

External Fixation for a Proximal Humerus Fracture

An older patient with serious medical comorbidities cannot undergo surgery to repair a 2-part proximal humerus fracture. The authors chose closed reduction with external fixation as a safer alternative.



Authors

Daniel Davis, MD, and Luke S. Austin, MD

Disclosures

Daniel Davis, MD, has no conflicts of interest to report. Luke S. Austin, MD, is a consultant for Tornier.

Case Presentation

An 81-year-old man who tripped and fell onto his left side presented to the emergency department with left shoulder pain and swelling. He has a significant number of comorbidities:

- Non-Hodgkin's lymphoma with secondary neutropenia
- Coronary artery disease
- Cerebrovascular disease
- Chronic obstructive pulmonary disease
- Atrial fibrillation

- Vertigo

Physical Examination

- Left shoulder with significant swelling, ecchymosis, and obvious deformity of proximal humerus
- Skin tinting but intact
- Global tenderness to palpation about the shoulder with limited range of motion secondary to pain
- Deltoid motor function intact and full strength distally in the left upper extremity
- Sensation intact to light touch distally with a palpable radial pulse

Differential Diagnosis

- Proximal humerus fracture
- Shoulder dislocation
- Massive rotator cuff avulsion
- Acromioclavicular joint injury

Imaging

An anteroposterior (AP) view and scapular-Y view of the left shoulder were obtained in the emergency department (Figures 1a-b).

- AP: Two-part surgical neck, proximal humerus fracture with 100% displacement and 90 degrees of varus angulation
- Scapular-Y: Displaced proximal humerus fracture with angulation in the sagittal plane



Figures 1a-b. AP (left) and scapular-Y (right) views of a 2-part proximal humerus fracture.

Diagnosis

- Completely displaced closed but pending open left 2-part proximal humerus fracture

Treatment

The authors determined that the best procedure would be closed reduction and external fixation. The patient had significant medical comorbidities and was a high-risk candidate for general anesthesia and contraindicated for intubation. This procedure can be performed under light sedation with local anesthesia over the shoulder.

Advantages of closed reduction and external fixation include the following:

- Alternative to non-operative treatment in a patient at high risk for general anesthesia and contraindicated for intubation

- Low morbidity
- Stable construct with better anatomic alignment than non-operative management
- Provides stable construct for early range of motion
- Reduces operative time and blood loss
- Prevents malunion and nonunion
- Reduces soft tissue stripping, potentially reducing avascular necrosis and adhesions
- Fixator able to be removed in the office

Disadvantages of closed reduction and external fixation include the following:

- Must be performed within 1 or 2 weeks of the fracture, when fracture fragments are still mobile
- If closed reduction cannot be obtained, it is difficult to convert to an open procedure
- Risk of delayed union would result in prolonged use of external fixator

The authors used an NBX Shoulder external fixator (Nutek Orthopaedics, Fort Lauderdale, Florida) for this procedure (Figures 2a-c).

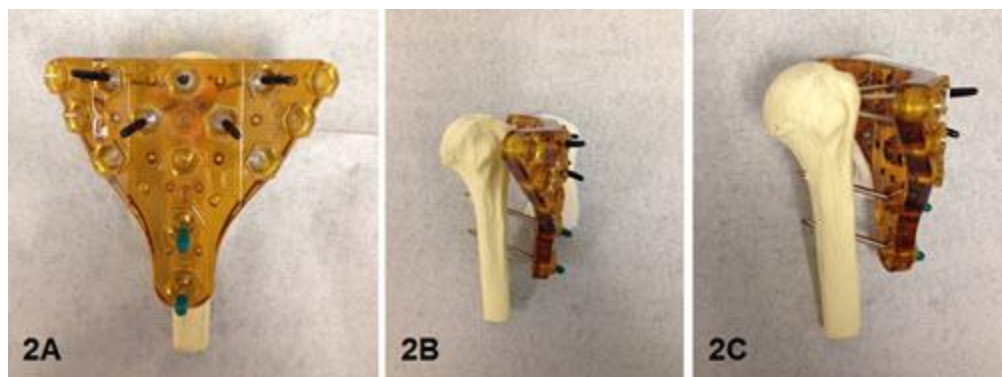


Figure 2a-c. NBX Shoulder external fixator used in this procedure.

