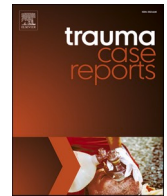




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## Case Report

# Locking compression plate fixation of periprosthetic distant humeral fracture after intramedullary nail for humeral shaft fracture: A case report

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Periprosthetic distant humeral fracture after intramedullary nail for humeral shaft fracture is relatively rare in clinical practice. Only a few cases have been reported in literature [1,2]. It is extremely rare for a distal humerus fracture around the prosthesis due to re-injury only 3 weeks after intramedullary nailing. Also, the treatment of such case is very complex and challenging. Because it is always difficult to achieve satisfactory fixation with an intramedullary device, while minimizing soft tissue disruption. We hereby present a case of a periprosthetic distal humeral fracture (occurring below an intramedullary humeral nail inserted for fixation of a midshaft humeral shaft fracture) that was successfully managed using a locking compression plate with cerclage cables.

## Case presentation

A 47-year-old woman injured her left humerus due to a fall. Initial radiographs and CT revealed a transverse, angulated, midshaft of left humeral shaft fracture (2018 OTA 12A3) (Fig. 1a–b), and the patient underwent a close reduction and internal fixation with an intramedullary nail four days after injury. Excellent reductions were achieved according to post operation X-ray and CT (Fig. 1c–f). However, after the patient was discharged from hospital one week after the operation, the patient reinjured her left humerus with swelling and pain due to a fall from 0.8 meter high of window platform at home 3 weeks after the operation. She was then sent to the emergency department of our hospital immediately and initial radiographs revealed periprosthetic distal humeral fracture occurred below the intramedullary humeral nail while the humerus shaft fractures were well aligned without intramedullary nail loosening (Fig. 1g–i). She was readmitted and reoperated one week after the injury.

The patient was placed in a supine position under general anesthesia. The posterior-lateral of distal humerus approach was used. The distal locking screw was removed and radial nerve of posterior humerus was exposed and protected. Reduction forceps were used

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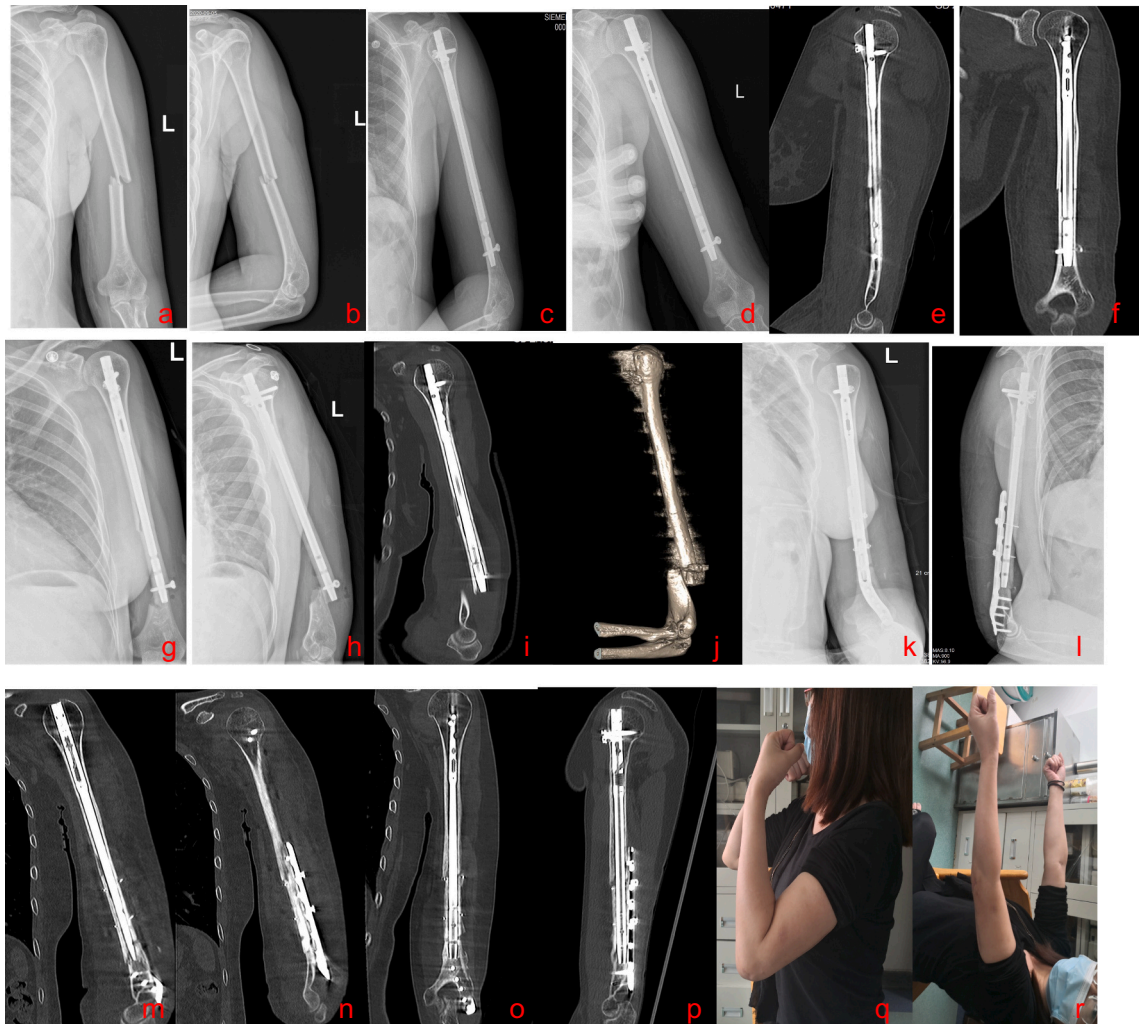
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**Fig. 1.** Female 47 years old. Humeral shaft fracture of left side a–b. AP and lateral view X-ray of left humerus showed mid shaft of humeral fracture (OAT classification of 12A3). c–f. AP and lateral view X-ray and CT of left humerus first day after surgery showed excellent reduction and good alignment by intramedullary nail fixation. g–j. AP and lateral view X-ray and CT of reinjury left humerus three weeks after surgery showed periprosthetic distant humeral fracture. k–n. AP and lateral view X-ray and CT of left humerus first day after reoperation showed excellent reduction of periprosthetic distant humeral fracture. o–p. CT of left humerus five months after reoperation showed union of periprosthetic distant humeral fracture. q–r. Outside view of patient five months after reoperation showed good motion of elbow joint.

