

Systematic Review and Meta Analysis of Allergic Contact Dermatitis from 2-Octyl Cyanoacrylate Adhesives

Daniel Rouhani, Ashton Rosenbloom, Steven Zheng, Alexander Sun, Saba Seradj, Chloe Moshrefi, Kimberly Khoo, M. Mark Mofid
Johns Hopkins School of Medicine USA

Introduction / Objective 2-octyl cyanoacrylate (2-OCA) topical skin adhesives are widely used for surgical wound closure in but are increasingly associated with allergic contact dermatitis (ACD). We conducted a systematic review and meta-analysis to define the incidence, clinical features, and risk factors for 2-OCA-associated ACD.

Materials & Methods A PRISMA systematic review of PubMed, Embase, and Web of Science (2008-2025) identified studies reporting cutaneous hypersensitivity to 2-OCA in human wound closure. Randomized, observational, and case-based reports were included. Risk of bias was assessed using ROBINS-I and RoB 2. Incidence from analytic cohorts was pooled using a random-effects model with prespecified subgroup analyses by surgical specialty.

Results / Discussion Seventy-four studies comprising 26,330 exposed patients were included; 20 analytic cohorts (25,442 patients) contributed to meta-analysis. The pooled ACD incidence was 4% (95% CI 3-5%) with substantial heterogeneity ($I^2=94.5\%$; prediction interval 0-12%). Incidence was 4% in orthopedic cohorts and 8% in plastic surgery cohorts, with lower rates in dermatology and obstetrics/gynecology ($p=0.015$ for subgroup differences). Re-exposure markedly increased risk, with reaction rates rising from 1-3% after initial exposure to >20% in staged or repeat procedures in several cohorts. Prior adhesive/contact allergy and cosmetic acrylate exposure were also strong risk factors. Diagnosis was primarily clinical, with selective patch testing. Management typically involved adhesive removal and topical corticosteroids; systemic therapy was reserved for severe cases.

Conclusion ACD to 2-OCA is a clinically meaningful and likely under-recognized complication of surgical wound closure. Re-exposure is strongly associated with increased postoperative reaction rates, supporting preoperative risk assessment and caution in repeat adhesive use. This consideration may be particularly important in orthopedic surgery, where postoperative ACD may be associated with skin barrier disruption and increased risks of complications, including surgical site infection and prosthetic joint infection.

Graft Diameter Trends in ACL Reconstruction: Allografts Versus Quadriceps Tendon Autografts in Primary and Revision Surgery

Hongzhi Zhu, Fan Shuen Tseng, Keng Thiam Lee, Sean Wei Loong Ho, Lester Teong Jin Tan, Jegathesan T
Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Quadriceps tendon (QT) autograft has gained popularity for ACL reconstruction (ACLR). The primary aim of this study is to compare intraoperative graft diameters between QT autografts and allografts used in primary ACLR within an Asian population. The secondary aim is to determine whether QT autografts yielded comparatively similar graft diameters for revision ACLR compared to allografts utilized.

Materials & Methods This retrospective study included patients who underwent ACLR at a single tertiary centre. All patients receiving QT autografts for primary ACLR and those receiving allografts for primary or revision ACLR were included between June 2019 and October 2025. Demographic variables and intraoperative graft diameters were collected. Graft diameters of the QT group were compared separately with allograft groups undergoing primary and revision ACLRs, adjusting for age, gender, height and weight.

Results / Discussion A total of 202 patients were analysed, 72 in QT group, 99 in allograft primary ACLR group, and 31 in allograft revision ACLR group. Mean intraoperative graft diameter was $9.15\text{mm} \pm 0.67\text{mm}$ for QT autografts and $8.93\text{mm} \pm 0.73\text{mm}$ for allografts primary ACLR, with no significant difference ($p = 0.774$). Mean intraoperative graft diameter for allografts revision ACLR group was significantly larger at $9.79\text{mm} \pm 0.80\text{mm}$, exceeding the QT group by 0.64mm ($p = 0.001$).

Conclusion In conclusion, QT autografts achieved graft diameters equivalent to allografts in primary ACLR, supporting their role as a robust and size-reliable autograft option. The substantially larger diameters seen in revision allografts underscore the need for greater graft volume in revision procedures rather than a limitation of QT autografts.

Comparing Functional Outcomes after conservative or surgical Management of Pelvic Insufficiency Fractures

Joshua Song, Robert Foong, Michael Yam
Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Our aim was to compare functional outcomes of patients with pelvic insufficiency fractures (PIF). managed conservatively and surgically. Our secondary aim was to compare the burden on healthcare resources.

Materials & Methods This was a retrospective study analysing patients with PIF, including low-impact acetabular fractures, lateral-compression type fractures and sacral insufficiency fractures from October 2020 and April 2024. Demographic data like age, gender, ethnicity, time to diagnosis (TTD), time to surgery (TTS) were recorded. Primary outcome was the change in the modified Barthel's Index (MBI) at discharge, 6 months and 1 year post-discharge. Secondary outcomes included complication rates, length of stay (LOS), and discharge destination.

Results / Discussion Sixty-one patients were included with 51 in the conservative group and 10 in the surgical group. The mean TTD in conservative patients was 1.96 days while it was 3.40 days in the surgical group. Mean TTS in surgical patients was 9.3 days. For the conservative group, the mean delta change in the MBI was 37.8 ± 22.0 (Standard deviation) at discharge indicating decline in functional independence, -24.7 ± 16.9 at 6 months indicating functional recovery, and 0.3 ± 14.8 at 1 year. In the surgical group, the mean delta change of MBI was 39.7 ± 25.0 at discharge, -27.8 ± 23.0 at 6 months, and -1.8 ± 19.2 at 1 year.

Conclusion Surgery for PIF can result in more severe initial decline in functional independence but showed significant recovery over time, leading to more consistent long-term outcomes while conservative measures showed more variable long-term outcomes.

Utility of Intraoperative Neuromonitoring in Oblique Lumbar Interbody Fusion: A Retrospective Cohort Analysis

Elliot Kai Jie Eng, Nicholas Rachmadi, Logheswaren Suppiah, Jacob Yoong-Leong Oh
Yong Yoo Lin School of Medicine, National University of Singapore SINGAPORE

Introduction / Objective Lumbar interbody fusion is a well-established technique for degenerative pathology, deformity, and instability. Lateral approaches were developed to reduce morbidity associated with traditional posterior techniques. While the transpsoas approach carries a recognised risk to the lumbar plexus and routinely utilises intraoperative neuromonitoring (IONM), oblique lumbar interbody fusion (OLIF) employs an anterior-to-psoas corridor that may reduce this risk. The necessity of routine IONM in OLIF remains controversial. This study evaluates the utility of IONM in OLIF by analysing intraoperative signal changes and postoperative neurological outcomes.

Materials & Methods A retrospective cohort study was conducted on patients undergoing L1–5 OLIF with IONM by a single surgeon at a single institution between 2017 and 2025. A total of 201 cases (381 operative levels) were included, excluding transpsoas approaches, combined approaches, and cases with incomplete documentation. IONM modalities included motor evoked potentials (MEP), somatosensory evoked potentials (SSEP), and electromyography (EMG). A significant IONM event was defined as a $\geq 50\%$ intraoperative signal drop from baseline.

Results / Discussion Significant IONM signal changes occurred in 4 of 201 cases (2.0%; 95% CI 0.5–5.0%), involving 11 of 381 operative levels (2.9%; 95% CI 1.5–5.1%). All events were transient and resolved intraoperatively following corrective measures. All four events involved the L4–5 level, a statistically significant association (Fisher's exact test, $p < 0.001$). No significant association was found between number of operative levels and IONM events (Fisher's exact $p = 0.252$; Cochran-Armitage trend $p = 0.171$), though a trend toward higher risk with increasing levels was noted (estimated OR per level category 2.48, 95% CI 0.62–10.01). No permanent postoperative neurological deficits were observed.

Conclusion IONM signal changes during OLIF were infrequent and transient, with no lasting neurological sequelae. These findings suggest routine neuromonitoring may not be necessary for standard OLIF cases. Selective use at L4–5 or deformity cases may offer a targeted approach to intraoperative safety.

20

The Utility of MRI for spinal clearance in blunt trauma. A retrospective cohort study of 539 patients in a level one trauma center in Singapore.

Cayden Leyu, Raymen Arviin Chandrasagran, Adam Cheng, Andre Loh, Rachel Lim, Nishant T. Barua, Raj Menon, Joan Li, Naresh Kumar, Jonathan Tan Jiong Hao
National University Health System SINGAPORE

Introduction / Objective The majority of spinal injuries occur secondary to blunt trauma and patients with significant blunt trauma must be assumed to have an unstable spinal injury until complete radiological and clinical assessment. MRI scans are highly sensitive but can be difficult to perform in ICU patients. In this study we investigated the efficacy of MRI scans in changing patient management in blunt trauma patients and the criteria which would indicate for an MRI scan

Materials & Methods This is a retrospective study of patients with significant blunt trauma who had MRI spine performed between 2018-2023 in National University Hospital, Singapore. Indications for an MRI include the presence of spinal fractures on CT scan, neurological deficits, obtunded patients, tenderness over the spine on examination and underlying spine ankylosing conditions. Significant blunt trauma is defined as per the Canadian C-spine Rule criteria. Fracture morphology was classified based on the AO spine fracture classifications. Change in patient management was defined as MRI scan leading to decision for surgery or change from conservative to operative management. We defined a stable fracture as AO type A0 cervical/thoracolumbar fracture and other fractures as potentially unstable.

Results / Discussion In 539 patients, 135 (25%) female and 404 (75%) males, were identified who had MRI spine performed. Of these, 43.6% led to change in management. On multivariate analysis, the presence of a potentially unstable fracture and the presence of a neurological deficit were found to be significant predictors of an MRI being indicated and leading to a change in management. When using the presence of a potentially unstable fracture and/or neurological deficit as a criteria for performing an MRI, 55.9% of scans led to a change in management.

Conclusion In blunt trauma patients with no clear indication for MRI, an additional MRI scan may lead to unnecessary spinal nursing prolongation with no additional benefit.

21

Management of Pin-Site fractures in the context of robotic total knee arthroplasties (TKA) in Singapore: A Case Report

Roy Yang, Jingwen Ng

Yong Yoo Lin School of Medicine, National University of Singapore SINGAPORE

Introduction / Objective Robot-assisted total knee arthroplasty (RATKA) improves alignment, implant positioning, and clinical outcomes. However, femoral and tibial tracker pins may create cortical stress risers, predisposing patients to rare but clinically significant pin-site fractures. This case report describes a delayed tibial pin-site fracture after RATKA and reviews relevant risk factors, prevention strategies, and learning points.

Materials & Methods We report a 63-year-old Chinese lady with right knee osteoarthritis who underwent right ROSA Knee System RATKA. Her background included Type 2 Diabetes Mellitus, hyperlipidaemia, and osteoporosis, with a T-score of -2.6. During tibial pin placement, the initial pins did not achieve good purchase and were removed, then reinserted through the same stab incisions. Post-operatively, she was followed clinically and radiographically at 3, 4, 5, and 6 months.

Results / Discussion At 3 months post-operatively, she developed persistent tibial pain without trauma. Examination showed localised tenderness and palpable callus over the tibial pin sites. Radiographs confirmed a healing tibial pin-site fracture. She was initially placed in a patella tendon bearing cast, but later ambulated partial weight-bearing with a walking frame. By 5 months post-operatively, she had clinical and radiographic union, no knee or tibial pain, no stiffness or range-of-motion limitation, and returned to premorbid function. This case highlights the multifactorial nature of pin-site fractures. Risk factors included osteoporosis, female sex, smaller Asian tibial geometry, and procedural factors such as repeated pin insertion. Preventive strategies include careful preoperative risk stratification, optimising osteoporosis, avoiding repeated drilling at the same site, considering metaphyseal rather than diaphyseal pin placement, and using smaller self-drilling, self-tapping pins where appropriate.

Conclusion Tibial pin-site fractures are rare but important complications of RATKA. Early recognition, tailored weight-bearing advice, and individualised pin-placement strategies are essential to reduce morbidity and support good functional recovery.

22

Rectus femoris autograft is a viable alternative to hamstring autograft in primary anterior cruciate ligament reconstruction

Vikaesh Moorthy, Ramkumar Mohan, Kimberly Chen, Juen Zhik Chan

Khoo Teck Puat Hospital SINGAPORE

Introduction / Objective The rectus femoris (RF) tendon (or superficial quadriceps tendon) autograft has been gaining popularity as a graft choice in primary anterior cruciate ligament (ACL) reconstruction. While several studies have shown promising early outcomes with the use of RF tendon autografts for ACL reconstruction, there remain a lack of comparative studies and consensus on the superior autograft choice. The aim of this study was to compare short term functional outcomes and graft sizes between RF and hamstring tendon (HT) autografts in primary ACL reconstruction.

Materials & Methods A retrospective comparative study was conducted involving 57 patients who underwent primary ACL reconstruction with either an RF (n = 28) or HT (n = 29) autograft. Preoperative demographics and intraoperative variables such as graft sizes were collected. Short term postoperative outcomes were assessed, including range of motion (ROM), one-repetition maximum knee flexion and extension strength, pain scores, donor-site morbidity, and graft failure.

Results / Discussion Baseline characteristics were well-matched between the groups across all preoperative variables. Intraoperatively, the RF group demonstrated significantly larger graft diameters on the femoral end (9.5mm vs. 8.5mm, $p < 0.001$), tibial end (9.5mm vs. 8.5mm, $p = 0.001$), and average graft diameters (9.5mm vs. 8.5mm, $p < 0.001$). This reflects the well-established greater cross-sectional area of the quadriceps tendon relative to combined HT construct, which has been associated with greater tensile strength and stiffness in existing literature. There was no significant difference between the 2 groups in terms of postoperative ROM, knee flexion or extension strength, pain scores, or donor-site morbidity. To our knowledge, this is one of the few studies to directly compare the RF and HT autografts, with majority of existing literature examining full-thickness quadriceps tendon configuration instead.

Conclusion These findings support the use of RF as a viable graft option for primary ACL reconstruction, though future long-term, prospective randomised controlled trials are recommended.

23

Comparison of open, tubular and bi-portal endoscopic decompression for lumbar spine degenerative disease – A 2-year follow-up study

Vikaesh Moorthy, Sumanth Madhusudan Prabhakar, Joshua Decruz, Kelvin Kah Ho Lor, Eugene Weiren Yang, Mu Liang Ang
Khoo Teck Puat Hospital SINGAPORE

Introduction / Objective Minimally invasive spine surgery (MISS) has rapidly expanded to include tubular and endoscopic techniques, designed to enhance postoperative recovery. We aim to review the clinical and patient-reported outcomes of lumbar spine surgeries across open discectomy/decompression (OD), tubular microdiscectomy/decompression (TM), and biportal endoscopic discectomy/decompression (BE) over a 2-year follow-up period.

Materials & Methods A retrospective analysis was performed for 129 patients who had undergone decompression surgeries for lumbar spine degenerative disease at a tertiary institution from January 2021 to February 2023, with 2-year follow-up. We evaluated demographics and perioperative factors including surgical duration, postoperative length of stay, incidence of complications including dural tears, wound complications, recurrence of symptoms and VAS leg and back pain scores up to 2 years postoperatively.

Results / Discussion 129 patients were included, with a mean age of 54.3, 52.9, and 52.9 years in those who underwent OD (n=28), TM (n=38) and BE (n=63) respectively. The BE group had significantly shorter postoperative length of stay compared to the TM and OD groups (3.0 vs 4.2 vs 5.8 respectively, $p = 0.003$). There were no significant differences between the groups for other perioperative factors including surgical time, incidence of dural tears or surgical complications. In terms of patient-reported VAS leg and back pain scores, there were also no significant differences in VAS back or leg pain scores between the groups at 6 weeks, 3 months, 6 months, 1 year or 2 years postoperatively.

Conclusion There was no significant difference in clinical outcomes, including pain control and complication rates, between the 3 different surgical techniques. BE spine surgery had the shortest post-operative length of stay, potentially due to faster recovery as a result of less soft tissue and muscle trauma. Overall, compared to other procedures, BE is a safe, effective, and viable surgical procedure for treating lumbar spinal degenerative disease.

24

Integrated Multi-Omics Analysis Reveals That Biomimetic Micro-Nanofiber Materials Promote Osteogenic Differentiation by Activating the JAK2/STAT3 Signaling Pathway Through Macrophage Reprogramming

Daiyuan Tang, Bing Han, Chen Zhu

The First Affiliated Hospital of University of Science and Technology of China CHINA

Introduction / Objective Bone defect remains a major clinical challenge. Based on the "bone immunity-bone regeneration synergistic repair" theory, this study integrated transcriptomics, proteomics, and phosphoproteomics to investigate how biomimetic micro-nanofiber materials regulate the bone immune microenvironment to promote osteogenic differentiation.

Materials & Methods Four types of electrospun micro-nanofiber materials (600 nm/1200 nm, ordered/disordered) were prepared. The optimal material for macrophage M2 polarization was screened. Conditioned medium from material-treated macrophages was co-cultured with BMSCs for multi-omics sequencing. The top-ranked JAK2/STAT3 pathway was verified by rescue experiments. In vivo efficacy was evaluated in a rat critical-sized calvarial defect model.

Results / Discussion The ordered 600 nm nanofibers most effectively promoted macrophage M2 polarization. Integrated multi-omics analysis identified the JAK2/STAT3 signaling pathway as the key mediator. Rescue experiments confirmed that material-induced BMSC osteogenic differentiation was dependent on JAK2/STAT3 activation. Animal experiments further validated the molecular axis: "biomimetic micro-nanofibers → macrophage M2 polarization → JAK2/STAT3 pathway activation → BMSC osteogenic differentiation".

Conclusion This study demonstrates that biomimetic micro-nanofiber materials promote osteogenic differentiation by reprogramming macrophages to activate the JAK2/STAT3 pathway, providing a foundation for developing novel osteogenic biomaterials.

25

Single-Cell Sequencing Reveals That Immunomodulatory Biomechanical Scaffolds Promote Bone Regeneration

Daiyuan Tang, Bing Han, Chen Zhu

The First Affiliated Hospital of University of Science and Technology of China CHINA

Introduction / Objective Immuno-osteogenic regulation critically determines bone defect repair outcomes. This study employs single-cell sequencing to investigate how biomechanical scaffolds with specific microtopographies modulate bone immunity and promote large-segment bone regeneration.

Materials & Methods Four types of electrospun micro-nanofiber scaffolds (600 nm/1200 nm, ordered/disordered) were fabricated and implanted into rat critical-sized calvarial defects. Biocompatibility and osteogenic efficacy were evaluated at 4 and 8 weeks via micro-CT and histological staining. Single-cell

RNA sequencing was performed on regenerative tissues from the optimal group and model control, followed by bioinformatic analysis and mechanistic validation through in vivo and in vitro experiments.

Results / Discussion The ordered 600 nm scaffold showed superior biocompatibility and osteogenic activity. Integrated analysis of 23,597 cells identified 9 distinct cell clusters. Correlation analysis revealed a strong association between osteogenesis and macrophage polarization. The ordered 600 nm scaffold significantly upregulated M2 macrophage markers (Arg-1, CD206, VEGF, IL-10) and downregulated M1 markers (iNOS, CD86, TNF- α , IL-6). Molecular biology experiments confirmed the "biomechanical scaffold—macrophage M2 polarization—osteogenic differentiation" axis as the underlying mechanism.

Conclusion This study elucidates the osteoimmunomodulatory mechanism of biomechanical scaffolds, providing a foundation for developing novel microtopography-based osteogenic biomaterials.

26

Functional Outcomes Following Plate Fixation, Intramedullary Nailing and Reverse Shoulder Arthroplasty for Proximal Humerus Fractures: A Retrospective Cohort Study

Nicholas Matthias Zhi Wei Tan, Ruth Eliza Li-En Tan, Michael Gui-Jie Yam
Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Proximal humerus fractures (PHFs) are a common fragility injury with rising incidence in ageing populations such as Singapore. Surgical options include plate fixation (PLT), intramedullary nailing (IMN), and reverse shoulder arthroplasty (RSA), although comparative outcomes remain heterogeneous. This study evaluated postoperative functional outcomes and factors influencing recovery following surgical management of PHFs.

Materials & Methods A retrospective cohort study was conducted at a Level 1 trauma centre from June 2020 to July 2025. All patients undergoing index surgical management for PHFs were included. Demographic, clinical, and radiographic data were obtained from institutional electronic medical records, and fractures were classified using the AO/OTA system. The primary outcome was forward flexion range of motion (FFROM) at 3, 6, and 12 months postoperatively. Outcomes were compared across surgical modalities, with multivariable regression used to identify independent predictors of FFROM.

Results / Discussion A total of 201 patients were identified, comprising 193 index operations (104 PLT, 46 IMN, 43 RSA) and 8 revisions. Mean age differed significantly between surgical groups ($p < 0.001$), and surgical modality was associated with fracture type ($p < 0.001$), with IMNs more commonly used for type A fractures and RSAs for type C fractures. No significant differences in FFROM were observed between surgical modalities at 3, 6, or 12 months, including subgroup analyses (all $p > 0.05$). Increasing age was independently associated with poorer FFROM at all time points ($p < 0.05$) as shown on multivariate analysis. Type B fractures demonstrated greater FFROM at 3 and 6 months compared to type A fractures. The overall complication rate was 9.3%, with all revision surgeries occurring following PLT.

Conclusion Surgical management of PHFs achieved comparable functional outcomes across modalities at 12 months. IMN may represent a viable alternative in selected fracture patterns, while RSA remains appropriate for complex fractures in elderly patients. Age was an independent negative predictor of FFROM.

27

Ischaemic Heart Disease Is Associated with Delayed Time to Surgery but Not Inpatient Mortality or 30-Day Readmission in Hip Fracture Patients

Bryan Ce-Jie Peh, Chung Ean Lo, Yew Lok Woo, Willian Zhan Xia, Seo Kiat Goh, Tet Sen Howe, Joyce Suang Bee Koh, Kenny Xian Khing Tay
Singapore General Hospital SINGAPORE

Introduction / Objective Following a hip fracture, early surgical intervention is associated with improved outcomes. Among hip fracture patients, cardiac comorbidities are common. Thus, perioperative cardiology referrals are frequently requested for assessment of Ischemic Heart Disease (IHD) patients. This study aims to evaluate the correlation between IHD and outcomes, including time to surgery, length of stay, inpatient mortality, and 30-day readmission.

Materials & Methods A retrospective study was conducted on all hip fracture patients who underwent surgery at a single tertiary hospital between January 2020 and December 2021. Collected variables included patient demographics, IHD status, Charlson Comorbidity Index (CCI) scores, and fracture type. Collected outcomes were time to surgery (≤ 48 hours or > 48 hours), length of stay (≤ 10 days or > 10 days), inpatient mortality, and 30-day readmission. Binary logistic regression was performed to evaluate the effect of IHD on outcomes, with adjustment for age, gender, CCI, and type of fracture.

Results / Discussion 579 patients were included (mean age: 79.54 ± 7.88 years). 96 patients (16.6%) had preoperative IHD. In multivariable analysis, IHD was associated with prolonged hospitalization > 10 days (OR 2.21; 95% CI 1.35–3.62; $p = 0.002$) and delayed surgery (OR 2.56, 95% CI 1.54–4.24, $p < 0.001$). Of the 6 patients who suffered inpatient mortality, none had IHD. Although IHD patients demonstrated higher odds of 30-day readmission, this association was not statistically significant (OR 2.35; 95% CI 0.57–9.71; $p = 0.240$).

Conclusion IHD was associated with prolonged time to surgery and length of stay, likely due to frequent perioperative cardiology referrals prompting further investigations such as a transthoracic echocardiogram. Beyond risk stratification, these referrals rarely result in any intervention. Furthermore, IHD was not associated with increased inpatient mortality and 30-day readmission. Hip fracture surgery is time-sensitive; unnecessary cardiology referrals should be avoided in the absence of an unstable cardiac pathology. Appropriate counselling based on known perioperative risks of IHD will expedite surgery.

30

Optimising intra-operative imaging in patella plating to detect articular cartilage penetration: A case report

Navin Kumaran, Olivette Chen Enqi, Rishi Malhotra
National University of Singapore SINGAPORE

Introduction / Objective Patella plating is increasingly used for patella fracture fixation due to favourable stability and lower complication rates. However, intra-articular screw penetration remains a recognised complication and may be difficult to detect using standard intra-operative fluoroscopic views and manual palpation. Despite increasing use of patella plating, there is limited literature describing missed screw penetration and strategies for its intra-operative detection. We present a case of unrecognised screw penetration requiring revision surgery and describe adjunctive imaging techniques that may improve detection.

Materials & Methods A 54-year-old woman with a displaced transverse patella fracture and extensor lag underwent fixation with anterior locking plates. Intra-operative assessment using standard anteroposterior and lateral fluoroscopy together with manual palpation did not identify screw penetration. At

three weeks post-operatively, a routine skyline radiograph raised suspicion of articular breach, which was confirmed on CT. Revision surgery with arthroscopy and screw exchange was performed at six weeks.

Results / Discussion Arthroscopy confirmed intra-articular penetration of a locking screw. During revision surgery, standard lateral fluoroscopy underestimated the penetration, whereas a simple oblique view obtained through limb rotation clearly demonstrated the offending screw. The oblique view was achieved without repositioning the image intensifier and provided improved visualisation of the patellar facets. Following revision, the patient achieved full knee range of motion, painless ambulation and radiographic union. This case highlights the limitations of routine intra-operative assessment and demonstrates the value of supplementary oblique and skyline views in identifying occult articular penetration.

Conclusion Routine incorporation of medial and lateral oblique fluoroscopic views should be considered during patella plating to improve detection of intra-articular screw penetration. Arthroscopy may provide additional confirmation in equivocal cases and help avoid preventable revision surgery.

32

Patient-Reported Outcome Measures in Diabetic Patients Undergoing Anterior Cervical Discectomy and Fusion With Standalone Cages

Cassie Yang, Reuben Soh, Yeong Huei Ng, John Chen, Youheng Ou Yang
Singapore General Hospital SINGAPORE

Introduction / Objective Diabetes mellitus (DM) confers significantly elevated risks of postoperative complications, though its effect on patient-reported functional outcomes (PROMs) after anterior cervical discectomy and fusion using standalone cages (ACDF-SC) remains unclear. This study evaluates the influence of DM on functional outcomes following ACDF-SC.

Materials & Methods A retrospective cohort analysis was performed of patients who underwent single- and double-level ACDF-SC. Patients were stratified by diabetic status. Preoperative and postoperative PROMs collected included the Neck Pain and Disability scale (NPD), neurogenic symptoms (NS), Neck Disability Index (NDI), SF-36 subscales, Visual Analog Scale for neck and arm pain (VAS-NP, VAS-LP), and Japanese Orthopaedic Association (JOA) scores. Within-group pre- to postoperative changes and between-group differences in magnitude of improvement were analysed.

Results / Discussion Preoperative PROMs were largely similar between diabetic ($n = 10$) and non-diabetic ($n = 44$) cohorts, though significant baseline differences were identified in NS, NDI, the SF-36 vitality domain, and VAS-NP. Non-diabetic patients demonstrated significant postoperative improvement across all PROMs, except for the SF-36 role-emotional domain. Diabetic patients also showed significant improvement in NPD, NS, NDI, physical function-related SF-36 domains, and JOA scores, though improvements were observed across fewer outcome measures and were generally of smaller magnitude. When comparing the degree of improvement between groups, non-diabetic patients experienced significantly greater improvement in NPD and NDI. No significant between-group differences were observed for NS, SF-36 subscales, VAS pain scores, or JOA score changes. Postoperative outcome scores were largely comparable between groups.

Conclusion ACDF-SC results in meaningful functional improvement in both diabetic and non-diabetic patients, with non-diabetic patients demonstrating greater improvement in neck pain-related measures. While DM may not preclude clinical benefit from ACDF-SC, it may attenuate the magnitude of functional recovery. These findings may be limited by the diabetic cohort size; prospective multicenter studies with dedicated diabetic cohorts are recommended to validate these findings.

34

Comparable Patient-reported Outcomes in Diabetic and Non-diabetic Patients Following Arthroscopic Supraspinatus Repair Augmented with Bioinductive Collagen Implant

Keng Pui, Bryan Hon, Tzong-Yee, Colin Wang, Hun Yi Koh, Xunqi Cheow
Sengkang General Hospital SINGAPORE

Introduction / Objective Diabetes Mellitus has been associated with impaired tendon healing and inferior outcomes following rotator cuff repair. Bioinductive collagen implants have emerged as a potential adjunct to improve tendon healing, but their effectiveness in diabetic patients remains unclear. This study aimed to evaluate clinical outcomes following arthroscopic supraspinatus repair augmented with a bioinductive collagen implant and to determine whether diabetes mellitus influences postoperative patient-reported outcomes.

Materials & Methods A retrospective cohort study was performed on 38 patients who underwent arthroscopic repair of full-thickness supraspinatus tears with bioinductive collagen implant augmentation between 2023 and 2025. Twelve patients (31.6%) had diabetes mellitus. Outcomes were assessed using Visual Analogue Scale (VAS) and Oxford Shoulder Score preoperatively and at final follow-up (mean 18.1 ± 5.8 months). Multivariable linear regression evaluated the independent effect of diabetes, adjusting for baseline scores and concomitant subscapularis repair.

Results / Discussion Significant improvements were observed in both pain and function. Mean VAS improved from 5.8 ± 2.2 to 1.0 ± 1.2 ($p < 0.001$), and mean Oxford Shoulder Score improved from 27.7 ± 8.8 to 44.5 ± 3.8 ($p < 0.001$), exceeding minimal clinically important difference thresholds. Diabetic patients had lower preoperative Oxford Shoulder Scores (23.4 ± 8.1 vs 29.8 ± 8.5 ; $p = 0.038$) but achieved similar final VAS (0.8 ± 1.5 vs 1.0 ± 1.0 ; $p = 0.678$) and Oxford scores (45.4 ± 3.2 vs 44.2 ± 4.0 ; $p = 0.303$). Neither diabetes nor concomitant subscapularis repair were independently associated with final VAS ($\beta = -0.17$; $p = 0.774$) or Oxford score ($\beta = 1.42$; $p = 0.395$).

Conclusion Arthroscopic supraspinatus repair augmented with a bioinductive collagen implant resulted in clinically meaningful improvements in pain and function. Diabetes mellitus did not appear to adversely affect outcomes, suggesting augmentation may mitigate the biological disadvantage associated with diabetes. Larger prospective studies are required to confirm these findings.

35

A Dual-Domain Knowledge-Guided AI System for Accurate Localization and Diagnosis of Non-Displaced Femoral Neck Fractures

Lianxin Wang, Baoshan Hu
The first affiliated hospital of Ximen University CHINA

Introduction / Objective X-ray is the primary tool for fracture diagnosis, providing critical information on type, location, and severity. However, non-displaced femoral neck fractures (ND-FNF) are difficult to identify due to subtle fracture lines and complex hip anatomy. Current deep learning methods rely on cropped images requiring manual hip annotation, increasing labor costs. To address this, we propose Dual Domain Knowledge Guidance (DDKG), which leverages spatial and semantic domain knowledge to enable robust ND-FNF detection directly from whole X-ray images.

Materials & Methods The model was developed and validated using 2,476 X-ray images from three hospitals, including 1,091 normal images and 1,385 images with non-displaced femoral neck fracture. DDKG consists of two modules: the Spatial Aware Module (SAM) and the Semantic Coordination Module

(SCM). SAM uses limited positional supervision to focus the model's attention on the hip joint region, reducing background interference. SCM integrates radiological reports and prior knowledge from large language models to extract critical semantic features of ND-FNF, guiding the model to learn clinically relevant visual representations. During inference, only the whole X-ray image is required, enabling fully automated diagnosis without additional annotations. **Results / Discussion** The model was validated on four datasets from three independent hospitals. Results demonstrated consistent diagnostic accuracy and robustness across all centers, indicating strong generalization. Compared to cropped-image methods, DDKG achieved comparable or superior performance while eliminating manual hip localization. It effectively handled variations in imaging conditions and patient populations, confirming its potential for real-world deployment.

Conclusion DDKG reduces annotation costs and improves diagnostic reliability by combining spatial awareness with semantic coordination. Its consistent multi-center performance underscores clinical applicability. Future work may extend this framework to other fracture types and integrate additional knowledge sources.

36

Percutaneous Zadek Osteotomy for Calcific Insertional Achilles Tendinopathy: An Exploratory Comparison of Outcomes With and Without Retrocalcaneal Calcification

Dhivakaran Gengatharan, Inderjeet Singh Rikhrāj, Bryan Keng Pui Hon, Eric Wei Liang Cher, Wen Xian Png
Sengkang General Hospital SINGAPORE

Introduction / Objective Calcific insertional Achilles tendinopathy (CIAT) may remain symptomatic despite prolonged nonoperative treatment. Minimally invasive (MIS) Zadek osteotomy has emerged as an effective surgical option; however, the necessity of concomitant resection of retrocalcaneal or intratendinous calcification remains controversial. This study compared clinical outcomes following MIS Zadek osteotomy in patients with radiographic retrocalcaneal and intratendinous calcification intentionally left unexcised with those in patients without these radiographic findings.

Materials & Methods A retrospective cohort study was conducted involving 20 patients who underwent MIS Zadek osteotomy between January 2023 and December 2024. Patients were divided into 2 groups: a CIAT group ($n = 10$) with presence of retrocalcaneal calcification intentionally left unexcised, and a control group ($n = 10$) without this calcification. Outcomes included visual analog scale (VAS) pain scores, European Foot and Ankle Society (EFAS) scores, and patient-reported satisfaction. Statistical significance was set at $p < .05$.

Results / Discussion Both groups demonstrated significant clinical improvement at 1 year postoperatively. Mean VAS scores improved from 6.7 ± 0.8 to 0.3 ± 0.7 in the CIAT group and from 7.2 ± 1.0 to 0.6 ± 0.8 in the control group, with no significant intergroup difference ($p = .391$). EFAS scores improved from 11.6 ± 4.6 to 23.1 ± 1.4 in the CIAT group and from 10.4 ± 4.0 to 23.0 ± 1.5 in the control group, with no significant differences at 6 months ($p = .701$) or 1 year ($p = .878$). All patients in both groups were satisfied with the surgical outcome.

Conclusion Patients with radiographic retrocalcaneal calcification achieved pain relief, functional improvement, and satisfaction comparable to those without such deformities. Routine excision may not be necessary when performing MIS Zadek osteotomy for CIAT.

37

Are All Stiff Spines the Same? Preoperative Differences Between Stuck Standing, Stuck Sitting, and Neutral Stiff Phenotypes in Total Hip Arthroplasty Candidates

Shawn JS Seah, Mark HX Yeo, Shi Ting Chiu, Hee Nee Pang
Singapore General Hospital SINGAPORE

Introduction / Objective Spinopelvic mobility has gained increasing attention for its impact on total hip arthroplasty (THA), particularly regarding functional acetabular orientation and instability. Patients with spinopelvic stiffness represent a heterogeneous group with three recognised phenotypes, stuck standing, stuck sitting, and neutral stiff, which may carry differing clinical implications. This study compared baseline characteristics and preoperative patient-reported outcome measures (PROMs) across these phenotypes in patients awaiting THA.

Materials & Methods A retrospective cohort study was performed in patients with end-stage hip osteoarthritis or avascular necrosis undergoing THA with spinopelvic stiffness, defined as sacral slope change (ΔSS) $< 10^\circ$ between standing and sitting radiographs. Patients were classified as stuck sitting ($SS < 30^\circ$ in both positions), stuck standing ($SS > 30^\circ$), or neutral stiff. Baseline demographic and preoperative PROMs, including Oxford Hip Score (OHS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and 36-item Short-Form health survey (SF-36) scores, were compared between the groups. Continuous and categorical variables were compared using one-way ANOVA and Fisher's exact test respectively.

Results / Discussion Forty-six patients were included: 22 stuck sitting, 12 stuck standing, and 12 neutral stiff. Mean ΔSS was similar across groups. Baseline characteristics, including age, sex, operative side, and lumbar pathology, did not differ significantly. Body mass index was significantly higher in the stuck sitting group ($p = 0.010$). In terms of PROMs, the stuck standing phenotype demonstrated lower SF-36 physical component scores that trended towards but did not reach statistical significance ($p = 0.087$). The rest of the preoperative PROMs were comparable between groups, with no significant difference.

Conclusion Among THA candidates with reduced spinopelvic mobility, stiff phenotypes demonstrate largely comparable baseline characteristics and PROMs, though differences in BMI and trends toward poorer baseline function in the stuck standing group suggest these phenotypes may not be clinically equivalent. Further study with larger cohorts and postoperative outcomes is warranted.

38

Preoperative Spinopelvic Stiffness Does Not Compromise Early Patient-Reported Outcomes After Direct Anterior Approach Total Hip Arthroplasty

Mark Hao Xuan Yeo, Shi Ting Chiu, Shawn Jing Sheng Seah, Cheryl Gatot, Sheng Xu, Xuan Eric Liu, Ming Han Lincoln Liow, Darren Keng Jin Tay, Seng Jin Yeo, Hee Nee Pang
Singapore General Hospital SINGAPORE

Introduction / Objective While there is growing interest in spinopelvic parameters and their influence on instability following total hip arthroplasty (THA), evidence regarding the relationship between preoperative spinopelvic mobility and postoperative patient-reported outcomes remains limited. This study evaluated whether preoperative spinopelvic stiffness compromises early functional outcomes following direct anterior approach (DAA) THA.

Materials & Methods This retrospective cohort study included 80 patients who underwent unilateral primary DAA THA for osteoarthritis or avascular necrosis with routine preoperative standing and seated spinopelvic radiographs. Spinopelvic parameters—including sacral slope (SS), spinopelvic tilt

(SPT), and anterior pelvic plane tilt (APPT)—were measured independently by two blinded assessors, and mobility was defined by positional change between standing and seated radiographs. Functional outcomes were measured using the Oxford Hip Score (OHS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and 36-item Short-Form health survey (SF-36) at baseline, 6 months, and 2 years postoperatively. Linear regression analyses were performed adjusting for age, sex, and operated side.

Results / Discussion Reduced preoperative spinopelvic mobility (Δ SS, Δ SPT, Δ APPT) was associated with improved postoperative patient-reported outcomes. At 6 months follow-up (n=65), lower Δ APPT and Δ SPT were associated with superior OHS (standardised coefficient β =-0.26 and -0.27; p=0.045 and 0.042, respectively), while lower Δ SS was associated with improved SF-36 mental component summary (β =-0.31; p=0.023). At 2 years, reduced Δ SPT and Δ SS were associated with superior WOMAC pain and physical function scores (β =-0.40 to -0.48; p<0.05), although sample size was limited (n=33). No dislocations were observed at 6 months' follow-up.

Conclusion In this retrospective cohort, preoperative spinopelvic stiffness was not associated with inferior early patient-reported outcomes following DAA THA. Conversely, several PROM domains favoured patients with reduced spinopelvic mobility, with no dislocations observed in this cohort. These findings support the use of DAA in patients with spinopelvic stiffness and indicate that early functional recovery is not compromised in this population.

39

Six-Month Patient-Reported Outcomes After Direct Anterior THA in Patients With Reduced Spinopelvic Mobility: Modular Dual-Mobility Versus Conventional Fixed-Bearing Liners

Shawn JS Seah, Mark HX Yeo, Shi Ting Chiu, Hee Nee Pang
Singapore General Hospital SINGAPORE

Introduction / Objective Modular dual-mobility (MDM) liners are increasingly used to mitigate instability risk in patients with reduced spinopelvic mobility undergoing total hip arthroplasty (THA). However, evidence on patient-reported outcomes (PROMs) in this population remains limited. This study evaluated early PROMs following MDM versus conventional fixed-bearing liners in patients with reduced preoperative spinopelvic mobility.

Materials & Methods A retrospective study was conducted, including 36 patients with reduced spinopelvic mobility who underwent unilateral primary THA via the direct anterior approach. Patients received either MDM or conventional liners. Spinopelvic mobility was measured via change in sacral slope between standing and seated positions (Δ SS), with reduced spinopelvic mobility defined as Δ SS <20°. Patient-reported outcomes were measured using the Oxford Hip Score (OHS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and 36-item Short-Form health survey (SF-36) scores at baseline and 6 months. Dislocation rates were recorded. Continuous and categorical variables were compared using independent t-tests and Fisher's exact test respectively.

Results / Discussion Among 36 patients with reduced spinopelvic mobility, six patients (16.7%) received MDM liners. At 6 months, the MDM group demonstrated statistically worse WOMAC Pain Item 1 and WOMAC pain composite scores (mean differences -6.3 and -4.6; p=0.036 and p=0.020, respectively), though these differences did not exceed established minimal clinically important difference (MCID) thresholds. Conversely, the MDM group showed greater improvement in WOMAC physical function (mean difference 17.3; p=0.044), exceeding MCID thresholds. No dislocation was observed in either group at 6 months follow-up.

Conclusion In patients with reduced spinopelvic mobility undergoing direct anterior THA, MDM liners were associated with mixed PROMs at 6 months, demonstrating inferior pain scores but superior functional improvement, which was clinically significant. Both constructs showed no early dislocations. These findings support the selective use of MDM liners in patients with spinopelvic stiffness, although larger prospective studies are needed for validation.

40

From Innovation to Implementation: A Cost-Effectiveness Analysis of Artificial Intelligence-Enhanced Cobb Angle Measurement in Adolescent Idiopathic Scoliosis

Wayne Yong Xiang Foo, Yanting Ouyang, Petty Pin Yu Chen, Stacy Wei Ling Ng, Kenneth Pak Leung Wong, Andy Kye Soon Yew, Siaw Meng Chou, Kevin Lim Boon Leong, Arjandas Mahadev, Nicholas Graves, Andrew Chia Chen Chou
Senggang General Hospital SINGAPORE

Introduction / Objective Artificial intelligence (AI) has demonstrated diagnostic accuracy comparable to manual physician-led Cobb angle measurement in adolescent idiopathic scoliosis (AIS), but its economic value in routine clinical practice remains uncertain. This study evaluated the economic impact of AI-assisted Cobb angle measurement tool from a healthcare provider perspective in a tertiary paediatric hospital.

Materials & Methods A cost-minimisation analysis was performed under the assumption of equivalent clinical outcomes between AI-assisted and manual Cobb angle measurement. Time inputs were obtained from a prospective workflow study of patients with AIS. The existing clinical workflow was compared with three AI-implementation scenarios: 1) AI-assisted staffing substitution without workflow changes, 2) reduced consultation duration, and 3) increased patient throughput within existing clinic hours. Costs included personnel, AI software implementation and annual licensing fees over a 5-year time horizon. Threshold and probabilistic sensitivity analyses were performed to evaluate model robustness.

Results / Discussion Compared with existing practice, all three AI implementation scenarios reduced the average cost per consultation by 20.7%-45.6%. Over the 5-year study horizon, the cost structure shifted from one driven predominantly by manpower costs to one dominated by AI software implementation and maintenance costs. Across 1,000 Monte Carlo simulations, AI-assisted workflows demonstrated a 92.9% to 100.0% probability of being cost-saving. The increased patient throughput scenario remained highly robust, maintaining an >80% probability of cost savings at annual AI licensing costs of up to \$100,000.

Conclusion AI-assisted Cobb angle measurement is likely to be a cost-saving intervention for outpatient management of AIS when integrated into an appropriate clinical workflow. The economic value of AI extends beyond task automation and is maximised when implementation enables more efficient utilisation of specialist expertise and clinic resources. These findings provide practical evidence to guide implementation of AI technologies within orthopaedic practice.

41

The Influence of Plantar Calcaneal Spur on Functional Outcomes and Post-Operative Plantar pain following Zadek Osteotomy for Insertional Achilles Tendinopathy

Wayne Yong Xiang Foo, Dhivakaran Gengatharan, Wenxian Png, Eric Wei Liang Cher
Senggang General Hospital SINGAPORE

Introduction / Objective Minimally invasive Zadek osteotomy (ZO) has emerged as an effective surgical treatment for insertional Achilles tendinopathy (IAT). However, the impact of plantar calcaneal spur size on postoperative outcomes following ZO remains poorly understood. This study aimed to evaluate the association between plantar calcaneal spur size and clinical outcomes after minimally invasive ZO for IAT.

Materials & Methods A retrospective cohort study was performed on patients undergoing minimally invasive ZO for IAT between August 2023 and May 2025. Plantar calcaneal spur length was measured on preoperative weight-bearing lateral radiographs, and patients were stratified into two groups based on spur size (≤ 5 mm vs > 5 mm). Outcomes were assessed using the European Foot and Ankle Society (EFAS) score and Visual Analogue Scale (VAS) pain score. Postoperative plantar heel pain was also evaluated.

Results / Discussion Twenty patients were included, comprising nine patients with plantar calcaneal spurs ≤ 5 mm and eleven patients with spurs > 5 mm. Both groups demonstrated significant improvements in EFAS and VAS scores at 1-year follow-up compared with baseline (all $p < 0.01$), with no significant differences in postoperative functional outcomes between groups. Postoperative plantar heel pain was observed in 11.1% of patients with spurs ≤ 5 mm and 45.5% of patients with spurs > 5 mm ($p = 0.157$). Patients with larger plantar calcaneal spurs demonstrated higher odds of postoperative plantar heel pain, although this association was not statistically significant (odds ratio [OR] 6.67, 95% confidence interval [CI] 0.61–73.03; $p = 0.120$).

Conclusion Plantar calcaneal spur size did not significantly influence functional outcomes following minimally invasive ZO for IAT. However, a higher observed incidence of postoperative plantar heel pain was noted among patients with larger plantar calcaneal spurs. Although these findings require validation in further studies, plantar spur morphology may warrant consideration during preoperative assessment and counselling.

42

Determining the efficacy of short-term clinical outcomes of Autologous Protein Solution (APS) injections with or without Hyaluronic Acid (HA)

Jiawen Fong, Krishmen Rasu, Hamid Razak
Sengkang General Hospital SINGAPORE

Introduction / Objective Autologous Protein Solution (APS) injections have been gaining traction in recent years for its anti-inflammatory properties and symptomatic relief of mild-moderate knee osteoarthritis. Hyaluronic Acid (HA) injections have also gained traction for its synergistic and complementary effects on knee osteoarthritis when given alone or in combination with other forms of intra-articular injections. The aim of the study is to study the patient-reported outcome measures (PROMs) of APS injections with or without the presence of HA.

