Extended Neviaser Portal Approach to Antegrade Humeral Nailing

MATTHEW F. DILISIO, MD; RYAN E. FITZGERALD, MD; ERIC T. MILLER, MD

abstract

Certain arthropathies can distort the normal acromiohumeral relationship and make traditional anterolateral access to the proximal humerus for nailing difficult or impossible. This article presents a case of bilateral antegrade humeral nailing in which the Neviaser portal approach was used for humeral shaft fractures in a patient with distorted shoulder anatomy secondary to severe cuff tear arthropathy and rheumatoid arthritis. Based on a literature review, extending the traditional superomedial (Neviaser) portal to the shoulder to perform humeral nailing has never been described clinically.

An 85-year-old woman with rheumatoid arthritis and bilateral cuff tear arthropathy presented after a mechanical fall from standing height with bilateral acute humeral shaft fractures. Preoperative fluoroscopy confirmed the inability to access the traditional starting point with an anterolateral approach due to a shield acromion resulting from cuff tear arthropathy and rheumatoid arthritis. Bilateral locked antegrade humeral nails were successfully placed through a 3-cm incision just off the medial border of the acromion and directly posterior to the acromioclavicular joint (the extended Neviaser portal approach). Postoperatively, the patient demonstrated early evidence of clinical and radiographic union. She was able to return to her preinjury function level, with an active range of motion comparable with her baseline.

The Neviaser portal approach to antegrade humeral nailing is an effective solution to diaphyseal humeral fractures when access to the traditional anterolateral proximal humeral starting port is not possible due to distorted shoulder anatomy.

The authors are from the Department of Orthopaedic Surgery, Summa Health System, Akron, Ohio. The authors have no relevant financial relationships to disclose. Correspondence should be addressed to: Matthew F. Dilisio, MD, Department of Orthopaedic Surgery, Summa Health System, 444 N Main St, Akron, OH 44310 (dilisiom@gmail.com). doi: 10.3928/01477447-20130122-30
Antegrade humeral nailing can be an effective treatment for diaphyseal humerus fractures. Compared with the traditional open plating technique, antegrade humeral nailing can achieve stable fixation with less soft tissue damage through a smaller incision.\textsuperscript{1-3} Patients with operatively treated humeral shaft fractures can also bear weight and mobilize earlier compared with nonoperatively treated patients.

Although multiple approaches to intramedullary nailing of the humerus have been described, the anterolateral approach to the proximal humeral starting point is the most commonly used.\textsuperscript{3,8} Rarely, certain pathologic conditions such as cuff tear arthropathy and rheumatoid arthritis can distort the normal acromiohumeral relationship and make traditional anterolateral access to the proximal humerus for nailing difficult or impossible. The authors report a technique of bilateral antegrade humeral nailing using the Neviaser portal approach in a patient with distorted shoulder anatomy due to cuff tear arthropathy and rheumatoid arthritis.

**CASE REPORT**

An 85-year-old, right-hand-dominant woman with rheumatoid arthritis and bilateral cuff tear arthropathy presented after a mechanical fall caused bilateral acute humeral shaft fractures (Orthopaedic Trauma Association, 12-A2 and 12-B2) (Figure 1). Although she lived alone and functioned independently prior to injury, her shoulder function was limited to less than 90° of maximum forward elevation.

Her neurologic examination was intact. Plain radiographs demonstrated significant acetalubization of her right distal clavicle and acromion, femoralization of her humeral head, and superomedial erosion of the glenoid. The shoulders demonstrate acetabularization of the humeral head, and superomedial erosion of the glenoid consistent with advanced cuff tear arthropathy and rheumatoid arthritis.

After appropriate medical clearance, she underwent surgery in January 2012. The senior author (E.T.M.) routinely performs antegrade humeral nailing with patients in a supine position on a Jackson table. Several positioning tips warrant mention. The patient is moved as far as possible to the opposite side of the table from the surgeon to allow the injured extremity to rest on the table. This facilitates reduction maneuvers and placement of anterior-to-posterior distal locking screws. In addition, the patient is moved as far distally on the table as possible to allow access to the superior shoulder. The torso should be angled slightly toward the injured arm to allow the trajectory of the guide wires and nail to pass beside the large base at the head of the table. The endotracheal tube should be placed away from the injured arm, and the head should be turned away from the operative limb. Making these minor adjustments allows for easier access to the shoulder for this technique.

Preoperative fluoroscopy confirmed the inability to access the traditional starting point with an anterolateral approach. The decision was made to use the Neviaser portal for nail placement after confirmation that the impaction handle was long enough to allow safe nail placement below the superior margin of the articular surface without impinging on the superior clavicle and acromion. Alternately, an open approach to nailing, retrograde nailing, or percutaneous plating could have been considered.

After routine prep and drape, a 3-cm incision was made directly over the Neviaser portal. Distal fibers of the trapezius muscle were split bluntly, and the initial guide pin was placed just posterior to the distal clavicle and acromioclavicular joint (Figure 2). All dis-
section and manipulation was completed as lateral as possible to minimize the risk of iatrogenic injury to the suprascapular nerve. Orthogonal fluoroscopy views confirmed placement. Once the guide wire was confirmed to be appropriately positioned within the proximal humerus, the remainder of the preparation and insertion of the humeral nail was performed routinely. Proximal locking screws could be placed through the insertion handle, and distal screws were appropriately placed using fluoroscopy (Figure 3). After fixation of the first fracture, the patient was repositioned, prepped, and draped to allow placement of the second nail using the same technique. Postoperative radiographs revealed adequate fracture alignment and nail placement (Figure 4).

