

**MAOA BREAK-OUT SESSION #7**  
**TRAUMA**  
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**74. Treatment of Radiographically Occult Intertrochanteric Hip Fractures**

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A retrospective review was undertaken of patients with radiographically occult intertrochanteric hip fractures from September 1996 through May 2005. Data collected include patient's age at injury, mechanism of injury, medical comorbidities, ambulatory status before injury and after fracture union, radiographic images, and time until able to ambulate after injury. Thirty patients were treated operatively or non-operatively based on the percent of bony fracture identified by MRI; the patient's symptoms, functional demands, and ability to mobilize; as well as the surgeon's preference. Radiographic and clinical follow-up information was available for 24 of these patients. Seventeen patients received non-surgical treatment; seven received surgical treatment. All fractures treated healed regardless of non-operative or surgical management. In the patients treated non-operatively, the average time until protected weight-bearing ambulation (i.e., out of bed) after injury was 1.3 days. The patients treated surgically averaged 2.9 days until ambulation after injury and 1.6 days (range, one to two days) until ambulation after surgery. Our data demonstrate a radiographically equivalent non-surgical treatment option for occult intertrochanteric hip fractures with decreased time until ambulation after injury as well as elimination of operative time and surgical morbidity in most patients treated.

**75. The Treatment of Distal Femoral Fractures Using the Less Invasive Stabilization System (LISS)**

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**INTRODUCTION:** The less invasive stabilization system has the theoretical advantage of bridging the supracondylar fracture zone as an internal fixator and does not require extensive dissection of soft tissues and bony fragments. We present our results of using LISS for distal femoral fractures.

**OBJECTIVES:** To assess the outcome of patients with distal femoral fractures treated with LISS plates.

**METHODS AND RESULTS:** We present a retrospective review of 18 patients (13 females and 5 males) treated with LISS plates for distal femoral fractures. The mean age was 70 years (range 18-102). The most common mechanism of injury was simple mechanical fall. According to the AO classification, there were 9 type 33A, 2 type 33C, 6 type 32A, and 1 type 32B. There were six periprosthetic fractures of which two occurred during total hip replacement. The mean follow-up period was 13 months. One patient died 13 months after fixation of fracture. At the time of follow-up, 16 patients had united, and the remaining patient was proceeding to union. The average time to union was 4 months (range 2-6). Sixteen patients had closed reduction. There were no deep infections, thromboembolic events, persistent pain, or malunion.

**CONCLUSION:** The results of LISS plating are encouraging. In articular fractures, anatomical reconstruction before fixation is paramount. The procedure requires careful planning and experience in the operative technique. Most fractures proceed to union without the need for primary bone grafting.

**76. Stability of Stable Intertrochanteric Hip Fractures Treated with the Long Gamma Nail without Distal Locking Screws**

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**INTRODUCTION:** Recent trends in treating intertrochanteric fractures have shown an increased use of intramedullary devices. The Short Gamma Nail gained popularity for its targeted distal locking compared to the Long Gamma Nail. However, cases document a higher rate of peri-implant fracture with the Short Gamma Nail. We believe using the Long Gamma Nail without distal locking provides adequate stability to allow healing without malunion.

**METHODS:** Ten third generation adult femoral synthetic bones were divided into two evenly paired groups. OTA type 31-A1 fractures were created. Each fracture was then fixed using 130° Long Gamma Nail. In Group 1, distal locking bolts were placed whereas they were left out in Group 2. The distal end of each femur was potted and secured to the 858 MTS servohydraulic biaxial mechanical test system load cell. Physiological loading forces for normal walking were applied to the femoral head of the construct through a pseudo-acetabulum via an adjustable pulley system. Torque and angular deviation were analyzed for construct stability.

**RESULTS:** Both groups showed no difference in rotational or axial stability when placed under physiologic loads.

**DISCUSSION:** Our results show no additional stability is gained by locking a Long Gamma Nail when treating a stable intertrochanteric fracture in a synthetic bone model. We believe if an intramedullary hip screw construct is chosen for fixation, then a Long Gamma Nail without distal locking may safely be used without decreasing fracture stability, peri-implant failure, and increasing operative time; thus, decreasing the risk of peri-implant failure and avoiding difficult placement of distal locking screws.

**77. Comparison of Three Methods for Measuring Intracompartmental Pressures in Compartment Syndrome: A Clinical and Laboratory Study**

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**PURPOSE:** The purpose of this study is to determine the accuracy of several methods for measuring intracompartmental pressures in a clinical and laboratory setting.

**METHODS:** *Clinical Analysis:* Between July 2003 and December 2004, traumatized limbs where compartment syndrome was suspected underwent intracompartmental pressure testing using three methods: (1) a slit catheter device (SLC), (2) an electronic transducer-tipped catheter (ETTC), and (3) an 18g IV needle attached to an arterial line transducer and CVP monitor system (MWT, our modification of Whitesides' technique). *Laboratory Analysis:* SLC, ETTC, and MWT were tested and compared using a thick plastic sheathed homogeneous gel "compartment" model. Pressures within the compartment model were increased incrementally, and 12 trials were performed for SLC, ETTC, and MWT at each pressure. A comparison of clinical and laboratory data collected using these methods was performed using repeated measures ANOVA and intraclass correlation coefficients.