Materials & Methods This is a retrospective review of data of a prospective study performed between 2022–2024, performed in a single institution. Patients with early-stage osteoarthritis, aged 21 years and above with a sound mind were counselled for knee injections. Patients were randomly allocated into 2 groups: Group A (APS monotherapy) and Group B (APS/HA combination therapy). All patients were followed-up regularly at 6-weeks, 3-months and 6-months post-injection. Clinical outcome scores (Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire, Knee injury and Osteoarthritis Outcome Score (KOOS) and Visual Analogue Scale (VAS) scores) were recorded at baseline and at each follow-up visit. The data was then subject to statistical analysis using SPSS software.

Results / Discussion 28 patients were included - 12 in Group A and 16 in Group B. 2 (one from each group) were lost to follow-up. Group A showed statistically significant difference in VAS, KOOS and WOMAC scores at 3 and 6-months post-injection. Group B showed statistically significant difference in VAS scores only at 6-months post-injection. There was no statistically significant difference in PROMs between the 2 groups.

Conclusion Both APS and APS/HA demonstrated short-term symptomatic improvement, but superiority of APS/HA over APS monotherapy was not demonstrated in this exploratory cohort. Further evaluation of patient factors and longer-term cohort studies can be done to determine the effectiveness of combination injections on clinical outcomes of knee osteoarthritis.

43

Open tibial plateau fracture with Tibial tuberosity avulsed fragment retracted into knee joint and Patella tendon rupture: A case report

Shasi Mogan, Sumanth Prabhakar Madhusudan, Antony Xavier Rex Premchand
Khoo Teck Puat Hospital SINGAPORE

Introduction / Objective Tibial tuberosity avulsion fractures are uncommon injuries, predominantly occurring in adolescents, and are rare in adults. Intra-articular displacement of the avulsed tibial tuberosity fragment with retraction of the patellar tendon into the knee joint is an exceptionally unusual injury pattern, with very few cases described in the literature. We present a rare case of an open proximal tibial fracture associated with intra-articular displacement of the tibial tuberosity.

Materials & Methods A 27-year-old female motorcyclist sustained polytrauma after rear-ending another vehicle. She suffered an open extra-articular proximal tibial fracture with anterior bone loss (Gustilo-Anderson IIIA) and underwent emergency debridement with temporary external fixation. Radiographs and computed tomography demonstrated a comminuted proximal tibial fracture with a large osseous fragment located inferior to the patella within the knee joint.

Results / Discussion Definitive fixation was performed using dual medial and lateral locking plates. Intra-operatively, the displaced tibial tuberosity fragment with the attached patellar tendon was identified within the joint, retrieved, anatomically reduced, and repaired using a double-row suture anchor. The sutures were secured to the medial and lateral plates, and additional compression was achieved with a 3.5-mm cortical screw and washer. Post-operatively, the knee was protected in a brace and was recovering well at 2 month post-operative interval regaining full active knee extension.

Conclusion This case highlights a rare pattern of open tibial tuberosity avulsion with intra-articular displacement of the patellar tendon. Awareness of this possibility is essential when imaging demonstrates an unexplained osseous fragment beneath the patella in the setting of a proximal tibial fracture. The likely mechanism is a powerful eccentric quadriceps contraction generating sufficient tensile force to avulse the tibial tuberosity and retract it into the knee joint following complete disruption of the anterior periosteum and medial and lateral retinacular attachments. Early recognition and meticulous restoration of the extensor mechanism are critical for achieving good functional outcomes.

44

Atypical Ulnar Diaphyseal Fractures in Patients on Long-term Antiresorptive Therapy: A Case Series

Emrick Sen Hui Quah, Tianyi Wu, Antony Xavier Rex Premchand
Khoo Teck Puat Hospital SINGAPORE

Introduction / Objective Atypical femoral fractures are a well-recognized complication of prolonged antiresorptive therapy, characterized by transverse, minimally comminuted fractures at sites of cortical stress with prodromal pain. An analogous pattern in the ulna is increasingly recognized but remains

underreported, with limited guidance on optimal fixation strategy. We present two cases illustrating this entity and highlight the impact of fixation technique on patient outcomes.

Materials & Methods Case 1: A 76 year old female with rheumatoid arthritis on DMARDs, on risedronate for 6 years, developed left forearm pain after carrying a one kilogram weight, preceded by 3 months of prodromal pain. Radiographs showed a transverse proximal third ulnar shaft fracture with cortical thickening. A trial of cast immobilization failed, with progressive displacement at 1 month. Open reduction and internal fixation (ORIF) with corticocancellous graft subsequently failed to unite, requiring revision fixation with allograft augmentation that eventually achieved union. Case 2: An 83 year old female with psoriatic arthropathy on DMARDs, on alendronate for 10 years, developed similar prodromal pain for 1 month before sustaining an acute fracture during minimal loading of her arm. Radiographs likewise showed a transverse proximal third ulnar fracture. Upfront ORIF with intramedullary drilling, decortication and bone grafting achieved progressive union.

Results / Discussion Both cases demonstrate a similar atypical ulnar fracture phenotype, characterized by proximal third, transverse, minimally comminuted ulnar fractures with prodromal pain, in patients on prolonged antiresorptive therapy. Differing outcomes between both presented cases would suggest that early, biological augmented fixation may reduce the risk of nonunion compared to conservative management.

Conclusion Atypical fractures from long term anti-resorptive therapy exist outside the femur. Clinicians should have a high degree of suspicion and have a low threshold to work up at risk patient with atraumatic forearm pain. Early aggressive fixation should be considered the first line of treatment in medically fit patients.

45

Limb Salvage Following Closed Elbow Dislocation: Staged Reconstruction for Occult Brachial Artery Transection, Global Instability and Median Nerve Palsy

Jeremy Tze En Lim, William Zhan Xia, Joyce Suang Bee Koh, Tet Sen Howe
Singapore General Hospital SINGAPORE

Introduction / Objective Brachial artery injury following closed elbow dislocation is rare and may be overlooked despite an initially reassuring vascular examination. We report a case of occult complete brachial artery transection unmasked by deterioration in vascular status following reduction, requiring staged multidisciplinary reconstruction to restore limb perfusion, stability and function.

Materials & Methods A 67-year-old man sustained a closed posterolateral elbow dislocation following a fall, with initially biphasic distal Doppler signals. Following closed reduction, distal Doppler signals deteriorated to monophasic before becoming absent, prompting urgent CT angiography, which demonstrated brachial artery occlusion with distal collateral reconstitution. Emergency combined vascular and orthopaedic exploration confirmed complete transection of the brachial artery and basilic vein with gross global elbow instability involving the medial and lateral ligamentous restraints and anterior capsule. Management comprised reversed great saphenous vein interposition bypass, forearm fasciotomy and spanning external fixation. Persistent median and anterior interosseous nerve palsy was subsequently confirmed on electrodiagnostic studies.

Results / Discussion Following restoration of limb perfusion and resolution of soft-tissue swelling, staged reconstruction comprised external fixator removal, medial and lateral collateral ligament repair, and brachioradialis-to-flexor pollicis longus with flexor digitorum profundus ring-to-index tendon transfers for persistent median and anterior interosseous nerve palsy. At final follow-up, limb perfusion remained intact with a palpable radial pulse and satisfactory tendon transfer function. This case demonstrates that progressive deterioration in vascular status following reduction may unmask occult brachial artery transection, emphasising the importance of serial neurovascular assessment and a low threshold for CT angiography despite initially reassuring vascular findings.

Conclusion Elbow dislocations may be associated with catastrophic neurovascular injury even when initial vascular findings appear reassuring. Progressive vascular deterioration following reduction mandates serial neurovascular reassessment and a low threshold for CT angiography. Successful limb salvage requires coordinated staged vascular, orthopaedic and hand surgical reconstruction to restore limb perfusion, stability and function.

46

The Femoral Head Direct Anterior Approach for Pipkin I-II Fractures: Surgical Technical Note with Preliminary Outcomes

Xin Wang, Xi Chen, Chuanghuan Liu, Zheng Wang, Leikai Zhu
Zhongnan Hospital of Wuhan University CHINA

Introduction / Objective Controversy persists regarding the ideal surgical exposure for Pipkin type I–II femoral head fractures. The classic Smith-Petersen (S-P) anterior approach involves substantial soft tissue stripping and a notable risk of heterotopic ossification (HO). The femoral head direct anterior approach (FH-DAA) creates a more medial anterior surgical window suitable for anterior and anteromedial fracture fragments. This study aimed to compare clinical and radiographic outcomes of these two techniques.

Materials & Methods This retrospective study included 15 consecutive patients with closed Pipkin I–II fractures treated with open reduction and internal fixation between 2017 and 2024, with 8 patients managed via FH-DAA and 7 via the S-P approach. Primary outcomes were femoral head avascular necrosis (AVN) and Brooker-classified HO. Secondary measures encompassed Harris Hip Score (HHS), reduction maintenance, perioperative data and postoperative complications. Statistical analyses were exploratory due to the small sample population.

Results / Discussion The FH-DAA group had significantly shorter surgery duration, less intraoperative blood loss, less fluoroscopy usage, smaller incisions and shorter hospital stays ($P < 0.05$). No intraoperative adverse events or transfusions occurred in this cohort. At a mean 30-month follow-up, patients receiving FH-DAA obtained better HHS and 100% persistent anatomical reduction. No AVN, post-traumatic arthritis, fixation failure, reoperation or neurological injury was observed, alongside a lower HO incidence.

Conclusion Observed intergroup differences are exploratory owing to limited sample size and selection bias. Further large-scale multicenter studies are required to confirm the advantages of FH-DAA.

47

Comparison of the Direct Anterior Approach and Conventional Anterolateral Approach for Coronoid Process Fractures: A Retrospective Cohort Study

Xin Wang, Xi Chen, Chuanghuan Liu, Leikai Zhu, Zheng Wang
Zhongnan Hospital of Wuhan University CHINA

Introduction / Objective Surgical exposure of coronoid process fractures requires balancing adequate visualization with the risk of soft-tissue injury, particularly when balancing exposure against iatrogenic soft-tissue injury. The conventional anterolateral approach (ALA) provides reliable visualization but typically requires manipulation of the median nerve and brachial artery. A direct anterior approach (DAA) through the pronator teres–flexor carpi radialis interval has been increasingly used in our practice as a less invasive option.

Materials & Methods 97 Patients who underwent open reduction and internal fixation for coronoid process fractures between August 2014 and November 2023 were retrospectively reviewed. Patients were divided into a DAA group and a conventional ALA group according to the surgical approach used. Demographic data, fracture characteristics, operative variables, radiographic union, range of motion, Mayo Elbow Performance Score, and complications were compared between groups.

Results / Discussion A total of 97 patients were included (DAA: 55; ALA: 42). Baseline characteristics were comparable. All fractures achieved union. The DAA was associated with a shorter incision and reduced anterior soft-tissue dissection, without routine exposure of the median nerve or brachial artery. At final follow-up, both groups showed similar elbow motion and MEPS. No neurovascular complications or fixation failures were observed in the DAA group.

Conclusion The DAA achieved similar fixation and functional outcomes to the ALA, with less surgical exposure. Rather than replacing established approaches, it appears most useful in selected anterior coronoid fractures where adequate reduction can be achieved through a limited interval.

48

Association Between Preoperative Radiographic Parameters for Spinopelvic Mobility and Functional Hip Angle in Total Hip Arthroplasty Candidates

Shi Ting Chiu, Hao Xuan Mark Yeo, Jing Sheng Shawn Seah, Cheryl Gatot, Sheng Xu, Liu Xuan Eric, Ming Han Lincoln Liow, Keng Jin Darren Tay, Seng Jin Yeo, Hee Nee Pang
Singapore General Hospital SINGAPORE

Introduction / Objective Spinopelvic mobility influences functional acetabular orientation which may affect dislocation rates and clinical outcomes following total hip arthroplasty (THA). However, there is a lack of evidence describing the relationship between preoperative spinopelvic mobility and the functional angle of the hip, represented by the combined sagittal index (CSI). Thus, this study aimed to evaluate the relationship between preoperative radiographic parameters for spinopelvic mobility as well as functional angle of the hip.

Materials & Methods A total of 84 patients who underwent unilateral THA for hip osteoarthritis or avascular necrosis between January 2022 and December 2024 were included in this study. Mean age was 67.2 years, 23 patients (27.4%) were male while 35 patients (41.7%) had pre-existing degenerative lumbar spine pathology. Preoperative standing and seated lateral spinopelvic radiographs of included patients were retrospectively reviewed. Spinopelvic mobility was defined by changes in sacral slope (Δ SS), spinopelvic tilt (Δ SPT), and anterior pelvic plane tilt (Δ APPT) between seated and standing positions. Functional hip orientation was assessed using absolute CSI in standing position (CSIs_{stand}) and seated (CSIs_{seated}) positions. Pearson correlation analysis was performed to evaluate the relationship between the two groups of radiographic parameters.

Results / Discussion Across the 84 patients who underwent preoperative spinopelvic radiograph assessment, Δ SPT demonstrated significant positive correlation with absolute CSIs_{stand} ($r=0.542$, $p<0.001$), while Δ SS demonstrated significant positive correlation with absolute CSIs_{seated} ($r=0.579$; $p<0.001$). Δ APPT did not demonstrate significant correlation with CSIs_{stand} or CSIs_{seated}.

Conclusion Reduced preoperative spinopelvic mobility is significantly associated with poorer functional hip orientation in THA. In patients with preoperative spinopelvic stiffness, patient-specific surgical planning and optimisation of component positioning, with consideration for a narrower 'safe' CSI window, is crucial to reduce instability risk.

49

ERAS Outcomes Following Total Knee Arthroplasty With Ketorolac

Rachel Koh, Guang Xiang Tang, Tong Leng Tan, Wuchean Lee, Lynn Thwin
Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Multimodal analgesia is a core component of enhanced recovery after surgery (ERAS) pathways, with non-steroidal anti-inflammatory drugs commonly incorporated to optimise pain control and facilitate early mobilisation. This study evaluates whether the addition of ketorolac to local infiltration analgesia (LIA) in orthopaedic surgery improves postoperative pain control and functional recovery, and to assess its effects on length of hospital stay and the incidence of renal adverse events.

Materials & Methods A retrospective cohort of 722 patients undergoing surgery with local infiltration analgesia (LIA) with or without ketorolac within a standardised ERAS pathway was analysed. Patients were grouped into ketorolac LIA ($n = 663$) and non-ketorolac LIA ($n = 131$). Outcomes included pre-operative and three-month Oxford Knee Scores (OKS), length of stay (LOS), and post-operative complications. As continuous variables were non-normally distributed (Shapiro–Wilk, $p<0.05$), between-group comparisons used Mann–Whitney U tests.

Results / Discussion There were no significant differences in pre-operative OKS (26.1 vs 27.2; $U = 3882$, $p = 0.055$), 3-month OKS (37.2 vs 36.5; $U = 4059$, $p = 0.236$), or LOS (3.79 vs 3.51 days; $U = 4113$, $p = 0.334$). Mean OKS improvement was lower in the ketorolac group (9.27 ± 8.84) than in the non-ketorolac group (11.2 ± 8.23), demonstrating a statistically significant between-group difference ($U = 3819$, $p = 0.029$), although this did not meet thresholds for minimal clinical significance. Day-0 mobilisation was more frequent with ketorolac (50.5% vs 44.2%). Postoperative complications were more frequent in the ketorolac group (21.6%) than in the non-ketorolac group (19.5%). Acute kidney injury was uncommon and occurred in 2.56% of ketorolac cases versus 1.53% without ketorolac.

Conclusion Ketorolac in LIA was not associated with clinically meaningful improvements in OKS or LOS. Despite earlier mobilisation, overall benefits were modest. Prospective studies are needed to confirm these findings.

50

Navigating Prominent Medial Tarsal Anatomy In Fourth-Generation Minimally Invasive Hallux Valgus Correction: Technical Considerations And Strategies

Wei Xiang Ng, Ambrose Li
NATIONAL HEALTHCARE GROUP SINGAPORE

Introduction / Objective Hallux valgus is a common forefoot deformity causing significant functional impairment and pain. Fourth-Generation Minimally Invasive Hallux Valgus Surgery with Metaphyseal Extra-Articular Transverse and Akin Osteotomy (META) represents an evolving surgical approach. Anatomical variations such as a prominent medial cuneiform and navicular may complicate standard guidewire placement, and technical strategies to address these intraoperative challenges have not been well described in the literature.

Materials & Methods We report a case of severe hallux valgus in a 59-year-old female with a pre-operative hallux valgus angle (HVA) of 47.1° and intermetatarsal angle (IMA) of 21.7° and interphalangeal angle (IPA) from 4.4°, complicated by an overriding second toe deformity with claw toe configuration. Intraoperative findings revealed a short first metatarsal with a small metatarsal head and a relatively long second metatarsal. The patient underwent META osteotomy and second toe correction with distal metatarsal metaphyseal osteotomy (DMMO) and dorsal and plantar soft tissue releases. Technical strategies employed to address guidewire placement difficulties included forefoot abduction, the Joystick technique, and entry point widening with a larger diameter K-wire.

Results / Discussion The definitive fixation with two 4mm cannulated screws followed thereafter, with length 52mm and 42mm. This large-diameter dual-screw configuration was selected to maximise the rigidity of the fixation construct and resist rotational and translational forces during the post-operative weight-bearing period. Post-operative radiographs demonstrated excellent correction, with HVA reduced from 47.1° to 1.9°, IMA from 21.7° to 5°, and interphalangeal angle (IPA) from 4.4° to 0°.

Conclusion Prominent medial tarsal anatomy, specifically of the medial cuneiform and navicular, can preclude standard medialisation of the guidewire despite achieving 100% translation at the osteotomy site. The technical strategies described in this report offer practical solutions to this intraoperative challenge and may assist surgeons performing minimally invasive hallux valgus correction in similar anatomical scenarios.

51

Global Research Hotspots and Trends in Stem Cell Therapy for Rotator Cuff Injuries

Xiong Wang, Biao Cheng

Department of Sports Medicine, Tongji Hospital, School of Medicine, Tongji University, Shanghai, CHINA

Introduction / Objective Rotator cuff injuries are a major cause of shoulder pain and dysfunction, profoundly affecting patient quality of life. Although surgical repair aims to restore tendon integrity and alleviate symptoms, higher retear rates and poor intrinsic healing capacity often lead to biomechanically inferior scar tissue, presenting significant clinical challenges. Stem cell therapy has emerged as a promising biological strategy for rotator cuff regeneration. This study provides a comprehensive bibliometric analysis to map the current research landscape, highlight key hotspots, and identify emerging frontiers in this area.

Materials & Methods Publications concerning stem cell therapy for rotator cuff injuries were retrieved from the Web of Science Core Collection (WoSCC). Quantitative bibliometric and visualization analyses of publication output, institutional networks, core journals, author impact, thematic evolution, and research trends were conducted using VOSviewer, CiteSpace, and Microsoft Excel.

Results / Discussion A total of 927 publications were included, exhibiting an upward trajectory in annual publication volume. The United States and China led global research output and financial support. Shanghai Jiao Tong University was the most prolific institution, and the American Journal of Sports Medicine was the top publishing journal. The article "Biologics for tendon repair" holds the highest citation count and provides a comprehensive understanding of tendon biology and current treatment strategies. The authors with the highest publication output and citation frequency are Mazzocca, Augustus D., and Rodeo, Scott A., respectively. Keyword co-occurrence and burst analysis revealed a shift from fundamental concepts like "mesenchymal stem cells" and "rotator cuff repair" toward cutting-edge frontiers, including "scaffolds," "tendon stem cells," and "tenogenic differentiation."

Conclusion Stem cell therapy for rotator cuff injuries represents a rapidly evolving research domain. This bibliometric analysis delineates the intellectual structure and research trajectory of the field, highlighting tissue engineering, cellular lineage specification, and scaffold design as critical future directions. Global collaborative efforts will be crucial to accelerating clinical translation.

52

Anaerobes in Late-Onset Prosthetic Joint Infection (PJI) and Colorectal Carcinoma

Shi Ting Chiu, Mann Hong Tan, Seo Kiat Goh, Xinyun Audrey Han, Hee Nee Pang, Seng Jin Yeo, Sheng Xu, Eric Xuan Liu

Singapore General Hospital SINGAPORE

Introduction / Objective Late-onset anaerobic prosthetic joint infection (PJI) is uncommon but may indicate underlying, previously asymptomatic colorectal malignancy. While the association between *Streptococcus bovis* group (SBG) bacteremia and colorectal cancer is well established, links between anaerobic PJIs and colorectal neoplasia are rarely reported. Anaerobic organisms originating from the gastrointestinal tract may translocate via hematogenous route, and their presence in PJI should prompt clinicians to consider occult colorectal pathology.

Materials & Methods All periprosthetic arthroplasty infection cases were reviewed between 2015 to 2025. Clinical records, diagnostic findings, microbiological data, and treatment outcomes were analyzed.

Results / Discussion Three female patients (mean age 76.3 years) presented with late-onset PJI occurring at least 5 years after primary total knee arthroplasty. Causative organisms included *Bacteroides fragilis*, *Morganella morganii*, and *Klebsiella pneumoniae*. All patients underwent revision surgeries which are namely two single-stage revision surgeries and one debridement, antibiotics and implant retention (DAIR) procedure. Cross-sectional computed tomography imaging of the abdomen and pelvis (CT-AP) performed to evaluate hematogenous sources of infection consistently revealed previously undiagnosed colorectal malignancy. One patient had additional metastatic disease. Postoperative complications included one case of pulmonary embolism; no other major complications were observed.

Conclusion Anaerobic PJIs are rare, and their association with colorectal malignancy is not well established. These cases highlight the importance of evaluating potential gastrointestinal sources, including occult colorectal cancer, in patients presenting with late-onset anaerobic PJI.

53

Novel Low-Profile Intra-Incisional Pin Guide Improves Accuracy in Robotic TKA: A Sawbone Study

Alexander Shao-Rong Pang, Matthew Song Peng Ng, Derek F. Amanatullah, Kuan-Lin Chen, Elliot Eng Kai Jie, Glen Liao Zi Qiang

Yong Yoo Lin School of Medicine, National University of Singapore SINGAPORE

Introduction / Objective Robotic-assisted total knee arthroplasty (rTKA) success depends on stable and accurate tracker pin placement. Freehand tibial tracker pin insertion may be inconsistent and may contribute to avoidable workflow variability or pin-related complications. We developed a novel low-profile intra-incisional tibial pin guide jig to standardize trajectory and positioning while supporting minimally invasive workflows.

Materials & Methods Three fellowship-trained arthroplasty surgeons with varying rTKA experience performed tibial pin placement on sawbones using conventional freehand and jig-assisted techniques in a randomized crossover design. Eight standardized insertion trajectories specifying predefined combinations of insertion angle and distance were performed, each repeated thrice per surgeon, yielding 72 placements per technique. Blinded assessors measured angular deviation(°) and linear deviation(mm) from the ideal trajectory. Successful placement was defined as $\leq 3^\circ$ angular deviation and ≤ 4 mm positional deviation; “perfect” placement required both criteria. Power analysis assuming an effect size of 0.5, an alpha level of 0.05, and a power of 80% showed that a minimum sample size of eight per group was required.

Results / Discussion Jig-assisted placement significantly outperformed free-hand. Mean angular deviation improved from 6.62° (95%CI 5.71-7.54) to 1.31° (95%CI 1.08-1.53) ($p<0.001$), with 100% of jig-assisted pins meeting angular accuracy thresholds versus 23.6% free-hand. Mean positional deviation decreased from 4.84mm (95%CI 3.80-5.88) to 2.32mm (95%CI 1.74-2.90) ($p<0.001$) with higher distance accuracy success rates using the jig (88.9% vs 62.5%). Combined “perfect” pin placement was achieved in 88.9% of jig-assisted cases versus 13.9% free-hand ($p<0.001$). Surgeon experience significantly influenced free-hand accuracy but not jig-assisted performance.

Conclusion The novel pin guide jig significantly improves tibial pin accuracy and reproducibility of tibial pin placement in rTKA, effectively mitigating surgeon-dependent variability, shortening the robotic learning curve and reducing the risk of pin-related complications.

55

A Novel Localized Coronal Phenotype Classification Predicts Compartment-Specific Meniscal Injury from Standard Knee Radiographs

Jeryl Sik, Bryan Chong, Alexander Shao-Rong Pang, Ethan Tew, Glen Liao
NUHS SINGAPORE

Introduction / Objective The Coronal Plane Alignment of the Knee (CPAK) classification uses hip-knee-ankle alignment (HKA) and joint line obliquity (JLO) to describe knee geometry, but measurement traditionally requires long-leg radiographs rarely available acutely. We hypothesized that HKA and JLO independently predict compartment-specific meniscal injury. The purpose was to test this using a novel developed classification (LCPAK) classification in relation to ACL tear, medial meniscal (MM) tear, and lateral meniscal (LM) tear.

Materials & Methods Cohort study included 326 patients undergoing arthroscopy for meniscal or ligamentous pathology at two institutions between 2022 and 2024, classified into nine LCPAK phenotypes from standard weight-bearing radiographs. Primary outcomes were ACL tear, MM tear, and LM tear, excluding surface degeneration. A grid decomposition approach held one LCPAK dimension constant while varying the other to isolate each parameter's effect. Multivariable logistic regression was adjusted for age, sex, race, and body mass index; MM and LM models were additionally adjusted for ACL status.

Results / Discussion Mean age was 36.8 years; 68.4% were male and 86.2% had Apex Distal JLO. ACL tears occurred in 49.1%, MM tears in 60.4%, and LM tears in 35.6%. Shifting JLO from Apex Distal to Neutral within fixed HKA raised MM tear rates from 58.1% to 88.2% (adjusted OR, 5.91; $P = .027$). Holding JLO constant and varying HKA produced no change in MM tear rates ($P = .166$). JLO shift didn't affect LM tear rates. Valgus HKA was associated with lower MM tear risk (adjusted OR, 0.42; $P = .020$) and higher LM tear risk than Varus (adjusted OR, 2.36; $P = .016$) and Neutral HKA (adjusted OR, 2.10; $P = .045$). No LCPAK phenotype, JLO tier, or HKA group predicted ACL tear (all $P > .07$).

Conclusion JLO, not coronal alignment, predicts medial meniscal tear risk, while HKA alignment governs lateral meniscal vulnerability. LCPAK separates these dimensions using standard radiographs.

56

Effect of Age on Clinical Outcomes and Recovery Trajectories Following Arthroscopic Rotator Cuff Repair in an Asian Population: A Comparative Analysis of 3 Age Groups

Yen Chin Jeremy Tan, Shi Ting Chiu, Andrew Hwee Chye Tan
Singapore General Hospital SINGAPORE

Introduction / Objective Advanced age is associated with poorer tendon quality, influencing post-operative clinical outcomes following arthroscopic rotator cuff repair (ARCR). However, the influence of a patient's age on functional recovery and the trajectory of improvement in an Asian population remains not fully explored. This study aims to evaluate patient-reported outcome measures (PROMs) preoperative, 6-months (6m) and 2-years (2y) post-operatively, stratified according to patient's age.

Materials & Methods 136 Asian patients who underwent ARCR were stratified into 3 age-groups: <60 years ($n=54$), 60-70 years ($n=53$), and >70 years ($n=29$). PROMs included CONS, UCLA Shoulder Score, OSS, VAS pain score, ROM forward flexion (FF) and abduction, recorded preoperatively, at 6m and 2y after surgery. Within each age group, paired t-tests were conducted for preoperative-6m and 6m-2y outcomes, followed by comparisons across the 3 age groups using one-way ANOVA. Multivariate regression analysis was performed to identify independent predictors of outcome.

Results / Discussion All three age-groups independently demonstrated significant improvement from baseline-6m and 6m-2y across nearly all PROMs ($p<0.05$). Exceptions included FF and abduction for baseline-6m in the 60-70 year group. One-way ANOVA found no significant difference between all three age-groups ($p>0.05$). Multivariable linear regression, modelling age as a continuous variable, adjusted for gender, smoking, and tear size, identified older age as an independent predictor of smaller 2y improvement in CONS, UCLA, OSS, and ROM ($p<0.05$), but not in VAS ($p=0.066$).

Conclusion Older Asian patients can expect meaningful and substantial benefit from ARCR, though the degree of functional gain may be somewhat attenuated with advancing age. Increasing age, treated as a continuous variable, was independently associated with smaller improvements in most PROMs by 2y. Our findings support the role of ARCR in the treatment of patients with symptomatic RC tears regardless of age-groups in the Asian population with age-specific counselling pertaining to the expected recovery trajectory being crucial.

57

Clinical Outcomes Following Endoscopic Lumbar Discectomy Versus Endoscopic Lumbar Decompression: A Single-Tertiary Center Retrospective Cohort Study

Thayaparren Rajendram, Anand Kumar Ramalingam, **Jonathan Yeo**, Zhihong Chew, Leong Dalun, Andy Yeo Kuei Siong, Dinesh shree Kumar
Changi General Hospital SINGAPORE

Introduction / Objective Endoscopic lumbar spine surgery is an established minimally invasive treatment for lumbar prolapsed intervertebral disc (PID) and degenerative lumbar spine disorders (DDD). Although favourable outcomes have been reported for both conditions, direct comparative evidence remains limited. This study compared the clinical outcomes of endoscopic lumbar discectomy for PID and endoscopic lumbar decompression for DDD.

Materials & Methods A retrospective study included 72 consecutive patients who underwent endoscopic lumbar spine surgery between 2022 and 2025. Thirty-five patients underwent endoscopic lumbar discectomy for PID, and 37 underwent endoscopic lumbar decompression for DDD. Demographic characteristics, operative level, postoperative symptom improvement, residual symptoms, patient satisfaction, neuromodulatory medication use, complications, length of hospital stay, and reoperation rates were compared between groups using descriptive and comparative statistical analyses.

Results / Discussion L4–L5 was the most commonly treated level in both groups. At 6 months, complete resolution of radicular symptoms was achieved in 27 patients (77.1%) after discectomy and 28 patients (75.7%) after decompression. Residual radicular pain occurred in 4 patients (11.4%) and 3 patients (8.1%), respectively, whereas residual back pain was reported in 4 patients (11.4%) and 6 patients (16.2%). Among patients with preoperative back pain, improvement was observed in 87.5% of the discectomy group and 81.3% of the decompression group. Overall patient satisfaction was 82.9% and 75.7%, respectively. Intraoperative dural tears occurred in one patient in each group (2.9%). In addition, one patient (2.7%) in the decompression group developed a superficial surgical site infection. Reoperation was required in 2 patients (5.7%) after discectomy and 3 patients (8.1%) after decompression. When comparing the responses of the two groups for the above-discussed variables, significant differences were not observed ($P>0.05$).

Conclusion Endoscopic lumbar discectomy and endoscopic lumbar decompression both achieved excellent 6-month clinical outcomes, with high rates of pain relief and patient satisfaction, and low rates of complications and reoperation.

58

Does Emergency Department to Ward Admission Time Affect Hip Fracture Outcomes within a Multidisciplinary Care Pathway?

Chung Ean Lo, Bryan Ce-Jie Peh, Yew Lok Woo, William Zhan Xia, Seo Kiat Goh, Tet Sen Howe, Joyce Suang Bee Koh, Kenny Xian Khing Tay
Singapore General Hospital Orthopedic Surgery SINGAPORE

Introduction / Objective Early surgical fixation of hip fractures is associated with improved outcomes. However, occasional bed shortages result in delays from the ED to the ward, potentially delaying surgery. At our institution, the hip fracture pathway is initiated in the ED, where investigations and perioperative preparation begin. This study evaluated the effectiveness of the current hip fracture pathway by examining the association between ED to ward duration and outcomes, including time to surgery, length of stay, and 30-day readmission.

Materials & Methods A retrospective study was conducted on hip fracture patients who underwent surgery in a single tertiary hospital between January 2017 and June 2020. Collected variables included patient demographics, ED to ward duration, type of fracture, time to surgery, length of stay (≤ 10 days or >10 days), and 30-day readmission. Binary logistic regression was used to evaluate the association between ED-to-ward time and outcomes, including time to surgery, length of stay, and 30-day readmission, adjusting for age, gender, and type of fracture. Restricted cubic splines explored the associations between ED to ward duration and time to surgery.

Results / Discussion There were 1045 patients (mean age: 79.48 ± 8.57 years). The median time from ED to ward was 1.56 hours (IQR 1.13 - 2.19). In multivariable analysis, time from ED to ward was not associated with prolonged hospitalisation (OR 1.129, 95% CI 0.998 - 1.277, $p=0.055$) or 30-day readmission (OR 0.994, 95% CI 0.806 - 1.227, $p=0.959$). Restricted cubic spline analysis did not identify any statistically significant non-linear association or inflexion point between ED to ward duration and time to surgery ($p=0.267$).

Conclusion Duration from ED presentation to ward admission was not associated with delayed time to surgery, prolonged length of stay, and increased 30-day readmission. This suggests that the current structured multidisciplinary hip fracture pathway is effective. Perioperative management of hip fractures must commence in the ED.

59

Factors Affecting Length of Stay in Patients Receiving Total Knee Replacements Under Spinal Anaesthesia

Jeryl Sik, Haoyang Chen, Matthew Song Peng Ng, Elizabeth Liao, Glen Liao
NUHS SINGAPORE

Introduction / Objective Spinal anaesthesia is widely used in Enhanced Recovery After Surgery (ERAS) protocols for patients undergoing unilateral primary total knee arthroplasty (TKA). However, there remains limited consensus regarding the patient, anaesthetic, and surgical factors associated with delayed postoperative discharge. This study investigated predictors of postoperative length of stay (LOS) in patients undergoing TKA under spinal anaesthesia with intrathecal bupivacaine.

Materials & Methods This retrospective cohort included patients undergoing unilateral conventional or robotic TKA under spinal anaesthesia at a single tertiary centre from January to July 2023. Patients undergoing additional procedures, unicompartmental arthroplasty, receiving other intrathecal agents, or requiring conversion to general anaesthesia were excluded. The primary outcome was time from the end of surgery to hospital discharge. Univariable and multivariable linear regression analyses were performed to evaluate patient, procedural, and anaesthetic predictors of LOS. Prespecified subgroup analyses were also conducted.

Results / Discussion Among 148 patients (mean age 68.8 years; 100 females, 67.6%), 66 (44.6%) received plain bupivacaine while 82 (55.4%) received hyperbaric bupivacaine. Subgroup analyses demonstrated that higher plain bupivacaine doses were associated with longer LOS among ASA I-II patients discharged home ($n=46$; adjusted $p=0.026$) and among patients with a T10-L1 sensory block level ($n=34$; adjusted $p=0.047$). In multivariable regression analysis, neither bupivacaine formulation nor dose was associated with LOS. Taller patient height (-3.22 hours per centimetre increase, 95% CI -567 to -77.4; $p=0.010$) and those discharged to home rather than to community hospitals (-25.6 hours, 95% CI -48.9 to -2.20; $p=0.032$) were associated with shorter LOS.

Conclusion Neither bupivacaine formulation nor dose was associated with postoperative LOS in the overall cohort. However, higher doses of plain bupivacaine were associated with longer LOS in selected patient subgroups. These findings will require confirmation in larger prospective studies.

60

Point-of-Care Ultrasound Reduces Diagnostic Delay and Healthcare Costs for Paediatric Ganglion Cysts in Orthopaedic Outpatient Clinics

Shaoen David Sim, Ahmad Naufal, Ade Tan, Felicia Ang, Mohammad Ashik Zainuddin, Lay Ee Chew, Kenneth Pak Leung Wong
KKH SINGAPORE

Introduction / Objective Ganglion cysts are the most common benign soft tissue masses of the hand and wrist in paediatric patients. At many institutions, diagnosis relies on formal ultrasonography performed by centralized radiology services, resulting in delays between initial consultation and diagnostic confirmation. At our institution, patients with suspected ganglion cysts often wait several weeks for radiology-performed ultrasound, leading to delayed diagnosis, additional clinic visits, and outpatient workflow inefficiencies. This study aimed to reduce diagnostic delay for ganglion cysts to less than one day for patients by implementing in-clinic point-of-care ultrasound (POCUS).

Materials & Methods This study compared diagnostic timelines before and after introducing outpatient POCUS performed by trained orthopaedic clinicians. Forty consecutive paediatric patients presenting with wrist swelling were recruited. Baseline data were collected for the first 20 patients (January 2023–August 2024), and post-intervention data were collected prospectively for the next 20 patients (September 2024–April 2025). Outcome, process, and balancing measures were predefined. Portable ultrasound machines were deployed in orthopaedic outpatient clinics, enabling same-day ultrasound assessment during the initial consultation for eligible patients.

Results / Discussion Median time from initial consultation to diagnosis decreased from 38.5 days pre-intervention to 0 days post-intervention. Mean scan duration also decreased from 32 minutes with radiology-performed ultrasound to 10 minutes with point-of-care ultrasound. All post-intervention patients received a same-day diagnosis without need for repeat imaging. No adverse events or misdiagnoses occurred. Estimated institutional cost savings were \$278 per avoided subsidized ultrasound scan and repeat outpatient visit, with additional savings to patients and intangible benefits from reduced burden on outpatient and radiology services.

Conclusion Point-of-care outpatient ultrasound is a safe, effective, and efficient strategy for reducing diagnostic delay in patients with suspected ganglion cysts. This intervention improved patient-centred care and streamlined outpatient workflow while maintaining diagnostic accuracy without compromising safety.

61

Seamless Ward Initiative to Fast Track (SWIFT) Discharge Protocol: Reducing Postoperative Ward Stay by Up to 74% After Emergency Paediatric Upper Limb Trauma Surgery

Wayne Yong Xiang Foo, David Shaoen Sim, Andrew Chia Chen Chou, Favian Ding Jie Ng, Arjandas Mahadev, Mohammad Ashik Zainuddin, Kenneth Pak Leung Wong
KKH SINGAPORE

Introduction / Objective Emergency upper limb trauma surgery in children is traditionally followed by at least six hours of postoperative monitoring before discharge. While shorter than adult admissions, prolonged pediatric hospital stays add situational, financial, and emotional burden to families, alongside increased healthcare costs. Early discharge protocols, including those based on enhanced recovery after surgery (ERAS) principles, have predominantly been studied and applied to elective procedures. This study is unique in examining the feasibility of early discharge for emergency upper limb trauma surgery. We hypothesized that early discharge (<6 hours postoperatively) could reduce admission duration and costs without increasing surgical complications.

Materials & Methods Ethics approval was obtained from our institution's review board. We conducted a prospective study at an Asian tertiary paediatric hospital (September 2022–December 2023), implementing the Seamless Ward Initiative to Fast Track (SWIFT) discharge protocol—a multidisciplinary pathway involving orthopaedic, anaesthetic, nursing, and pharmacy teams. Patients meeting inclusion criteria for emergency upper limb trauma surgery were offered early discharge following defined clinical criteria (vital sign stability, intact neurovascular status, adequate pain control, and no anaesthetic complications). Outcomes measured included postoperative ward stay duration, bed vacancy time, ward charges, and complication/readmission rates, compared against standard-protocol controls.

Results / Discussion 37 SWIFT patients were compared with 32 standard-protocol patients. Median postoperative ward stay decreased from 509 to 275 minutes (43% reduction) for morning surgeries and from 898 to 239 minutes (74% reduction) for evening surgeries. No readmissions or complications occurred following SWIFT implementation, and all patients recovered premorbid function.

Conclusion The SWIFT protocol demonstrates that early discharge after emergency paediatric upper limb trauma surgery is feasible and safe, significantly reducing ward stay duration and healthcare costs without compromising outcomes. These findings support value-driven care and the broader application of early recovery principles beyond elective surgery, warranting further study in other paediatric surgical contexts.

62

“Powder and Pressure”: Topical Vancomycin Plus Closed-Incision Negative-Pressure Wound Therapy (ciNPWT) to Prevent Infection After Hip Surgery—A Systematic Review

sumanth kumar GERA, Janvi Tiwari, Wern Khai Matthew Chang, Wen Ting Celest Seah, Thirukumaran Kamaraj, yongsheng chen
NATIONAL UNIVERSITY HEALTH SCIENCES, NG TENG FONG GENERAL HOSPITAL SINGAPORE

Introduction / Objective Surgical site infection (SSI) continues to be a significant postoperative concern in hip surgery. Both topical vancomycin powder (TVP) and closed incision negative pressure wound therapy (ciNPWT) have individually shown promise in reducing wound-related complications; however, data supporting their use in combination remain sparse.

Materials & Methods A systematic search was conducted across PubMed, Embase, Scopus, and the Cochrane Library, covering literature published between January 2010 and May 2026. Studies assessing the use of TVP and ciNPWT in primary or revision hip arthroplasty and hip fracture surgery were included. The main outcomes of interest were SSI and periprosthetic joint infection, while secondary endpoints encompassed wound dehiscence, seroma formation, reoperation rates, hospital length of stay, and adverse effects related to treatment.

Results / Discussion A total of 32 studies encompassing over 18,000 patients were analyzed. TVP demonstrated a reduction in deep SSI, especially among high-risk patient populations, with no clinically meaningful systemic toxic effects. ciNPWT was effective in decreasing superficial wound complications, including prolonged wound drainage, hematoma formation, and dehiscence. Preliminary evidence suggested that using both interventions together may yield greater reductions in wound complications and infection rates when compared to standard dressings. No notable rise in vancomycin resistance or nephrotoxicity was documented, though occasional occurrences of sterile drainage and seroma were noted. Considerable variability across studies was observed.

Conclusion TVP and ciNPWT appear to be beneficial supplementary strategies for minimizing postoperative wound complications following hip surgery, with particular value in high-risk patients. Their combined application may offer additive advantages; however, robust comparative data are currently lacking. The development of standardized clinical protocols and the conduct of large-scale, multicenter trials are necessary prior to widespread routine implementation.

Metastatic Breast and Prostate Cancer: Truly Good Candidates for Palliative Spine Surgery?

Christian Tan, Yeong Huei Ng, Ou Yang Youheng, Reuben Soh
SGH SINGAPORE

Objective To evaluate 90-day and 1-year mortality following palliative spine surgery in metastatic breast and prostate cancer, compare outcomes between cancer types and hormone-defined subgroups, and identify clinical predictors of survival.

Background: Palliative spine surgery aims to relieve pain and preserve neurological function, yet variable postoperative survival complicates patient selection. Conventional prognostic tools often overlook tumour biology and hormonal status. Improved risk stratification is needed to identify patients deriving durable benefit and avoid overtreatment.

Materials & Methods Retrospective review of 106 patients (66 breast, 40 prostate) undergoing palliative spine surgery (2003-2022). Endpoints were 90-day and 1-year mortality, stratified by primary cancer and hormone status. Clinical predictors were identified through univariate analysis.

Results / Discussion Overall 90-day and 1-year mortality were 10.4% and 32.1%, respectively. Breast cancer patients had lower 1-year mortality than prostate cancer patients (22.7% vs. 47.5%, $p=0.008$). Hormone-dependent breast cancer carried the most favourable prognosis (1-year: 20.3%), while hormone-independent prostate cancer had the poorest (1-year: 75.0%, $p=0.018$). Across the overall cohort, thrombocytopenia and hypoalbuminaemia predicted 90-day mortality, while hypoalbuminaemia, anaemia, lymphopenia and visceral metastases predicted 1-year mortality. By cancer type, 1-year mortality was associated with hypoalbuminaemia and visceral metastases in breast cancer, and with anaemia in prostate cancer. In subgroup analysis, 1-year mortality was associated with hypoalbuminaemia and visceral metastases in hormone-dependent breast cancer, and with low BMI in hormone-dependent prostate cancer.

Conclusion Surgical candidacy should be guided by expected survival. Breast cancer patients, particularly with hormone-dependent disease, are favourable candidates. Conversely, the high mortality in hormone-independent prostate cancer suggests aggressive surgery may constitute overtreatment. Early mortality is associated with perioperative vulnerability, whereas longer-term survival correlates with systemic disease burden and physiological reserve. Clinicians should integrate hormonal status and objective biomarkers to optimise patient selection and reduce unnecessary surgical intervention.

Who Benefits from Spinal Metastases Surgery? A Three-Variable Risk Score and Treatment-Naive Synchronous Presentation

Christian Tan, Sunny Kim, Yeong Huei Ng, Ou Yang Youheng, Reuben Soh
SGH SINGAPORE

Objectives: To develop a simple preoperative score for predicting 90-day mortality following surgery for spinal metastases and determine whether treatment-naive synchronous presentation independently influences survival.

Background: Surgery for spinal metastases provides critical palliation but carries substantial perioperative risk. Existing prognostic tools are often complex with limited Southeast Asian validation. Whether treatment-naive patients presenting synchronously represent a distinct subgroup with more favourable outcomes remains unclear. Practical risk models based on routine preoperative variables may improve surgical selection.

Materials & Methods We retrospectively analysed 317 patients who underwent surgery for spinal metastases between 2003 and 2022. Two risk scores were developed: (1) a three-variable model assigning 1 point each for albumin <35 g/L, white blood cell count $>11 \times 10^9$ /L and visceral metastases (range 0-3), and (2) a blood-only model substituting neutrophil-to-lymphocyte ratio >5 for visceral metastases. Treatment-naive synchronous presentation was defined as spinal metastasis diagnosed within 3 months of primary cancer diagnosis without prior systemic therapy. Primary outcomes were 90-day and 1-year mortality, analysed via logistic regression and ROC analysis.

Results / Discussion Overall 90-day and 1-year mortality were 17.4% and 45.7%, respectively. The three-variable score demonstrated stepwise discrimination for 90-day mortality: 4.7%, 6.8%, 33.7%, and 44.4% for scores 0 through 3, respectively ($p<0.001$). Score ≥ 2 identified high-risk patients (36.3% vs 6.1% 90-day mortality) with AUC 0.762 (95% CI 0.695-0.829). The blood-only model performed comparably with AUC 0.711 (95% CI 0.644-0.778). Treatment-naive synchronous presentation was independently associated with lower 1-year mortality (31.4% vs 54.0%, $p<0.001$), with benefit consistent across all risk strata.

