. Total knee arthroplasty with PCL retaining CR, PCL resected CR or PS prosthesis: a 2-year randomised controlled multicentre trial**

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### Introduction

Most of the contemporary knee arthroplasties are performed with PCL retaining CR prosthesis. However, PS prosthesis have been used in PCL deficient knees. No randomized controlled trials have been performed investigating the outcomes of PCL retained CR vs PCL resected CR vs PS knee arthroplasty.

### Aims and Objectives

To study the outcomes of PCL retained CR vs PCL resected CR vs PS knee arthroplasty in RCT setting.

## Materials and methods

The present study was a multicenter RCT from three university hospitals in Finland (Helsinki, Turku and Kuopio) between 2007–2010. Patients with indication to knee arthroplasty ( $n = 245$  at baseline) were randomized into three groups: CR arthroplasty with retained PCL (CR PCL +), CR arthroplasty with resected PCL (CR PCL -) and PS arthroplasty. The outcomes of the arthroplasty were investigated with Oxford Knee Score (OKS) and WOMAC preoperatively and at 2 years. Power calculations were performed prior to RCT. The study was accepted in the ethical committee of Helsinki University. Statistical analysis was performed with SPSS version 27 using the general linear model.

## Results

The mean age of the study population was 65,7 years. 65 % were females. Overall, knee arthroplasty improved OKS and WOMAC scores in all three groups. The OKS points changed during the follow-up (BL to 2 years) as follows: CR PCL + (21.9 to 31.6), CR PCL - (21.8 to 31.5), PS (22.4 to 29.8). The WOMAC points changed during the follow-up (BL to 2 years) as follows: CR PCL + (44 to 12.2), CR PCL - (42.1 to 11), PS (43.3 to 13.6). There were no clinically or statistically significant differences between the three groups in OKS or WOMAC at baseline or 2 years post operatively. There were no significant differences between the sexes.

## Conclusions

In terms of patient reported outcomes there were no differences between knee designs used with or without the PCL. No instability was recorded even if pcl was absent and cruciate retaining components were used. Longer follow-up may provide information on long-term stability of the knee.

## Key words

Arthroplasty; PCL; CR prosthesis; PS prosthesis; RCT.

## 9. PELVIS AND SPINE

### 9.1. Acetabulum fracture management. Primary THA combined with ORIF

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## **Introduction**

The total hip arthroplasty (THA) as part of acute fracture management is used for acetabular fractures in elderly patients. The acetabular fracture in these situations could be managed by one- or two-stage surgery.

## **Aims and Objectives**

Our objective was to assess the stability of acetabular osteosynthesis performed using two different techniques in combination with THA in an experimental model and report our results of clinical practice.

## **Materials and methods**

We conducted 20 experiments using the left-side hemipelvis composite bone models. There were 2 testing groups: one- and two-stage osteosynthesis. The acetabular fractures of the anterior and posterior columns were simulated. The same THA cemented technique was used in both groups. The stability of osteosynthesis was explored and compared between the groups by measuring the fracture displacement of anterior and posterior columns under the standardized test load protocol. In addition, we compared the outcomes of 29 patients treated in our centre under the same surgery protocol.

## **Results**

15 patients were treated in our centre using one-stage technique with a follow-up of 2 to 16 years postoperatively. 14 patients were treated using two-stage technique with a follow-up of 2 to 9 years postoperatively. Seventy-five percent in one-stage group and 80 percent in two-stage group patients had a good to excellent Harris hip ratings and none required revision for loosening or mechanical failure. The conducted biomechanical study concluded the same result – two-stage osteosynthesis was biomechanically superior to one-stage surgery.

## **Conclusions**

The two-stage osteosynthesis of the anterior and posterior acetabular columns in combination with THA provides better stability when compared to one-stage method.

## **Key words**

Acetabular fractures; acetabular fracture osteosynthesis.

## **9.2. Intrapartum pubic symphysis disruption. Case report**

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### **Introduction**

Intrapartum pubic symphysis disruption is a rare injury, more frequently it occurs in women older than 35 years old. The incidence ranges from 0.005 % to 0.8 % of live births. During pregnancy and childbirth, modulated hormonal levels promote pelvic ligament relaxation. Joint laxity increases during pregnancy starting around the 10th week of gestation and may last approximately 4–12 weeks postpartum. As a result, asymptomatic pubic symphysis diastasis up to 7.0 mm can occur, allowing a vaginal delivery.

### **Aims and Objectives**

This study aims to report a severe intrapartum pubic symphysis disruption in two primiparous patients which underwent open reduction and internal fixation of the pelvic ring.

### **Materials and methods**

We report two patients that were treated for intrapartum pubic symphysis disruption.

### **Results**

Two patients were treated for intrapartum pubic symphysis disruption. One patient had no complications following the open reduction and internal fixation of the pelvic ring and the recovered to preinjury functional level. The second patient developed a persistent infection and experienced the hardware removal 6 months after surgery. The patient successfully recovered after hardware removal.

### **Conclusions**

Intrapartum pubic symphysis disruption is a rare injury. Open reduction and internal fixation is indicated when a severe disruption is present ( $>4.0$  cm); simple radiographs show persistent instability signs or the patient still experiences disabling pain 3 months postpartum. We believe that good anamneses, correct physical examination, and adequate imaging studies are extremely useful to early recognize and correctly manage the spontaneous separation of the pubic symphysis during childbirth. Further studies with

larger case series and longer follow-ups are necessary and must be encouraged to increase the knowledge of advanced prevention and optimized treatment.

#### Key words

Intrapartum pubic symphysis disruption; open reduction and internal fixation.

### **9.3. Spinopelvic dissociation: pelvic functional outcomes and quality of life over a one-year period**

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#### Introduction

Spinopelvic dissociation is a rare but complicated sacral injury. It is usually associated with high-energy trauma. In the literature, spinopelvic dissociation is described as transverse sacral fracture in conjunction with a vertical fractures of the sacrum on both sides, which causes the dissociation of the upper sacrum and spine from the pelvis. These fractures are often complicated by vascular and neurological damage. Because this injury is rare, there is still a lack of data in the literature on pelvic function and quality of life after spinopelvic dissociation.

#### Aims and Objectives

The aim of this study was to assess the injury characteristics, changes in the quality of life and functional outcomes in the one-year period after spinopelvic dissociation.

#### Materials and methods

During the four year period (January 2016–January 2020), 17 patients with spinopelvic dissociation after high-energy trauma were treated in the Centre of Orthopaedics and Traumatology, Republican Vilnius University Hospital. One patient died in the first days of hospitalization, therefore the remaining 16 patients were included in the study. Patients were followed for 12 months after injury. The SF-36 questionnaire was used to assess quality of life, and

the Majeed pelvic score was used to assess pelvic function. Patients completed the questionnaires twice: during the first hospitalization (asking them to assess their condition before the injury) and one year after the injury (asking them to assess their condition at the current time).

## Results

The mean age of the patients included in the study was  $40.2 \pm 17.7$  years. Before trauma, the mean Majeed pelvic score was  $95.81 \pm 9.50$ , and the mean scores for the PCS and MCS domains of the SF-36 questionnaire were  $55.87 \pm 8.89$  and  $43.76 \pm 12.45$  points, respectively. One year after spinopelvic dissociation, the mean results of the Majeed pelvic score, SF-36 PCS, and MCS domains were  $71.13 \pm 20.98$ ,  $43.45 \pm 9.64$ , and  $43.41 \pm 7.56$ , respectively. Compared with the pre-trauma results, the results of Majeed pelvic score and the PCS domain of the SF-36 questionnaire were statistically significantly lower after one year ( $p = 0.001$  and  $p = 0.003$ , respectively) and the results of MCS domain of the SF-36 questionnaire remained similar ( $p = 0.501$ ).

## Conclusions

According to our study, pelvic function and quality of life are significantly impaired after spinopelvic dissociation, and only one-third of patients regained pre-traumatic pelvic function within one year.

## Key words

Pelvic function; quality of life; sacral fractures; spinopelvic dissociation.

### **9.4. Functional outcomes and quality of life after pelvic ring fractures: a one-year follow-up study**

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## Introduction

Pelvic fractures account for 2 % to 8 % of all bone fractures. Pelvic fractures commonly occur in young people with high-energy injuries during car accidents, falls from height or crushing by heavy objects. In the group of polytrauma patients, pelvic bone fractures are significantly more common and occur in 13–25 % of cases. Patients who have survived after pelvic fractures have significantly reduced quality of life, physical activity and deterioration of mental status in the short- and long-term.

## Aims and Objectives

The aim of this study was to investigate the quality of life and functional outcomes in patients with pelvic fractures over a one-year period.

## Materials and methods

This study was a single-centre prospective cohort study that included patients with pelvic fractures after high-energy injury admitted to a single trauma centre during the period of one year (1<sup>st</sup> of November 2016–1<sup>st</sup> of November 2017). One year after injury, patients completed Majeed pelvic score and SF-36 questionnaires to assess functional outcomes and quality of life.

## Results

During this period, 49 patients were enrolled in this prospective study. Out of 49 patients, 31 (63.3 %) were female and 18 (36.7 %) were male. The mean age was  $35.9 \pm 13.4$  years. According to AO/OTA classification, 32 patients (65.3 %) had type B, 16 patients (32.7 %) – type C, and 1 patient (2.0 %) – type A pelvic fractures. A total of 44 patients (89.8 %) were treated surgically. Mean Majeed pelvic score result representing functional outcomes was  $83.7 \pm 16.1$  one year after pelvic fracture. According to the results of SF-36, the mean PCS result representing physical status was  $47.71 \pm 9.11$ , and mean MCS result representing mental status was  $47.02 \pm 10.08$  one year after the injury.

## Conclusions

Patients after pelvic ring fractures have good functional outcomes after one year. Physical status of quality of life was the same compared with the population. Mental status was not affected by the injury. No significant differences were found among the different fracture types in these patients.

## Key words

Pelvic fractures; pelvic injury; functional outcomes; quality of life

## **9.5. The „touched vertebra“ method distal adding on and Trunk Shift**

### **in patients with Lenke Type I in AIS: a prospective randomized study**

Giedrius Bernotavicius, Vykintas Sabaliauskas, Dominykas Varnas, Rimantas Zagorskis, Irena Zagorskiene, Ona Lapteva, Kestutis Saniukas

#### **Introduction**

Selection of instrumentation levels in adolescent idiopathic scoliosis (AIS) surgery remains one of the most heatedly discussed subjects of the past 20–30 years. Therefore, it is crucial for spinal surgery practice to define better criteria for the selection of appropriate levels to achieve a balanced spine. The purpose of this prospective randomized study was to identify risk factors for distal adding on and Trunk Shift after surgery according fixation level selecting “touched vertebra” method.

#### **Aims and Objectives**

When the risk factors are assessed, the Lenke I type curve fixation distal level can be done above the “touched vertebra” and thus save more vertebrae. To prevent the possibility of distal adding on and Trunk Shift, fixation should end at the level of the “touched vertebra”.

#### **Materials and methods**

The prospective randomized study was carried in single institution. The subjects were randomly assigned into three groups according to the type of lumbar spine fixation method on the concept of the “touched vertebra”. Randomization was carried out by applying the envelope technique with the sequence of digits 1, 2 and 3. Risk factors were evaluated before surgery and 2 years post op.

#### **Results**

We identified 3 factors for an NFLC progression before surgery: Risser 0 before surgery, the OR for progression is 40.14 (95 % CI 3.074 to 524.141,  $p = 0.005$ ), LIV +1 distance the OR for progression is 1.11 (95 % PI 1.012 to 1.212,  $p = 0.03$ ) and lumbar curve flexibility the OR is 0.96 (95 % PI 0.929 to 0.996,  $p = 0.03$ ). Total area under ROC curve of this logistic regression model is 0.96 ( $\chi^2 = 51.028$ ,  $p < 0.0001$ , Nagelkerke  $R^2 = 0.7183$ ). We identified 4 factors for Trunk Shift after surgery: C7- CSVL distance before surgery, the OR for progression is 0.8,  $p = 0.02$ , correction of lumbar curve OR is 0.9,  $p = 0.003$ , correction of thoracic curve OR 1.1,  $p = 0.01$  and

fixation level above LTV, the OR 3.3 p = 0.04. Total area under ROC curve of this logistic regression model is 0.89 ( $\chi^2 = 33.7$ , p = 0.006, Nagelkerke R<sup>2</sup> = 0.5). Fixation level at LIV-1 group in distal adding-on subgroup had statistically larger Trunk Shift after 2 years f/u, p = 0.02.

## Conclusions

When the risk factors are assessed, fixation to LTV could be performed in AIS Lenke I type curve and thus prevent distal adding on and Trunk Shift progression after surgery at 2 years f/u.

### **9.6. Posterolateral endoscopic lumbar discectomy. Surgery technique, five years' experience**

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#### Introduction

The application of techniques we use is often described by the term “percutaneous endoscopic lumbar discectomy” (PELD). The SpineTIP System is an instrument set that combines the three standard percutaneous approaches – transforaminal, interlaminar and posterolateral – into one system whose endoscopes and operating instruments have been specifically designed for a particular approach. With the availability of endoscopic systems that integrate a high-resolution optical system, cold-light source adapters, and working and irrigation channels into a functional unit, it gives an opportunity to perform true minimally invasive coaxial and monoportal surgery under excellent visual control. Posterolateral approach ensures safe corridor for intradiscal surgery for working within the foramen.

#### Aims and Objectives

Our aim was to evaluate the five years' results of endoscopic lumbar discectomy using posterolateral approach.

#### Materials and methods

41 patients underwent PELD for single-level surgery. Macnab criteria were evaluated postoperatively. Operation time, duration of hospital stay, postoperative complications, and the rates and reasons for readmission were recorded and analyzed.

## Results

The satisfactory result rate was 95.1 %. The mean operative time was  $47.8 \pm 8.4$  minutes. The average duration of hospital stay was 1.7 days. The overall readmission rate was 4.9 %. The most common reasons for readmission were reherniation, sequestered herniation and pain.

## Conclusions

PELD is safe and effective procedure in lumbar disc surgery.

## Key words

PELD; lumbar disc herniation

## **9.7. Prediction of spinal diseases for different spine alignment profiles**

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### Introduction

Spinal sagittal imbalance is one of the main factors for back pain and decrease in quality of life. Therefore, it is crucial to investigate how certain spinal curvature types, predispose spinal sagittal imbalance, and which spinal curvature types are at biggest risk of developing spinal sagittal imbalance. Different spinal curvature types have different presenting symptoms, sites of low back pain, predisposition for disc hernia, spinal stenosis or spondylolisthesis.

### Aims and Objectives

To investigate how does an alteration of spinopelvic parameters cause spinal imbalance and to evaluate prevalence of spinal imbalance, disc hernia, spinal stenosis and spondylolisthesis among Roussouly spinal types of primary and operated patients.

### Materials and methods

Digital pelvic and sagittal spine radiograms of 89 patients treated in Republican Vilnius University Hospital in 2018–2020 years were included into retrospective study. Spinopelvic parameters: PT (pelvic tilt), PI (pelvic incidence) and SS (sacral slope); SVA (sagittal vertical axis); presence of retrolisthesis was calculated; Cobb angle of lumbar lordosis were measured on digital images. Using SVA values the results were split to two groups –

balance (SVA <5cm) and imbalance (SVA ≥5cm). Using spinopelvic parameters and appearance of global spine alignment the results were assigned to 4 Roussouly spinal types. The results were calculated using Pearson correlation, independent samples T-criterion and ANOVA test in IBM SPSS Statistics 25 program.

## Results

Digital pelvic and sagittal spine radiograms of 89 patients (70 women, 19 men, age 33–97 years, Med = 60) were measured. 36 (40.4 %) patients investigated post-surgery. Distributions in Roussouly spinal types: I: 21 (23.6 %), II: 27 (30.3 %), III: 25 (28.1 %), IV: 16 (18.0 %). All Roussouly types had patients with spinal imbalance, but Roussouly type I composed the highest number of imbalanced patients and differed significantly from other types (67 %, p = 0.003). Significant difference of LL (p < 0.05) and PT (p = 0.016) found among balance and imbalance groups. Significant correlations were found between: LL and SVA ( $r = -0.369$ , p = 0.005), PT and SVA ( $r = 0.303$ , p = 0.004), LL and SS ( $r = 0.694$ , p < 0.05), retrolisthesis and SVA ( $r = 0.319$ ; p = 0.02). Compensatory retrolisthesis was most common in Roussouly type I (82 %, p = 0.024) at the level of L3 vertebra.

