Midterm results of shoulder hemiarthroplasty for glenohumeral osteoarthritis

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Background
Degenerative disease is a common cause of shoulder pain and dysfunction. Osteoarthritis is the most frequent cause of the degeneration. Prosthetic shoulder arthroplasty is becoming increasingly popular. The most widely reported procedure is hemiarthroplasty.

Patients and methods
Thirty patients were included in this study. The average age of the patients was 55 years. The deltopectoral approach was adopted in all cases, and the prosthesis implanted in all patients was the global prosthesis. The mean follow-up period was 36 months. The Simple Shoulder Test (SST) was used for functional evaluation of patients. The initial SST questionnaire was administered before surgery, and the final SST questionnaire was administered at the most recent follow-up.

Results
At the most recent follow-up, the average active elevation was 90°. The mean SST score at final follow-up was 9.5 of 12. There were no reports of prosthesis loosening or prosthesis subsidence.

Conclusion
The data from this study suggest that hemiarthroplasty is a reliable procedure with good results for improvement in pain, range of motion, and function. Prosthetic arthroplasty remains the treatment of choice for the management of end-stage osteoarthritis.

Keywords:
osteoarthritis, results, results osteoarthritis, shoulder arthroplasty, shoulder prosthesis

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Introduction

The shoulder has a greater range of motion than any other joint in our body; however, because it can perform multiple movements, it is vulnerable to stress, injury, and arthritis. Degenerative disease is a common cause of shoulder pain and dysfunction. Osteoarthritis is the most frequent cause of the degeneration, followed by rheumatoid arthritis, avascular necrosis of the humeral head, rotator cuff tear arthropathy, and post-traumatic degeneration that can occur after fractures of the proximal humerus. Degenerative disease of the shoulder can be mistaken clinically for rotator cuff disease and adhesive capsulitis as their symptoms can be similar. Radiographic images, however, can easily distinguish degenerative diseases from these other conditions. As the degeneration progresses, pain manifests at rest and more frequently at night. Active and passive motion also becomes progressively restricted. People tolerate their symptoms for long periods of time because the arm is not a weight-bearing extremity; for this reason, arthritis of the shoulder is not as common as that in the hip and knee.

Shoulder arthroplasty was first performed in 1894 by the French surgeon Jean Péan [1–3]. The original implant consisted of a platinum and rubber implant for the glenohumeral joint. Charles Neer [4], who since the 1950s has developed more modern prostheses for surgical procedures, is credited with the advancement of modern total shoulder arthroplasty [1,5,6]. More than 70 different shoulder systems have been designed for shoulder reconstruction arthroplasty [7]. In the last few decades, important steps have been taken to design prosthetic components for partial shoulder arthroplasty [8].

Prosthetic shoulder arthroplasty is becoming increasingly popular. The most widely reported procedure is hemiarthroplasty. The current indications for hemiarthroplasty are: primary osteoarthritis with a normal glenoid surface and a traumatic four-part fracture dislocation of the shoulder joint [9].

Primary osteoarthritis of the glenohumeral joint is less common than that of the hip and knee, but it is not very rare. Prosthetic arthroplasty remains the treatment of choice for the management of end-stage osteoarthritis [10].

Hemiarthroplasty continues to be a common surgical treatment for glenohumeral osteoarthritis and is currently used to treat avascular necrosis, osteoarthritis, and rheumatoid arthritis with good and reproducible results [11–15].

Adams *et al.* [16] reviewed 98 patients (110 shoulders) and reported that the long-term outcome for total shoulder arthroplasty and hemiarthroplasty were favorably comparable.

The aim of this study was to present the midterm result of hemiarthroplasty in the treatment of primary osteoarthritis of the shoulder joint and to evaluate the outcome of this surgical procedure with regard to the function of the shoulder joint.

Patients and methods

Between April 2006 and March 2010, 30 patients were included in the study. All cases were presented and operated upon at King Faisal Specialist Hospital and Research Center, Jeddah, Saudi Arabia. The study group included 18 women and 12 men, 60 and 40%, respectively.