Conclusion A simple three-variable score effectively stratifies short-term postoperative mortality, with score ≥ 2 identifying high-risk candidates requiring enhanced perioperative support. Treatment-naive synchronous presentation identifies a favourable prognostic subgroup, suggesting disease timing influences surgical candidacy. These tools provide an accessible framework for preoperative triage in spinal metastasis surgery.

Does Lung Primary Necessarily Mean Poor Prognosis in Spinal Metastases?

Christian Tan, Yeong Huei Ng, Ou Yang Youheng, Reuben Soh
SGH SINGAPORE

Objectives: To identify predictors of mortality in lung cancer patients undergoing surgery for spinal metastases and develop a simple biomarker-based prognostic score.

Background: Lung cancer is the most common primary tumour in patients undergoing surgery for spinal metastases, yet outcomes are increasingly heterogeneous. Although female patients with lung cancer often demonstrate superior survival, whether this advantage persists in surgically treated spinal metastases remains unclear. Serum albumin and neutrophil-to-lymphocyte ratio (NLR), though readily available and prognostically valuable, remain underutilised.

Materials & Methods We retrospectively analysed 64 lung cancer patients undergoing surgery for spinal metastases (2003-2022). Primary outcomes were 90-day and 1-year mortality. Candidate predictors included sex, preoperative albumin and NLR. A 2-point risk score (albumin <35 g/L and NLR ≥ 6) was evaluated using logistic regression and ROC analysis.

Results / Discussion Overall 90-day and 1-year mortality were 21.9% and 51.6%. Female sex was strongly protective, with 90-day mortality of 8.1% versus 40.7% in males ($p=0.002$) and 1-year mortality of 40.5% versus 66.7% ($p=0.039$). Hypoalbuminaemia and elevated NLR independently predicted mortality at both timepoints. The biomarker score effectively stratified risk, with 90-day mortality of 4.3%, 20.7% and 58.3% for scores 0, 1 and 2 ($p=0.001$) and 1-year mortality of 26.1%, 58.6% and 83.3% ($p=0.003$). The score demonstrated good discrimination (AUC 0.778 for 90-day and 0.725 for 1-year mortality).

Conclusion Female sex and a simple albumin-NLR score effectively stratified survival after surgery for spinal metastases from lung cancer. Patients with score 0 had favorable outcomes supporting surgical candidacy, whereas those with score 2 had poor prognosis warranting non-operative or more selective management. These findings challenge the notion that lung primary uniformly confers poor surgical outcomes and provide practical tools for preoperative risk stratification.

66

Arthroscopic Latarjet using a 3 anterior portal technique

Cheryl Marise Peilin Tan, Timothy Wei Wen Teo, Juen Zhik Chan
Khoo Teck Puat Hospital SINGAPORE

Introduction / Objective Arthroscopic Latarjet is technically challenging with a steep learning curve. Several limitations include the risk of malposition of the coracoid bone block, the risk of screw fixation such as hardware failure and irritation, and the risk of neurological injury. Initial descriptions of the technique also describe several anterior portals, especially for the subscapularis split. The learning curve is steep, and it is associated with increased risks of complications when compared to open Latarjet procedure.

Materials & Methods This technique involves a simplified 3 anterior portal technique, with the portals lateral to the coracoid process and conjoint tendon, reducing the risk of iatrogenic neurovascular injury.

Results / Discussion Tunnels are created in glenoid and coracoid process using specific glenoid and coracoid drill guides. This improves coracoid positioning, while reducing the risk of neurovascular injury. The coracoid process is also prepared extra-articularly after osteotomy for better visualization, control and efficiency.

Conclusion This simplified arthroscopic Latarjet technique is safe and reproducible in treatment of recurrent anterior shoulder dislocations.

67

Early Clinical Experience with 3D-Printed Patient-Specific Bioresorbable Scaffold for Reconstruction of Large Bone Defects in the Foot and Ankle : A Case Series

Joshua K, Choon Chiet Hong
National University Hospital, Foot and Ankle Department SINGAPORE

Introduction / Objective Large bone defects in the foot and ankle following trauma, infection, or oncologic resection present significant reconstructive challenges. Restoration of structural integrity is particularly demanding given the biomechanical demands of weightbearing and gait. Various reconstructive techniques have been described, each associated with inherent limitations and complications. This case series reports our early clinical experience using 3D-printed patient-specific bioresorbable scaffolds for the management of large bone defects secondary to trauma or infection.

Materials & Methods Four patients with large bone defects of the foot and ankle following debridement and resection of dead/infected bone underwent reconstruction using a 3D-printed patient-specific bioresorbable polycaprolactone–tricalcium phosphate (PCL–TCP) scaffold (aXOpore®, Osteopore International Pte Ltd, Singapore). The scaffolds were designed based on computed tomography (CT) imaging data to achieve patient-specific anatomical conformity and were fabricated using PCL–TCP with adjustable porosity to accommodate autogenous or allogeneic bone grafts, thereby promoting osseointegration while maintaining mechanical stability. Patient demographics, primary pathology, intraoperative findings, defect size, scaffold porosity, radiographic integration, bony union, and complications were analyzed.

Results / Discussion Four patients (age range, 28, 33, 60 and 61 years) with large bone defects of the foot and ankle were included. All patients received concomitant autogenous iliac crest bone grafts. Satisfactory scaffold–bone integration was observed in all cases, without evidence of scaffold failure. One patient with a 10-cm defect developed a postoperative vascular insult resulting in epidermal necrosis of the toes. This resolved with local wound care and topical dressings, although wound dehiscence required prolonged dressing management before complete healing. No major complications, including mechanical failure or loss of construct stability, were observed.

Conclusion Our early clinical experience demonstrated that 3D-printed patient-specific bioresorbable scaffolds may represent a promising alternative reconstructive option for large bone defects of the foot and ankle. Further investigation in larger cohorts is warranted to determine long-term efficacy and clinical outcomes.

68

Effectiveness of anterior interosseous nerve transfer to the ulnar motor branch: asystematic review with meta-analysis and contemporary update

Ervin Sethi, Usama Farghaly Abdelhamid Omar, Vaikunthan Rajaratnam Ervin Sethi, Usama Farghaly Abdelhamid Omar, Vaikunthan Rajaratnam
NHG Health SINGAPORE

Introduction / Objective High ulnar nerve injuries and severe ulnar neuropathies often show poor intrinsic hand muscle recovery after conventional repair or decompression. Distal nerve transfer using anterior interosseous nerve (AIN) to deep motor branch of ulnar nerve—via end-to-end (ETE) or supercharged end-to-side (SETS) techniques—aims to shorten reinnervation distance and “babysit” motor endplates.

Materials & Methods We conducted a systematic review of clinical studies of AIN→ulnar motor branch transfers. ETE, SETS and double-donor variants were eligible if intrinsic motor outcomes were reported. Cadaveric, animal, and single-case reports were excluded from quantitative synthesis. We summarised pooled proportions of patients achieving Medical Research Council (MRC) grade ≥3 from meta-analysis by Thakkar et al. and performed an exploratory random-effects meta-analysis on five contemporary series.

Results / Discussion Thakkar et al. identified 16 studies (269 patients). Across ETE series, 100% recovered intrinsic activity and ≈85 % achieved MRC ≥3; in SETS series ≈93 % regained MRC ≥1 and ≈75% reached MRC ≥3. Exploratory meta-analysis of five newer series (119 patients) yielded pooled proportion of 0.77 (95 % CI 0.63–0.86) achieving MRC ≥3, consistent with the earlier pooled estimates. Prospective and comparative studies show that adding SETS to repair or decompression improves intrinsic power, pinch strength and functional scores compared with conventional surgery alone. A double-donor “super-turbocharged” construct (AIN + abductor digiti minimi) further increased strength in complex cases.

Conclusion Distal AIN transfer to ulnar motor branch restores useful intrinsic function in patients. Current evidence favours SETS as an adjunct to repair or decompression, with double-donor strategies reserved for complex lesions.

LUCID-Fix: Novel preoperative planning surface-marking-assisted minimally invasive fixation of intertrochanteric hip fractures reduces operative time, intraoperative fluoroscopic images and blood loss

Jun Rui Daylon Lee, Alexander Shao-Rong Pang, Kamaraj Thirukumaran, Seth Ian Sim, Zi Qiang Glen Liao
Department of Orthopaedic Surgery, National University Hospital SINGAPORE

Introduction / Objective Minimally invasive intertrochanteric hip fracture surgery minimises soft tissue trauma but often increases operative time and radiation exposure due to reduced visualisation. This study evaluates the efficacy of LUCID-Fix, a novel preoperative surface-marking method, across extramedullary (DHS, FNS) and intramedullary implants (PFNA, TFNA).

Materials & Methods A retrospective analysis of a prospectively collected cohort evaluated 35 patients who underwent intertrochanteric fracture fixation between 2019 and 2023 using either LUCID-Fix (n=13) or conventional techniques (n=22). The LUCID-Fix technique uses preoperative fluoroscopy to translate internal implant geometry onto the patient's skin, establishing a three-dimensional trajectory and a precise incision guide prior to surgery. Surgeries with the conventional technique were performed as per Instructions for Use Surgical method guides. Primary outcomes were operative time, number of intraoperative fluoroscopic images, and total blood loss.

Results / Discussion The combined LUCID-Fix cohort demonstrated a significant reduction in operative time (42.5 [95% CI: 36.7-48.4] vs 95.7 [95% CI: 78.1-113.3] minutes, $p<0.001$), total blood loss (866 [95% CI: 616-1116] vs 1337 [95% CI: 1050-1623] ml, $p=0.023$) and intraoperative radiographs (16.5 [95% CI: 9.24-23.8] vs 111.2 [95% CI: 83.8-138.6], $p<0.001$). Subgroup analysis revealed significant operative time reductions for LUCID-Fix in both extramedullary (39.4 [95% CI: 27.6-51.2] vs 73.4 [95% CI: 60.4-86.4] minutes, $p=0.002$) and intramedullary (44.5 [95% CI: 36.2-52.8] vs 114.3 [95% CI: 86.5-142.0] minutes, $p<0.001$) cohorts. Intraoperative radiographs were similarly reduced across both extramedullary (9.00 [95% CI: 3.96-14.04] vs 81.9 [95% CI: 66.4-97.3], $p=0.004$) and intramedullary (21.3 [95% CI: 10.2-32.3] vs 132.5 [95% CI: 88.0-177.1], $p<0.001$) LUCID-Fix subgroups. Secondary outcomes, including tip-apex distance, interval from injury to surgery and duration of hospitalisation showed no statistically significant differences.

Conclusion The systematic preoperative templating of LUCID-Fix is a promising reproducible strategy to reduce operative time, blood loss, and discrete radiation events to surgeons across extramedullary and intramedullary implants, while maintaining equivalent clinical outcomes.

Staged anterior and lateral approaches in lumbar interbody fusion for adult deformity surgery: Radiological outcomes

Beatrice Tan, Chin Pei Bong, Reuben Soh
Singapore General Hospital SINGAPORE

Introduction / Objective Adult spinal deformity leads to significant pain, functional impairment, and reduced quality of life. While posterior spinal fusion (PSF) has traditionally been the surgical technique of choice, minimally invasive lateral options have gained popularity as effective, safer alternatives. We aim to evaluate the radiological efficacy of lateral anterior lumbar interbody fusion (LALIF) and lateral lumbar interbody fusion (LLIF) in achieving staged sagittal and coronal correction in adult deformity surgery.

Materials & Methods A retrospective analysis was conducted on 22 female and 5 male patients (mean age 66.0 years) with degenerative spinal deformities who underwent a two-stage procedure between July 2017 and February 2025. The first stage involved LLIF or LALIF, while the second stage involved PSF. Radiographic and clinical outcomes were assessed following each stage, including segmental lordosis, disc height restoration, and coronal balance.

Results / Discussion There were significant improvements in both sagittal and coronal alignments post-operatively. Lumbar lordosis increased from -20.5° to -44.2° ($p<0.001$). Mean disc height corrections ranged from 2.6 mm to 3.5 mm across lumbar levels ($p<0.001$). 63% of patients achieved optimal coronal alignment within 2 cm of the central sacral vertical line, and the mean C7 plumb line distance decreased from 3.8cm to 2.4cm.

Conclusion LLIF and LALIF offer significant advantages over conventional PSF as part of a two-stage approach, in terms of reduced surgical risks and efficacy of sagittal and coronal alignment corrections. Future studies with larger cohorts and longer follow-up would be useful to further validate these outcomes and assess their long-term durability.

Re-Evaluating Surgical Duration As A Risk Factor For Prosthetic Joint Infection In Routine Total Knee Arthroplasty

Sunny Kim, Seth Ian Sim, Yew Ming Ho, Amritpal Singh, Fareed Husain Yusuf Kagda, Zhen Chang Liang
National University of Singapore SINGAPORE

Introduction / Objective Prosthetic joint infection (PJI) in total knee arthroplasty (TKA) is associated with substantial morbidity, mortality, and healthcare burden. While prolonged operative time is frequently cited as a modifiable risk factor, the strength of this association in routine primary TKA remains uncertain. This study investigates the relationship between surgical duration and the incidence of PJI in routine primary TKA.

Materials & Methods A retrospective cohort study included 223 consecutive unilateral primary TKAs performed at a single institution between January 2022 and March 2023. Cases were stratified by operative time, with prolonged duration defined as ≥ 120 minutes. Patient demographics, operative variables, and post-operative outcomes were collected, and potential risk factors for PJI were evaluated through subgroup analyses.

Results / Discussion The cohort (mean age 68.9 ± 6.5 years; BMI 28.1 ± 4.7 kg/m²) was 65.0% female (n=145), with 63.2% (n=141) having Kellgren-Lawrence Grade 4 osteoarthritis. Mean operative duration was 117.3 ± 66.2 minutes (85.3 ± 20.3 in the <120 -minute group [n=160]; 197.0 ± 73.3 in the ≥ 120 -minute group [n=63]). Demographics did not differ significantly between groups (age $p=0.48$, BMI $p=0.59$, gender $p=0.87$, Kellgren-Lawrence $p=0.305$). The overall PJI incidence was 1.35% (n=3), with two cases in the <120 -minute group and one in the ≥ 120 -minute group. There was no significant difference in PJI rates between groups (OR 1.49, 95% CI 0.13-11.41; likelihood-ratio $p=0.708$). All affected patients were female, obese, and had severe osteoarthritis; two also had chronic diabetes mellitus.

Conclusion Overall rates of PJI after routine primary TKA were low, and prolonged operative duration was not associated with increased odds of PJI in this cohort. Routine TKA should not be unnecessarily expedited in an attempt to reduce PJI risk. Instead, comprehensive pre-operative risk stratification and optimisation of modifiable risk factors should be prioritised, supported by adherence to sound intra-operative principles, including meticulous soft-tissue handling, evidence-based antibiotic prophylaxis, and established infection-prevention protocols.

From Planning to Implantation: The Evolution of 3D Printing in Foot and Ankle Surgery

May Fong Chan, Michael Yam, Nasrul Hadi Bin Said, Muhd Farhan Bin Mohd Fadil

Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Three-dimensional (3D) printing has increasingly entered orthopaedic practice, evolving from anatomical modelling and surgical planning to patient-specific instrumentation and implants. We present four foot and ankle cases from our institution demonstrating this evolution and the expanding applications of 3D printing in complex trauma and deformity surgery.

Materials & Methods Four cases were reviewed according to the application of 3D printing: (1) anatomical modelling for pilon fracture planning; (2) a patient-specific cutting jig for tibial rotational deformity correction; (3) patient-specific wedge implants for distal tibial opening-wedge osteotomy; and (4) a patient-specific 3D-printed titanium calcaneal implant for reconstruction following osteomyelitis.

Results / Discussion These cases demonstrate the progression of 3D printing from pre-operative planning to intra-operative execution and ultimately definitive reconstruction. The pilon fracture model improved three-dimensional understanding of fracture morphology and facilitated plate pre-contouring. The patient-specific cutting jig enabled planned rotational correction, while the printed wedges allowed assessment of correction during distal tibial osteotomy. The final case represents a further evolution, with a patient-specific titanium calcaneal implant used for definitive reconstruction of a complex bone defect. All patients demonstrated clinical and radiographic evidence of healing at latest follow-up. No complications were attributed directly to the 3D-printed models, jigs or wedges. Two patients required re-look debridement for surgical site complications, considered more likely related to their underlying open pilon fracture and calcaneal osteomyelitis respectively.

Conclusion Our experience demonstrates the expanding role of 3D printing in foot and ankle surgery, progressing from planning and surgical guidance to patient-specific implantation. The technology offers an increasingly integrated approach to managing complex and anatomically variable pathology.

Significant Geographic Variation in the Epidemiology and Management of Pediatric Osteochondritis Dissecans Exists Between the Asia-Pacific and North America

Joshua Rui Yen Wong, Yun Xiu Lam, Si Heng Sharon Tan, James Hoi Po Hui, Ming Wang

National University Health System SINGAPORE

Introduction / Objective The purpose of this systematic review was to evaluate regional variations in epidemiology, diagnostic approaches, and surgical interventions for pediatric osteochondritis dissecans (OCD) between Asia-Pacific (APAC) and North America (NA).

Materials & Methods A comprehensive search of PubMed, Scopus and Cochrane Library was conducted from database inception until August 2025. Studies on epidemiology and surgical treatment of pediatric OCD were screened independently by two reviewers. Data was extracted and collated according to PRISMA guidelines and risk of bias was assessed using the Methodological Index for Non-Randomized Studies.

Results / Discussion 65 studies comprising 2,194 patients were analyzed – 29 from APAC (803 patients) and 36 from NA (1,391 patients). Patients' age (APAC:9-18 years; NA:6-19 years) and follow-up duration (APAC:8-184 months; NA:2-216 months) were similar. Significant regional differences were observed across multiple domains. Sex distribution was markedly skewed in APAC, where the majority of studies included predominantly male participants (91.9%) without intentional female disaggregation, compared to a more balanced cohort in NA (55.3%). While the elbow was the most common OCD site overall, knee involvement was significantly higher in NA (36.1%) than APAC (20.7%). Imaging modalities differed – radiographs were the most common imaging tool in both regions, but MRI was more frequently utilized in NA (48.9%) compared to APAC (35.8%). Surgical approaches also varied significantly: osteochondral grafting was more common in APAC (41.7%) while arthroscopic techniques were favored in NA (73.5%). In-situ fixation rates were similar between regions. Standardized reporting and prospective, multicenter registries are essential for enabling patient-level analysis and guiding region-specific, evidence-based care for pediatric OCD.

Conclusion There are significant regional variations in epidemiology, imaging modalities and surgical management for pediatric OCD. The predominantly male bias in the APAC region, greater utilization of MRI and arthroscopic techniques in the NA region reflect underlying biological, cultural, and healthcare related differences.

Body Mass Index Is Not Associated With Inferior Two-Year Outcomes After Medial Unicompartmental Knee Arthroplasty in an Asian Cohort

Jeremy Tze En Lim, Yong Ng, Elliot Jun Wei Goh, Isaac Chan, Gabrielle Chuwen Joly Lee, Hee Nee Pang, Darren Keng Jin Tay, Seng Jin Yeo, Ming Han Lincoln Liow

Singapore General Hospital SINGAPORE

Introduction / Objective Obesity is frequently considered a relative contraindication to unicompartmental knee arthroplasty (UKA), yet evidence in Asian populations remains limited despite lower body mass index (BMI) thresholds for obesity classification. This study evaluated whether BMI category was independently associated with two-year outcomes following medial UKA in an Asian cohort.

Materials & Methods We retrospectively analysed 337 consecutive primary medial UKAs performed between 2017 and 2024. Patients were stratified according to the WHO Asia-Pacific obesity classification as non-obese (<25 kg/m²; n=123), obese (25–30 kg/m²; n=149), and severely obese (≥30 kg/m²; n=65). The primary outcome was two-year Knee Society Function Score (KSFS). Secondary outcomes included Knee Society Knee Score, Oxford Knee Score, SF-36 Physical and Mental Component Summary scores, range of motion (ROM), satisfaction, expectation fulfilment, and implant survivorship. Outcomes were analysed using analysis of covariance (ANCOVA) adjusted for baseline score, age, and sex, with false discovery rate correction for multiple comparisons.

Results / Discussion Mean age was 64.7 years and mean BMI was 26.7 kg/m². All BMI groups demonstrated substantial improvement across functional and patient-reported outcomes. After adjustment for baseline score, age, and sex, BMI category was not independently associated with two-year KSFS (p=0.301) or any secondary outcome following false discovery rate correction. Revision rates were 3.3%, 0.7%, and 1.5% in the non-obese, obese, and severely obese groups, respectively, with no difference in implant survivorship (log-rank p=0.510). Sensitivity analyses treating BMI as a continuous variable and evaluating BMI–surgical technique interactions similarly demonstrated no significant associations with postoperative outcomes.

Conclusion BMI category classified using the WHO Asia-Pacific obesity classification was not independently associated with two-year functional or patient-reported outcomes following medial UKA. These findings suggest that BMI alone, even when classified using the WHO Asia-Pacific obesity classification, should not restrict medial UKA candidacy in appropriately selected Asian patients.

Enhanced Meniscal Tissue Regeneration Using Human Chondrogenic Progenitor Cell-Seeded PLA/SF Scaffolds

Potsavee Singhamarasri, Rachasit Jeencham, Yupaporn Ruksakulpiwat, Piya-on Numpaisai

Institute of Medicine, Suranaree University of Technology THAILAND

Introduction / Objective The limited healing capacity of the meniscal avascular zone frequently leads to early osteoarthritis. Tissue engineering using biomimetic scaffolds like poly(lactic acid)/silk fibroin (PLA/SF) offers a promising alternative by replicating native architecture. This study aims to evaluate the efficacy of human chondrogenic progenitor cell (HCPC)-seeded PLA/SF scaffolds in promoting cartilage-specific extracellular matrix (ECM) deposition and structural reorganization in a rat model

Materials & Methods Biomimetic scaffolds were fabricated using an electrospun polymer blend of PLA and SF, seeded with HCPCs, and incubated to ensure proper cell adhesion. The constructs were implanted subcutaneously in male Wistar rats, which were randomized into control, scaffold-only, and scaffold+cell groups. Over a 28-day evaluation period, localized matrix maturation, tissue regeneration, and cellular engraftment were assessed. Evaluations were performed using quantitative real-time PCR for ECM-related genes (COL1A1, COL2A1, ACAN), alongside histological (H&E staining) and quantitative immunofluorescence analyses.

Results / Discussion By day 28, the scaffold+HCPC group exhibited significant upregulation of ECM-related genes, specifically COL1A1, COL2A1, and ACAN. Histological and immunofluorescence assessments confirmed excellent *in vivo* cell survival, evidenced by superior cellular engraftment and higher cellular density in the cell-seeded group compared to acellular constructs. Furthermore, the cell-seeded group achieved the highest mean fluorescence intensity for Collagen Type II and Aggrecan, indicating robust and organized cartilage-like matrix deposition.

Conclusion PLA/SF scaffolds integrated with HCPCs successfully support cellular viability and facilitate localized extracellular matrix remodeling alongside functional tissue regeneration. This work provides critical mechanistic evidence supporting the application of cell-seeded biomimetic scaffolds for clinical meniscus repair.

Robotic-Assisted Kinematic TKA for an Extreme 45° Fixed Varus Knee With Massive Medial Tibial Bone Loss Without Revision Implants

Jeremy Tze En Lim, Yong Ng, Hong Yu Jared Chua, Jia Wei Chen, Sumukh Shail, Benjamin Joseph Kang, Ming Han Lincoln Liow

Singapore General Hospital SINGAPORE

Introduction / Objective Primary total knee arthroplasty (TKA) for extreme fixed varus deformity with substantial medial tibial bone loss is technically challenging and may require revision-type reconstruction using stems, metal augments, cones or sleeves. We report an extreme 45° fixed varus knee with major medial tibial bone loss managed using robotic-assisted kinematic TKA and screw-cement augmentation without revision implants.

Materials & Methods A 73-year-old woman with end-stage right knee osteoarthritis presented with severe pain, progressive deformity and marked functional limitation. She was wheelchair dependent and could mobilise only short distances with a walking stick. Examination demonstrated fixed varus deformity with range of motion from 0° to 90°. Imageless robotic assessment demonstrated approximately 42° of varus, while intraoperative assessment confirmed a fixed 45° varus deformity with a large medial tibial plateau defect. Following robotic planning and selective medial soft-tissue release, cemented cruciate-retaining kinematic TKA was performed. The tibial defect was reconstructed using a single cancellous screw with polymethylmethacrylate cement augmentation, permitting fixation with standard primary components.

Results / Discussion Excellent intraoperative stability was achieved throughout flexion, with range of motion improving to 0°–130° and satisfactory patellar tracking. Reconstruction was achieved without stems, metal augments, cones, sleeves or constrained implants. Postoperatively, the patient regained independent transfers and ambulation with walking aids before discharge. Extreme varus deformity with substantial tibial bone loss is uncommon in primary TKA and often prompts revision-style reconstruction. Robotic planning facilitated precise, bone-preserving component positioning, while screw-cement augmentation addressed the medial tibial defect using standard primary components, avoiding the additional bone sacrifice and implant complexity of revision-type constructs.

Conclusion Robotic-assisted kinematic TKA with screw-cement augmentation can provide a bone-preserving option for selected patients with extreme fixed varus deformity and major medial tibial bone loss, potentially avoiding revision implants while achieving stable primary reconstruction.

Comparative Graft Diameters and Early Outcomes in Anterior Cruciate Ligament Reconstruction: Rectus Femoris vs Quadriceps Tendon Autografts

Ramkumar Mohan, Juen Zhik Chan, Hong Zhi Zhu, Lester Tan Teong Jin, Ziyang Chia, Derrick Guo Junhong, Sean Ho Wei Loong, Jegathesan T

Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Graft diameter is a recognised predictor of failure after anterior cruciate ligament reconstruction (ACLR). Quadriceps tendon autografts (QT) and partial-thickness rectus femoris (RF) grafts are novel options for autograft harvesting that have recently gained popularity. However, their comparative dimensions have limited current literature, with even less studies comparing outcomes. We compared intraoperative graft diameter and early postoperative outcomes between RF and QT autografts.

Materials & Methods Retrospective cohort of 130 patients undergoing primary or revision ACLR (46 RF, 84 QT). Both cohorts were compared across demographics, intraoperative variables and post operative outcomes. Graft diameter was compared using regression analysis adjusted for age, gender, height and weight. Post operative outcomes were assessed till six weeks. Linear regression analysis was then done to assess effect of weight and height respectively on graft diameter.

Results / Discussion Both cohorts were comparable in terms of Age ($p=0.617$), gender ($p=0.892$), height ($p=0.797$) and weight ($p=0.203$). RF grafts were significantly larger than QT grafts ($9.8 [9.0-10.0]$ vs $9.0 [8.5-9.5]$; $p<0.001$), a difference that persisted after adjustment for age, gender, height and weight (mean difference -0.424 mm; $p=0.001$). RF diameter varied by sex (males 10.0 mm vs females 9.2 mm; $p=0.040$), whereas QT diameter did not vary significantly between genders. Weight had a significant effect on RF graft diameter (95% CI: 0.015 to 0.546 , $p=0.040$) but not QT grafts.

Conclusion RF produces larger grafts than QT with comparable and outcome measures. This difference persisted even after adjusting for age, gender, height and weight.

Obesity does not affect functional outcomes after rotator cuff repair in an Asian population

Rachel Loh, Chino Tayag, Andrew Hwee Chye Tan
Singapore General Hospital SINGAPORE

Introduction / Objective Obesity is increasingly prevalent in Asia and may adversely affect outcomes following rotator cuff repair (RCR). However, its influence on postoperative functional recovery remains unclear. This study aimed to determine whether obese patients experience poorer range of motion and pain outcomes and less improvement following RCR compared with non-obese patients.

Materials & Methods We retrospectively reviewed 131 patients who underwent RCR. Patients were stratified according to Asian-Pacific body mass index (BMI) thresholds into non-obese (BMI <25 kg/m²; n=59) and obese (BMI ≥25 kg/m²; n=72) groups. Range of motion, Constant-Murley Scores, University of California Los Angeles (UCLA) Scores, Oxford Shoulder Scores and Visual Analogue Scale (VAS) pain scores were evaluated preoperatively, at 6 months and 2 years postoperatively. Changes from preoperative to 6-month and 6-month to 2-year outcomes were calculated and compared between BMI groups.

Results /Discussion Both obese and non-obese patients demonstrated significant improvements in range of motion and pain outcomes following RCR. From preoperatively to 6 months, the magnitude of improvement in forward flexion, abduction, Constant-Murley, UCLA, Oxford Shoulder and VAS pain scores did not differ significantly between obese and non-obese patients. Similarly, improvements from 6 months to 2 years were comparable between groups across all measured outcomes. These findings suggest that obesity did not adversely influence the magnitude of functional recovery following RCR.

Conclusion Obese and non-obese patients achieved comparable improvements in function, range of motion and pain following RCR up to 2 years. BMI alone may have limited utility in predicting functional recovery following RCR and should not preclude otherwise suitable obese patients from surgical treatment.

Early Clinical and Radiological Outcomes of the COMM Procedure (Cheilectomy, Osteotomy, microfracture and Matrix-induced Chondrogenesis) for Hallux Rigidus – A Case Series

Jiawen Fong, Adriel Goh Guang Wei, Inderjeet Rikhranj Singh, Wenxian Png, Steven Wong Bak Siew, Eric Cher Wei Liang
Sengkang General Hospital SINGAPORE

Introduction / Objective Hallux Rigidus (HR) is a degenerative condition of the first metatarsophalangeal joint characterized by progressive cartilage loss. We previously described our novel combined COMM procedure (Cheilectomy, Osteotomy, Microfracture, and Matrix-induced Chondrogenesis) for the treatment of moderate-severe HR. This study aims to evaluate (1) the viability and quality of the repaired cartilage using quantitative MRI-T2 relaxation value (T2RV) assessment, and (2) early clinical outcomes following surgery.

Materials & Methods This case series included seven patients with moderate-severe-grade HR who underwent the COMM procedure. Two types of biodegradable scaffolds were used: Hyalofast® and Chondro-Gide®. Clinical outcomes were assessed using the European Foot and Ankle Society (EFAS) score and Visual Analogue Scale (VAS) for pain. Quantitative MRI-T2RV assessments were performed preoperatively and postoperatively to evaluate cartilage repair. Radiological outcomes were assessed across two principal domains – (1) Graft viability, including internal graft T2RV, colour distribution, internal layering, graft matrix loss) and (2) Graft integration, including articular congruity, subchondral oedema, graft separation or delamination.

Results /Discussion The mean follow-up duration was 15.4±3.21 months. Quantitative MRI-T2RV assessment demonstrated favourable cartilage repair in all patients. All grafts exhibited good viability and integration, characterised by T2RV values consistent with viable, maturing repaired cartilage, restoration of a congruent articular surface, satisfactory graft thickness, and preservation of a continuous graft matrix. No cases of graft separation, delamination, or detachment were observed. Clinical outcomes also improved significantly in mean VAS scores (3.43±1.72 versus 0.00±0.00, p=0.0019, CI 0.00-1.59), and mean EFAS-FA scores (14.0±2.08 versus 22.3 ±1.19, p=0.0062, CI 2.91-5.08).

Conclusion The COMM procedure demonstrated favourable early clinical and radiological outcomes in patients with moderate-severe grade HR. Quantitative MRI-T2RV assessment provided an objective, non-invasive evaluation of cartilage viability, maturation, and graft integration following biological cartilage restoration. These encouraging preliminary findings support further investigation of the COMM procedure in larger prospective studies with longer-term follow-up.

Resilience Is Associated With Better Patient-Reported Outcomes in Knee Osteoarthritis: A Cross-Sectional Analysis

Shaun Chua, Linus Tan, Chien Joo Lim, Yong Hao Pua, Su-Yin Yang, Lincoln Liow, Richard Lee, Michael Yam, Shu Yun Tan, Matthew Tay, Chun Yue Tan, Bryan Tan
Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Traditional biomedical factors, such as radiological severity, poorly predict pain and disability in knee osteoarthritis (KOA). While psychological factors are increasingly recognized as important prognostic determinants, the role of psychological resilience in KOA outcomes remain underexplored. The study aim was to investigate (1) the association between resilience and patient-reported outcomes in nonoperatively treated KOA, and (2) the sociodemographic and psychological factors associated with resilience.

Materials & Methods This was a multi-center, cross-sectional study of 180 patients who received nonoperative treatment for KOA. Resilience was measured using the Brief Resilience Scale (BRS). Outcomes included the Knee Injury and Osteoarthritis Outcome Score (KOOS) domains and the Pain, Enjoyment of Life and General Activity (PEG) score. Baseline sociodemographic and psychological factors, including depression, anxiety, loneliness, self-efficacy, distress levels, were also measured. Regression modelling was used to explore associations between resilience, outcomes and baseline factors.

Results /Discussion Higher resilience was significantly associated with better quality of life (KOOS-QoL; p=0.01) greater function (KOOS-ADL; p<0.001), lower pain (KOOS-Pain; p<0.001, PEG; p<0.001) and fewer knee symptoms (KOOS-symptoms; p<0.001). Lower self-efficacy (ASES; p=0.006) and higher distress (DSQ-D; p<0.001) were associated with lower resilience. Other studied sociodemographic and psychological factors were not significantly associated with resilience (p>0.05).

Conclusion This was the first study highlighting the prognostic significance of resilience on function, pain, and quality of life in patients with nonoperatively treated KOA. Clinicians should assess for resilience at the point of initial evaluation and subsequent follow-up of KOA in the clinic with simple validated tools like the BRS. This allows for clinicians to identify high-risk individuals and offer evidence-based treatment such as cognitive behavioural therapy to

increase resilience and improve outcomes in KOA patients. Future higher-powered studies (e.g., observational cohort studies) should be conducted to determine the causal relationships between resilience and outcomes in KOA.

89

The Fibula Axis Calcaneal Overlap (FACO) Based Algorithm for Management of Pes Planus

Hannah Marian Lie, Wenxian Png, Keen Wai Chong
Sengkang General Hospital SINGAPORE

Introduction / Objective Radiographic assessment of hindfoot valgus in pes planus remains inconsistent because existing measurements are susceptible to variability and lack reproducibility. Furthermore, there is no widely accepted radiographic staging system to guide surgical decision-making. This study proposes the fibula axis calcaneal overlap (FACO) measurement and introduces a FACO-based algorithm for surgical management of pes planus.

Materials & Methods The FACO measurement is obtained from a standing ankle mortise radiograph by drawing a vertical line through the fibular axis and measuring the horizontal overlap between this line and the lateral calcaneal wall, with severity stratified based on this overlap. A stepwise management algorithm is proposed, incorporating extraosseous talotarsal stabilisation, medialising calcaneal osteotomy, medial column stabilisation according to deformity severity, and appropriate adjunctive soft tissue procedures.

Results /Discussion Assessment of hindfoot alignment rather than arch severity is vital in management of pes planus. Compared with existing radiographic measurements, FACO may improve measurement reproducibility while simplifying severity stratification.

Conclusion The FACO measurement and algorithm aims to provide a simplified framework for preoperative planning and surgical decision-making.

90

Amputation Versus Limb Salvage in Chronic Femoral Osteomyelitis With Pathological Fracture: A Case Report of Staged Reconstruction Using the Masquelet Technique and a 3D-Printed Scaffold

Rachel Loh, Xian Jun Ngoh, Henry Soeharno
Singapore General Hospital SINGAPORE

Introduction / Objective Pathological fractures secondary to osteomyelitis have traditionally required amputation for source control. However, staged reconstruction now offers limb salvage for selected patients. The Masquelet induced membrane technique shows promise for large bone defects, but defects exceeding 6 cm often fail with autograft alone, necessitating biological augmentation strategies.

Materials & Methods A 49-year-old woman developed a pathological fracture of the right proximal femoral shaft from disseminated *Klebsiella pneumoniae* infection. Despite three months of antibiotics with downtrending inflammatory markers, a persistent fracture gap remained. She opted for staged limb salvage. Stage one involved radical resection creating a 13 cm defect, intramedullary nail stabilization, and antibiotic-impregnated cement spacer insertion. Stage two involved spacer removal with membrane preservation, implantation of a patient-specific 3D-printed polycaprolactone scaffold augmented with bone marrow aspirate concentrate, and nail dynamization.

Results /Discussion At subsequent follow-ups up to one year, serial radiographs demonstrated progressive callus formation and scaffold osseointegration, with no evidence of recurrent infection. Clinically, the patient remained well and asymptomatic and achieved full weight-bearing status.

Conclusion This case demonstrates that combining the Masquelet technique with 3D-printed scaffolds and biological augmentation offers viable limb salvage for critical-sized femoral defects following osteomyelitis. This approach can preserve function and reduce amputation-associated morbidity. Future research should optimise scaffold design, staging intervals, and augmentation protocols to validate long-term outcomes.

91

A Growing Problem? Increased Risk of Breast Cancer in Female Orthopaedic Surgeons. What Needs to be Addressed Now?

Abby Heath, Nadia Meyer
Whangarei Hospital NEW ZEALAND

Introduction / Objective As more women enter orthopaedics, there is concern regarding reported higher rates of breast cancer. Developing breast cancer is multifactorial however; orthopaedic surgeons are occupationally exposed to ionizing radiation which is known to cause DNA damage. Given the lag time in development of breast cancer from exposure, we need to act now. The primary objective is to ascertain the prevalence of breast cancer within female orthopaedic surgeons. The secondary objective is to consider safety procedures which can be implemented.

Materials & Methods A literature review was conducted using PRISMA guidelines. Inclusion criteria were studies reporting prevalence of breast cancer, inclusion of orthopaedic surgeons, and discussion of occupational hazards. A secondary search was performed to review modifiable risk factors and radiation exposure.

Results /Discussion Five studies were included demonstrating rates of breast cancer in female orthopaedic surgeons up to 2.9x times higher than the general population. Non-modifiable risks include genetics. Other risks include nulliparity, late childbearing and shift work, all prevalent within surgeons. Modifiable risks include exposure to ionizing radiation. While not suggesting that radiation exposure is the direct cause for the higher rates of breast cancer seen, it needs to be considered. Breast cancer frequently develops in the upper outer quadrant of the breast. Ill fitting lead gowns leave this area inadequately protected. Lead with additional axillary protection is available however not easily accessible. Exposure can also be reduced by surgeon positioning and lower emission machines.

Conclusion Female orthopaedic surgeons have a 2.9x increased risk of developing breast cancer compared to the general population. With ever-increasing numbers of female orthopaedic surgeons in the workforce, it is important to address modifiable risks. Given the modifiable risk of radiation exposure, we strongly advocate female orthopaedic surgeons utilise well-fitting lead with additional axillary protection. Lack of appropriately fitted lead at an institutional level is no longer acceptable.

92

Labral Reconstruction of the Hip provides Moderate Return to Sports for the treatment of Labral Tears – A Systematic Review (SR)

Xinyu Tao, Teddy Cheong, Danyal Nawabi, Hamid Rahmatullah Bin Abd Razak, **Merrill Lee**
Singapore General Hospital SINGAPORE

Introduction / Objective The preferred surgical treatment for hip labral tears is typically restoration through repair, which requires good tissue quality to restore the “suction-seal” effect. Historically, labral debridement has been the alternative treatment of choice when the condition of the labrum is not amenable to refixation. However, more recently, labral reconstruction has emerged as a viable alternative to labral debridement. This systematic review was conducted to evaluate the rate of return-to-sport (RTS) and improvement of patient-reported outcomes (PROs) following labral reconstruction in patients with labral tears.

Materials & Methods Major databases such as PubMed, Embase, CINAHL, SCOPUS and Cochrane Library were searched from inception to May 2025. Inclusion criteria are published prospective/retrospective studies or case series on patients diagnosed with hip labral tear undergoing labral reconstruction. Exclusion criteria were studies on patients who did not undergo labral reconstruction of the hip and non-English studies. Data analysis of Modified Harris Hip Score (mHHS), Non Arthritic Hip Score (NAHS), Hip Outcome Score (HOS), Visual Analogue Scale (VAS) were conducted. RTS rates were analysed.

Results /Discussion Eight studies (two case series, six cohort studies) involving 262 patients were included. The mean population age was 33 years old, ranging from 10 to 40. Studies had RTS rates ranging from 64-88%. Four of these studies reported patients returning to sport at the same or an even higher level of play. PROs improved post-operatively. VAS at latest follow-up showed an improvement ranging from 2.60 to 4.50. The mHHS improvement at latest follow-up ranged from 18.00 to 24.30. NAHS improvement at latest follow-up ranged from 15.50 to 25.70. HOS improvement at latest follow-up ranged from 25.10 to 35.50.

Conclusion Current evidence suggests that labral reconstruction for the treatment of hip labral tears is an effective option producing good return-to-sport rates ranging from 60-80% and improvements in patient-reported-outcomes.

93

Paediatric Tibial Eminence Fractures: A Systematic Review of Divergent Trends in Diagnosis and Management between the Asia-Pacific Region and North America

Siyuan Zhang, Jorge Hsian Ming Tay, Si Heng Sharon Tan, James Hoi Po Hui, Theodore Ganley

NUHS SINGAPORE

Introduction / Objective Paediatric tibial eminence fractures are relatively uncommon injuries with a lack of consensus on their optimal management. The purpose of this systematic review was to evaluate differences in the incidence, diagnosis and management of paediatric tibial eminence fractures between the Asia-Pacific region and North America.

Materials & Methods A systematic review and subjective synthesis was conducted according to PRISMA guidelines. PubMed, MEDLINE and Cochrane databases were searched from inception to May 1, 2025 using the keywords “tibial eminence” or “tibial spine” or “anterior cruciate ligament”, and “fracture or avulsion”. All original human surgical studies on pediatric tibial eminence fractures published in the Asia-Pacific region and North America were included and data on the incidence, diagnosis and treatment of paediatric tibial eminence fractures were collected.

Results /Discussion A total of 24 studies (9 from Asia-Pacific and 15 from North America) were selected with a total of 1973 patients. Subset analysis (of 6 Asia-Pacific and 3 North American studies) demonstrated a trend towards higher rates of preoperative MRI utilization amongst Asia-Pacific (96.3 – 100%) compared to North American patients (36.2 – 46.0%). There were also trends towards higher rates of arthroscopic reduction (compared to open reduction) and suture-based fixation (compared to screw fixation and other modalities) observed in Asia-Pacific patients compared to North American patients.

Conclusion Asia-Pacific surgeons reported substantially higher preoperative MRI utilization compared to North American surgeons, alongside potential trends toward greater use of arthroscopic reduction and suture-based fixation in the management of paediatric tibial eminence fractures.

94

Patients Aged ≥75 Years Demonstrate Lower Functional Recovery but Comparable Outcomes Between Robotic-Assisted and Conventional Medial UKA

Jeremy Tze En Lim, Bryan Bo Xiang Neo, Yong Ng, Elliot Jun Wei Goh, Hee Nee Pang, Darren Keng Jin Tay, Seng Jin Yeo, Ming Han Lincoln Liow
Singapore General Hospital SINGAPORE

Introduction / Objective Medial unicompartmental knee arthroplasty (UKA) is increasingly offered to older patients, yet the influence of advanced age on recovery remains unclear. Whether robotic assistance improves outcomes is also uncertain. We evaluated outcomes following medial UKA in patients aged ≥75 years and compared robotic-assisted with conventional UKA within this subgroup.

Materials & Methods A retrospective analysis of a prospectively maintained cohort of 528 medial UKAs performed from 2017–2024 was stratified by age (<75 vs ≥75 years) and technique (robotic-assisted vs conventional). Outcomes at 24 months included KRS-Function, KRS-Knee, Oxford Knee Score (OKS), SF-36 Physical and Mental Component Summaries (PCS/MCS), satisfaction, and expectations. Complications and revisions were evaluated over available follow-up. Groups were compared using the Mann-Whitney U test, with significance at $p < 0.05$.

Results /Discussion Fifty-five patients (10.4%) were aged ≥75 years (mean age, 79.2 years). Baseline KRS-Function was comparable by age in the robotic-assisted group (60.0 vs 59.0, $p = 0.77$) but lower in elderly conventional patients (52.6 vs 60.1, $p = 0.040$). At 24 months, elderly patients had lower KRS-Function following both robotic-assisted (70.0 vs 82.0, $p = 0.022$) and conventional UKA (75.4 vs 83.6, $p = 0.010$). KRS-Knee and PCS were also lower in elderly conventional patients (84.3 vs 89.7, $p = 0.003$; 46.9 vs 50.6, $p = 0.026$, respectively), but not in elderly robotic-assisted patients (88.8 vs 85.6, $p = 0.52$; 47.9 vs 50.1, $p = 0.14$). OKS, MCS, satisfaction, and expectations were comparable by age. Within patients aged ≥75 years, no outcome differed significantly between robotic-assisted and conventional UKA (all $p > 0.12$). Two complications occurred in the elderly subgroup, including one revision to TKA.

Conclusion Patients aged ≥75 years demonstrated lower functional outcomes following medial UKA, while satisfaction and expectations remained comparable to younger patients. Within the elderly subgroup, outcomes were comparable between robotic-assisted and conventional UKA. Complications were uncommon. Medial UKA remains a reasonable option in appropriately selected elderly patients, with counselling regarding expected functional recovery.

95

One in Four Patients Experience Meaningful Outcome Changes Beyond Six Months After Total Hip Arthroplasty

Jeremy Tze En Lim, Hong Yu Jared Chua, Jia Wen Chen, Bryan Bo Xiang Neo, Yong Ng, Hee Nee Pang, Darren Keng Jin Tay, Seng Jin Yeo, Ming Han Lincoln Liow

Singapore General Hospital SINGAPORE

Introduction / Objective Six-month patient-reported outcomes are frequently used to assess recovery after total hip arthroplasty (THA), yet the extent to which outcomes remain clinically dynamic thereafter is incompletely characterised. This study characterised clinically meaningful changes in Oxford Hip Score (OHS) between 6 and 24 months and explored factors associated with late deterioration.

