

COA Paper Session 7: Trauma Lower Extremity 1 •

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Even Undisplaced Fracture Neck of Femur Can Result into Poor Outcome Depending on Associated Co-morbidities: A Study of AO Cannulated Screws Done in 315 Patients

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Purpose: The aim of this study was to analyze the outcome of AO cannulated screws for undisplaced fracture neck of femur and find out the correlation in outcome with respect to co-morbidities in a general trauma unit in UK. **Method:** A retrospective study was conducted using data from electronic patient record, clinical coding information, clinic letters and GP's. 315 patients who underwent AO screws for fracture neck of femur during 2000 to 2004 were included. We looked into age, place of living, classification, mechanism of injury, comorbidities, mobility before fracture, allergy, addictions, whether patient was anticoagulated, delay for theatre with reasons, length of stay in hospital, complications and treatment for complications. We assessed reasons for other admissions later on, need and type of another operation, consequently developed comorbidities, patient getting fracture of other side and its treatment, time and cause of death if happened? **Results:** There were 81 males and 234 females in the study. Mean age of patients was 72 years (range 50-96 years). Non-union occurred in 19 patients (6%) and avascular necrosis occurred in 49 patients (15.5%). Reoperation with an arthroplasty was required in 69 patients (21.9%). The incidence of avascular necrosis with internal fixation at 1 year was 31 (9.8%). Fifty-one (16%) patients died in 2 year period. The age, walking ability of the patient, and associated co-morbidities were of statistical significance in predicting fracture healing complications. We correlated our complications with comorbidities and found them more in patients with end-stage renal failure, steroid intake, osteoporosis and diabetes mellitus etc. **Conclusion:** The rate of fracture healing complications and reoperations in patients with undisplaced fractures was high in our series with two year follow up. It was even higher in patients with age greater than 80 years and some specific comorbidities. We should also consider co-morbidities and age before deciding for internal fixation rather than only the fracture configuration (Treat patient not the X-rays). Outcome is multifactorial and depends on many predictive factors. Each patient should be evaluated carefully and we should treat the physiological age and not the chronological age.

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A Study Analysing the Outcome of AO Cannulated Screws for the Fracture Neck of Femur in Patients with Diabetes Mellitus

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Purpose: The aim of the study was to analyze the outcome of AO cannulated screws for fractures neck of femur in patients with Diabetes mellitus. **Method:** Sixty-two patients aged 50 years or more (17 males & 45 females) who underwent AO screws for fracture neck of femur over seven years (1999 - 2005) and followed-up for a minimum of two years formed the study population. A retrospective review of data from electronic patient record (EPR), clinical coding, clinic & GP letters was made. Age, residential placement, Garden's classification of fracture, mode of injury, associated other co morbidities, pre-admission mobilisation status, allergies, addictions and anticoagulation status details were collected. **Results:** The mean age of patients was 67 years (range 52-96 yrs). Eleven patients died in two years time. Forty-one patients were less than 75 years of age and 21 patients were more than 75 years of age. All the patients more than 75 years of age had undisplaced intracapsular fractures. Thirteen patients were type I and 49 patients were type II diabetic. Non-union and avascular necrosis occurred in nine (17%) & 13 (26%) patients respectively. Revision surgery in the form of total hip replacement or hemiarthroplasty were performed in 21 (41%) cases. The incidence of avascular necrosis following osteosynthesis at one year was 14 %. Age, control of diabetes, post-operative complications, pre-fracture mobilization status etc. Complications like wound infection were more principally in patients who had poorly-controlled diabetes. **Conclusion:** Patients with diabetes mellitus have metabolic bone disease due to vasculitis. This increases the risk of complications associated with fracture fixation such as non-union, cut-through and avascular necrosis (AVN). The complications and revision surgery rate was high in patients with displaced fractures and with poorly controlled diabetes. Comorbidities like diabetes and patient's age were also strong predictors of healing in addition to fracture configuration. Looking at very high complication and re-operation rate, our recommendation in patients with diabetes is primary hemiarthroplasty irrespective of femoral head displacement, if there age is more than 75 years.