**RESULTS:** *Clinical Analysis:* Thirty-five muscle compartments were tested in 22 limbs of 20 patients, and 16 fasciotomy operations were performed. There were 9% major deviations (2 SLC, 4 ETTC, and 3 MWT) and 12 12% minor deviations (4 SLC, 4 ETTC, and 4 MWT) between the measurements obtained using the three testing methods. Treatment would have changed in two cases (6%) if treatment decisions had been based solely on these erroneous measures. *Laboratory Analysis:* No statistical difference was seen between the values obtained using SLC, ETTC, and MWT using the "compartment" model. The mean differences between the methods were 1.5-1.8 mmHg.

**DISCUSSION AND SIGNIFICANCE:** SLC, ETTC, and MWT are similarly accurate in measuring intracompartmental pressures clinically and in the laboratory. However, erroneous pressure measurements were seen in 21% of injured limbs when these methods were used clinically. These problems were not seen in the laboratory using the homogeneous gel-filled compartment model.

## **78. Treatment of Bicondylar Tibial Plateau Fractures Using Locking Plates versus External Fixation**

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**INTRODUCTION:** Bicondylar tibial plateau fractures are complex injuries which are difficult to treat and often associated with high complication rates. The purpose of this study was to compare the clinical outcomes utilizing open reduction and internal fixation with locking plates versus treatment with external fixation (ex-fix).

**METHODS:** A retrospective review was undertaken of all bicondylar tibial plateau fractures (OTA type 41C) occurring at a level one trauma center between January 2000 and August 2004. Twenty-eight of the fractures were treated utilizing either Synthes (Paoli, IN) standard locking plates or the Less Invasive Stabilization System (L.I.S.S.), and 30 fractures were treated with external fixation, either hybrid or circular frames. There were 14 males and 14 females in the locking plate group and 9 males and 21 females in the external fixation group with a mean age of 46.6 and 48.8 years respectively. The average length of follow-up was 10.2 months for plating and 16.4 months for external fixation with a minimum of 6 months in both groups.

**RESULTS:** Twenty-one of 28 (75%) patients treated with locked plating versus 19 of 30 (63%) treated with ex-fix healed by six months with 3 (10%) and 4 (13%) nonunions respectively at latest follow-up. The average time to union in the locking plate cohort was 5.9 (3-14) months versus 7.4 (3-15) months with external fixation, and significant loss of knee range of motion (flexion <90°) was seen in 1 (4%) of the plating patients versus 4 (13%) of the ex-fix patients. There were 27 complications, including 1 infection, requiring 8 additional procedures in the plating group versus 48 associated complications, 2 infections, and 24 additional procedures in the ex-fix group. Malunion of the articular surface occurred in 2 (7%) of the plating patients and 12 (40%) of the ex-fix patients (p=0.0027).

**DISCUSSION AND CONCLUSION:** Locked plating offers a good treatment option for difficult bicondylar tibial plateau fractures. When compared with external fixation, locked plating provides improved healing rates and restoration of the articular surface, and decreased complications including fewer incidences of knee stiffness and reoperation.

**79. Evaluation of Accumed Clavicle Plate Against 3.5 mm LCDC Plate**

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This study evaluates the stability of the new Accumed clavicle plate. The Accumed plate is compared to the 3.5 mm limited contact dynamic compression (LCDC) plate as this plate was recommended in a study by Iannotti *et al.* This was done by comparing the stiffness of the clavicle-plate construct to the intact bone stiffness, as well as comparing the failure point of the constructs created with each plate. Eight matched pairs of human clavicles were used for testing. The intact clavicle was cleaned of soft tissue, potted in PVC rings with resin and mounted on an Enduratec Axial/Torsion test frame to obtain axial and torsional stiffness values. A midshaft transverse osteotomy was thereafter created, and study plates placed on the superior border. For each pair, one clavicle was repaired with the Accumed clavicle plate, and the other with the 3.5 mm LCDC plate. Each clavicle was then remounted on the test frame with an extensometer at the osteotomy site to obtain axial and torsional construct rigidity/stiffness values. Each clavicle was finally subjected to alternating loads of compression and tension as well as positive and negative torsion until failure occurred.

It was found that the axial and torsional stiffness of the clavicles fixed with the Accumed Clavicle plate were closer to that of the intact bone, while the LCDC plate construct was much stiffer. The Accumed plate also produced higher load to failure in load to failure testing. This implies a biomechanical advantage when the Accumed plate is utilized for mid-shaft clavicle fracture.

**81. Mega-Prostheses for Mega-Problems: The Use of Primary Prosthetic Replacement in Severe Orthopedic Trauma**

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The treatment of complex, severely comminuted or devitalized femur fractures poses a significant challenge to orthopedic surgeons. Even with the current advancements in biomechanics and the vast array of implements available for the fixation of femoral fractures, the treatment of such injuries is fraught with complication and results are often disappointing. A review of the current literature demonstrates that moderate to severe complications occur in 10-45% of patients treated with complex femoral fractures. Furthermore, failure of osteofixation has been reported to occur in 3-70% of such cases.

