Complications of Locked Intramedullary Nail Treatment of Proximal Humerus Fractures

Armodios Hatzidakis, MD[1]; Thomas D'Ollonne, MD[2]; Tara Hawkes, BS[1]; Philippe Clavert, MD, PhD[3]; Pascal Boileau, MD[4];
[1]Western Orthopaedics Research and Education, Denver, Colorado, USA; [2]L'Archet2 Hospital, FRANCE; [3]Shoulder and Elbow Service, FRANCE; [4]Hopital de l'Archet, FRANCE

Background/Purpose: Proximal humeral intramedullary nailing allows a less invasive surgical intervention than locked plating, maintaining the vascularity of fracture fragments while potentially providing angular stability of proximal fixation. Some studies have demonstrated that this technique shows comparable or improved clinical outcomes and complications to locked plating, with others showing less favorable outcomes and a higher complication rate, particularly in complex fractures. The purpose of this study is to assess the early outcomes and complications of 2-, 3-, and 4-part fractures of the proximal humerus using a locked intramedullary nail for open reduction and internal fixation of fractures of the proximal humerus. The nail utilized in this study provides angular-stable targeted proximal screw orientation for compressive fixation of the tuberosities.

Methods: From April 2009 to April 2013, 110 consecutive proximal humeral fractures with displaced Neer 2-, 3-, or 4-part proximal humerus fractures were acutely treated with the short antegrade intramedullary locked nail at three institutions. Inclusion criteria were a fracture confined to the proximal humerus without associated humeral shaft extension and a minimum of 12-month clinical and radiographic follow-up. Outcomes were evaluated using the Constant score, radiographic evaluation, and assessment of complications or additional surgical intervention.

Results: 32 patients (29%) were lost to follow-up, or had not been seen for a minimum of 1-year follow-up. Of the 78 patients with at least 1-year follow-up (mean 17 months, range 12-51 months), 35 were 2-part, 26 were 3-part, and 17 were 4-part fractures. 48 were female and 30 were male, with a mean age of 58 years (range, 16-86). Complications included 4 cases of avascular necrosis, two of which occurred in 4-part fractures, one with a 3-part fracture, and one after revision of a 2-part fracture that had failed another form of fixation. One patient, with a 2-part fracture, complained of shoulder stiffness that was treated with arthroscopic adhesiolysis. Three patients with 3-part fractures had one or more screws removed after healing. One patient, with a 3-part fracture, exhibited signs of rotator cuff failure postoperatively and underwent nail removal with rotator cuff repair. One patient with a 4-part fracture underwent revision intramedullary nailing for fracture displacement after the index surgery. For the entire cohort, final follow-up average active forward flexion was 128° (range, 60°-170°), active abduction 137° (range, 60°-170°), and active external rotation 46° (range, 0-90°). Constant scores were available for 76 fractures. The average final age-adjusted Constant score was 86.9 (range, 13-121), with an average pain score of 13.3 (range, 5-15).

Conclusion: Operative treatment of displaced proximal humerus fractures using this technique resulted in favorable healing rates and clinical outcomes. At average 17-month follow-up the avascular necrosis rate was 5%. Nine patients (12%) required additional surgery

See pages 47 - 108 for financial disclosure information.

during the follow-up period and three patients (4%) required conversion to an arthroplasty. The majority of complications occurred in more complex fracture patterns.

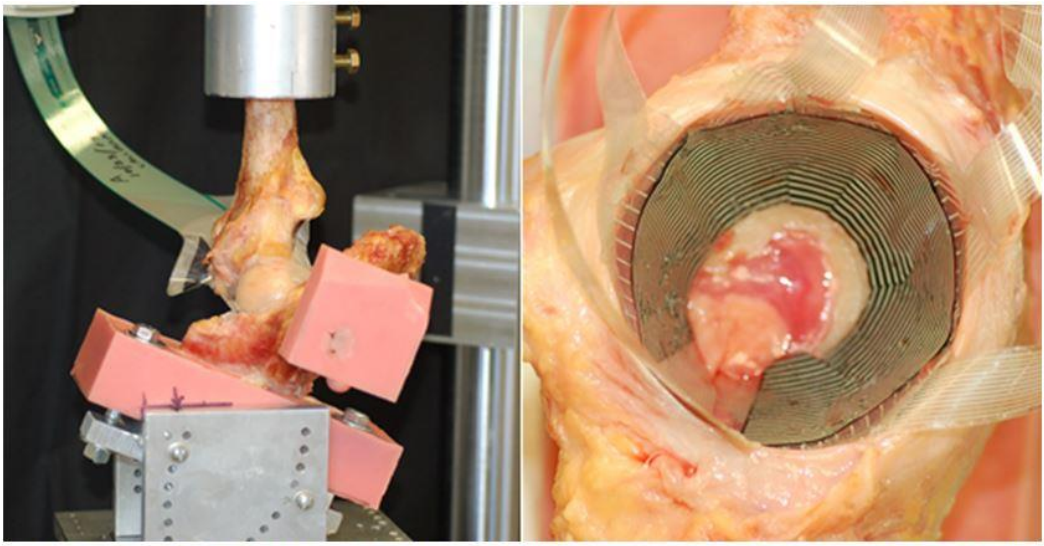

Figure 1. Experimental setup using a custom fixture to apply a 1,000N compressive force across the hip joint (Left). The pelvis was rigidly attached to a plate that was free to translate in the X-Y directions. The femoral shaft was rigidly attached to the material testing machine loaded in the z-direction. Coverage of the acetabular cartilage by the Tekscan sensor is shown on the right.