## Conclusions

Different Roussouly spinal types have the tendency for spinal imbalance, but Roussouly type I has a highest probability of sagittal imbalance. Increasing SVA causes compensatory retrolisthesis, higher PT (pelvic retroversion) decline of SS and therefore increase spinal imbalance.

## Key words

Spondylolisthesis; Sagittal imbalance; spinopelvic parameters; roussouly spinal types.

## 10. TRAUMA SYMPOSIUM

### 10.1. The majority of community-dwelling hip fracture patients return to independent living with minor increase in care needs

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## Introduction

Hip fracture patients are fragile, and the majority fail to fully recover to their pre-fracture functional level, resulting in an increase in institutionalization.

## Aims and Objectives

We aimed to investigate risk factors for poor short-term functional recovery and failure to return to independent living 12 months after a hip fracture.

## Materials and methods

From 2011 and through 2017, all surgically treated hip fracture patients admitted from their own homes were included in a prospective cohort study. Patient characteristics were registered, including age, sex, lifestyle, comorbidities, pre-fracture New Mobility Score (NMS), biochemical measures, fracture type, and surgical method. Short-term functional recovery was measured at discharge using a cumulated ambulatory score (CAS) and timed-up-and-go (TUG). At 12 months, patients were interviewed regarding residence, post-fracture NMS and care needs. Multivariable logistic regression was used, reporting odds ratio (OR) with 95 % confidence intervals (95 % CI).

## Results

2006 patients were included in the study with data regarding their hospital stay and discharge, and in the analyses for short-term functional recovery. 1 342 patients were interviewed at 12 months and used in the analyses for failure to return to independent living. Modifiable variables associated with poor short-term functional recovery (CAS <6) were hypoalbuminemia (OR: 1.94, 95 % CI: 1.38–2.71), not mobilized to standing within 24 hours (OR: 1.88, 95 % CI: 1.12–3.15), general anaesthesia (OR: 1.35, 95 % CI: 1.07–1.71) and length of stay (OR: 1.12, 95 % CI: 1.06–1.18). Failure to return to independent living at 12 months was found in 10 % of the patients and was primarily associated with patient characteristics and proxy variables for comorbidities, but also poor short-term functional recovery (CAS <6).

## Conclusions

The risk factors associated with poor short-term functional recovery were primarily static. However, mobilizing patients to standing within 24 hours from hip fracture surgery is modifiable and found to be associated with short-term functional recovery. The present study found that failure to return to independent living at 12 months is seen in the frailest patients. However, the majority remains in their own home with a slight increase in care needs.

## Key words

Hip fracture; independent living; independence; care needs; functional outcome.

### **10.2. Subsequent ipsi- and contralateral femoral fractures after intramedullary nailing of a trochanteric or subtrochanteric fracture: a cohort study on 2 012 patients**

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## Introduction

The literature is inconclusive as to whether an intramedullary nail changes the distribution of a subsequent ipsi- or contralateral fracture of the femur. We have compared the incidence, localisation, and fracture pattern of subsequent femoral fractures after intramedullary nailing of trochanteric or subtrochanteric fractures in patients without previous implants in either femur at the time of surgery.

## Aims and Objectives

This study aimed to investigate how an intramedullary nail affects the incidence, pattern and localisation of subsequent femoral fractures in patients

treated for a trochanteric or subtrochanteric fracture with documented normal femora without implants or sequelae after previous surgery in either femur.

### Materials and methods

Retrospective analysis was performed of a two-centre cohort of 2 012 patients treated with a short or long intramedullary nail for the management of trochanteric or subtrochanteric fracture between January 2005 and December 2018. Subsequent presentations with ipsi- and contralateral femoral fractures were documented. Only patients with no previous femoral surgery performed, other than the index nailing were followed. Odds ratios (ORs) for subsequent femoral fracture were calculated using robust variance estimates in logistic regression.

### Results

The mean age of the cohort was 82.4 years and 72.1 % were female. The total number of patients presenting with subsequent femoral fractures was 299 (14.9 %). The number of patients presenting with subsequent ipsilateral and contralateral femoral fractures was 51 (2.5 %) and 248 (12.3 %) respectively (OR 5.0; CI 3.7–6.9). Twenty-six (8.7 %) of all subsequent femoral fractures occurred in the ipsilateral shaft, 14 (4.7 %) in the ipsilateral metaphyseal area, one (0.33 %) in the contralateral shaft, and three (1.0 %) in the contralateral metaphysis (OR 10; CI 3.6–29).

### Conclusions

An intramedullary nail significantly changes the fracture pattern in the event of a second low-energy trauma, reducing the risk of subsequent proximal ipsilateral femoral fractures and increasing the risk of subsequent ipsilateral femoral fractures in the shaft and distal metaphyseal area compared with the native contralateral femur.

### Key words

Trochanteric fractures; intramedullary nail; subsequent fracture.

### **10.3. Socioeconomic factors – effects on outcome after hip fractures**

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#### **Introduction**

Socioeconomic factors are known to have an impact on general health and mortality. Level of education, residential status, and household income have been shown in some studies to affect outcomes after hip fractures. The association between socioeconomic factors and post-treatment mortality has been less thoroughly investigated and empirical evidence based on the Norwegian hip fracture population is missing.

#### **Aims and Objectives**

The aim of this study was to investigate to what extent socioeconomic factors have an impact on mortality after hip fractures in the Norwegian fracture population.

#### **Materials and methods**

The study is based on data from Norwegian Hip Fracture Register (NHFR), the National Patient Register (NPR), and Statistics Norway (SN). All patients with hip fractures reported to the NHFR between 2014–2018 were eligible for inclusion ( $n = 41,699$ ). Patients with pathological fractures, foreigners, patients with contralateral fractures, and patients with missing data on fracture type, ASA grade, and missing patient identification in NHFR or NPR were excluded. Patient data from the 3 sources were coupled using the person-specific national identification number. In total 37 394 patients were available for analyses. Analyses were performed using a logistic regression model adjusting for age, sex, ASA grade, and Charlson Comorbidity Index (CCI). We collected socioeconomic data from SN. Patients' residential status was defined as living alone, cohabitant or living in a healthcare facility.

Household income, defined as income the year prior to injury was categorized to quartiles of income (Low to High). Educational status was grouped in three levels according to the International Standard of Classification of Education: Low (lower secondary education), Medium (upper secondary to short-cycle tertiary education), and High (Bachelor's level and beyond).

## Results

One-year mortality after hip fractures was increased in patients with Low and Medium level of education compared to High education level (OR 1.13 and 1.05 respectively). Mortality in the High household income group (Q4) was lower than that in the low income group (Q1; OR 1.19), Intermediate low income (Q2; OR 1.29), and intermediate high income (Q3; OR 1.15). Patients living in healthcare facility (OR 2.65) had higher mortality than patients residing alone (reference level) and those cohabitating (OR 1.11). The 30-day mortality in patients living in a health care facility was also increased (OR 2.22). Education and income had no significant impact on 30-day mortality.

## Conclusions

Socioeconomic factors such as level of education, household income, and residential status affect mortality after hip fractures. Higher education and income were independently associated with lower mortality. Residing in a health care facility was associated with higher mortality compared to those living alone and were cohabitant.

## Key words

Socioeconomic factors; mortality; hip fracture.

### **10.4. Intramedullary nail versus sliding hip screw for stable and unstable trochanteric and subtrochanteric fractures in 17 341 patients from the Norwegian Hip Fracture Register**

Kirsten Marie Larsen Gronhaug<sup>1,2</sup>, Eva Dybvik<sup>3</sup>, Kjell Matre<sup>2,3</sup>, Bengt Ostman<sup>1</sup>, Jan Erik Gjertsen<sup>2,3</sup>

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## Introduction

The choice of implant in the treatment of trochanteric fractures and subtrochanteric fractures has been debated for decades without reaching consensus. The most common implants are extramedullary sliding hip screws (SHS) and intramedullary nails (IMN), skewing towards IMN over the past two decades. In this study, based on data from the Norwegian Hip Fracture Register (NHFR) from 2013–2019, we compared reoperation rates between SHS and IMN in stable fractures (AO/OTA A1) and unstable fractures (AO/OTA A2, AO/OTA A3 and subtrochanteric combined) one and three years postoperatively. Secondary aims were to compare reoperation rates between SHS and IMN in A2, A3 and subtrochanteric fractures separately, and to compare mortality and patient-reported outcomes after SHS and IMN for stable and unstable fractures one year after surgery.

## Aims and Objectives

The aim of this study was to investigate if there were differences in outcome between sliding hip screw (SHS) and intramedullary nail (IMN) with regard to fracture stability.

## Materials and methods

We assessed data from 17 341 patients with trochanteric or subtrochanteric fractures treated with SHS or IMN in the Norwegian Hip Fracture Register from 2013 to 2019. Primary outcome measures were reoperations for stable fractures (AO/OTA type A1) and unstable fractures (AO/OTA type A2, A3 and subtrochanteric fractures). Secondary outcome measures were reoperations for A2, A3 and subtrochanteric fractures individually, one-year mortality, quality of life (EQ-5D-3L), pain (Visual Analogue Scale (VAS)), and satisfaction (VAS) for stable and unstable fractures. Hazard rate ratios (HRRs) for reoperation were calculated using Cox regression analysis with adjustments for age, sex and ASA-score.

## Results

Reoperation rate was lower after surgery with IMN for unstable fractures one year (HRR: 0.82, 95 % CI: 0.70 to 0.97, p = 0.02) and three years postoperatively (HRR: 0.86, 95 % CI: 0.74 to 0.99, p = 0.036), compared to

SHS. For individual fracture types, no clinically significant differences were found. Lower 1-year mortality was found for IMN compared to SHS for stable (HRR: 0.87, 95 % CI: 0.78 to 0.96, p = 0.007), and unstable fractures (HRR: 0.91, 95 % CI: 0.84–0.98, p = 0.014).

## Conclusions

This national register-based study indicates a lower reoperation rate for IMN than SHS for unstable trochanteric and subtrochanteric fractures, but not for stable fractures or individual fracture types. The choice of implant may not be decisive to the outcome of treatment for stable trochanteric fractures in terms of reoperation rate. One-year mortality rate for unstable and stable fractures was lower in patients treated with IMN. However, the lower one-year mortality rate for unstable and stable fractures in patients treated with IMN should be further investigated.

## Key words

Trochanteric fractures; sliding hip screw versus intramedullary nail; reoperation rate; mortality; patient recorded outcome.

### **10.5. Short-term clinical outcome following flexor hallucis longus tendon transfer in neglected Achilles tendon rupture**

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## Introduction

Reported incidence of misdiagnosed Achilles tendon rupture is up to 20 %. It presents a challenging problem for orthopaedic surgeons. Various treatment protocols have been suggested. Most of them are based on Achilles tendon gap size. It has been suggested that in Mayerson type III Achilles tendon rupture (gap size 5 cm and above) flexor hallucis longus tendon transfer is appropriate surgical procedure.

## Aims and Objectives

This study aims to evaluate clinical results following flexor hallucis longus tendon transfer in neglected Achilles tendon rupture.

## Materials and methods

This is a retrospective case series of 7 patients, who presented with Mayrson type III chronic Achilles tendon rupture in a tertiary orthopaedic referral centre. All of the patients underwent single-incision FHL transfer. The tendon was fixed with Smith and Nephew Biosure HA interference screw. All surgeries were performed 2020–2021 by 3 dedicated foot and ankle surgeons. 6 patients were male, 1 was female. The mean age at the time of surgery was 56 years (49 to 68). The mean time from rupture to surgery was 3.8 months (1 to 6). The mean postoperative follow-up was 8 months (5 to 13). There were no complications.

## Results

All patients were evaluated using ATRS and Leppilahti sores. The mean postoperative Achilles tendon Total Rupture Score (ATRS) was 70 (38 to 96) and the mean Leppilahti score was 77 (67–89).

## Conclusions

Flexor hallucis longus tendon transfer for neglected Myerson type III Achille tendon rupture is a quick and reliable procedure with a low complication rate. It provides satisfactory clinical results.

## Key words

Neglected Achilles rupture; Flexor hallucis longus transfer.

## **10.6. Hip arthroplasty after acetabular fracture and complicated internal fixation (FRI, PJI)**

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## Introduction

With the increase incidence of high kinetic energy caused injuries, acetabular and pelvic ring fractures tend to become a more common part of polytrauma patients. Despite growing incidence, successful management of these injuries remains one of the most difficult challenges in orthopaedic surgery. As these patients are usually multiply injured – it is not only life-threatening

trauma in acute settings, but also devastating condition in the long-term perspective. Especially if internal fixation of acetabular fracture is complicated by fracture related deep musculoskeletal infection requiring removal of implants. In these situations there is a high need in systemic approach to the complicated injury management which can be achieved by simultaneous application of adequate surgery, appropriate fixation and proper antibiotic management strategy. In this scenario involvement of at least 3 different field specialists is of key importance-orthopedic and trauma surgeon experienced in acetabular fracture surgical treatment, microbiologist, infectiuos disease specialist, sometimes augmented by the input from plastic and reconstructive surgery doctor.

### Aims and Objectives

To show sequelae of acetabular fracture surgical treatment complicated by FRI infection and outcomes.

Multidisciplinary approach, strict adherence to reliable FRI, PJI guidelines (having in mind both: surgical part and antibiotic therapy) are key measures in the road to successful treatment of failed acetabular fracture, complicated by infection. Despite the complexity of the complicated injury (both mechanical and microbiology issues) one can expect successful eradication of infection and definite endoprosthesis implantation.

### Materials and methods

We present 3 chalenging cases of fracture related infection after acetabular both columns fracture (2 patients suffered from high energy trauma (MVA), one trauma was sustained when falling from the standing hight) and performed ORIF osteosynthesis. Patients were treated in 2 Vilnius university hospitals during 11 years period (2009–2020) – emergency healthcare services were provided in Republic Vilnius university hospital, as well as initial infection diagnostics, evaluation, removal of implants, antibiotic therapy. On the other side infection eradication (debridement, cement spacer implantation, antibiotics therapy before definitive arthroplasty treatment) and final revision arthroplasty were performed in Vilnius university hospital Santaros clinics. X-ray, CT images, microbiology samples and laboratory findings were presented.

## Results

In all 3 patients eradication of infection during short-term follow-up period was achieved. Follow-up time was 19 months, 20 months and 10 months respectively. Changes in Harris hips score, SF-12 score and Majeed questionnaire were registered. No signs of infection relapse observed. Although patients did not return to the level of activity as it was before the acetabular fracture.

## Conclusions

Multidisciplinary approach, strict adherence to reliable FRI, PJI guidelines allow successful management of failed acetabular fracture, complicated by FRI infection, although at the expence of overall functional capabilities as measured by the questionnaires (HHS, SF-12, Majeed score).

## Key words

Acetabular fracture; fracture related infection; revision arthroplasty.

### **10.7. Effects of adherence to guidelines in treatment of displaced femoral neck fractures**

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## Introduction

Reviews of international and national guidelines on treatment of displaced femoral neck fractures (FNFs) demonstrate fairly consistent recommendations. Despite the apparent professional consensus, data from the Norwegian Hip Fracture Register (NHFR) annual reports have shown a significant variation in FNF treatment in Norwegian hospitals.

## Aims and Objectives

The aim of this study was to investigate if FNF-patients received best practice treatment expressed as adherence to guideline recommendations, and whether adherence affected selected outcomes in the Norwegian FNF population.

