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NOVEL TECHNIQUES FOR SUPERIOR FIXATION OF SIMPLE TRANSVERSE INTRA-ARTICULAR PATELLA FRACTURES

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Background: Traditional tension band wiring (TBW) remains the gold standard treatment for most simple displaced intra-articular fractures of the patella. It can be challenging to site the longitudinal K-wires without further damage to the soft tissues. Malposition of the metalwork can lead to late complications. We designed and tested three novel techniques to improve fixation. Principally we have moved the longitudinal K-wires to a crossed position to facilitate ease of insertion and minimise soft tissue trauma. We also considered the implications of moving the TBW to the sides of the patella.

Methods: An initial proof of concept was undertaken on human cadaveric knees to ensure configurations could be constructed in a manner representing safe and reproducible surgery.
A biomechanical study was undertaken on porcine patellae. The method was based on published techniques and a specially designed rig was constructed. Load was applied to each patella from an Instron 5965 5Kn universal testing machine. Displacement of the fracture was measured by a Caldaro S8FLP-10A-10K linear variable displacement transducer. Specimens were tested cyclically from 90 - 45 degrees at 6.7 seconds for 100 cycles. Incremental displacements/cycle were derived from the data at 3 points.

Results: Seventeen of 22 specimens achieved 100 cycles. Crossed K-wires with side TBW performed best with average fracture displacement (AFD) of 0.43mm under average load 84.1N. Crossed K-wires with standard TBW achieved AFD of 0.61mm under average load 69.2N. Standard TBW construct achieved AFD of 1.72mm under average load 79.6N. Longitudinal K-wires and side TBW performed worst with AFD of 1.93mm under average load 75.4N. Data for final incremental displacement/cycle also suggested the Cross K-wire configurations conferring greater stiffness to the fracture gap under loading than the other configurations.

Conclusions: Two novel techniques showed biomechanical superiority to AO standard TBW.

Implications: These techniques may reduce soft tissue trauma and improve patella fixations.

Disclosure: Nothing to disclose.

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ROUTINE SCREENING FOR MRSA AND DECOLONISATION OF HIP FRACTURE PATIENTS SIGNIFICANTLY REDUCES MRSA AND SUPERFICIAL WOUND INFECTION, BUT NOT DEEP INFECTION

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Introduction: Surgical site infection (SSI) is devastating after hip fracture surgery, with Methicillin resistant staphylococcus aureus (MRSA) SSI increasing both healthcare costs and one-year mortality compared to non-MRSA SSI. During 2008 routine MRSA screening and decolonisation of trauma patients was implemented. We sought to establish the impact of MRSA screening.

Methods: Using prospectively collected data for all hip fracture admissions to our hospital, we compared a cohort of consecutive patients admitted before screening (from 1999 to 2007, n = 6260) to another post-screening cohort (2008 to 2016, n = 7314). Rates of MRSA SSI, overall SSI and one-year mortality were compared. Multi-variable logistic regression analysis was used to investigate SSI risk factors.

Results: Sixty-nine cases of MRSA SSI occurred in the pre-screening group versus 12 in the post-screening group ($p < 0.0001$). Overall superficial SSI decreased (1.5% vs 0.45%, $p < 0.0001$) however deep SSI did not (0.88% vs 1.1%, $p = 0.2680$). We observed an increase in Coagulase negative staphylococcus SSI (0.11% vs 0.33% $p = 0.0085$), suggesting that the targeted elimination of one organism may allow others an opportunity to cause SSI.

Multi-variable logistic regression demonstrated that surgery using an Austin Moore (OR 3.175, $p = 0.005$) or Dynamic Condylar Screw (OR 5.888, $p =0.036$), anticoagulation with warfarin (OR 2.117, $p = 0.004$) and sacral pressure sores (OR 3.058, $p =0.02$) were significant risk factors for SSI. One-year mortality without SSI was lower post-screening (33% vs 25% < 0.001) showing a continuous improvement in neck of femur care but after deep SSI remains high (50% vs 46%, $p = 0.56$).

Conclusions: MRSA screening and decolonisation significantly reduces MRSA and superficial SSI, supporting the implementation of screening programmes. However rates of, and survival after, deep SSI have not improved over a 17-year period, demonstrating that deep SSI remains a serious and unsolved problem.

Disclosure: Nothing to disclose

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RIB FRACTURE FIXATION IMPROVES CHEST WALL FUNCTION - MAJOR TRAUMA CENTRE EXPERIENCE

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Background: Rib fracture fixation has shown improvement in mortality, morbidity and length of hospital stay in patients with chest wall injury. Purpose of this study was to assess outcomes and complications of rib fracture fixation in our major trauma centre from 2014 to 2018.