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Hip Fracture Complications and 30-day Mortality Outcomes within Acute Care in Canada from 2001-02 to 2003-04

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Purpose: Decubitus ulcers and post-operative infections significantly impact patients' outcome and resource utilization. The purpose of this study is to report incidence of post-surgical infection, decubitus ulcer and associations to 30-day in-hospital mortality among elderly Canadians admitted for hip fracture. **Method:** Statistics Canada's national Health Person-Oriented Information database of linked acute care hospital discharges was queried for fiscal 2001-02, 2002-03, 2003-04 creating a cohort of 67,434 hip fracture patients aged 60+. Demographics, comorbidities (enhanced Charlson Index), fracture type and treatment were used in logistic regression models to report

odds ratios for outcomes. **Results:** Women were 76% of the cohort, median age was 82 yrs. Decubitus ulcer was detected in 2.3% of hip fracture patients. Increased risk was indentified for trochanteric fractures (OR 1.14, $p < .05$), dementia (OR 1.25, $p < .05$) and increasing age (OR: 1.02, $p < .05$). Decubitus ulcer more than doubled to 2.9% for those with 1-2 comorbidities, increasing to 6.3% for 3+ comorbidities. Between 1.2% and 1.3% of the cohort developed a post-surgical infection/inflammatory response depending on method used to calculate 30-day follow-up. Compared to internal fixation, arthroplasty showed higher infection (OR: 1.38, $p < .05$). Overall cohort 30-day in-patient mortality was 7%. Selected complications were significantly associated to 30-day in-hospital mortality (decubitus ulcer OR: 1.51 $p < .05$, post-surgical infection/inflammatory response (OR: 1.52 $p < .05$). Trochanteric fractures (OR: 1.19 $p < .05$) and hemi-arthroplasty (OR: 1.10, $p < .05$) were associated to 30-day mortality. No significant variation was found between total arthroplasty and internal fixation for 30-day in-patient mortality. **Conclusion:** Quantification of these rates and risk factors may offer normative values to measure health system performance and possibly reflect care strategies and delays to surgery. Results may identify target groups at risk for complications and potentially highlight the impact of clinical decisions such as performing arthroplasty for all (displaced and undisplaced) femoral neck fractures.

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Percutaneous Reduction and Fixation of Acetabulum Fractures in Elderly Patients

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Purpose: Acetabular fractures in elderly patients are difficult problems with various treatment options. Our institution treats many of these patients with percutaneous acetabular fixation. We reviewed medical records and contacted patients to determine the rate of conversion to total hip arthroplasty. **Method:** Our institutional trauma database was searched for all patients age 60 and older who had been treated with percutaneous screw fixation for an acetabular fracture. Seventy-nine consecutive patients (80 fractures) were identified. Medical records were examined to obtain peri-operative and follow-up information regarding the hospital course and conversion to total hip arthroplasty. A survivorship analysis was created with conversion to total hip arthroplasty as the censored event, and standard Kaplan-Meier curves were constructed. Five categorical variables were used to test for differences in survival of the native hip: age, sex, simple versus complex fracture pattern, closed versus limited open reduction, and occurrence of a medical complication. **Results:** Seventy-five fractures had adequate clinical follow-up with a mean of 3.9 years (range 0.5 - 11.9 years). Average blood loss was 69 cc and there were no postoperative infections. 19/75 (25%) were converted to total hip arthroplasty at a mean time of 1.4 years after the index procedure. Survivorship analysis demonstrated a cumulative survival of 65% at 11.9 years of follow-up. There were no conversions to arthroplasty beyond 4.7 post-operatively. There were no

statistically significant associations between conversion to arthroplasty and age, sex, closed versus limited open reduction, simple versus complex fracture pattern, and occurrence of a medical complication. **Conclusion:** Percutaneous fixation is a viable treatment option for patients age 60 or greater with acetabular fractures. Rates of conversion to total hip arthroplasty are comparable to other treatment methods and if conversion is required, soft tissues are preserved for future surgery.

