

**MAOA BREAK-OUT SESSION #3
HAND AND UPPER EXTREMITY
April 20, 2006**

**29. Microvascular Supply of the Lateral Epicondyle and
Common Extensor Origin**

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INTRODUCTION: Lateral epicondylitis is a common condition affecting 1% to 3% of the population. While the exact cause is still unknown, numerous theories have been put forth. One theory suggests a hypovascular zone at the insertion of the common extensor mass. This study examines the microvascular supply of the lateral epicondyle and the common extensor mass utilizing India ink injection and the Spalteholz tissue clearing technique.

METHODS: Six fresh frozen cadaver arms underwent serial sectioning (5 coronal plane, 1 axial plane) after vascular injection with India ink. Sections were cleared using a modified Spalteholz technique. Photos were taken before and after the clearing procedure and the microvascular pattern of the common extensor mass and the lateral epicondyle were described.

RESULTS: Two hypovascular zones were identified in the region of the lateral epicondyle. The first was noted at the proximal lateral epicondyle just distal to the supracondylar ridge and the second 2 to 3 cm distal to the lateral epicondyle on the deep surface of the common extensor tendon.

DISCUSSION: Two regions of hypovascularity are noted at the lateral epicondyle and within the common extensor origin. These hypovascular regions may preclude the normal inflammatory cascade and healing response to microtearing in this region. Thus, these zones may play a role in the etiology of lateral epicondylitis.

30. The Distal Radioulnar Joint in Galeazzi Fractures

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OBJECTIVE: The goal of this study was to conduct a cadaver study of artificially produced Galeazzi fractures and measure motion about the DRUJ with a constant force applied at various phases of the injury pattern.

DESIGN: Seven cadaveric forearms were used to create a Galeazzi fracture pattern. Using a set force value of 65 N, the displacement of the radius in relation to the ulna was determined. Displacements were recorded after each of the following points: intact, distal radius fracture, sectioning of the interosseous membrane, sectioning the volar DRUJ ligaments, and sectioning the dorsal DRUJ ligaments. All displacements were compared using a student's T-test.

RESULTS: The DRUJ's normal translation perpendicular to the joint is 13.1973 ± 2.7463 mm. When the radius is fractured, the motion is 14.2229 ± 3.8467 mm. Next, the interosseous membrane is cut and the motion is 14.8383 ± 4.1806 mm. Neither of these injuries produced a significant change in motion about the DRUJ. However, when the DRUJ is injured, there is a significant change in displacement. When the volar ligaments are sectioned, the amount of motion increases to 17.5041 ± 5.2407 mm. Lastly, when the entire DRUJ is sectioned, the motion at the joint is 22.3207 ± 6.4250 mm.

CONCLUSION: The presence of a fracture of the distal third of the radius does not always indicate an injury to the DRUJ. Also, if there is displacement of the radius relative to the ulna on a true lateral of the wrist, the DRUJ is not necessarily injured. The mechanism of the injury must be consistent with some type of rotational force to the forearm to disrupt the interosseous membrane (IOM) and the DRUJ. When doing a shuck test on a patient, it should be done bilaterally because normally there is motion at the DRUJ. When a significant difference in the shuck test and the mechanism of injury and radiographs are consistent with a Galeazzi fracture, the DRUJ should be treated along with the radius fracture. However, if the joint does not appear to be involved in the injury, no additional treatment is needed for the DRUJ.

31. Nonoperative History of Carpal Tunnel Syndrome

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BACKGROUND: Carpal tunnel syndrome (CTS) is a common orthopedic complaint. Literature contains many studies concerning surgical and nonsurgical treatment options. Long-term outcomes of carpal tunnel syndrome treated without surgery are lacking in published works. This study attempts to describe the natural course of CTS and detect whether significant differences exist between serial outcome measures in a uniform population.

METHODS: A group of 31 patients from a Veterans Administration Medical Center with an established diagnosis of CTS by history, physical examination, and electro-diagnostic evaluation were studied. None of these patients were treated with carpal tunnel release for CTS. These patients were followed for an average of 44 months. Fifteen of these 31 patients were then re-examined at an average 110 months. Subjective data were collected using a disease-specific, standardized, patient-centered questionnaire that contained questions on functional status, symptom severity, work status, and satisfaction with treatment. A focused, objective upper extremity physical examination was performed to measure grip strength, thenar muscle structure, two point discrimination, Tinel's sign, and Phalen's sign. Statistical analyses were performed using SPSS software (SPSS version 12.0.1 for Windows, 11 Nov 2003, Chicago, Illinois) with an alpha value set at 0.05.

RESULTS: The group of 15 patients followed in this study were found to have no statistically significant worsening of symptoms, function, satisfaction, or exam findings when followed for 110 months.

