

## **Technique for Intramedullary Nailing for Proximal Humerus Fractures Using a Straight Antegrade Nail With Locking Tuberosity Fixation**

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### **Background**

Intramedullary straight nail fixation of proximal humerus fractures with the use of a locking mechanism is associated with advantages compared with plating, including (1) less soft-tissue dissection, which preserves periosteal blood supply and soft-tissue attachments; (2) improved construct stability for comminuted fractures or osteopenic bone; and (3) shorter surgical time for simpler fractures.

### **Description**

The patient is placed in the beach-chair position with the head of the bed elevated approximately 45°. The fracture is reduced via closed or percutaneous methods (preferred) or open approaches, if required. Temporary fragment fixation can be attained with the use of percutaneous Kirschner wires.

Just anterior to the acromioclavicular joint overlying the zenith of the humeral head and in-line with the diaphysis, a 1-cm incision is created. A guide pin is then placed through this incision and verified to be centrally located and in-line with the humeral diaphysis on fluoroscopic images. The guide pin is advanced into the diaphysis. A cannulated 9-mm reamer is inserted over the guide pin to create a starting position. The nail is then inserted while adequate fragment reduction is maintained until the proximal nail portion is buried under the subchondral humeral head. The proximal screw trajectory and alignment are assessed fluoroscopically.

The proximal locking screws are addressed first via a percutaneous technique using the drill sleeves through the jig. The screw is inserted through the guide and advanced into the nail until appropriately seated. This process is then repeated for the other proximal screws as necessary. Finally, the distal diaphyseal screws are addressed in a similar percutaneous fashion. The jig is removed. Final orthogonal images are obtained. Copious irrigation of the percutaneous (and open) incisions is performed. Percutaneous incisions are closed and dressed with the use of a sterile dressing. The surgical arm is placed in an abduction sling.

### **Alternatives**

Alternative treatment options for proximal humerus fractures includes nonsurgical management (sling immobilization), percutaneous reduction and internal fixation with the use of Kirschner wires, open reduction and internal fixation with the use of a locking plate and screw construct, hemiarthroplasty, and anatomic or reverse total shoulder arthroplasty.

### **Rationale**

This technique for proximal humerus fracture fixation with the use of a straight, antegrade locking nail allows for minimal soft-tissue disruption, which preserves vascularity and soft-tissue support while achieving angular stable fixation, often in patients with osteopenic bone. The superior and in-line entry point avoids rotator cuff injury and/or subacromial impingement. The proximal locking screws avoid screw penetration or migration. This technique is appropriate for surgically indicated Neer two-, three-, and four-part humerus fractures, including those in elderly patients, if the humeral head fragment is viable.

### **Expected Outcomes**

Expected outcomes are based on available level III and level IV studies on this technique. All patients recovered motion to perform activities of daily living independently. Mean active elevation was 132° to 136°. Mean external rotation was 37° to 52°. Internal rotation was to L3. Pain scores substantially improved postoperatively. The mean visual analog scale score was 1.4. Patient-reported outcomes were good to excellent. The mean Single Assessment Numeric Evaluation score was 80 to 81. The mean Constant assessment score was 71 to 81. High satisfaction was reported, with 97% of patients being satisfied or very satisfied with the procedure. Good to excellent fracture healing was observed. No tuberosity migration was reported, and the rate of nonunion was low (zero to 5%). The rate of humeral head necrosis ranged from zero to 4%. The revision rate ranged from 10.5% to 16.7%.