The average age of the patients was 55 years (range 53–68 years). The left side shoulder was affected in 18 patients (60%) and the right side in 12 patients (40%). The dominant side was affected in 10 patients (33%).

Routine radiography was performed to obtain three orthogonal images (anteroposterior, supraspinatus outlet view or scapular, and axillary) to view all aspects of the humeral head and glenoid.

Hemiarthroplasty is contraindicated if there is loss of deltoid and rotator cuff musculature, brachial plexus injury, chronic infection, or chronic osteomyelitis. None of the patients in this series had any of these contraindications preoperatively.

During operation, the patient is placed in a modified beach chair position with the torso at the extreme edge of the table; the shoulder is prepared and draped, keeping the upper extremity freely moving. The deltopectoral approach was adopted in all cases. The deltopectoral interval is carefully marked with a marking pen from the clavicle to the deltoid insertion of the humerus. The interval is usually easily palpable by gently pressing one's fingers into the deltopectoral crease. The skin markings should be made before applying the transparent plastic drape.

Great care was taken to leave enough bone attached to the rotator cuff to allow solid fixation of the tuberosities to the diaphysis. At the end of the procedure, the tuberosities were fixed both to the implant and to the humeral shaft using heavy nonabsorbable sutures. The tendon of the biceps was tenodesed in one case (3%). The greater tuberosity was fixed at a position 3–5 mm lower than the upper part of the prosthetic head, or at the same level, to prevent impingement. The autologous cancellous graft harvested from the removed head was packed under the tuberosities.

The prosthesis that was implanted in all patients was the global prosthesis (DePuy Orthopedics, USA).

The mean follow-up period was 36 months (range 24–48 months). Radiographs were assessed for the presence of subluxation and a shift in the component position.

Isometric exercises and passive mobilization were started on the first or second postoperative day. No active muscular activity was started until a complete range of passive movement had been achieved, which mostly occurred after about 2 weeks. Physiotherapy was continued for 2–3 months in all cases.

Patients were asked to wear a shoulder immobilizer during the day for the first week and at night for the first month. Four weeks after the surgery, patients were asked to wear a shoulder sling.