CONCLUSIONS: Patients with CTS can be followed for several years with the knowledge that their symptoms, function, and satisfaction will be minimally changed. Physical exam findings, including thenar atrophy, were not noted to significantly worsen even when followed for over nine years.

32. Evaluation of Dorsal Screw Penetration Following Volar Fixed Angle Plating of the Distal Radius: A Cadaveric Study

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The purpose of this study was to define the extensor tendon compartments at risk secondary to dorsal screw penetration and compare 45° pronation and supination radiographs with standard lateral radiographs in demonstrating dorsal screw prominence during volar locked plating.

Eight human cadaveric upper extremities underwent fixation with a volar, fixed angle distal radius locked plate. Three radiographic views (lateral, 45° supinated and 45° pronated) followed by dorsal wrist dissections were compared to determine accuracy in detecting dorsal screw prominence and extensor tendon compartment violation. Subsequently, screws measuring 2, 4, 6, 8, and 10 mm longer than the measured depths were sequentially inserted into each distal locking screw position. The three radiographic views were repeated for each longer screw with each image deemed either “in” or “out”.

The radial most distal locking screw violated either the first (25%) or second (75%) extensor tendon compartments. The average screw prominence required for radiographic detection was: 6.5 mm (lateral) and 2 mm for (45° supinated). Screws occupying plate position-2 consistently entered Lister’s tubercle. The average screw prominences for radiographic detection were: 2.75 mm (lateral) and 3.0 mm (45° supinated). Screws occupying plate position-3 violated the third extensor tendon compartment in 7/8 specimens with 1/8 exiting the ulnar base of Lister’s tubercle. The average screw prominences for radiographic detection were: 3.5 mm (lateral) and 2.5 mm (45° pronated). Screws occupying plate position-4 all violated the IV dorsal extensor compartment. The average screw prominences required for radiographic detection were: 4.0 mm (lateral) and 2.5 mm (45° pronated).

Standard PA and lateral radiographs cannot adequately visualize screw position and length secondary to the complex geometry of the dorsal cortex. We believe this study supports the routine application of intra-operative, oblique pronosupination radiographs for enhanced confirmation of distal locking screw position and length.

33. Complications of Operative Treatment of Olecranon Bursitis: A Community Experience

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INTRODUCTION: The olecranon bursa is one of the most commonly inflamed in the body. Many etiologies have been identified including trauma, infection, and those related to systemic disorders. The purpose of this study was to evaluate the complications encountered after olecranon bursectomy in a community setting and potentially identify associated factors.

METHODS: Patients who underwent olecranon bursectomy were identified through surgical records. Subjects were excluded if they had a previous surgical procedure on the affected elbow, inadequate documentation, or did not attend their postoperative visit. Preoperative data was collected and included: age, sex, diagnosis, past medical history, medications, culture results, and smoking status. Intraoperative data was evaluated specifically for diagnosis and pertinent findings. Postoperative data included: drain placement and type, immobilization, and complications encountered. Minor complications included delayed wound healing and superficial infection. Major complications were those requiring hospitalization and/or surgical treatment.

RESULTS: Preliminary results revealed 16 minor and 4 major complications in 51 patients. The major complications included: wound bleeding and swelling with need for repeat bursectomy, development of an infected hematoma, persistent hematoma, and recurrence of bursitis. The minor complications included persistent hematoma, prolonged wound drainage, prolonged drainage from drain site, broken sutures, skin maceration, wound breakdown, and recurrent swelling. Early analysis did not show a correlation between complications and perioperative factors.

DISCUSSION/CONCLUSION: We have described the complications encountered in the operative treatment of olecranon bursitis in a community setting. Awareness of these risks is important in operative decision making as well as preoperative patient counseling.

34. Is Physical Therapy Necessary After Distal Biceps Tendon Repair?

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BACKGROUND: The endobutton technique of distal biceps tendon repair provides strong biomechanical fixation. This strength of fixation may allow earlier postoperative range of motion (ROM).

METHODS: A retrospective review of 16 male patients undergoing endobutton repairs was used. Six subjects participated in supervised postoperative rehabilitation while ten subjects were allowed unrestricted ROM after two weeks. Final ROM, time to full ROM, and time to discharge were computed and analyzed via independent sample t-tests.

RESULTS: There was a significant difference for time to full ROM ($p < .05$). The mean time to full ROM for the supervised therapy group was 8.67 weeks and 4.38 weeks for the unrestricted group. There were no reruptures in either group. There were no significant differences in final ROM or in time to discharge.

DISCUSSION: These data suggest that unrestricted ROM results in a quicker return to full ROM without an increased risk of rerupture. Further study with larger subject populations and matched pairs is needed to support this finding.

35. Complications of Operatively Treated Proximal Humerus Fractures

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INTRODUCTION: Minimal information exists regarding complications following operatively treated proximal humerus fractures. The purpose of this study was to assess the rate and types of complications in this patient population.