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Modified Stoppa Approach for Acetabular Fractures of the Elderly Patient

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Purpose: The age of patients presenting with acetabular fracture has increased over the last ten years. Older patients tend to have patterns involving the anterior column with comminution of the quadrilateral plate. Our goal was to investigate the appropriateness of open reduction and internal fixation using the modified Stoppa approach for geriatric acetabular fractures. **Method:** A retrospective review of patients over the age of 60 having presented to an academic level I trauma center over the course of four years. Twenty patients were identified and treated using the modified Stoppa approach with plating of the quadrilateral surface. Patients were evaluated clinically using both SF-36 and Harris Hip Score. Records and radiographs (using criteria described by Matta) were reviewed retrospectively. **Results:** All patients were followed for a minimum of two years with no lost at follow-up. Mean age for patients at time of intervention was 68 years. Average blood lost was 800cc and surgical time was 130 minutes (range, 55-210). There was one traumatic injury to the obturator nerve and two patients were noted to have temporary weakness of the hip adductors postoperatively. Average Harris Hip Score and the SF-36 were improved significantly ($p < 0.05$). Significant loss of reduction was seen in two patients and was correlated to superior dome impaction ($p < 0.0001$). Three patients required re-intervention with a Total Hip Arthroplasty. **Conclusion:** Internal fixation using the modified Stoppa approach to buttress the quadrilateral plate should be considered a viable alternative to total hip arthroplasty for the initial treatment of acetabular fractures of the anterior column in the elderly.

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Mortality Following Cemented and Uncemented Hemiarthroplasty

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Purpose: The appropriate means of fixation for hemiarthroplasty of the hip is a matter of ongoing debate. Proponents of uncemented components cite the

risk of perioperative mortality with cement implantation as justification for avoiding cement in certain patients. Because cement-related mortality is rare, we wished to compare the incidence of peri-operative mortality in patients receiving cemented versus uncemented hemiarthroplasty using a large national database. Further, we wished to compare overall revision rate between fixation methods to assess their role in implant survivorship. **Method:** All recorded hemiarthroplasty cases from the AOA National Joint Replacement Registry were cross-referenced to the Australian mortality data, and deaths at 1d, 7d, 28d, and one year were compared between groups. Further, subgroup analysis of monoblock, modular, and bipolar hemiarthroplasty were compared as a surrogate measure of different patient populations. **Results:** Comparing all hemiarthroplasty procedures as a group, there was a significantly increased mortality rate at day one post-operatively ($p = 0.0005$) when cement was used. By day 7, this trend reversed, revealing a reduced mortality risk with cement ($p = 0.02$). This trend reversal persisted at day 28 and one year post-operatively ($p = 0.028$ & $p < 0.0001$, respectively). With subgroup analysis, monoblock hemiarthroplasty revealed a similar trend reversal in early versus late mortality. Modular and bipolar hemiarthroplasty procedures failed to reveal a significant difference in mortality when cemented and uncemented components were compared at all time points. When fixation method was compared in different age groups, a favourable mortality rate was seen at one year when cemented monoblock components were used in patients aged 71-80, and in patients ≥ 81 years old ($p = 0.005$ & < 0.001 , respectively). The opposite was true with cemented modular implants at one year in patients < 70 years old ($p = 0.009$). There was no significant difference in mortality between cemented and uncemented implants in any other age investigated. Revision rates were significantly higher in patients treated with uncemented hemiarthroplasty regardless of prosthesis type. **Conclusion:** This study demonstrates a higher overall success rate, and comparable or reduced long-term mortality risk when cement is used in hip hemiarthroplasty.