In the proximal femur, a Mega-prosthesis with diaphyseal support is a potential solution to this devastating problem. From 1991-2004, 13 patients at Akron General Medical Center received a Mega-prosthesis as the principle treatment for their complex proximal femur fractures. Twelve patients were able to be included in this study. The mean age at time of fracture was 76 years and the mean time of follow-up was 44 months. Patients were evaluated with a Merle D'Aubigne rating scale and assessed for functional independence and ability to perform ADLs.

The composite functional results were more than satisfactory given the patients' complex fractures and concomitant injuries. Seventy-two percent of patients involved in the study had a good result or better using validated outcome instruments. If only absence of pain and range of motion are considered, however, 92% of patients were found to enjoy an excellent, very good, or good outcome. The current series shows that primary Mega-prosthetic replacement of the fractured femur is a viable option and has been shown to have a reasonable outcome in the treatment of complex proximal femoral injuries. More work, however, must be done before we can fully quantify the full potential of this treatment modality.

## **82. Anterior Sacroiliac Plating for Unstable Pelvis Fractures**

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**INTRODUCTION:** Horizontally and vertically unstable pelvis fractures (Young-Burgess Anteroposterior Compression – 3 [APC-3], and Vertical Shear [VS]) are significant life-threatening injuries that require secure anterior and posterior fixation to restore pelvic stability. With recent emphasis on percutaneous iliosacral screw fixation (PISF), there has been little published regarding the clinical outcome of anterior SI plating. The lead author has had significant experience in SI plating prior to the popularity of PISF. When assessing outcomes of his patients, our hypothesis is: for unstable pelvis fractures (APC-3, VS), dual anterior SI plating is safe, and the clinical results are comparable to other methods of posterior pelvic fixation.

**METHODS:** A retrospective review was done on 18 trauma patients (11 male, 7 female; mean age = 29.7 years [range = 14-48]) classified as an APC-3 or VS pelvis fracture and treated with anterior SI plating. An ilioinguinal approach was performed and dual anterior SI plating (large fragment 3-hole pelvic reconstruction plate) was used for posterior pelvic ring fixation and either 1-2 pubic symphysis plates or external fixator was used for anterior pelvic ring fixation. Follow-up included office visits for an average follow-up of 57.2 weeks.

**RESULTS:** Patients were placed into a scoring system based on their follow-up assessment (i.e., pain, return to work, radiographic evaluation, etc). Eight patients had an excellent outcome, five were good, two fair, one poor, and two were unable to be assessed. Eight patients had minor complications including infected Pfannenstiel incisions (no infections of the SI incision), leg length discrepancy, sciatica, pubic ramus nonunion, lateral femoral cutaneous neuropraxias, displaced SI joint, and heterotopic ossification.

**DISCUSSION:** Several biomechanical studies have shown that anterior SI plating along with anterior pelvis stabilization restores adequate stability for patient mobilization. When assessing our patient population and their clinical outcomes, this study showed that anterior SI plating is a reliable and reproducible method for treatment of unstable (APC-3, VS) pelvis fractures.

**83. ♦ Trochanteric C-Clamp for Provisional Pelvic Stability**

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**INTRODUCTION:** The purpose of this study is to demonstrate the efficacy of the trochanteric pelvic c-clamp in reducing anterior posterior compression pelvic fractures. The clamp is modified by placing the clamp tines in the trochanters of the femur.

**METHODS:** Eight fresh frozen cadaveric specimens were used. A complete symphysiotomy and left sacroiliac disruption was performed surgically. An APC2 injury was mechanically created by hemipelvic external rotation, followed by an APC3 injury created similarly. The trochanteric c-clamp was applied and closed to obtain reduction of the open book injury. Reduction was assessed by measuring the symphysis diastasis and left anterior sacroiliac widening on the inlet radiographs both pre- and post-application of the clamp.

**RESULTS:** The average pubic symphysis diastasis in the APC2 and APC3 injuries were 4.07 cm and 6.32 cm respectively, pre clamp, and 0.38 cm and 1.24 cm post clamp; ( $p < 0.001$  and  $p < 0.001$ ). The average anterior sacroiliac widening in the APC2 and APC3 injuries were 1.81 cm and 3.81 cm respectively, pre clamp, and 0.69 cm and 1.86 cm post clamp; ( $p < 0.001$  and  $p < 0.002$ ).

**DISCUSSION AND CONCLUSION:** This study demonstrates the efficacy of the trochanteric c-clamp in a cadaveric model for reducing stable and unstable open book pelvic injuries. The technique was reliable, easily reproducible, and no difficulty was encountered with clamp slippage or damage to surrounding vital structures.

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◆The FDA has not cleared the drug and/or medical device for the use described in this presentation (i.e., the drug or medical device is being discussed for an “off label” use).