

Case Report

Periprosthetic humeral fracture after Copeland resurfacing and the role of revision arthroplasty: A report of three cases

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ABSTRACT

Follow-up series of the Copeland resurfacing hemiarthroplasty have reported few postoperative fractures around the prosthesis. We report three cases of periprosthetic fracture around a Copeland resurfacing arthroplasty. Due to prosthetic loosening and tuberosity comminution, all cases were managed with revision shoulder arthroplasty. All patients had good functional outcome and range of movement on early follow-up.

Key words: Copeland, Copeland resurfacing, hemiarthroplasty, periprosthetic fracture, reverse shoulder replacement, revision arthroplasty, total shoulder replacement

INTRODUCTION

Follow-up series of the Copeland shoulder resurfacing arthroplasty have reported few postoperative fractures around the prosthesis.^[1-3] With advancing population age, periprosthetic fractures are becoming an increasing problem with social and financial implications.^[4]

We report three cases of periprosthetic fracture around a Copeland resurfacing arthroplasty and subsequent management with an anatomic or reverse total shoulder replacement.

CASE REPORT

In 2013, three patients presented to our hospital with periprosthetic fractures around a Copeland surface-replacement hemiarthroplasty. The fractures occurred around the stem of the prosthesis and in all cases the mechanism was a simple fall onto the affected shoulder. Demographics of the patients are shown in Table 1. In patient 3, there was significant comminution of the greater tuberosity and also an ipsilateral intra-articular fracture of the distal humerus [Figures 1-3].

In all cases, the initial decision was made to manage these injuries nonoperatively. In two patients at follow-up, there was further evidence of prosthetic loosening, and in one patient, tuberosity comminution with displacement. As a result, in all cases, it was deemed that open reduction and internal fixation would have unfavorable results.

Patients 1 and 2 underwent revision to anatomic shoulder replacement (Epoca, DePuy Synthes, Leeds, UK) while patient 3 had a reverse polarity shoulder arthroplasty and a total elbow replacement at the same sitting.

All patients had undergone a previous deltopectoral approach to the shoulder, and the same approach was used at revision

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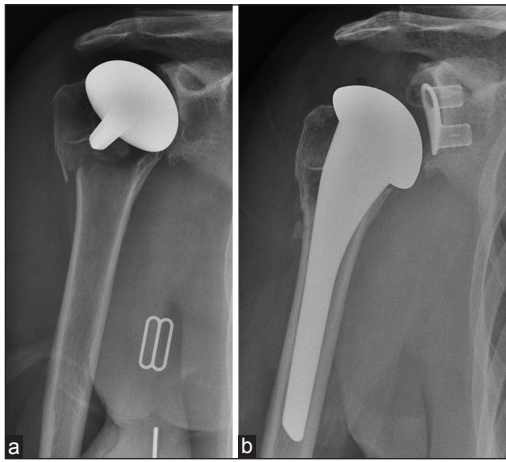


Figure 1: Patient 1 (a) Preoperatively and (b) Postoperatively

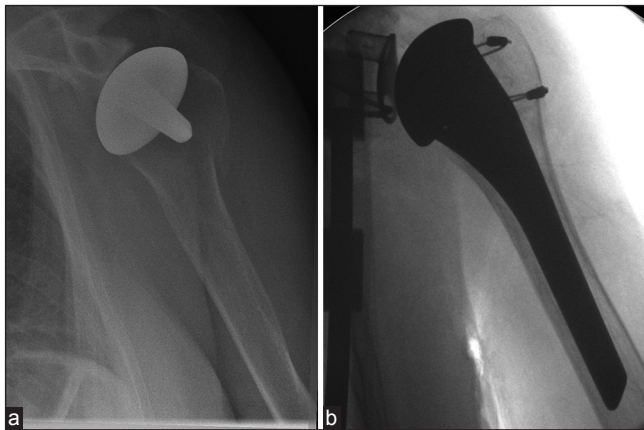


Figure 2: Patient 2 (a) Preoperatively and (b) Postoperatively

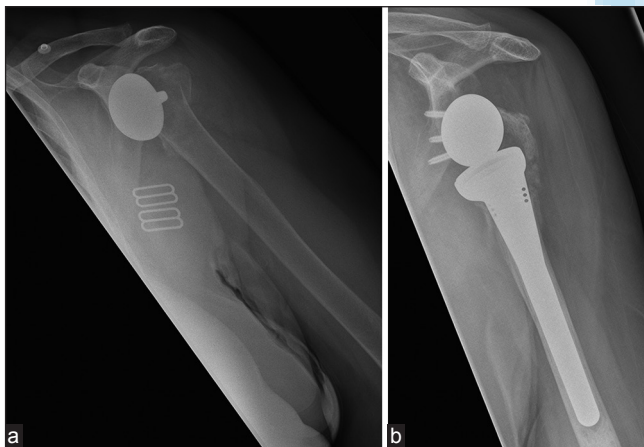


Figure 3: Patient 3 (a) Preoperatively and (b) Postoperatively

surgery. The Copeland implant was found to be loose in two cases and easily removed in the third case. In patients 1 and 2, a metal-backed glenoid was used and an uncemented humeral stem (Epoca, DePuy Synthes, Leeds, UK). In patient 3, who underwent a reverse shoulder replacement, the humeral stem was cemented (Delta International Ltd., Leeds, England, UK). In all cases, the tuberosities were repaired using Fiber wire (Arthrex, FL, USA) or cerclage cable.