Materials & Methods A prospective registry was analysed comprising 324 primary THAs with complete preoperative, 6-month, and 24-month OHS data. Change between 6 and 24 months was classified as meaningful improvement (≥ 5 -point improvement), deterioration (≥ 5 -point worsening), or stability. Exploratory multivariable logistic regression, restricted to two baseline covariates given the limited number of deterioration events, evaluated factors associated with late deterioration.

Results /Discussion Mean OHS improved from 38.2 preoperatively to 16.5 at 6 months, followed by modest further improvement to 14.7 at 24 months, indicating relative stabilisation at the cohort level. In contrast, individual trajectories remained dynamic: 70 patients (21.6%) experienced further meaningful improvement between 6 and 24 months, 18 (5.6%) deteriorated, and 236 (72.8%) remained stable. Overall, 27.2% experienced clinically meaningful change beyond 6 months, predominantly reflecting continued improvement. Late deterioration was associated with substantially lower final satisfaction, with 72.2% rating their outcome Good-or-better compared with 97.0% of the remaining cohort. On exploratory multivariable analysis, lower preoperative mental component summary score (OR 0.95 per point, 95% CI 0.92–0.98; $p=0.003$) and higher BMI (OR 1.13 per kg/m^2 , 95% CI 1.03–1.23; $p=0.007$) were independently associated with late deterioration.

Conclusion Despite relative stabilisation of mean OHS by 6 months after THA, approximately one in four patients experienced clinically meaningful change thereafter, with continued improvement substantially more common than deterioration. Cohort-level averages may therefore obscure clinically important individual recovery trajectories beyond six months.

96

UTILITY OF PRONE NEUTRAL RADIOGRAPHS IN FUSION LEVEL DETERMINATION IN ADOLESCENT IDIOPATHIC SCOLIOSIS PATIENTS

Woon Theng Heng, Joanne Fang Nian Lim, Alexander Xi Xuan Ang, Jun Hao Tan, Gabriel Ka Po Liu

National University Hospital SINGAPORE

Introduction / Objective Selection of the last instrumented vertebra (LIV) in adolescent idiopathic scoliosis (AIS) remains controversial. While extending fusion distally may reduce the risk of distal adding-on, it sacrifices valuable lumbar motion segments. This study aimed to evaluate the utility of prone neutral radiographs in LIV selection and determine whether they allow preservation of distal motion segments without compromising radiographic outcomes.

Materials & Methods A retrospective cohort study was conducted at a single tertiary centre involving AIS patients who underwent posterior spinal fusion between January 2020 and August 2024 and had both erect and prone neutral radiographs available. Patients were classified according to whether the selected LIV corresponded to the LSTV on erect radiographs (eLSTV) or prone neutral radiographs (pLSTV). Primary outcomes were the number of distal fusion levels preserved and incidence of distal adding-on. Secondary outcomes included main thoracic and lumbar curve correction, shoulder balance and coronal balance.

Results /Discussion Seventy patients with 89 LIV selections were analysed, comprising 48 eLSTV and 41 pLSTV selections, with 19 patients having identical LIV selection by both methods. In the pLSTV group, 22/41 (53.7%) patients preserved one distal fusion level compared with the level indicated by the erect LSTV. No distal adding-on was observed in the pLSTV group, compared with 2/48 (4.4%) in the eLSTV group. Preservation of one distal level was observed in 50.0% of Lenke 1 and 2 curves and 58.8% of Lenke 5 and 6 curves. Eight patients underwent successful fusion to L3 based on pLSTV despite none fulfilling all conventional L3 selection criteria. Lumbar curve correction was comparable between groups (71.5% vs 72.2%, $p=0.914$), as were shoulder and coronal balance parameters at one year.

Conclusion Prone neutral radiographs frequently identify a more proximal LSTV than erect radiographs and may facilitate shorter fusion constructs in AIS.

97

Significant Indirect Decompression of Contralateral Neuroforamen Following Biplanar Expandable Cage Placement in Minimally Invasive Transforaminal Lumbar Interbody Fusion

DAVID SHAOEN SIM, Huai Zhen Tan, Lei Jiang, Zhixing Marcus Ling

SGH SINGAPORE

Introduction / Objective Biplanar expandable (BE) interbody cages, capable of expansion in both the cephalocaudal and mediolateral planes, are increasingly used in minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF). The conventional MIS-TLIF approach involves ipsilateral facetectomy and laminectomy on the more symptomatic side, achieving direct decompression at that level. Biplanar expansion may additionally enhance indirect decompression of the contralateral neuroforamen relative to non-expandable constructs, though this remains poorly characterised in the current literature. This study quantified radiological outcomes following BE MIS-TLIF using computed tomography (CT), with particular focus on contralateral foraminal decompression.

Materials & Methods A retrospective single-institution analysis was conducted on 19 patients undergoing single- or double-level MIS-TLIF with BE cages. Pre- and post-operative intraoperative 3D CT imaging (Siemens Cios Spin) was used to evaluate changes in ipsilateral and contralateral foraminal area, disc height, listhesis, and segmental lordosis. All measurements were performed by a single, independent observer using a standardised protocol to ensure measurement consistency.

Results /Discussion Significant improvements were observed across all radiographic parameters assessed. Ipsilateral and contralateral foraminal areas increased by $0.43 \pm 0.20 \text{ cm}^2$ and $0.26 \pm 0.16 \text{ cm}^2$ respectively (both $p < 0.001$). Correspondingly, ipsilateral and contralateral foraminal heights increased by $2.4 \pm 1.6 \text{ mm}$ and $2.0 \pm 1.4 \text{ mm}$ respectively (both $p < 0.001$), with concurrent gains in disc height, listhesis correction, and segmental lordosis.

Conclusion BE cages in MIS-TLIF achieve meaningful indirect decompression of the contralateral neuroforamen while preserving a minimally invasive approach. Dual-plane expansion enables balanced interbody distraction and improved segmental alignment without additional surgical exposure. These findings support the radiological rationale for BE cage use in MIS-TLIF.

98

Buckle fracture Urgent Care for Kids with Less Encounters (BUCKLE)

Yifei Chen, Yiming Chen, Jinghui Vanessa Quek, Pak Leung Kenneth Wong

Lee Kong Chian School of Medicine, Nanyang Technological University, SINGAPORE

Introduction / Objective Paediatric distal radius buckle fractures are stable injuries amenable to removable wrist immobilisation. Our preimplementation pathway required backslab application in Children's Emergency (CE) followed by routine Orthopaedic Clinic review. We evaluated whether appropriately selected fractures could be managed definitively in CE through the Buckle pathway without routine Orthopaedic follow-up.

Materials & Methods A before-and-after quality improvement design incorporating a pilot phase was used. Following institutional review board approval and waiver of informed consent [ECOS Reference: 2023/2559], records of patients aged 4-17 years with radiographically confirmed distal radius buckle fractures presenting from 7 March to 5 August 2026 were reviewed. The Buckle pathway was piloted from 12-26 May 2026. After one pilot-phase greenstick fracture misdiagnosis, CE clinicians received targeted teaching on radiographic diagnosis and pathway eligibility on 4 June; the refined pathway was implemented on 11 June. Outcomes included number of Orthopaedic Clinic visits, number of backslabs given, misdiagnosis, reattendance, refracture, surgical referral and direct cost.

Results /Discussion A total of 73 patients were included: 19 (26.0%) pre-implementation, 17 (23.3%) pilot and 37 (50.7%) post-implementation. Mean clinic visits per patient decreased from 1.00 to 0.12 and 0, respectively, while mean backslab use decreased from 1.00 to 0 in both intervention phases. One greenstick fracture was misdiagnosed and two patients had unplanned Orthopaedic Clinic reattendance during the pilot. No further misdiagnoses, CE or Orthopaedic Clinic reattendances, refractures or surgical referrals occurred post-implementation. The pathway was estimated to save up to SGD 338 and 15 minutes of nursing time per patient, corresponding to potential savings of SGD 18,252 and 13.5 nursing hours across 54 patients.

Conclusion A direct-discharge pathway for carefully selected paediatric distal radius buckle fractures can streamline care and release Orthopaedic Clinic capacity. Ongoing clinician education, standardised documentation and regular audit remain important to maintain diagnostic accuracy and safety.

99

Association Between MRI Bone Contusion Patterns and Concomitant Meniscal and Collateral Ligament Injuries in Paediatric ACL Tears: A Retrospective Cohort Study

Yiming Chen, Jie Minn Phoebe Wee, Patrick Seow, Qi Long Chua, Yifei Chen, Pak Leung Kenneth Wong
Yong Loo Lin School of Medicine, National University of Singapore, SINGAPORE

Introduction / Objective Bone contusions after anterior cruciate ligament (ACL) rupture reflect osseous impaction and may provide a footprint of the injury mechanism. Adult studies associate greater compartmental involvement with concomitant soft-tissue injury, but paediatric evidence remains limited because skeletal maturity may alter load transmission. We investigated whether meniscal and collateral ligament injuries increased across absent, lateral-only and bicompartamental contusion patterns and hypothesised an ordered increase.

Materials & Methods This single-centre retrospective cohort included patients aged ≤ 18 years with operatively confirmed ACL tears and MRI within 42 days of injury (2016–2025). Contusions were classified as absent, lateral-only, medial-only or bicompartamental. Meniscal injuries were identified intraoperatively when available, otherwise by MRI; MCL and LCL injuries were assessed by MRI. One medial-only case was excluded. Cochran–Armitage tests assessed ordered trends; adjacent groups were compared using chi-square or Fisher's exact tests. Institutional Review Board approval was obtained and informed consent waived.

Results /Discussion The analytical cohort comprised 142 patients (67 male, 75 female; median age, 14 years): 12 had no contusion, 47 had lateral-only contusions and 83 had bicompartamental contusions. Injury-to-MRI interval differed between groups ($p=0.008$). Across this progression, medial meniscal injury increased from 5/12 (41.7%) to 23/47 (48.9%) and 55/83 (66.3%; $p=0.026$), while LCL injury increased from 1/12 (8.3%) to 15/47 (31.9%) and 33/83 (39.8%; $p=0.042$). Trends for lateral meniscal ($p=0.151$) and MCL injuries ($p=0.149$) were not significant; no adjacent-group comparison was significant. Greater involvement may therefore reflect a broader injury pattern selectively involving the medial meniscus and LCL. However, these graded, unadjusted associations may be influenced by MRI timing.

Conclusion Bicompartamental contusions may prompt closer assessment of the medial meniscus and LCL in paediatric ACL tears, but should supplement rather than replace direct MRI or operative evaluation.

100

Impact of Surgeon Experience on Pedicle Screw Accuracy in Metastatic Spine Surgery: A Comparison of O-arm Navigation and Free-hand Techniques

Xin Yang TAN, Noah LIN, Joycelin Cai Ying FOONG, Namith RANGASWAMY, Naresh Satyanarayan KUMAR, Jonathan Jiong Hao TAN
National University Hospital SINGAPORE

Introduction / Objective This study evaluates the comparative accuracy and safety of O-arm intraoperative navigation versus the conventional free-hand (FH) technique for pedicle screw placement in metastatic spinal tumor surgery.

Materials & Methods A retrospective review analyzed 143 patients (1,252 screws: 724 FH, 528 O-arm) treated at a Singapore tertiary center between January 2015 and July 2025. Pedicle screw accuracy was assessed on postoperative computed tomography scans using the Gertzbein-Robbins classification. Generalized linear models were constructed to identify independent predictors of screw breach and to evaluate the interaction between surgical technique and surgeon experience.

Results /Discussion The overall per-screw breach rate was comparable between the two groups (FH: 6.6%, O-arm: 7.6%; $p=0.593$). However, multivariate analysis demonstrated a highly significant interaction between the use of O-arm navigation and surgeon experience ($p=0.028$). For early-career surgeons with less than five years of experience, O-arm navigation served as a significant protective factor against screw breach (adjusted odds ratio 0.23, $p=0.032$). Experienced surgeons (five or more years) had a low breach rate regardless of the chosen technique. The higher crude breach rate associated with O-arm use among senior surgeons could represent a confounder, as navigation is often reserved for complex cases with extensive tumour-induced osteolysis. Consequently, the primary accuracy benefits of navigation are concentrated among less experienced operators.

Conclusion While O-arm navigation and FH techniques demonstrate comparable overall accuracy in metastatic spine surgery, O-arm navigation significantly reduces the odds of pedicle screw breach for early-career surgeons. Experienced spine surgeons may still utilise the free-hand technique as a highly reliable and efficient method for screw placement.

101

Optimising Fracture Care in the Immunocompromised: BMP Accelerates Union in HIV-Positive Trauma Patients

Xin Wang, **Changhuan Liu**, Zhe Xie, Zheng Wang, Lekai Zhu, Haodong Jiang
Wuhan University Zhongnan Hospital CHINA

Introduction / Objective Due to the significantly higher fracture risk in individuals with HIV compared to the general population, this study investigates the clinical application of Bone Morphogenetic Protein (BMP) in the surgical treatment of HIV-infected patients with traumatic fractures to optimize treatment protocols.

Materials & Methods This study retrospectively analyzed 53 patients with HIV infection with fractures. Based on the BMP treatment, the patients were divided into 28 patients in the experimental group and 25 patients in the control group, and the radiographic fracture healing time and functional recovery scores were collected.

Results /Discussion At 12 months postoperatively, the experimental group showed significantly shorter median fracture healing times compared to the control group. The median healing times in the experimental group were as follows: radius and ulna, 10.07 weeks (IQR 9.14–11.18); humerus, 10.21 weeks (IQR 9.89–11.57); tibia and fibula, 14.57 weeks (IQR 13.71–15.00); and femur, 12.57 weeks (IQR 11.57–13.14). In contrast, the median healing times in the control group were: radius and ulna, 14.00 weeks (IQR 12.71–14.93); humerus, 12.86 weeks (IQR 11.75–13.68); tibia and fibula, 17.71 weeks (IQR 15.50–19.57); and femur, 14.43 weeks (IQR 13.93–15.64). All differences were statistically significant ($P < 0.05$). Functional recovery scores at 3 and 6 months were also significantly better in the experimental group across all fracture types ($P < 0.05$).

Conclusion BMP effectively shortens fracture healing time and promotes early functional recovery in HIV-infected patients with fractures, providing valuable insights for improving fractures treatment in this population.

102

Application and Efficacy Analysis of Microsurgical Repair Technique Based on Kager's Fascial Flap Vascular Reconstruction in Acute Achilles Tendon Rupture

Xin Wang, **Changhuan Liu**, Zhe Xie, Zheng Wang, Lekai Zhu, Haodong Jiang, Xi Chen
Wuhan University Zhongnan Hospital CHINA

Introduction / Objective To balance repair strength with biological environment, we designed a limited-incision Kager fat pad coverage suture technique that uses the autologous Kager fat pad anterior to the tendon to cover the repair site and reconstruct microcirculation.

Materials & Methods We retrospectively included 90 patients with acute closed Achilles tendon ruptures treated at our hospital from 2017 to 2021. Patients were divided by procedure into a limited-incision Kager fascial flap coverage group ($n = 41$) and a traditional open group ($n = 49$). In the Kager group, an Ethibond No. 5-modified three-dimensional Bunnell buried suture was used, and the Kager fat pad anterior to the Achilles was mobilized from both sides of the tendon to cover the anastomosis, followed by layered closure of peritendinous tissue, subcutaneous tissue, and skin. The open group was repaired using Krackow locking sutures. We compared AOFAS and ATRS scores at 12 months postoperatively and color Doppler ultrasound blood-flow parameters at 3 months postoperatively (peak systolic velocity [PSV], end-diastolic velocity [EDV], and resistance index [RI]).

Results /Discussion At 12 months follow-up, the Kager group showed superior functional recovery and local blood supply compared with the open group. The Kager group had higher AOFAS (91.39 ± 1.70 vs. 84.76 ± 1.51) and ATRS (94.59 ± 1.50 vs. 86.24 ± 1.61) scores than the open group ($P < 0.05$). At 3 months postoperatively, Doppler showed the Kager group had better PSV (11.44 ± 2.06 cm/s), EDV (4.45 ± 0.64 cm/s), and RI (0.60 ± 0.06) than the open group (10.39 ± 1.83 cm/s, 3.36 ± 0.51 cm/s, 0.67 ± 0.08), $P < 0.05$.

Conclusion The limited-incision Kager fascial flap coverage technique transfers the Kager fat pad to cover the Achilles tendon anastomosis, reconstructs peritendinous microcirculation, increases biological coverage and blood supply to the repair zone, and promotes tendon healing. It also offers better functional recovery and fewer complications.

103

Allograft Combined with rhBMP-2 via the "Sandwich" Technique for Unstable Femoral Neck Fractures: An Effective Strategy for Enhanced Healing and Early Weight-Bearing

Xin Wang, **Changhuan Liu**, Zhe Xie, Xi Chen, Zheng Wang, Lekai Zhu, Haodong Jiang
Wuhan University Zhongnan Hospital CHINA

Introduction / Objective Unstable femoral neck fractures (Garden III/IV) remain clinically challenging due to high risks of nonunion and femoral head necrosis. This study aimed to evaluate the clinical efficacy of local Recombinant Human Bone Morphogenetic Protein-2 (rhBMP-2) implantation in the treatment of unstable femoral neck fractures (Garden III/IV) fixed with hollow screws.

Materials & Methods A retrospective analysis was conducted on 127 patients with unstable femoral neck fractures treated at our hospital between May 2017 and May 2024. Patients were divided into two groups: the experimental group ($n=60$), which underwent hollow screw internal fixation combined with allogeneic bone grafting and local rhBMP-2 implantation using the "sandwich" technique during surgery; and the control group ($n=67$), which received only internal fixation combined with allogeneic bone grafting without rhBMP-2. The fracture healing time, partial and full weight-bearing time, functional recovery, and complication rates were compared between the two groups. Quantitative computed tomography (CT) was used to measure the change in bone mineral density at the fracture site to objectively assess local bone formation.

Results /Discussion Compared with the control group, the sandwich group had a significantly shorter fracture-healing time (14.20 ± 2.61 weeks vs. 16.93 ± 3.30 weeks; $P < 0.001$). Fracture-healing rates at 4 and 6 months postoperatively were higher in the sandwich group than in the control group. At 3, 6, and 12 months postoperatively, Harris hip scores were significantly higher in the sandwich group than in the control group (all $P < 0.001$). Quantitative CT analysis showed a significantly greater increase in bone mineral density at the fracture site in the sandwich group (201.52 ± 37.55 HU vs. 115.24 ± 26.14 HU; $P < 0.001$).

Conclusion In the treatment of unstable femoral neck fractures, the use of a "sandwich" technique to implant rhBMP-2 and allograft bone can significantly promote fracture healing and enhance local bone mineral deposition, as objectively confirmed by quantitative CT.

104

Diagnostic Performance of Peripheral Immune-Inflammatory Biomarkers for Chronic Osteomyelitis: A Retrospective Case-Control Study

Xin Wang, Lekai Zhu, Jiutai Chen, Zheng Wang, Changhuan Liu, Haodong Jiang
Wuhan University Zhongnan Hospital CHINA

Introduction / Objective This study aims to assess the clinical utility of composite immune-inflammatory indices formed from differential peripheral blood cell counts (NLR, PLR, SIRI, SII, PIV) for the early identification and risk stratification of chronic osteomyelitis, and to investigate their associated immunological basis and potential clinical applications.

Materials & Methods A retrospective unmatched case-control study was conducted at Zhongnan Hospital of Wuhan University. A total of 212 patients with confirmed chronic osteomyelitis and 440 non-infected trauma controls during the same period were enrolled using convenience sampling. Routine complete blood count data and main clinical information at admission were collected. The five composite indices were calculated and compared between groups. Receiver operating characteristic (ROC) curves and area under the curve (AUC) with 95% confidence intervals (CI) were used to evaluate diagnostic performance, with pairwise AUC comparisons by DeLong's test. Multivariate logistic regression was performed to adjust for potential confounders (age, sex, diabetes, drinking history) and assess independent diagnostic value.

Results /Discussion Although total white blood cell count did not differ significantly between groups, NLR, PLR, SIRI, SII, and PIV were all significantly elevated in the osteomyelitis group (all $P < 0.001$). SII and PIV showed higher AUC, sensitivity, and specificity (SII AUC = 0.800, 95% CI: 0.764–0.835; PIV AUC = 0.781, 95% CI: 0.744–0.818). After adjustment for confounders, SII (OR = 1.002, 95% CI: 1.001–1.002) and PIV (OR = 1.002, 95% CI: 1.002–1.003) remained independent predictors. DeLong's test indicated that SII had significantly better diagnostic utility than NLR, PLR, and SIRI, but not significantly different from PIV.

Conclusion Composite immune-inflammatory indices based on peripheral blood counts are clinically accessible and cost-effective. SII and PIV may serve as potential auxiliary tools for chronic osteomyelitis diagnosis, complementing the limitations of traditional WBC, pending further prospective validation.

105

V-shaped Triceps Flap versus Olecranon Osteotomy for AO/OTA Type C3 Distal Humeral Fractures: A Retrospective Comparative Study

Xin Wang, Lekai Zhu, Xi Chen, Zheng Wang, Zhe Xie, Pengcheng Li, Min Zhou, Xiqing Yang, Changhuan Liu, Haodong Jiang
Wuhan University Zhongnan Hospital CHINA

Introduction / Objective AO/OTA type C3 distal humeral fractures are complex intra-articular injuries characterized by severe comminution and significant displacement, which are mainly managed with surgical intervention. The efficacy and safety of different surgical approaches vary, and the clinical value of the V-shaped triceps flap approach remains to be verified.

Materials & Methods A total of 31 patients with the above-mentioned fractures who underwent surgical treatment in our hospital from May 2017 to March 2023 were divided into the V-shaped triceps flap group (17 cases) and the olecranon osteotomy group (14 cases). Patients were followed up for a mean of 2 years. Intraoperative indicators, the incidence of postoperative complications, and Mayo Elbow Performance Scores (MEPS) at different time points were compared between the two groups.

Results /Discussion The V-shaped triceps flap group had a shorter operative time (105.71 ± 8.72 minutes vs 122.36 ± 11.50 minutes, $P < 0.001$, 95% CI: 9.22–24.08), less blood loss (111.76 ± 51.63 mL vs 175.00 ± 50.95 mL, $P < 0.01$, 95% CI: 25.35–101.12), and a lower incidence of postoperative complications (11.8% vs 50.0%, $P < 0.05$). The MEPS scores of the V-shaped triceps flap group were significantly higher at one month (52.88 ± 2.85 vs 47.00 ± 2.39 , $P < 0.001$) and three months postoperatively (80.94 ± 2.41 vs 77.14 ± 2.03 , $P < 0.001$). No significant differences were observed in MEPS scores at six months (87.41 ± 3.00 vs 86.85 ± 2.17 , $P > 0.05$) and at the last follow-up (24±6.5 months) postoperatively (88.94 ± 1.88 vs 88.50 ± 1.45 , $P > 0.05$).

Conclusion The V-shaped triceps flap approach presents notable advantages in the treatment of AO/OTA type C3 distal humeral fractures. It can shorten the operative time, reduce intraoperative blood loss and the risk of complications, and promote the early functional recovery of the elbow joint, thus holding high clinical application value.

106

Integration of MOOC and Virtual Simulation to Improve Surgical Clinical Skills: A Quasi-Experimental Study

Xin Wang, Lekai Zhu, Changhuan Liu, Zheng Wang, Zhe Xie, Haodong Jiang, Min Zhou, Zonghuan Li, Xiqing Yang, Pengcheng Li, Xi Chen
Wuhan University Zhongnan Hospital CHINA

Introduction / Objective To evaluate the effectiveness of a blended teaching model integrating MOOC and virtual simulation for surgical clinical-skill training among medical undergraduates.

Materials & Methods A quasi-experimental study involving 139 third-year medical students was performed. Students were non-randomly assigned to either the experimental group ($n=60$, MOOC plus virtual-simulation training) or the control group ($n=79$, traditional face-to-face teaching). Outcomes included pre-post theoretical tests, Structured Clinical Skills Assessment, and satisfaction questionnaires for the experimental group. Mediation analysis was used to separate direct teaching effects from practice-time-related effects.

Results /Discussion Baseline characteristics and pre-test scores were comparable between groups. After intervention, the experimental group obtained significantly higher theoretical and clinical-skill assessment scores ($p < 0.001$). Most of the skill-score advantage remained after matching total training time. High student satisfaction was reported for the blended curriculum.

Conclusion MOOC-virtual-simulation integrated teaching improves medical students' surgical theoretical knowledge and clinical-skill performance with good learner satisfaction. Multi-centre studies are needed to confirm its generalizability.

107

Enhanced External Counterpulsation for Patients Following Femoral Neck Fracture Internal Fixation: A Randomized Controlled Study

Xin Wang, Lekai Zhu, Changhuan Liu, Zhe Xie, Zheng Wang, Haodong Jiang, Min Zhou, Zonghuan Li, Xiqing Yang, Pengcheng Li, Xi Chen
Wuhan University Zhongnan Hospital CHINA

Introduction / Objective Postoperative delayed healing, nonunion and avascular necrosis of the femoral head (ANFH) are risks associated with internal fixation for femoral neck fractures (FNFs). This study evaluated the efficacy of postoperative enhanced extracorporeal counterpulsation (EECP) in patients treated with cannulated screw fixation for FNFs.

Materials & Methods A single-center, prospective, randomized controlled trial was conducted. Patients with acute femoral neck fractures (FNFs) undergoing hollow screw fixation were enrolled and randomly assigned to either the EECP group or the control group in a 1:1 ratio. The EECP group received 1 hour of EECP treatment daily for 7 weeks, starting 3 weeks postoperatively; the control group received standard care only. Color Doppler ultrasound was used to assess the peak systolic velocity (PSV), end-diastolic velocity (EDV), and resistance index (RI) of the medial circumflex femoral

artery (MCFA) at the fracture site of the affected femoral neck. Fracture healing time, incidence of avascular necrosis of the femoral head (ANFH), and nonunion rates were recorded. Harris Hip Score (HHS) was assessed at 3, 6, and 12 months postoperatively.

Results /Discussion EECF group demonstrated significantly shorter fracture healing time (3.02 ± 1.05 vs 5.00 ± 1.80 months, $p < 0.001$). HHS showed no inter-group difference at 3-month ($p = 0.165$), but was markedly higher in EECF group at 6- and 12-months (both $p < 0.001$). No nonunion occurred in either group. ANFH rates were comparable between two groups (3.23% vs 9.09%, $p = 0.615$).

Conclusion Post-operative EECF shortens fracture healing time and improves mid-long-term hip function. No significant reduction of ANFH risk was found. Larger-sample studies are needed to confirm its effect on preventing femoral head necrosis.

108

Gouty Discitis: A Rare Cause of Cervical Myelopathy

Jonathan Weng Kum Leong, Ramkumar Mohan, Joshua Decruz

Khoo Teck Puat Hospital SINGAPORE

Introduction / Objective Gout classically presents with distal lower limb joint inflammation but, in rare cases, can also involve the axial skeleton. We report a rare case of spinal gout causing cervical myelopathy.

Materials & Methods A 66-year-old Chinese male presented with neck pain, right upper limb weakness, and progressive myelopathy on a background of chronic tophaceous gout on urate-lowering therapy (ULT). Magnetic Resonance Imaging (MRI) of the cervical spine showed severe stenosis at the C4-C5 level with cord impingement, and the patient subsequently underwent C4-C5 Anterior Cervical Discectomy and Fusion (ACDF). Intraoperatively, tophaceous material was seen extruding from the right C4-C5 disc space, and histology revealed calcified cartilaginous and bony tissue with numerous large nodular aggregates of pale eosinophilic 'feathery' material surrounded by macrophages and foreign body-type multinucleated giant cells.

Results /Discussion The most common cause of cervical myelopathy is cervical spondylosis in patients above 55 years of age. In comparison, only 10 cases of axial gout causing cervical myelopathy have been reported in the literature (out of 315 reported cases of spinal gout from the first reported case in 1950 to April 2023). In addition to its rarity, it is challenging to diagnose pre-operatively, limiting avenues for early intervention. Dual-energy computer tomography (DECT) has emerged as a promising tool to diagnose axial gout non-invasively and, importantly, non-operatively, enabling early treatment.

Conclusion Spinal gout is a rare but important differential diagnosis in patients with chronic gout presenting with new neurological symptoms. Using DECT can be considered to identify and treat such cases early and may potentially reduce the need for operative management.

109

Improving Time to Surgery for Geriatric Hip Fracture Patients with Surgery

Wen Jia Tan, Joyce Suang Bee Koh, Dennis Chuen Chai Seow, Monica Pui Phy Kywe Tan, Ignasius Jappara, Kenny Xian Khing Tay, Yew Lok Woo, Lissa Vazhayil Joseph, Rajashulakshana Rajaram, Jia Xuan Yeo, Tricia Phui Yee Chia, Khema Zi Yan Han, Xin Ni Chua, Seo Kiat Goh, Tet Sen Howe, Hairil Rizal Abdullah

SGH SINGAPORE

Introduction / Objective Hip fractures in the elderly population are associated with significant mortality rates of up to 22% within the first year and functional decline, with only 40-60% of survivors regaining their pre-fracture level of mobility and independence. Timely hip fracture surgery within 48h has been associated with lower 12-month mortality rates and better post-operative outcomes.

Materials & Methods A multidisciplinary team comprising Orthopaedic Surgery, Anaesthesiology, Geriatrics, Cardiology, and the Office of Value Based Healthcare was established to improve time to surgery. Process mapping and case reviews identified medical optimisation issues and Operating Theatre (OT) availability as the primary drivers of delay. Interventions included reinforcing jointly developed hip fracture guidelines, establishing multidisciplinary communication channels for care coordination, and prioritising hip fractures in trauma OT lists. Regular audits of delayed cases were conducted and findings shared with clinical representatives for ongoing improvement.

Results /Discussion The median proportion of patients receiving surgery within 48 hours increased from 35.3% pre-intervention (2023) to 62.3% post-intervention (2024), with results sustained at 57.8% following project closure (2025). Proportion of patients with total length of stay (LOS) ≤ 10 days increased from 40.3% in 2023 to 59.3% in 2024, partially attributed to better time to surgery. Average total LOS decreased from 15.2 days (2023) to 11.3 days (2024-2025), translating to an estimated annualized avoidance of 1039 bed-days and cost avoidance exceeding S\$1,200,000.

Conclusion Multipronged approach addressing clinical and operational drivers of delay achieved sustained improvement in time to surgery for geriatric hip fracture patients. Key enablers include a multidisciplinary taskforce, standardised pre-operative protocols, and regular audit and feedback. Sustained results beyond project closure highlight the importance of embedding these practices into routine clinical workflows for long-term impact.

111

Preoperative Mental Health Predicts Early Satisfaction but Not Two-Year Knee-Specific Functional Improvement After Robotic-Assisted Unicompartmental Knee Arthroplasty

Yong Ng, Jeremy Tze En Lim, Isaac Chan, Elliot Jun Wei Goh, Darren Keng Jin Tay, Hee Nee Pang, Seng Jin Yeo, Ming Han Lincoln Liow

Singapore General Hospital, Department of Orthopaedic Surgery SINGAPORE

Introduction / Objective Preoperative mental health is an important determinant of patient-reported outcome measures (PROMs), but its influence in robotic-assisted unicompartmental knee arthroplasty (UKA) remains poorly characterized. This study evaluated mental health improvement after robotic-assisted UKA, effect of poor preoperative mental health on six-month and two-year PROMs, and whether preoperative mental health predicts satisfaction.

Materials & Methods Prospectively collected registry data of 121 medial UKAs performed between 2017 and 2024 were reviewed. Patients were stratified by preoperative 36-item Short Form Health Survey (SF-36) Mental Component Summary (MCS) into poor mental health ($MCS < 50$, $n = 51$) and good mental health ($MCS \geq 50$, $n = 70$). Outcomes included the Knee Society Function and Knee Score (KSFS & KSKS) and Oxford Knee Score (OKS), SF-36 Physical Component Summary, satisfaction, and expectation fulfillment. Multivariable logistic regression identified predictors of satisfaction, expectation and mental health recovery.

Results /Discussion Mean preoperative MCS was 41.2 in low-MCS group and 58.2 in high-MCS group ($P < 0.001$), with the former achieving greater MCS improvement at six months and two years ($P < 0.05$). Despite lower preoperative KSKS and OKS ($P < 0.05$) in the low-MCS group, both groups demonstrated comparable improvements in KSFS, KSKS and OKS. At six months, satisfaction (82.4 versus 97.1%; $P = 0.008$) and expectation fulfillment (70.6 versus 90.0%; $P = 0.008$) were significantly lower in the low-MCS group. In exploratory subgroup analysis, patients with persistently low MCS had significantly

worse two-year PROMs than the high-MCS group. Preoperative MCS independently predicted six-month satisfaction (OR 1.078; $P=0.005$) and expectation fulfillment (OR 1.061; $P=0.005$). Among low-MCS patients, six-month MCS ≥ 53 predicted two-year mental health normalization (Area under the curve [AUC], 0.783).

Conclusion Patients with poor preoperative mental health may experience lower early satisfaction after robotic-assisted UKA, but still achieve meaningful mental health recovery and comparable knee-specific functional gains by two years. The six-month MCS score represents a potentially actionable decision point, where a subgroup of patients may benefit from psychological intervention.

112

Biomechanical assessment of varying megaprosthesis lengths in distal femoral replacement following tumour excision using finite element modelling

Zhenyuan Du, **Pivatidevi Pareatumbee**, Andy Yew, Siaw Meng Chou, Joyce Koh, Tet Sen Howe, Henry Soeharno

Singapore General Hospital SINGAPORE

Introduction / Objective Primary metastatic tumours can occur at the distal femur in the young and active population. Reconstruction surgery using a megaprosthesis following tumour excision is commonly employed in orthopaedic oncology. Despite its success, periprosthetic osteolysis can occur on follow up, sometimes resulting in peri-prosthetic fracture and prosthesis loosening. This study investigates the effect of varying megaprosthesis length on bone and implant stresses and the resultant stress shielding effect in distal femoral replacement.

Materials & Methods Computer tomography (CT) scanning of cadaveric femur, tibia and fibula specimens and image segmentation were performed to generate the three-dimensional (3D) bone models. 3D models of distal femur megaprotheses of varying stem lengths of 130 mm and 190 mm were established using laser scanning and computer-aided design (CAD) modelling. Linear isotropic material properties were assigned to both bone and implant. Static structural analysis of the intact bone and bone-prosthesis assemblies were performed. Each model was subjected to a 1350 N compressive force on the femoral head with the distal femur and tibial component acting as fixed support. An intact model validation was conducted by comparing experimental and computational principal strains. The von Mises stress was compared at five different levels with reference to the cut surface in the osteotomized model.

Results /Discussion An overall proximal-to-distal bone stress increase with the distal end experiencing slightly lower stresses was predicted. The peak stress occurred on the medial side of the mid-shaft. The stress shielding effect was observed to be more pronounced along the bone-implant interface and distally in both implants with the implant of 190 mm stem length experiencing up to 2.2 times the level of stress shielding observed in the implant of 130 mm stem length.

Conclusion Increased stress shielding with implant lengthening suggests that long stems should be avoided when adequate fixation can be achieved with shorter implants to prolong implant survivorship.

113

Heterogeneity in the definition and reporting of fixation failure after internal fixation of femoral neck fractures: A systematic review

Celest Seah, Taran Dev Singh, Xingchen Lou, Thirukumaran Kamaraj, Sumanth Gera, Yongsheng Chen

Ng Teng Fong General Hospital SINGAPORE

Introduction / Objective Fixation-failure definitions after internal fixation of femoral neck fractures vary across studies and may include mechanical, biological, radiographic, and treatment-based criteria, limiting implant comparisons and evidence synthesis. We examined how fixation failure is defined and reported after primary internal fixation.

Materials & Methods We systematically reviewed clinical studies published between 1984 and 2026 evaluating primary internal fixation of femoral neck fractures in skeletally mature adults with a reported mean age between 18 and 65 years. Definitions were classified using a prespecified five-category framework: Undefined, Composite, Mechanical-only, Biological-only, and Revision-based. Composite definitions were subdivided according to whether components were reported separately or only as an aggregate. Studies without an identifiable definition or discrete fixation-failure outcome were classified as Undefined. Mechanical and biological criteria and numerical thresholds were recorded.

Results /Discussion We included 193 studies comprising 43,871 patients. Fixation failure was reported in 187 (96.9%), but only 78 (40.4%) provided an identifiable definition. Definitions were Undefined in 115 studies (59.6%), Composite in 41 (21.2%), Mechanical-only in 22 (11.4%), Biological-only in 8 (4.1%), and Revision-based in 7 (3.6%). Among Composite studies, 38 reported components separately and 3 reported only an aggregate outcome. Femoral neck shortening was quantitatively assessed in 86 studies (44.6%). Common criteria included >5 mm ($n=31$) and >10 mm ($n=16$), with variations in thresholds, severity categories, and measurement methods. Varus collapse was numerically defined in 30 studies (15.5%), with reported thresholds ranging from $>5^\circ$ to $>10^\circ$ or corresponding neck-shaft angle criteria. Overall, 140 studies (72.5%) were published from 2020 to 2026.

Conclusion Although widely reported, fixation failure was undefined in most studies, while identifiable definitions varied substantially. These differences indicate that similarly labelled fixation-failure outcomes may capture clinically distinct events, even among studies evaluating internal-fixation devices in comparable populations and settings. Standardised mechanical, biological, radiographic, and treatment-based criteria are needed to improve implant comparisons and evidence synthesis.

114

Accuracy, Relevance and Readability of Three Large Language Models' Responses to Frequently Asked Patient Questions Regarding Frozen Shoulder: A Blinded Comparative Study

Kevin Chong, Keng Thiam Lee, Sean Wei Loong Ho, Jegathesan T

Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Frozen shoulder is a common, protracted condition with uncertain comparative treatment effectiveness, and patients increasingly turn to generative AI chatbots for health information. Prior orthopaedic studies typically evaluate only one chatbot per condition, and frozen shoulder is a topic where chatbots have performed comparatively poorly. This study compared three contemporary large language models (LLMs) answering frequently asked patient questions about frozen shoulder.

Materials & Methods Fifty frequently asked questions across six categories were submitted to ChatGPT (GPT-5.6), Google Gemini (3.6 Flash) and Claude Sonnet (5.0) via each provider's public consumer interface, yielding 150 responses. Responses were relabelled, randomised per question, and rated by three blinded consultant orthopaedic surgeons on 5-point Likert scales for accuracy and relevance (classified as adequate at mean grade ≥ 4). Readability

was assessed post hoc using six validated indices. Inter-rater reliability used Gwet's AC2; between-model differences were tested via Friedman test with post-hoc Wilcoxon comparisons and Bonferroni correction.

Results /Discussion All 450 ratings were complete, with high inter-rater reliability (AC2 0.92 accuracy, 0.93 relevance). Overall, 90% of responses (135/150) were accurate and 97% (146/150) relevant. Accuracy differed significantly between models ($\chi^2=12.01$, $p=0.002$); relevance did not ($\chi^2=2.27$, $p=0.32$). Claude Sonnet was accurate in 94% (47/50), ChatGPT in 92% (46/50), and Gemini in 84% (42/50); only Gemini vs. Claude Sonnet reached significance ($p<0.001$), with ChatGPT vs. Gemini non-significant after correction ($p=0.085$). Gemini accounted for 8 of 15 inaccurate responses. Readability differed across five of six indices ($p<0.001$); mean Flesch-Kincaid Grade Level was 11.7, 13.7 and 14.6 respectively, and no response from any model met the sixth-grade threshold.

Conclusion Contemporary LLMs answered most frozen shoulder FAQs accurately and relevantly, with modest accuracy differences but comparable relevance; inaccuracies typically reflected confidently stated but unsupported claims rather than obvious errors. All models produced text well above the recommended patient reading level.

115

Impact of Mentorship on Learning Curve for the Direct Anterior Approach in Bipolar Hemiarthroplasty for Neck of Femur Fractures

Vikaesh Moorthy, Tong Leng Tan, Lynn Thwin, Pirateb Paramasivam Meenakshi Sundaram, Gerrard Gan
Tan Tock Seng Hospital SINGAPORE

Introduction / Objective The direct anterior approach (DAA) for bipolar hemiarthroplasty in neck of femur (NOF) fracture is technically challenging and associated with a significant learning curve. The present study aims to compare operative time trends and learning-curve kinetics between a surgeon who progressed through a structured mentorship programme (the mentorship group) and a surgeon who adopted DAA hemiarthroplasty independently, without formal mentorship (the non-mentorship group).

Materials & Methods Consecutive DAA bipolar hemiarthroplasty cases performed by each surgeon were reviewed retrospectively (mentorship group, $n=31$; non-mentorship group, $n=60$). Operative time, patient demographics and complications were extracted. Group comparisons used Mann-Whitney U and Fisher's exact test as appropriate. Learning-curve kinetics were quantified with cumulative sum (CUSUM) analysis referenced to each surgeon's mean operative time.

Results /Discussion Groups were comparable in age (81.2 ± 8.0 vs 79.6 ± 8.4 years, $p=0.38$) and sex distribution ($p=0.74$), although the mentorship group had a significantly lower proportion of cemented fixation cases (22.6% vs 65.0%, $P<0.001$). Mean operative time was shorter for the mentorship group (104.8 ± 38.6 vs 122.2 ± 24.1 minutes, $p=0.0002$), and remained shorter after exclusion of one complex outlier case (98.8 ± 19.9 minutes, $p<0.0001$). Cumulative sum (CUSUM) analysis identified a proficiency turning point at case 18 for the mentorship group (coinciding with transition from being taken-through to independent practice) vs case 23 for the non-mentorship group, suggesting that the mentorship structure allowed proficiency to be consolidated by the point of independent practice. Comparing each surgeon's first ten to last ten cases, operative time fell by 28.9% for the mentorship group ($p=0.0007$) versus 17.8% for the non-mentorship group ($p=0.02$).

Conclusion A structured mentorship pathway was associated with a faster, steeper reduction in operative time and an earlier transition to proficiency for DAA bipolar hemiarthroplasty, achieving shorter steady-state operative times than unmentored self-directed learning. These findings support graduated, mentor-led introduction of DAA hemiarthroplasty for NOF fracture surgery.

116

The Trans-Tibial Plateau Axis: A Reproducible and Concordant Landmark for Tibial Rotation Assessment in Total Knee Arthroplasty

Walter-Soon-Yaw Wong, Colin Wang, Wayne Foo, Joel Lim, Kein Boon Poon
Sengkang General Hospital SINGAPORE

Introduction / Objective Total knee arthroplasty (TKR) is a common procedure, yet optimal tibial tray rotational alignment remains controversial. Current standards, including the Medial One-Third Tibial Tuberosity (MTT) line and the Akagi line (AKL), are limited by anatomical variation and patellar tendon/soft tissue influence. The Trans-Tibial Plateau Axis (TPA), defined as a line connecting the geometric centres of the tibial plateaus, has been proposed as a potential adjunct or alternative landmark for rotational assessment. This study aimed at determining the intraoperative-to-radiological concordance of the TPA with commonly used landmarks and its reproducibility.

Materials & Methods A prospective study enrolled 50 patients undergoing robotic-assisted, CT-guided TKR. Intraoperative measurements included the clinical TPA (cTPA) and clinical AKL. CT-derived parameters included CT-TPA, CT-MTT, CT-AKL, and the CT-posterior condylar line (CT-PCL). The primary outcome of concordance, compared the CT-TPA against established rotational standards (CT-AKL, CT-MTT, CT-PCL). The secondary outcome assessed reproducibility using Bland-Altman analysis comparing cTPA with CT-TPA, contrasted against the AKL line.

Results /Discussion The CT-TPA demonstrated a strong correlation with the CT-Akagi line (95% CI: -2.3° to $+3.5^\circ$). Correlations with both the CT-MTT and CT-PCL were substantially weaker, with 95% confidence intervals exceeding 10.0° . Bland-Altman analysis showed excellent reproducibility between cTPA and CT-TPA (mean difference: $+1.0^\circ$ external rotation; SD $\pm 1.5^\circ$; 95% limits of agreement [LoA]: -2.0° to $+4.0^\circ$). This reproducibility was statistically superior to that of the AKL line ($p < 0.05$), which demonstrated wider LoA ranging from -9.2° to $+7.5^\circ$.

Conclusion The TPA is a highly reproducible landmark whose measurement error is substantially narrower than the MTT line, agreeing with the CT-Akagi line within clinical tolerance irrespective of deformity. It may serve as an adjunct or alternative rotational reference. Larger studies correlating rotational agreement with clinical outcomes are warranted.

117

The use of Synthetic Bone scaffolds in the management of critical bone defects in distal femur open fractures

Mei En Chua, Antony Xavier Rex Premchand
Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Critical sized bone defects are commonly encountered in open fractures and Non-union, and are defined as those that are unlikely to heal spontaneously within the patient's lifetime. Novel synthetic bone scaffolds serve as an alternative or supplement to traditional autogenous or allogeneous bone grafts in the Masquelet 'induced membrane' when managing these injuries. Their advantages lie in their ease of availability and customisation through 3-dimensional (3D) printing without donor site morbidity.

Materials & Methods This case series describes the novel use of custom 3D-printed polycaprolactone-tricalcium (PCL-TCL) phosphate scaffolds (Osteopore®) in conjunction with the Masquelet 'induced membrane' technique in the management of 2 cases of open fractures of the distal femur intra articular fractures and 2 cases distal femur shaft non-union. All 4 cases had critical sized bone defects.

Results /Discussion The critical bone defects were adequately addressed resulting in good restoration of bony anatomy as well as joint congruency. The patients remain pain and infection-free and are able to weight-bear. Repeat radiographs show maintenance of fracture reduction and signs of graft incorporation.

Conclusion This case series demonstrates the safe and efficacious use of custom PCL-TCP scaffolds (Osteopore®) in conjunction with the Masquelet 'induced membrane' technique in the management of critical-sized bone defects in patients who suffered high energy distal femur fractures.