## Materials and methods

The study is based on data from the NHFR. Displaced FNFs (Garden III-IV) reported to the NHFR between 2014–2018 were included. Patients with the following characteristics were excluded: under 65 years, ASA grade 5, pathological fractures and patients with missing data. Finally, 14 260 patients with displaced FNF were included. Contemporary guideline recommendations for this patient group comprised a) treatment with prosthesis; b) use of cemented stem; and c) operation within 48 hours after fracture. Treatment fulfilling all recommendations were defined as best practice. Outcome measures (end points) were proportion of patients receiving best practice, mortality rates (30 days and 1 year), and reoperation within 1 year. Logistic regression analyses were used with adjustments for age, sex, and ASA grade.

## Results

There was a significant variation in compliance with guideline recommendations in Norwegian hospitals, and 59.7 % (7.6 % – 84.4 %) of patients received best practice treatment.

30-day mortality for prosthesis vs osteosynthesis was 8.1 % vs 14.1 % (OR 0.75; 95 % CI 0.59–0.97;  $p = 0.028$ ), for hemiprosthesis with cemented vs uncemented stem 8.2 % vs 7.9 % (OR 1.08; 95 % CI 0.91–1.27;  $p = 0.374$ ), and for operation  $\leq 48$  h vs  $>48$  h after fracture 8.2 % vs 9.5 % (OR 0.96; 95 % CI 0.82–1.12;  $p = 0.612$ ).

1-year mortality for prosthesis vs osteosynthesis was 24.8 % vs 35.6 % (OR 0.71; 95 % CI 0.59–0.86;  $p < 0.001$ ); for hemiprosthesis with cemented vs uncemented stem 24.9 % vs 24.4 % (OR 1.05; 95 % CI 0.94–1.17;  $p = 0.374$ ), and for operation  $\leq 48$  h vs  $>48$  h after fracture 24.5 % vs 28.8 % (OR 0.89; 95 % CI 0.79–0.97;  $p = 0.014$ ).

Reoperation rates for prosthesis vs osteosynthesis was 4.2 % vs 15.2 % (OR 0.24; 95 % CI 0.19–0.30;  $p > 0.001$ ), for hemiprosthesis with cemented vs uncemented stem 4.0 % vs 5.0 % (OR 0.77; 95 % CI 0.63–0.94;  $p = 0.011$ ), and for operation  $\leq 48$  h vs  $>48$  h after fracture 4.6 % vs 5.0 % (OR 0.92; 95 % CI 0.76–1.13;  $p = 0.430$ ).

## Conclusions

Six out of ten FNF patients received guideline-recommended treatment in the 5-year period. Adherence to guideline recommendations had a varying but positive effect on outcome in this national cohort of FNF patients. Deviation from guideline recommendations had a detrimental effect on patient outcomes. A selection of more morbid patients to osteosynthesis might be a factor increasing mortality in this group.

## Key words

Hip fracture; guidelines; unwarranted variation

## 11. PLENARY SESSION

### **11.1. Effectiveness of a multifaceted quality improvement intervention to improve patient outcomes after total hip and knee arthroplasty: a registry nested cluster randomised controlled trial**

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#### Objective

To assess the effectiveness of a prospective multifaceted quality improvement intervention on patient outcomes after total hip and knee arthroplasty (THA and TKA).

#### Design

Cluster randomised controlled trial (RCT) nested in a national registry. From January 1, 2018 to May 31, 2020 routinely submitted registry data on revision and patient characteristics were used, supplemented with hospital data on readmission, complications, and length of stay (LOS) for all patients.

#### Setting

20 orthopaedic departments across hospitals performing THA and TKA in the Netherlands.

## Participants

32 923 patients underwent THA and TKA, in 10 intervention and 10 control hospitals (receiving no specific intervention and continued with usual care).

## Intervention

The implementation period lasted 8 months and consisted of the following components: 1) Monthly updated feedback on 1-year revision, 30-day readmission, 30-day complications, long (upper-quartile) length of stay (LOS), and these 4 indicators combined in a composite outcome; 2) Interactive education; 3) An action toolbox including evidence-based QII to facilitate improvement of specific performance indicators; and 4) Bimonthly surveys to report on quality improvement initiatives (QII) undertaken.

## Main outcome measures

The primary outcome was textbook outcome, an all-or-none composite outcome representing the best outcome on all performance indicators (i.e., the absence of revision, readmissions, complications, and long LOS). The individual indicators were analysed as secondary outcomes. Changes in outcomes from pre-implementation to implementation period were compared between intervention versus control hospitals, adjusted for case-mix and clustering of patients within hospitals using random effect binary logistic regression models. The same analyses were conducted for intervention hospitals that did and did not introduce QII.

## Results

16 314 patients were analysed in the intervention hospitals (12 475 before and 3 839 during intervention implementation) versus 16 609 in the control hospitals (12 853 versus 3 756). After implementation of the intervention, the absolute Textbook Outcome probability increased by 4.32 % (95 % confidence interval (CI) 4.30–4.34) more in intervention than control hospitals, corresponding to 21.6 (95 % CI 21.5–21.8) i.e. 22 patients treated in intervention hospitals to achieve one additional patient with Textbook Outcome. Intervention hospitals had a larger increase in patients achieving Textbook Outcome (ratio of adjusted odds ratios 1.24, 95 % CI 1.05–1.48) than control hospitals, a larger reduction in patients with long LOS (0.74, 95 % CI 0.61–0.90) but also a larger increase in patients with reported 30-day complications (1.34, 95 % CI 1.00–1.78). Intervention hospitals that introduced QII increased more in Textbook Outcome (1.32, 95 % CI 1.10–

1.57) than control hospitals, with no effect shown for hospitals not introducing QII (0.93, 95 % CI 0.67–1.30).

## Conclusion

Implementation of a multifaceted quality improvement intervention including monthly feedback, education, and a toolbox to facilitate QII was effective to improve the number of patients achieving Textbook Outcome. The effect size was associated with the introduction of (evidence based) QII, considered as the causal link to achieve better patient outcomes.

### **11.2. Maintenance of syndesmosis reduction in pronation-external rotation ankle fractures: a minimum 6-year follow-up of a randomised controlled trial comparing suture button and syndesmosis screw fixation**

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## Introduction

Short-term randomised controlled trials (RCT) have shown that, in treatment of syndesmosis injuries, a suture button device (SB) resulted in better radiographic and functional outcome compared to syndesmosis screw fixation (SS). However, only one RCT has reported long-term results (5-year follow-up); thus, the syndesmosis malreduction rates for both implants might increase during longer follow-up.

## Aims and objectives

The primary objective of this RCT was to evaluate the maintenance of syndesmosis reduction with the SS compared to the SB fixation during a minimum follow-up of 6-years. The secondary objectives were to assess the grade of post-traumatic osteoarthritis (OA) and the functional outcome.

## Materials and methods

We enrolled 43 patients with Lauge-Hansen pronation-external rotation type 4/Weber C, ankle fractures with unstable syndesmosis, between January 2010 and December 2011 at Oulu University Hospital. Patients were randomised to treatment with either a single 3.5-mm tricortical SS (22 patients) or an SB (21 patients). The mean follow-up was 7.1 years (range, 6.2–7.9). Syndesmosis reduction and OA grade was assessed with standing cone-beam computed tomography (CBCT) of both ankles. Malreduction was defined as >2 mm side-to-side difference in the mean width of the syndesmosis. OA was graded according to the Morrey & Wiedeman classification. The Olerud-Molander Ankle Outcome Score (OMAS) and a quality of life questionnaire (RAND 36-Item Health Survey) were used to evaluate functional outcome.

## Results

Two syndesmoses in the SS group and one in the SB group were malreduced ( $P = 0.58$ ). Moderate OA after a mean of 7 years post-injury was common. In the SS and SB groups, 9 of 16 and 11 of 13 patients, respectively, had one or more grades serious OA in the injured ankle than in the uninjured ankle ( $P = 0.11$ ). The mean OMAS was 88 in the SS group and 78 in the SB group (difference between means 7.1, 95 % CI: -7.0-21.1,  $P = 0.32$ ). The RAND-36 results did not differ between groups.

## Conclusions

The SS and SB maintained syndesmosis reduction equally well during follow-up. Our study findings also suggest that both methods result in moderate OA rates and the functional outcome is comparable between these two syndesmosis fixation methods.

## 12. PLENARY SESSION

### 12.1. Patients' experiences of discontentment one year after total knee arthroplasty – a qualitative study

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## Background

Total knee arthroplasty is a common procedure with generally good results. However, there are still patients who are dissatisfied without known explanation. Satisfaction and dissatisfaction have previously been captured by quantitative designs, but there is a lack of qualitative studies regarding these patients' experiences. Qualitative knowledge might be useful in creating strategies to decrease the dissatisfaction rate.

## Methods

Of the 348 patients who responded to a letter asking if they were satisfied or dissatisfied with their surgery, 61 (18 %) reported discontent. After excluding patients with documented complications and those who declined to participate, semi-structured interviews were conducted with 44 patients. The interviews were analyzed according to qualitative content analysis. The purpose was to describe patients' experiences of discontentment 1 year after total knee arthroplasty.

## Results

The patients experienced unfulfilled expectations and needs regarding unresolved and new problems, limited independence, and lacking of relational supports. They were bothered by pain and stiffness, and worried that changes were complications as a result of surgery. They described inability to perform daily activities and valued activities. They also felt a lack of relational supports, and a lack of respect and continuity, support from health care, and information adapted to their needs.

## Conclusion

Patient expectation seems to be the major contributing factor in patient discontentment after knee replacement surgery. This qualitative study sheds light on the meaning of unfulfilled expectations, in contrast to previous quantitative studies. The elements of unfulfilled expectations need to be dealt with both on the individual staff level and on the organizational

level. For instance, increased continuity of healthcare staff and facilities may help to improve patient satisfaction after surgery.

#### Keywords

Content analysis; patient contentment; patient satisfaction; qualitative research; surgery; total knee arthroplasty.

### **12.2. Combined anterior cruciate ligament revision with reconstruction of the antero-lateral ligament does not improve outcome at 2-year follow-up compared to isolated ACL revision; a randomized controlled trial**

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#### Background

It is essential to obtain rotational stability of the knee after anterior cruciate ligament reconstruction (ACL-R) and a supplemental reconstruction of the antero-lateral ligament (ALL-R) has been suggested to support this. It is unknown, if ALL-R in combination with ACL revision after failed ACL reconstruction result in better outcome than ACL revision alone.

#### Aim

To investigate the effect of ALL-R in ACL revision surgery.

#### Materials and Methods

Patients eligible for first time ACL revision were randomized to either isolated ACL revision (-ALL group) or ACL revision combined with a single-stranded allograft ALL-reconstruction (+ALL group). Patient reported outcomes and function were evaluated at two-year follow-up using KNEES-ACL, KOOS, and Tegner activity scale. Objective knee laxity was evaluated using an instrumented Rolimeter test, the pivot shift test, and a manual Lachman test.

#### Results

A total of 103 patients were enrolled with 49 patients in the +ALL group and 54 patients in the -ALL group. No baseline differences between groups were

seen regarding age, gender, and body mass index. Meniscal injury and cartilage lesions were seen in 27 % and 45 % in the +ALL and in 20 % and 41 % in the -ALL group, respectively. The ACL revision was performed with allograft in 20 % of the patients in the +ALL group and 15 % in the -ALL group. There were no significant differences in the KNEES-ACL subgroups, KOOS subgroups and Tegner score between groups at two-year follow-up. No significant differences between groups were seen at one-year follow-up regarding objective laxity measured with Rolimeter test, Lachman test, and pivot shift test.

#### Interpretation / Conclusion

Supplemental ALL reconstruction in ACL revision does not improve subjective outcome at two-year follow-up and objective outcome at one-year follow-up compared to isolated ACL revision.

### **12.3. Classification of trochanteric hip fractures as unstable or stable using both X-ray and CT scans**

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#### Introduction

About 1/3 of hip fractures are trochanteric hip fractures (FTF). X-ray imaging is the gold standard for preoperative assessment of FTF. The choice of treatment is based on fracture morphology. Hence, classifications systems have been developed to facilitate the orthopedic surgeon's decision making. There are many classification systems for FTF, the most common are AO/OTA and Evans classification modified by Jensen (EVJ). Classification systems on FTFs are partly designed to categorize the fractures as stable or unstable subtypes. There is evidence suggesting that unstable subtypes (AO31.2.2-3.3 / EVJ III-V) may have fewer osteosynthesis failure rate when treated with intramedullary nail.

Introduction of Computer Tomography (CT) in fracture diagnostics have provided orthopedic surgeons the opportunity for 3D reconstruction in the

process of preoperative planning. A classification system for FTFs in accordance to 3D reconstructions is developed by Nakano.

### Aims and Objectives

The aim of this study was to compare if introduction of CT scans in patients with FTF would change the observers understanding of the fracture pattern and consequently have an impact on the classification and stability evaluation.

### Materials and methods

All patients  $\geq 65$  years with identified FTF on X-ray imaging have been offered inclusion in this prospective quality study from September 2021 at Stavanger University Hospital. The X-ray versus CT scan preoperatively was to be assessed and classified in accordance to three different classifications systems for FTFs (AO/OTA, Modified EVJ, and Modified Nakano classification). Low-energy CT of the pelvis in this age group gives little radiation exposure and is considered justifiable.

### Results

As of August 2021, 59 FTFs were included in the preliminary analyzes. 113 assessments of both X-rays and CT scans were made. By X-ray assessment with AO, EVJ and Nakano, respectively, the fractures were considered stable in 55, 37 and 46 cases. After assessment of CT scans, 12 (22 %), 9 (24 %), and 10 (22 %) were re-evaluated to be unstable fractures, respectively. The fractures were considered unstable at 58, 76 and 67 X-ray assessments. After the assessment of CT scans, 4 (7 %), 6 (8 %), and 1 (1 %) were re-evaluated to be stable, respectively.

### Conclusions

Preliminary data from this study show that approximately one out of five FTFs classified as stable when assessed on X-ray were re-evaluated to be unstable after assessment of the CT scan. Similar observations were made with all classification systems (AO/OTA, EVJ, Nakano). CT seems to give a better understanding of the fracture morphology, thus provide a more accurate fracture diagnosis that may affect the choice of operation method.

## **13 TRAUMA SYMPOSIUM**

### **13.1. Morphological patterns and clinical course in geriatric patients with displaced two-part humeral neck fractures managed non-surgically**

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#### **Introduction**

High-quality evidence has failed to demonstrate superiority of surgical management of geriatric displaced two-part fractures of the proximal humerus. However, little is known about the spontaneous healing and patient outcome outside a few clinical trials or in very fragile elderly. Malunion is inevitable when severely displaced fractures in adults are treated without restoring the anatomy. Initial radiographic displacement and subsequent malunion may challenge evidence-based orthopaedic practice.

#### **Aims and Objectives**

To review morphological patterns and clinical appearance of displaced two-part humeral neck fractures in geriatric patients.

#### **Materials and methods**

An iconography. Nineteenth century cases and pathoanatomical drawings from surgical textbooks are revisited with special focus on displaced two-part fracture patterns. The morphologies are analyzed and compared to modern patients with comparable morphologies treated non-surgically. Clinical photographs are added to illustrate the shoulder function compatible with severe radiographic malunion.

#### **Results**

Surprisingly good function and patient satisfaction can be obtained even in cases with severe malunion. Radiographical appearance does not adequately mirror clinical outcome.

## Conclusions

When applying an evidence-based and non-surgical approach to these, often severely displaced, fractures we should acknowledge that malunion is part of the natural healing process and may be compatible with good patient outcome. Large prospective studies of patient reported outcome after non-surgical management of displaced proximal humeral fractures are needed.

## Key words

Shoulder fractures; proximal humeral fractures; non-operative; non-surgical; history; 19<sup>th</sup> century; evidence-based orthopaedics.

### **13.2. Closed suction wound drain reduces postoperative opioid consumption in adolescents undergoing pedicle screw instrumentation for idiopathic scoliosis. A randomized clinical trial (DAISY)**

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## Introduction

Closed suction subfascial drain is used routinely after instrumented posterior spinal fusion for adolescent idiopathic scoliosis (AIS). However, postoperative drain output has been associated with up to 50 % of total blood loss in these patients.

