Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 7, 1476-1481
2025
Publisher: Learning Gate
DOI: 10.55214/25768484.v9i7.8943

Proximal humerus fixation failure for 3 parts proximal humeral fracture in plating and reverse total shoulder arthroplasty: A case report

Faizal Ariffianto Soehadak[1], Vincent Gunawan[2], Rio Yudistira Christianto[3], Heri Suroto[4*]
[1,2,3,4]Department of Orthopedics and Traumatology, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia; faizalsoehadak@gmail.com (F.A.S.) vincent.gunawan97@yahoo.com (V.G.) rioyudistira26@gmail.com (R.Y.C.) heri-suroto@fk.unair.ac.id (H.S.).
[1,2,3,4]Department of Orthopedics and Traumatology, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.
[4]Cell and Tissue Bank-Regenerative Medicine Center, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.

Abstract: Proximal humeral fracture (PHF), with an incidence rate of 266: 100.000 people, is a common and challenging fracture. Open reduction internal fixation (ORIF) is an option for managing it by using a proximal humeral plate or Reverse Total Shoulder Arthroplasty (RTSA) if shoulder arthroplasty is being considered. We report a 66-year-old male with a 3-part PHF initially treated with ORIF. Twenty-six months later, the patient developed non-union with humeral head osteonecrosis (HHO), leading to RTSA. After initial improvement, he presented 40 months post-RTSA with shoulder dysfunction following a massage. Imaging revealed implant failure. Revision surgery showed wear of the metaphyseal component and soft tissue metallosis. The component was replaced, and the tissue debrided. Postoperatively, the patient experienced mild pain with improved but limited shoulder motion. This case illustrates multiple complications in PHF management, including fixation failure and HHO due to lack of medial calcar support. Despite literature supporting RTSA over ORIF in older patients, implant design and bone loss remain significant factors for RTSA failure. Metallosis, although rare, may arise from component wear and should be considered in revision planning. In managing PHF, medial calcar support restoration should be done to minimize the risk of HHO, especially in elderly osteoporotic bone. When HHO occurs, osteosynthesis could be converted to RTSA. In the case of RTSA, further research is needed to minimize the risk of implant failure, reoperation, and especially metallosis because an extensive debridement can lead to instability.

Keywords: *Fixation failure, Metallosis, Plating, Reverse total shoulder arthroplasty, Proximal humerus.*

1. Introduction

Proximal humeral fracture (PHF) is a common type of humerus fracture with an incidence rate of 266 cases in 100.000 people. Managing it can be challenging, especially in older people with osteoporotic bone. The one-year mortality rate of the patient managed by conservative means is as high as 16.4% compared to surgical and shoulder arthroplasty means (9.3% and 7.4%, respectively) [1]. Osteosynthesis by Open reduction and internal fixation (ORIF) is an option for managing PHF using a proximal humeral plate. However, many factors must be considered to avoid undesired results, such as Humeral Head Osteonecrosis (HHO) [2-4].

When HHO has occurred, osteosynthesis may be converted to shoulder arthroplasty.[3] Similar to osteosynthesis, in shoulder arthroplasty, many factors must be considered, too, to avoid complications. Those complications include instability, infection, implant loosening, periprosthetic fracture, component failure, and even an uncommon case of metallosis [5, 6].

We report a case of proximal humerus fixation failure after plating fixation and component failure with metallosis in reverse total shoulder arthroplasty (RTSA).

History: Received: 23 May 2025; Revised: 24 June 2025; Accepted: 27 June 2025; Published: 18 July 2025
* Correspondence: heri-suroto@fk.unair.ac.id

2. Case Report

A 66-year-old man presented with acute right shoulder pain due to a motorcycle accident but was otherwise healthy. His right shoulder appeared swollen and tender, with a limited active and passive Range of Motion (ROM). His X-ray showed 3 Parts of PHF (Figure 1a). He is planned to undergo ORIF using a proximal humeral plate and screw. The pain was controlled, and the patient was discharged without complications.