MATERIALS AND METHODS: From January 1995 to December 2002, 116 shoulders had operative treatment of acute proximal humerus fractures. Patients were followed from the clinical and radiographic record to assess adverse event outcomes along the course of care. Ninety-three shoulders with osteosynthesis and 23 with hemiarthroplasty were followed to assess "acute" medical and surgical complications.

RESULTS: In shoulders with osteosynthesis, the overall complication rate was 58% (54 of 93) with 22 requiring further surgery. Fourteen of the 93 (15%) had initial fracture malpositioning. Fixed angle plates had lower rates of initial malpositioning and resultant malunion. In shoulders undergoing hemiarthroplasty, the overall complication rate was 74% (17 of 23); 14 patients (61%) had complications relating to initial fracture malpositioning, tuberosity nonunion, or resorption, and 7 developed humeral head subluxation. There was no difference in surgeon experience or fracture type with rates of other "early" complications.

CONCLUSIONS: The rate of complications following operative treatment of proximal humerus fractures is high. Efforts at osteosynthesis should be directed to obtaining anatomic fracture fixation that resists fracture displacement. Complications related to tuberosity reconstruction after hemiarthroplasty are common. A stable shoulder with healed tuberosities should be the primary goal in the immediate and early phase of recovery.

36. Surgical Treatment of Displaced Proximal Humeral Fractures with a Short Intramedullary Nail

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INTRODUCTION: The Polarus nail is an intramedullary device for stabilization of displaced proximal humerus fractures with few published studies to support its use. Results of a consecutive series of patients treated with the Polarus nail are presented.

METHODS: Sixteen patients with a mean age 71 years (range 24-100) were treated for ten 2-part and six 3-part fractures. Radiographic results for all patients were evaluated. Thirteen patients with an average follow-up of 42 months (range: 21-84) were available for functional evaluation.

RESULTS: Fifteen of 16 patients healed. One nonunion required revision to a hemiarthroplasty. Postoperatively, the neck/shaft angle collapsed an average 11° into varus. Nine of 16 patients had final neck/shaft angles <120° and were considered radiographic malunions. The mean Constant score was 61 (range: 20-100) with 4 excellent, 4 satisfactory, and 5 poor results. The mean ASES score was 68 (range: 10-100). Patients could perform an average 6.5 of 12 Simple Shoulder Test tasks. Forward elevation averaged 122° with 3.5/5 strength. Patients had an average 4/8 positive rotator cuff signs. Patients with 3-part fractures had no excellent, 3 borderline satisfactory, and 2 poor results. Six complications included five hardware failures and one nonunion. Five patients underwent reoperation for loss of fixation or prominent hardware.

CONCLUSIONS: This study shows a higher than reported percentage of unsatisfactory results using the Polarus nail. The device violates the rotator cuff and is unable to resist the deforming forces on the proximal humerus which can lead to loss of fixation and fracture collapse.

38. Transulnar Pinning of Gunshot Wounds to the Radius

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PURPOSE: Gunshot wounds to the radial shaft are difficult fractures to treat because of severe comminution, associated soft tissue injury, and polytrauma. Some fractures are often not amenable to conventional plating techniques. In this study, we sought to compare an alternative method of fixation, transulnar pinning, that seeks to achieve similar goals to those sought with plating or external fixation, but is easier, faster, less expensive, and more amenable to military applications.

METHODS: Nine fractures resulting from gunshot wounds to the forearm involving the proximal or distal radius (22-B2.2) in nine patients from 1999 to 2004 were analyzed by chart and x-ray review. Results were analyzed based on amount of radial shortening, time to union, presence of malunion, degree of ulnar variance, and development of a synostosis.

RESULTS: All nine patients were male with an average age of 24.9 years (range 19-31 years). Average follow-up was 3.6 months (range: 0-8 months). Eight of nine patients sustained multiple gunshot wounds and multiple injuries. Fracture fixation occurred on the average 3.1 days post-injury (range: 0-19 days).

Five patients had undergone transulnar pinning alone. Of the five patients undergoing transulnar percutaneous pinning alone, four had fractures that involved the proximal radius and one involved the distal radius. Pins were removed at an average of 7.5 weeks. One patient developed a proximal radioulnar synostosis. Of the two patients undergoing external fixation, one underwent plating and soft tissue coverage five days later. The other patient had a delayed union. When a combination of both techniques was used, one patient developed a malunion. This surgery was performed 19 days post-injury because of polytrauma. No patient developed a synostosis.

CONCLUSION AND SIGNIFICANCE: Transulnar pinning does not immobilize the wrist joint, is inexpensive, fast, and if necessary, can be performed without the use of C-arm, making it ideal for military applications. We believe transulnar pinning is another tool for the orthopedic surgeon to meet the goals of Damage Control Orthopaedics.