## Aims and Objectives

To compare the effects of subfascial drain on postoperative hemoglobin levels, wound healing, and postoperative opioid consumption and pain. We hypothesized that postoperative hemoglobin change and total blood loss

would be larger in the group with subfascial drain. Secondary outcome was pain and 48 hour opioid consumption using patient-controlled analgesia.

### Materials and methods

In a randomized, multicenter clinical trial 90 consecutive adolescents (mean [SD] age 15.7 [1.9] years, 68 females) undergoing segmental pedicle screw instrumentation for AIS (mean [SD] major curve 55° [8.0°] preoperatively and 16° [6.7°] postoperatively) were randomized into 24-hour subfascial closed suction drain or no drain group at the time of wound closure using the sealed envelope technique (1:1). Forty-seven patients received a drain and forty-three did not.

### Results

The mean [SD] total postoperative blood loss (intraoperative and drain output) was significantly greater in the group with subfascial drain than in the no drain group (1008 [520] mL vs. 631 [518] mL,  $p < 0.001$ ). The 24-hour or 48-hour postoperative decrease in hemoglobin did not differ between the groups (mean [SD] 48-hour decrease: 35 [16] g/L vs. 32 [15] g/L,  $p = 0.42$ ). Two patients in the drain group and three patients in the no drain group needed allogenic blood transfusion. One patient in each group developed deep surgical site infection. The mean [SD] 48-hour opioid consumption (58 patients) was significantly higher in the no-drain group (2.0 [0.9] mg/kg vs. 1.4 [0.6] mg/kg,  $p = 0.0044$ ). Mean pain in numerical rating scale did not differ between the groups.

### Conclusions

Use of subfascial drain increases total blood loss after pedicle screw instrumentation for adolescent idiopathic scoliosis but is not associated with decreased hemoglobin level or wound healing issues. Subfascial closed suction drain reduced 30 % postoperative opioid consumption after instrumented posterior spinal fusion in adolescent idiopathic scoliosis.

### Key words

Adolescent idiopathic scoliosis; pedicle screw instrumentation; randomized clinical trial; subfascial closed suction drain; no drain

### **13.3. Unsuccessful microsurgical reconstructions of open fractures of the lower limb are not associated with a higher anatomical level of amputation**

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#### **Introduction**

High energy trauma to the lower limbs can result in open fractures, treated by reconstructive surgery or amputation. There is uncertainty among surgeons whether initial attempts of microsurgical reconstruction might lead to an anatomically higher level of amputation if reconstruction is unsuccessful.

#### **Aims and Objectives**

Investigate whether a failed attempt at limb salvage after severe injury to the lower leg results in a more proximal level of amputation than a primary amputation.

#### **Materials and methods**

We performed a nationwide population-based study using the Swedish National Patient Register to identify all adult patients who between 1998 and 2014 underwent reconstruction or amputation after an open fracture below the knee, along with consequent procedures within the same time frame.

#### **Results**

Out of 275 individuals undergoing surgery after an open fracture below the knee during the study period, the first surgery was reconstructive in 160 patients (58 %) and amputation in 115 (42 %) patients. Mean follow-up time was seven years (range 0–15 years). Out of the reconstructive patients, 12 (8 %) had a subsequent transtibial amputation. None were amputated at a more proximal level.

There was no difference in anatomical level of amputation between patients who underwent primary versus patients who underwent secondary amputation ( $p > 0.05$ ).

## Conclusions

After lower limb trauma, an initial microsurgical soft-tissue reconstruction is only followed by later amputation in a small amount of cases. We found no evidence of an initial attempt of reconstruction leading to a later anatomically higher level of amputation in case of unsuccessful reconstruction. The management of open lower limb trauma continues to be a challenge; however, our findings ought to be reassuring for surgeons and patients alike. The initial treatment decision should not be influenced by fear of the need for a later higher level of amputation.

## Key words

Trauma; open fracture; amputation; limb salvage.

### **13.4. Early complications after tibial plateau fractures**

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#### Introduction

Tibial plateau fractures appear in 10,3 from 100 000 people every year and are difficult to manage injuries, that have a great risk of complications (3–45 % according to literature), especially infection.

#### Aims and Objectives

The aim of this study was to evaluate the early complications following surgical treatment of tibial plateau fractures.

#### Materials and methods

In this study were included patients, treated in Republican Vilnius University Hospital (RVUL) for tibial plateau type IV, V, VI fracture, according to Schatzker classification. Early complication was considered as any trauma related complication or complication treated surgically regarding injured knee after surgery, which emerged in 6 month. Patients were divided into two groups: with and without complications, and those groups were analysed and compared.

#### Results

There were 177 patients treated for tibia plateau fractures in RVUL hospital during study period of 5 years – 88 men and 89 women. There were 27 %

type IV, 15 % type V and 58 % type VI tibia plateau fractures based on Schatzker classification. Complication appeared in 25 (14 %) cases, of which 28 % were trauma related complications (2 compartment syndromes, 3 neurovascular complication, 2 pulmonary embolism) and 72 % were surgery related complications (3 implant migration, 15 infection). Surgery related complications (10 % of all cases) emerged from 10 to 159 days after surgery, usually in 3 months (74 % cases). The average patient age (54 years without and 56 years with complication,  $p = 0,532$ ) or time from trauma to definite surgery (8 days without and 10 days with complication,  $p = 0,276$ ) nor the usage of external fixation or skeletal traction had no significant difference between the groups. Trauma mechanism, high versus low velocity, had no impact on complication. Surgery time was significantly longer in surgery related complications group ( $p = 0,008$ ).

### Conclusions

Tibial plateau fractures has a high complication rate. Compared to literature, complication ratio in RVUL hospital is not as high as other hospitals, surgery related complications consists of only 10 % and can be influenced by longer surgery duration. The time to surgery after the trauma does not increase the risk of complication. However, 4 % of all cases are trauma related that can not be avoided.

### Key words

Tibia plateau fracture; infection; Schatzker classification.

## **14. CHALLENGES IN TREATMENT OF FOOT AND ANKLE TRAUMA. CASE BASED PRESENTATIONS**

### **14.1. Challenges in treatment of talus fractures**

Giedrius Mazarevicius

*Republican Vilnius University Hospital, Lithuania*

#### Introduction

Why are talus fractures challenging to treat?

## Aims and Objectives

A lot of things to think of: rarity, blood supply, approaches, complications etc. Due to the short time of the presentation, I'll stress only two: essential primary and post operative care.

## Materials and methods

Literature review and case series.

## Results

- Complete joint dislocations should undergo emergent reductions
- If irreducible with closed techniques, then surgical reductions (percutaneous or open) should be performed emergently
- Definitive fixation may be delayed.

## Conclusions

- Complete joint dislocations should undergo emergent reductions.
- If irreducible with closed techniques, then surgical reductions (percutaneous or open) should be performed emergently.
- Definitive fixation may be delayed.
- Early passive and active exercises, to nurture the cartilage and save ROM.

Progressive weightbearing – follow the Hawkins sign.

## **14.2. TMT joint fusion**

Giedrius Mazarevicius

*Republican Vilnius University Hospital, Lithuania*

### Introduction

Lisfranc fracture-dislocations are complex. Surgeons tend to choose between primary fusion and fixation of the TMT joints.

## Aims and Objectives

To discuss the pros and cons of the primary fusion

- The most important point to consider is that fusion has the potential to offer the patient one surgery versus two or three.
- One period of healing and rehab. If results are similar, why choose multiple surgeries? (Time & money)
- When do you remove the hardware?

- If you leave the hardware – simply fuse. No difference in possible TMT joint motion.

## Materials and methods

Literature review and case series.

## Results

- All studies agreed: less hardware removal operations.
- Almost studies agreed that there was no difference between revision surgery, anatomic reduction, postoperative infection, total complications, and patient satisfaction.

## Conclusions

Bones heal, ligaments scar.

If it is designed to be rigid – fuse, if mobile – fix.

## **15. SPORT INJURIES / ARTHOSCOPY SYMPOSIUM**

### **15.1. Posterior shoulder instability associated with bone defect: cases report**

Eugenijus Piesina

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#### Introduction

Locked posterior dislocation of the shoulder (LPDS) is an uncommon condition that is often misdiagnosed and becomes chronic due to an inadequate physical examination. As a rule LPDS are fracture-dislocations and especially rare isolated posterior dislocations without any fracture pattern. Posterior fracture-dislocation of the shoulder is infrequent in orthopaedic practice, constituting only 2 % to 4 % of all shoulder dislocations, and its annual incidence is 0.6 in 100 000. So not every orthopaedic traumatology surgeon has possibility to see even one case per year in his every day practice. This severe pathology cause rather small pain in rest position, often there is no clinically clear deformation of the shoulder, sometimes it looks like “healthy shoulder” in incorrect X-ray examination. Too small attention is paid to such painful shoulder in emergency room, especially, if the patient has leading seizure pathology. Urgent treatment of

the seizure is the priority, so LPDS is very often overlooked (79 %) and becomes chronic in 3 weeks.

### Aims and Objectives

Our hospital is the biggest trauma centre in Baltic countries and include in its structure departments important for this pathology: orthopaedic traumatology centre, neurology department, neurosurgery department, intensive care department. Therefore, concentration of patients with seizure and posterior shoulder dislocation conditions are higher than in other hospitals. We want to share our experience in diagnostic pitfalls and treatment possibilities.

### Materials and methods

We present 10 different cases of LPDS, which bone defects differ from small to large reverse Hill-Sachs impaction. Correct radiologic examination is highlighted. Special attentions are paid to cracks in anatomic neck, because they are frequent, and closed reposition could be crucial for such cases. Wide spectrum of treatment options we propose for different situations: open reposition with lesser tuberosity suture fixation, different types of bone augmentation, osteosynthesis, anatomic or reverse arthroplasties.

### Results

Radiological and clinical early and middle-time results will be shown in presentation.

### Conclusions

There is no gold standard treatment for LPDS and no specific study on the treatment algorithm has been published. We prefer anatomic reconstruction up to 16 weeks after trauma. Surgeon can always choose shoulder arthroplasty as a primary treatment for LPDS with bigger bone defects, but he must understand that it is temporary solution and must be responsible, especially for young patients.

### Key words

Posterior dislocation; shoulder instability; Hill-Sachs.

## **15.2. Large ACL graft diameter and knee stability after ACL reconstruction**

Rimtautas Gudas\*, Mantas Staskunas, Augustinas Rimkus, Laimonas Siupsinskas

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*Lithuanian University of Health Sciences, Kaunas Clinics, Lithuania*

### **Introduction**

Novel surgical techniques allow to obtain optimal ACL graft size, but there is little data on how the stability of the knee joint and the patient's well-being in the postoperative period are dependent on the size of the graft.

### **Aims and Objectives**

To determine how the ACL graft diameter and knee stability affect patient well-being after ACL reconstruction.

### **Materials and methods**

The study included 62 randomly selected patients who underwent primary ACL reconstruction using semitendinosus and gracilis tendon autografts. Patients were assessed 6 months after surgery based on the IKDC system and Genourob (GNRB) knee mobility study. The patients were divided into 5 groups according to obtained ACL graft diameter: Graft diameter groups: Group 1 – graft size – 12 mm; Group 2 – graft size – 11 mm; Group 3 – graft size – 10 mm; Group 4 – graft size – 9 mm; Group 5 – graft size – 8 mm. The GNRB system was used to assess knee joint mobility in operated and healthy knee joints by applying an equal force of 134N to both knees. All patient knee joints were assessed 6 months post-surgery using the GNRB system, the results of which were compared with ACL graft diameter and IKDC scores.

### **Results**

After comparing the data 6 months after ACL reconstructions, we found that 12mm diameter ACL graft was obtained in 7 patients, 11 mm in 9 patients, 10 mm in 26 patients, 9 mm in 14 patients, and 8 mm in 6 patients. When evaluating the stability of knee joints using the GNRB system, a difference of <0 mm between healthy and operated knee joints were found in 24 patients, 0–1 mm in 20 patients, 1–2 mm in 6 patients, 2–3 mm in 4 patients, >3 mm in 6 patients. IKDC questionnaire scores 6 months after operation:

60–70 – 10 patients; 70–80 – 13 patients; 80 to 90 – 15 patients; 90–100 – 23 patients. The highest mean IKDC score (92.55) was established in the 12 mm diameter graft group, 76.6 in the 11 mm group, 84.5 in the 10 mm group, 82.5 in the 9 mm group, 73.1 in the 8 mm group. Patients who scored 60–70 in the IKDC questionnaire mean GNRB shift was 1,1 mm, mean graft size – 9,6 mm; IKDC 70–80 – GNRB 1,3 mm mean graft size – 10,1 mm; IKDC 80–90 – GNRB – 0,1 mm, mean graft size – 9,8 mm; IKDC 90–10 – GNRB 0,5 mm, mean graft size – 10,1 mm. GNRB knee stability study showed the highest IKDC score for patients with the lowest, and particularly negative displacement compared to a healthy knee joints: mean <0 mm difference between healthy and operated knees scored mean IKDC score of 85, compared to mean IKDC 82.8 – mean 0–1 mm GNRB, mean IKDC 77.4 – mean 1–2 mm GNRB, mean IKDC 75.8 – mean 2–3 mm GNRB, and mean IKDC 78.5 – mean >3 mm GNRB group ( $p < 0.05$ ).

### Conclusions

Based on our data, we found that ACL graft diameter of 8mm and less was associated with poorer well-being and highest GNRB stability scores ensure the best well-being 6 months after ACL reconstruction, when evaluating patient well-being using the IKDC questionnaire.

### Key words

Anterior cruciate ligament; knee instability; large diameter ACL graft; Genoroub; IKDC; Graft diameter.

### **15.3. Multiple and single articular cartilage lesion treatment with multi-layer MaioRegen chondroplus scaffolds and bone marrow stimulation**

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### Introduction

Articular cartilage (AC) lesions are among the most difficult to diagnose and treat of all joint disorders. The affected AC usually lacks regeneration and initiates degenerative processes which are difficult to control and lead to osteoarthritis. Most often, in Lithuania these lesions are treated only by microfracture; it is known that only 1–3 % of cells capable of regeneration

remain in the joint after this procedure. Recently, the use of multilayer collagen scaffolds together with bone marrow stimulation methods (BMS +S) is becoming increasingly popular. This type of treatment is expensive and not covered by national healthcare insurance in Lithuania, which shows the need of efficiency analysis and indication determination for this treatment.

### Aims and Objectives

Compare BMS +S and bone marrow stimulation (BMS) treatment methods when treating singular and multiple AC lesions.

### Materials and methods

A retrospective study compared BMS+S (35 patients) and BMS (40 patients) methods in treating singular and multiple AC lesions. In total 75 patients were included, operated between 2010 and 2018. Patients who underwent concurrent high tibial osteotomy (HTO), anterior cruciate ligament reconstruction (ACLR) and medial patellofemoral ligament reconstruction (MPFLr) were included in the study. BMS +S method was carried out using MaioRegen chondroplus multi-layer collagen and hydroxyapatite scaffolds secured with fibrin glue. All diagnosed AC lesions were treated in all cases. For final evaluation 8 groups were distinguished by procedure complexity – 1 – BMS+S; 2 – BMS+S+HTO; 3 – BMS+S+ACLR; 4 – BMS+S+MPFLr; 5 – BMS; 6 – BMS+HTO; 7 – BMS+ACLR; 8 – BMS+MPFLr. The results were evaluated using the ICRS questionnaire and in some cases – MRI assessment. Mean time of evaluation in the BMS+S groups – 9.5 months (8–24 mo.) and 6,8 years (2–8 y) in the BMS groups. In the pre-operative assessment there was no difference between BMS+S and BMS groups, other than patients in the BMS+S group being younger (mean age 38,7 y) and larger defect size (mean 5,8c m<sup>2</sup>) compared to BMS group (mean age 49,5 y; mean lesion size 2,8 cm<sup>2</sup>).

### Results

Significant clinical ICRS score improvements was noted in all groups during the assessment period ( $p < 0.05$ ). Comparison between BMS+S and BMS groups showed highest ICRS scores when treating single patellar groove ( $p = 0.001$ ), medial femoral condyle ( $p = 0.04$ ) and lateral femoral condyle ( $p = 0.02$ ) AC lesions. Mean BMS+S group's ICRS score after 9,5 months (8–24 mo) was 87, and the BMS group's 68.7 after 6.8 years (2–8 y) ( $p = 0.001$ ).