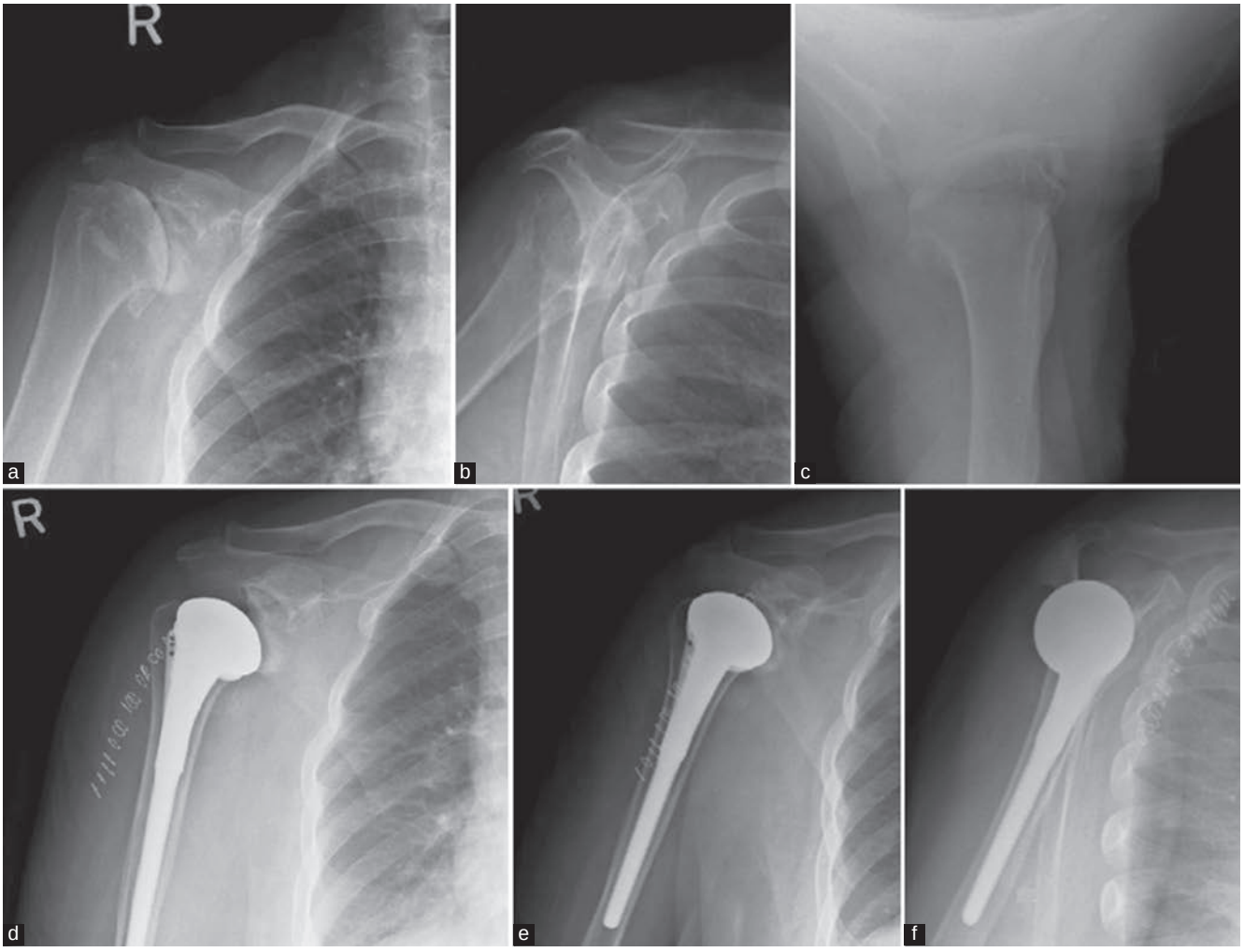
The Simple Shoulder Test (SST) [17] is a validated measurement tool that was used for functional evaluation of patients in this study. The initial SST questionnaire was administered before surgery, and the final SST questionnaire was administered at the most recent follow-up.

Table 1 shows the SST questionnaire, which comprises 12 questions. The patient has to answer either yes or no: yes is awarded 1 point. The higher the score, the better the result and outcome.

Table 1 The Simple Shoulder Test [17]

1. Is your shoulder comfortable with your arm at rest by your side?	Yes	No
2. Does your shoulder allow you to sleep comfortably?	Yes	No
3. Can you reach the small of your back to tuck in your shirt with your hand?	Yes	No
4. Can you place your hand behind your head with the elbow straight out to the side?	Yes	No
5. Can you place a coin on a shelf at the level of your shoulder without bending your elbow?	Yes	No
6. Can you lift 1 lb (a full pint container) to the level of your shoulder without bending your elbow?	Yes	No
7. Can you lift 8 lb (a full gallon container) to the level of the top of your head without bending your elbow?	Yes	No
8. Can you carry 20 lb (a bag of potatoes) at your side with the affected extremity?	Yes	No
9. Do you think you can toss a softball underhand 10 yards with the affected extremity?	Yes	No
10. Do you think you can throw a softball overhand 20 yards with the affected extremity?	Yes	No
11. Can you wash the back of your opposite shoulder with the affected extremity?	Yes	No
12. Would your shoulder allow you to work full-time at your regular job?	Yes	No

Figure 1



(a–c) Preoperative radiographs of a 53-year-old woman with primary osteoarthritis of the right glenohumeral joint; (d–f) postoperative radiographs.

Results

At the most recent follow-up, the average active elevation was 90° (range 50–160°) and external rotation was 30° (range 10–70°). Average internal rotation was defined as the ability of the thumb to reach L5 (range abdomen–T11). An active postoperative elevation of at least 90° was achieved in 20 of 30 patients.

The mean SST score at final follow-up was 9.5 (range 7–11) of 12. Preoperatively, the mean SST score was 4 (range 2–6) of 12.