Methods: Retrospective analysis of the data collected prospectively of all rib fractures treated with open reduction and internal fixation from March 2014 to April 2018 was performed. Outcome measures included length of hospital/ intensive care stay, mechanism of injury, length of procedure, inspiratory spirometer volume (ISV), and mortality and morbidity.

Results: One hundred and fifty-eight patients (103 male, 55 female, mean 61 years) underwent rib fracture fixation. Fifty-one patients (32.2%) suffered rib fractures due to road traffic accidents while 103 patients (67.8%) due to fall or crush injury. Ninety-nine patients (62.6%) had flail segment while 109 (68.9%) had pneumothorax. Mean procedure length was 93.5 minutes. Mean drop in Hb% was 10.24. Fifty-nine patients (37.3%) had concurrent additional procedures. Mean length of stay was 13 days, ITU stay was 8.2 days. Mean time to surgery was 2.3 days, postoperative stay was 10.7 days. Chest wall inspiratory function was measured objectively using inspiratory spirometer volume, mean 1241mL preoperatively and 2013mL postoperatively ($p < 0.0005$). Chest infection was common, affecting 46 patients (29.11%). One patient had wound infection with seroma requiring evacuation. One patient had drain site infection requiring debridement. Twenty-one patients (13.2%) died during follow up, of which four died within 30 days, eight within 90 days.

Conclusions: The study further confirms the existing evidence of improved outcome in chest wall inspiratory function and reduction in length of stay following fixation, early fixation shows satisfactory outcome.

Disclosure: Nothing to disclose.

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FACTORS AFFECTING MORTALITY AND RE-OPERATIONS IN HIGH-ENERGY PELVIC FRACTURES

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Factors affecting mortality during the first year following high-energy pelvic fractures has not been reported previously. Surgical complications leading to re-operations has not been reported in this cohort.

We aimed to report and analyse factors affecting outcome, in terms of mortality and re-operations, up to one year after the injury in patients with a traumatic pelvic ring injury due to a high-energy trauma. Data from the "SweTrau" (Swedish National Trauma Registry) on patients admitted to the Trauma Center Karolinska in Stockholm, Sweden, were collected. Inclusion criteria were adults (age ≥ 18), trauma with a high-energy mechanism, alive on arrival, Swedish personal identification number, reported pelvic fracture on CT scan. Patient records and radiographies were reviewed. The study period was 2011 - 2015 with one year follow-up time. Univariate and regression analysis on factors affecting mortality was performed. Risk of reoperation was analysed using univariate and case-by-case analysis. We included 385 cases with mean age 47.5 ± 20.6 years (38% females): 317 pelvic fractures, 48 acetabular fractures and 20 combined injuries. Thirty-day mortality was 8% (30/385), and one-year mortality was 9% (36/385). The main cause of death at one year was traumatic brain injury (14/36) followed by high age (> 70) with extensive comorbidities (8/36). Intentional fall from high altitude (OR 6, CI 2-17), GCS < 8 (OR 12, CI 5 - 33) and age > 70 (OR 17, CI 6 - 51) were factors predicting mortality. 30 patients (22%, 30/134) were further reoperated due to hardware-related (n = 18) or non-hardware-related complications (n = 12). Hardware-related complications included: mal-placed screws (n = 7), mal-placed plate (n = 1), implant failure (n = 6), or mechanical irritation from the implant (n = 4). Non-hardware-related reasons for reoperations were: infection (n = 10), skin necrosis (n = 1), or THR due to post-traumatic osteoarthritis (n = 1).

Disclosure: Nothing to disclose.

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WHAT DO TRAUMA PATIENTS CONSIDER IMPORTANT JUST BEFORE GOING UNDER THE KNIFE?

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Background: The Montgomery ruling marked a paradigm shift in the legal framework on consent, introducing the concept of a clinician having to second guess factors that would be important to the patient during consent. This qualitative study aims to look at what factors the patient considered important during consent and to see if any common themes emerged.

Methods: The study used semi-structured interviews from 12 patients admitted to a Major Trauma Centre for definitive treatment of injury in a single surgical procedure. Patients under 18 years of age, who had sustained polytrauma or who were confused (AMTS < 8) were excluded. An exploratory thematic analysis was employed to develop themes and coded in NVIVO©.