Mean ICRS scores in the BMS+S groups were 78.9 in multiple lesion subgroup and 89.7 in single lesion subgroup ( $p = 0.0001$ ), and 68.9 and 79.7 respectively in BMS groups. When treating AC lesions together with ACLr, HTO, or MPFLr a 35 % relapse was observed in the BMS+ACLR, 40 % after BMS+HTO, 70 % after BMS+MPFLr groups at a mean of 6.8 years (2–8 y) after surgery. No relapses in the BMS+S groups have been observed, due to the short evaluation period (9.5 mo).

## Conclusions

Based on our study and evidence shown in orthopedic literature, we are changing our practice of treating all cartilage defects with microfracture and wherever possible recommend using additional scaffolds when treating multiple and single cartilage also in combination with ACLr, MPFLr or HTO.

## 16. TRAUMA SYMPOSIUM

### 16.1. Active clinical issues at discharge predict readmission within 30 days and one year following hip fracture surgery

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## Introduction

Early readmission to the hospital may be seen as a preventable failure to ensure safe discharge following a hip fracture. There is a need for knowledge regarding modifiable risk factors for readmissions to prevent such readmission. Premature discharge may be evaluated based on vital signs at discharge and medical complications during the hospital stay. Such active clinical issues (ACIs) have received little attention, but knowledge of ACIs may potentially help develop tailor-made treatment plans and follow-up measures upon discharge. Furthermore, time to surgery's association to

readmission have been investigated, but not the reasoning for delaying surgery which may explain the inconsistent findings.

### Aims and Objectives

To identify risk factors contributing to readmission within 30 days and one year after hip fracture surgery. Furthermore, to explore any association between 30-day readmission and: 1) medical issues as delaying surgery and 2) ACIs at the time of discharge.

### Materials and methods

We studied a consecutive cohort of hip fracture patients surgically treated from 2011 to 2017. Data were collected prospectively about patient characteristics, proxy variables for comorbidities and hospital-related variables. ACIs were defined as unstable vital signs or antibiotic treatment at discharge.

### Results

2 510 patients were included, of whom 14 % were readmitted within 30 days and 39 % within one year after hip fracture surgery. The most frequent causes of readmission (30 days / one year) were medical causes unrelated to the hip fracture (62 % / 53 %) and new trauma (13 % / 19 %). After adjustment, patient characteristics associated with increased readmission risk were age >85 years, male sex, living independently, smoking and a Body Mass Index (BMI)  $<18.5 \text{ kg/cm}^2$ . Proxy variables for comorbidities associated with a higher readmission rate were high ASA score, anticoagulation therapy, low albumin and high creatinine. For hospital-related variables, ACIs were associated with an increased risk of readmission, especially due to medical and infectious causes. ACIs attributed to 46 % of readmissions for medical causes. However, medical issues resulting in surgery delays exceeding >24 hours did not increase the risk of readmission within 30 days.

### Conclusions

Readmission following hip fracture surgery is high, but some readmissions may be prevented. Resolving ACIs before discharge using tailor-made discharge plans and focused follow-up may reduce readmissions following hip fracture surgery in this fragile patient group.

## Key words

Hip Fracture; readmission; active clinical issues; safe discharge; surgical delay.

## **16.2. Conversion to arthroplasty after femoral neck fractures in 805 younger patients treated with internal fixation; a national register-based study**

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### Introduction

Treatment of femoral neck fractures, in particular displaced ones (dFNF), in younger patients is a challenge. Sparing the native femoral head has been a goal for both the dFNF and undisplaced FNF (uFNF) in younger individuals, leading to internal fixation (IF) as gold standard. Still, the result of IF, in terms of conversion to secondary arthroplasty, is insufficiently described. A previous population-based study found a conversion rate of 14 %, but did not differentiate between uFNFs and dFNFs, and a smaller single-center case series presented a conversion rate of 22 % in dFNFs. We designed a national register-based study to determine the rate of conversion to arthroplasty from IF due to uFNFs and dFNFs.

### Aims and Objectives

The primary aim of the study was to analyze the rate of conversion to secondary arthroplasty after internal fixation (IF) with parallel pins/screws or sliding hip screw devices (SHS) of uFNFs and dFNFs. As secondary aim,

differences in conversion rates were analyzed regarding age, trauma mechanism, fracture displacement and fracture treatment.

## Materials and methods

This is a national register-based study with prospectively collected data from the national Fracture Register (FR) and Arthroplasty Register (AR). Data on age, sex, trauma mechanism, index fracture based on AO/OTA classification, and primary treatment was retrieved from the FR during 2012–2018. These data were combined with data on secondary arthroplasties from the AR until December 31, 2019. Data is reported to both registries by all orthopaedic institutions nationwide.

Inclusion criteria were age 18–59 years and either an uFNF (AO/OTA 31-B1) or a dFNF (AO/OTA 31-B3). Fractures treated with IF with parallel pins/screws or SHS were identified. Exclusion criteria were pathological, spontaneous and stress fractures ( $n = 89$  in total), non-operative treatment or other surgical methods (e.g. arthroplasty or intramedullary nail) ( $n = 180$ ). Length of follow-up was defined as time from injury to date of death or end of study period. Association of categorical variables were analyzed by Chi<sup>2</sup>-tests, significance level predefined at  $<.05$ . The national ethical review board approved the study.

## Results

From a total of 1 074 FNFs identified in the FR, 805 treated by IF with parallel pins/screws or SHS were included in the analyses. Median (IQR) age at the fracture was 52 (46–57), 59 % of the fractures occurred in men and 77 % were due to low-energy trauma. dFNFs were more often caused by high-energy trauma (20 %) than uFNFs (12 %,  $p <.001$ ). Parallel pins / screws were the treatment in 94 % of the cases, the proportion was similar in uFNFs and dFNFs.

With a mean follow-up of 3.5 years, 110 of the 805 (13.7 %) internally fixed fractures were converted to arthroplasty. The conversion rate in dFNFs was 82/394 (21 %), and in uFNFs, 28/411 (7 %). Patients aged  $\geq 50$  ( $n = 278$ ) with an uFNF had a higher conversion rate (9 %) than those  $<50$  ( $n = 133$ , 2 %,  $p =.011$ ). For dFNFs, the conversion rates for age  $\geq 50$  ( $n = 233$ , 23 %) and  $<50$  ( $n = 161$ , 17 %) was insignificantly different ( $p =.207$ ).

## Conclusions

Our register-based study is the largest one to date and adds updated knowledge on the results after IF due to FNFs in younger patients. The conversion rate from IF to secondary arthroplasty, especially for dFNFs where one in five was converted, indicates there might be room for improvement of the primary treatment.

## Key words

Femoral neck fracture; adult; internal fixation; secondary arthroplasty; national register.

### **16.3. Incidence, complications and survival of operatively treated periprosthetic distal femoral fractures**

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## Introduction

Periprosthetic distal femoral fractures (PPDFFs) associated with total knee arthroplasty (TKA) are typically fragility fractures affecting elderly patients and can have devastating consequences, including a loss of ambulatory status, perioperative morbidity, high rate of complications and mortality. The number of TKAs increases yearly and, at the same time, patients tend to live longer, so the overall number of TKAs, especially in an ageing population, is increasing rapidly. The current incidence of PPDFF is estimated at 2.4 per 100 000 population per year. However, the literature lacks studies examining the annual incidence of these fractures per arthroplasty patient and per population living in precisely defined districts.

Surgical fixation is the preferred management strategy of the PPDFFs. The overall complication rate after operatively treated PPDFF has been reported to be as high as 24 % in the one-year follow-up and the overall one-year mortality rate has between 8 % and 27 %.

## Aims and Objectives

We aimed to investigate the population-based incidence, complications and survival of operatively treated PPDFFs.

## Materials and methods

A retrospective analysis was performed for all patients with a previously implanted TKA, and who lived in the hospital district (approximately 245 000 inhabitants) and had consecutive undergone surgery due to PPDFF in the study period from January 1<sup>st</sup>, 2004 to December 31<sup>st</sup>, 2016. The number of patients with TKA and living in our hospital district at the end of each year during the study period was calculated using the data for all TKA (re)operations since 1980 from the Finnish Arthroplasty Register and Finnish Hospital Discharge Register. A total of 108 operatively treated PPDFFs were found [93/108 (86 %) females and 15/108 (14 %) males].

## Results

The mean annual incidence of operatively treated PPDFF related to 1 000 people living with implanted TKA per year was 1.3 (SD 0.6; range, min 0.4 at year 2004 and max 2.6 at year 2015) during the study period and the overall incidence was 3.2 per 100 000 person years (SD 1.8; range, min 1.2 at year 2005 and max 2.6 at year 2015). Open reduction and internal fixation was performed for 102/108 (94 %) of the cases. Complications after PPDFF surgery were found in 24/108 (22 %) of the cases and the cumulative incidence of death was 14.8 % at 1 year (95 %CI 8.9–22.2 %), 47.7 % at 5 years (95 %CI 37.5–57.2 %) and 64.9 % at 10 years (95 %CI 53.5–74.1 %).

## Conclusions

The present study showed a four-fold increasing trend of PPDFF incidence from 2004 to 2016 while the number of primary TKAs raised only 20 % within the same time frame. Typically, PPDFF patients are elderly females with compromised physiological reserve and consequently, there is high rate of complication and mortality expected.

## Key words

Survival; complications; mortality; endoprosthesis; lateral locking plate; periprosthetic fracture.

## **16.4. Does circumferential casting prevent fracture redisplacement in reduced distal radius fractures? A retrospective multicentre study**

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### **Introduction**

Distal radius fractures account for up to 20 % of all fractures. Displaced distal radius fractures are generally reduced in the emergency room and immobilized in a cast. Up to 30–40 % of reduced fractures show fracture redisplacement in the first weeks which often results in operative treatment. It is unclear if treatment with a circumferential cast prevents fracture redisplacement more than treatment with a splint.

### **Aims and Objectives**

This study aims to evaluate whether a circumferential cast compared to a plaster splint reduces the risk of fracture redisplacement in reduced extra-articular distal radius fractures in adults during the first treatment week.

### **Materials and methods**

This retrospective multicentre study was performed in four hospitals (two teaching hospitals and two academic hospitals). Adult patients with a displaced extra-articular DRF, treated with closed reduction, were included. Patients were included from a 5-year period (January 2012–January 2017). According to the hospital protocol, fractures were immobilized with a below elbow circumferential cast (CC) or a plaster splint (PS). The primary outcome concerned the difference in the occurrence of fracture redisplacement at one-week follow-up.

### **Results**

A total of 500 patients were included in this study (PS n = 184, CC n = 316). At one-week follow-up, fracture redisplacement occurred in 52 patients (17 %) treated with a CC compared to 53 patients (29 %) treated with a PS. This difference was statistically significant ( $p = 0.001$ ).

## Conclusions

This study suggests that treatment of reduced DRFs with a circumferential cast might cause less fracture redisplacement at 1-week follow-up compared to treatment with a plaster splint. Level of Evidence Level III, Retrospective study.

## Key words

Bone; circumferential cast; distal radius fracture; fracture; redisplacement; splint.

### **16.5. Operatively treated ankle fractures are increasing in elderly population**

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## Introduction

Ankle fractures are one of the most common fractures requiring operative treatment. They occur most commonly in postmenopausal women and younger men and recent studies suggest that the incidence of ankle fractures is increasing.

## Aims and Objectives

The aim of this study was to analyze the incidence, annual trend, age and sex distribution, associated comorbidity and seasonal variation of operatively treated ankle fractures in Finland in 33 year period.

## Materials and Methods

This register study was performed on the whole population of Finland from 1987 to 2019. On the last day of 2019, the population of Finland was 5 525 292.

We identified all ankle fracture patients who were treated operatively in Finnish hospitals during the period between 1<sup>st</sup> January 1987 and 31<sup>st</sup> December 2019 from The Finnish National Hospital Discharge Register, which is maintained by The Finnish Institute for Health and Welfare. The register contains data on procedures performed in public and private

hospitals, and the quality of the data is good. We gathered age and sex group specific population sizes from the statistics of Finland's (StatFin) online services, which is maintained by Statistics Finland.

Register-based numbers of operations were stratified by year, age group (0–19, 20–49, 50–69 and over 70 years), sex, and season (summer / winter). We calculated the incidence of operatively treated ankle fractures per 100 000 person-years in total, for age and sex groups. To illustrate the continuous smoothed trend from stratified values locally estimated scatterplot smoothing (LOESS) technique was used. We examined patients' comorbidities according to the Charlson Comorbidity Index. The Poisson regression model was used to obtain Incidence rate ratios (IRR) of the considered risk factors (sex, age group, summer / winter).

## Results

Between 1987 and 2019, a total of 118 929 ankle fractures were operatively treated in Finland. Of these, lateral malleolar fractures numbered 33 %, bi- or trimalleolar fractures 51 %, there were 7 % medial malleolar fractures, and other fractures numbered 9 %. For both sexes, the annual incidence increased towards the turn of the 21<sup>st</sup> century, after which the incidence in women levelled off and in men began to decline. However, the incidence is increasing in the elderly women group (over 70 years of age). The incidence of ankle fractures was higher during the winter months (November–March). In the age over 50, comorbidities have increased over the years. In Poisson regression analysis IRR for men is 2 % higher compared to women, and people aged 50–69 have a 2-fold risk compared to those aged 20–49 years. The IRR is 62 % higher in winter months.

## Conclusion

The number of operatively treated ankle fractures has leveled off during the last 33 years. However, the incidence of ankle fracture in elderly patients is increasing and these patients have more comorbidities – which may lead to more severe fractures and increased risk of complications.

## Key words

Ankle; fracture; surgery; incidence.

## **17. PLENARY SESSION**

### **17.1. Intraoperative complications in total hip arthroplasty using a new cementless femoral implant (SP-CL®)**

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#### **Background**

Considering the excellent results already achieved in total hip arthroplasty (THA), new implants must be at least as safe as currently used implants and lead to longer survival. A new cementless femoral stem, SP-CL®, has been introduced. The aim of this study is to evaluate intraoperative complications and assess the risk factors of THA with the SP-CL® implant.

#### **Materials and methods**

All THA patients who were operated on using the SP-CL® (LINK, Hamburg, Germany) implant between 2015 and 2018 were included in the analysis. Data were collected from medical records from national and hospital electronic databases. Radiological measurements were made from standard pre- and postoperative radiographs.

#### **Results**

A total of 222 THA were performed using the SP-CL® implant. The average age of the patients was 56 years (14–77 years). There were 1 transient sciatic nerve injury, 1 acetabular fracture, and 11 (5.0 %) intraoperative femoral fractures (IFF), of which 7 were treated with cerclage wire or titanium band during the operation while the other fractures were treated conservatively. None of the IFF patients were revised due to fracture during the follow-up period (one revision due to infection). The radiographic morphology of proximal femur was associated with increased risk of IFF ( $p = 0.02$ ).

## Conclusions

The results of the current study demonstrate a 5 % incidence of IFF when using the LINK SP-CL® femoral stem in THA. The radiographic morphology of the proximal femur was an important predictor of IFF and should be assessed when using SP-CL®.

## Keywords

Cementless; complications; hip arthroplasty; intraoperative fracture; SP-CL.

## **17.2. Nonoperative hip fracture management practices and patient survival compared to surgical care: an analysis of Estonian population-wide data**

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## Introduction

A notable proportion of hip fracture patients receive nonoperative management, but such practice is seldom analysed. Although highly variable reasons underpin hip fracture nonoperative management, none of these practices conclusively outweigh the superiority of operative management. Nonoperative management should be only considered when surgery is not an option.

## Purpose

Reasons underpinning hip fracture (HF) nonoperative management (NOM) are seldom analysed. This study aims to identify the reasons behind NOM and assess the accuracy of these decisions using these patients' survival compared with those treated with operative management (OM).

## Methods

This is a retrospective cohort study based on population-wide administrative health data, including patients aged  $\geq 50$  with an index HF diagnosis between January 2009 and September 2017. NOM patients were subgrouped according to their expected prognoses, and their survival up to 36 months was compared with those treated surgically.