There was no case of prosthesis loosening in this series at the longest follow-up, as well as no revision procedures.

One patient developed the complication of a periprosthetic fracture at the distal end of the stem (Fig. 3). In this patient, active physiotherapy was delayed and a humeral brace was used for 6 weeks; good results were reported after 2 months with good union of the fracture as the fracture was only at the outer cortex.

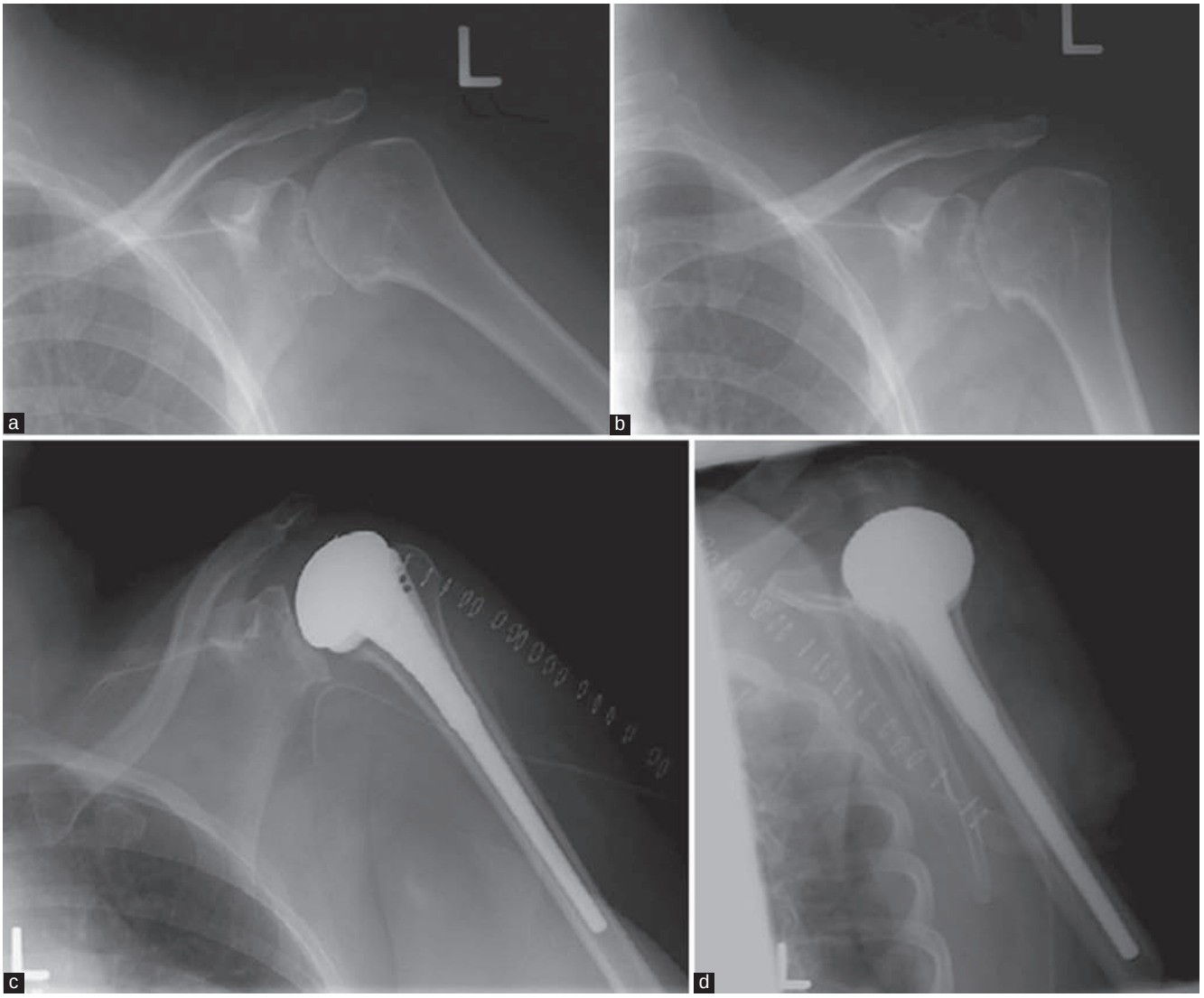
Glenohumeral subluxation was evaluated for the direction and the amount of translation of the center of the prosthetic head relative to the center of the glenoid. It was recorded as mild if translation was less than 25%, moderate if translation was 25–50%, and severe if translation was more than 50%. Two cases showed mild translation at the latest follow-up, which did not affect the gain in the range of motion (Fig. 4).