Advantages of this implant include:

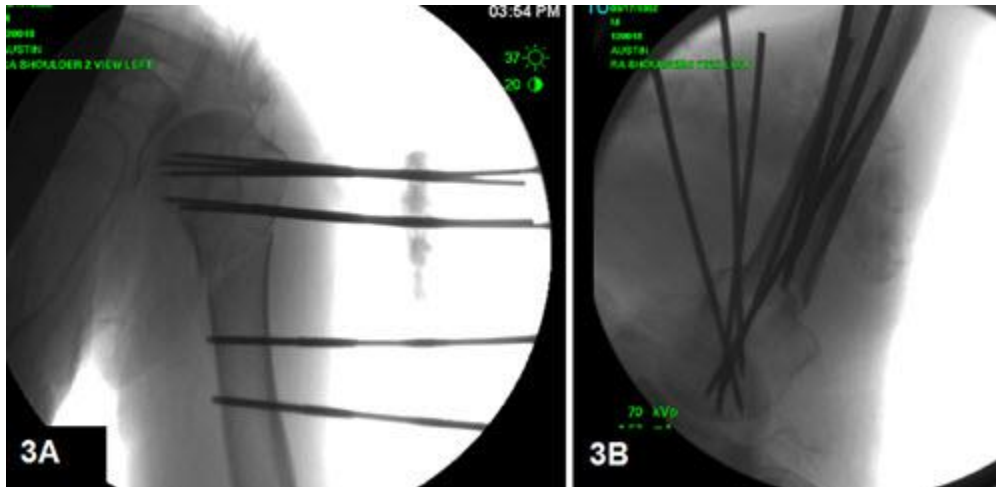
- The ability to be placed with light sedation and local anesthesia
- The ability to be removed in an outpatient setting

Disadvantages of this implant include the:

- The risk of pin track infection
- The risk of nonunion or delayed union if construct unstable

Procedure

- The patient was positioned supine on a regular bed, with his affected arm draped free. Prior to draping, the OR staff ensured adequate AP and axillary views could be obtained to confirm closed reduction.
- The C-arm was placed at the head of the bed.
- Light sedation was obtained by anesthesia with ketamine. A patient under light sedation can be bagged as need.
- Local anesthesia was obtained with Marcaine. A regional block can affect the phrenic nerve and lead to unintended intubation.
- A 3-mm pin was placed through the superior lateral greater tuberosity and advanced into the humeral head.
- The fixator was placed on the first pin and the distal fin of the fixator was aligned with the long axis of the humeral shaft in the reduced sagittal position prior to tightening.
- Two additional 3-mm pins were placed through the fixator, anterior and posterior the first pin. This allows for complete control of the humeral head.
- Manipulation and reduction of the fracture was then performed. This is usually done via traction and elevation of the arm in the sagittal plane. Sagittal plane reduction is critical.
- Two 4-mm half pins were placed through the distal fin of the fixator and into the humeral shaft.
- The head was reduced on the shaft and an external fixation device was used to secure the fracture in a reduced position (Figures 3a-b).
- Two final pins were placed into a more distal position in the humeral head and also secured in the external fixation device.
- Adequate reduction was assessed with AP and axillary shoulder fluoroscopic images in the operating room.



Figures 3 a-b. External fixation device secures the 2-part proximal humerus fracture in a reduced position.

Postoperative Course

Immediate Postoperative Course

The patient tolerated the procedure well without any complications. He discharged per the medical team to a nursing home facility for initial rehabilitation. He was non-weight-bearing in a sling.