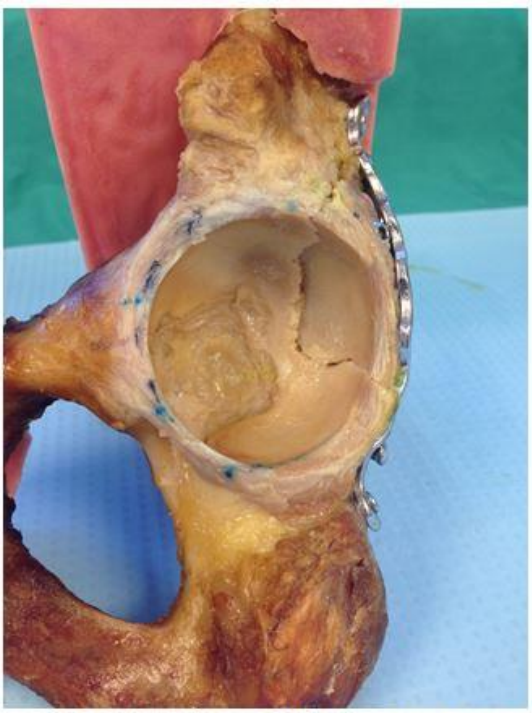

Figure 2. The posterior wall fracture and 2-mm step-off malreduction created in Specimen 1.

The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device he or she wishes to use in clinical practice.

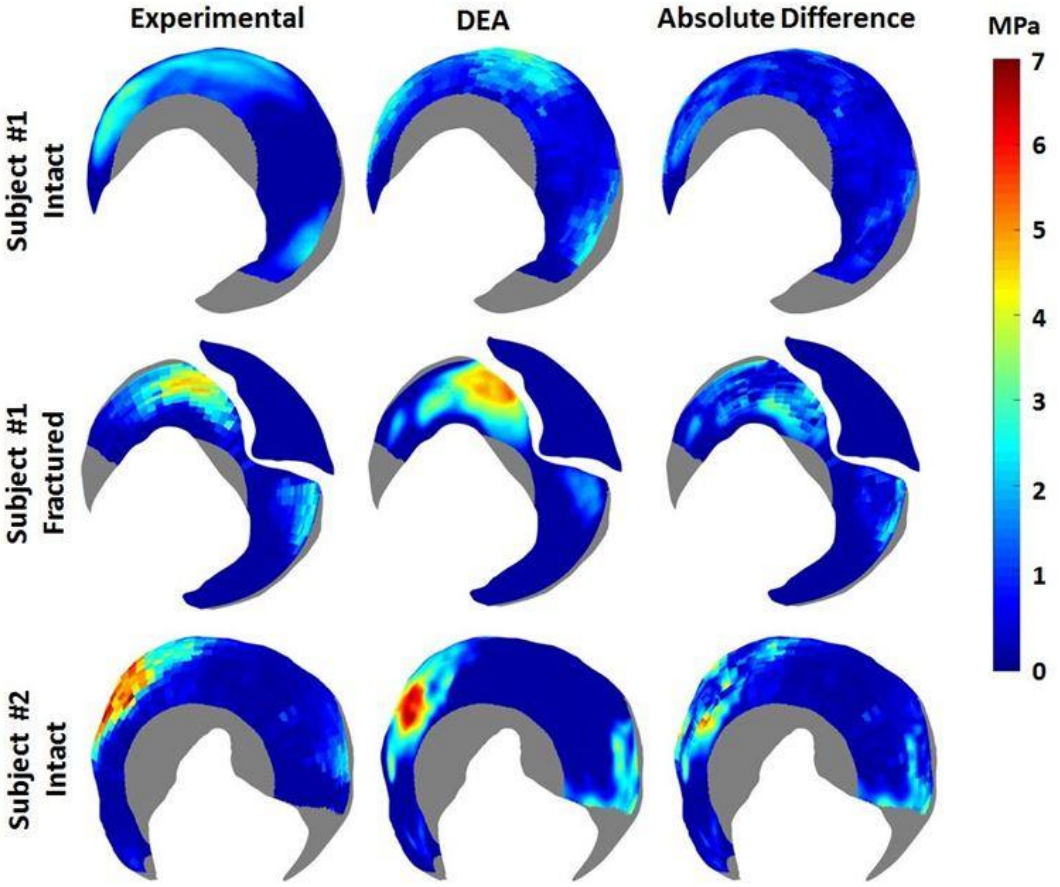

Figure 3. Plots of experimental contact stresses, DEA-computed contact stresses, and a point-by-point absolute difference map(|DEA – Experimental|) for subject #1 intact hip (top row), subject #1 malreduced fractured hip (middle row) and subject #2 intact hip (bottom row). Areas of acetabular cartilage not covered by the Tekscan sensor during testing are colored grey and were not included in contact stress comparisons.

See pages 47 - 108 for financial disclosure information.