



# Reverse shoulder arthroplasty for proximal humeral fractures: outcomes comparing primary reverse arthroplasty for fracture versus reverse arthroplasty after failed osteosynthesis

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**Background:** Surgical treatment of proximal humeral fractures in the elderly pose challenges in decision making. Reverse total shoulder arthroplasty (RTSA) has been established as a reliable option for salvage of failed hemiarthroplasty, although few studies have analyzed RTSA after failed open reduction with internal fixation (ORIF). This study evaluated the outcomes of patients with failed osteosynthesis who undergo salvage RTSA compared with patients undergoing primary RTSA for proximal humeral fractures.

**Methods:** We retrospectively reviewed 18 patients who underwent primary RTSA for acute proximal humeral fractures and 26 patients who underwent arthroplasty after failed ORIF at our institution between 2003 and 2013. Minimum follow-up was 2 years, with a mean follow-up 3 years (range, 2.0-6.0 years).

**Results:** There are no statistically significant differences in clinical outcomes between the two cohorts in the American Shoulder and Elbow Surgeons scores and in the most recent forward flexion or external rotation. The salvage RTSA cohort experienced a higher complication rate (8%), including dislocation and aseptic loosening. The primary RTSA cohort had a 5% complication rate, with 1 late prosthetic joint infection requiring reoperation.

**Conclusion:** Although RTSA after failed ORIF has a higher rate of complications compared with acute RTSA, the revision and reoperation rate as well as clinical outcomes and shoulder function remained comparable. When a surgeon approaches these complex fractures in patients with poor underlying bone stock, this study supports acute arthroplasty or ORIF with the knowledge that salvage RTSA still has the potential to achieve good outcomes if osteosynthesis fails.

**Level of evidence:** Level III; Retrospective Cohort Design; Treatment Study

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**Keywords:** Proximal humeral fracture; open reduction internal fixation; reverse total shoulder arthroplasty; failed osteosynthesis; elderly patients; osteoporosis

This study was approved by the Mayo Clinic Institutional Review Board (IRB# 12-007498).

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Proximal humeral fractures account for 5% of all fractures, often occurring in elderly individuals in the eighth to ninth decades of life.<sup>5,8</sup> Although some estimate that only 20% of these fractures require surgery, with the growing elderly population, the number of those with fracture patterns requiring surgical intervention has the potential to rise.<sup>7,13,17,21</sup> Surgical

treatment of proximal humeral fractures in elderly patients poses challenges in decision making.

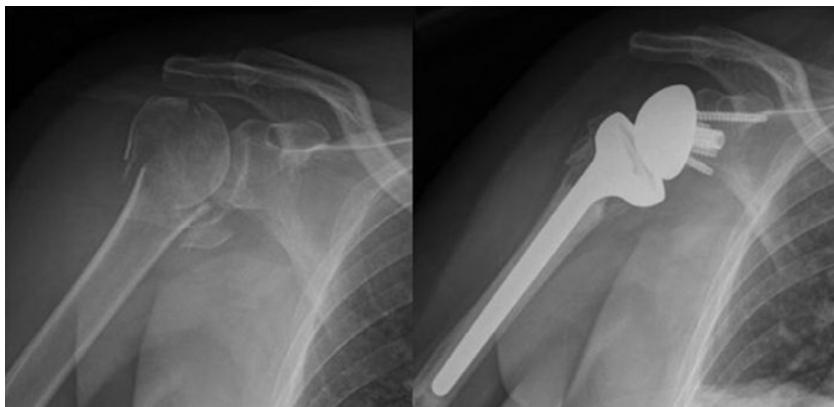
Locking plate technology was perceived as a major improvement in fracture fixation; however, a relatively high complication rate has been reported after internal fixation in patients with fracture comminution and osteoporosis.<sup>2,14,15,18</sup> Failed osteosynthesis results in substantial pain and disability secondary to osteonecrosis, malunion, nonunion, post-traumatic arthritis, humeral head collapse, or a combination of these conditions.<sup>2,14,15,19</sup> When considering alternatives to open reduction with internal fixation (ORIF), some surgeons turn to arthroplasty. In the past, shoulder hemiarthroplasty was the only available option when joint replacement was considered for proximal humeral fractures, with variable outcomes reported.<sup>1,10,12,19,21</sup> Currently, reverse total shoulder arthroplasty (RTSA) has emerged as an attractive option when arthroplasty is considered for acute proximal humeral fractures in low-demand or elderly patients.<sup>3</sup>

Although RTSA has been reported to provide reasonable outcomes for the salvage of failed hemiarthroplasty after fracture, few studies have analyzed the outcome of RTSA after

failed proximal humeral ORIF.<sup>11</sup> Whether attempted ORIF will compromise potential salvage arthroplasty in the future is unknown. This study evaluated whether patients with failed osteosynthesis who undergo salvage RTSA have different outcomes compared with patients undergoing primary RTSA for proximal humeral fractures.

## Materials and methods

This was a retrospective case-control study of patients with failed osteosynthesis treated with RTSA compared with patients undergoing primary RTSA for proximal humeral fractures. We used our institution's total joint registry database to identify all patients who sustained a proximal humeral fracture treated with RTSA after failed ORIF or RTSA as the primary intervention between the years 2003 and 2013. Polytrauma patients were excluded. During this 10-year period, 18 patients underwent a primary RTSA acutely (Fig. 1), and 26 underwent RTSA after a prior failed ORIF of a proximal humeral fracture (Fig. 2). The indications for RTSA in all 26 patients with prior ORIF were pain and limited function resulting from a number of complications, including post-traumatic degenerative joint disease



**Figure 1** Acute 4-part proximal humeral fracture treated with reverse total shoulder arthroplasty.



**Figure 2** Four-part proximal humeral fracture that underwent open reduction with internal fixation, with subsequent failure and salvage reverse total shoulder arthroplasty.

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