Patients were discharged home when comfortable. We were conscious of the need for the commencement of tuberosity healing before allowing a full active range of movement. We, therefore, initiated a gradual rehabilitation protocol. For the first 2 weeks we allowed pendulum movements. At 2 weeks, we allowed full passive and active-assisted movements. At 6 weeks, we allowed a full range of active movement as tolerated.

There were no intra-operative or postoperative complications. All patients were satisfied with the outcome of their surgery. The two patients who were revised to an anatomic total shoulder replacement reported their shoulder to be “better” than prior to their periprosthetic fracture with the Copeland hemiarthroplasty *in-situ*. Patient 3 reported her shoulder to be “similar” to prefracture status. Telephone functional scores including Oxford and American Shoulder and Elbow Surgeon scores were collected. The most recent modification of the Oxford score was used, which uses a score of 0-48 with 48 being the best outcome.^[5]

Demographics and functional outcome of the patients are shown in Table 1. All postoperative radiographs were satisfactory, with the prosthesis well-seated and no signs of loosening. All patients had a minimum range of abduction and forward flexion of 150° with a minimum range of internal and external rotation of 40°.

DISCUSSION

Before the introduction of the humeral surface-replacement, several problems had been identified with stemmed designs. Loosening could lead to significant osteolysis on the humeral side, making revision difficult or impossible. There was an increased risk of fracture using stemmed designs both on insertion and due to the increased stress riser postoperatively.

The Copeland surface replacement arthroplasty has been in use clinically since 1986. The prosthesis was designed to reconstruct natural anatomy, minimize bone loss, and preserve the tuberosities and rotator cuff in contrast to previous shoulder arthroplasty designs. In more recent years, due to the risk of glenoid loosening from polyethylene wear, many surgeons when performing Copeland resurfacing, prefer to resurface the humeral head only and perform multiple drilling of the glenoid, using microfracture technique, to encourage secondary fibrocartilage. We do not, however, know of any proven evidence that this technique works or is of benefit in shoulder resurfacing. Designer series report encouraging results with the prosthesis for osteoarthritis, rheumatoid arthritis, and avascular necrosis at medium-term.^[1-3] More recently, independent series have also shown a low rate of revision and good functional outcome.^[6,7] Concerns exist with regards to glenoid wear and restoration of normal glenohumeral offset.^[7,8]

All the original Copeland resurfacings in our series had been implanted in other departments, and we were unable to

Table 1: Demographics and outcomes of the cases (TSR = Anatomic shoulder arthroplasty, RSR = Reverse shoulder arthroplasty)

Patient	Age/sex	Hand dominance	Time from injury to surgery (days)	Years from original surgery	Revision prosthesis	Follow-up radiographs and range of movement (months)	Range of movement in degrees at follow-up (abduction/forward flexion/internal rotation/external rotation)	Follow-up functional scores	ASES score	Oxford score
1	67 female	R	16	9	TSR	6	160/150/45/40	12	82	47
2	72 female	R	21	1	TSR	18	140/140/40/45	21	54	30
3	78 female	R	13	8	RSR	17	150/150/45/45	20	73	45

RSR = Reverse shoulder replacement; TSR = Total shoulder replacement; ASES = American Shoulder and Elbow Surgeon

objectively assess function prior to fracture. It is encouraging, however, that two out of three patients reported their shoulders to be better than the pre injury state. We could not find any literature reporting the outcome of revision of Copeland resurfacings for periprosthetic fracture.

We believe that undisplaced fractures in this scenario should have a trial of conservative management, as long as the implant is not loose. However, late displacement or a loose prosthesis warrants operative intervention. We acknowledge that these are only early clinical results. In our practice, through rehabilitation, we would expect continued improvement throughout the 1st year to 18 months following revision arthroplasty. We plan to follow this cohort up to report medium-term results in the future. Patient 2 was a low demand patient with several comorbidities. She scored poorly particularly on questions concerning overhead or sports activities. These activities were outside of the usual daily pattern for this patient. She nevertheless reported her outcome to be “satisfactory” overall, and in fact “better” than her pre injury state. This may also have reflected some dysfunction with her index Copeland arthroplasty.

The Copeland surface replacement arthroplasty has been one of the most common shoulder replacements used in the UK since it was introduced over 20 years ago. Periprosthetic fractures around these implants will potentially become an increasing problem with an aging population. Revision of these periprosthetic fractures to an anatomic total or reverse shoulder arthroplasty is an option that can produce good results as indicated by our small number of cases.

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Conflicts of interest

There are no conflicts of interest.

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