

General

Minimal invasive plate osteosynthesis for the dislocated humeral head fracture associated with ipsilateral humeral shaft fracture: A case report

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The condition combining a dislocated humeral head fracture and an ipsilateral humeral shaft fracture is seen to be rare in literature, which is limited to case report or case series. Furthermore, effective management of these coexistent injuries is still a subject of debate. The essential purpose of this article is to report another treatment method for this condition. We present a case of a 79-year-old female patient who suffered a three-part humeral head fracture-dislocation associated with the ipsilateral humeral shaft fracture. The combined injuries were managed by minimal invasive plate osteosynthesis (MIPO) through the deltopectoral approach with the eventual result of bone healing and good function after thirty-three months of follow-up. In conclusion, MIPO should be considered a safe and effective option, however, the risk of traumatic osteonecrosis of the humeral head is taken into account before operation decision-making.

INTRODUCTION

The dislocated humeral head fracture associated with ipsilateral humeral shaft fracture is a rare injury. Some articles regarding two-part or three-part humeral head fracture-dislocation combined with humeral shaft fracture are reported, however, these articles are limited to case report or case series.¹⁻⁵ The condition usually occurs in the elder population over 60-year-old with high-energy mechanical trauma or in osteoporosis population with low-energy mechanism. Different treatment protocols are applied among authors; thus, the optimal one is still a controversial issue. We report a successful clinical case by MIPO protocol with the essential purpose of providing a different perspective of treatment.

CASE PRESENTATION

A 79-year-old female was referred to our emergency department with a painful left arm shortly after slipping on a wet floor. Initial assessment revealed no life-threatening injuries, severe pain and swelling from her shoulder to the middle third humerus, angular deformity in the middle third, bony crepitus palpable in the injured site, and no neurovascular impairment. X-ray delineated that a three-part humeral head fracture involved greater tuberosity and surgical neck fragments, anterior glenohumeral dislocation, and spiral fracture of the humeral shaft. A shoulder

CT scan was indicated to obtain further information for operative planning, demonstrating a three-part fracture with little bone loss; and a calcar fragment > 8mm and its displacement < 2mm (Fig 1).

ETHICAL CONSIDERATIONS

We present a case report that doesn't require ethical review or approval. We ensure that the patient has already been informed and consented to the protocol management and publication in Orthopedic Reviews Journal.

MANAGEMENT AND OUTCOMES

The patient was operated in beach-chair position with a small pillow under the ipsilateral scapula to isolate the injured arm. Under general anesthesia, a 6-cm incision was made corresponding to the traditional deltopectoral approach. Blunt dissection then was performed to expose the fracture without soft tissue impairment. The dislocation-fracture of the humeral head was delicately reduced and temporarily fixed by 1.8-2.0mm Kirschner wires under fluoroscopic imaging. A technical tip was the usage of Kirschner wires as joysticks associated with Fiber suturing through infraspinatus tendon footprints to manipulate the great tuberosity fragments. A 7-hole PHILOS (Synthes) plate was percutaneously placed across the humeral shaft fracture for definitive fixation of the combined fractures