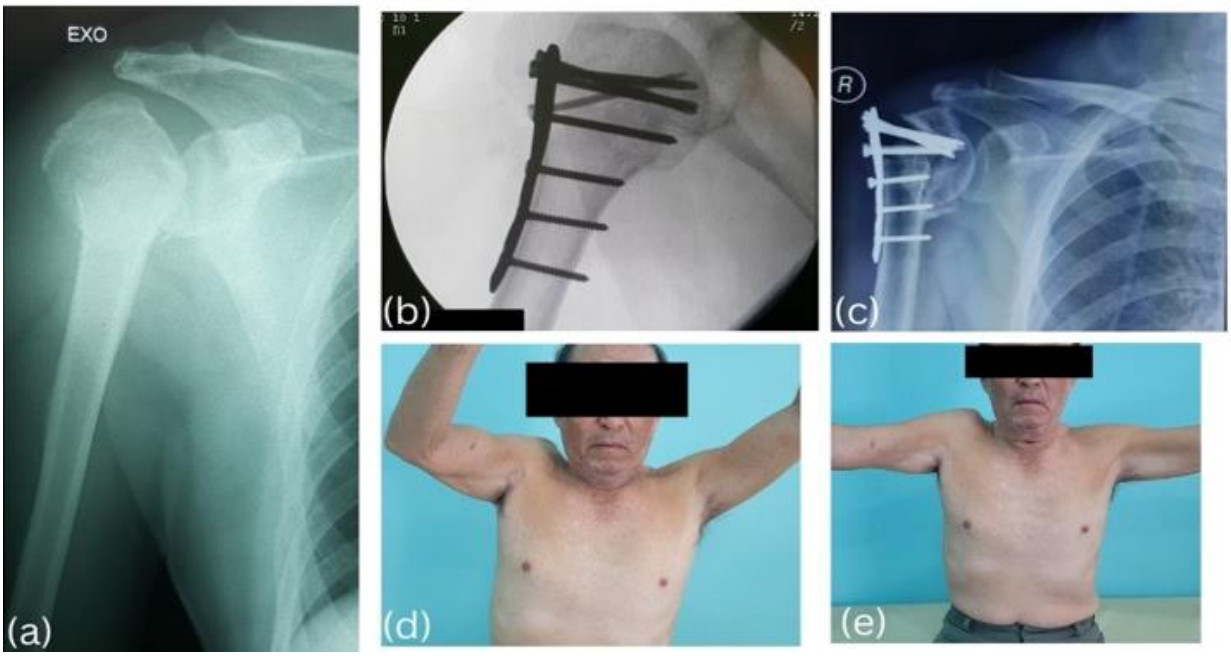

Figure 1.
(a) Preoperative radiography, (b) intraoperative, (c) 26 months postoperative in AP, (d) clinical shoulder abduction 26 months after proximal humeral plate and screw, (e) with mark deformities.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 7: 1476-1481, 2025
DOI: 10.55214/25768484.v9i7.8943

Figure 2.
(a) X-ray after RTSA, (b) shoulder abduction in 2 months after RTSA, (c) performing overhead activity, (d) weighted abduction 2 years after RTSA.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 7: 1476-1481, 2025
DOI: 10.55214/25768484.v9i7.8943

Figure 3.
(a) X-ray showed a failed component of RTSA, (b) intraoperative documentation of a mark wear-out of the metaphyseal component of the RTSA, (c) metallosis of adjacent tissue, (d) clinical picture 10 days after RTSA revision in active and passive, (e) shoulder flexion active (f) shoulder flexion passive, (g) shoulder abduction.

He eventually came back 26 months postoperatively with right shoulder pain that worsened even during rest and difficulty in abducting it since three months prior—no history of trauma or any systemic symptoms. There is a deformity on his right shoulder in 90 degrees of abduction, active ROM (aROM) of 0–95 degrees, and no signs of infections (Figure 1d,e). A shoulder X-ray revealed a non-union PHF with HHO (Figure 1c). He is being planned to undergo Reverse Total Shoulder

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 7: 1476-1481, 2025
DOI: 10.55214/25768484.v9i7.8943

Arthroplasty (RTSA). Intraoperatively, there was no evidence of an infection process. Therefore, the proximal humerus plate was removed and replaced by RTSA (Figure 2a). 2 months after RTSA; he could perform shoulder abduction better without any disturbing pain with aROM of 0–135 degrees (Figure 2b). 2 years after RTSA he could perform weighted abduction and overhead activities without any marked pain (Figure 2c,d). He had a Quickdash-9 score of 23.5.

