# Re-Injury Fall Leading to Gross Hardware Failure in Humeral Shaft Fracture Revised with Intermedullary Nail with Additional Distal Fracture: A Salvage Case Study

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## BACKGROUND

Proximal humerus fracture is the third common limb fracture following hip and distal radius fractures[1]. At this point in time, there no definitive standard of treatment for these fractures. Fractures of the proximal humerus can be managed non-operatively or surgically with plate and screw constructs or with intramedullary nails (IMNs). Conservative management eliminates all surgical risk, however, carries the risk of secondary displacement [1], malunion, and non-union depending on severity of initial injury displacement. IMN has been shown to have an overall smaller incision length, shorter operation time, reduced peri-operative bleeding and faster fracture healing time[1,2,3] and is preferred for patients with comorbidities[4]. Biomechanically, the central fixation of IMN can resist greater varus force and maintains better stability in eversion, flexion and extension[1]. However, IMN has been linked an increased risk of shoulder complications such as shoulder impingement, restriction of movement and concern for injury to the radial nerve[5].

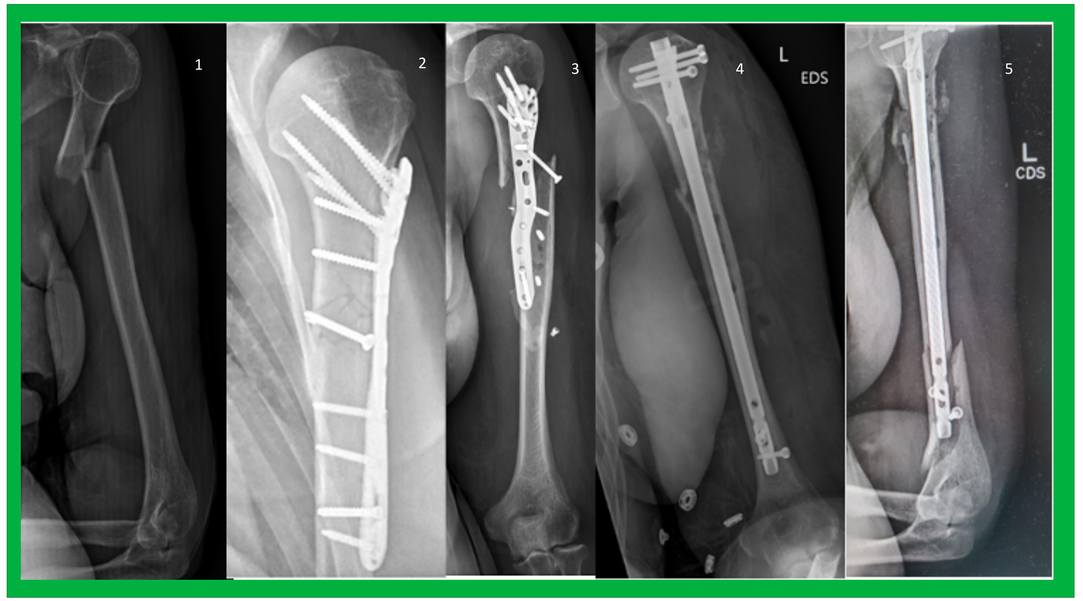
Like proximal humerus fractures, the management of distal humerus fractures ranges from conservative functional bracing to internal fixation with plate and screws. However, distal humerus fractures have a unique challenge with the proximity to the elbow joint. Although it may be difficult to obtain a rigid fixation structure without compromising the joint, operative fixation has been shown to give greater satisfactory results with long term success and is now largely considered the current standard treatment [6]. Non-operative treatment is utilized in non-displaced fractures and in patients unable to tolerate surgery [6].

### Case Snapshot

- Proximal radius fracture treated with ORIF plate and screw construct
- Fall leading to construct failure 6 weeks s/p ORIF
- Hardware removal and placement of IMN
- Fall leading to distal peri-implant fracture
- Long arm cast to hinged elbow brace
- Removal of proximal hardware

## CASE PRESENTATION

A 68-year-old female presented to the ED with left proximal arm pain that she sustained after a fall. Imaging confirmed a left proximal third humerus fracture that was >100% displaced with valgus and recurvatum angular deformity (1). Six days following the initial injury the patient underwent open reduction and internal fixation with a plate and screw construct. At the six-week post-op, the patient showed significant improvement (2). Three days after this visit, the patient returned to the ED with pain following another fall. Imaging identified gross construct failure with new fracture and comminution in addition to re-displacement of the initial fracture (3). The decision was made to place an IMN pending successful removal of the broken hardware. All hardware was removed, and the patient underwent revision open reduction internal fixation using an IMN (4). The patient then fell again about 3 weeks after the second surgery sustaining a peri-implant fracture around the distal nail and locking screws (5). There was also slight backing out of proximal screw which was palpated through the skin. Overall, the alignment was well maintained with intact hardware and so the decision was made to treat the new fracture with a long-arm cast and quickly replaced to a hinged elbow brace to allow range of motion. The proximal screws have since been removed and the patient is doing well.




## DISCUSSION

This case represents a complex problem of revision and salvage following a re- injury after typical humeral shaft fracture surgery. The choice of revision construct required consideration of multiple factors including the ability to remove all broken hardware and use of a trephine creating large holes and stress risers that needed to be sufficiently spanned. With the successful removal of all hardware, IMN allowed the ability to stabilize the previous screw holes as well as areas of comminution spanning the entire humerus without the larger more invasive approach with a plate. It additionally provided the benefit of a biomechanically stronger construct than a plate which was an added advantage in this accident-prone patient.

The subsequent distal humerus fracture in our patient had maintained alignment and the remaining hardware intact, a non-operative approach was successful in treatment and eliminated the risks of an additional operation. Ultimately, IMN was successful in the revision of a plate construct failure due to traumatic re-fracture in proximal humerus and conservative management was successful in treating an additional distal humerus fracture.

### Surgical Considerations

- Healthy surgical candidate and co-morbidities
- Displaced vs non-displaced fractures
- Risk of non-union or mal-union
- Ability to remove broken hardware
- Biomechanical advantages and disadvantages of constructs
- Clinical expectations

### References

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