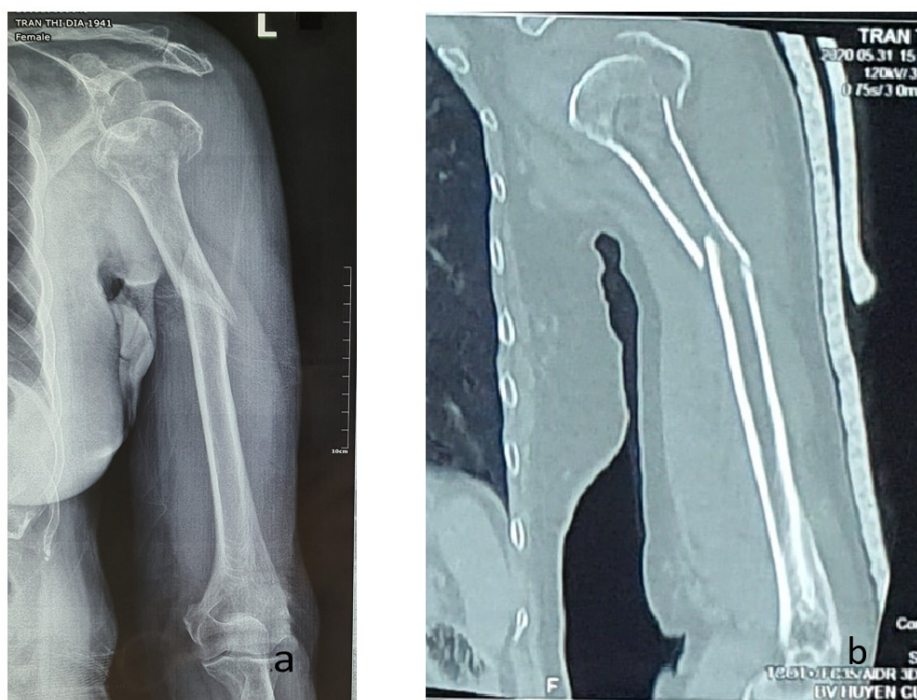


Figure 1. X-ray and CT scan depicted a three-part humeral head fracture and spiral middle part fracture of the humerus.

(Fig 2). The plate was bent in a helical fashion in the middle third of the plate. A 3-cm incision was made in the distal fragment to control the distal position of plating, followed by another 1.5-cm incision in the middle to add a cortical screw compressing the plate on the bone, finally adding locking screws under fluoroscopic imaging to accomplish osteosynthesis. Because of the large greater tuberosity, which was not completely stabilized by the PHILOS plate, a 2.0mm K-wire was not withdrawn to increase its stability. A degenerative supraspinatus tendon tear was found when exposing the humeral head, and repaired to its footprint by a transosseous suture procedure. Incised wounds were carefully closed without drainage.

Postoperatively, a rotator cuff brace was indicated for six weeks to protect the rotator cuff repair. The patient was transferred to a physiotherapist for enhanced recovery after surgery (ERAS) protocol. Scapulothoracic mobilization was encouraged immediately at the first postoperative days. PROM of shoulder was steadily increased from the 2nd to 6th week. Associated AROM was allowed from the 4th week and gradually converted to full AROM in the 12th week. Moreover, bisphosphonate and daily calcium - vitamin D3 were prescribed for management of osteoporosis and prevention of refracture. The formation of the soft callus occurs in humeral head fracture and humeral shaft fracture, respectively in the 8th week and 12th week. The patient complained about the irritated protrusion of K-wires in the proximal fracture site, which was removed in the 12th week then. After thirty-three months, the fractures were completely healing without avascular osteonecrosis of the humeral head and good shoulder function with 73 points Constant-Murley (Fig 3).

DISCUSSION

Humeral head fracture associated with ipsilateral humeral shaft fracture was seen as a rare condition. We searched on many published resources and found not many articles regarding this issue, especially series case. We found three articles reporting three-part fracture dislocation of the humeral head associated with ipsilateral humeral shaft fracture with different operative protocols.

Flint et al. (2008) described a 69-year-old female who sustained a three-part humeral fracture with anterior dislocation, three-part humeral head fracture and concomitant humerus shaft fracture was conservatively treated due to operative rejection.³ The patient ended with a good outcome, however, the author recommended conserved treatment is not suitable for those young and high-level functional demand.

Tomás Pérez Cervera et al. (2016) reported a 63-year-old male who sustained a three-part humeral fracture-dislocation involved with anatomical neck and great tuberosity, ipsilateral humeral shaft fracture.⁵ The patient got an iatrogenic injury of the axillary artery when the first attempt at close reduction of the fracture-dislocation. The combined fractures were treated 5 days ago with cemented stem hemiarthroplasty associated with a long proximal humeral plate. The outcome was good eventually.

Guillaume Herzberg et al. (2017) reported an 84-year-old male who suffered similar injuries was operated with a long stem shoulder hemiarthroplasty associated with screw osteosynthesis of humeral shaft fracture.⁴ The patient had a good to excellent result after thirty months of follow-up.

The above articles showed that conservative treatment could be a good indication for old patients or those having