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Surgical Delay and its Effect on Mortality in Elderly Hip Fracture Patients: A Systematic Review and Meta-analysis

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Purpose: Hip fractures are associated with a high rate of mortality and profound temporary and sometimes permanent impairment of independence and quality of life. While guidelines exist for the surgical treatment of hip fracture patients, the effect of surgical delay on mortality and other patient-important outcomes remains unclear. The objective of this systematic review and meta-analysis was to determine the effect of early surgery compared with delayed surgery on the risk of mortality, common postoperative complications, and length of hospital stay among elderly hip fracture patients. **Method:** We searched MEDLINE and EMBASE for relevant prospective studies evaluating surgical delay in patients undergoing surgery

for hip fractures published in all languages between 1966 and 2008. We identified additional studies through contacting experts, as well as hand searches of the bibliographies of relevant articles and the archives of orthopaedic annual meetings. Two reviewers independently assessed methodological quality and extracted relevant data. When necessary, we contacted authors for clarification of study design or to provide additional data. Data were pooled by use of a DerSimonian and Laird random-effects model based on the inverse variance method. **Results:** Of 1917 citations identified, 16 observational studies, which included a total of 13,565 patients with complete mortality data, met our inclusion criteria. Irrespective of the cut-off for delay (24, 48, or 72 hours), earlier surgery (<24, <48, or <72 hours) was significantly associated with a reduction in the risk of unadjusted one-year mortality (relative risk 0.55; 95% confidence interval, 0.40 to 0.75, $p=0.0002$) and adjusted mortality rates (relative risk 0.81; 95% confidence interval, 0.68 to 0.96, $p=0.01$). Earlier surgery also reduced in-hospital pneumonia (relative risk 0.59; 95% confidence interval, 0.37 to 0.93, $p=0.02$), pressure sores (relative risk 0.48; 95% confidence interval, 0.34 to 0.69, $p<0.0001$) and hospital stay (weighted mean difference 9.95 days; 95% confidence interval, 1.52 to 18.39, $p=0.02$). **Conclusion:** Earlier surgery reduced the risk of mortality, postoperative pneumonia, pressure sores, and length of hospital stay among elderly hip fracture patients suggesting that it may be warranted to reduce administrative delays whenever possible. However, potential residual confounding of observational studies may limit any definitive conclusions.

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Prediction of Pulmonary Morbidity and Mortality in Femur Fracture Patients

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Purpose: To evaluate the effect of the presence of femur fracture on mortality, pulmonary complications, and ARDS in trauma patients. In addition, we aim to compare the effects of other major musculoskeletal injuries to femur fractures on these outcomes. **Method:** We retrospectively reviewed the trauma registry of two tertiary level trauma centers for a period of 12 years (1995-2007). We evaluated data points on all patients: gender, age, AIS scores, GCS, SBP, and ICD-9 codes for femur fractures and other major orthopaedic injuries. Outcome measures were death in hospital and occurrence of a pulmonary complication (Adult respiratory distress syndrome, fat embolism syndrome, pneumonia and respiratory failure) and ARDS as a sub-group. Logistic regression was used to evaluate the effect of these variables and the presence of femur fracture on the three outcomes (death, pulmonary complications, and ARDS). The effect of other major orthopaedic injuries in these models was also compared to the effect of femur fractures. **Results:** There were 83, 349 patients, with 3, 433 deaths, evaluated in the initial regression models. Gender, GCS <8, age > 60, blood pressure <90, 4 AIS scores and femur fracture were all independent predictors of mortality. The strongest predictors of mortality were GCS <8

(OR 16.976, 95% CI 15.176-18.990) and SBP <90 (OR 6.835, 95% CI 6.046-7.726). Femur fracture was an independent predictor of mortality (OR 1.480 95% CI 1.135 – 1.929). The presence of femur fracture was not a statistically significant independent predictor of pulmonary complication (OR 1.29, 95% CI 0.911-1.766) while gender, GCS, and 5 of 6 AIS scores were. Other musculoskeletal injuries were significant predictors, including pelvic ring fractures and spinal fractures. In the ARDS regression model, femur fractures were not an independent predictor (OR 1.127, 95% 0.636-1.999). **Conclusion:** The risk of mortality and pulmonary complications is multifactorial; most affected by age, GCS at presentation, SBP at presentation, gender and injury severity. In this study, the presence of a femur fracture does independently increase the risk of death, but not ARDS or other pulmonary complications. There are other musculoskeletal injuries that have a greater effect on mortality and pulmonary complications.