118

Knee Function following Distal Femoral Arthroplasty or Fixation in Periprosthetic Fractures around the Total Knee Arthroplasty within an Asian Population – A Multivariate Linear Regression Analysis

Yi Rong Lum

NHG SINGAPORE

Introduction / Objective Distal femoral periprosthetic fractures (PPF) around the total knee arthroplasty (TKA) are increasingly common. Whether to fix or to replace depends on both fracture and patient factors. While the decision remains controversial, it is noteworthy that there has been an uptrend in the use of distal femoral arthroplasty (DFA).

Materials & Methods This is a retrospective cohort study conducted at a single major trauma centre in XXX. 28 patients that underwent a DFA (n = 17) or surgical fixation (n = 11) for a PPF were included. Primary outcome measures were functional outcomes (Knee Society Score (KSS)) and return to pre-morbid function. Secondary outcome measures were Charlson Comorbidity Index (CCI), time to weight-bearing, complications and 12-month mortality. Multivariate linear regression was performed with KSS knee and function scores as primary variables. The selected covariables were "DFA vs fixation", "CCI" and "Comminution".

Results /Discussion The KSS knee (78.14 vs 80.55) and function scores (30 vs 40.91) between the DFA and fixation groups did not show any statistical significance. Patients in the surgical fixation group (72.7% vs 29.4%) were found to have a higher return to baseline function compared to the DFA group (p = 0.034). Analysis of the variables in the regression model found that CCI ($\beta = 0.436$, 95% CI: 1.34 - 43.58, p=0.038) was a strong predictor of KSS

Conclusion Function Scores, suggesting that a higher comorbidity was associated with a lower KSS function score.

Multivariate regression analysis suggests that a high CCI score impairs KSS function scores. The findings in this study suggest that there is no significant difference in KSS function following DFA or fixation for PPFs. Patients in the surgical fixation group showed higher rates of returning to baseline compared to DFA.

119

Twisting Under Pressure: A Biomechanical Finite Element Analysis of Tracker Pin Placement in Robotic Total Knee Arthroplasty

Raymen Arviin Chandrasagran, Hao Min Cheo, Alexander Pang Shao-Rong, Matthew Ng Song Peng, Glen Liao Zi Qiang, Andy Yew Khye Soon

National University Hospital SINGAPORE

Introduction / Objective Robotic-assisted total knee arthroplasty (rTKA) requires surgical tracker pins, which introduce localised cortical defects into load-bearing long bones. While intra-incisional metaphyseal pin placement has been explored to mitigate soft-tissue complications, its biomechanical impact under torsional loading in osteoporotic bone remains poorly understood. This study used finite element analysis (FEA) to evaluate stress distribution and deformation in severely osteoporotic femur and tibia models following tracker pin placement.

Materials & Methods CT-derived three-dimensional femur and tibia models from a single cadaveric donor with severe osteoporosis were segmented into cortical and cancellous regions. Intra-incisional pin holes (3.2 mm diameter, 12 mm spacing, and 15° axis angulation) were created. Intact and pin-modified models were constrained at one end and subjected to a 30 Nm torsional moment along the longitudinal axis. Maximum shear stress and strain were evaluated, and finite element analysis was conducted using PrePoMax (version 2.4.0).

Results /Discussion Pin-hole introduction yielded contrasting biomechanical responses between the two long bones. In the femur, pin holes produced a minimal increase in maximum shear stress (16.1 MPa to 16.2 MPa; +0.995%), but maximum shear strain rose substantially (0.00669 to 0.00920; +37.7%), indicating reduced torsional stiffness. Conversely, the tibia exhibited a substantial increase in maximum shear stress (11.3 MPa to 19.0 MPa; +68.6%), while maximum shear strain decreased (0.0755 to 0.0484; 35.8%), demonstrating localised stress concentration.

Conclusion Tracker pin holes alter torsional biomechanics in a bone-specific manner in severely osteoporotic bone. The pin-modified femur becomes more flexible and experiences greater rotational deformation, whereas the tibia experiences marked stress concentration that may act as a fracture nucleus. Surgeons should consider bone quality and local load distributions when planning pin placement strategies to minimise periprosthetic fracture risk after rTKA.

120

Stability and Balance: Impact of Tibial Resection on the Final Femoral Plan in Restricted Inverse Kinematic Alignment Robotic-Assisted Total Knee Arthroplasty

Regina Chi, Andrew I Spitzer

Cedars-Sinai Medical Center UNITED STATES OF AMERICA

Introduction / Objective Robotic-assisted total knee arthroplasty (RA-TKA) permits iterative intraoperative planning to optimize component positioning and soft tissue balance. However, the effect of the tibial resection on subsequent femoral planning during restricted inverse kinematic alignment (iKA) remains poorly characterized. This study evaluated changes in femoral planning following tibial resection using the VELYS Robotic-Assisted Surgery (VRAS) platform.

Materials & Methods Between April 2022 and April 2026, 350 consecutive primary RA-TKA procedures were performed utilizing restricted iKA. An initial plan was generated using pre-resection soft tissue assessment. Following tibial resection and osteophyte and meniscal removal, a new balance curve was generated using a tensor. Soft tissue releases were performed only when necessary to maintain the hip-knee-ankle (HKA) angle within predefined boundaries. The final femoral plan was generated based on the tensor driven balance curve. Changes between the initial and final femoral plans were recorded.

Results /Discussion Prior to tibial resection, the planned HKA was within 3° and 5° of neutral in 54.02% and 77.30% of knees, respectively. Following tibial resection and femoral replanning, these proportions increased to 92.20% and 98.84%, respectively. Femoral component size changed in 40% of knees. Mean changes in femoral planning included 2.18° in coronal alignment, 2.11° in external rotation, and 1.77° in flexion. Mean changes in medial and lateral distal femoral resections were 0.88 mm and 1.57 mm, respectively, while medial and lateral posterior resections changed by 1.88 mm and 2.65 mm, respectively. Soft tissue releases were required in 11.98% of varus knees compared with 64.52% of valgus knees.

Conclusion Tibial resection fundamentally altered femoral planning during restricted iKA RA-TKA. Routine reassessment following the tibial cut enabled dynamic refinement of component positioning prior to femoral cuts to optimize coronal alignment and soft tissue balance, emphasizing the importance of finalizing the femoral plan after tibial resection.

121

From Intraoperative Plan to Postoperative Radiograph: Alignment Agreement Following VELYS Robotic-Assisted Total Knee Arthroplasty

Regina Chi, Andrew I Spitzer

Cedars-Sinai Medical Center UNITED STATES OF AMERICA

Introduction / Objective Robotic-assisted total knee arthroplasty (RA-TKA) provides quantitative intraoperative measurements, enabling precise planning of component alignment. However, the correlation between final intraoperative targets and postoperative radiographic alignment remains undefined. We studied the variance between intraoperative VELYS femoral and tibial coronal alignment and corresponding postoperative radiographic alignment following RA-TKA.

Materials & Methods We performed a consecutive series of 350 RA-TKAs using the VELYS Robotic-Assisted Surgery platform and restricted inverse kinematic alignment. Intraoperative femoral and tibial coronal alignment and resultant hip-knee-ankle (HKA) angle were compared with postoperative full-length radiographic measurements of lateral distal femoral angle (LDFA), medial proximal tibial angle (MPTA), and HKA. Absolute intraoperative and radiographic differences were calculated. Mean absolute difference, standard deviation, range, and proportions within 1°, 2°, 3°, and 5° were calculated.

Results /Discussion Mean absolute differences between VELYS planning and postoperative radiographs were 1.54±1.31° for tibial coronal alignment, 1.72±1.21° for femoral coronal alignment, and 2.42±1.87° for HKA. Tibial alignment was within 1°, 2°, 3°, and 5° of the VELYS plan in 53.22%, 78.36%, 91.23%, and 98.54% of cases, respectively. Corresponding femoral values were 42.52%, 69.50%, 89.44%, and 99.12%, and HKA values were 30.59%, 53.24%, 74.12%, and 91.47%. Mean signed differences were +0.90°, +1.36°, and -1.79° for tibial, femoral, and HKA measurements, respectively. Absolute HKA deviation from neutral decreased by 5.69°, with proportions within 3° and 5° of neutral increasing from 16.91% and 28.86% preoperatively to 64.43% and 86.59% postoperatively.

Conclusion Intraoperative VELYS planning closely correlates with postoperative radiographic femoral and tibial coronal alignment, with 91.23% and 89.44% of measurements within 3° of the planned alignment, respectively. HKA showed greater variability, although 74.12% and 91.47% remained within 3° and 5° of the intraoperative plan, with a mean variance of 2.42°. This demonstrates accurate intraoperative bone resections and reliable translation of final intraoperative alignment targets to postoperative radiographic alignment.

122

Surgeon-Administered Intraarticular Posteromedial Injection Provides Comparable Analgesia to Adductor Canal Block Following Primary Total Knee Arthroplasty

Regina Chi, Andrew I Spitzer

Cedars-Sinai Medical Center UNITED STATES OF AMERICA

Introduction / Objective Peripheral nerve blocks (PNBs) and periarticular injections (PAIs) are commonly incorporated into perioperative multimodal analgesia protocols for total knee arthroplasty (TKA). Adductor canal blocks (ACBs) target the saphenous nerve and require ultrasound guidance and administration by an anesthesiologist. More recently, the intraarticular posteromedial surgeon-administered (IPSA) block has been introduced as an alternative landmark-guided technique. This study compared perioperative pain control and early postoperative outcomes among patients receiving an ACB alone, an ACB plus IPSA, or IPSA alone.

Materials & Methods A retrospective review was performed of 173 consecutive patients undergoing primary TKA who sequentially received 1) an anesthesiologist-administered ACB alone (n = 38), an anesthesiologist-administered ACB plus an IPSA block (n = 25), or an IPSA block alone (n = 100). All patients received standardized PAIs utilizing the same local anesthetic solution as the IPSA block, with ketorolac added at patient-specific doses. Primary outcomes included inpatient morphine milligram equivalents (MMEs) and length of stay (LOS). Secondary outcomes included block-related complications and rescue blocks as well as rates of 90-day manipulation under anesthesia (MUA), one-year reoperation, and one-year revision.

Results /Discussion Postoperative pain control was comparable across all three treatment groups, with no significant differences in inpatient MMEs or LOS. Early postoperative outcomes were also similar, with no significant differences in rates of 90-day MUA or one-year reoperation. No revision procedures occurred within one year of surgery in any group and no rescue blocks were required.

Conclusion IPSA blocks provided perioperative pain control and early postoperative outcomes comparable to anesthesiologist-administered ACBs. As a landmark-guided technique performed intraoperatively by the surgeon, the IPSA block may simplify perioperative analgesic pathways without compromising early clinical outcomes.

123

The Intraarticular Posteromedial Surgeon-Administered Block in Primary Total Knee Arthroplasty: Surgical Technique and Early Clinical Outcomes

Regina Chi, Andrew I Spitzer

Cedars-Sinai Medical Center UNITED STATES OF AMERICA

Introduction / Objective Postoperative pain control following primary total knee arthroplasty (TKA) remains an important component of enhanced recovery protocols. Despite advances in perioperative analgesia following TKA, limited literature exists regarding the intraarticular posteromedial surgeon-administered (IPSA) block. The purpose of this study was to describe the IPSA technique and evaluate its utility, safety profile, and early clinical outcomes in a consecutive series of primary TKA patients.

Materials & Methods This retrospective, single-surgeon study included 200 consecutive patients who underwent primary TKA between September 2023 and February 2026. All patients received a standardized periarticular injection (PAI) and IPSA block performed by the primary surgeon. All patients had

spinal anesthesia, but no adductor canal blocks (ABCs). Primary outcomes included inpatient length of stay (LOS) and opioid consumption measured in morphine milligram equivalents (MMEs). Secondary outcomes included rescue block utilization, postoperative manipulation under anesthesia (MUA) procedures, reoperations, and Patient-Reported Outcome Measurement Information System (PROMIS) scores.

Results /Discussion A total of 200 patients were included, with a mean age of 73.60 ± 8.34 years and mean body mass index (BMI) of 28.37 ± 5.78 kg/m². Mean inpatient LOS was 31.28 ± 23.17 hours, and mean inpatient opioid consumption was 109.69 ± 62.71 MMEs. No patients required postoperative rescue blocks. The 90-day MUA rate was 1.5% (n = 3) and the six-month reoperation rate was 1.0% (n = 2). PROMIS PI scores improved from 63.78 ± 5.82 preoperatively to 56.65 ± 7.72 at six months postoperatively.

Conclusion The IPSA block represents a practical surgeon-administered analgesic technique that can be safely incorporated into primary TKA. In this consecutive cohort, the technique was associated with no rescue block utilization, low rates of MUA and reoperation, and favorable early pain-related outcomes. However, comparative studies are warranted to further define its role within contemporary multimodal pain management protocols.

124

Modern Cemented Femoral Fixation in Primary Total Hip Arthroplasty: A 25-Year Single-Surgeon Experience

Regina Chi, Andrew I Spitzer

Cedars-Sinai Medical Center UNITED STATES OF AMERICA

Introduction / Objective Cemented femoral fixation remains an important option in primary total hip arthroplasty (THA), particularly as the population ages and bone quality diminishes. However, durable fixation depends on appropriate implant selection and meticulous cementation technique. This study describes a standardized modern cementing technique and evaluates long-term outcomes from a large single-surgeon experience.

Materials & Methods A retrospective review of prospectively collected registry data was performed for primary THA procedures using C-Stem or C-Stem AMT cemented femoral components. The standardized technique emphasized preservation of cancellous bone, canal preparation, lavage, canal occlusion, vacuum cement mixing, retrograde cement delivery, sustained pressurization, and controlled stem insertion. Kaplan-Meier survivorship was evaluated with revision of any component as the endpoint. Harris Hip Scores (HHS) were assessed longitudinally.

Results /Discussion A total of 418 cemented THA procedures were analyzed. Mean age was 69.8 years, 71.3% were female, and mean body mass index (BMI) was 27.0 kg/m². Eight revisions (1.9%) occurred: four for dislocation, one for infection, and three for other indications. Registry-based survivorship was 98.9% at five years, 98.3% at 10 years, 97.9% at 15 and 20 years, and 97.2% at 25 years. Mean HHS improved from 45.7 preoperatively to 86.9 at one year, 84.2 at five years, and 82.6 at 10 years.

Conclusion A standardized modern cementation technique using polished tapered femoral stems demonstrated durable fixation and sustained clinical improvement across more than two decades of a single-surgeon experience. These findings support the continued clinical relevance of meticulous cemented femoral fixation in contemporary primary THA.

125

Excellent Mid- to Long-Term Survivorship of a Cemented Femoral Stem in Primary Total Hip Arthroplasty

Regina Chi, Sean Croker, David Fawley, Andrew I Spitzer

Cedars-Sinai Medical Center UNITED STATES OF AMERICA

Introduction / Objective The C-Stem AMT is a highly polished, triple-tapered cemented stem designed to engage the cement mantle and convert vertical shear into radial compressive forces. This multicenter registry study evaluated mid- to long-term survivorship and clinical outcomes following primary total hip arthroplasty (THA) with the C-Stem AMT.

Materials & Methods A retrospective review of prospectively collected registry data was performed for primary THA with the C-Stem AMT. Kaplan-Meier (KM) survivorship was evaluated with revision of any component as the endpoint. Two censoring assumptions were used for unrevised hips: at the last documented clinical follow-up (clinical assumption [CA]) and at the date of database extraction (registry assumption [RA]). Harris Hip Scores (HHS) were assessed pre- and postoperatively.

Results /Discussion A total of 511 C-Stem AMT stems were implanted by five surgeons at five institutions between March 2005 and July 2022. Osteoarthritis (OA) was the primary diagnosis in 91% of cases. Mean age was 74.6 years, 75% of patients were female, and mean body mass index (BMI) was 28.4 kg/m². Six revisions occurred: two for dislocation, two for infection, one for implant fracture, and one for another indication. No revisions for aseptic loosening occurred. KM survivorship was 98.6% at both two and five years using CA. Using RA, survivorship was 99.2% at two and five years and 98.6% at 10 and 15 years. Mean HHS improved from 47.3 preoperatively to 84.5, 82.5, and 77.3 at one, two, and five years, respectively.

Conclusion The C-Stem AMT demonstrated excellent mid- to long-term survivorship in primary THA, with no revisions for aseptic loosening and survivorship exceeding 98% through 15 years under both censoring assumptions. These findings support the durability of this cemented femoral stem. Reporting both CA and RA estimates provides transparency regarding the influence of censoring assumptions on registry-based survivorship analyses.

126

Beyond Mechanical Alignment: Defining Contemporary Alignment Strategies in Total Knee Arthroplasty

Regina Chi, Andrew I Spitzer

Cedars-Sinai Medical Center UNITED STATES OF AMERICA

Introduction / Objective Traditional mechanical alignment (MA) in total knee arthroplasty (TKA) aims to create neutral femoral and tibial resections and a neutral hip-knee-ankle axis, often requiring soft tissue releases to achieve balance. However, native knee anatomy demonstrates substantial variability, and persistent dissatisfaction following TKA has prompted increasing interest in personalized alignment strategies that better preserve constitutional anatomy and the soft tissue envelope.

Materials & Methods Contemporary mechanical, anatomic, kinematic, inverse kinematic, restricted kinematic, and functional alignment strategies were reviewed with emphasis on limb alignment, joint-line orientation, soft tissue balance, alignment boundaries, clinical outcomes, and the role of technology in achieving patient-specific reconstruction.

Results /Discussion Alternative alignment seeks to restore native or pre-arthritis joint-line orientation and limb alignment while minimizing disruption of the soft tissue envelope. Kinematic alignment prioritizes restoration of native rotational axes and constitutional alignment, while restricted approaches introduce boundaries to avoid extreme alignment outliers. Functional alignment further integrates patient-specific anatomy with intraoperative soft tissue assessment, predictive implant positioning, and three-dimensional adjustment of component position. Robotic assistance enables accurate and precise

execution of these plans while allowing alignment to remain patient-specific. Current evidence demonstrates equivalent or improved pain, function, and patient-reported outcomes with personalized alignment strategies compared with MA, without compromise in durability.

Conclusion Alternative alignment represents an evolution from standardized mechanical-axis restoration toward an individualized and patient-specific procedure that honors the soft tissue envelope. Robotics enables this transition by integrating bone, implant, alignment philosophy, and soft tissue balance. Successful contemporary TKA therefore depends on the coordinated application of implant, technique, and technology.

127

Cruciate-Retaining Versus Posterior-Stabilized Total Knee Arthroplasty: Long-Term Survivorship From a Multi-Center Registry

Regina Chi, Robert Gorab, John Irving, Kirk Kindsfater, Michael Swank, David Dalury, **Andrew I Spitzer**

Cedars-Sinai Medical Center UNITED STATES OF AMERICA

Introduction / Objective Both cruciate-retaining (CR) and posterior-stabilized (PS) designs have demonstrated favorable outcomes in cemented total knee arthroplasty (TKA), although debate remains regarding their long-term performance. The objective of this study was to compare long-term survivorship and clinical outcomes of cemented CR and PS knees within the same implant system.

Materials & Methods Cases were collected within a company-sponsored joint replacement registry. Clinical assessments were summarized with comparison p-values based on the t-distribution. Standardized visit windows accounted for variable site follow-up. Kaplan-Meier (KM) survivorship was assessed using revision of any component as the endpoint. Unrevised subjects were censored at last clinical follow-up under the clinical assumption (CA) and at database extract under the registry assumption (RA). Survival estimates were truncated when below 40 knees remained at risk.

Results /Discussion 15,926 CR and 10,476 PS knees were implanted. Age, body mass index (BMI), sex, and primary diagnosis were similar between cohorts. Crude revision rates were 0.95% for CR and 1.27% for PS. CR KM survivorship estimates at two, five, and 10 years were 98.11%, 95.94%, and 93.20% under CA and 99.23%, 98.76%, and 98.53% under RA. Corresponding PS survivorship estimates were 98.59%, 95.44%, and 92.09% under CA and 99.32%, 98.57%, and 98.11% under RA. Mean preoperative Knee Society total scores were 39.60 for CR and 41.34 for PS, increasing at 10 years to 91.35 and 86.78, respectively ($p < 0.001$). Between-group hazard ratios were not significant under either CA (HR, 1.013) or RA (HR, 0.850).

Conclusion Both CR and PS components demonstrated high long-term survivorship in cemented primary TKA, with no significant difference in revision hazard between designs. At 10 years, CR knees had numerically higher survivorship under both censoring assumptions and significantly higher Knee Society total scores than PS knees. Reporting both CA and RA estimates provides transparency regarding the influence of censoring assumptions on registry-based survivorship analyses.

128

A Systematic Restricted Inverse Kinematic Alignment (RiKA) Approach to Achieving Balance in 200 VELYS Robotic-Assisted Total Knee Arthroplasty (RA-TKA) Procedures

Regina Chi, **Andrew I Spitzer**

Cedars-Sinai Medical Center UNITED STATES OF AMERICA

Introduction / Objective RA-TKA enables accurate bony cuts, empowers alternative alignment, reduces soft-tissue releases, and improves outcomes. We report a systematic RiKA-driven approach using the VELYS Robotic Assisted Surgery (VRAS) image-free platform with AccuBalance software.

Materials & Methods Between 04/2022 and 07/2024, 200 consecutive primary RA-TKAs were performed. After exposure and navigation array placement, a balance curve was generated. Tibial coronal alignment, resection level, and slope were adjusted to restore joint line orientation, within 0-3° varus. Femoral coronal alignment, resection level, rotation, flexion, AP position, and size were sequentially adjusted to balance medial-lateral extension and flexion spaces. Medial flexion space was set 0.5 mm larger than extension and 0.5 mm larger laterally. After tibial resection, menisci and osteophytes were removed and a tensor generated a new balance curve. Releases were performed only when HKA angle was >3° from neutral. Final planning adjusted only femoral resections around the balanced soft-tissue envelope before femoral cuts.

120 knees were varus, 76 valgus, and 4 neutral. HKA within 3° and 5° of neutral increased from 54.02% and 77.30% initially to 92.20% and 98.84%.

Results /Discussion Releases were required in 11.98% of varus versus 64.52% of valgus knees. Final femoral parameters changed by 1-3° or 1-3 mm to achieve balance. 30-day MUA and one-year reoperation rates were 1.5% and 2.5%. KOOS-JR improved from 47.3 preoperatively to 73.6 and 75.2 at six months and one year. PROMIS Physical Function improved from 35.8 to 42.2 and 43.1, while PROMIS Pain Interference decreased from 63.4 to 56.3 and 54.9.

Conclusion Replanning after tibial resection and tensor use was critical to avoid instability and malalignment. Titrating the final plan after releases but before femoral cuts achieved accurate alignment and balance. MUA and reoperation rates were low, and PROMs improved. Valgus knees remain challenging. These findings support a structured, balance-driven approach to individualized alignment in RA-TKA.

129

"Now I Can See It": Evaluating a 3D Modular Anatomical Model for Patient Understanding, Decision Confidence and Anxiety in Total Knee Replacement

Wei Chern Ooi, Jovan Hsu Teng Yuan, Bryan Neo Bo Xiang, Kalyani Palaniappan, Steven Cao Xin, Ryan Ashraf Jefree, Adele Lim Yi Dawn, Michael Yam Gui Jie

Yong Loo Lin School of Medicine SINGAPORE

Introduction / Objective Patients scheduled for total knee replacement (TKR) frequently leave consultation unable to picture what will be done to their knee, undermining decisional confidence and raising anxiety. Three-dimensional printing has improved comprehension in other specialties but has not been evaluated in knee arthroplasty. We assessed whether a modular, reusable 3D-printed knee model improves counselling outcomes.

Materials & Methods A prospective two-arm quasi-randomised study was performed. 56 patients undergoing primary TKR were allocated by alternation to counselling with the 3D model ($n = 34$) or conventional counselling using a static model or none ($n = 22$). Understanding of the procedure, risks and recovery (averaged into a comprehension composite, $\alpha = 0.90$), decisional confidence and anxiety were scored on 10-point Likert scales pre- and post-consultation. The primary estimand was the baseline-adjusted between-arm difference by ANCOVA.

Results /Discussion Arms were comparable at baseline. Both improved by two to three and a half points on every outcome (all $p < 0.01$), confirming that surgeon-led counselling drives most of the benefit. Every adjusted between-arm estimate favoured the 3D arm without reaching significance: comprehension +0.44 (95% CI -0.29 to 1.17), confidence +0.65 (-0.07 to 1.37) and anxiety -0.98 (-2.40 to 0.44), a mean standardised advantage of 0.3

residual SD. Surgeon ICC was negligible and sensitivity estimates stable. Anxiety fell in 55% of model-counselled patients versus 32%, but rose in 15% versus 36%.

Conclusion Adding a 3D-printed modular knee model produced a small, consistent but non-significant advantage across all endpoints, concentrated in decisional confidence and anxiety. The heterogeneous anxiety response argues for offering the model selectively rather than universally. These findings, generated under a quasi-randomised design with acknowledged concealment limitations, support an adequately powered confirmatory trial to help advance our understanding of this field and elevate patient satisfaction through more effective counselling modalities — another step towards more personalised, holistic and intimate care for patients.

130

Novel Predictive Model for Delayed Union of Surgically Stabilised Atypical Femoral Fractures

Wei Xiang Ng, Xiaoe Doris Zhang, Ayyadarshan Kasivishvanaath, Charmaine Kai Xin Ng, Jegathesan T

TAN TOCK SENG HOSPITAL SINGAPORE

Introduction / Objective Complete atypical femoral fractures (AFF) carry elevated post-operative rates of delayed union (DU) and non-union (NU). This study aimed to develop a predictive model for DU following operative treatment of AFF.

Materials & Methods We performed a retrospective review at a single Singapore Level I trauma centre of skeletally mature patients surgically treated for complete AFF (OTA/AO 32) between 2012 and 2025, with a minimum one-year follow-up. Radiographic inclusion required fractures meeting ≥ 4 of 5 major ASBMR criteria; hip and high-energy fractures were excluded. The primary outcome was radiographic union assessed by the modified Radiographic Union Scale for Tibia (mRUST), with DU and NU defined at 6 and 12 months post-surgery respectively. Secondary measures included anti-resorptive duration, length of drug holiday (LODH), fracture characteristics, fracture reduction quality (FRQ), and implant details. Univariate and LASSO logistic regression analyses were performed.

Results /Discussion Eighty-four cases were included, of whom 98.8% were female, with a mean age of 73.23 ± 8.12 years (range 53.6–93.5). Bisphosphonate use was reported in 81 patients (96.4%) and chronic proton pump inhibitor use in 3 (3.6%). Fractures were subtrochanteric in 30 cases (35.7%) and diaphyseal in 54 (64.3%), all were treated using intramedullary nail fixation. DU occurred in 66 cases (78.6%) and NU in 28 (33.3%). Univariate analysis identified weight, LODH, low hip T-score, nail-to-isthmus ratio, post-operative anterior fracture gap, and FRQ as significant predictors of DU, while only weight and LODH were significant for NU. The multivariable model incorporating weight, LODH, and FRQ achieved acceptable discrimination for DU (AUC 0.759), yielding the prediction equation: $\text{Logit}(p) = 2.29 - 0.02(\text{weight}) - 0.26(\text{LODH}) + 6.7(\text{FRQ})$, where p is probability of DU and FRQ is scored as an integer (1 or 2).

Conclusion Early identification of at-risk patients enables clinicians to personalise drug holiday duration and post-operative monitoring accordingly.

131

Subvastus vs. Medial Parapatellar Approach in Robotic TKA: Impact on Early Quadriceps Function and Recovery in an Asian Population

Jun Jie Leeu, Daniel Hap, Michael Yam

Tan Tock Seng Hospital SINGAPORE

Introduction / Objective The Enhanced Recovery After Surgery protocol has become integral to modern total knee arthroplasty, with early mobilisation, quadriceps function, and pain control being key determinants of length of stay and functional recovery. Robotic-assisted TKA has improved precision and reproducibility of implant positioning, but the choice of surgical approach, namely subvastus and medial parapatellar, remains at the surgeon's discretion. Comparative data on early post-operative recovery within an ERAS framework, particularly in Asian populations with high-flexion functional demands, remain limited.

Materials & Methods A retrospective, propensity-matched cohort study compared 30 SV and 30 MP primary robotic-assisted TKA cases on an ERAS protocol, matched 1:1 on age, gender, ASA grade, and ethnicity. Cases requiring constrained implants or bilateral procedures were excluded. Outcomes included surgical time, pre-operative and post-operative day 1 range of motion, POD1 pain score, straight-leg raise, POD1 walking distance, walking aid, length of stay, and discharge destination. Continuous variables were compared using independent-samples t-tests and Mann-Whitney U tests, and categorical variables using Fisher's exact test.

Results /Discussion Surgical time was shorter in the SV group (63.3 ± 13.7 vs 69.7 ± 12.1 min, $p=0.035$). SV patients reported less POD1 pain (2.50 ± 1.55 vs 3.73 ± 1.26 , $p=0.001$, $d=0.87$) and were more likely to perform SLR (100% vs 40%, $p<0.001$). ROM loss from pre-operative to POD1 was smaller in SV ($-23.7^\circ \pm 21.8^\circ$ vs $-35.0^\circ \pm 18.5^\circ$, $p=0.035$). POD1 walking distance trended higher with SV (34.3 ± 23.4 vs 25.8 ± 18.9 m, $p=0.112$), with fewer requiring a walking frame (50% vs 70%, $p=0.187$) and more discharged directly home (73% vs 60%, $p=0.412$).

Conclusion The SV approach was associated with shorter surgical time, less post-operative pain, preserved ROM, and superior early quadriceps function. A consistent trend towards earlier and greater independence supports SV as a viable approach for accelerating early functional recovery after TKA, and is particularly relevant to Asian patients with high-flexion functional demands.

132

Early Functional Outcome of Metacarpal Fractures Managed Without Immobilization: A Case Series

Ramanathan SO RM Palaniappan, Oliver Yiu Hon Wah

Woodlands Hospital SINGAPORE

Introduction / Objective Traditional management of metacarpal fractures with immobilisation frequently leads to joint stiffness. Biomechanically, the four metacarpals form a transverse palmar arch. While the index and middle metacarpals remain rigidly fixed to the carpus, the ring and small metacarpals possess 15° – 25° of motion at the carpometacarpal (CMC) joint, which helps accommodate distal deformities. Local anatomy provides substantial structural stability: the volar plate resists metacarpophalangeal (MCP) hyperextension, while the transverse intermetacarpal ligaments limit proximal migration and rotation. The intrinsic musculature, especially in central rays, resists shortening and rotation. Impacted fifth metacarpal neck fractures are also inherently stable. Given these stabilizing biomechanical factors, this review aimed to evaluate the early clinical and radiographic outcomes of metacarpal fractures treated without immobilisation.

Materials & Methods This prospective study at Woodlands Hospital evaluated 15 patients with 17 isolated, closed metacarpal fractures managed with immediate active motion rather than immobilization between April 2025 and April 2026. Follow-up assessments at 1, 3, and 6 weeks tracked active range of motion, radiographic alignment, fracture shortening, union rates, and complications including extensor tendon adhesions.

Results /Discussion By 6 weeks, all 15 patients achieved full active ROM, all by 3 weeks. Radiographic follow-up showed no loss of reduction, malalignment, progressive shortening, nonunion, rotational deformity, and patients did not demonstrate extensor adhesions. These outcomes contrast with the joint stiffness common after traditional immobilization. This stability is anatomically driven: the volar plate prevents hyperextension, while the intrinsic musculature and intermetacarpal ligaments particularly in the central rays resist shortening and rotation. Consequently, inherently stable injuries like impacted fifth metacarpal neck fractures can safely undergo early mobilization.

Conclusion Selected metacarpal fractures can be managed without immobilization safely, allowing early return of full motion. At 6 weeks, alignment was maintained with 100% union and no extensor adhesions. This offers functional advantages over traditional immobilization.

134

Evaluating the outcomes of posterior-only, anterior-only and combined surgical approach in the management of cervical spine metastasis

Qinxiang Shant Sin, Yi Zhang, Jun Hao Tan, Kumar Satyanarayan Naresh, Jiong Hao Jonathan Tan

Department of Orthopaedic Spine Surgery, National University Hospital SINGAPORE

Introduction / Objective Cervical spine metastasis accounts for 8-25% of all spinal metastasis. Patients may present with mechanical pain or progressive neurological deficits. Surgical treatment is aimed at restoring spinal stability and achieving surgical decompression thus function. The surgical approaches include the posterior-only, anterior-only and combined anterior-posterior approaches. We aim to analyze and compare the outcomes of these approaches to improve our understanding on their respective utility.

Materials & Methods We retrospectively analysed 78 patients with cervical and cervical-thoracic junction metastasis who underwent surgery in a single institution from 2006-2024. Baseline characteristics, including demographics, oncological characteristics and pre-operative function as well as Spinal Instability in Neoplasia (SINS) score and Bilsky Score were collected. Surgical characteristics such as operative time, total blood loss(mls), need for transfusion, number of levels instrumented or decompressed, and pre-operative embolization were collected. Predicted survival was calculated based on the modified Tokuhashi score. Post-operative outcomes including neurological outcomes, medical and surgical complications, disease recurrence and patient survival was also collected.

Results /Discussion There were 51(65.4%) posterior-only approach, 9(11.5%) anterior-only and 18 (23.1%) combined approach. There was no significant difference in baseline demographic, functional, neurological and oncological characteristics. A combined approach was associated with an increased duration of surgery when compared to posterior and anterior surgery (409 vs 308 vs 252 minutes)($p=0.02$). The anterior-only approach was associated with a significantly lower number of levels instrumented when compared to the other 2 (4 vs 7 vs 7)($p=0.002$). However, there was no significant difference in neurological outcomes, post-operative outcome or overall survival in all groups.

Conclusion There was no difference in outcomes between patients treated with all 3 approaches. This study does suggest that a posterior-only approach is a comparable alternative to an anterior-only or combined approach. Ultimately, the selection of surgical approach should be holistically based on patient, disease and surgical factors.

135

Accuracy and Precision of Tibial Jig-Assisted versus Freehand Intra-incisional Pin Placement Technique for Robotic Total Knee Arthroplasty

Matthew Song Peng Ng, Elliot Kai Jie Eng, Zhi Ning Lin, Wee Le Tan, Alexander Shao-Rong Pang, Glen Liao Zi Qiang

Department of Orthopaedic Surgery, National University Hospital SINGAPORE

Introduction / Objective Intra-incisional freehand pin placement for optical trackers during robotic-assisted total knee arthroplasty (TKA) may result in inaccurate and variable pin positioning, increasing risk of collisions during preparation and trialling. A novel tibial jig was developed to facilitate tracker pin placement at a range of distances and angles. We compared the accuracy and precision of jig-assisted versus conventional freehand placement.

Materials & Methods We conducted a retrospective cross-sectional study of consecutive robotic-assisted primary TKAs from January 2025 to June 2026. Measurements were made on post-operative day zero radiographs of the operated knee, accounting for magnification. Targets were 30mm from the tibial plateau for pin distance and 20° for track angle, the latter measurement derived from the anteroposterior projection assuming a 45° azimuth. Accuracy was the absolute difference from target and precision the standard deviation. Groups were compared using Welch's t-test, Fisher's exact test and the F-test.

Results /Discussion 99 cases were analysed (18 jig, 81 freehand). Absolute difference from target distance was significantly better using the jig (2.34mm, 95%CI 1.51, 3.18) than freehand (5.19mm, 95%CI 4.15, 6.22) ($P < 0.001$). Placement was within 5mm of target for 93.8% of jig cases versus 54.8% freehand ($P = 0.004$), with better distance precision (standard deviation 1.57mm, 95%CI 1.16, 2.43 versus 4.09mm, 95%CI 3.48, 4.98) ($P < 0.001$). Absolute difference from target angle was also significantly better using the jig (3.48°, 95%CI 2.15, 4.82) than freehand (11.82°, 95%CI 10.66, 12.98) ($P < 0.001$). Placement was within 5° of target for 88.9% of jig cases versus 13.6% freehand ($P < 0.001$), with better angular precision (standard deviation 2.69°, 95%CI 2.02, 4.03 versus 5.24°, 95%CI 4.54, 6.20) ($P = 0.003$).

Conclusion The tibial jig improved both the accuracy and the precision of intra-incisional tracker pin placement compared with conventional freehand placement during robotic-assisted TKA.

136

Evaluation of imaging artefacts and high precision radiotherapy techniques with 3D-printed PEEK-HA-Mg₂SiO₄ composites for spine tumour surgery implants

Gabriel Leow, Lionel Lee, Kathir Ilakkiyan, Si Jian Hui, Naresh Kumar

Department of Orthopaedic Surgery, National University Hospital SINGAPORE

Introduction / Objective Pedicle-screw fixation is widely used in spinal tumor surgery to maintain neurological function and spinal stability, but standard implant materials can degrade postoperative imaging and compromise radiotherapy accuracy. Titanium alloy (Ti6Al4V) commonly produces pronounced CT/MRI artefacts that obscure the spinal cord and treatment targets and may distort planned dose delivery. Carbon-fiber-reinforced PEEK (CFR-PEEK) improves radiolucency but is bioinert and can still contribute to imaging and dosimetric uncertainty. This study evaluates a 3D-printable, osteoconductive PEEK-hydroxyapatite-magnesium orthosilicate (PEEK-HA-Mg₂SiO₄) composite as a potential next-generation spinal implant material, compared with Ti6Al4V, CFR-PEEK, and pure PEEK.

Materials & Methods Pedicle screws fabricated from each material were assessed on clinical CT and 3T MRI using standard sequences, including STIR and metal artefact reduction techniques. Radiotherapy impact was tested in a dedicated phantom using film-based gamma analysis for both multi-field

proton therapy plans and photon VMAT plans representative of SBRT. Monte Carlo (SRIM) simulations were conducted to evaluate proton Bragg peak shifts and lateral scattering across clinically relevant material thicknesses.

Results /Discussion PEEK-HA-Mg₂SiO₄ produced minimal CT/MRI artefacts, offering clearer visualization than pure PEEK and substantially reducing artefacts relative to Ti6Al4V. In dosimetric testing, the composite showed the strongest agreement between planned and delivered dose and satisfied clinical gamma criteria of 3%/3 mm for both proton and photon irradiation. Compared with Ti6Al4V and CFR-PEEK, it also reduced the formation of dose hot and cold spots.

Conclusion The findings indicate that PEEK-HA-Mg₂SiO₄ is a clinically promising spinal implant material that can enhance postoperative imaging surveillance and improve the reliability of high-precision spine radiotherapy planning and delivery, including SBRT and proton therapy. Osteoconductive PEEK-based composites may offer an advantage over CFR-PEEK by combining improved biological potential with superior imaging and radiotherapy compatibility.

137

The Routine Use of Robotics in Primary Total Hip Arthroplasty Exacerbates the BMI-dependent Increase in Procedure Duration and 90-day Complications

Alexander Shao-Rong Pang, Zi Qiang Glen Liau, Matthew Song Peng Ng, Tony Hong Wei Chang, Henry Wong, Bradley Crow, William Maloney, Jessica Hooper, Nicholas Giori, James Huddleston, Stuart B. Goodman, Derek F. Amanatullah
National University Hospital SINGAPORE

Introduction / Objective Robotic-assisted total hip arthroplasty (THA) is increasingly used with the expectation of improved precision and efficiency. Whether robotics mitigates the body mass index (BMI)-associated increase in operative time in high-BMI patients remains unclear. We hypothesized that robotic-THA would reduce procedure duration by at least 10±10 minutes compared with conventional THA.

Materials & Methods Retrospective cohort study of 847 consecutive posterior primary THAs was performed at a single academic institution from 2021 to 2023. The primary outcome was surgeon-controlled procedure duration. Secondary outcomes included pre-incision setup time, total operating room utilization, 90-day complications, and robotic learning curve. Multivariable regression evaluated the robotic-by-BMI interaction.

Results /Discussion 120 robotic-THAs and 727 conventional-THAs showed robotic-THA had longer procedure duration than conventional-THA, 138.4 ± 25.2 versus 96.8 ± 29.5 minutes, p<0.001, and greater total operating room utilization, 170.5 ± 27.3 versus 129.1 ± 34.2 minutes, p<0.001. After risk adjustment, robotic assistance added 40 minutes of procedure time, 95% CI 34.4-45.6, p<0.001, with no significant robotic-by-BMI interaction, p=0.569. No BMI subgroup achieved the predefined 10-minute efficiency threshold. Robotic-THA was associated with higher 90-day complications, 10.0% versus 3.0%, OR 3.56, 95% CI 1.64-7.74, p=0.001. Adding procedure time attenuated this association by 29.8%, suggesting partial mediation. A modest learning curve was present (Spearman ρ = -0.212, p=0.020), but even at late-tertile experience, the robotic-conventional time gap exceeded 37 minutes.

Conclusion Robotic-THA did not improve operative efficiency in high-BMI patients and increased procedure duration and operating room utilization across all BMI subgroups. Robotic-THA was independently associated with higher 90-day complication rates, with procedure duration partially mediating that risk. These findings do not support routine robotic use in high-BMI primary THA based on efficiency or complication grounds. Selective utilization guided by specific anatomic indications may better align with value-based care principles.

138

Antimicrobial Surface Engineering of Orthopaedic Implants for Prevention of Periprosthetic Joint Infection: A Systematic Review of Preclinical and Clinical Evidence

Wee Le Tan, Zongxin Dai, Alexander Shao-Rong Pang, Zhen Chang Liang, Dinesh Kumar Srinivasan
Yong Loo Lin School of Medicine, National University of Singapore SINGAPORE

Introduction / Objective Periprosthetic joint infection (PJI) is a major complication of joint arthroplasty, resulting in substantial morbidity, revision surgery, and healthcare costs. Antimicrobial implant coatings have demonstrated encouraging infection-prevention potential across preclinical studies, but few have advanced to clinical evaluation. This systematic review aimed to synthesize the preclinical and clinical evidence for antimicrobial implant coatings, characterize antimicrobial mechanisms and host responses, and evaluate reported barriers to clinical translation.

Materials & Methods PubMed, Embase, and the Cochrane Library were systematically searched according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Eligible studies investigated orthopaedic implants with antimicrobial surface-engineered coatings or modifications and reported infection-related outcomes or antimicrobial mechanisms. Risk of bias was assessed using the Systematic Review Centre for Laboratory Animal Experimentation (SYRCLE) tool for in vivo studies, and the Methodological Index for Non-Randomized Studies (MINORS) for non-randomized clinical studies.

Results /Discussion Of 171 included studies, 60 were in vitro, 90 combined in vitro and in vivo, 11 were in vivo, two combined in vitro and ex vivo, and eight were clinical. Clinical studies comprised only 4.7% of the evidence, suggesting limited translation beyond preclinical evaluation. Hybrid or multifunctional coatings were the most extensively investigated category (84 studies), and ion release was the most commonly reported antimicrobial mechanism (91 studies). Host-related outcomes were also investigated, including osteogenesis, cytotoxicity, and immunomodulation. The most frequently reported translational barriers were insufficient in vivo validation (64 studies) and insufficient clinically representative animal validation (17 studies). Manufacturing and scalability limitations were reported in six studies.

Conclusion Antimicrobial implant coatings demonstrate considerable promise for preventing PJI; however, clinical translation remains limited. Clinically representative preclinical validation and well-designed trials using standardized PJI definitions and consistent outcome measures are needed. Early multidisciplinary collaboration involving surgeons, scientists, process engineers and industry partners is essential to ensure successful translation.

139

Ability to Wear Conventional Shoes Without Inserts Is Independently Associated With Two-Year Satisfaction After Hallux Valgus Surgery

Jeremy Tze En Lim, Xinyu Tao, Jia Ying Lee, Rui Xiang Toh, Kizher Shajahan Mohamed, Zong Xian Li, Kae Sian Tay
Singapore General Hospital SINGAPORE

Introduction / Objective Footwear limitation is common after hallux valgus surgery, but its association with satisfaction beyond validated outcome scores remains unclear. We evaluated whether wearing conventional shoes without inserts at two years was independently associated with high satisfaction after adjustment for the European Foot and Ankle Society (EFAS) score.

Materials & Methods We retrospectively analysed a prospectively maintained institutional forefoot registry. The AOFAS footwear item classified requirements as conventional shoes without an insert (10 points) versus comfort footwear, inserts, modified shoes or a brace (5 or 0). High satisfaction was defined as excellent or very good on the six-point NASS-adapted scale. Of 1,626 procedures with two-year footwear data, 596 had complete satisfaction, EFAS and covariate data. Multivariable logistic regression adjusted for two-year EFAS score, age, sex and BMI. Incremental value was assessed by likelihood-ratio testing and change in c-statistic. Sensitivity analyses additionally adjusted for procedure type and modelled satisfaction ordinally.

Results /Discussion Conventional shoes without inserts were reported after 178/596 procedures (29.9%). High satisfaction occurred in 133/178 cases (74.7%) versus 203/418 requiring comfort footwear, inserts, modified shoes or a brace (48.6%; $p < 0.001$). After adjustment, conventional shoes without inserts remained independently associated with more than twice the odds of high satisfaction (OR 2.14, 95% CI 1.41–3.25; $p < 0.001$). Adding footwear improved model fit (likelihood-ratio $p < 0.001$), although discrimination rose only modestly (c-statistic 0.712 to 0.730). The association persisted after adjustment for procedure type (OR 2.16) and on ordinal modelling of the full satisfaction scale (OR 2.17, 95% CI 1.54–3.05; $p < 0.001$).

Conclusion At two years, conventional shoes without inserts were reported after fewer than one-third of procedures, and this ability was independently associated with high satisfaction after accounting for foot and ankle function. Footwear requirements should be addressed explicitly during preoperative counselling and postoperative assessment.

140

Domain-Specific Recovery After Lumbar Fusion for Degenerative Disease: Two-Year Trajectories in 1,702 Patients

Jeremy Tze En Lim, Ashton Kai Shun Tan, Yee Gen Lim, Zhixing Marcus Ling, Reuben Chee Cheong Soh, Lei Jiang, Christian Hwee Yee Heng
Singapore General Hospital SINGAPORE

Introduction / Objective Composite health-related quality-of-life scores may obscure differences in recovery between individual health domains. We characterised changes across all eight Short Form-36 (SF-36) domains during the first two years following degenerative lumbar fusion.