No case of superficial or deep infection in the early or late postoperative stage was reported.

No case of prosthesis subsidence, measured in millimeters, was reported.

Figures 1–4 show preoperative and postoperative follow-up radiographs following hemiarthroplasty for glenohumeral osteoarthritis.

Figure 2



(a, b) Preoperative radiographs of a 65-year-old woman with primary osteoarthritis of the left glenohumeral joint; (c, d) postoperative radiographs.

Discussion

Gregory *et al.* [1] reported that indications for shoulder arthroplasty are numerous, the main ones being glenohumeral osteoarthritis, rheumatoid arthritis, or fracture of the proximal humerus. All patients in this study had glenohumeral osteoarthritis.

Shoulder arthroplasty has become the standard treatment for primary osteoarthritis. Prosthetic replacement of the proximal humeral head can be a very successful procedure in patients with glenohumeral arthritis. Clinical results seem to deteriorate with time and the revision rate is ~20%, usually for persistent pain [10]. This finding was not reported in this study, probably because of the short mean follow-up period of 3 years.

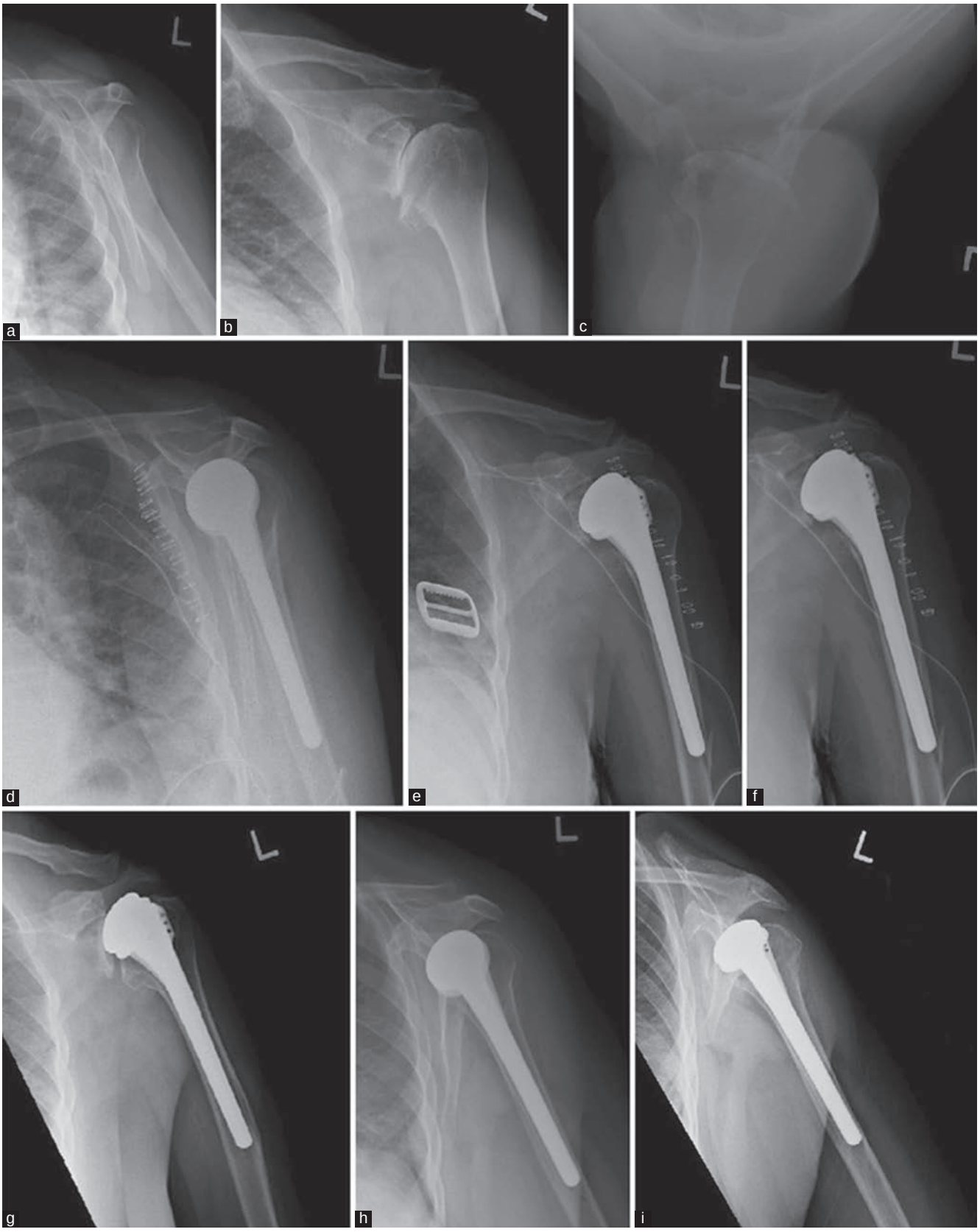
Mansat *et al.* [10] reported that good results can be expected especially for primary osteoarthritis, with pain relief in almost all cases and good motion, improvement in functional activities, and patient satisfaction in at least 90% of cases. These findings are similar to those of this study.