Feature Articles

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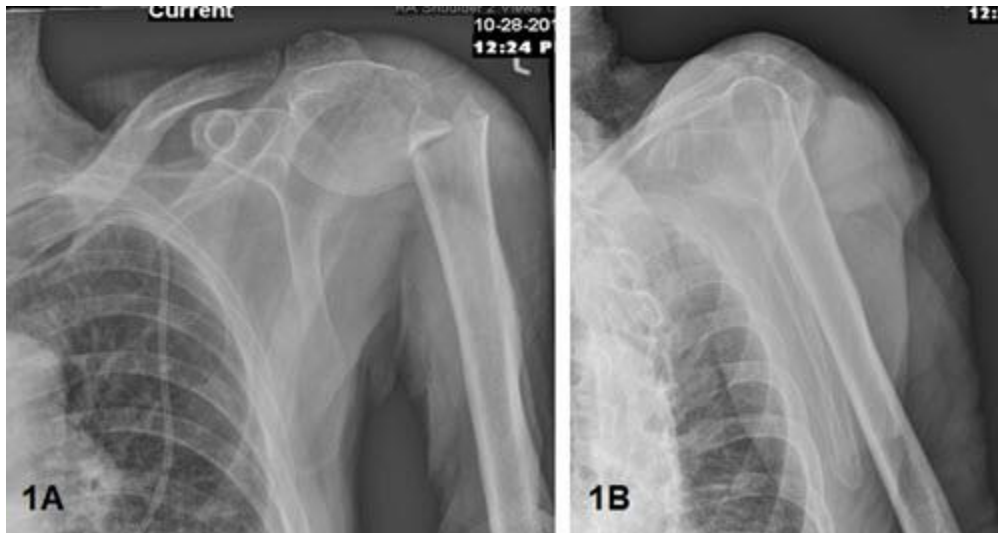
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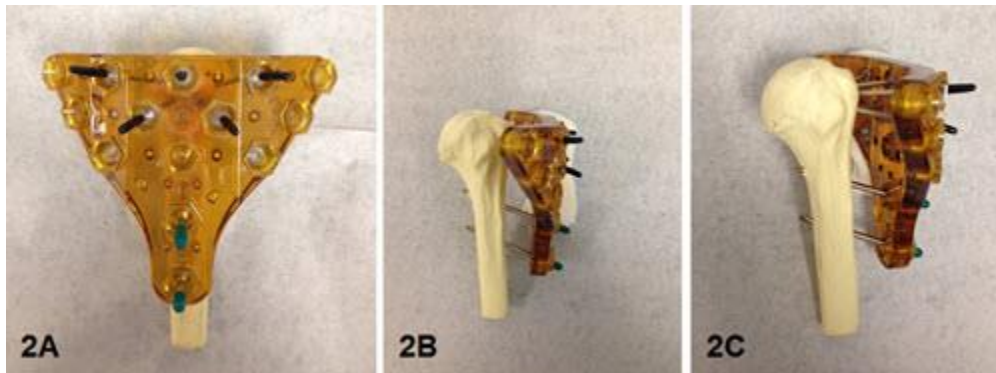