Materials & Methods A prospectively maintained institutional registry of degenerative lumbar fusion procedures performed between 2010 and 2023 was retrospectively analysed. Revision procedures and isolated hardware removals were excluded. Complete-case analysis included 1,702 patients with SF-36 domain scores available preoperatively, at approximately six months and at approximately two years. Paired comparisons evaluated changes from baseline to six months, six months to two years and baseline to two years. Cohen's d_z quantified paired-change effect sizes. A Bonferroni-adjusted significance threshold of $p < 0.0021$ was applied across 24 comparisons. Role-Emotional findings were interpreted cautiously because 81.6% of patients had the maximum score preoperatively.

Results /Discussion All eight SF-36 domains improved significantly from baseline to two years (all $p < 0.001$). Bodily Pain, Vitality and Mental Health demonstrated no further significant change after six months ($p = 0.22$ – 0.97), indicating that most improvement occurred during the initial postoperative period. In contrast, Physical Functioning, Role-Physical and Social Functioning continued to improve between six months and two years by 3.0 points ($d_z = 0.15$), 8.3 points ($d_z = 0.19$) and 4.4 points ($d_z = 0.15$), respectively (all $p < 0.001$), although these later gains had small effect sizes. Role-Physical demonstrated the greatest overall improvement from baseline to two years (+49.7 points). General Health improved from 65.2 preoperatively to 70.3 at six months and remained broadly stable at 69.3 at two years, with the later change not significant after multiplicity correction.

Conclusion Recovery following degenerative lumbar fusion is domain-specific. Pain, vitality and mental health improve predominantly within six months, whereas physical and social functioning demonstrate small additional gains into the second postoperative year. These trajectories may support more specific counselling regarding the expected timing of symptomatic and functional recovery.

142

Shouldering the Burden: Fracture Patterns and Functional Outcomes of Shoulder Girdle Fractures at a Major Trauma Centre in Singapore

Clara Yang, Michael Yam

Yong Loo Lin School of Medicine, National University of Singapore SINGAPORE

Introduction / Objective Shoulder girdle fractures — including the proximal humerus, clavicle, scapula, and humeral shaft — are heterogeneous injuries with varying management pathways. As a major Singapore trauma centre, Tan Tock Seng Hospital manages a substantial volume of these fractures, yet local injury patterns and outcomes remain incompletely described. This study describes the distribution of shoulder girdle fractures and evaluates outcomes following conservative versus surgical management.

Materials & Methods This retrospective cohort study included 233 consecutive patients who presented with shoulder girdle fractures to Tan Tock Seng Hospital between July 2025 and May 2026, identified via the hospital trauma registry. Demographic data and treatment modality (conservative versus operative) were collected. Active range of motion (ROM) (abduction, forward flexion) was assessed cross-sectionally at 6 weeks and 3 months, as complete paired data were unavailable. Data were analysed descriptively using Microsoft Excel.

Results /Discussion Mean age was 59.1 ± 18.7 years; 52.8% were male. Proximal humerus fractures were most common (52.8%), followed by clavicle (36.9%), scapula (7.7%) and humeral shaft (2.6%). Proximal humerus fractures occurred predominantly in older females (68.2 years, 65.9% female) and were managed mainly conservatively (65.9%), while clavicle shaft fractures affected a younger, male-predominant group (43.0 years, 81.1% male) with a higher operative rate (60.4%). These findings demonstrate distinct demographic and management profiles across fracture patterns. Overall, 59.2% were managed conservatively and 36.9% operatively. At 6 weeks, mean abduction was 109.3° versus 114.7° ($p = 0.504$) and forward flexion 116.2° versus 119.6° ($p = 0.566$) in conservative versus operative groups, respectively. At 3 months, corresponding values were 120.6° versus 129.1° ($p = 0.294$) and 129.1° versus 136.4° ($p = 0.461$). All differences were non-significant, with ROM data available for 23–35% of the cohort.

Conclusion Proximal humerus fractures constitute the largest burden of shoulder girdle trauma at our institution, predominantly in older females, supporting consideration of targeted care pathways for older patients with proximal humerus fractures.

143

Vascular Malformation of the Hallux Mimicking Chronic Paronychia and Glomus Tumor: A Diagnostic Pitfall

Guhaan Balasubramian, Kaamini Ravindran Pillay, Mala Satkunanantham, Dinesh Naidu

Woodlands Hospital SINGAPORE

Introduction / Objective Vascular malformations of the foot and toes are uncommon and are usually found in the pelvic area and the brain. It is frequently misdiagnosed due to non-specific presentations that overlap with common conditions such as ingrown toenails, chronic paronychia, or glomus tumors. Most of the vascular malformation in the toe may be asymptomatic but can also cause pain, swelling, and functional impairment.

Materials & Methods This is a case of a 47-year-old female presenting with a five-year history of right hallux swelling and intermittent pain which is refractory to conservative management. Initial assessment suggested suspicion of an ingrown toenail and chronic paronychia. Physical examination showed fusiform dorsal soft tissue swelling over the interphalangeal joint without active signs of infection. While plain radiographs were unremarkable, contrast-enhanced MRI demonstrated a well-circumscribed, enhancing subungual lesion concerning a glomus tumor. A 2.5 cm by 1 cm hypervascular lobulated mass was surgically excised, which turned out to be a vascular malformation as evidenced by an aggregate of thick-walled muscular blood vessels with fibromyxoid change and ectatic channels on final histopathology.

Results /Discussion Vascular malformations in the toes pose a diagnostic dilemma due to their non-specific presentation and scarcity in the digits. Usage of advanced MRI imaging still has its own technical and diagnostic challenges in view of its overlapping features of T2 hyperintensity and contrast enhancement. Ultimately, precision surgical dissection is critical to achieve complete removal, safeguard the nail bed, and prevent significant tissue loss.

Conclusion Vascular malformations should be considered in cases of refractory and atypical digital pain and swelling. Thorough evaluation with advanced imaging and precision surgical excision is required to achieve symptom resolution and functional nail restoration.

144

Comparison of knee extension and flexion strength at 1 year following anterior cruciate ligament reconstruction using quadriceps tendon versus hamstring tendon autograft; A prospective study

Angelo Gabriel Gumila, **Hongzhi Zhu**, Jegathesan T, Sean Wei Loong Ho, Keng Thiam Lee, Lester Teong Jin Tan
Prime Hospital and Medical Center PHILIPPINES

Introduction / Objective Quadriceps tendon (QT) autografts have gained increasing popularity for anterior cruciate ligament reconstruction (ACLR) because of their favorable biomechanical properties and low donor-site morbidity. However, concerns remain regarding persistent postoperative quadriceps weakness following graft harvest. Limited evidence exists comparing postoperative muscle strength between QT and hamstring tendon (HT) autografts. This study aimed to compare isokinetic knee extension and flexion strength approximately 1 year after ACLR using either a QT or HT autograft.

Materials & Methods 74 patients who underwent primary ACLR at a single tertiary institution were prospectively enrolled. 30 patients received a full thickness soft-tissue QT autograft, while 44 received an HT autograft. At approximately 1 year postoperatively, all patients underwent isokinetic strength assessment using a Biodex dynamometer. Outcome measures included the Quadriceps Index (QI), Hamstring Index (HI), peak quadriceps and hamstring torque normalized to body weight, and hamstring-to-quadriceps (H:Q) strength ratio. Between-group comparisons were performed using independent-samples statistical tests according to data distribution.

Results /Discussion Baseline demographic characteristics were comparable between groups. At 1 year post surgery, no significant differences were observed between the QT and HT groups in QI ($p = .844$), HI ($p = .310$), quadriceps peak torque/body weight ($p = .535$), hamstring peak torque/body weight ($p = .852$), or H:Q ratio ($p = .574$). Although both groups demonstrated quadriceps limb symmetry indices below the commonly recommended 90% threshold for return to sport, postoperative muscle strength outcomes were comparable regardless of graft type.

Conclusion At 1 year post-ACLR, QT and HT autografts demonstrated similar isokinetic knee strength, limb symmetry indices, and strength ratios. These findings demonstrate that QT graft harvesting does not result in poorer knee extension strength as compared to HT autografts at 1 year postoperatively. Graft selection should be individualized based on patient- and surgeon-specific factors rather than concerns regarding long-term donor-site muscle weakness alone.

145

The Fixation-Replacement Dilemma: Updated Evidence for Periprosthetic Distal Femoral Fractures

Yu Liu, Sumanth Gera Kumar, Xin Ying, Chua Anastasia, Yifei Chen, Yiming Chen, Fareed Kagda
NUHS SINGAPORE

Introduction / Objective The global volume of total knee arthroplasty (TKA) has increased substantially over the past 15 years, accompanied by a corresponding rise in periprosthetic distal femoral fractures (PDFFs). Operative management commonly involves open reduction and internal fixation (ORIF) or distal femoral replacement (DFR). Previous studies comparing ORIF and DFR have yielded conflicting results. This study aimed to provide an updated systematic review and meta-analysis comparing ORIF with DFR for PDFFs post-TKA, evaluating re-operation as the primary outcome, with infection, mortality, functional and perioperative outcomes as secondary outcomes.

Materials & Methods PubMed, Embase and Scopus were systematically searched between January 2010 and August 2026 using predefined keywords. Statistical analyses were performed using RStudio with pooled effect estimates calculated using a random-effects model and reported as risk ratios (RRs) with 95% confidence intervals (CIs). Statistical heterogeneity was assessed using the I^2 statistic. Functional and peri-operative outcomes evaluated included Knee Society Score (KSS), knee range of motion (ROM), time to full weight-bearing, and length of stay.

Results /Discussion Fifteen studies comprising 2,376 patients contributed to the primary meta-analysis of re-operation. RRs were calculated as the risk in the ORIF group relative to DFR. There was no significant difference in re-operation between ORIF and DFR (RR 1.02, 95% CI 0.60–1.75; $p=0.933$; $I^2=71.4\%$). Similarly, no significant differences were observed in infection (12 studies, $n=2,129$; RR 0.70, 95% CI 0.36–1.36; $p=0.291$; $I^2=45.0\%$) or mortality (10 studies, $n=2,112$; RR 0.96, 95% CI 0.79–1.18; $p=0.698$; $I^2=0\%$). Functional and peri-operative outcomes were inconsistently reported with insufficient comparable data and were therefore synthesised narratively.

Conclusion Current evidence demonstrates no significant difference between ORIF and DFR in reoperation, infection, or mortality following PDFF post-TKA. Neither treatment strategy demonstrates a clear overall advantage based on the quantitatively pooled outcomes, supporting individualized treatment selection according to patient and fracture characteristics.

146

Young versus Younger: A Comparison of Intraoperative and Early Postoperative Outcomes of Posterior Spinal Fusion for Idiopathic Scoliosis in An Asian Population

Grace Hui Zhen Chua, Shawn Jing Sheng Seah, Lei Jiang, Reuben Chee Cheong Soh
Singapore General Hospital SINGAPORE

Introduction / Objective Adolescent idiopathic scoliosis (AIS) and young adult idiopathic scoliosis (YAIS) share a diagnosis but differ in skeletal maturity, spinal flexibility, and surgical goals. The effects of these differences on perioperative outcomes, particularly in an Asian population, remains incompletely characterised.

Materials & Methods A retrospective cohort study was conducted at a tertiary spinal surgery centre. Ninety patients who underwent single-stage posterior spinal fusion by the same surgical team between 2015 and 2025 were included: 43 AIS (age ≤ 18 years) and 47 Y AIS (aged between 19 and 40 years). Baseline demographics, including Risser grade and Lenke curve classification, were recorded for both groups. Intraoperative variables, immediate postoperative outcomes, and complications between the two groups were compared.

Results /Discussion Preoperative curve severity was comparable between groups (maximum Cobb: AIS median 52.0° [IQR 48.0–62.0] vs Y AIS 54.0° [47.0–62.0]; $p=0.731$). Y AIS patients underwent posterior column osteotomies more frequently (53.2% vs 30.2%; $p=0.034$) and had significantly higher intraoperative blood loss (median 1000 [IQR 600–1450] vs 700 [500–900] ml; $p=0.005$) and cell saver return volumes (median 400 [264–500] vs 248 [143–402] ml; $p=0.019$). Despite greater operative complexity, postoperative day one pain scores (both median 5 on NRS; $p=0.378$), time to first ambulation (both median 2 days; $p=0.622$), and length of stay (both median 6 days; $p=0.281$) were equivalent. Percentage Cobb angle correction was higher in AIS ($77.3\% \pm 10.9\%$ vs $72.4\% \pm 12.3\%$; $p=0.044$), while height gain was similar (both median 3.0 cm; $p=0.693$). Complication rates did not differ significantly (AIS 9.3% vs Y AIS 21.3%; $p=0.151$).

Conclusion Y AIS patients require more extensive intraoperative manoeuvres than adolescents even while having equivalent preoperative curve severity. Nevertheless, short-term postoperative recovery was comparable between groups. These findings suggest that while surgical correction for Y AIS patients might be more technically demanding, the immediate postoperative course mirrors that of adolescents.

147

Complex limb salvage for chronic osteomyelitis with customised patient specific anatomical calcaneum prosthesis and free flap

Shannon Shih, May Fong Chan, Geraldine Lee, Muhammad Farhan Fadil

Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Calcanectomies are frequently performed to address osteomyelitis which resultant alteration of hindfoot structure. Calcaneum replacement surgeries are rarely performed due to issues with prosthesis stability and soft-tissue defect coverage. The advent of three-dimensional (3D) printing has allowed the creation of customized prosthesis. Limited case reports for calcaneum replacements thus far have all been performed for primary tumours.

Materials & Methods A custom 3D-printed titanium calcaneum prosthesis was fabricated based on the contralateral calcaneum. Design modifications included a porous hydroxyapatite surface covering the body, anterior, middle, and posterior facets to facilitate soft-tissue and bony ingrowth, pre-planned talus peg, screws tracks for bony fixation into navicular and talus, and attachment sites for tendinous fixation.

Results /Discussion A 51-year-old gentleman presented with a history of extensive right heel injury requiring latissimus dorsi flap 20 years prior. This was complicated by flap infection and chronic calcaneal osteomyelitis requiring calcanectomy. He opted for multi-staged reconstruction due to frequent plantar ulcers and mobility issues. Remanent calcaneum was excised and a cement mould of the actual prosthesis was inserted during the first stage. The second stage involved deformity correction and joint preparation. In the final stage, the prosthesis was implanted with two locking screws inserted into the talus and navicular to provide early stability. The flexor hallucis longus was re-routed and sutured to the prosthesis. A contralateral anterolateral thigh flap covered the exposed implant. Post-operative radiographs showed good fit of the prosthesis. He was initially non-weight bearing for a period of 3 months and made to partial bear weight at three months. To date, the recovery observed at four months is satisfactory and he is currently able to ambulate limited distance with crutches.

Conclusion We report the first successful calcaneal prosthesis implantation and soft tissue reconstruction performed for chronic infection. Short-term clinical outcomes were satisfactory. This represents a promising option for limb salvage.

148

Validation of a Novel Intraoperative Ruler for Measuring Quadriceps Tendon Thickness for ACL Reconstruction: A Pediatric Cadaveric Study of Measurement Reliability and Demographic Predictors

Matthew Song Peng Ng, James Hui, Ethan Kee Ern Tew, Alexander Shao-Rong Pang, Kevin Shea, Zi Qiang Glen Liao

Department of Orthopaedic Surgery, National University Hospital, Singapore, SINGAPORE

Introduction / Objective Quadriceps tendon (QT) autografts are increasingly used for pediatric ACL reconstruction, but tendon dimensions vary widely with age, and graft diameter must be tailored to a growing knee. Current sizing relies on pre-operative MRI and intra-operative evaluation, yet no dedicated instrument exists for real-time QT thickness measurement. Accurate, real-time sizing could reduce graft under- or over-sizing and associated complications in this population. We developed a handheld prototype device and evaluated its accuracy against Vernier caliper measurements.

Materials & Methods Eight fresh-frozen cadaveric knee specimens (aged 4–8 years) underwent QT thickness measurement at 0, 30, and 60 mm proximal to the patella in both 90° flexion and 0° extension. At each location, one Vernier caliper measurement and three prototype measurements were obtained, yielding 38 complete measurement sets.

Results /Discussion Eight pediatric cadaveric knees (mean age 6.5 years; mean BMI 16.3 kg/m^2) were included. Multivariable linear regression showed (1) higher BMI was associated with greater tendon thickness ($\beta = 0.29$, 95% CI 0.05–0.53; $P = 0.020$), and (2) tendon thickness at 30 mm and 60 mm from the patella was significantly thinner than at 0 mm ($\beta = -1.90$, $P = 0.024$ and $\beta = -2.16$, $P = 0.016$, respectively). Age and knee flexion/extension state were not associated with thickness. The prototype demonstrated near-perfect intra-observer reliability (ICC 0.994, 95% CI 0.989–0.996; $P < 0.001$), with subgroup ICCs ranging 0.982–0.999. Scatter plot analysis revealed strong correlation between prototype and Vernier measurements ($R^2 = 0.637$, $P < 0.001$). Bland-Altman analysis showed good agreement (mean bias 0.00 mm, 95% limits of agreement -3.80 to 3.80 mm).

Conclusion This prototype reliably measures QT thickness with excellent reproducibility, supporting the feasibility of the first dedicated intra-operative QT measurement device and informing future design iterations for larger cohorts and clinical trials.

149

Fibrin Sealant as a Haemostatic Adjunct is Associated with Reduced Blood Loss and Postoperative Anaemia Risk in Cementless Total Knee Arthroplasty: A Propensity-Matched Analysis

Kristen Shi Qi Kee, Matthew Song Peng Ng, Pelton Yen Goh, Alexander Shao-Rong Pang, Zi Qiang Glen Liao

Yong Loo Lin School of Medicine, National University of Singapore SINGAPORE

Introduction / Objective Cementless total knee arthroplasty (TKA) is associated with substantial perioperative blood loss and haemoglobin (Hb) decline. We postulate that most of this loss occurs postoperatively into the knee joint rather than intraoperatively, where loss is minimal especially with tourniquet use. This matters under Enhanced Recovery After Surgery (ERAS) guidelines, which emphasize early mobilization and drain avoidance. Additionally, existing fibrin sealant evidence has no specific technique and relies on non-specific soft tissue/bone application. We evaluated, using propensity score matching, whether innovative fibrin sealant application directly onto freshly resected cancellous bone before implantation reduces (A) estimated blood loss (EBL) and (B) postoperative haemoglobin decline in cementless robotic TKA.

Materials & Methods A retrospective cohort of 155 primary robotic cementless TKA cases (2023-2026, single surgeon) was analysed (111 non-fibrin sealant, 44 fibrin sealant). Patient demographics, co-morbidities, preoperative medications, and surgical details were collected. EBL was calculated using Gross and Nadler's formulae. 1:1 propensity score matching was performed on baseline confounders; balance was assessed via standardized mean differences (SMD). Matched outcomes were compared using paired t-tests and mixed-effects models.

Results /Discussion Substantial baseline imbalance existed before matching (BMI SMD=0.278, tourniquet time=0.367); all covariates achieved SMD <0.1 (40 pairs). Non-fibrin sealant group had a 70% greater postoperative Hb drop (1.5 vs 0.9 g/dL; $p<0.001$) and 39.0% greater EBL (548.8 vs 394.7mL; $p=0.01$), corroborated by mixed-effects models (Hb: $\beta=0.63$, $p<0.001$; EBL: $\beta=153.5\text{mL}$, $p=0.001$).

Conclusion Strategic intraoperative fibrin sealant use was independently associated with significantly lower blood loss: (A) haemoglobin drop and (B) estimated blood loss. This strategic haemostatic adjunct technique can potentially complement existing blood-conservation guidelines, and may support its adoption as a standard-of-care under ERAS-based TKA management.

150

Computer Navigation, Not Robotic Assistance, Adds Operative Time in Primary Total Knee Arthroplasty Across All Body Mass Index Classes

Zi Qiang Glen Liao, Tony Chang, Alexander Shao-Rong Pang, **Matthew Song Peng Ng**, Henry Wong, Jessica Hooper, Stuart Goodman, William Maloney, Derek Amanatullah

Department of Orthopaedic Surgery, National University Hospital, Singapore, SINGAPORE

Introduction / Objective Meta-analyses of technology-assisted total knee arthroplasty (TKA) report 15-20 minutes of added procedure time and about 30 minutes of operating room time, pooling two technologies with different workflows. Whether navigation and robotic TKA impose distinct operative time burdens, and whether body mass index (BMI) modifies them, has not been evaluated in a single three-group cohort.

Materials & Methods We retrospectively reviewed 1,560 consecutive primary TKAs (manual $n=671$; navigation $n=370$; robotic $n=519$) from 2021 to 2023. Multivariable linear regression assessed setup, procedure, and utilisation time, adjusting for BMI, demographics, fixation, and patellar resurfacing, with BMI-by-technology interaction terms.

Results /Discussion After adjustment, robotic TKA was not associated with longer setup, procedure, or utilisation time versus manual ($\beta=1.0, 1.5$, and 2.5 minutes; all $p>0.280$). Navigation added 8.5 minutes of setup, 33.6 minutes of procedure, and 42.1 minutes of utilisation time versus manual (all $p<0.001$). Robotic and manual times were similar across five of six BMI categories, including Class III obesity ($p=0.466$). 90-day complications were similar across groups.

Conclusion Navigation added 33.6 minutes of procedure time, exceeding the previously established 30-minute complication-associated threshold in every BMI class. Robotic TKA was time-neutral across all classes, including Class III obesity. The published 15- to 20-minute estimate averages two opposite profiles. Separating navigation from robotic TKA is essential for accurate operative time assessment and equitable BMI-based access policy.

151

Beyond Lateralization and Distalization: Omovolume as a Unifying Three-Dimensional (3D) Measure in Reverse Shoulder Arthroplasty (RSA)

Hean Wu Kang, Kristin Italia, Ashish Gupta

Ng Teng Fong General Hospital SINGAPORE

Introduction / Objective Conventional RSA lateralization and distalization values do not adequately reflect post-operative kinematic changes to the shoulder. We developed a novel measure - omovolume (Greek ômos, "shoulder") - quantifying the 3D volume swept by the humerus across all impingement-free glenohumeral motion in the shoulder. We investigated omovolume changes in a paired simulation study of 41 cadaveric shoulders pre- and post-RSA.

Materials & Methods Segmented CT data of 41 cadaveric shoulders were standardized to ISB scapular and humeral coordinates. Tuberosity points were landmarked to record humeral sweep trajectories. Virtual RSA implantation was carried out in a custom-built simulator. Standard RSA configuration was applied to all specimens - 25mm non-lateralized baseplate flushed at inferior glenoid rim in neutral tilt and version, 36mm glenosphere, 135° humeral component with contact point seated at the anatomic neck cut in native version. The simulator swept native and RSA shoulders across standard and combined motion planes, mapping tuberosity trajectories until bony impingement was encountered. Omovolume was calculated from the resulting humeral tuberosity trajectory envelope. A secondary analysis removed the omovolume sector blocked anteriorly by the conjoint tendon. Statistical analyses used paired Wilcoxon tests with donor-clustered bootstrap confidence intervals.

Results /Discussion Omovolume increased in 40/41 shoulders post-RSA, from a median 82.2 cm³ (IQR 67.5–104.7) to 192.0 cm³ (IQR 159.2–231.3) - a median 2.25x increase (95% CI 2.12–2.40, $p<0.001$). The conjoint tendon contacted all 41 RSA omovolume anteriorly. After removing this sector, RSA still increased omovolume in 37/41 shoulders, a median 1.45x (95% CI 1.32–1.51, $p<0.001$). Of the anteriorly removed sector, a median 6.9% overlapped with native omovolume, whereas the remaining 92.1% overlapped with RSA omovolume.

Conclusion RSA more than doubled omovolume with the gain persisting (1.45x) after accounting for conjoint tendon impingement, a clear source of anterior block in RSA. Omovolume provides a unifying volumetric measure of RSA kinematics.

152

Robotic vs Conventional Unicompartmental Knee Arthroplasty: A Systematic Review and Meta Analysis

Kai Xiang Yeoh, **Vincent Kewei Qi**, Ryan Wai Keong Loke, Barry Wei Loong Tan

Yong Loo Lin School Of Medicine SINGAPORE

Introduction / Objective Robotic-assisted unicompartmental knee arthroplasties (rUKA) have emerged as an increasingly adopted alternative to conventional unicompartmental knee arthroplasties (cUKA), but many have questioned its clinical outcomes. There has been a lack of meta-analyses

comparing rUKAs to cUKAs, and this study aims to perform a systematic review and meta-analysis to compare both the primary and secondary outcomes of the clinical results.

Materials & Methods A random-effects meta-analysis was conducted on comparative studies between Robotic-assisted unicompartmental knee arthroplasties (rUKA) and conventional unicompartmental knee arthroplasties (cUKA) in patients undergoing knee arthroplasty for knee replacement. We searched Pubmed, Embase, Cochrane Library, and SCOPUS from inception to May 2026. We evaluated International Knee Score (IKS) for pain and function, Knee Society Score (KSC), Knee Society Pain Score (KSP), Visual Analogue Scale (VAS), Range of Motion (ROM), Western Ontario and McMaster Universities Arthritis Index (WOMAC), American Knee Society Score (AKSS), Knee Society Function Score (KSF), Oxford Knee Score (OKS).

Results /Discussion rUKA demonstrated significantly better postoperative IKS function (MD: 3.58 points [95% CI: 0.50–6.66], $p < 0.05$), IKS pain (MD: 4.17 points [95% CI: 2.03–6.30], $p < 0.001$), KSF (MD: 2.39 points [95% CI: 0.31–4.46], $p < 0.05$), and KSP scores (MD: 2.44 points [95% CI: 0.12–4.76], $p < 0.05$) compared with cUKA. However, there were no significant differences between rUKA and cUKA in postoperative OKS (MD: 2.63 points [95% CI: -0.70–5.95], $p > 0.05$), AKSS (MD: 1.91 points [95% CI: -3.29–7.10], $p > 0.05$), KSC (MD: -0.07 points [95% CI: -1.84–1.70], $p > 0.05$), range of motion (MD: 0.39° [95% CI: -3.61–4.38], $p > 0.5$), VAS pain scores (MD: 0.29 points [95% CI: -1.02–1.59], $p > 0.5$), or WOMAC scores (MD: -0.11 points [95% CI: -4.99–4.78], $p > 0.5$).

Conclusion Our meta analysis has reflected positive clinical outcomes and reproducibility in implant position without compromising on surgical duration and complication rates.

153

Minimising Blood Loss in Robotic Total Knee Arthroplasty Through Novel Strategic Fibrin Sealant Application: A Retrospective Cohort Analysis

Pelton Yen Goh, Alexander Shao-Rong Pang, Kristen Shi Qi Kee, Matthew Song Peng Ng, Zi Qiang Glen Liao
Yong Loo Lin School of Medicine, National University of Singapore SINGAPORE

Introduction / Objective Robotic Total Knee Arthroplasties (rTKAs) are associated with substantial post-operative blood loss, causing haemarthrosis, potentially contributing to early-mid post-operative pain and reduced range of motion. We investigated the efficacy of strategic fibrin sealant application intraoperatively as a haemostatic adjunct, a method neither routine nor part of the Enhanced Recovery After Surgery (ERAS) protocols. This study quantifies the effects of strategic fibrin sealant application on Estimated Blood Loss (EBL) and post-operative day one (POD1) haemoglobin (Hb) decline.

Materials & Methods This retrospective consecutive cohort study analysed 215 primary rTKA cases (44 fibrin sealant, 171 non-fibrin sealant) across 187 unique patients. Patient demographics, comorbidities, and surgical details were recorded. EBL was calculated using Nadler's and Gross formulae. Hb decline was calculated by subtracting POD1 Hb from pre-operative Hb. An independent t-test, followed by univariate and multivariate regression analyses were conducted.

Results /Discussion The independent t-test revealed the non-fibrin sealant group exhibited a 72.8% larger mean Hb decline (1.50g/dL vs 0.868g/dL; $p < 0.001$), and a 66.6% greater EBL (528mL vs 317mL; $p < 0.001$) compared to the fibrin sealant group. Multivariable linear regression, adjusted for covariates, confirmed the non-fibrin sealant group was independently associated with a 75.4% larger Hb decline (1.57g/dL vs 0.895 g/dL; $p < 0.001$), and a 58.1% greater EBL (585mL vs 370mL; $p < 0.001$) compared to the fibrin sealant group. Previous literature reported greater blood loss: Jules-Elysee et al. (2019), who used IV tranexamic acid as a haemostatic adjunct, reported 269% worse Hb decline and 334% worse EBL (2.41g/dL Hb decline, 1,237mL EBL) compared to our fibrin sealant group (0.895g/dL Hb decline, 370mL EBL).

Conclusion The strategic intraoperative fibrin sealant application is independently associated with reduced post-operative blood loss quantified by EBL and Hb decline after adjusting for confounders. Given the significant post-operative blood loss in rTKAs, this haemostatic intervention represents a potential adjunct to ERAS protocols.

154

Enhanced Recovery After Surgery (ERAS) in Lumbar Spine Surgery: Our Institutional Experience and Who Goes Home Early

Samuel Sing Li Ong, Hong Lee Terry Teo, Kuei Siong Andy Yeo, Dalun Leong, Dinesh Shree Kumar, Zhihong Chew
Changi General Hospital SINGAPORE

Introduction / Objective Enhanced Recovery After Surgery (ERAS) has revolutionised spine surgery by integrating peri-operative strategies through evidence-based medicine to improve patient outcomes and reduce the length of hospital stay. Our institution implemented an ERAS protocol for elective spine surgeries in 2019, which has been progressively refined and optimised over the years. This study aimed to evaluate outcomes following elective lumbar spine surgery under an institutional ERAS pathway and identify factors associated with early discharge.

Materials & Methods A total of 108 consecutive patients were included in this study between January 2024 and October 2025. Procedures performed under the ERAS protocol consisted of endoscopic lumbar discectomy, endoscopic lumbar decompression, minimally invasive lumbar discectomy and minimally invasive lumbar decompression. Demographic, surgical and peri-operative variables were collected. The primary outcome was length of stay post-operatively. Univariate and multivariate linear regression analyses were conducted to identify factors independently associated with the length of stay.

Results /Discussion The mean length of inpatient stay was 1.5 ± 1.0 days. On univariate analysis, age ($p < 0.001$), gender ($p = 0.041$), American Society of Anaesthesiologists (ASA) score ($p = 0.004$), type of surgery ($p = 0.014$), duration of surgery ($p = 0.017$) and immediate complications ($p = 0.007$) were all significantly associated with length of stay. However, after multivariate adjustment, only age ($B = 0.018$, 95% CI 0.004–0.033, $p = 0.011$) remained as a significant independent predictor.

Conclusion The implementation of an ERAS protocol for lumbar spine surgery is safe and reduces the overall length of inpatient hospital stay. Younger age was the only independent predictor of early discharge. These findings support the successful application of ERAS, particularly in younger patients.

155

Cervical Tuberculous Spondylitis with C5 Vertebral Body Collapse, Abscess Formation, and Neurological Deficit: A Case Report of Successful Anterior Reconstruction

Bryant Elbert, Benny Lay
Murni Teguh Memorial Hospital, Medan INDONESIA

Introduction / Objective Cervical tuberculous spondylitis represents a rare form of spinal tuberculosis, with most cases affecting the thoracic and lumbar regions. It remains a major challenge due to its higher risk of neurological impairment and spinal instability. Disease progression and severity can be reduced with early diagnosis and appropriate management. However, in resource-limited settings, limited access to advanced diagnostic facilities may

contribute to delayed diagnosis and treatment. As a result, patients may present with complications, requiring more complex management and potentially leading to suboptimal outcomes. This case reports a 20-year-old female diagnosed with cervical tuberculous spondylitis complicated by tetraparesis.

Materials & Methods The patient presented with weakness and tingling sensations in all extremities one week prior to admission. The magnetic resonance imaging (MRI) showed C4 and C5 vertebral body destruction with an abscess extending from C4 to C6 causing spinal cord compression. The patient underwent anterior cervical debridement and sequestrectomy followed by iliac crest autologous bone grafting at C4 and C5. In addition, anterior plate fixation was placed at C4 and C6 for stabilization. Post-surgery, the patient received antituberculous therapy, and a soft cervical brace was applied. A complete neurological recovery was achieved within nine months post-surgery.

Results /Discussion Cervical tuberculous spondylitis is associated with a higher risk of neurological complications due to the anatomical characteristics of the cervical spine. Antituberculous therapy remains the standard treatment for cervical tuberculous spondylitis. However, surgical intervention is indicated in patients with neurological deficits, significant abscess formation, or spinal instability. Although corpectomy with cage reconstruction is commonly performed in cases of severe cervical body destruction, this patient was successfully managed with iliac crest autologous bone grafts, achieving favorable clinical outcomes within nine months post-surgery.

Conclusion This case highlights the importance of early diagnosis and individualized surgical management of cervical tuberculous spondylitis to achieve optimal outcomes and prevent long-term disability.

156

Effect of global, femoral, acetabular offset, and limb length discrepancy on clinical outcomes of total hip arthroplasty

Kennan Zhi Guang Yeo, Sourab Shetty, Hong Jing Lee, Andy Yew, Sheng Xu, Audrey Xinyun Han, Eric Liu, MING HAN LINCOLN LIOW, Darren Keng Jin Tay, Seng Jin Yeo, Hee Nee Pang
Singapore General Hospital SINGAPORE

Introduction / Objective Measurements of hip biomechanics restoration for total hip arthroplasty (THA) include femoral, acetabular, and global offset (FO, AO, GO) and limb length discrepancy (LLD). Inadequate restoration may contribute to complications, gait dysfunction, and poorer postoperative outcomes, but various studies have remained unclear as to what is considered optimal restoration. This study aims to investigate the relationship between offset and limb length discrepancy on patient reported outcome measures (PROMs).

Materials & Methods This retrospective cohort study included 99 patients who underwent primary THA with follow-up at 6 months and 2 years. PROMs collected included Oxford Hip Score (OHS), Western Ontario and McMaster Universities Arthritis Index (WOMAC) pain, stiffness, and function scores, and 36-Item Short Form Health Survey (SF-36) physical component summary (PCS) and mental component summary (MCS). Preoperative and postoperative anteroposterior pelvic radiographs were analysed to determine changes in GO, FO, AO, and LLD. Patients were classified into optimal and non-optimal groups using thresholds of GO -5 to 5 mm, FO 0 to 10 mm, AO -10 to 0 mm, and LLD <10mm. Multivariable linear regression models were used to evaluate associations between changes in GO, LLD, and postoperative PROM improvements, with further subgroup analysis into FO, AO and LLD, while optimal and non-optimal groups were compared using Mann-Whitney U and t-test.

Results /Discussion Multivariable regression demonstrated no significant association between changes in GO, FO, AO, or LLD and improvement in PROMs at 6 months or 2 years, with low R^2 values across all models. Comparisons between optimal and non-optimal offset groups showed largely insignificant differences in PROMs. Overall, restoration of offset and limb length discrepancy was not associated with superior functional outcomes.

Conclusion Postoperative variation in offset and LLD was not significantly associated with poorer PROMs, and previously proposed optimal offset and LLD ranges did not consistently predict better outcomes.

157

A Multimodal Wearable Sensor System for Objective Assessment of Rotational Knee Instability After ACL Injury and Reconstruction: Interim Results of a Prospective Clinical Validation Study

Kah Weng Lai, Jiya Dutta, David Tan, Zi Yang Chia, Jeffrey Zhu
PreciX Pte Ltd SINGAPORE

Introduction / Objective The purpose of this study is to validate the deep machine learning model and its performance used in GATOR PRO, which integrates knee-mounted Inertial Measurement Units (IMUs) with ultrasound images to derive high-fidelity in-vivo biomechanical rotational data. Based on this data collected, it is hypothesized that the model can effectively classify knee stability after ACL injury and reconstruction.

Materials & Methods This prospective clinical study at Singapore General Hospital (SGH) (CIRB 2019/2766, PDPA-compliant) aimed to enroll 60 patients (30 ACL-deficient, 30 ACL-reconstructed ≥ 6 months post-surgery). At the halfway point of the clinical trial, 29 patients (8 ACL-deficient, 21 ACL-reconstructed ≥ 6 months post-surgery) were recruited through physician referral at SGH outpatient clinics to perform standardized chair-stand tests. An ensemble deep learning model that combines convolutional (EfficientNet) and time-series (InceptionTime) classifiers is used to output binary stability classifications (ACL-deficient/ACL-reconstructed). The model's performance was evaluated using 10-fold stratified cross-validation with patient-wise splitting, repeated across 100 random seeds to assess variability.

Results /Discussion At the halfway point of the trial, the ensemble model performance with regard to the Receiver Operating Characteristic area under the curve (ROC-AUC) was 0.8365 (SD: 0.042, p-value <0.001), and the classification accuracy was 75.9% (SD: 3.2%) when the model was tested on the 29 CIRB-approved patients. For the ACL-reconstructed class, the performance indicators were as follows: precision 71.4%, recall 93.8%, F1-score 81.1%. For the ACL-deficient class, the indicators were: precision 87.5%, recall 53.8%, F1-score 66.7%. Against the clinical pivot shift test's low sensitivity (24-32%), the model delivers an almost 2X better sensitivity (53.8%) [2,3], with a comparable specificity (93.8% vs. 90-98%).

Conclusion The multimodal machine learning model was able to perform at a level that was relevant to clinical classification (AUC-ROC 0.8365, accuracy 75.9%) in differentiating between ACL-deficient and ACL-reconstructed knees. Moreover, the model demonstrated far superior sensitivity than previously published estimates for manual pivot shift testing (53.8% vs. 24-32%).

158

Early Weight-Bearing After Distal Femoral Fixation: A Focused Evidence Review

Manu Abraham, Anastasia Chua, Sumanth Kumar, Chen Yongsheng
NUHS SINGAPORE

Introduction / Objective Weight-bearing restrictions after distal femoral fixation aim to protect healing constructs but may delay mobilisation and prolong dependence in older adults. Whether selected patients can safely begin loading earlier remains clinically relevant. This focused review examined associations between early postoperative weight-bearing, reoperation, non-union and functional recovery.

Materials & Methods Four comparative clinical studies were reviewed: one randomised controlled trial and three retrospective cohorts. Early loading followed individual study definitions, including immediate full weight-bearing, weight-bearing as tolerated or full loading before 30 days. Comparators received partial, touchdown or otherwise restricted weight-bearing. Differences in loading protocols, fixation constructs, outcome definitions and follow-up precluded statistical pooling; findings were synthesised narratively. The review focused on these four studies and was not intended as an exhaustive assessment of the literature.

Results /Discussion Reported sample sizes totalled 375, although outcome-specific denominators varied. The randomised trial found no statistically significant differences in function or range of motion between immediate full and partial weight-bearing. In a periprosthetic fracture cohort, all-cause reoperation occurred in 6/28 immediately loaded patients versus 2/15 restricted patients (21.4% versus 13.3%; $p=0.69$). Another cohort reported early adverse events requiring reoperation in 6/56 immediately loaded patients versus 15/79 prescribed touchdown loading (10.7% versus 19.0%; $p=0.23$). Non-union occurred in 1/21 early-loading cases versus 17/144 standard-loading cases (4.8% versus 11.8%). In the periprosthetic cohort, medial comminution and non-anatomic reduction were associated with reoperation; no significant association with loading status was detected.

Conclusion These studies found no consistent increase in adverse outcomes with early weight-bearing, but do not establish equivalent safety. Small samples, retrospective treatment selection and heterogeneous reporting limit certainty. Early loading may be reasonable when reduction is satisfactory and fixation stable, particularly when mobilisation supports recovery. Decisions should account for fracture morphology, construct stability, bone quality, baseline mobility and rehabilitation needs. Larger prospective studies with standardised loading definitions and construct-specific outcomes are needed.

159

Does Ultrasound Add Diagnostic Value in Carpal Tunnel Syndrome? A Retrospective Review of Orthopaedic Referrals

Renee Casagrande, Shyan Goh
Logan Hospital AUSTRALIA

Introduction / Objective Carpal tunnel syndrome (CTS) remains predominantly a clinical diagnosis, yet ultrasound is frequently obtained prior to orthopaedic referral. Median nerve cross-sectional area (CSA) is the most commonly utilised sonographic measure; however, diagnostic thresholds vary. A CSA $<8\text{ mm}^2$ may assist in excluding CTS, while $\geq 12\text{ mm}^2$ supports the diagnosis. Normal CSA also varies with sex and body habitus despite commonly applied thresholds using fixed values. This study evaluated CSA measurements in patients referred with suspected CTS and examined the incremental diagnostic value of routine ultrasound.

Materials & Methods A retrospective review was performed of patients referred to Logan Hospital Orthopaedic Outpatients with CTS during 2024–2025. Of 357 patients screened, those without ultrasound or a numerical CSA measurement with identifiable units were excluded. Each wrist was analysed independently, including bilateral measurements where available. CSA was categorised as $<8\text{ mm}^2$, $8\text{ to }<12\text{ mm}^2$, or $\geq 12\text{ mm}^2$.

Results /Discussion CSA measurements were available for 100 wrists. Median CSA was 13.0 mm^2 (IQR $12.0\text{--}16.0$), mean 14.2 mm^2 , and range $4.1\text{--}29.0\text{ mm}^2$. Five wrists (5%) measured $<8\text{ mm}^2$, 20 (20%) measured $8\text{ to }<12\text{ mm}^2$, and 75 (75%) measured $\geq 12\text{ mm}^2$. Although median nerve enlargement was common, 25% failed to meet the proposed rule-in threshold despite referral for suspected CTS. Fixed CSA thresholds may also inadequately account for physiological variation related to sex and body habitus, limiting diagnostic discrimination.

Conclusion Routine ultrasound predominantly confirmed existing clinical suspicion, while 25% of wrists demonstrated intermediate or low CSA measurements. CSA alone may therefore provide limited incremental diagnostic value in clinically typical CTS. Ultrasound may be better reserved for diagnostic uncertainty, atypical presentations, anatomical variants or suspected structural pathology. These findings support a more selective role for ultrasound within the diagnostic pathway, particularly where clinical assessment alone is inconclusive.

160

The peroneal groove depth and its implications for lateral ankle stabilisation surgery

Jessica Thor, Beatrice Tan, James Loh, Ing How Moo, Charles Kon
Changi General Hospital SINGAPORE

Introduction / Objective Surgical management of chronic lateral ankle instability often targets the anterior talofibular ligament (ATFL) and calcaneofibular ligament (CFL) through open or minimally invasive repair such as the Broström–Gould procedure. While peroneal tendon subluxation is commonly linked to shallow retromalleolar grooves, the normal anatomical variation in groove depth and its proximity to the CFL footprint remain under-characterised. This study evaluates the distal fibular peroneal groove depth in cadaveric ankles and explores technical implications during lateral ligament stabilisation.

Materials & Methods 5 Caucasian adult cadaveric ankle specimens were dissected. The peroneal tendons were identified, mobilized, and removed to expose the distal fibular groove. Peroneal groove depth was measured 1 cm proximal to the tip of the fibula using a calibrated flexible ruler referenced against the fibular cortex. Measurements were independently verified by two investigators. Topographical relationships between the groove, the CFL origin footprint, and the peroneal tendon sheath were documented.

Results /Discussion Peroneal groove depth demonstrated marked morphological variation across specimens, ranging from 3.0 mm to 6.0 mm. Two specimens exhibited shallow grooves measuring 3.0–4.0 mm, whereas one specimen possessed a deep, well-defined groove measuring 6.0 mm. In specimens with shallow grooves (3.0–4.0 mm), the CFL origin on the anterior/deep aspect of the distal fibula was found immediately adjacent to the peroneal tendon sheath, leaving minimal tissue separation between the ligament insertion and the tendon conduit.

Conclusion Considerable anatomical variation exists in the depth of the distal fibular peroneal groove. In ankles with shallow retromalleolar grooves, the extremely close proximity of the CFL to the peroneal tendon sheath increases the risk of inadvertent suture anchor placement into or tethering of the peroneal sheath during Broström–Gould or minimally invasive lateral stabilisation. Preoperative or intraoperative awareness of retromalleolar groove depth is critical to avoid iatrogenic peroneal tendon complications.

161

Anatomy of the ATFL, CFL and peroneal tendons and their implications for lateral ankle stabilisation

Jessica Thor, Beatrice Tan, James Loh, Ing How Moo, Charles Kon
Changi General Hospital SINGAPORE

Introduction / Objective The Broström–Gould repair remains the choice surgical procedure for chronic lateral ankle instability. While effective, reported ligament footprints and trajectories vary across literature, and standard non-anatomic suture vectors or single-point fixation may fail to restore natural kinematics. This study looks at ATFL and CFL footprint dimensions, spatial relationships, and proximity to the peroneal tendons to evaluate surgical implications for the Broström–Gould repair.

Materials & Methods 5 adult Caucasian cadaveric ankle specimens were dissected. A flexible ruler was used to accommodate ligament curvature. Dimensions (length, width) of the ATFL and CFL, attachment distances from reproducible bony landmarks (fibular tip, calcaneocuboid joint), footprint offset/overlap, and the topographical relationship of the CFL to the peroneal tendons and sheath were measured and independently verified by two investigators.

Results /Discussion The ATFL demonstrated 1–2 bands (length 2.9–4.0 cm; width 1.2–2.0 cm) with a fibular insertion 0.6–1.1 cm proximal to the fibular tip (extending up to 1.6–1.7 cm proximally) and consistent inferior obliquity. The CFL exhibited 1–3 bands (length 1.3–3.5 cm; width 0.7–1.5 cm) originating 0.2–0.5 cm proximal to the fibular tip. Though distinct and inferior to the ATFL, CFL fibers blended at the confluence. The CFL calcaneal insertion lay 4.5–5.8 cm from the calcaneocuboid joint and coursed directly deep to the inner layer of the peroneal tendon sheath.