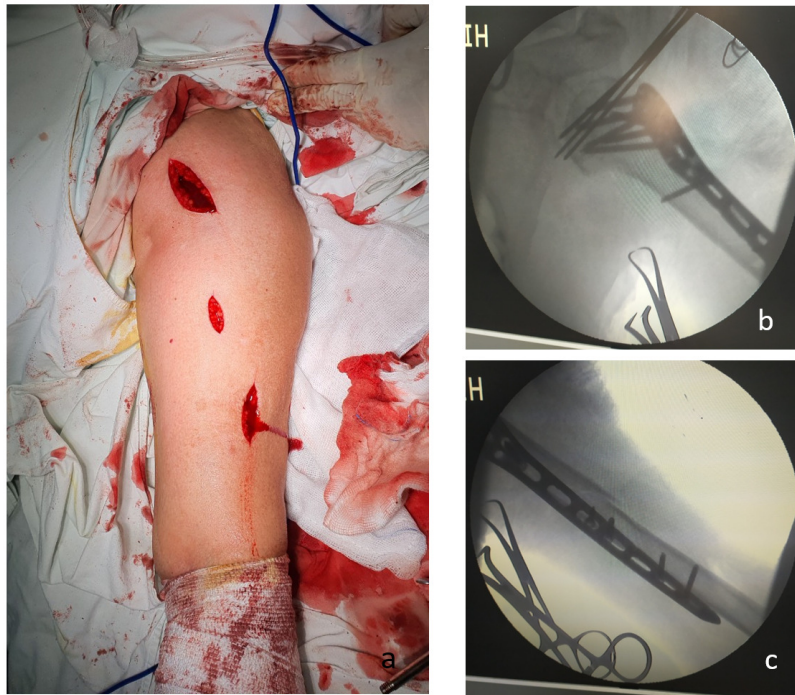


Figure 2. (a) 3 mini incisions were made in MIPO approach. (b) (c) fluoroscopic images checked the bone-plate-screw figuration in operation.

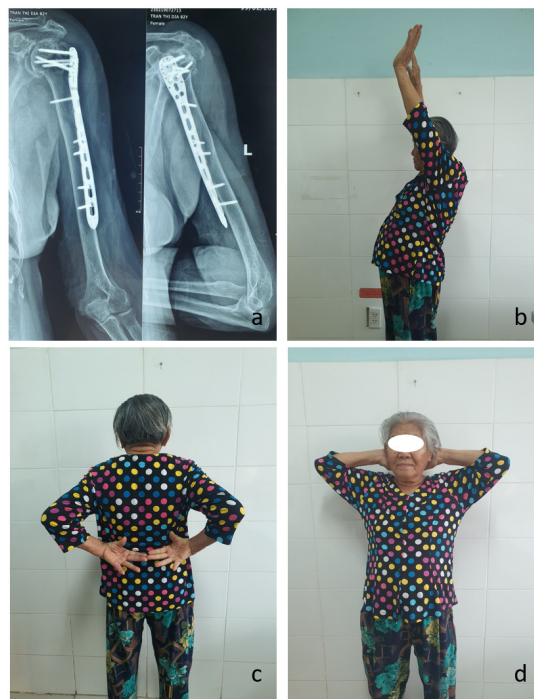


Figure 3. (a) X-ray in 33 months of follow-up showed good fracture healing without osteonecrosis of the humeral head. (b)(c)(d) The patient had good function of the left arm compared to the right eventually.

low-level functional demands but for those young and high demands. Arthroplasty associated with osteosynthesis could be a good alternative protocol, however, intervention has much complexity, invasion, and a high risk of operative complications, especially in old patients with comorbidities. In our case, we performed MIPO protocol for the combined fracture with well-defined bone healing, good should-

er function, and cosmetics. Bone graft was no need due to little bone loss in CT scan.

The vascular supply of the proximal humerus originated from the anterior circumflex humeral artery and posterior circumflex humeral artery. Hertel et al. measured humeral blood supply by Doppler laser and discovered that if the calcar fragment of humeral head fracture is measured over

8mm and displaced below 2mm, the risk of avascular necrosis of humeral head is significantly low due to no impairment of its blood supply.⁶ In our case, the imaging findings (CT scan and X-ray) showed the calcar fragment with measurement above 8mm and minimal displacement, thereby reflecting a low risk of avascular necrosis. As a result, osteosynthesis is considered as a reasonable option for this case.

In studies conducted by Ugur G onç,⁷ Riccardo Luigi Alberio,⁸ and Dario Attala,⁹ MIPO with delta splitting approach is reported as a safe and effective option for three-part proximal humeral fractures. Manipulation of multifragmentary proximal humeral fractures through a small lateral anterior window is technically high demand, meanwhile, [W Kongcharoensombat](#) et al. demonstrated that a 5-cm safe zone from the lateral edge of acromion described in traditional literature is not suitable for Asian regarding threat to the axillary nerve.¹⁰ Recent studies showed MIPO through the deltopectoral approach had safety and good results when treating proximal humeral fractures as well as humeral shaft fractures.^{11,12} Furthermore, when reduction failed with MIPO through the deltopectoral approach, it's quite easy to convert MIPO approach into the traditional deltopectoral approach as a backup plan. Consequently, we preferred MIPO through deltopectoral for treating our case.