Results: Twelve patients (age range = 19 - 81, M:F = 7:5) were interviewed. Types of fracture were: neck of femur (n = 6), ankle (n = 4), humerus (n = 1), acetabulum (n = 1). When asked to identify important factors in granting consent, the majority related procedural expertise rather than particular risks affecting mortality and morbidity. In a trauma surgery setting, no risks were identified to alter patients' decision-making about giving operative consent. Most patients felt that they had no realistic non-operative alternatives. Patients were particularly influenced by complications that previously occurred to themselves, close family or friends.

Conclusions: The Montgomery ruling places an unrealistic burden on the clinician, as immediately after consent for trauma surgery patients are unable to identify factors that are important in making the decision to proceed to surgery. If risks are identified, they were based on past experiences of friends and family. Thus we suggest that the surgeon asks about these complications, as this may elicit material concerns.

Implications: This work for the first time demonstrates that at the time of consent, patients are unable to identify risks that are important them in granting consent for surgery.

Disclosure: Nothing to disclose.

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DYNAMIC HIP SCREW VS CANCELLOUS SCREWS FOR INTRACAPSULAR NECK OF FEMUR (NOF) FRACTURES IN YOUNG PATIENTS

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Background: Proximal femur fractures account for 3.6% of all fractures and almost about 53% of all fractures occurring in the hip region. There are a number of surgical modalities available for the treatment of neck of femur fractures but till date, a clear consensus regarding the optimal management modality has not been reached.

Objectives: To compare clinical and radiological outcomes of young patients presenting with intracapsular NOF fractures treated with either the dynamic hip screw (DHS) or multiple cannulated screws (MCS).

Methods: This is a retrospective comparative analysis between two matched cohorts treated with either DHS or MCS. Our study group consisted of a consecutive series of 94 patients aged < 60 years admitted to the hospital with intracapsular NOF fractures between January 2009 and December 2015.

The two groups of patients were matched for age, sex, mechanism of injury, fracture pattern and fracture type, $p < 0.05$ and compared for their clinical and radiological outcomes. All patients were analysed for their clinical function, pain, radiological union at the fracture site, complications following fixation and re-operation rates.

Results: Out of the total 94 patients, 45 were operated with DHS and 49 with MCS. The average age of the study group was 51.53 years. The average follow-up time for the study group was 2.6 years. There was no significant difference in the hospital stay or operative time. The MCS group experienced a significantly higher overall complication rate (37% compared to 22% in the DHS group) and a higher rate of re-operations (24% as compared to 8% in the DHS group).

Conclusions: DHS and MCS are both very effective means of treatment of NOF fractures. Although the dynamic hip screw may have a larger incision and increased soft tissue dissection, it is associated with significantly less rates of post-operative fixation failures, overall complications and re-operations.

Disclosure: Nothing to disclose.

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THE USE OF 3D PRINTING IN PREOPERATIVE PLANNING IN ORTHOPAEDIC TRAUMA SURGERY: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Background: With the increasing complexity of surgical interventions performed in orthopaedic trauma surgery and the improving technologies used in three-dimensional (3D) printing, there has been an increased interest in the concept. It has been shown that 3D models allow surgeons to better visualize anatomy, aid in planning and performing complex surgery. It is however not clear how best to utilize the technique and whether this results in better outcomes. This study aimed to evaluate the effect of 3D printing used in pre-operative planning in orthopaedic trauma surgery on clinical outcomes.

Methods: We performed a comprehensive systematic review of the literature and a meta-analysis. Medline, Ovid and Embase were searched from inception to 8th February 2018. Randomised controlled trials (RCTs), case-control studies, cohort studies and case series of five or more patients were included across any area of orthopaedic trauma. The primary outcomes were operation time, intra-operative blood loss and fluoroscopy used.

Results: Seventeen studies (922 patients) met our inclusion criteria and were reviewed. The use of 3D printing across all specialties in orthopaedic trauma surgery demonstrated an overall reduction in operation time of 19.85% (95% CI -22.99, -16.71), intra-operative blood loss of 25.73% (95% CI -31.07, -20.40) and number of times fluoroscopy was used by 23.80% (95% CI -38.49, -9.10).

Conclusions: Our results suggest that the use of 3D printing in pre-operative planning in orthopaedic trauma reduces operative time, intraoperative blood loss and the number of times fluoroscopy is used. Better quality evidence is required to further enhance our knowledge of the role of 3D printing in orthopaedics and its application to daily clinical practice.

Implications: 3D printing should be considered as an adjunct to improve patient care by minimising operative insult in orthopaedic trauma surgery.

Disclosure: Nothing to disclose.