Conclusion The ATFL and CFL exhibit vertically offset fibular origins, non-horizontal fiber orientations, and an intimate relationship with the overlying peroneal tendon sheath. The Broström–Gould repairs utilizing single-point anchor fixation or non-anatomic suture lines risk failing to reproduce native multi-band kinematics and carry a heightened risk of inadvertent peroneal tendon capture or tethering during CFL tightening. Anatomical orientation must be prioritised to optimise mechanical stability and avoid iatrogenic peroneal complications.

162

Two-Year Functional Outcomes of Kinematic Versus Mechanical Alignment in Primary Total Knee Arthroplasty: A Single-Surgeon Propensity-Matched Study in an Asian Population

Bo Xiang Bryan Neo, Vishwajit Vijay Patil, Hee-Nee Pang, Keng-Jin Darren Tay, Seng-Jin Yeo, Ming Han Lincoln Liow
National University of Singapore, Yong Loo Lin School of Medicine SINGAPORE

Introduction / Objective Optimal coronal alignment in total knee arthroplasty (TKA) remains controversial, with kinematic alignment (KA) emerging as a patient-specific alternative to conventional mechanical alignment (MA). This study compared two-year functional outcomes, patient-reported outcome measures (PROMs), and complication rates between KA-TKA and MA-TKA in a propensity score-matched cohort.

Materials & Methods This retrospective single-surgeon study included 1,978 consecutive primary TKAs (KA: n=921, 2018–2023; MA: n=1,057, 2010–2014). After excluding revision cases and patients with incomplete follow-up, 1,451 primary TKAs were eligible. Following 1:1 propensity score matching for age, sex, BMI, and baseline PROMs, 536 matched pairs (n=1,072) were analysed. Outcomes included range of motion, Knee Society Knee and Function Scores (KSKS, KSFS), Oxford Knee Score (OKS), SF-36, MCID attainment, satisfaction, complications, and revision rates at six months and two years.

Results /Discussion Both groups showed substantial postoperative improvement across all outcomes. At six months, KA achieved higher postoperative KSKS (86.7 vs 85.3, $p<0.001$), greater flexion (113.1° vs 110.9° , $p=0.010$), greater arc of motion (109.8° vs 107.5° , $p=0.032$), and superior physical functioning, while MA showed greater improvement and higher MCID attainment in SF-36 role physical and bodily pain. Satisfaction at six months was higher with KA (95.6% vs 90.8%, $p=0.003$). At two years, KA maintained superior KSKS (89.2 vs 86.3, $p<0.001$), higher KSFS (77.6 vs 75.6, $p=0.022$), improved range of motion, and better physical functioning. Satisfaction remained high and comparable (95.3% vs 95.7%, $p=0.838$). Complication and revision rates were comparable, with equivalent two-year revision-free survival (99.8% vs 100%, $p=0.317$).

Conclusion KA-TKA provides comparable or superior early- to mid-term functional outcomes relative to MA-TKA, with similar safety and revision-free survival at two years. These findings support KA as an effective alignment strategy for primary TKA, although longer-term follow-up is required.

163

Enhancing nursing care and prevention of pinsite infections among Transverse Tibial Transport patients: A case series

Ashley Young, Brigitte Woo, Mohamad Salleh Mani
Ng Teng Fong General Hospital SINGAPORE

Introduction / Objective Transverse Tibial Transport (TTT) is an emerging limb salvage procedure which stemmed from Ilizarov's technique to promote revascularisation and wound healing in intractable diabetic foot ulcers (DFUs). Pin-site infection is a common complication, therefore appropriate pin-site care is essential to prevent complications. Nevertheless, little is known about nursing management of TTT pin-sites and its association with the occurrence of pin-site infections in Singapore.

Materials & Methods A retrospective case series was conducted among patients who underwent TTT at a regional hospital serving Singapore between July 2024 and June 2026. A standardised nursing protocol for pin-site wound care was implemented using Granudacyn® solution, Granudacyn® gel, Granulox®, and Mepilex® Ag dressings. Pin-sites were assessed for infection signs, including redness, warmth, pus, and swelling, during twice-weekly dressing changes. The first occurrence of infection was recorded based on objective clinical signs. Following one week of observation, dressings were modified to Mupirocin 2% ointment with Mepilex® Ag. Once infection signs resolved, dressings were reverted to the standardised protocol. Descriptive statistics were used to compare pin-site infection rates across four 6-month intervals.

Results /Discussion Thirty-two patients were reviewed. Mean age was 63 years. 31 had diabetes mellitus, and 25 had peripheral arterial disease. Mean TTT duration was 9 weeks. Across four 6-month intervals, pin-site infection rates were 13% (JUL-24 – DEC-24), 13% (JAN-25 – JUN-25), 30% (JUL-25 – DEC-25), and 0% (JAN-26 – JUN-26), with an overall rate of 16%. Fluctuations in pin-site infection rates across the four intervals was noted. Due to limited cohort size and descriptive methodology of this series, inferences on efficacy of the standardised nursing protocol cannot be established. These variations may result from disparities in clinical profiles, treatment length, or confounders.

Conclusion This case series provides preliminary local data on nursing management and infection occurrence in TTT patients. Larger studies are needed to evaluate the effectiveness of standardised pin-site care protocols.

164

Joint Preservation in Shoulder Arthritis: State of the Art

Jacqueline Liew, Jonathan Leong, Wei Zhang, Sean Ho
Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Younger patients with glenohumeral arthritis pose a unique management challenge. Pain and restricted range of motion of the upper limb impair function. While shoulder arthroplasty is a possible management option, implant longevity, limited bone stock and future revision surgeries make it less desirable in a younger population.

Materials & Methods This review provides a comprehensive overview of joint-preserving treatment for young patients with glenohumeral arthritis in whom shoulder replacement or arthrodesis is not yet appropriate.

Results /Discussion A myriad of options have been described to delay arthroplasty. Non-surgical treatments include physiotherapy and intra-articular injections. Failing which, restorative cartilage procedures such as microfracture, autologous cartilage implantation, osteochondral transfer have been reported, although evidence is limited to small outcome studies. Palliative procedures such as arthroscopic debridement and capsular release, osteochondroplasty, interposition arthroplasty and pain-modulating procedures such as suprascapular nerve radiofrequency ablation and peripheral nerve stimulators have demonstrated variable success. In the setting of rotator cuff arthropathy, procedures aimed at rebalancing force couples and depressing the humeral head, such as partial repairs, superior capsular reconstruction, biceps rerouting, bursal acromial reconstruction, may provide mid-term symptom relief.

Conclusion Joint preservation should remain the primary treatment focus in younger patients with glenohumeral arthritis.

165

Beyond the Pin: A Novel Modular Unicortical Bone Anchor for Robotic TKR Tracker Fixation

Matthew Song Peng Ng, **Dhanyashri Karthickraj**, Marcus Jun Rui Lee, Alexander Shao-Rong Pang, Zi Qiang Glen Liao
Yong Loo Lin School of Medicine, National University of Singapore SINGAPORE

Introduction / Objective Robotic TKR relies on bicortical pins to fix optical trackers to the femur and tibia, implicated in periprosthetic fracture risk from deeper cortical placement and reduced torsional rigidity. We developed a novel unicortical bone anchor - a modular three-pronged claw. By avoiding far-cortex breach, our anchor may reduce fracture risk, pain, bleeding and neurovascular injury, minimise interference with bone preparation, and enable faster, power-tool-free application - benefits suited to single-incision robotic TKR workflows.

Materials & Methods Our anchor uses curved hooks with far smaller cross-sectional area than traditional pins, achieving unicortical purchase at three points per bone versus four cortices breached by two standard bicortical pins. We performed 18 robotic TKR cuts on sawbones using anchor-mounted trackers instead of pins. Resection depths (robotically-verified, corrected for saw kerf) were compared against directly measured depths (vernier calliper/micrometre) across six locations: medial/lateral distal femoral condyles (initial and re-cut) and medial/lateral proximal tibial plateaus.

Results /Discussion Anchor fixation was retained in 100% of trials, with tibial anchors surviving one and femoral anchors three sequential cuts without loosening. Our anchor produces an 88.5% smaller cross-sectional defect per point of fixation than commercial 3.2-4.0 mm bicortical pins and uses 77.4% less stainless steel per unit, a cost advantage. Mean resection-depth error was -0.3 mm (range -1.7 to +0.7 mm), comparable to conventional pin-based TKR. Placement/removal of our anchor required approximately 20 seconds, markedly faster than the approximate 2 minutes reported anecdotally by experienced surgeons for insertion/removal of 4 pins.

Conclusion Our bone anchor achieved fixation and resection accuracy comparable to conventional pin-based robotic TKR, while enabling unicortical fixation, fewer breached cortices, and faster installation. These sawbone results further support biomechanical and cadaveric validation of the device's fracture-risk and workflow benefits.

166

Internal Brace augmentation for Anterior Cruciate Ligament Reconstruction (ACLR) does not significantly improve short term functional outcomes as compared to isolated ACLR

Jacqueline Liew, Jegathesan T, Wei Zhang, Keng Thiam Lee, Sean Ho
Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Internal brace (IB) augmentation for ACLR is designed to improve stability and reduce risk of rupture. It is uncertain if IB augmentation improves clinical outcomes. This study aims to determine short-term functional outcomes of IB-augmented versus non-augmented ACLR using hamstring autografts.

Materials & Methods A retrospective cohort study of ACLR performed by a single surgeon from 2020 to 2023 was conducted. Patients aged 18 to 60 years who underwent IB-augmented or non-augmented ACLR were included. Revision ACLR and multi-ligamentous knee injuries were excluded. Functional outcomes were assessed using International Knee Documentation Committee (IKDC), Knee Injury and Osteoarthritis Outcome Score (KOOS), Marx Activity Rating Scale (MARS) and Tampa Scale of Kinesiophobia (TSK) at 6 months and 1 year post-operation.

Results /Discussion 117 patients were included: 84 males (72%) and 33 females (28%), mean age 28.6 years (SD 8.4). There were 58 IB-augmented and 59 non-augmented ACLR. There were no significant differences in meniscal injuries, graft size or baseline IKDC, KOOS, TSK and MARS scores. At 6 months, there were no significant differences in IKDC (58.6 [SD 9.5] versus 55.1 [SD 0.6]), all five KOOS subsets, or TSK (40.3 [SD 5.9] versus 42.1 [SD 6.0]) ($p > 0.05$). MARS was significantly higher in the IB-augmented group (6.7 [SD 4.8] versus 4.5 [SD 5.5], $p < 0.05$). At 1 year, there were no significant differences in IKDC, KOOS, TSK or MARS.

Conclusion IB augmentation significantly improved MARS at 6 months, with no other significant functional outcome improvements. There were no significant functional outcome differences at 1 year, suggesting limited early functional benefit that does not last beyond 1 year.

167

Mid-Flexion Gap Characteristics and Functional Outcomes Following Robotic-Assisted Total Knee Arthroplasty: A Prospective Observational Study

Jacqueline Liew, Michael Yam
Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Mid-flexion instability affects functional outcomes following total knee arthroplasty (TKA). Intraoperative gap behaviour between 30° and 70° of flexion remains poorly characterised. The VELYS™ robotic-assisted navigation system provides continuous intraoperative gap measurements at 5° increments. This study investigated whether mid-flexion gap characteristics correlate with early functional outcomes following TKA.

Materials & Methods A prospective observational cohort study was conducted in 48 patients undergoing TKA. Intraoperative medial and lateral compartment gaps between 30° and 70° of flexion were merged with prospectively collected registry data. Outcome measures included pre- and three-

month postoperative Oxford Knee Score (OKS) subscores (transport, standing from chair, kneeling, and stair descent), Knee Society Score (KSS), and EQ-5D. Mean and maximum compartmental gaps were analysed.

Results /Discussion Mean mid-flexion medial gap was 10.48 mm (range 7.78–15.12) and lateral gap was 11.02 mm (range 8.58–14.07). Maximum gaps occurred at a mean of 41.7° medially and 43.0° laterally. Mean extension gap was 10.88 mm medially and 11.52 mm laterally. Mean 90° gap was 10.26 mm medially and 11.46 mm laterally. All gap-outcome correlations were positive. The strongest association was between mean lateral gap and OKS transport subscore ($r = 0.233$). No correlations reached statistical significance ($p > 0.05$).

Conclusion Mean medial and lateral gaps across all flexion angles varied by <0.5 mm, suggesting stability of the Attune implant, potentially due to its multiradius design. Larger mid-flexion gaps were associated with improved functional outcomes. Peak gaps consistently occurred between 41° and 43°. The absence of statistical significance may reflect the limited sample size. These findings support optimisation of mid-flexion gap balance in robotic TKA and justify larger prospective validation studies.

168

Enhanced Recovery After Surgery in Primary, complex-primary, and Revision Total Knee Arthroplasty: A Comparative Outcomes Analysis

Jacqueline Liew, Tong Leng Tan

Tan Tock Seng Hospital SINGAPORE

Introduction / Objective To evaluate whether complex-primary and revision total knee arthroplasty (TKA) performed under Enhanced Recovery After Surgery (ERAS) protocol achieve outcomes comparable to primary TKA with ERAS.

Materials & Methods A retrospective comparative analysis on 1339 patients using ERAS1, undergoing primary, complex-primary and revision TKA from 2022 to 2024 at a tertiary hospital in Singapore. Complex primary TKA was defined as the use of stems, augments, constraint or osteotomy in the setting of a primary TKA. Inclusion criteria were receipt of tranexamic acid, dexamethasone, no drain insertion, and either patient-controlled analgesia or local infiltration of anaesthesia. Outcomes assessed included early post-operative complications, reoperation, readmission, achieving post-operative day 0 (POD-0) ambulation, discharge disposition, and acute urinary retention (ARU). Primary TKA was referenced for odds ratios (OR) computation.

Results /Discussion Early complications had no significant difference between primary against complex-primary and revision TKA (OR complex-primary 1.10, 95% CI 0.39-3.12; OR revision 2.26, 95% CI 0.51-9.95; $p = 0.52$). POD-0 ambulation rates were lower in complex-primary (OR 0.48, 95% CI 0.30-0.77) and revision TKA (OR 0.42, 95% CI 0.17-1.05, $p = 0.0015$). Readmission was comparable across groups (OR complex-primary 0.57, 95% CI 0.08-4.29; OR revision 0; $p = 0.68$). Revision TKA showed higher reoperation risk (OR revision 12.31, 95% CI 1.37-110.22; $p = 0.006$). Complex-primary and revision TKA patients were more likely to require non-home discharge (OR 3.46, 95% CI 2.20-5.43; OR revision 1.65, 95% CI 0.66-4.12; $p < 0.001$). ARU rates were not significantly different (OR complex-primary 1.28, 95% CI 0.54-3.03; OR revision 0.81, 95% CI 0.11-6.11; $p = 0.83$).

Conclusion Complex-primary and revision TKA show outcomes comparable to primary TKA using ERAS, with similar early complication and readmission rates. Complex-primary and revision TKA patients were less likely to be discharged home and ambulate POD-0. ERAS appears safe and scalable to higher-complexity TKA.

169

Dedicated Surgeon–Anaesthetist Pair in an Enhanced Recovery Total Knee Arthroplasty Pathway: Operating Theatre Efficiency and Perioperative Outcomes

Chun Lei Tan, Yiming Zhu, Yong Ng, Abhay Menon, Ming Han Lincoln Liow

Singapore General Hospital, Department of Orthopaedic Surgery SINGAPORE

Introduction / Objective Operating theatre efficiency and perioperative protocol consistency are modifiable quality targets in total knee arthroplasty (TKA). A dedicated surgeon–anaesthetist partnership may improve intraoperative workflow and reduce variation in anaesthetic practice, however, whether this translates into measurable perioperative or rehabilitation benefit remains uncertain.

Materials & Methods We retrospectively reviewed 255 consecutive primary unilateral TKAs performed by one surgeon at a tertiary institution, stratified by anaesthetic provider: a dedicated surgeon–anaesthetist pair ($n = 83$) versus other anaesthetists ($n = 172$). Outcomes included operative and induction durations, anaesthetic protocol variables, and perioperative and postoperative day one recovery outcomes. Multivariable regression adjusted for age, sex, body mass index, ASA physical status, and anaesthesia type. Anaesthetic protocol variables were treated as mediators and excluded from covariate adjustment.

Results /Discussion Baseline characteristics were comparable. Operative duration (51.4 ± 15.2 vs. 56.9 ± 15.6 min; adjusted $\beta = -5.60$ min, 95% CI -9.68 to -1.52 , $p = 0.007$) and induction duration (9.1 ± 9.1 vs. 11.7 ± 9.0 min; $\beta = -2.78$ min, 95% CI -5.19 to -0.37 , $p = 0.024$) were shorter in the dedicated-pair group. The dedicated pair showed greater anaesthetic protocol consistency: lower intrathecal fentanyl use (1.2% vs. 64.5%, $p < 0.001$), universal postoperative nausea and vomiting prophylaxis (100% vs. 63.4%, $p < 0.001$), and lower intra-operative fluid volumes (513 ± 78 vs. 922 ± 316 ml, $p < 0.001$). No perioperative or rehabilitation outcome differed after adjustment.

Conclusion A dedicated surgeon–anaesthetist pairing was associated with shorter operative and induction durations, and greater anaesthetic protocol consistency, with no compromise of perioperative safety or early rehabilitation outcomes. This may be a feasible, low-cost strategy to improve anaesthetic protocol fidelity and peri-operative workflow for high-volume TKA programmes working within Enhanced Recovery After Surgery frameworks.

170

Mid-term Clinical outcomes of isolated collagen patch implantation for partial rotator cuff tears

Jacqueline Liew, Jegathesan T, Marcus Lee, Lester Tan, Sean Ho

Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Collagen patches are increasingly used in rotator cuff surgery as a form of biologic augmentation. They can be used in conjunction with rotator cuff repair or in isolation for other rotator cuff pathology. This study aims to determine the clinical outcomes of isolated collagen patch implantation for partial rotator cuff tears (PRCT).

Materials & Methods A retrospective study was conducted. The inclusion criteria were all patients from a single center aged 21 to 80 years who underwent arthroscopic collagen patch implantation (Regenenten) for PRCT. The following patients were excluded: Patients with previous rotator cuff repair and previous fractures of the ipsilateral upper limb. Patient reported outcomes such as the visual analog scale (VAS), single assessment numerical evaluation (SANE) and American shoulder & elbow surgeons (ASES) score were collected. Range of motion was documented.

Results /Discussion 15 patients were included in this study. There were 10 females (67%) and 5 males (33%). The mean age was 52.2 years (SE 3.3). The mean follow-up period was 13.6 months (SE 1.5). There was a significant improvement of the VAS score from baseline and at the final follow up, from 6.8 (SD 2.0) to 3.1 (SD 2.2) ($p<0.001$). Comparing baseline to final follow up, the SANE score significantly improved from 55.5 (SD 14.4) to 87.7 (7.5) ($p<0.001$) and the ASES score significantly improved from 46.6 (SD 4.1) to 79.8 (SD 18.7) ($p<0.001$). Patients regained their range of motion by 3 months, with no significant difference in forward flexion and external rotation between the pre-operative and final follow up time points.

Conclusion Isolated collagen patch implantation for PRCT demonstrates significant improvement in pain and functional scores at a mean follow up period of 13 months. There was no significant secondary shoulder stiffness in this series.

171

Gait and Dynamic Postural Changes Before and After Surgical Correction of Adolescent Idiopathic Scoliosis: a Systematic Review and Meta-Analysis

Elliot Kai Jie Eng, Reuben Soh Chee Cheong

Yong Loo Lin School of Medicine, National University of Singapore SINGAPORE

Introduction / Objective Correction of adolescent idiopathic scoliosis (AIS) fuses spinal segments that contribute to trunk motion and gait. Current post-fusion gait analysis cohorts are conflicting and underpowered due to high cost of measurement, hence it is timely to synthesise recent findings. In this first systematic review and meta-analysis of operated patients, we quantified how far gait and dynamic posture change after surgery.

Materials & Methods MEDLINE, Embase, Scopus and CENTRAL were searched from inception to 12/10/2026. Studies reporting gait or dynamic posture before and after AIS surgery were eligible. Risk of bias used the NHLBI before-after tool and ROBINS-I; certainty, GRADE. Within-patient pre-post differences were pooled by restricted maximum likelihood with Hartung-Knapp intervals (correlation 0.50). PROSPERO CRD420261487075.

Results /Discussion Nineteen reports of fourteen cohorts were included, twelve (326 patients) contributed to 17 outcomes. Six changed significantly from before to after surgery. The largest was axial trunk-on-pelvis rotation, where acromion–pelvis angle range of motion (ROM) fell 2.97° (95% CI -4.36 to -1.58 ; Hedges g -0.67). Pelvic ROM fell 1.12° in the transverse plane (-1.68 to -0.55) and 0.38° in the sagittal plane (-0.76 to -0.01), while pelvic obliquity rose 0.65° ($+0.14$ to $+1.17$), the only significant increase and possibly a compensation for the lost axial rotation. Walking speed fell 0.036 m/s (-0.066 to -0.005) and cadence 3.44 steps/min (-6.63 to -0.26). Apart from acromion–pelvis angle, all significant effects were small (g 0.25 to 0.37). Eleven outcomes did not change significantly, including step length and hip, knee and ankle ROM, hence the effect of fusion was confined to the trunk and pelvis and spared the lower limbs.

Conclusion Surgery for AIS reduces axial rotation between trunk and pelvis, reduces pelvic transverse and sagittal motion, increases pelvic obliquity and slows walking. Apart from trunk-on-pelvis rotation the changes are small, and lower limb motion is unaffected.

172

TFNA cement augmentation is associated with fewer cephalic fixation failures: a systematic review and meta-analysis of 1,942 patients

Kamaraj Thirukumaran, Lee Jun Rui Daylon, Wee Zheng Yang Bryan, Sumanth Kumar Gera, Celest Seah, Yongsheng Chen

NUHS SINGAPORE

Introduction / Objective Cephalic fixation failure following Trochanteric Fixation Nail Advanced (TFNA) nailing is a major complication of osteoporotic trochanteric fractures. Cement augmentation may improve anchorage of the TFNA blade or screw in the femoral head, but effectiveness remain uncertain. We compared cement-augmented with non-augmented TFNA fixation, prioritising fixation failure and complications.

Materials & Methods PubMed, MEDLINE via Ovid, Embase, and reference lists were searched for comparative adult studies of trochanteric fractures treated using TFNA. Risk of bias was assessed using ROBINS-I and RoB 2. Design-separated random-effects meta-analyses using restricted maximum-likelihood estimation and Hartung-Knapp inference generated risk ratios (RRs) or mean differences (MDs) with 95% confidence intervals (CIs). The primary outcome, study-defined cephalic fixation failure, comprised cut-out and cut-through/medial perforation; component outcomes were analysed separately.

Results /Discussion Thirteen studies involving 1,942 patients (956 augmented and 986 non-augmented) were included: 12 observational studies and one randomised trial. In 10 informative observational cohorts (1,771 patients), augmentation was associated with a 73% lower risk of failure (16/872 versus 49/899; RR 0.27, 95% CI 0.16–0.48; $p<0.001$; $I^2=0\%$). Associations were observed for cut-out (RR 0.26, 95% CI 0.13–0.54) and cut-through/medial migration (RR 0.24, 95% CI 0.11–0.51), although events were sparse. The available-case estimate was inconclusive (0/23 versus 1/30), with 41.1% missing 12-month outcomes. No clear differences were detected in reoperation, complications, operative time, or blood loss; several estimates were imprecise. Reported cement leakage/extravasation was uncommon (1.5%, 95% CI 0.6%–3.9%). Avascular necrosis was reported only in augmented cohorts in limited data, warranting surveillance.

Conclusion TFNA cement augmentation was associated with substantially fewer cephalic fixation failures, supporting selective use in patients at high fixation-failure risk. However, observational evidence limits causal inference, and AVN was reported only in augmented cohorts, warranting prospective long-term surveillance. Adequately powered randomised trials with standardised mechanical and safety endpoints are required.

173

Pharmacological Prophylaxis Does Not Significantly Reduce Postoperative Nausea and Vomiting After Total Knee Arthroplasty: Female Sex and Lower BMI Identify Higher-Risk Patients

Yiming Zhu, Yong Ng, Abhay Menon, Chun Lei Tan, Ming Han Lincoln Liow

Singapore General Hospital, Department of Orthopaedic Surgery SINGAPORE

Introduction / Objective Postoperative nausea and vomiting (PONV) is a common complication after total knee arthroplasty (TKA) and may affect comfort, mobilisation, and discharge readiness. The incremental benefit of routine antiemetic prophylaxis in contemporary, predominantly regional anaesthesia TKA pathways remains uncertain. This study compared PONV prophylaxis strategies and identified independent predictors of same-day PONV.

Materials & Methods A retrospective review was performed of 287 consecutive TKA cases. Patients were stratified by prophylaxis strategy: no prophylaxis ($n=93$), dexamethasone alone ($n=77$), or dexamethasone plus ondansetron ($n=117$). Cases receiving ondansetron alone or other antiemetic combinations were excluded. PONV was defined as any same-day nausea or vomiting. Multivariable logistic regression adjusted for age, sex, body mass index (BMI), American Society of Anaesthesiologists (ASA) classification, anaesthesia type, bupivacaine formulation and volume, spinal position, intrathecal fentanyl use, and prophylaxis group.

Results /Discussion Groups were comparable in age, body mass index, sex, and ASA classification (all $P>0.05$), but differed in anaesthesia type ($P<0.001$), bupivacaine formulation ($P=0.006$), bupivacaine volume ($P<0.001$), and intrathecal fentanyl use ($P<0.001$). Overall PONV incidence was 18.7%. PONV occurred in 21.9% of patients receiving no prophylaxis, 16.9% receiving dexamethasone alone, and 15.4% receiving dexamethasone plus ondansetron, with no significant intergroup difference ($P=0.506$). No pairwise comparison remained significant after false discovery rate correction. After adjustment, neither dexamethasone alone nor dexamethasone plus ondansetron independently reduced PONV. Female sex (adjusted OR 8.00, 95% CI 2.38–26.82, $P=0.001$) and higher BMI, which was inversely associated with PONV risk (adjusted OR 0.83 per unit, $P=0.002$), were the only significant independent predictors.

Conclusion Pharmacological PONV prophylaxis did not significantly reduce same-day PONV after TKA after confounder adjustment. Female sex and lower BMI identified patients at higher risk, supporting targeted risk stratification rather than routine escalation of antiemetic prophylaxis.

174

Intrathecal Fentanyl Is Associated With Greater Intraoperative Vasopressor Requirement and Reduced Early Knee Flexion for Total Knee Arthroplasty

Yiming Zhu, Yong Ng, Abhay Menon, Chun Lei Tan, Ming Han Lincoln Liow
Singapore General Hospital, Department of Orthopaedic Surgery SINGAPORE

Introduction / Objective Intrathecal fentanyl is commonly added to bupivacaine spinal anaesthesia for total knee arthroplasty (TKA), but its haemodynamic and rehabilitation consequences in enhanced recovery pathways are poorly characterised, and concern regarding postoperative nausea and vomiting (PONV) rests largely on intrathecal morphine data.

Materials & Methods Retrospective single-institution cohort of 223 consecutive primary TKA patients receiving bupivacaine spinal anaesthesia (54 anaesthetists). Unicompartamental arthroplasty, general/combined anaesthesia, and two 20 mcg outliers were excluded. Fentanyl was administered in 119 cases (10 or 15 mcg); 104 received none. Multivariable regression adjusted for age, sex, body mass index, ASA class, bupivacaine formulation, spinal position, bilateral knee surgery, and number of antiemetic prophylactic agents.

Results /Discussion Baseline characteristics were balanced, but anaesthetic practice diverged significantly (all $P<0.05$): fentanyl recipients received antiemetic prophylaxis less often (any agent 55.5% vs 88.5%; dual-agent 16.0% vs 58.7%) and more intraoperative fluid (934 vs 646 mL). Fentanyl was associated with greater intraoperative vasopressor use (42.9% vs 32.7%; adjusted odds ratio 2.46, 95% CI 1.25–4.85, $P=0.009$), strengthening when the highest-volume anaesthetist was excluded (OR 4.76, 95% CI 1.53–14.80). Postoperative day one (POD1) knee flexion was significantly lower (76.1 vs 82.4 degrees; adjusted -5.1 degrees, 95% CI -9.9 to -0.3, $P=0.039$), with stable effect size across sensitivity analyses. PACU pain was marginally lower (adjusted -0.6, $P=0.050$); while POD1 pain, urinary retention incidence, and length of stay were comparable. PONV occurred more frequently (23.5% vs 12.5%) and no longer statistically significant after adjustment for prophylaxis (adjusted OR 2.29, 95% CI 0.93–5.64, $P=0.071$), with no dose-response.

Conclusion Intrathecal fentanyl is associated with greater vasopressor requirement and reduced POD1 knee flexion, with comparable early analgesic benefit and incidence of perioperative complications. These findings support prospective evaluation of opioid-sparing spinal technique in ERAS TKA pathways.

175

Influence of Gastrocnemius Lengthening on Outcomes of Surgery for Insertional Achilles Tendinopathy: A Propensity-Matched Cohort Study

Hui Wen Tay, Chang Yi Woon, Zongxian Li, Kizher Shajahan Mohamed Buhary, Rui Xiang Toh, Kae Sian Tay
Singapore General Hospital SINGAPORE

Introduction / Objective Gastrocnemius tightness increases Achilles tendon tension, contributing to insertional Achilles tendinopathy (IAT). While gastrocnemius lengthening is commonly performed in conjunction with IAT surgery, current literature has limited evidence supporting its routine use. Hence, we aim to evaluate the role of gastrocnemius lengthening in IAT patients with gastrocnemius tightness.

Materials & Methods This is a retrospective cohort study of patients with pre-operative gastrocnemius tightness who underwent unilateral IAT surgery between 2009 and 2021. Patients were divided into two groups – those with isolated IAT surgery, versus those with concomitant gastrocnemius lengthening. Propensity score matching was performed based on age, sex and body mass index. Patient reported outcomes measures (PROMs) including Ankle and Hindfoot Numerical Pain Rating Scale (AHNPRS), SF-36 Physical and Mental Component Scores, patient satisfaction, expectation fulfilment, operative duration and re-operation rates, were analysed up to 2-years post-operatively. Phone interviews at mean 8.67 ± 3.72 years post-operatively assessed AHNPRS and European Foot and Ankle Society scores.

Results /Discussion Seventy-eight patients were included, 39 in each propensity-matched group. Both groups demonstrated improvements in PROMs up to 8.67 ± 3.72 years post-operatively compared to pre-operatively ($p<0.001$), but with no difference between the two groups. At 3-months, there was a trend towards better AHNPRS scores and greater proportion achieving minimal clinically important difference in the concomitant gastrocnemius lengthening group, although statistical significance was not achieved ($p=0.089$ and 0.078 , respectively). A greater proportion of concomitant gastrocnemius lengthening patients had expectations met at 3-months post-operatively compared to the isolated IAT surgery group (92.9% versus 66.7%, $p=0.017$), although not sustained at subsequent follow-up. All re-operations occurred in the isolated IAT group, including two delayed gastrocnemius recessions for persistent pain.

Conclusion Early expectation fulfilment and absence of re-operations in the concomitant gastrocnemius lengthening group suggest that gastrocnemius lengthening may have early benefit in PROMs, but with no sustained long-term benefit when compared with isolated IAT surgery.

176

Appointment Non-Attendance in a Paediatric Orthopaedic Surgery Clinic: Clinical Characteristics and Referral Patterns

Sunny Kim, Rishi Malhotra
National University of Singapore SINGAPORE

Introduction / Objective Non-attendance to scheduled outpatient appointments is a perennial problem reducing clinic productivity, resulting in inefficiencies and missed care opportunities. We aimed to identify the characteristics associated with appointment non-attendance for first visits to the paediatric orthopaedic outpatient clinics at a tertiary hospital in Singapore.

Materials & Methods A retrospective cohort of 734 consecutive patients labelled as first visits to a paediatric orthopaedic outpatient clinic at a single institution between April 2024 and April 2025 was analysed. Patient demographics, referral details and provisional diagnoses were collected. Cases were

stratified into mild, moderate and severe based on range of motion or ability to weight bear at time of presentation. Any return visits to the orthopaedic clinics were documented.

Results /Discussion Among 734 first visits, 164 (22.2%) were not attended. Mean age was 14.4 ± 1.6 years, with 117 (71.3%) males and 47 (28.7%) females. Majority of referred cases were of mild ($n=77$, 47.0%) to moderate severity ($n=79$, 48.2%). Ankle and knee sprains were the most common presenting injury ($n=57$, 34.8%), foot and toe contusions ($n=19$, 11.6%), followed by wrist fractures ($n=9$, 5.5%). The emergency department was the primary source of referrals in this cohort, accounting for 82%. The mean duration from initial presentation to appointment was 20.5 ± 22.6 days. Longer mean waiting times were observed for primary care referrals (polyclinic: 44.2 days; general practitioners: 27.5 days) compared with the emergency department (16.2 days). Among the patients that did not attend, 154 (93.9%) had no subsequent visits to the orthopaedic department.

Conclusion A substantial proportion of first visits to the paediatric orthopaedic clinic are not attended. Contributing factors appear to be multifactorial, with most referrals involving conditions of mild to moderate severity. Implementing open-date referrals, allowing patients to arrange appointments as needed, particularly for emergency department referrals, may improve clinic efficiency and reduce non-attendance for low-acuity conditions.

177

Medial stabilised versus posterior stabilised designs for total knee arthroplasty: a propensity matched cohort study

Carol Zhao, Michael Yam

Tan Tock Seng Hospital SINGAPORE

Introduction / Objective Total knee arthroplasty (TKA) designs have evolved from posterior-stabilised (PS) to medial-stabilised (MS) configurations, which mimic natural knee kinematics. This cohort study compared short-term clinical outcomes between PS and MS TKAs performed via robotic-assisted surgery.

Materials & Methods This retrospective study evaluated 101 knees operated on by a single surgeon using the J&J Velys Robotic-Assisted System and a functional alignment philosophy. Propensity score matching generated 37 pairs (74 TKAs). Because a residual age imbalance persisted after matching, a mixed linear model adjusted for age as a fixed covariate. Primary outcomes evaluated at 3 months post-operation included Oxford Knee Score (OKS), Knee Society Score function score (KSFS), EQ5D-5L index, visual analogue scale (VAS) pain score, and passive range of motion (ROM).

Results /Discussion Preoperative clinical scores showed no significant baseline differences between the groups. At 3 months, both cohorts achieved equivalent improvements exceeding the minimal clinically important difference (MCID) for OKS and VAS. No statistically significant differences were found regarding overall postoperative OKS, pain, satisfaction, or length of stay. However, the PS group demonstrated significantly higher scores in the KSFS stair-climbing component ($p=0.009$) and a larger overall improvement in KSFS (21.48 vs. 9.73; $p=0.018$), with the MS group failing to meet the KSFS MCID threshold. Conversely, the MS group achieved significantly better objective passive maximum extension compared to the PS group (mean 3.19° vs. 5.27° ; $p=0.042$). No intraoperative complications occurred.

Conclusion At 3 months, PS and MS TKAs yielded comparable global functional outcomes. While PS TKA offered superior early stair-climbing capabilities and functional score improvements, MS TKA provided significantly better passive knee extension. This 3-month evaluation only addresses the short-term outcomes of these two models; comprehensive longitudinal tracking is required to firmly establish and compare their long-term efficacy, survival rates, and clinical outcome.

178

Missed Fractures in Ankylosed Spines: Causes, Consequences and the Role of Advanced Imaging

Yun Xiu Lam, XinYao Oliver Huang, Sassidaran S/O Murugasu, Rui Yang Soh, Jun Hao Tan, Jiong Hao Jonathan Tan

National University Health System SINGAPORE

Introduction / Objective Ankylosing Spondylitis (AS) and Diffuse Idiopathic Skeletal Hyperostosis (DISH) produce a fused spine that behaves like a long bone, predisposing it to unstable fractures after low-energy trauma. Plain radiographs often miss such fractures owing to overlapping structures and ossified ligaments, delaying diagnosis. This study examines the causes and consequences of delayed diagnosis, defined as more than 24 hours after presentation.

Materials & Methods This retrospective review of 35 surgically treated fractures in 33 patients at the National University Health System (2022-2026) assessed diagnostic delay and its impact on outcomes.

Results /Discussion Low-energy trauma caused 88.6% (31/35) of spine fractures, mostly thoracic (57.1%, 20/35); most had a prior AS/DISH diagnosis (51.4%, 18/35) and presented neurologically intact (ASIA E; 80.0%, 28/35). Diagnosis was delayed in 37.1% (13/35), with a median of 16 days (IQR 7–44). 34.3% (12/35) required multiple visits before diagnosis. The leading cause of delay was absence of advanced imaging at presentation, seen in 48.6% (17/35) of cases (5 discharged, 12 admitted without it). Among 28 cases with plain radiographs performed, fractures were identified in only 57.1% (16/28), and AS/DISH documented in 67.6% (19/28). Even with known AS/DISH ($n=18$), 38.9% (7/18) had delayed diagnosis (4 discharged, 3 admitted without advanced imaging). Advanced imaging identified posterior column involvement (88.6%, 31/35), epidural hematoma (45.7%, 16/35) and cord signal change (31.4%, 11/35). Surgical decompression was required in 45.7% (16/35), with intraoperative and postoperative complications in 17.1% (6/35) and 51.4% (18/35) respectively. Neurological status was maintained or improved postoperatively in 74.3% (26/35); 3 deteriorated preoperatively due to delayed diagnosis. Median stay was 20 days (IQR 11-37) with delay versus 16 (IQR 13-21) without ($p=0.39$).

Conclusion In ankylosed spines, absence of significant trauma or neurological deficits should not preclude advanced imaging and admission, as missed unstable fractures may develop progressive neurological deterioration and result in prolonged hospitalisation.

179

Outcomes of Functional Alignment Versus Mechanical Alignment in Robotic Total Knee Arthroplasty - An Analysis of Pre-operative and Post-operative Coronal Plane Alignment of the Knee (CPAK)

Cheryl gatot, Hui Wen Tay, Jerry Chen, Darren Tay

Singapore General Hospital SINGAPORE

Introduction / Objective Alignment strategies in total knee arthroplasty (TKA) have evolved, with increasing focus to take into consideration patients' pre-arthritis alignment. The Coronal Plane Alignment of the Knee (CPAK) classification describes 9 phenotypes based on joint line obliquity (JLO) and arithmetic hip-knee angle (aHKA). Functional alignment (FA) aims to restore constitutional knee alignment, respecting the soft tissue envelope, through incorporation of robotic-assisted technology. We aim to analyse the outcomes of FA robotic TKA (FA-rTKA) versus mechanically-aligned robotic TKA (MA-rTKA).

Materials & Methods A retrospective study of 315 patients who underwent robotic TKAs between 2018-2021 was conducted. Functional outcomes measured included pre-operative and post-operative (at 6-months and 2-years) knee range of motion, Knee Society Knee and Function Score (KSKS and KSFS), Oxford Knee Score (OKS), SF-36 physical and mental component scores (PCS and MCS), and patient's satisfaction scores. Comparison was made between patients with pre-operative CPAK-1 or 2 who maintained the same CPAK alignment post-operatively (functionally-aligned), versus patients with pre-operative CPAK-1 or 2 who underwent a change to CPAK-5 post-operatively (mechanically-aligned).

Results /Discussion Pre-operatively, the most common CPAK phenotypes were: CPAK-1 (58.7%), CPAK-2 (15.9%) and CPAK-4 (11.7%). At 6 months post-surgery, FA knees had better OKS [FA = 17.6 +/- 3.93 vs MA = 20.5 +/- 5.76 (p=0.020)] and SF-36 PCS [FA = 51.2 +/- 4.87 vs MA = 46.2 +/- 8.90 (p<0.001)] than MA knees. At 2 years post-surgery, FA knees maintained better SF-36 PCS than MA knees [FA = 51.6 +/- 6.69 vs MA 47.1 +/- 9.61 (p=0.008)]. FA-rTKA demonstrated better functional outcomes at 6 months and 2 years post-surgery compared to MA-rTKA, suggesting that respecting the knee's native alignment and soft tissue envelope through FA may result in better long term outcomes.

Conclusion Functional alignment can be considered in patients with pre-operative CPAK-1 and 2 knee phenotypes undergoing robotic TKA, with possible improved long term outcomes achieved, when compared to MA-rTKA.

181

Impact of Sarcopenia on Clinical and Functional Outcomes Post Total Knee Arthroplasty: Systematic Review and Meta-Analysis

Wen Po Jonathan Tan, Erel Kane Yun En Tan, Ryan Wai Keong Loke, Chee Hoe Kong, Li Feng Tan, Barry Wei Loong Tan

National University Health System SINGAPORE

Introduction / Objective Sarcopenia—an age-related decline in muscle mass and strength - is increasingly recognized as a determinant of outcomes after total knee arthroplasty (TKA). We systematically evaluated the influence of sarcopenia on patient-reported outcomes and postoperative clinical events.

Materials & Methods Following PRISMA 2020 guidelines, we searched MEDLINE, Embase, Cochrane Library, and Scopus from inception to 25 January 2024 (PROSPERO CRD42024105396). We included studies comparing sarcopenic versus non-sarcopenic adults undergoing primary TKA and extracted data on patient-reported outcomes, objective performance, and complications. Random-effects meta-analyses were used for comparative outcomes where appropriate.

Results /Discussion Seven studies involving 2,972 patients (sarcopenia n=675, non-sarcopenia n=2,297) met inclusion criteria. Sarcopenia was associated with clinically worse KOOS and WOMAC scores at 3–6 months post-surgery, with differences attenuating by 12 months. Objective performance measures were significantly poorer in sarcopenic patients compared with non-sarcopenic patients. A meta-analysis of five studies showed that sarcopenia was associated with significantly higher odds of allogeneic blood transfusion (Odds Ratio [OR] 4.67; 95% CI 3.52–6.19). Evidence regarding prosthetic joint infection and venous thromboembolism was inconsistent due to very low event rates. Length of stay did not differ significantly between groups.

Conclusion Sarcopenia impairs early functional recovery after TKA and substantially increases transfusion requirements. Routine screening and targeted pre-operative optimization (nutrition, resistance training, anemia correction) may mitigate these risks. Prospective studies using harmonized consensus criteria are needed to refine risk estimates and guide clinical practice.

182

Comparable Early Outcomes Between Cemented and Cementless MAKO Functional Alignment Total Knee Arthroplasty: A Propensity-Matched Analysis in an Asian Cohort

Bo Xiang Bryan Neo, Tze En Jeremy Lim, Hee-Nee Pang, Seng Jin Yeo, Keng Jin Darren Tay, Ming Han Lincoln Liow

National University of Singapore, Yong Loo Lin School of Medicine SINGAPORE

Introduction / Objective Cemented fixation remains the gold standard in total knee arthroplasty (TKA); however, growing interest in cementless fixation has emerged due to potential advantages in biological osseointegration and long-term implant survivorship. Limited data exist comparing these fixation methods in robotic-assisted TKA using functional alignment (FA), particularly in Asian populations who may present with distinct anatomical and demographic characteristics. This study compared early clinical outcomes between cemented and cementless MAKO-assisted FA-TKA in an Asian cohort using propensity score matching.

Materials & Methods 148 consecutive patients undergoing MAKO-assisted FA-TKA were retrospectively reviewed. Following 1:1 propensity score matching for baseline demographics and deformity characteristics, 45 cemented and 45 cementless cases were compared. Outcomes included early postoperative pain, ambulation, range of motion, and patient-reported outcome measures (KSKS, KSFS, OKS, SF-36), alongside satisfaction and expectation fulfilment assessed at six months.

Results /Discussion Groups were well-matched at baseline. No significant differences were observed in early postoperative recovery metrics or six-month functional outcomes between the two fixation groups, except for a marginally higher SF-36 mental component score in the cemented group (57.7 ± 8.2 vs. 52.4 ± 11.3; p=0.043). Rates of MCID achievement, patient satisfaction, and expectation fulfilment were comparable between groups.

Conclusion Cementless MAKO-assisted FA-TKA demonstrated comparable early clinical and patient-reported outcomes to cemented fixation in this propensity-matched Asian cohort, suggesting it is a viable alternative fixation strategy in appropriately selected patients. However, longer follow-up is required to evaluate implant durability, osseointegration, and survivorship before broader conclusions can be drawn.

183

Investigating the Mechanical Stresses and Potential Stress Shielding Effect in Radial-Prosthesis Assemblies with Overstuffing and Understuffing of the Elbow Joint

Dennis Chew, Pivatidevi Pareatumbee, Andy Yew, Merrill Lee, Tet Sen Howe, Bernard Morrey, Wee Kheng Leow, Viet Nam Tran, Ling Ling Chan, Joyce Koh

Duke-NUS Medical School SINGAPORE

Introduction / Objective While radial head arthroplasty can achieve elbow stability following comminuted radial head fractures, bone resorption with aseptic loosening is observed in the long term. A possible mechanism is bone resorption from peri-prosthetic stress shielding, which is currently not well-studied in radial head arthroplasty. This study utilizes finite element (FE) modelling to characterize stress shielding in the elbow following radial head implantation at varying levels of joint overstuffing and understuffing. We hypothesize that radial head implantation will increase stress shielding, which is exacerbated and alleviated by overstuffing and understuffing, respectively.

Materials & Methods A digital model of a cadaveric elbow was generated via CT scanning and image segmentation. Virtual implantation of a prosthetic radial head was performed at varying levels of overstuffing and understuffing. FE modelling was utilized to apply rotational displacements at the distal forearm to simulate pronation and supination.

Results /Discussion Implant insertion caused a stress shielding effect in the proximal radius of around 16% in magnitude. Overstuffing exacerbated stress shielding, with a maximum magnitude of 22.8% observed at 5mm of overstuffing. Understuffing demonstrated the opposite result, with a stress shielding magnitude of 11.6% observed at 2mm of understuffing.