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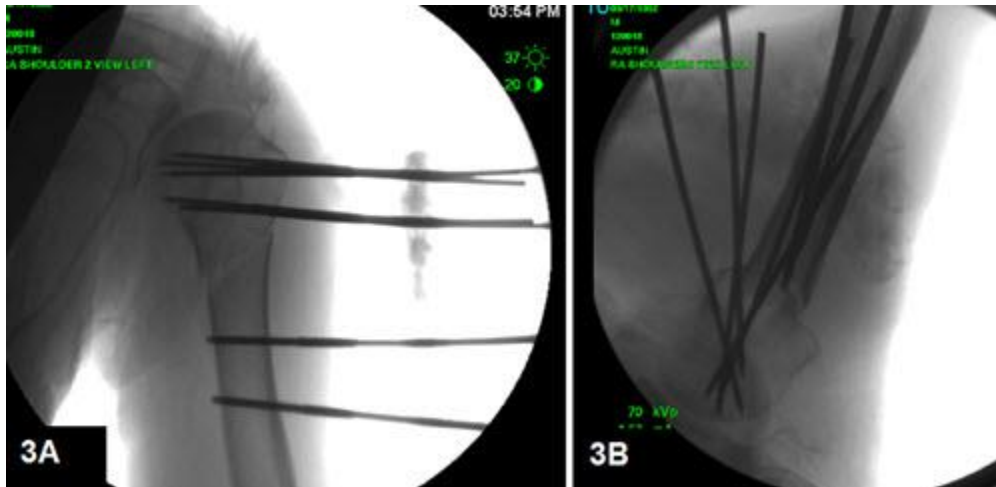
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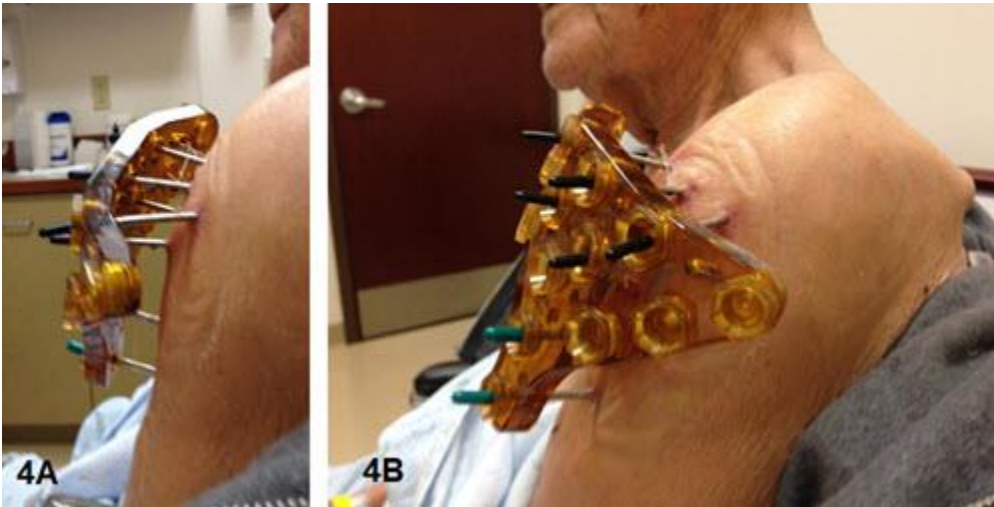
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Patient Progress

- Initial 2-week postoperative visit
 - Range of motion 25° external rotation and 60° forward elevation
 - The fixation device was in a good position (Figures 4a-c); X-rays were obtained (Figures 5a-c)
 - VAS pain score of 40 mm
 - Patient started on passive supine forward elevation exercises
- 6-week follow-up visit
 - Passive range of motion of 30° external rotation and 95° forward elevation
 - VAS pain score of 30 mm
 - Mild erythema at one pin site, but no purulent drainage; patient placed on Keflex for 10 days
 - Radiographs revealed maintained fracture reduction and callus formation

- 8-week follow-up visit
 - Returned for removal of the external fixator (may be performed at 6 weeks)
 - Performed in the outpatient clinical setting; well tolerated by the patient
 - 3-month follow-up visit
 - VAS pain score of 10 mm
 - Active forward elevation 135°, active external rotation 40°, and internal rotation to T12
 - Strength 4 out of 5 in internal and external rotation and 4 out of 5 in his deltoid
 - Radiographs revealed continued bony healing with no loss of reduction
- 6-month follow-up visit
 - Patient had recurrent fall and sustained distal clavicle fracture but no injury to proximal humerus
 - Active forward elevation 135°, active external rotation 45°, and internal rotation to T10
 - Strength 4+ out of 5 in internal and external rotation and 4+ out of 5 in his deltoid
 - VAS pain score of 40 mm, SANE score of 85%, Simple Shoulder Test score of 8
 - Radiographs revealed continued bony healing with no loss of reduction (Figures 6a-c)