## Results

From a total of 11 210 included patients, 6.8 % (766) received NOM. Varying reasons lead to NOM, dividing them further into five distinct subgroups: (I) 46 % NOM decision due to poor expected prognosis with OM; (II) 29 % NOM decision due to poor expected prognosis for mixed reasons; (III) 15 % NOM decision due to good expected prognosis with NOM; (IV) 8.0 % NOM decision due to patient's refusal of OM; and (V) 1.3 % NOM decision due to occult HF. Only poor prognosis and patients who refused OM (I, II, IV) had worse survival than OM patients. However, a relatively high proportion of the poor prognosis patients survived 1 year (29 %).

## Conclusion

Although there was high variability in reasons underpinning HF NOM, none of these practices conclusively outweigh OM's superiority. NOM should be considered with utmost care and only for patients for whom OM is out of the question – well-defined medical unfitness or carefully considered refusal by understanding the increased mortality risk.

## Keywords

Clinical decision-making; hip fracture; nonoperative management; operative management.

### **17.3. How long does it take to recover after the arthroscopic cartilage repair of the knee. Criteria based recovery plan**

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## **Introduction**

Local knee cartilage defects are often found in relatively young physically active patients. Articular cartilage damage is often associated with significant discomfort such as pain, swelling, and functional impairment (Heir et al. 2010). Associated risk factors for the development of premature osteoarthritis (OA) include the size, depth, and localization of the defect, as well as possible additional injuries to knee protective structures, such as ligaments, the meniscus, or other comorbidities like axial or patellar malalignment (Khella et al, 2021). The rehabilitation the essential part of the whole treatment process. Variables that must be considered when designing postoperative rehabilitation protocols following articular cartilage procedures: lesion location, size depth, containment, quality of surrounding tissue, patient age, body mass index, general health, nutrition, quality of articular cartilage, previous activity level, specific goals, motivation level, surgery repair procedure, tissue involvement and concomitant procedures (Reinold et al, 2006).

## **Aims and objectives**

The aim of this research is to make an overview of the rehabilitation programs and describe the main criteria for successful recovery after the cartilage repair procedures of the knee for the physically active patients.

## **Materials and methods.**

Analysis of the scientific papers and clinical experience in the rehabilitation of the patients after the regenerative cartilage knee surgery

## **Results**

The rehabilitation before the regenerative cartilage surgery is called prehabilitation. Preoperative quadriceps strength, neuromuscular control, and general fitness are considered the most important factors in the postoperative functional ability of patients with focal cartilage defects in the knee. To increase muscular strength, strength training novices are required to participate in at least 2, ideally 3 training sessions per week. In trained or athletic populations, the number of training units should be raised to 4 to 6 times per week. The minimum total time to achieve strength gain is 4–6 weeks, which induces an increase in maximum contractile muscle force mainly due to neuronal adaptations. Structural changes in the muscle architecture including muscle fibre hypertrophy can be expected after 3 months (Hirschmuller et al. 2019). The criteria for the progression of

rehabilitation are pain intensity and localization of pain and swelling (at rest or at night; during passive and active movements, weight – bearing or non-weight bearing). Special attention should be made to fever and risk of infection.

## Conclusions

The main criteria-based steps for rehabilitation progression: prehabilitation (exercises before the surgery), education of the patient (daily activities and limitations), control of pain, edema and range of motion (continuous passive motion device), progression from non-weight bearing exercises to weight bearing activities, progress from open kinetic chain to closed kinetic chain exercises, fully restored the strength of the muscles before loading the joint, load the joint, get neuromuscular control, balance, complexity and variability of the movements.

Statistically significant and clinically meaningful improvements in clinical parameters from the pre-operative status were achieved as early as 3 months after treatment (first time point measured) and were maintained through month 24. The primary study endpoint was met in a confirmatory manner from month 3 onward to month 24 (Niemeyer et al. 2022).

### **17.4. Trochanteric femur fracture operated with dynamic hip screw system augmented with a biphasic apatite sulphate combined with local bisphosphonate**

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## Introduction

Osteoporosis and fragility fractures are increasing with age and are only partly halted by primary and secondary national prevention programs. More than 8.9 million osteoporotic fractures occur annually worldwide, with approximately one-third in Europe. Due to the aging population, the number of fragility fractures is predicted to increase further in the next decade. The life expectancy in hip fracture patients decreases by nearly 25 % when compared to age and gender matched populations. One-fifth of all fragility fractures occur in the hip with an almost equal ratio in the cervical and trochanteric regions. The interest in osteoporosis therapy is declining, in

particular for secondary fracture prevention where the risk of subsequent hip fractures following a first fracture is high.

### Aims and Objectives

To create a novel proximal femur bone augmentation model and to study the process of bone regeneration around the metal device in the femoral neck canal locally using drugs that affect bone metabolism. To investigate whether a Cerament Bone Void Filler acts as a carrier delivering Zoledronic acid locally can improve bone regeneration in the femoral neck around the osteosynthesis device.

### Materials and Methods

This is an open-labelled pilot study to investigate the bone augmentation and remodelling around the dynamic hip screw or proximal femoral nail using drugs that affect bone metabolism (Cerament and Zoledronic acid). The planned number of enrolled patients in the study is 20: Osteosynthesis + local Cerament BVF (10 ml) + Systemic Zoledronic acid (4 mg i/v, 1–2 weeks post-surgery) – 10 patients. Osteosynthesis + Systemic Zoledronic acid (4 mg i/v, 1–2 weeks post-surgery) – 10 patients; The post-procedural follow-up period is 6 months. Computed tomography of both femoral heads and necks were performed for evaluation 3 days, 3 months and 6 months surgery. This comparative clinical trial of lag-screw augmentation in TFs was approved by the Institute Review Board (IRB) at the Kaunas University Hospital, Kaunas, Lithuania, and the study details can be found at ClinicalTrials.gov (Identifier: NCT04498715).

### Results

14 patients (-3 patients) 8 with cerament. 6 without cerament. All patients got Zoledronic acid after 1–2 weeks. Average of age 79.9 years. 2 men and 12 women. 9 patients completed follow-up. 1 patient died – a few weeks before. 1 patient changed their mind and 1 patient moved to another country.

### Conclusion

We present a new clinical trial and its methodology which was done investigate whether a Cerament Bone Void Filler acts as a carrier delivering Zoledronic acid locally can improve bone regeneration in the femoral neck around the osteosynthesis device. We will present the results after one year.

# **POSTER PRESENTATION ABSTRACTS**

The content of the abstracts presented is the responsibility of their authors  
and co-authors.

The abstracts are arranged in sequence alphabetically according to the  
surname of first author of abstract.

## **18. POSTER ABSTRACT SESSION**

### **18.1. Virtual planning and personalized surgical instruments (guides) for tumor cases. Results of clinical practice**

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#### **Introduction**

Excisions of bone tumors are a challenging procedure due to complex geometry, poor visibility, and restricted workspace and are associated with a high rate of relapse. Although the effectiveness of patient-specific surgical guides over free-handed resection has been demonstrated, they are rarely used due to a time consuming pre-surgical planning, costs and increased lead time. Alongside technological breakthrough towards personalized surgery, it is primordial to accompany the transition in the surgical practice through the development of innovative ICT means to improve pre-surgical planning and surgeon-manufacturer communication, translating clinical history and treatment strategy into the design of PSI. We report on a new approach for pre-surgical planning towards excision using PSI's for bone tumors in 3, 12 and 15 years of age old in patients.

#### **Aims and Objectives**

Bone tumors excisions with virtual planning and PSI.

#### **Materials and methods**

Crucial for the accurate design of PSI, CT images are acquired with high spatial resolution. The CT series are reconstructed in 3D using segmentation software (Mimics Medical (Materialise, Belgium)) and used to discriminate the tumor from the bony structure. The virtual models acquired were then loaded into the first open-access 3D-virtual-model-based ICT tools (MICE) (Ortho Baltic, Lithuania)) for surgeon-manufacturer communication and pre-surgical planning, surgical guide design validation serving as patient-specific surgical-guide (Geomagic® FreeForm® Plus (3D systems Inc., U.S.)) configurator in regard to patient and pathology specificities to initiate pre-surgical planning.

## Results

Through the manipulation of 3D models, the surgeon has the ability to precisely target the tumor to remove it individually, as the way of individual solution. Additionally, the surgeon participation in the co-creation and approval processes is facilitated by the specification of requirements on virtual models and the systematization of the design features. This resulted in a fast and accurate design of PSI's, comprises resection plans with emergency margins of 1 cm. The PSI were designed with matching contact surfaces, defined and validated by both surgeon and clinical engineer, fitting into one specific position determined by the anatomy of the patient and pathology peculiarities.

## Conclusions

This newly developed 3D-virtual-model-based technology, set as a surgeon-manufacturer communication tool for PSI order and configurator, ensures correct data interpretation, product safety, and functionality. This will accelerate the transition towards personalized approach and undoubtedly help achieve better clinical outcomes, shorter delivery times, and lower costs related to this procedure. Along with it, the accumulated experience from PSI applications is used as clinical decision support and learning tool to create added value not only for patients but also for surgeons and medical institutions.

## Key words

Bone tumors, 3D-virtual-model, technology, virtual planning.

## **18.2. Efficiency of treatment methods for bone cysts of the humerus in pediatric patients**

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## Introduction

Aneurysmal and unicameral bone cysts (ABC and UBC) are non-cancerous bone tumors. 75 % occurs in first two decades of life. Mostly discovered after pathological fracture. ABC: UBC = 1:1 (~0.3/100,000). Treatment is controversial. Life quality after surgery mostly is decreased. Non-

vascularized fibula allograft can be used for restoration of the humerus after wide cyst resection, healed 4–6 months.

### Aims and Objectives

To compare: efficiency of the different treatment methods for bone cysts of the humerus in pediatric patients; bone structure of the humerus of the same patients' healthy and surgically treated hand by clinical, X-ray and MRI findings.

### Materials and methods

Single center retrospective study. 34 patients with ABC or UBC, yr 2000–2014. Mean age -10.24 ( $\pm 0.54$ ) yrs. Mean follow-up – 7.56 yrs (SD 4.75). 13 patients' clinical exam., X-rays, MRI were performed. 13 patients' quality of life was evaluated using RFGK questionnaires. MRI scanning was performed on 10 patients who received surgical treatment to compare bone structure of healthy and operated humerus.

### Results

Mean age  $10.24 \pm 0.54$  years. In 31 (91.2 %) patients cyst was diagnosed after the pathological fracture ( $p < 0.001$ ). Total reoperation rate was 18.52 % (n = 27). 5 (45.45 %) of the patients who suffered from two or more fractures needed second surgery ( $p = 0.002$ ). 16 (47.06 %) ABC's and 18 UBC's (52.94 %) were diagnosed. 14 (35 %) radical and 18 (45 %) non-radical surgeries were performed. Average length of radical and non-radical surgeries (2h 53 min vs 1h 41 min) and postoperative stay (12 vs 8 days) was significantly different ( $p < 0.05$ ). In all 7 patients who received fibular graft transplantation bone structure in MRI is the same as in analogical section of healthy humerus or with some minor defects. Although no significant difference was found depending on surgery type ( $p > 0.005$ ).

### Conclusions

In 5 out of 7 patients MRIs after reconstruction of humerus using non-vascularized fibular allograft showed no difference comparing to healthy humerus.

After both types of surgeries patients were satisfied with the function of their arm and health.

## Key words

Bone cysts, paediatric, bone tumors, aneurysmal cyst.

### **18.3. Pubo-femoral distances measured reliably by midwives in hip dysplasia ultrasound**

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#### Introduction

The pubo-femoral distance (PFD) has been suggested as an ultrasound screening tool for developmental dysplasia of the hip (DDH) but the accuracy has so far only been documented in the hands of radiologists, making it difficult to implement in a potential universal screening program for DDH.

#### Aims and Objectives

The aim of this study was to examine if novice ultrasound users undergoing minimal training, could reliably perform pediatric hip ultrasound and PFD measurements and to evaluate the learning curve.

#### Materials and methods

Eight midwives were recruited for training in pediatric hip ultrasound. The midwives performed two rounds of independent blinded PFD measurements on 15 static ultrasound images and participated in four supervised live scanning sessions. The midwives were compared to a group of three experienced musculoskeletal radiologists. Reliability was evaluated using inter-rater correlation coefficients (ICC). Linear regression was used to quantify the learning curve of the midwives as a group with absolute differences between midwives and radiologists as a function of number of scans.

#### Results

There was near complete intra- and inter-rater agreement (ICC >0.89) on static ultrasound images across both rounds of rating and across midwives and radiologists.

The midwives scanned a mean of 29 hips (range 24–35). The mean difference between midwives and supervising radiologists was 0.36 mm 95 % CI (0.12–0.61) for the first session, which decreased to 0.20 mm 95 % CI (0.04–0.37) in the final session.

ICC for PFD measurements between radiologists and midwives increased from 0.59 95 % CI (0.37–0.75) to 0.78 95 % CI (0.66–0.86) with progression in sessions.

## Conclusions

Midwives reliably perform PFD measurements of pediatric hips with minimal training, and with clinically insignificant differences compared to experienced musculoskeletal radiologists.

## Key words

Developmental dysplasia of the hip; ultrasound; mass screening.

### **18.4. Treatment with modified Judet quadricepsplasty in posttraumatic extension contractures of knee**

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## Introduction

Post-traumatic extension contracture of the knee (PECK) is a complication that is difficult to manage and treat.

Quadricepsplasty is a frequently used method in tight knee surgery.

This study, we prefer a modified Judet quadricepsplasty (MJ) technique in patients with PECK.

## Aims and Objectives

We present our surgical technique, follow-ups, results, postop rehabilitation program and complications of the patients. Our aim is to evaluate the results

of the MJ technique in the surgical treatment of PECK and to give an idea about the appropriate treatment method.

### Materials and methods

Inclusion criteria: preoperative no range of motion (ROM) was increased after manipulation under anesthesia, history of trauma, older than 18 years, no infection, preop ROM less than 60°.

Exclusion criteria: Early knee contractures opened only with rehabilitation, follow-up period <12 months.

It was a retrospective case-control study. 13 patients who were operated with MJ between 2015 to 2021. All patients were male and soldier. Age ranged 23–33 years old. 9 femur fracture, 2 femur and tibia fractures, 1 tibial plateau fracture and 1 spinal cord injury. 10 of the patients were operated with a spider frame.

In some patients, we used iv transamine as a bolus dose of 15 mg/kg half an hour before the operation and as a continuous infusion of 10 mg/kg during the operation.

After epidural anesthesia with tunneled catheter (ETC), first a 10 cm lateral incision was made. Tensor fascia lata, joint capsule, retinacular structures, iliotibial band, vastus lateralis and intermedius were released. Second, a 7 cm medial incision was made. Joint capsule, vastus medialis were released. Additional 4 cm lateral proximal incision was made with leave intact skin. Quadriceps tendon was released. Release of rectus femoris not performed. All incisions closed with a drain.

Postop management was very important. ETC was used for patient-controlled anesthesia for continuous infusion and bolus.

The drains were usually removed until 10 ml in the last 12 hours.

Continuous passive motion (CPM) was started in day 0 and used all day. Half an hour before the active exercise (end of first week), bolus done through the ETC.

### Results

Time from injury to operation was mean 19.5 months. Preop and perop iv transamine was administered to 8 of the patients. The mean hospital stay was 9.2 days. Follow-up time was mean 15.5 months.

According to Judet criteria, functional outcomes were excellent in 6 patients, good in 4, fair in 2 and poor in 1 case.

Preop Average of flexion (AF) was 34,6°. Intraop AF was 108,2°. AF gain at the surgery is 73,6°. Final AF after rehabilitation was 89,4°. AF loss at the last follow-up of the patients was 18,7° compared to the intraoperative period. AF gain of the patients was 54,8° compared to the preop period. Blood transfusion was performed in 4 patients on the 2nd day. IV transamin was not used in these patients.

1 patient had patellar tendon rupture. After reoperation, he has 10° extension lag. No extension lag was observed in any patient except this patient.