to maintain reduction for the distal humeral fracture temporary. A six-hole distal humeral plate (LCP plating system, Depuy Synthes) was then chosen as a dynamic compression plate. After that, five locking screws were inserted into the distal humerus, while the proximal humeral of fracture were fixated by two unicortical locking screws and two cerclage cables. Good reduction and stable fixation of fracture were confirmed under direct vision. Postoperatively, a triangular towel was suspended on the forearm for 6 weeks, gradually restoring elbow function and allowing shoulder and elbow movement. CT showed bony union at 5 months after ORIF (Fig. 1o–p). At the last follow-up on the end of 5 months postoperatively, the patient had no shoulder and elbow pain. The active elbow ranges of motion were an extending of  $0^{\circ}$ , flexion of  $140^{\circ}$  (Fig. 1r–s), pronation of  $90^{\circ}$ , supination of  $90^{\circ}$ . The active shoulder ranges of motion were an anterior elevation of  $120^{\circ}$ , external rotation at the side of  $50^{\circ}$ , and internal rotation to the 3rd lumbar vertebra. The numerical rating scale for pain was zero. The American Shoulder and Elbow Surgeons shoulder scores were 80 and she was able to perform all daily activities without assistance.

## Discussion

Periprosthetic distal humeral fractures are uncommon injuries in clinical practice. There have been a number of reports in the literature on distal humeral fractures occurring near the humeral component of either a shoulder arthroplasty or an elbow

arthroplasty. Periprosthetic distant humeral fracture after intramedullary nail for humeral shaft fracture is relatively rare in clinical practice. Only a few cases have been reported in literature [1–3].

It is extremely rare for a distal humerus fracture around the prosthesis due to re-injury only 3 weeks after intramedullary nailing. As far as we know, there has been no report in the literature. Similar to our patient, the distal region of the intramedullary nail locking screw had an increased risk of fracture due to increased stress [3]. The treatment of such a case is very complex and challenging.

Firstly, Fractures of the distal humerus around prosthesis with intramedullary nailing are obviously displaced and difficult to reduce due to the mass effect of intramedullary nails. Secondly, for extremely unstable fractures, maintaining reduction with cast to this kind of short oblique fracture can also be complex and challenging. Even when unavoidable, prolonged immobilization can lead to stiff elbows and dysfunction. ORIF is a treatment option in the absence of evidence of intramedullary nail loosening.

ORIF is also a challenge in this situation. Both distal humeral and humeral shaft fractures require plate fixation after nail removal, which inevitably require extended incisions and extensive soft tissue dissection. And it would also lead to a nonunion or delayed union of humeral shaft fracture or even failure of operation that destroyed blood supply both inside and outside of humeral intramedullary.

It would limit the way of screw fixation on the proximal plate such as bicortical locking screws that cannot be fixed due to the mass effect of the nail and the thickness of the bone cortex. Therefore, it could only be done by cerclage cable or one cortical screw fixation which is inferior to bicortical locking screws concerning torsion load and axial compression load [4,5]. That is why we increased two cerclage cables after two uncortical locking screw fixation in operation to avoid loose and failure of internal fixation. We removed the distant locking screw of the nail for the reason that it alleviates the distant humeral fracture and provides a better location of the plate. Primary humeral shaft fracture lines were confirmed under direct vision after removing the screw. Periprosthetic distant humeral fractures were found stable after fixation of a posterior lateral locking compression plate.

## Conclusion

The periprosthetic distant humeral fracture is rare in clinical practice but should be paid more attention to because of its special fracture site. We demonstrated how to manage these difficult fractures successfully through a posterior incision with the use of a single locking plate combination with uncortical locking screws and cables around the region overlapped with the humeral nail. Soft tissue management is paramount to maintain vascularity to the fracture region and maximize healing potentials.

## Consent informed

Consent was obtained from the patient for publication of this case report and accompanying images.

## Conflict of interests

The authors declare that they have no conflict of interests.

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