Wirth *et al.* [18] evaluated 57 patients who had undergone isolated humeral hemiarthroplasty for glenohumeral arthritis. They reported a mean SST score of 9.4 at final follow-up, whereas the SST score was 9.5 in the present series. This shows that the results of the procedure are reproducible.

Pain after total shoulder arthroplasty or humeral hemiarthroplasty is uncommon. The impingement syndrome can be an infrequent source of pain after shoulder arthroplasty [19]. No cases pain were reported in this study.

Anatomic reconstruction of the greater tuberosity and its bony union to the shaft have been

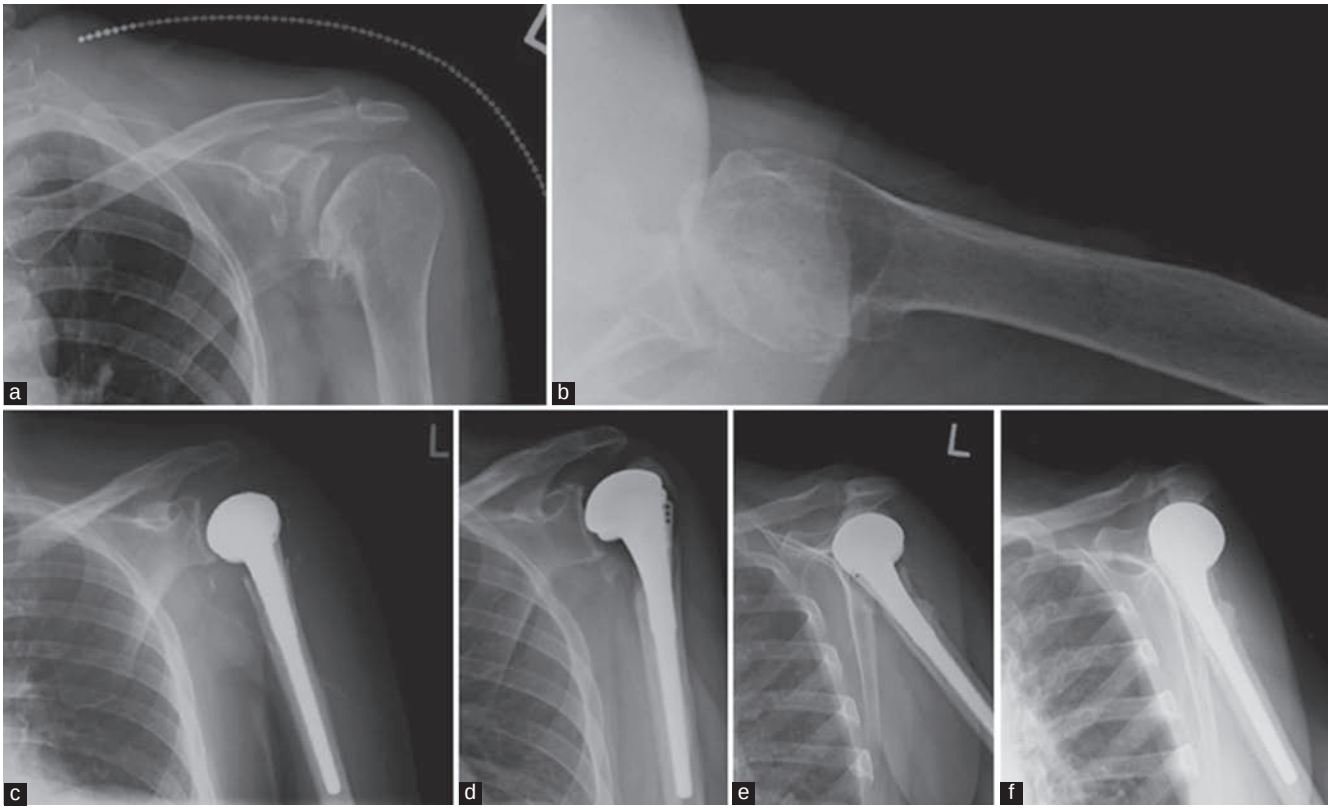
Figure 3



(a–c) Preoperative radiographs of a 62-year-old woman with primary osteoarthritis of the left glenohumeral joint; (d–f) postoperative radiographs showing a fracture at the tip of the distal end of the humeral prosthesis stem; (g–i) radiographs at 36 months of follow-up showing healed fracture.

proven to be essential to achieve satisfactory shoulder function. This has led some surgeons to revise and improve the tuberosity synthesis technique [20–22].

Figure 4



(a, b) Preoperative radiographs of a 60-year-old man with primary osteoarthritis of the left glenohumeral joint; (c–f) radiographs at 48 months of follow-up showing proximal migration.

Preserving the tuberosities and the rotator cuff is essential for a good clinical outcome [8]. It is often possible to remove enough bone from the deep surface of the greater tuberosity to allow implantation of the humeral component and still maintain continuity of the tuberosity and the rotator cuff [23]. This was always taken into consideration during surgery in this series.