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OPERATIVE TREATMENT OF ACETABULAR FRACTURES - A CONTEMPORARY LITERATURE REVIEW

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Introduction and aims: The operative management of acetabular fractures is a constantly evolving surgical sub-specialty. Giannoudis et al[1] published a literature review 15 years ago, outlining practice prior to 2005. This paper aims to provide a more contemporary outline of the specialty, based on papers published from 2005 to 2018 inclusive, and compare findings with those published earlier by Giannoudis[1].

Methods: We undertook a meta-analysis evaluating the classification, surgical approach, functional outcomes and complications in patients who have undergone operative treatment of acetabular fractures.

Results: We analysed a total of 9269 fractures. An isolated Kocher-Langenbeck approach was used in 52% of operations, with the average time to surgery being 6.96 days, and average patient age of 42.4 years. A significant difference in complications and revision procedures was observed. Heterotopic ossification was the most common long-term complication, occurring in 19% of patients. Further late complications such as osteoarthritis and avascular necrosis occurred in 16% and five percent of patients respectively. Patients that required further surgery following their initial operative management totalled 14%, with 10.5% undergoing a total hip replacement. Anatomic reduction was achieved in 69.6% of cases; 81.5% of patients achieved an excellent or good result. Patients were followed up for an average of 41 months.

Conclusions: Functional outcomes continue to be influenced by both controllable and uncontrollable factors. Minimising the surgical approach and achieving anatomic fracture reduction continue to be two key markers in improved outcomes.

References: 1. Giannoudis et al Operative treatment of displaced fractures of the acetabulum. A meta-analysis. J Bone Joint Surg Br. 2005 Jan; 87(1):2-9.

Disclosure: Nothing to disclose.

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RADIOGRAPHIC MALUNION AFTER ANKLE FRACTURES IN OLDER ADULTS: DEFINITIONS AND NEW THRESHOLDS DERIVED FROM CLINICAL OUTCOME DATA FROM THE AIM TRIAL

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Background: The rationale for exacting anatomic reconstruction of ankle fractures is to improve outcomes by reducing complications from malunion; however, current definitions of malunion lack confirmatory clinical evidence.

Methods: Participants were ankle injury management (AIM) trial participants who were aged 60 years and over with unstable ankle fractures. Radiographic and clinical definitions of malunion were compared. Linear regressions were used to explore the relationship between pre-defined radiographic malunion (talar tilt > 2°, talar subluxation > 2mm, or tibiofibular clear space > 5mm, and for posterior malleolus malunion >5% articular surface and articular step > 2mm) at six months and changes in function measured with the Olerud and Molander Ankle Score (OMAS) at three years. Piecewise linear models were used to investigate new radiographic thresholds which better explain symptom impact on ankle function.

Results: Four hundred and twenty-two participants provided radiographic and long-term follow-up data. Previously described measures of radiographic malunion and surgeon opinion of clinically significant malunion were shown to be related but with important differences. The usual malunion thresholds for talar tilt and tibiofibular clear space were shown to be conservative, and new thresholds which better explain function were identified (talar tilt > 2.4° and tibiofibular clear space > 6mm). Based on this new definition the presence of radiographic malunion has an impact on function which is both statistically and clinically significant (-8.9 points on the OMAS scale; 95% CI -13.97 to -3.97). In subsequent analysis, radiographic malunion of a posterior malleolar fracture was also shown to have a statistically significant impact on OMAS change scores (-12.5 points; 95% CI -23.5 to -1.5) but no new threshold was identified.

Conclusions: These results provide clinical evidence which support the previously accepted definitions, whilst suggesting they may be conservative with a greater tolerance in older patients.

Disclosure: The AIM trial was funded by the National Institute for Health Research.

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SIMULTANEOUS FRACTURE FIXATION AND HIP REPLACEMENT FOR OSTEOPOROTIC ACETABULAR FRACTURES IN THE ELDERLY

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Introduction: Displaced acetabular fractures in the elderly population present significant treatment challenges. To allow early post-operative rehabilitation, limit the sequelae of immobility and avoid the risk of post-traumatic arthritis; simultaneous fracture fixation and total hip replacement (THR) has been advocated in selected patients. We present a consecutive series of 41 patients treated with simultaneous acetabular fracture fixation and THR.

Methods: Between April 2014 and May 2017, 41 patients underwent simultaneous fracture fixation and THR for acetabular fractures. The median age at surgery was 77 years (range 57 - 94), 70% were ASA grade III or above. Median follow-up was 30 months (range 13 - 57 months). Patient reported outcomes were assessed at one year with Oxford Hip Scores (OHS) and EQ-5D questionnaires. Radiographic assessment was performed at six weeks and at one year.