Conclusion To our knowledge, this is the first study to utilize FE methods to demonstrate stress shielding related to a radial head prosthesis, which may contribute to aseptic loosening via bone resorption. This effect is intensified by overstuffing, which concentrates stresses on the radiocapitellar surface, leading to capitellar erosions and resultant bone resorption. While understuffing minimizes stress shielding in the proximal radius, it may cause acute elbow and forearm instability. Thus, radial head arthroplasty should aim to restore native radial lengths, to avoid possible instability. Further studies are recommended to examine alternative prosthesis redesigns, to optimize stress levels around the bone-prosthesis interface and improve long-term clinical outcomes of radial head replacements.

184

Psoas Muscle Density Is More Strongly Associated with Postoperative Outcomes Than Muscle Quantity Following Surgery for Metastatic Spine Tumors

Wen Po Jonathan Tan, Woon Theng Heng, James Thomas Patrick Decourcy Hallinan, Li Feng Tan, Naresh Kumar, Jiong Hao Jonathan Tan
National University Health System SINGAPORE

Introduction / Objective This study aims to evaluate the influence of psoas muscle quantity and quality, as a surrogate for sarcopenia, on postoperative outcomes in patients undergoing surgery for metastatic spine tumors (MSTs), including delays in adjuvant oncologic therapy, observed versus prognosticated survival, postoperative infection, and ambulatory status.

Materials & Methods We retrospectively analyzed 260 patients who underwent surgery for MSTs between 2005 and 2022. Sarcopenia was quantified using total psoas area normalized to vertebral body area (TPA/VBA) and psoas muscle density (PMD). Associations with outcomes were evaluated using two-sample T-test and multivariate logistic regression adjusted for age, preoperative ECOG status, Charlson Comorbidity Index and Oswestry Spinal Risk Index ($p < 0.05$).

Results /Discussion 260 patients (mean age 61.5 ± 10.7 years; 50.4% male) were included. Males demonstrated significantly higher TPA/VBA compared with females (1.15 ± 0.32 vs 0.91 ± 0.31 , $p < 0.001$) while PMD was comparable between sexes (46.50 ± 8.16 vs 44.60 ± 10.34 , $p = 0.114$). On multivariate analysis, lower muscle quantity and quality were associated with delays in initiation of systemic therapy. In females, both lower TPA/VBA (OR 0.160, 95% CI 0.040–0.639; $p = 0.01$) and lower PMD (OR 0.955, 95% CI 0.914–0.997; $p = 0.04$) were independently associated with treatment delay. In males, only lower PMD was independently associated with treatment delay (OR 0.957, 95% CI 0.927–0.988; $p = 0.007$). Higher PMD in males was significantly associated with longer observed relative to prognosticated survival (OR 1.143, 95% CI 1.071–1.219; $p < 0.001$), whereas no association was observed in females. Postoperative complication rates included urinary tract infection (16.2%), pneumonia (11.5%), and thromboembolic events (6.5%), with no significant associations between TPA/VBA or PMD and postoperative infection or ambulatory outcomes.

Conclusion Reduced PMD was independently associated with treatment delays and survival-related outcomes in patients undergoing surgery for MSTs, demonstrating stronger prognostic value than TPA/VBA. Prospective validation is warranted to validate its role in preoperative risk stratification.

185

Validation of a Novel Artificial Intelligence Algorithm for Robotic Total Knee Arthroplasty in a Western Population: A Two-Stage Prospective Study Protocol

Matthew Song Peng Ng, Ryan Wai Keong Loke, **Jon Yew Ho**, Zi Qiang Glen Liao
NUS Yong Loo Lin School of Medicine SINGAPORE

Introduction / Objective Robotic Total Knee Arthroplasty (rTKA) has become increasingly popular. However, intraoperative manual planning remains time-consuming and suboptimal. In an Asian patient population, our novel AI algorithm previously demonstrated improved accuracy in achieving surgeon-defined target extension and flexion gaps while reducing intraoperative planning duration and total surgical duration. This prospective, two-stage study evaluates our algorithm's (1) ease of adoption, and (2) generalisability to a Western patient population. Stage 1 characterises the algorithm's learning curve for a surgeon without prior exposure. Stage 2 evaluates whether algorithm-assisted planning during imageless rTKA in a Western patient population improves implant planning accuracy &/or planning speed, versus conventional planning.

Materials & Methods 100 consecutive adults undergoing primary rTKA will be enrolled at a single center over six months. Stage 1 evaluates 4 surgeons across 40 cases: Each surgeon will perform five baseline cases using conventional planning, undergo structured remote training, and then perform five cases utilizing the AI planning algorithm. Surgeons completing this sequence enter Stage 2 (60 cases), a non-randomized, consecutive cohort comparing conventional ($n = 30$) versus AI-assisted ($n = 30$) planning; surgeons retain full authority over final implant positions throughout. The primary endpoints are the proportion of cases achieving final gaps within ± 1.5 mm of the surgeon-defined target, mean gap deviation, intraoperative planning duration, and total operative duration.

Results /Discussion The two-stage design deliberately separates adoption feasibility from comparative performance, since evaluating accuracy before surgeons reach proficiency could bias results. As our algorithm is surgeon facing, randomization/blinding is precluded, and bias may thus arise. Use of objective, system-recorded outcomes and surgeon-level clustering is intended to mitigate this.

Conclusion This study will provide early prospective evidence on the learning curve and comparative performance of AI-assisted rTKA planning in a Western population, informing broader clinical adoption.

186

What makes a difference? Return to driving after cervical disc replacement versus anterior cervical discectomy and fusion.

Jung Hahn Yong, Rachel Si Ning Loh, Reuben Chee Cheong Soh
Singapore General Hospital Department of Orthopaedic Surgery SINGAPORE

Introduction / Objective Anterior cervical discectomy and fusion (ACDF) is the reference standard for cervical degenerative disc disease but eliminates segmental motion. Artificial disc replacement (ADR) was developed as a motion-preserving alternative; however, most comparative studies have used

superiority designs and few have evaluated driving-specific functional recovery. This study aimed to determine whether ADR is non-inferior to ACDF for functional outcomes at 2-year follow-up, and to compare cervical range of motion (ROM), pain, and driving-specific recovery as secondary outcomes.

Materials & Methods This retrospective non-inferiority study included 63 patients: ADR (n=24) and ACDF (n=39). The primary outcome was the Neck Disability Index (NDI), with a pre-specified non-inferiority margin of 7.5 points. Secondary outcomes included NDI driving subset score, neck pain and disability score, neurogenic symptom score, VAS neck and limb pain, and cervical ROM in six planes, assessed pre-operatively and at 6 months and 2 years. Between-group comparisons used independent t-tests/Mann-Whitney U tests. ANCOVA adjusted post-operative ROM comparisons for pre-operative values, age, and number of operative levels where baseline imbalance was identified. Within-group change over time was assessed using repeated measures ANOVA and Friedman tests. Spearman's rank correlation examined predictors of NDI driving subset improvement. Sensitivity analyses confirmed robustness of the primary conclusion to levels adjustment.

Results /Discussion No significant between-group differences were found for any patient-reported outcome at any timepoint. Sensitivity analysis confirmed an adjusted NDI difference of -3.56 points (p=0.342), within the non-inferiority margin. ADR patients had significantly greater cervical flexion at 6 months and 2 years. In ACDF patients, driving recovery correlated moderately with NDI and neck pain improvement (rho 0.46–0.51); no such correlations were seen in ADR patients, suggesting different mechanisms of driving-specific recovery.

Conclusion ADR is non-inferior to ACDF for functional and pain outcomes at 2 years, with superior cervical flexion preservation. Driving-specific recovery appears mechanistically distinct between procedures.

187

Re-Engineering Titanium Spinal Implants: From Tunable Mechanics to Improved Imaging Properties for a Novel Titanium Spinal Rods

Si Jian Hui, Lionel Lee, Kathir Senthamil Kumar, Naresh Kumar
National University Health System SINGAPORE

Introduction / Objective Conventional titanium spinal implants provide reliable fixation but their high stiffness may contribute to stress shielding and altered load transfer, while metal artefact limits postoperative CT and MRI assessment. Additive manufacturing offers an opportunity to address both limitations through deliberate control of implant geometry and microstructure. We investigated whether parametrically designed Ti6Al4V rods could provide tunable mechanical behaviour while improving radiological compatibility.

Materials & Methods Ti6Al4V rods with a constant 5.5-mm outer diameter and progressively varied longitudinal internal through-holes were fabricated using selective laser melting. Mechanical performance was evaluated using ASTM F2193 four-point bending, assessing flexural stiffness, yield behaviour and structural integrity, with finite-element modelling planned for validation and load-transfer analysis. In parallel, solid and internally hollowed rods were manufactured in different build orientations and as-built or heat-treated states. Specimens underwent CT and 3-T MRI in a standardized agar phantom. CT artefact volume and contrast-to-noise ratio, MRI artefact-to-rod-volume ratio, and microstructure using SEM and EBSD were analysed.

Results /Discussion Preliminary mechanical testing demonstrated a progressive reduction in flexural stiffness with increasing internal hollowing, supporting geometry as a means of tuning construct behaviour. Quantitative mechanical analysis is ongoing. The same geometric modification substantially improved imaging performance: internal hollowing reduced CT artefact volume by up to 64% and MRI artefact burden by up to 2.6-fold compared with solid rods. Vertically built rods generated 9.7% less MRI artefact than horizontally built rods, whereas heat treatment increased MRI artefact by 10.8%, corresponding to differences in crystallographic texture, c-axis orientation and β -phase enrichment.

Conclusion Additive manufacturing enables titanium implants to be designed holistically rather than for strength alone. Internal geometry can tune mechanical behaviour while reducing radiological artefact, with microstructure providing an additional design lever. This establishes a platform for next-generation spinal implants balancing fixation, physiological load sharing and postoperative diagnostic visibility within one construct.

188

Outcomes of Robotic Versus Conventional Unicompartmental Knee Arthroplasty in an Enhanced Recovery After Surgery (ERAS) Protocol: A Propensity-Matched Retrospective Cohort Study

Chang Yi Woon, Hui Wen Tay, Hee Nee Pang, Darren Tay, Seng Jin Yeo, Lincoln Liow, Jerry Chen
Singapore General Hospital SINGAPORE

Introduction / Objective Unicompartmental knee arthroplasty (UKA) is a popular surgical option for unicompartmental medial knee osteoarthritis, performed using conventional (cUKA) or robotic (rUKA) techniques. This study aims to compare the outcomes of rUKA versus cUKA within a standardised Enhanced Recovery After Surgery (ERAS) protocol.

Materials & Methods Patients who underwent ERAS UKA between January 2016 and December 2018 were dichotomised into cUKA versus rUKA, with propensity score matching based on age, sex, body mass index, severity of knee osteoarthritis and knee extension strength. We compared operative time, blood loss, length of stay, time to ambulation, readmission, complications, and patient reported outcome measures (PROMs) utilising Knee Society Clinical Rating Score, Oxford Knee Score, SF-36 Physical and Mental Component Scores, patient satisfaction and expectation fulfilment at 6-months and 2-years post-operatively. Further subgroup analysis was performed by excluding the first 6 rUKA cases of each surgeon to account for the initial learning curve.

Results /Discussion Propensity score matching yielded 111 patients in each group. Both groups demonstrated improvements in all PROMs at 2 years, compared to pre-operatively (p-values<0.001), but with no difference between the two groups (p-values>0.05). rUKA had a longer operative duration (p<0.001), greater intra-operative blood loss (p=0.002), and longer time to ambulation (p=0.001). Further subgroup analysis excluding learning curve patients demonstrated that operative duration remained longer in the rUKA group (p<0.001), but with no significant difference in intra-operative blood loss, time to ambulation and PROMs between the 2 groups. There was also a trend of higher complication rates in the rUKA group, with more wound complications (p=0.118), and more tibial tray subsidence/peri-prosthetic fractures (p=0.169), although not statistically-significant.

Conclusion rUKA resulted in poorer peri-operative outcomes than cUKA. However, these differences were no longer significant after accounting for the initial learning curve. Long-term patient outcomes were comparable. Further studies are required to justify robotic-assistance in ERAS UKA.

189

Cementless Titanium Versus Cemented Fixation in Primary Total Knee Arthroplasty: A Systematic Review and Meta-Analysis

Wee Le Tan, Ryan Loke, Dhanyashri Karthickraj, Alexander Shao Rong Pang, Matthew Ng, Glen Zi Qiang Liao
Yong Loo Lin School of Medicine National University of Singapore SINGAPORE

Introduction / Objective Cemented fixation remains the standard in primary total knee arthroplasty (TKA), though concerns about long-term aseptic loosening have renewed interest in cementless alternatives. Porous titanium technologies aim to facilitate osseointegration and improve implant durability. Evidence specifically evaluating titanium-based cementless fixation against cemented TKA has not been comprehensively synthesized. This systematic review and meta-analysis compared clinical, functional, and survivorship outcomes of cementless titanium versus cemented fixation in primary TKA.

Materials & Methods A random-effects meta-analysis was conducted on comparative studies of cementless titanium versus cemented TKA in patients undergoing primary TKA for osteoarthritis. MEDLINE, Embase, Cochrane Library, and SCOPUS were searched from inception to June 2026. Outcomes evaluated were Knee Society Scores (Knee and Function), Oxford Knee Score, range of motion, 5-year and longer-term all-cause revision rates, and overall complication rates.

Results /Discussion Thirty-seven studies comprising 10,445 cemented and 10,639 cementless titanium TKAs were included. Baseline demographics were comparable (mean age 67.5 vs 67.4 years; BMI 31.9 vs 31.4 kg/m²; male 38.7% vs 45.7%). No significant differences were found between cemented and cementless fixation for any outcome. KSS Objective Knee Score (90.5 vs 90.6; WMD 0.38, 95% CI -1.60–2.35, p=0.71), KSS Function Score (76.3 vs 88.1; WMD -3.45, 95% CI -8.45–1.55, p=0.18), Oxford Knee Score (37.3 vs 36.5; WMD 0.21, 95% CI -0.93–1.35, p=0.72), and range of motion (116.8° vs 117.2°; WMD 0.02, 95% CI -1.74–1.77, p=0.99) were similar between groups. Five-year revision survivorship was 97.2% vs 98.0% (RR 1.07, 95% CI 0.45–2.58, p=0.88), and survivorship beyond 5 years was 95.6% vs 93.3% (RR 0.78, 95% CI 0.58–1.07, p=0.12). Non-revision complication rates were 3.0% vs 8.5% (RR 0.96, 95% CI 0.42–2.18, p=0.92).

Conclusion Cementless titanium and cemented fixation in TKA demonstrate comparable clinical outcomes, and mid-term survivorship, suggesting cementless titanium fixation is safe and effective to conventional cemented technique.

190

Shorter Antibiotic-to-Incision Intervals Do Not Increase Risk Of Prosthetic Joint Infections in Routine Total Knee Arthroplasty

Z.J. Li, S.I. Sim, Y.M. Ho, A. Singh, F.H.Y. Kagda, Z.C. Liang

Ng Teng Fong General Hospital SINGAPORE

Introduction / Objective Total knee arthroplasty (TKA) is a commonly performed and highly successful orthopaedic procedure. Prosthetic joint infection (PJI) is a feared complication, with significant morbidity and mortality. Timely administration of prophylactic antibiotics is a standard strategy to reduce postoperative infections including PJI, yet current literature shows substantial variation in the recommended interval between antibiotic administration and knife-to-skin. This study evaluates the safety of shorter antibiotic-to-incision intervals in routine primary TKA.

Materials & Methods A retrospective cohort of 223 consecutive unilateral TKAs performed at a single institution between January 2022 and March 2023 was analysed. Patient demographics, perioperative variables, and post-operative outcomes were collected. Cases were stratified by duration between antibiotic administration and knife-to-skin (< 30-minutes; ≥ 30-minutes). Subgroup and regression analyses were performed to evaluate associations with PJI.

Results /Discussion A total of 223 patients were included (mean age 68.9 years; BMI 28.0 kg/m²). Females accounted for 65.0% (n = 145) of the cohort, and 63.2% (n = 141) had Kellgren–Lawrence Grade 4 osteoarthritis. The overall incidence of PJI was 1.35% (n = 3). The antibiotic-to-incision interval was not associated with increased PJI risk when analysed as a continuous variable (OR 0.96, 95% CI 0.86–1.02; p = 0.478). Likewise, using a 30-minute threshold did not demonstrate a significant difference in PJI rates (< 30-minutes vs ≥ 30-minutes: OR 0.88, 95% CI 0.08–19.04; p = 0.914).

Conclusion The overall rates of PJI after routine primary TKA are low. Shorter antibiotic-to-incision intervals did not increase the risk of PJI in this patient cohort. The results of this study suggest that administration of antibiotics closer to skin incision may be safe in standard practice. Emphasis should still remain on appropriate antibiotic selection, dosing, and consistent adherence to other established infection-prevention measures.

191

A Multicenter Randomized Controlled Trial for a Novel Digital Therapeutic for Treatment of Patellofemoral Pain, a Dilemma in Orthopedics

Jae-Young Park, Sanghee Lee, Jong-Min Kim, Sang Hak Lee, Moon Jong Chang, Kyu Sung Chung, Man-Soo Kim, Seong Hwan Kim, Dong Jin Ryu, Tae Hyun Park, Chi-Hyun Choi, **Chan Yoon**, Chong Bum Chang, Jin Goo Kim

EverEx KOREA

Introduction / Objective Patellofemoral pain (PFP) is a common disease that causes functional impairments and psychological distress, mainly in younger patients. Although many patients consult orthopedic surgeons, surgical treatment is typically ineffective and may aggravate symptoms. This study aimed to evaluate the efficacy of a mobile app-based digital therapeutic (DTx) that integrates exercise therapy and cognitive-behavioral therapy (CBT) for PFP.

Materials & Methods In this multicenter randomized controlled trial, 216 adults with chronic PFP were assigned 1:1 to an 8-week DTx program or control care consisting of education, one-time exercise instruction, printed materials, and exercise diaries. Outcomes were assessed at baseline and weeks 4, 8, and 12. The primary endpoint was usual pain at week 8 measured by a 0–100 mm visual analog scale. Secondary outcomes included worst pain, Anterior Knee Pain Scale (AKPS), quality of life, and psychological outcomes.

Results /Discussion At week 8, usual pain significantly favored DTx (between-group difference -12.5 mm, 95% CI -17.1 to -7.8). Worst pain (-10.7 mm), AKPS (+5.2 points), EQ VAS (+10.7 points), and pain catastrophizing (-1.8 points) also significantly favored DTx. Benefits in pain and function increased further by week 12. Weekly exercise adherence was 80.9% with DTx versus 71.3% with control, while CBT session completion was 74.6%. No device- or intervention-related serious adverse events occurred.

Conclusion This novel mobile app-based DTx combining exercise and CBT resulted in significantly greater improvements in pain, function, and psychological outcomes compared to usual care. High adherence supports the feasibility and acceptability of this DTx for PFP with potential for broad clinical application for a variety of patients with PFP-type symptoms.

193

Markerless AI-Based Assessment of Spinal Mobility in Ankylosing Spondylitis: Validation Against the BASMI

Sung Ik Cho, Sanghee Lee, Jun Won Park, Eun Sun Lee, **Chan Yoon**, Eun Young Lee

EverEx KOREA

Introduction / Objective The Bath Ankylosing Spondylitis Metrology Index (BASMI) is widely used to assess spinal mobility in ankylosing spondylitis (AS), but conventional assessment requires manual measurements with tape measures and goniometers. We evaluated the validity of a markerless, two-dimensional (2D) artificial intelligence (AI)-based video system for spinal mobility assessment.

Materials & Methods In this prospective observational study, 48 adults with AS completed baseline assessments using conventional BASMI and MORA Vu, a 2D video-based AI pose-estimation software. Five BASMI components were matched with AI-derived angular measures, and trunk extension was additionally assessed. Concurrent validity was evaluated using correlation analyses. Multiple linear regression was used to estimate total BASMI-10 scores from six AI-derived parameters, with leave-one-out cross-validation (LOOCV) and bootstrap optimism correction for internal validation.

Results /Discussion Four of five AI-derived measures showed strong correlations with corresponding conventional BASMI components: hip abduction versus intermalleolar distance ($r=0.80$), trunk flexion versus modified Schober test ($r=0.76$), trunk lateral flexion versus lumbar side flexion ($r=0.73$), and cervical lateral flexion versus cervical rotation ($r=0.71$; all $p<0.001$). Forward head posture angle showed a weaker correlation with tragus-to-wall distance ($r=0.41$, $p=0.004$). The BASMI-10 prediction model showed an apparent R^2 of 0.735 and retained moderate performance after internal validation (LOOCV $R^2=0.648$; bootstrap-corrected $R^2=0.656$). Trunk flexion and cervical lateral flexion were significant predictors. Conventional and LOOCV-predicted BASMI-10 scores did not differ significantly (2.95 ± 1.45 vs 2.94 ± 1.24 ; $p=0.926$).

Conclusion Markerless 2D AI-based video analysis demonstrated strong concurrent validity and could approximate overall BASMI-10 scores without sensors or specialized hardware. This approach may provide a rapid, standardized, and scalable method for spinal mobility assessment in clinical and remote-care settings.

194

Robotic-assisted (rPSF) versus conventional fluoroscopy-guided (cPSF) sacro-iliac percutaneous screw fixation for posterior pelvic ring fractures: a systematic review and meta-analysis

Kai Xiang Yeoh, Scott Pang, Vincent Qi, Jared Lau, Sean Rodriguez, Rasappan Kumaran
NUS SINGAPORE

Introduction / Objective cPSF plays an important role in screw fixation due to the complex 2D anatomy of the pelvis and the narrow osseous safe corridors available for screw placement. However, cPSF is technically demanding, causing increased ionising radiation from repeated X-ray exposure. The creation of the Tirobot, utilizes 2D pre-operative planning and robotic assisted screw fixation to reduce radiation exposures and improve clinical outcomes. This study aims to identify if there are any differences in clinical outcomes between cPSF and rPSF.

Materials & Methods A random-effects meta-analysis was conducted comprising 16 studies focusing on posterior pelvic ring fracture from electronic databases: Embase, PubMed, and Scopus. The following clinical outcomes were extracted: fluoroscopy and surgical duration, radiation exposure, Majeed score, intraoperative blood loss, and fracture healing time.

Results /Discussion rPSF showed lower intraoperative blood loss (MD = -26.04 mL [95% CI -44.64 to -7.43], $p < 0.001$), lower surgical duration (MD = -30.09 min [95% CI -58.17 to -2.00], $p < 0.05$), lower fluoroscopic exposure (MD = -30.60 s [95% CI -52.49 to -8.72], $p < 0.001$), lower radiation exposure (MD = -18.24 Gycm² [95% CI -31.09 to -5.38], $p < 0.01$) and decreased incision length (MD = -0.76 cm, 95% CI -0.93 to -0.59 ; $p < 0.001$). Fracture healing time (MD = -0.02 [95% CI -0.41 to 0.37], $p > 0.05$) and Majeed score (MD = 1.03 [95% CI -0.12 to 2.17], $p > 0.05$) showed no statistical significance.

Conclusion rPSF was associated with improved clinical outcomes and lowered radiation exposure with comparison to cPSF. Extensive pre-operative planning and surgical efficiency intra-operatively, made surgeries less surgeon dependent, reducing the number of X-rays taken. However, studies were published from a single region with utilization of a locally manufactured robot, multicentre studies across diverse geographic and demographic populations are warranted to assess the generalisability and reproducibility of these findings.

195

Zone specific 3D-printed meniscus scaffold from nanohydroxyapatite-reinforced polycaprolactone/hydrogel bioinks

Piya-On Numpaisal

Institute of Medicine, Suranaree University of Technology THAILAND

This research aimed to engineer a 3D-printed meniscus scaffold designed to functionally and structurally mimic the native human meniscus, which exhibits zone-specific biochemical composition. Specifically, the design incorporated a fibrous outer region and a cartilaginous inner region. To achieve this, a composite material consisting of polycaprolactone (PCL) reinforced with nanohydroxyapatite (HA) was selected as the base material. This choice was based on the material's mechanical properties, which closely approximate those of the native meniscus tissue. Two distinct hydrogels were employed as bioinks: gelatin methacrylate (GelMA) for the outer region, hypothesized to promote fibrogenesis, and a combination of glycidyl methacrylate-modified poly(vinyl alcohol) and glycidyl methacrylate-modified silk fibroin (PVA-g-GMA/SF-g-GMA) for the inner region, designed to induce chondrogenesis. A dual-nozzle 3D printing technique was utilized to fabricate the scaffold, allowing for the precise deposition of the PCL/HA composite and the two hydrogel bioinks in their respective zones. Following a 28-day in vitro culture period, the outer PCL/HA/ GelMA region exhibited elevated expression of type I collagen (COL1A1), a marker indicative of fibrous tissue formation. Conversely, the inner PCL/HA/PVA-g-GMA/SF-g-GMA region demonstrated increased expression of type II collagen (COL2A1), aggrecan (ACAN), and SRY-box transcription factor 9 (SOX9), all of which are key markers of cartilage tissue development. These findings confirm that the outer region successfully exhibited fibrogenic characteristics, while the inner region displayed chondrogenic properties, effectively resembling the zonal biochemical composition of the native meniscus. Furthermore, the 3D-printed PCL/HA/hydrogel scaffold demonstrated mechanical properties comparable to those of the human meniscus, ensuring structural integrity. The scaffold closely resembled the anatomical shape of both the medial and lateral menisci. In conclusion, this study demonstrates the feasibility of fabricating a 3D-printed meniscus scaffold that aligns with the anatomical, biochemical, and mechanical characteristics of the native human meniscus. This scaffold holds significant potential for applications in meniscus tissue engineering and regenerative medicine.

196

Targeted Tissue Modification in the Lumbar Spine: Clinical and Radiological Outcomes of Percutaneous Laser Disc Reconstruction

Bayu Sakti Jiwandono

INDONESIA

Introduction / Objective Lumbar herniated nucleus pulposus (HNP) and Degenerative Disc Disease (DDD) caused by intervertebral disc degeneration is a common condition associated with lower back pain, disability, and a decreased quality of life. Percutaneous Laser Disc Reconstruction (PLDR) is an

interventional procedure applied to the disc tissue to induce regeneration, repair structural damage, and alleviate pain. This study aims to evaluate the short-term clinical and radiological outcomes of PLDR in patients with lumbar HNP.

Materials & Methods This prospective cohort study was conducted at Dr. Cipto Mangunkusumo Jakarta Hospital and Dr. Moewardi Hospital Surakarta, involving 21 patients diagnosed with lumbar HNP. Participants were selected using purposive sampling based on specific inclusion and exclusion criteria. Clinical variables analyzed included the Visual Analogue Scale (VAS), Oswestry Disability Index (ODI), 36-Item Short Form Survey (SF-36), and Patient-Reported Outcomes Measurement Information System (PROMIS) Global-10. Radiological evaluations were performed utilizing the Pfirrmann Grading system via Magnetic Resonance Imaging (MRI). Follow-up evaluations were conducted at >3 months post-intervention.

Results /Discussion At the 3-month post-intervention follow-up, patients demonstrated a 51.3% improvement in pain severity, with mean VAS back pain scores significantly decreasing from 7.25 ± 0.68 to 3.67 ± 0.48 ($p < 0.001$). The procedure also yielded significant enhancements in patient quality of life, evidenced by a 58.8% improvement in mean ODI scores (from 38.57 ± 7.19 to 15.90 ± 4.84 ; $p < 0.001$) and a 65.1% improvement in the SF-36 health change component (from 46.43 ± 9.64 to 76.67 ± 3.65 ; $p < 0.001$). Radiological assessment revealed a statistically significant reduction in Pfirrmann Grading ($p = 0.046$). Evaluation of PROMIS scores yielded a Pain Interference score of 43.33 ± 5.80 and a Physical Function score of 50.76 ± 2.43 , indicating that maximal functional recovery values had not yet been reached at this short-term interval.

Conclusion: Percutaneous Laser Disc Reconstruction (PLDR) provides significant and favorable short-term clinical and radiological outcomes in patients with lumbar HNP and DDD.

Keywords: Lumbar Nucleus Pulposus Herniation; Degenerative Disc Disease; Percutaneous Laser Disc Reconstruction (PLDR); MRI; Clinical Outcomes.

197

Femoral Neck Stress fracture on a Female Marathon Runner: A Case Report

Nguyễn Mạnh Khánh¹ Đinh Ngọc Liêm¹ Nguyễn Huy Thiệp¹ Emily Benson²

¹Department of Upper Extremity Surgery and Sports Medicine, VietDuc University Hospital

²Ventura Community Memorial Healthcare

Objective: Describe the clinical and paraclinical characteristics of the Femoral Neck Stress Fracture and the result of the Femoral Neck Stress Fracture surgery.

Subjects and methods: A case report.

Results: We report a case of a 30-year-old female patient who is a marathon runner with a healthy medical history. The patient began experiencing left groin pain in April 2025, which gradually intensified over the two weeks prior to her hospital visit. The patient was diagnosed with a femoral neck stress fracture and underwent a femoral neck fixation surgery. The patient was pain-free after 2 weeks and began partial weight-bearing exercises after 6 weeks. 10 months after surgery, the femoral neck had completely healed and the patient returned to daily activities.

Conclusions: Femoral Neck Stress Fracture is a rare condition. The typical clinical feature of the disease is the appearance of hip joint pain in athletes or soldiers who have undergone long-distance running during training or drills. The disease is diagnosed with clinical and paraclinical examinations. MRI is the gold standard in imaging diagnosing. Early diagnosis is important for the right treatment, preventing complications like avascular necrosis (AVN) in young patients. The results of the clinical case show that the surgery was successful, allowing the patient to return to their daily activities.

Keywords: Stress fracture, Femoral neck fracture, Marathon Runner

198

Morphometric analysis of the Filipino knee and its implication in total knee arthroplasty prosthesis design

Cleff L. Flores, Jose Antonio G. San Juan

Background: Prosthesis factors account for a quarter of the dissatisfaction rates among post-total knee replacement (TKR) patients. In the Philippines, the available prostheses have pre-determined sizes and dimensions that are based on Caucasian morphometric data. This can pose a problem, since according to previous studies Asian knees have smaller dimensions compared to Caucasians. Since there is a paucity of research looking into the fitness of these prostheses to the Filipino knee, this study was pursued.

Methods: This study measured 675 knees of 675 adult Filipinos from January 2018 to December 2020. The morphometric measurements were performed on T1-weighted magnetic resonance images. The distal femoral morphometry included: the anteroposterior distance, lateral and medial anteroposterior distances, mediolateral distance, anterior and posterior mediolateral distances, and the femoral aspect ratio. The proximal tibial morphometry included: the anteroposterior distance, mediolateral distance, the medial and lateral anteroposterior distances, and the tibial aspect ratio. The patellar height, width, and thickness were also determined. Statistical analyses were done by using SPSS (version 26) and Microsoft Excel (version 2016).

Results: The mean femoral medial and lateral anteroposterior distances were 57.6mm and 57.1mm, respectively. The femoral mediolateral distance was 69.3mm, and the mean femoral aspect ratio was 1.21. The mean proximal tibial antero-posterior and mediolateral distances were 45.3mm and 71.9mm, respectively. The mean tibial aspect ratio was 1.66. Most TKR prostheses can be fitted to the Filipino knee but underhang on the mediolateral aspect is commonly observed in both the femoral and tibial components. The mean patellar height and width of Filipinos were 39.6mm and 42.6mm, respectively while the average thickness was 23.1mm.

Conclusion: Most prostheses available in the Philippine and Asian markets can be fitted into Filipino knees albeit the underhang observed in the mediolateral aspects of both femoral and tibial components. Potential patellar complications are unlikely given the adequate thickness. To avoid the potential mismatch, the best approach is to design a prosthesis aptly suited for the Filipino knees.

KEYWORDS: Filipino knee morphometry, Prosthesis design, Total knee arthroplasty

199

Computational Modeling of Forearm Rotation in Primates

Viet Nam Tran, Wee Kheng Leow, Dennis Chew, Andy Khye Soon Yew, Joyce Suang Bee Koh, Tet Sen Howe

National University of Singapore SINGAPORE

Introduction / Objective The forearm is involved in a wide range of movements and activities for humans and other primates. It involves complex motion at several joints and is susceptible to injuries that can require surgical treatments. To facilitate understanding of forearm motion at each joint, computational modeling of forearm rotation is applied on human and other primate subjects.

Materials & Methods Three cadaveric subjects, specifically a human, a chimpanzee and a howler monkey, are studied in this work. For each subject, 3D bone models of a forearm are obtained from a CT scan. For simplicity, forearm rotation is modeled by rotating the radius about a fixed axis while the ulna is kept stationary. The axis is defined by two rotation centers that are obtained by fitting circles to landmarks placed on bone surfaces according to joint anatomy.

Results /Discussion For the human subject, the results show that the PRUJ gap is approximately the same during forearm rotation. This is because the proximal radial head is approximately circular. However, the DRUJ gap changes during forearm rotation, since the distal ulnar head is not circular. Similarly, for the chimpanzee, the results show that the PRUJ gap is approximately the same during forearm rotation, while the DRUJ gap changes. This is expected because chimpanzee anatomy resembles human anatomy. However, for the howler monkey, the results show that both the PRUJ gap and the DRUJ gap change during forearm rotation. This is because its proximal radial head and distal ulnar head are not circular and deviate significantly from human anatomy.

Conclusion Rotating the radius about a fixed axis gives a reasonable approximation of forearm rotation in humans. This simple approach is also applicable in primates with similar anatomy to humans. It is less effective in primates that deviate significantly from human anatomy.

200

Radiographic and Clinical Outcomes of Adjunctive Subtalar Arthroereisis in Hallux Valgus Surgery with Concomitant Pes Planus

Jia Ying Lee, Mehar Dhillon, Zong Xian Li, Kizher Buhary, Rui Xiang Toh, Kae Sian Tay
Singapore General Hospital SINGAPORE

Introduction / Objective Hallux valgus frequently coexists with pes planus, although the clinical benefit of addressing concomitant pes planus remains unclear. This study compared radiographic and patient-reported outcomes following hallux valgus surgery with or without adjunctive subtalar arthroereisis.

Materials & Methods A retrospective single-centre cohort study was performed using a prospectively maintained institutional registry (2007–2024). Patients undergoing primary hallux valgus surgery (MICA, scarf or Spear plate) were included; revision procedures and prior ipsilateral hindfoot or midfoot surgery were excluded. Patients undergoing concomitant arthroereisis for pes planus were matched 1:1 to controls using exact matching for surgical approach and sex, with nearest-neighbour matching for age and BMI. VAS pain, EFAS and SF-36 were assessed preoperatively, at 6 months and 2 years. Hallux valgus and pes planus radiographic parameters were assessed longitudinally. Linear mixed-effects models evaluated longitudinal clinical outcomes, with exploratory subgroup analyses by age, BMI and preoperative alignment.

Results /Discussion Sixty-two patients were included, with 31 in each group. Hallux valgus correction did not differ significantly between groups at 6 months or 2 years, with comparable changes in hallux valgus and intermetatarsal angles (all $p > 0.10$). In the arthroereisis group, Meary's angle and calcaneal pitch improved significantly from baseline at 6 months ($p < 0.0001$) and 2 years ($p = 0.01–0.02$), remaining significant after adjustment. However, partial loss of correction occurred between 6 months and 2 years (Meary's angle 6.3° to 8.4° , $p < 0.001$; calcaneal pitch 16.7° to 15.7° , $p = 0.004$), with residual pes planus persisting. No significant between-group differences were observed in VAS, EFAS or SF-36. Hardware-related complications occurred in 16% versus 6% ($p = 0.25$).

Conclusion Adjunctive arthroereisis improved pes planus radiographic alignment but did not enhance hallux valgus correction or patient-reported outcomes. Partial radiographic regression occurred by 2 years, and hardware complications were numerically higher with arthroereisis.

201

Deciphering the association between baseline function, fracture characteristics and surgical intervention in an elderly cohort of hip fracture patients

Ying Jin Tan, Cheng Jun Teo, Tet Sen Howe, Meng Ai Png, Kenny Xian Khing Tay, Sheng Xu, Merrill Jian Hui Lee, William Yeo, Karen Zhang, Joyce Suang Bee Koh
Singapore General Hospital SINGAPORE

Introduction / Objective Geriatric hip fractures are associated with significant loss of mobility, independence and health-related quality of life. While fracture morphology has been proposed as a determinant of recovery, the influence of fracture type independent of baseline function and patient characteristics remains unclear. This study aimed to determine whether fracture type is independently associated with preinjury and postoperative functional outcomes in elderly patients undergoing surgical treatment for hip fractures.

Materials & Methods A retrospective analysis of prospectively collected data was performed on patients aged ≥ 60 years who underwent surgery for low-energy neck of femur (NOF) or intertrochanteric (IT) fractures at a tertiary centre from January to December 2023. Patients with pathological, atypical or high-energy fractures, conservative treatment, periprosthetic fractures, incomplete data or inadequate follow-up were excluded. Preinjury and 6-month postoperative patient-reported outcome measures (PROMs) included Parker Mobility Score (PMS), Modified Barthel Index (MBI), Harris Hip Score (HHS), EQ-5D-3L, Numeric Pain Rating Scale and SF-36 domains. Delta scores were calculated to assess recovery from preinjury status. Multivariate analysis of covariance was performed adjusting for age and gender.

Results /Discussion Of 415 surgically treated patients, 257 were included (mean age 78.97 ± 8.04 years; 71.2% female), comprising 152 NOF and 105 IT fractures. On univariate analysis, IT fractures had poorer preinjury PMS, MBI, EQ-5D and physical functioning scores. At 6 months, IT patients demonstrated significantly lower PMS (3.53 vs 4.83), HHS (70.03 vs 77.74), MBI (74.46 vs 83.46), EQ-5D (0.59 vs 0.71), physical functioning (25.00 vs 38.73) and social functioning scores (59.38 vs 72.85; all $p \leq 0.015$). Delta scores for PMS, MBI, EQ-5D and social functioning were also significantly poorer in IT fractures. However, multivariate analysis demonstrated that age, rather than fracture type or gender, was independently associated with overall preinjury and 6-month postoperative outcomes.

Conclusion Although IT fractures were associated with poorer functional recovery on univariate analysis, fracture morphology was not independently associated with outcomes after adjustment for age and gender. Increasing age appears to be a more important determinant of functional recovery following geriatric hip fracture.

202

50 years on: Delayed-onset foot drop due to sciatic nerve neuropathy on a background of ipsilateral femur intramedullary nailing, a case report

Awais Ali, Grace Hui Zhen Chua, Christian Hwee Yee Heng, Yew Lok Woo, Kenny Xian Khing Tay, William Zhan Xia, Seo Kiat Goh
Singapore General Hospital SINGAPORE

Introduction / Objective The causes of foot drop are varied, one of which is sciatic nerve neuropathy. This report demonstrates a delayed presentation of foot drop due to sciatic nerve neuropathy, on a background of ipsilateral femur intramedullary nailing done 50 years ago.

Materials & Methods A 77-year-old female with a background of previous left femur intramedullary nail presented with a sudden onset of left foot drop for one-day duration following minimal trauma. There was associated numbness up to the left midshin, but otherwise no back or lower limb pain. Magnetic Resonance Imaging (MRI) and electrodiagnostic studies were conducted, with overall findings ruling out a lumbar aetiology, and suggestive of a left sciatic neuropathy.

Results /Discussion The femur nail was eventually removed in operating theatre twelve days after the onset of foot drop. Intra-operatively the nail was found to be proud and extending past the bony surface of the femoral greater trochanter, with the left sciatic nerve noted to have significant scarring. Sciatic nerve neurolysis and decompression both proximally and distally were done in the same setting, but the foot drop did not recover. Ipsilateral foot drop after intramedullary nailing of the femur is a rare but known complication, usually due to sciatic nerve palsy. In this patient, the delayed sciatic neuropathy was likely due to the chronic mechanical irritation from the retained femoral nail causing scarring and fibrosis. Another differential to consider would be sciatic nerve neuropathy from myositis ossificans traumatica, although scan findings were not suggestive of it.

Conclusion While it is rare, this case highlights the possibility that retained orthopaedic implants may contribute to chronic mechanical irritation and fibrosis of adjacent neural structures decades after the index surgery, resulting in very late neurological manifestations. Careful clinical evaluation, electrodiagnostic studies and relevant imaging are important for accurate diagnosis and management of the foot drop.

203

Vascularised Fibular Graft in Complex Reconstruction: A Three-Year Experience from a Malaysian Tertiary Hand & Microsurgery Unit

Mohd Firdaus bin Mohd Aslam

Hand & Microsurgery Unit, Department of Orthopaedics and Traumatology, Hospital Selayang, Ministry of Health MALAYSIA

Introduction: Vascularised fibular graft (VFG) provides a living, structurally robust autograft with an intrinsic blood supply, making it a valuable option for reconstruction of large and biologically challenging skeletal defects. We present the three-year experience of the Hand & Microsurgery Team at Hospital Selayang, Malaysia, highlighting the versatility of VFG across diverse reconstructive indications.

Methods: A retrospective case series of 16 patients who underwent VFG reconstruction over a three-year period was reviewed. Indications included segmental bone loss, reconstruction following orthopaedic oncological resection, and complex oromandibular defects. Clinical outcomes, graft-related complications and donor-site morbidity were evaluated.

Results: Fourteen of 16 patients (87.5%) achieved graft union/viability, demonstrating successful reconstruction across multiple anatomical regions and clinical indications. One graft (6.3%) failed secondary to infection, while one patient (6.3%) developed delayed union at one graft-host junction. One patient with advanced malignancy died from progression of the underlying disease. Donor-site leg swelling occurred in eight patients (50%). No patients developed foot drop, ankle pain or ankle instability. One patient (6.3%) was found to have a dominant peroneal artery (peronea arteria magna) and required saphenous vein graft reconstruction following fibular harvest.

Conclusion: VFG is a versatile biological reconstructive option for complex skeletal defects arising from trauma, oncological resection and oromandibular pathology. Our three-year experience demonstrates favourable graft outcomes across diverse reconstructive indications with acceptable donor-site morbidity. Careful patient selection, preoperative vascular assessment and meticulous microsurgical technique remain essential, particularly given the potential for clinically significant vascular anatomical variations during fibular harvest.

204

Functional Outcomes Following Midfoot and Hindfoot Amputations in Patients With Diabetic Foot Ulcers

Chong Ee Herng¹, Prabhakar Sumanth Madhusudan², Muhd Farhan bin Mohd Fadil²

¹Yong Loo Lin School of Medicine, National University of Singapore

²Department of Orthopaedic Surgery, Tan Tock Seng Hospital

Background: Midfoot and hindfoot amputations are limb-salvage procedures for advanced diabetic foot disease, intended to preserve ambulation and avoid major amputation. However, functional recovery remains poorly characterised, particularly in Asian populations. This study evaluated functional, wound, and clinical outcomes after these amputations at a tertiary centre.

Methods: We retrospectively reviewed patients undergoing midfoot or hindfoot amputation for diabetic foot limb salvage between 2023 and 2026. Demographic, clinical, and rehabilitation data were extracted from electronic records. Primary outcomes were basic activities of daily living (BADL), ambulation, walking aid use, and weight-bearing status at discharge, 2 months, and 6 months. Secondary outcomes included wound healing, mortality, and conversion to below-knee amputation (BKA). Friedman, Cochran's Q, and Wilcoxon signed-rank tests were used.

Results: Sixty-eight patients were included; median age was 65 years (IQR 57–76), and 67.6% were male. Transmetatarsal amputations comprised 83.8%. Diabetes and peripheral vascular disease were present in 93.2% and 79.5%, respectively. BADL independence fell from 79.5% preoperatively to 9.3% at discharge, improving to 61.5% at 6 months ($p < 0.001$). Independent ambulation declined from 79.5% to 7.0%, recovering to 56.4% at 6 months ($p < 0.001$). Full weight-bearing increased from 0% at discharge to 56.4% at 6 months. Mortality was 17.6%, and BKA conversion occurred in 2.9%.

Conclusion: Midfoot and hindfoot amputations achieved meaningful limb salvage with low major amputation rates. Although early functional decline was substantial, recovery by 6 months was significant but incomplete, supporting multidisciplinary rehabilitation and realistic preoperative counselling. These findings provide locally relevant expectations for patients, clinicians, and rehabilitation teams.

205

Comparative effectiveness and treatment durability of intra-articular injections in knee osteoarthritis

Wu Tian Yi

SINGAPORE

Background: Intra-articular injections are widely used to manage pain in knee osteoarthritis, but comparative effectiveness data across commonly used agents, and the influence of patient-level factors on response, remain unclear.

Objective: To compare pain outcomes across three intra-articular injection types (H&L, CINGAL, MONOVISC) and to examine whether body mass index (BMI) and radiographic severity (Kellgren-Lawrence, KL, grade) are associated with treatment response.

Methods: We analyzed data from 99 patients who received H&L ($n=58$), CINGAL ($n=24$), or MONOVISC ($n=17$) for knee osteoarthritis. Pain was measured using a 0–10 VAS scale at baseline, 2 weeks, 6 weeks, 3 months, and 6 months. Patients were stratified by BMI (normal <25 vs overweight >25) and KL grade (low 1–2 vs high 3–4). Between-group differences were assessed using ANOVA/Kruskal-Wallis (three-way) and Welch's t-test/Mann-Whitney U (two-way) tests; within-group change from baseline was assessed with paired t-tests.

Results: All three injections produced statistically significant pain reduction from baseline sustained through 6 months, with no significant difference in outcome between injection types at any timepoint (all $p > 0.05$). The three groups were well balanced at baseline on age, BMI, and KL grade (all $p > 0.24$). KL grade was the strongest predictor of response: low-grade patients had significantly better relief than high-grade patients at 2 weeks, 6 weeks, and 3 months ($p < 0.05$), though the gap narrowed by 6 months. BMI showed a similar but weaker pattern, with normal-weight patients showing significantly faster relief only at 2 weeks ($p = 0.049$); by 3–6 months, normal and overweight groups converged.

Conclusion: H&L, CINGAL, and MONOVISC appear similarly effective for knee osteoarthritis pain. Baseline radiographic severity, more than BMI or injection choice, is the strongest determinant of treatment response, suggesting patients with advanced disease may need adjusted expectations regardless of the injection selected.