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Endstage Arthritis Following Tibia Plateau Fractures: 10 Year Follow Up

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Purpose: Problem: Tibia plateau fractures may lead to end-stage post-traumatic arthritis that requires reconstructive surgery. The incidence of this problem is unknown but has been estimated at 20-40% by studies that were limited by small sample sizes, potential follow-up bias, and the limitations of using radiographic arthritis as a chosen outcome (not correlated to function). The use of administrative data bases to follow the care of a large number patients for robust end points such as surgery, offers an opportunity to address these limitations. Purpose: to determine the minimum ten year incidence of post-traumatic arthritis necessitating reconstructive surgery following tibia plateau fractures. **Method:** We queried our prospectively collected Orthopedic Trauma Data base to identify operatively treated patients with tibia plateau fractures. These cases were cross-referenced with the data from our Province's administrative health database and tracked over time for the performance of reconstructive knee surgery. Each individual's exposure/follow-up period was limited by end of health plan coverage on record or date of death from vital statistics data. The minimum follow-up was ten years. **Results:** Between 1987 and 1994, 378 patients with a tibia plateau fracture were treated at our institution. The average age was 46 years (sd=18, range 14-87), while 56% of patients were males. Seventeen out-of-Province residents were excluded, along with forty-six others whose "Medical Services Plan" numbers could not be identified. Of which seven were WCB patients and one who was affiliated with the military. The study cohort therefore consisted of 311 patients with 314 tibia plateau fractures. Four individuals (1.3%) we treated tibia plateau fractures have required reconstructive knee surgery for end-stage post-traumatic knee arthritis at 10 years. Of these 3 of 4 were type VI fractures and 1 of 4 was open. **Conclusion:** Patients who require surgical treatment of tibia plateau

fractures may be counseled on their long-term risk of requiring reconstructive knee surgery for endstage knee arthritis based on a clinical study. Based on our findings, the proportion of those who have required a total knee surgery, ten years following their injury, is lower than previously published.

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Osteotomy for Femoral or Tibial Shaft Malunion in Patients with End-stage Osteoarthritis of the Knee

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Purpose: Femoral and tibial shaft malunion may predispose to knee osteoarthritis but may also pose a problem for knee reconstruction; malposition of total knee prostheses being a known cause of early failure. Limb realignment may prove to be beneficial prior to proceeding with arthroplasty. The purpose of this study was to evaluate the outcome and effect of shaft osteotomy prior to total knee arthroplasty (TKA). **Method:** A search of the trauma database between 1987 and 2006 was conducted. Twenty-two osteotomies were performed on 21 patients with femoral or tibial shaft malunion who had been considered for TKA. Mean age at osteotomy was 54 years and mean follow-up 86 months. Time intervals between surgical procedures and Knee Society scores were calculated. Patients were surveyed regarding pain relief and functional improvement. **Results:** Femoral osteotomy improved mean Knee Society knee scores from 47 to 76 and function scores from 34 to 61. Tibial osteotomy improved knee scores from 53 to 82 and function scores from 28 to 50. Four osteotomies were complicated by nonunion and required further intervention. Osteotomy subjectively improved pain and function for a mean of 56 months. Femoral and tibial shaft osteotomy delayed TKA in 45% (10 cases) for a mean period of just over 6.5 years (89 and 73 months for femoral and tibial osteotomy respectively). Pre and post Knee society scores were: Femur: knee 56 to 88, function 41 to 72; Tibia: knee 65 to 85, function 25 to 57. One TKA was revised after 11 months due to valgus malalignment and was complicated by a wound infection. There were no other infections or wound complications. The procedure additionally relieved pain and improved function in the remaining 12 joints, not yet requiring arthroplasty. **Conclusion:** Femoral and tibial shaft osteotomy may delay and possibly avoid TKA, relieve pain and improve function in patients who present with malunion and end-stage knee arthritis. The complication rate and clinical results of TKA following shaft osteotomy appear to be similar to primary TKA. This treatment strategy should be considered in younger patients with post traumatic osteoarthritis where significant femoral or tibial deformity is present.