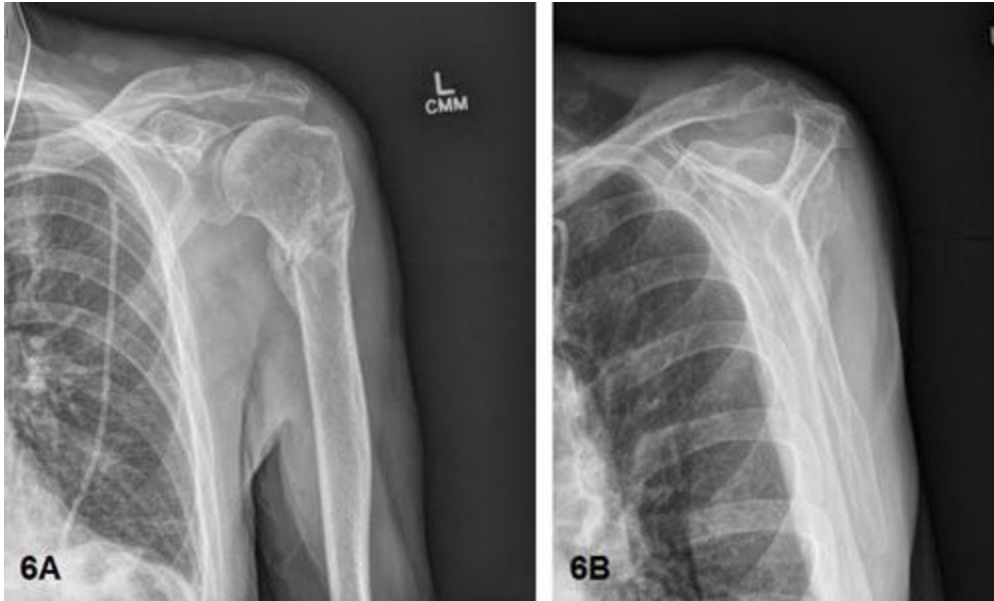




Figures 4a-c. Fixation device in position 2 weeks postoperatively.



Figures 5a-c. Radiographs confirm continued adequate reduction 2 weeks postoperatively.



Figures 6a-c. At the 6-month follow-up visit, radiographs show continued bony healing with no loss of reduction.

Author Information

Daniel Davis, MD, is a resident in the Department of Orthopaedic Surgery, Thomas Jefferson University, Sidney Kimmel Medical College, Philadelphia, Pennsylvania. [Luke S. Austin, MD](#), is a shoulder and elbow surgeon with The Rothman Institute, Philadelphia, Pennsylvania. He is also an Assistant Professor of orthopaedic surgery at Thomas Jefferson University Hospital, Philadelphia, Pennsylvania.

Shoulder Reconstruction Section Editor, Rothman Institute Grand Rounds

Luke S. Austin, MD

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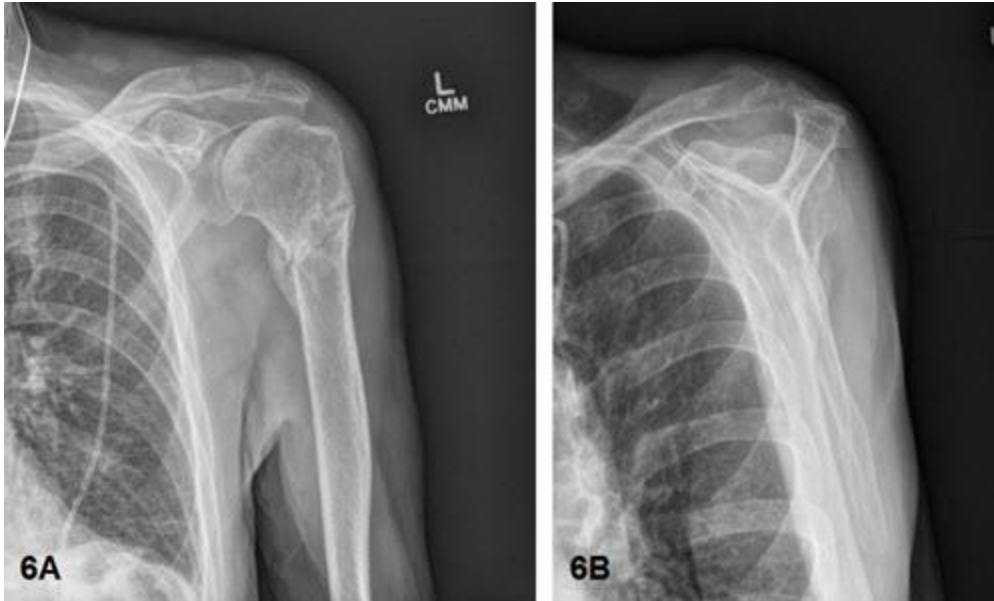
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