CONCLUSION

Three-part humeral fracture-dislocation associated with ipsilateral humeral shaft fracture is rare with few cases reported by different protocols. We present a case successfully treated by MIPO protocol. MIPO should be considered as a safe and effective option, however the risk of

traumatic osteonecrosis of the humeral head is taken into account before operation decision-making.

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AUTHOR CONTRIBUTION

Nhat Pham Van: Conceptualising the plan for surgery, performing the surgery, follow up patient's recovery, writing the literature review for case report, reviewing the manuscript.

Hieu Nguyen Chi: Completing the manuscript, submission of the article, writing the literature review.

Tuan Nguyen Anh: Assisting the surgery, analyzing the radiology and MRI.

Xuan Tran Chanh: Assisting in planning and in the surgery, writing the draft for case report.

Tuan Nguyen Anh: Assisting in planning and in the surgery, writing the literature review, taking note of post-operative functions.

CONFLICT OF INTERESTS

We declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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REFERENCES

1. Gupta Y, Jha RK. Compound fracture of humeral shaft associated with two-part fracture dislocation of ipsilateral shoulder: a rare combination. *J Surg Case Rep*. 2015;2015(2). doi:10.1093/jscr/rju153
2. Chun JM, Pawaskar A, Jeon IH. Fracture dislocation of the proximal humerus with ipsilateral shaft fracture: a report of two cases. *Acta Orthop Traumatol Turc*. 2013;47(5):370-375. doi:10.3944/aott.2013.2818
3. Flint JH, Carlyle LM, Christiansen CC, Nepola JV. Case report and literature review anterior shoulder dislocation with three-part proximal humerus fracture and humeral shaft fracture. *Iowa Orthop J*. 2009;29:105-113.
4. Herzberg G, Tebaa E. Combined three-part humeral anterior fracture-dislocation and humeral shaft fracture treated with one-stage long stem shoulder hemiarthroplasty in an active elderly patient- A case report and review of literature. *SICOT-J*. 2017;3(62):62. doi:10.1051/sicotj/2017045
5. Cervera TP, Roca L, Montalvo MÁM. Shoulder Dislocation with Head and Shaft Fracture Ipsilateral. *J Arthritis*. 2016;5:194.
6. Hertel R. Fractures of the proximal humerus in osteoporotic bone. *Osteoporos Int*. 2005;16(S02):S65-S72. doi:10.1007/s00198-004-1714-2
7. Gönç U, Atabek M, Tekler K, Tanrıöver A. Minimally invasive plate osteosynthesis with PHILOS plate for proximal humerus fractures. *Acta Orthop Traumatol Turc*. 2017;51(1):17-22. doi:10.1016/j.aott.2016.10.003
8. Alberio RL, Del Re M, Grassi FA. Minimally Invasive Plate Osteosynthesis for Proximal Humerus Fractures: A Retrospective Study Describing Principles and Advantages of the Technique. *Adv Orthop*. 2018;2018:1-10. doi:10.1155/2018/5904028
9. Attala D, Primavera M, Marcantonio A, et al. The role of minimally invasive plate osteosynthesis (MIPO) technique for treating 3- and 4-part proximal humerus fractures in the elderly - a case study. *Acta Biomed*. 2021;2;92(4):e2021251.
10. Kongcharoensombat W, Wattananon P. Risk of Axillary Nerve Injury in Standard Anterolateral Approach of Shoulder: Cadaveric Study. *Malays Orthop J*. 2018;12(3):1-5. doi:10.5704/moj.1811.001
11. Zhao L, Yang P, Zhu L, Chen AM. Minimal invasive percutaneous plate osteosynthesis (MIPPO) through deltoid-pectoralis approach for the treatment of elderly proximal humeral fractures. *BMC Musculoskelet Disord*. 2017;18(1). doi:10.1186/s12891-017-1538-9
12. Zhou ZB, Gao YS, Tang MJ, Sun YQ, Zhang CQ. Minimally invasive percutaneous osteosynthesis for proximal humeral shaft fractures with the PHILOS through the deltopectoral approach. *Int Orthop*. 2012;36(11):2341-2345. doi:10.1007/s00264-012-1649-8