Results: The median age was 77 years (range 57 - 94), 70% were ASA grade III or above. Eight patients (20%) required intraoperative transfusion of packed red blood cells. Twenty-one patients were sitting out in a chair by post-operative day one, sixty percent were mobilising by postoperative day five, two (5%) were returned to theatre within five days. There were no post-operative nerve palsies but three cases of infection. There were no deaths within 30 days, seven patients (17%) died within 12 months. Median baseline OHS was 44 (range 26 - 48) and at one year post-operatively was 37.3 (range 28 - 48). Mean pre- and post-operative EQ-5D scores were 8.4 and 11.3 respectively.

Conclusions: To our knowledge this study presents the largest consecutive series of acetabular fractures treated with a fix-and-replace technique. Whilst simultaneous fixation and THR is conceptually attractive, this patient group requires considerable medical support in the peri-operative period. Further studies are required to provide clinicians with more information to decide on how best to provide a holistic management strategy for this injury in this frail patient cohort.

Disclosure: Nothing to disclose.

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AN ANALYSIS OF THE TARN (TRAUMA AUDIT RESEARCH NETWORK) CHEST WALL INJURY DATASET: PATIENT, HOSPITAL AND INJURY FACTORS THAT PREDICT RIB FRACTURE FIXATION

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Background: Rib fractures are a common injury following trauma in the UK; a description of the rib fracture population and the decision factors that contribute to rib fixation is unclear.

Method: Acquisition of the TARN data followed an application to the TARN executive board for data between April 2016 and 30th May 2017. Inclusion criteria were adult patients with a rib or sternal fracture. As multiple factors are likely to influence whether a case is selected for rib fracture fixation a binary logistic regression model was constructed to explore the influences of several explanatory variables on whether rib fracture fixation was performed.

Results: Four hundred and two patients received rib fracture fixation and 16,236 were managed non-operatively. A greater proportion of patients who undergo rib fracture fixation were under the care of orthopaedics (26.0%), cardiothoracic surgery (28.8%) and the major trauma service (14.4%). The odds of rib fracture fixation in unilateral flail chest were 107.51 ($p < 0.0001$), in bilateral flail or combined complex sternal fracture 47.63 ($p = 0.007$) and in three or more non-flail ribs 15.62 ($p < 0.0001$) the odds compared to less than three non-flail rib fractures. The odds of rib fracture fixation were higher in a MTC ($p < 0.0001$) compared to the odds of being in a trauma unit. The odds of rib fracture fixation were higher the older the patient (1.02, $p < 0.0001$) and with higher Injury Severity Score (1.02, $p < 0.0001$).

Conclusions: From this analysis, we may hypothesise that indications for surgical rib fixation are drawn predominantly from type of injury and patient age. Hospital factors, specifically setting and specialty providing care have significant impact on likelihood of receiving rib fixation. These data will help to inform health care processes surrounding the management of chest trauma and will be instrumental to those designing trials to investigate interventions in this patient group.

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DEVELOPING A CONSENSUS ON INDICATIONS AND TIMING FOR SURGICAL FIXATION OF RIB FRACTURES: AN INTERNATIONAL DELPHI CONSENSUS EXERCISE

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Background: Systematic review evidence has shown that rib fractures are surgically fixed for a variety of indications and there is no clear evidence to suggest the optimum time for fixation.

Method: Indications and timing of surgical fixation of rib fractures were collated by way of systematic review and entered into a three round Delphi consensus completed anonymously online. Participants were international clinicians who are involved in the treatment of rib fractures. A consensus was reached if more than 70% of the participant group considered a statement highly relevant and less than 15% scored it not relevant.

Results: Fifty-two clinicians from eight countries and eight specialties completed round one with 16 completing round three. The specific injury of flail chest had a strong consensus as an indication for rib fracture fixation. Combining this with respiratory compromise, invasive ventilation, intractable pain and failure to wean from ventilation increased consensus. Less favourable, although still gaining consensus was flail chest with tracheostomy, underlying chronic lung disease, haemothorax and concomitant sternal fracture. Similarly, for multiple rib fractures this injury plus paradoxical movement, respiratory compromise, invasive ventilation, tracheotomy, sternal fracture and intractable pain gained consensus. The earliest fixation should occur is between 24 and 48 hours however due to lack of consensus on other statements the latest timing of fixation and whether a patient should have a trial of weaning still appears controversial. Patients should generally be referred, transferred and operated on within 48 hours with a smaller proportion of clinician agreeing this should be within 24 hours.

Conclusions: Both flail chest and multiple rib fractures are indications for multiple rib fracture fixation especially if the patient has respiratory compromise, invasive ventilation or has intractable pain. The indications and timing and fixation will be used in the future design of trials of surgical fixation of rib fractures.

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