Wound dehiscence was seen in 2 patients. They were treated with a dressing successfully. No patients presented infection.

### Conclusions

MJ is effective surgical treatment method for PECK. Intensive rehabilitation program is necessary for continued success. Despite this, patients have loss of flexion. Use of iv transamine reduces blood transfusion.

### Key words

Judet Quadricepsplasty; range of motion; stiff knee; femur fracture.

## 18.5. Adherence to the Dutch recommendation for physical activity: prior to and after THA and TKA

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\*We would like to acknowledge the members of the LOAS study group additional to the authors: PJ Damen<sup>6</sup>, HMJ van der Linden<sup>7</sup>, BL Kaptein<sup>7</sup>, SHM Verdegaal<sup>8</sup>, HH Kaptijn<sup>9</sup>, SBW Vehmeijer<sup>10</sup>, R Onstenk<sup>11</sup>

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## Introduction

In patients with end-stage osteoarthritis (OA) of the lower extremity, achieving and maintaining an appropriate amount of physical activity (PA) is difficult, as they often experience severe joint pain and functional impairment. Since both total hip and knee arthroplasty (THA/TKA) are aimed at relieving pain and decreasing functional impairment, these patients should therefore have the ability to become more physically active after surgery and to reach sufficient PA-levels. Nevertheless, studies including self-reported PA indicate that patients are more active postoperative, but when objective outcome measurements are used PA remained at or below preoperative levels.

## Aims and Objectives

To describe the course of self-reported (non) adherence to the Dutch recommendation for PA in patients with hip / knee OA before, and 6 and 12 months after THA/TKA. Moreover, to identify predictors for not adhering to the Dutch PA-recommendation 12 months postoperatively.

## Materials and methods

Multicenter cohort (Longitudinal Leiden Orthopedics Outcomes of Osteo-Arthritis Study group\* Outcomes of Osteo-Arthritis Study) including primary THA and TKA patients. Prior to and 6 and 12 months after surgery, patients were asked how many days/weeks they engaged in moderate intensity PA in the past 6 months (Adherence to the Dutch PA-recommendation ( $\geq 30$  minutes of moderate-intensity  $\geq 5$  days / week)). Possible predictors for non-adherence at 12 months were included in the multivariable logistic regression analysis, including backward elimination: sex, preoperative age, body mass index, comorbidities, smoking, living and working status, season, mental health and hip disability and knee injury and

osteoarthritis outcome score (HOOS/KOOS) subscales and PA-adherence 6 months postoperatively. The models were stratified by preoperative PA-adherence.

## Results

We included 1 005 THA and 972 TKA patients. Preoperatively, approximately 50 % of the THA and TKA populations met the PA-recommendation, at 6 and 12 months adherence increased to 59 %. At 12 months most patients remained at their preoperative PA-level: 78 % of the preoperative adherers versus 60 % of preoperative non-adherers. Hence, at 12 months, 22 % of the preoperative adherers decreased, while 40 % of the preoperative non-adherers increased their PA-levels at 12 months. Irrespective of joint and preoperative adherence, in all groups, meeting the PA-recommendation at 6 months was a predictor (OR range: 0.16–0.29) for not adhering to the PA-recommendation. Also in all groups, a lower score on one of the HOOS/KOOS domains at 6 months was predictive of non-adherence to the PA-recommendation at 12 months (THA: preoperative adherers: HOOS pain (OR: 0.99); preoperative non-adherers: HOOS function in daily living (OR: 0.99); TKA: preoperative adherers: KOOS quality of life (OR: 0.99); TKA preoperative non-adherers function of daily living: (OR: 0.99)).

## Conclusions

Preoperatively approximately 50 % adhered to the PA-recommendation. 22 % of the preoperative adherers decreased their PA-levels while 40 % of the non-adherers increased their PA-level at 12 months postoperative. Not adhering to the PA-recommendation at 6 months after surgery was highly predictive for not adhering at 12 months after THA/TKA. Therefore, PA can be evaluated as early as 6 months after surgery. Additionally, most patients remain at their preoperative level, indicating that PA-adherence is mostly lifestyle-related.

## Key words

Physical activity; recommendation; hip; knee; arthroplasty.

## **18.6. Epidemiological distribution of soft part tumors in a tertiary hospital**

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### **Aims and Objectives**

Evaluate cases of soft tissue tumors in the Orthopedic Oncology Service of Hospital PUC-Campinas and determine the epidemiological profile from February 2012 to November 2019, associating the participation of a non-referenced Hospital in the approach and treatment of the pathology.

Methods: 72 patients aged between 18 and 81 years of both genders with a diagnosis of soft tissue tumor were evaluated and divided into two groups I of primary etiology and II of metastatic etiology. Exploratory data analysis was performed, being a level II prognostic study. CAAE 39067920.1.0000.5481

### **Results**

Total of 146 patients admitted, with 22 deaths, 9 patients in Group I and 13 in Group II. For all patients with soft tissue tumors, aged between 51 and 58 years, admitted to the service in the period, the probability of survival after 46 months was 71.84 %, while in Group I it was 22.7 % in compared to Group II, which was 91.43 %.

### **Conclusions**

Despite the scarcity of epidemiological data related to soft tissue tumors, the data analyzed in the Hospital's service, not a reference, are compatible with data presented in specialized hospitals in Brazil, thus, in confluence with the literature.

### **Key words**

Sarcoma; soft parts; epidemiology; neoplasms.

## **18.7. 7.3-year long term follow-up confirms safe early conversion to below elbow cast for non-reduced diaphyseal forearm fractures of both bones in children**

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### **Introduction**

In a previous RCT we compared the short-term results of above elbow cast (AEC) with early conversion to below elbow cast (BEC) in children with non-reduced diaphyseal both bone forearm fractures. After a follow-up of 7 months both groups had comparable limitation of forearm rotation. However, the question is whether forearm rotation further improves over time. In other words if remaining growth behaves like a ‘friend or an enemy’ at long term follow up.

### **Aims and Objectives**

Secondary analysis after minimal of 5-year FU of patients from the previous RCT for functional outcomes and radiological analyses.

Determine the influence of remaining growth on functional outcome and radiologic malunions?

Is early conversion to below elbow cast a safe treatment also at long term FU?

## Materials and methods

Study design is a long-term follow-up of a previous RCT. The original RCT was registered in ClinicalTrials.gov NCT 00397995. Ethics approval was obtained for the current post-trial follow-up study at the regional medical ethical committee, NL41839.098.12. All children that participated in the original RCT were invited for the long-term follow-up measurements. Primary outcome was limitation of forearm rotation after 7 years compared to 7 months of follow-up. Secondary outcomes were loss of flexion and extension of the elbow and wrist compared to the contralateral forearm, the ABILHAND-kids questionnaire and the DASH questionnaire, JAMAR grip strength and radiological assessment.

## Results

The mean length of follow-up was 7.3 (range 6.2–8.4) years. Of the initial 47 children that participated in the RCT, 33 children participated in the follow-up study. Loss of forearm rotation showed improvement in both groups over time. The AEC group improved from a mean loss of rotation of 27.9 degrees at 2 months, to 17.8 degrees at 7 months and to 7.7 degrees at 7.3 years follow-up. For the BEC group this was 20.8 degrees at 2 months, 11.3 degrees at 7 months and 8.1 degrees at 7.3 years follow-up. There was no significant difference between both groups in the final forearm rotation. Secondary outcomes showed no statistically significant differences. Subgroup analysis showed a larger group of patients with 0–10 degrees of limitation in the AEC and more patients in the BEC group with no loss of forearm rotation. Finally, the function of children aged <9 years almost all fully recovered indifferent of their previous treatment, compared to more remaining loss of forearm rotation in children age >9 years.

## Conclusions

Long term follow-up after an average of 7.3 years showed that loss of forearm rotation improved significantly compared to 7 months, independent of the initial treatment.

## Key words

Fracture; forearm; pediatric orthopedics; trauma; long-term results; casting.

## **18.8. Long-term follow-up of a multicenter randomized controlled trial involving reduced diaphyseal both-bone forearm fractures in children**

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### **Introduction**

Due to the great remodeling ability in pediatric fractures, most displaced both-bone forearm fractures in children can be treated successfully with closed reduction and cast immobilization. However, this carries the risk of re-displacement, which can lead to malunions with impairment in forearm rotation. Some authors believe early conversion to below-elbow casting (BEC) has an increased risk of malunion, while others state that prolonged immobilization of the elbow in an above elbow cast (AEC) might lead to soft tissue contractures. To find out if early conversion to BEC is safe, our research group published a randomized controlled trial (RCT) including 127 children with a stable reduced diaphyseal both-bone forearm fracture and were randomized to 6 weeks of AEC or early conversion to BEC (3/3 weeks). This RCT found no significant differences in re-displacements or functional outcomes after 7 months, only a higher cast comfort in the BEC group. However, a minimal 5-year follow-up could change treatment insights. Furthermore, the previous study showed a high amount of malunions at 7 months, 23 cases, of whom 7 regained almost full pronation and supination while 8 children suffered from a limitation of  $\geq 31$  degrees. We performed an extended follow-up study of this RCT looking at the long-term outcome after

7 years and the possible further improvement in function. The group of children with malunion will be analyzed again, to see if they still show malunions and/or persistent loss of function at long term follow-up.

### Aims and Objectives

- Secondary analysis after minimal of 5 years of patients from the previous RCT for functional outcomes and radiological analyses.
- The group of children with malunion were analyzed again, to see if they still show malunions and/or persistent loss of function at long term follow-up.
- This will answer the question: should early conversion to BEC be the recommended treatment strategy for displaced diaphyseal both bone fractures of the forearm in children that are stable after closed reduction and possible even for children with secondary malunions?

### Materials and methods

Study design is a long-term follow-up of a previous RCT. The original RCT was registered in ClinicalTrials.gov with registry identifier NCT NCT00398242. Ethics approval was obtained for this post-trial follow-up study with protocol number NL41839.098.12. All patients that were initially included in the previous RCT were invited for the long-term follow-up measurements. A secondary analysis was performed after 7 years of patients with displaced diaphyseal both-bone forearm fractures who were initially randomized between 6 weeks of AEC or 3 weeks of AEC followed by 3 weeks of BEC. Primary outcome was limitation of forearm rotation after 7 years compared to the healthy contralateral side. Secondary outcomes were loss of flexion and extension of the elbow and wrist compared to the contralateral forearm, the ABILHAND-kids and DASH questionnaire, JAMAR grip strength and radiological assessment.

### Results

The mean length of follow-up was 7.5 (5.1–9.9) years. Of the initial 124 children that were followed up after 7 months, 94 (74 %) patients responded and participated in the long-term follow-up study. Baseline characteristics showed no differences between the responders and non-responders.

Loss of forearm rotation showed improvement in both groups over time. The AEC group improved from a mean loss of rotation of 28 degrees at 2 months, to 18 degrees at 7 months and to 6.7 degrees at 7.5 years follow-up. For the AEC/BEC group this was 21 degrees at 2 months, 11 degrees at 7 months

and 2.9 degrees at 7.5 years follow-up. The final loss of forearm rotation showed a statistically significant difference, but without any clinical value (p value of 0.03). Secondary outcomes showed no statistically significant differences. Radiological analysis was done with new X-rays, 33 included from the AEC group and 35 from the AEC/BEC group, this analysis showed significant differences between both groups. At 7 months angulation of the radius in the AP view was 4.6 degrees in the AEC group, compared to 7.2 degrees in the AEC/BEC group (p value 0.10), and as expected both increased over time to 8.5 and 9.7 degrees (p value 0.15). Same for the ulnar angulation in the AP view, with 1.3 degrees in the AEC group and 1.6 degrees in the AEC/BEC group (p value 0.86), both increasing to 5.7 and 5.0 degrees (p value 0.49). Lateral views showed comparable results, for the radius -3.4 and -8.0 degrees (p value 0.08), which improved to 0.6 and 0.7 degrees (p value 0.34). And for the ulnar bone 5.0 and 3.4 degrees (p value 0.62), which remained about the same after time, 5.0 degrees for the AEC group and 3.4 degrees for the AEC/BEC group (p value 0.04) This is the only significant result, but of no clinical value. Finally, the bowing of the radius increased in both groups, in the AEC group from 7.3 to 11.7 degrees and in the AEC/BEC group from 8.4 to 12.7 degrees.

Subgroup analysis did show a larger group of patients with 11–20 degrees of limitation in the AEC group 26 % (12) compared to 9 % (4) in the AEC/BEC group. Furthermore, there are more patients in the AEC/BEC group without loss of forearm rotation at final follow up, 63 % (30) compared to 45 % (21) in the AEC group.

Of the 23 children with malunions, 8 have lost to FU, but the other 15 children have all recovered without functional or radiological residual abnormalities. We are currently attempting to include the 8 children lost to FU.

## Conclusions

Long-term follow-up of children with stable reduced diaphyseal both-bone fractures of the forearm showed significant further improvement after an average of 7.5 years in forearm rotation compared to 7 months, indifferent of the initial treatment and children with secondary malunions seem to recover without residual complaints (we are still waiting for the data from the group lost to FU).

## Key words

Fracture; forearm; pediatric orthopedics; trauma; long-term results.

### **18.9. Influence of indications, previous surgery and exercise on: long-term results of Delta Xtend reverse total shoulder arthroplasty – a single-center prospective cohort study**

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#### Introduction

Reverse shoulder arthroplasty (RSA) is a successful treatment option of cuff tear arthropathy (CTA). Since its invention, the range of indications has been expanded and implant designs have been enhanced. However, there are few studies investigating the long-term results of modern implants.

#### Materials and methods

In this study, we included 108 consecutive patients receiving the newly introduced Delta Xtend (Depuy) prosthesis. Patients were divided into four indication groups: CTA (60 %), revision shoulder arthroplasty (15 %), fracture sequelae (19 %) and post-infectious implantation (6 %). The Constant Score was used to assess the function of the shoulder preoperatively and at follow-up. Radiographic follow-up was performed to assess signs of loosening, implant failure and inferior glenoid notching. Survival analysis was performed to investigate the durability of the implant.

#### Results

The median follow-up of all patients was 9.9 [5.4–12.3] years, the median follow-up of the patients presenting at checkup was 12.5 [11.5–12.6] years. Of the initially included 108 patients, 33 were examined at follow up (31 %). The median CS at follow-up was 56.0 [41.–64.0] points (pt), the increase in CS was 34.3 [23.3–44.0] pt. No significant difference could be observed between the 4 groups. Additional latissimus dorsi transfer (LDT) resulted in a slightly higher increase of the CS (Delta Xtend: 32.0 [22.0–40.0] pt, Delta Xtend + LDT: 39.6 [39.4–52.5] pt, p = 0.06). Patients who regularly exercised had a slightly higher increase in CS than non-exercising ones (exercising: 45.0 [36.0–51.0] pt, non-exercising: 27.0 [21.7–41.2] pt, p = 0.06).

Our linear regression analysis showed a significant influence of the preoperative CS and previous surgery on the CS reached at follow-up. Including revision, we observed 4 complications (6.3 %) in the CTA group, 2 complications (12.5 %) in the revision arthroplasty group, 4 complications (28.6 %) in the fracture sequelae group and no complication in the post-infectious implantation group. This difference in complication rates was not significant ( $p = 0.3$ ). The overall complication rate was 12.5 %.

Implant failure was observed in 4 cases and implant survival was 95.3 % at the latest follow-up. Logistic regression showed a significantly higher risk for revision in the fracture sequelae group than in the CTA group (odds ratio 11.1,  $p = 0.042$ ). Implant survival including any re-operation of the shoulder was 89.7 %. Patients with previous surgery had a significantly lower survival rate without any re-operation.

### Conclusions

We were able to confirm good functional results of RSA in the long term. For a broader spectrum of indications including revisions of failed arthroplasties and fracture sequelae, the functional results and implant survival are slightly inferior. Extending the spectrum of indications leads to higher complication and revision rates. Additional LDT can lead to a better shoulder function in the long term. Previous surgery of the shoulder leads to a worse function of the shoulder and a higher risk of implant failure, whereas exercise could lead to a better outcome.