Postoperatively, the patient was allowed to bear weight as tolerated bilaterally and was discharged to a rehabilitation unit on postoperative day 4. She followed an uneventful postoperative course, and evidence of clinical and radiographic union was seen at 12 weeks postoperatively. She progressed well with physical therapy and achieved shoulder function near her baseline at 6 months postoperatively, with a 2/10 visual analog pain scale score, and 85° of active forward elevation and 28° of external rotation on the right and 60° of active forward elevation and 17° of external rotation on the left. The patient was able to return to her preoperative level of independent living.

**DISCUSSION**

Neviaser first described the superomedial portal approach to the shoulder in 1987 as an inflow or outflow portal during diagnostic shoulder arthroscopy. The portal has been subsequently used to arthroscopically address rotator cuff, superior labrum, and distal clavicle pathology. Knierim et al first described the technique of using the Neviaser portal in antegrade humeral nailing in a cadaveric study. To the authors’ knowledge, extending the traditional superomedial portal to the shoulder to perform humeral nailing has never been described clinically.

The current patient presented with a severe, preexisting shoulder pathology prior to her trauma. In a patient with cuff tear arthropathy, the theoretical risk of increased shoulder pain after antegrade humeral nailing due to iatrogenic rotator cuff trauma does not exist because the patient does not have a rotator cuff. The authors believed she was also a candidate for humeral nails rather than a plate because creating bilateral incisions large enough for plate fixation in the patient was not optimal. However, the fixed superior migration and medialization of her humeral head due to her cuff tear arthropathy and rheumatoid arthritis resulted in a shield acromion that completely blocked the appropriate proximal humeral starting point. This created an anatomic obstacle that was not conducive to traditional antegrade humeral nailing. The authors’ novel approach used an extended Neviaser portal...
incision just medial to the acromion and posterior to the acromioclavicular joint. Correct patient positioning was vital to clear both the head and the operating table with the guide pin, guide rod, and nail. Careful dissection was performed through a 3-cm incision through the trapezius, and direct access to the proximal humerus was easily obtained. Because of the severe rotator cuff disease, the proximal humerus was devoid of a rotator cuff tendon. The starting point for the antegrade humeral nailing was easily visualized, and the nail was successfully placed.

One complication of antegrade humeral nailing is postoperative shoulder pain, which has been estimated to occur 20% to 41% of the time. The etiology of this pain has been attributed to the incision through the rotator cuff to facilitate proximal humeral entry-point exposure and nail passage. In an effort to avoid this problem, alternative approaches to humeral nailing have been described. Park et al described the rotator interval retrograde humeral nailing compared with the traditional anterolateral approach. After operative shoulder range of motion using a 14 fractures achieved union. Excellent recovery was reported, and all 14 fractures achieved union.

Rieger et al described improved postoperative shoulder range of motion using a novel anterior acromial approach to antegrade humeral nailing compared with the traditional anterolateral approach. After cadaveric analysis of their approach, the authors attributed the improved shoulder function not to sparing the avascular portion of the rotator cuff tendon, but rather to inadvertent sectioning of the coracoacromial ligament and subsequent decompression of the subacromial space. Retrograde nailing of humeral shaft fractures has also been described but is complicated by elbow stiffness, increased risk of iatrogenic fracture, and neurologic injury.

In an effort to avoid the rotator cuff footprint during humeral nail insertion, Knierim et al reported the Neviaser portal approach to antegrade humeral nailing in a cadaveric study. They noted that all nails passed entirely through supraspinatus muscle belly with no supraspinatus tendon or long head of the biceps tendon damage. However, nearly all specimens exhibited articular cartilage damage because 13 of 15 starting points were entirely on the articular surface. In addition, they were unable to perform the procedure in 1 cadaveric specimen with cuff tear arthropathy due to a large acromion. They noted that the use of fresh-frozen cadavers changes the pliability of the tissues and the ability to obtain a starting point.

In contrast to the study by Knierim et al, in the current case the authors were able to easily place humeral nails through the Neviaser portal in a patient with cuff tear arthropathy. The shielding effect of the acromion was the authors’ primary indication to use the extended Neviaser portal approach. The difference between the current authors’ experience and that of Knierim et al may be due to the difference in joint motion between living and cadaveric shoulders.

The major theoretical risk of the superomedial portal approach to the shoulder during arthroscopic surgery is the suprascapular artery and nerve, but multiple studies have demonstrated the safety and efficacy of the superomedial portal in cadaveric studies. However, placing an antegrade humeral nail in this region is different from placing a blunt trochar. Care must be taken to directly visualize the proximal humeral starting point and to not traumatize the spinoglenoid notch located immediately medial to the nail insertion. Although the supraspinatus is nonfunctional in cuff tear arthropathy, damage to the suprascapular nerve could cause pain and infraspinatus weakness resulting in decreased external rotation strength. A final important note is that this approach may have a limited indication in healthy shoulders without cuff tear arthropathy, which limits the expansion of this technique to more patients. Although the prior report of this technique demonstrated violation of only muscle belly without supraspinatus tendon damage, nearly all specimens exhibited cartilage damage. Placing the nail from this medial trajectory may result in too much chondral injury in a normal shoulder, leaving the patient with significant postoperative shoulder pain and decreased function.

**CONCLUSION**

The extended Neviaser portal approach to antegrade humeral nailing is an effective solution to diaphyseal humerus fractures when anterolateral access to the proximal humeral starting port is not possible due to distorted shoulder anatomy from severe cuff tear arthropathy or rheumatoid arthritis.

**REFERENCES**