Forty months after RTSA, he came again with an inability to abduct his right shoulder. It happened when he went for a massage, lying in pronation with an abducting arm. He heard a cracking sound in his right shoulder after the therapist pressed his lower back and couldn't abduct his right shoulder ever since. The radiograph revealed RTSA implant failure (Figure 3a), and RTSA revision is being planned. Intraoperatively, there is a failed metaphyseal component with a marked wear-out component that connects to the stem (Figure 3b.) A soft tissue metallosis was seen around the metaphyseal component (Figure 3c). We debrided the soft tissue and changed the metaphyseal component. 2 days postoperatively, he was discharged with no complications. 2 weeks after RTSA revision, he felt slight pain with shoulder abduction aROM of 0–40 degrees and passive ROM (pROM) of 0–80 degrees and shoulder forward flexion of 0–55 degrees and 0–85 degrees for aROM and pROM, respectively (Figure 3d-g). His Quickdash-9 score for 2 weeks postoperative is 49.5.

3. Discussion

Managing PHFs in the elderly population is challenging. In this case, a 66-year-old man with a 3-part PHF was initially managed by a proximal humeral plate using a deltopectoral approach. Twenty-six months later, it progressed to HHO and eventually underwent RTSA. With a disrupted medial hinge and <8mm of calcar length, based on Hertel criteria, the patient has a risk of developing HHO [7]. However, a systematic review and meta-analysis by Suroto, et al. [8] conclude that RTSA can be recommended over ORIF for patients above 65 years old [8, 9] in their meta-analysis, also found that ORIF has the worst clinical outcomes regarding reoperation rate compared to non-operative, RTSA, and hemiarthroplasty Du, et al. [9].

Cruz, et al. [4] and Campochiaro, et al. [10] found that Hertel criteria were insufficient in predicting the risk for HHO [4, 10]. Disruption of medial calcar support is a significant predictor for failure, even more so in fixation without restoration of calcar support [3, 11, 12]. In this case, no calcar screws are being used to support medial calcar. This factor could contribute to unstable fixation and a higher risk of fixation failure. It is also confirmed by Ott, et al. [2] that the use of a calcar screw, even more with a long calcar screw placed near the joint, may increase fracture stability [2].

RTSA was performed after osteosynthesis failure. Nevertheless, the RTSA also failed with component failure and metallosis of adjacent tissues. Figure 3a shows a metaphyseal component unscrewing with a wear out of the component. Cuff, et al. [13] found that in proximal humeral bone loss, modular RTSA in the humeral component is at a higher risk of mechanical failure Cuff, et al. [13] and Boileau [5] explained that due to the loss of proximal humeral bone, the humeral component only fixed distally and suffered rotational stress [5].

During RTSA revision, we found blackened soft tissue surrounding the RTSA implant, which indicates a metallosis process. The wear-out metaphyseal component may lead to metal debris formation attached to surrounding tissue, induce a hypersensitivity reaction, and lead to an inflammatory response. Rondon, et al. [14] and Garnier, et al. [6] found that all metallosis cases being reviewed have a similarity of the use of prosthesis with a titanium-based alloy, while in this case, we use a Titanium-aluminium-vanadium-based implant [6]. Debridement is the cornerstone of metallosis treatment, but other factors also need to be noticed, such as instability, periprosthetic fracture, infection, soft tissue failure, or, in this case, component failure.

4. Conclusion

In managing PHF, when deciding to use plate or osteosynthesis, restoring medial calcar support should be done to minimize the risk of HHO, especially in elderly or osteoporotic bone. Besides

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 7: 1476-1481, 2025
DOI: 10.55214/25768484.v9i7.8943

osteosynthesis, RTSA has also become an option for treating PHF in which the bone is at risk of developing HHO. Further research is needed regarding RTSA to minimize the risk of implant failure, reoperation, and especially metallosis because an extensive debridement can lead to instability.

Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

References

[1] N. Walter *et al.*, "Proximal humerus fractures–epidemiology, comparison of mortality rates after surgical versus non-surgical treatment, and analysis of risk factors based on Medicare registry data," *Bone & Joint Research*, vol. 12, no. 2, pp. 103-112, 2023.

[2] N. Ott *et al.*, "The effect of long calcar screws on the primary stability of 3-part, varus impacted proximal humeral fractures compared to short calcar screws: A real fracture simulation study," *Archives of Orthopaedic and Trauma Surgery*, vol. 143, no. 5, pp. 2485-2491, 2023.

[3] S.-W. Jung, S.-B. Shim, H.-M. Kim, J.-H. Lee, and H.-S. Lim, "Factors that influence reduction loss in proximal humerus fracture surgery," *Journal of Orthopaedic Trauma*, vol. 29, no. 6, pp. 276-282, 2015.

[4] M. A. Cruz, G. G. Mouraria, F. K. Kikuta, D. R. Zogbi, S. de Paula Coelho, and M. Etchebehere, "The hertel classification can't predict the risk of humeral head osteonecrosis after osteosynthesis using an anterolateral approach," *Clinics*, vol. 78, p. 100173, 2023.

[5] P. Boileau, "Complications and revision of reverse total shoulder arthroplasty," *Orthopaedics & Traumatology: Surgery & Research*, vol. 102, no. 1, pp. S33-S43, 2016.

[6] R. Garnier, J. Poupon, N. Djebrani-Oussedik, and J. Langrand, "Titanium cutaneous metallosis after reverse total shoulder arthroplasty," *JSES Reviews, Reports, and Techniques*, vol. 2, no. 2, pp. 190-193, 2022.

[7] R. Hertel, A. Hempfing, M. Stiehler, and M. Leunig, "Predictors of humeral head ischemia after intracapsular fracture of the proximal humerus," *Journal of Shoulder and Elbow Surgery*, vol. 13, no. 4, pp. 427-433, 2004.

[8] H. Suroto, B. De Vega, F. Deapsari, T. Prajasari, P. A. Wibowo, and S. K. Samijo, "Reverse total shoulder arthroplasty (RTSA) versus open reduction and internal fixation (ORIF) for displaced three-part or four-part proximal humeral fractures: A systematic review and meta-analysis," *EFORT Open Reviews*, vol. 6, no. 10, pp. 941-955, 2021.

[9] S. Du, J. Ye, H. Chen, X. Li, and Q. Lin, "Interventions for treating 3-or 4-part proximal humeral fractures in elderly patient: A network meta-analysis of randomized controlled trials," *International Journal of Surgery*, vol. 48, pp. 240-246, 2017.

[10] G. Campochiaro, M. Rebuzzi, P. Baudi, and F. Catani, "Complex proximal humerus fractures: Hertel's criteria reliability to predict head necrosis," *Musculoskeletal Surgery*, vol. 99, no. Suppl 1, pp. 9-15, 2015.

[11] D. Krappinger, N. Bizzotto, S. Riedmann, C. Kammerlander, C. Hengg, and F. S. Kralinger, "Predicting failure after surgical fixation of proximal humerus fractures," *Injury*, vol. 42, no. 11, pp. 1283-1288, 2011.

[12] J.-L. Chen *et al.*, "The outcome of surgical management of proximal humeral fractures using locking plates: Comparison between locking plates with different geometry," *Journal of Shoulder and Elbow Surgery*, vol. 27, no. 12, pp. 2159-2166, 2018.

[13] D. Cuff, J. C. Levy, S. Gutiérrez, and M. A. Frankle, "Torsional stability of modular and non-modular reverse shoulder humeral components in a proximal humeral bone loss model," *Journal of Shoulder and Elbow Surgery*, vol. 20, no. 4, pp. 646-651, 2011.

[14] A. Rondon, T. Clark, and H. Savoie, "Metallosis after reverse total shoulder arthroplasty," *Edorium Journal of Orthopedics*, vol. 3, no. 1, pp. 17–23, 2017.