## **18.10. Outcomes after 3-D corrective osteotomies for paediatric malunited both-bone forearm fractures**

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### Introduction

Displacement of pediatric forearm fractures in children can lead to malunion and decreased forearm rotation, which may need a corrective osteotomy. Conventional corrective osteotomy using two-dimensional radiographic

planning can be technically challenging due to multiplanar deformity. Three-dimensional (3D)-planned corrective osteotomy using patient-specific instruments (PSIs) may be an effective technique for accurate reconstruction of symptomatic pediatric forearm malunions.

### Aims and Objectives

The purpose of this study is to assess the functional gain in forearm rotation and radiographic accuracy of this technique and to assess if anatomic correction is associated with superior functional outcomes.

### Materials and methods

We performed a prospective cohort study in which patients with paediatric malunited diaphyseal both-bone forearm fractures underwent 3-D corrective osteotomy. Inclusion criteria were a malunited both-bone forearm fracture, sustained during childhood (<18 years), with a pro- or supination of <50°. Our primary outcome measure was the gain in pro-supination. Our secondary outcomes was the accuracy of the achieved correction. Accuracy was described using the maximum deformity angle (MDA), which is calculated by combining the angular deformity on both the coronal and sagittal plane derived from CT, as well as describing the rotational deformity measured on CT. Residual MDA <5° was defined as anatomic correction. One-way analysis of variance (ANOVA) and multivariate linear regression analysis was performed to assess the relationship between anatomic correction and pro-supination.

### Results

15 patients, with a median age at trauma of 10 years, were included between 2016–2018 and underwent 3-D corrective osteotomy. Functionally, 3D corrective osteotomy provided a mean improvement in pro-supination from 67° (44 % of contralateral) pre-operatively, to 128° (85 % of contralateral) at one year follow-up. Radiographically, the mean MDA of the radius and ulna from 16° (SD 7°) and 12° (SD 5°) pre-operatively to 3° (SD 3°) and 2° (SD 2°) at one year follow-up. The residual MDA of both radius and ulna was less than 5° in 28 out of 30 operated forearm bones at final follow-up (93 %). ANOVA revealed that 13 patients who had achieved an anatomic correction (residual MDA <5°) had a statistically significant greater arc of pro-supination at final follow-up of 132° (122°–143°), while two patients who had a non-anatomic correction (residual MDA ≥5°) had a mean arc of

pro-supination at final follow-up of  $103^\circ$  ( $71^\circ$ – $134^\circ$ ),  $p = 0.04$ . Multivariate linear regression analysis revealed that residual malrotation of the radius was significantly associated with inferior gain in pro-supination ( $p = 0.03$ ).

### Conclusions

3D corrective osteotomy using PSIs achieved accurate correction and excellent functional gain in pro-supination for paediatric malunited diaphyseal forearm fractures. In this series an anatomic correction was associated with a greater arc of pro-supination at final follow-up and a residual malrotation of the radius was associated with inferior gain in pro-supination. A larger case series is needed to further investigate if anatomic correction of angular as well as rotational malalignment of the radius is indeed associated with greater functional outcome.

### Key words

Corrective osteotomy; paediatric; radius; forearm.

### **18.11. Harvesting of tendon and bone allograft. 1-year experience in VUH Santaros clinics**

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### Introduction

Evaluation of allograft tissues for infectious diseases consists of 2 critical steps:

1. Donor screening – thorough review of the donor's medical records to an interview of an individual who knew the donor personally in order to flag any infectious disease risk factors, such as intravenous drug use.
2. Tissue processing – targeted culturing for at least 1 organism within each of the following classifications: Gram-negative bacilli, Gram-positive bacilli, Gram-positive cocci, yeast, anaerobes, and mold. With respect to viruses, blood is screened for hepatitis B surface antigen, total antibody to hepatitis B core antigen, antibodies to hepatitis C virus, antibodies to human T-lymphotropic virus, and syphilis. Finally, antibodies to human

immunodeficiency virus (HIV) are checked and nucleic acid testing for HIV is carried out.

### Aims and Objectives

Aim- to present 1<sup>st</sup> year experience of tendon and bone allograft harvesting in Vilnius university hospital Santaros clinics.

In order to achieve success in the harvesting of tendon and bone allografts one should follow strict rules of tissue processing as well as.

### Materials and methods

During 1<sup>st</sup> year (upon receiving licence for bone and tissue processing, preservation and implantation in Vilnius university hospital Santaros clinics) experience of harvesting of tendon and bone tissue, overall 40 SKU units were harvested: 19 tendons (hamstring, tibialis anterior, Achilles, bone-tendon-bone allografts), 18 femoral heads, 3 strut grafts (one full length tibia and 2 splitted in half tibia struts). During 2021 year 15 SKU were distributed: 12 femoral heads (mainly for revision arthroplasty and posterior lumbar inter-body fusion procedures, 1 case-filling of bone defect after giant cell tumor removal), 3 tendons (all BAR-below acromial reconstruction).

### Results

Initial donor harvesting failure rate was 86 % (6 out of 7 were destroyed due to microbiological pollution), 2<sup>nd</sup> donor failure rate 33 %. Situation improved dramatically after implementation of measures proposed by American Association of Tissue Banks – pre-soaking with vancomycin solution before fresh-freezing.

### Conclusions

Fresh freezing process allows preservation of the graft for 3 to 5 years. Microbiological pollution can be avoided if the graft is soaked in an antibiotic solution (e.g. vancomycin) for 1 hour before being frozen to -80 °C.

### Key words

Bone and tendon allograft; fresh freezing.

## **18.12. Radiographic and functional outcomes of delayed treatment of supracondylar humerus fractures in pediatric patients**

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### **Introduction**

Closed supracondylar humerus fractures in the pediatric population that present more than 21 days post-injury are commonplace in low resource settings. However, delayed open treatment of these fractures are believed to be associated with higher complication rate.

### **Aims and Objectives**

The objective of this study was to document the postoperative radiographic and functional outcomes of pediatric patients with Gartland III closed supracondylar fracture treated with open reduction and pinning more than 21 days post-injury.

### **Materials and methods**

Twenty-five (25) pediatric patients with closed displaced supracondylar humerus fracture who underwent open reduction and pinning via posterior paratricepetal approach at 21 days post-injury or later were included. Postoperative radiographic lines, range of motion, and functional outcomes using the Mayo Elbow Performance Index (MEPI) were examined on follow-up.

### **Results**

All elbows had functional range of motion with average elbow flexion of 131.5° (range: 106–148°) and average elbow extension of 2.7° (range: -10 to 30°). Average MEPI score was 98.2 points with 88 % (22 out of 25) having excellent outcomes. Only two patients had complications (pin tract infection and pin loosening), but did not have an untoward long term effect.

### **Conclusions**

Open reduction and pinning using a posterior paratricepital approach is safe and effective in the treatment of pediatric supracondylar humerus fractures 21 days post-injury or older.

## Key words

Supracondylar humerus; delayed treatment; open pinning; pediatric.

### **18.13. The safe distance of a proximal femoral shaft fracture from the proximal locking screw in retrograde intramedullary nailing: a mechanical study**

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#### Introduction

Femoral shaft fractures located supraisthmally have been considered a relative contraindication for retrograde intramedullary nailing because of the high strain surrounding this area. However, there have been no biomechanical studies verifying this.

#### Aims and Objectives

The objective of this study was to determine the shortest distance of a proximal femoral fracture to the more distal proximal locking screw that would not lead to failure.

#### Materials and methods

Nine fourth generation composite femurs were instrumented with retrograde nails with two locking screws proximally and distally. Fracture gaps were made at 1-, 2-, and 3-cm from the more distal proximal locking screw. 700-N cyclic loading was applied axially at 3 Hz for 1 million cycles.

#### Results

All nine femurs did not fail after 1 million cycles. There were no significant differences among the three groups in fracture gap displacement, coronal and sagittal angulation, and nail-to-cortex distances. All three femurs in the 1-cm group had toggle of 3° of internal rotation and loosening of the more distal proximal locking screw holes after 1 million cycles.

#### Conclusions

Fractures as close as 2 cm from the more distal proximal locking screw can be safely fixed with retrograde intramedullary nailing. The contact loading of the cortical bone in the subtrochanteric area provides load sharing, which decreases the stresses carried by the proximal locking screw. Fractures

located 1 cm or less decrease the contact area for loading, thereby increasing the stress carried by the more proximal locking screw. Extra caution is advised for retrograde nailing of fractures located 1 cm or less.

#### Key words

Retrograde nail; safe distance, proximal fracture; locking screw; biomechanical.

### **18.14. A comparison of postoperative outcomes between internal brace augment and non-augmented hamstring tendon autograft anterior cruciate ligament reconstruction (ACLR)**

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#### Introduction

Internal brace augmented ACL reconstruction is a novel technique in the Philippines and relatively even in the Asian population. In search for related literature regarding its safety, an animal study by Cook et al described canine models for all-inside arthroscopic complete ACL reconstruction with the use of a quadriceps tendon allograft with internal brace. (Malahias 2018) The dogs were evaluated over a 6-month period using a range of outcome measures required for preclinical animal models, and it was shown that the use of internal brace for ACL reconstruction could effectively contribute to knee stability and improve function without causing premature osteoarthritis. (Cook 2016)

A study by Daggett et al concluded that the use of a suture tape augmentation during ACL reconstruction can reinforce and protect the ACL graft during early incorporation and can potentially strengthen the construct to reduce the chance of reinjury in high-risk athletes. (Daggett 2018)

#### Aims and Objectives

##### General Objective

To compare graft / internal brace survival, self-reported functional outcomes, and joint laxity among patients who underwent ACL hamstring tendon autograft reconstruction versus ACL repair with internal brace ligament augmentation.

## Specific Objectives

1. To compare revision rates at 1-year post-surgery between those who underwent ACL hamstring tendon autograft reconstruction versus those with internal brace ligament augmentation.
2. To compare patient-reported outcomes between those who underwent ACL hamstring tendon autograft reconstruction versus those with internal brace ligament augmentation, specifically through IKDC, Lysholm Score, Tegner Score at 1 month, 4 months, 8 months and 1 year post-surgery.
3. To compare clinical performance outcomes between those who underwent ACL hamstring tendon autograft reconstruction versus those with internal brace ligament augmentation, specifically by testing pivot shift at 4 months, 8 months, 1 year post-operatively.

## Materials and methods

By blinding the exposed and control groups, the study design being applied is randomized control trial. Patients are randomly assigned into an experimental group or a control group. The control group will receive the standard practice of non-augmented hamstring autograft while the experiment group will be randomly assigned to the augmented hamstring autograft. The study design applied is prospective, experiment, experimental level of intervention, analytical and randomized control trial.

To minimize bias and errors, all participants of the study were operated on by the same orthopedic surgeon.

How is augmented hamstring tendon autograft ACLR done? The internal brace is fixed independently to the graft in order to act as a safety belt against excessive overload during the period of graft integration. This form of augmentation uses a braided ultrahigh-molecular weight polyester or polyethylene suture or suture tape and fixed on both the femoral and tibial sides independent of the graft to act as a backup or secondary stabilizer until complete integration and ligamentization of the graft take place. (Aboalata, 2017)

## Results

Ten patients (mean age 22.3 years, range 21–23) who underwent ACLR with internal brace augmentation and 27 patients (mean age 24.3 years, range 17–43) without internal brace augmentation were included in this study. No patient from both groups underwent reoperation. No patient in both groups experienced ACL failure and underwent revision ACLR. There were no

statistically significant differences between the internal brace and control groups for preoperative and postoperative Tegner activity scores (7.6 to 7.2, 6.1 to 7.0), postoperative IKDC scores (93.7 and 93.2), and Lysholm scores (96.2 and 95.9).

## Conclusions

Compared to standard hamstring ACLRs, the study showed that the population who underwent augmented hamstring ACLRs exhibited improved PROMs, less pain, and a higher percentage of and earlier return to pre-injury activity level without evidence of overconstraint.

## Key words

ACL; augmented; internal brace.

### **18.15. Modified vacuum assisted closure (mVAC): a 6 month case series on the methods and outcomes of using modified negative pressure wound therapy among patients with inadequate soft tissue coverage at Philippine Orthopedic Center (POC)**

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## Introduction

Vacuum Assisted Closure (VAC) is described and sometime interchangeable used along with the term negative pressure wound therapy (NPWT). This method of wound care has transformed the concept of wound healing by paving the way for promising management of inadequately covered soft tissue injury, acute and chronic wounds. It is an established method that can be used in order to cover for soft tissue defects. VAC refers to wound dressing systems that continuously or intermittently apply subatmospheric pressure to the system, which provides a positive pressure to the surface of a wound.

Hussain et al. 2012 [5], reported that the VAC has certain advantages. The method of application of VAC is easy to handle and understand by healthcare providers and patients. Patients subject to VAC dressings are not absolutely required to undergo hospital admission. In a study by Ruke, M et al, the use of indigenous substitutes of wound management which can be used in the rural areas of developing countries is essential. Multiple materials and sets are not readily available in developing countries. This generated creative

ideas on maintaining the principles of VAC but modifying it to available alternatives. Hence the birth of modified VAC (mVac).

## Aims and Objectives

### General Objective

To provide data and information regarding the use of modified VAC in POC within a 6 month period to help improve and standardize its application in the institution.

### Specific Objectives

To describe clinical situations for use of modified VAC in POC based on: diagnosis, comorbidities, BMI, wound size in cm, days following trauma when VAC was first applied, total duration of uninterrupted use, frequency of change, settings, bacterial growth, outcomes.

To report the outcomes of mVAC use in POC within 6 months under the following categories:

- (a) Able to provide adequate skin coverage with use of modified VAC alone
- (b) Able to provide adequate preoperative requirements as preparation for skin coverage procedure (e.g. flap, STSG)
- (c) Unable to provide provisions for skin coverage procedure (e.g. shift to a different wound dressing)
- (d) Identify reasons for terminating mVAC use.

## Materials and methods

### Study Design

This descriptive research study is a prospective consecutive case series wherein it is a medical research study that follows patients with known exposure, application of modified VAC dressing, over a period of time of 6 months. This study is a systematic investigation designed to contribute to generalizable knowledge.

### Data collection

This is a clinical study that includes all eligible patients identified by the researcher during the study registration period that satisfy the inclusion and exclusion criteria. The patients are treated in the order in which they are identified within the specified time. This type of study does not have a control group.

Patients admitted at the ER that qualify for the study are already identified at this point. Patients qualified for the study are also identified from the data of

Wound Care Clinic at the Out-patient Department. Others are reviewed through chart recordings and hospital data. A data questionnaire can be filled out by the doctor-in-charge upon enrolment and consent of the patient to the study. The principal investigator is tasked to assess the completeness of data gathered. Monthly collation of data is done by the principal investigator to routinely check for updates and revisions.

### Sample Size

The design of this study is a descriptive type. All patient populations that fall under the said inclusion criteria will be included in the study within the span of 6 months for collection.

### Results

A total of 58 patients were included in the study. The average age of the population was 35 and are predominantly male. The most common mechanism of injury was motorcycle accident and 37 of the patients were diagnosed with an open fracture of the lower extremity with open tibia fractures (22) being the most common. Average wound area measured was 24.12 cm<sup>3</sup>. All patients yield a bacteria growth with e. coli being the most frequent. Average duration of uninterrupted use was 39 days. Of the 58 included in the study, 8 patients underwent STSG, 2 had a flap coverage surgery, 4 patients eventually underwent amputation and 33 with complete resolution of soft tissue defect after conversion to biologic dressing post-mVAC. The rest of the population were still ongoing mVAC at the end of the study.

### Conclusions

mVAC is an alternative indigenous temporary medium for soft tissue coverage for cases with or without concomitant fractures. mVAC promotes removal of exudate from the wound, supports wound apposition and granulation bed proliferation. Usage mVAC helps prepare for skin coverage procedure and on some cases leads to full resolution of defect.

### Key words

VAC; negative pressure therapy; open fractures; soft tissue injury.

# Nordic Orthopaedic Federation (NOF) Congress

7–9 September 2022, Vilnius, Lithuania

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ISBN 978-609-96167-6-6

Publisher: Eventas, UAB

2022

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