It is currently unknown whether the operation of choice for patients with primary osteoarthritis of the shoulder is hemiarthroplasty or total shoulder arthroplasty. It has been reported [24] that there are no significant differences in the results of hemiarthroplasty and total shoulder arthroplasty in patients operated for primary osteoarthritis of the shoulder.

Trail and Nuttall [25], in their study over a period of 8.8 years, reported that there are no statistically significant differences between hemiarthroplasty and total arthroplasty.

Trail and Nuttall [25] reported that there was superior migration of the humeral component by more than 5 mm in 18 (28%) of 105 shoulders 2 or more years after hemiarthroplasty. This was also noted in this series with almost same percentage (25%) of patients. Superior migration had an effect on the outcome.

As with other total joint procedures, total shoulder arthroplasty can be associated with a multitude of complications, the most common being prosthetic loosening, glenohumeral instability, periprosthetic fracture, rotator cuff tears, infection, neural injury, and deltoid muscle dysfunction [8,26–28]. One case of a periprosthetic fracture at the distal end of the stem was reported in this study (Fig. 3); good results were reported in this case after 2 months with good union of the fracture as the fracture was only at the outer cortex. Other complications were not recorded in this series.

Conclusion

The data from this study suggest that hemiarthroplasty is a reliable procedure with good improvements in pain, range of motion, and function.

Prosthetic arthroplasty remains the treatment of choice for the management of end-stage osteoarthritis.

Physiotherapy and patient compliance and cooperation are necessary for a satisfactory outcome.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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