



EVALUATION OF RESULTS OF REVERSE SHOULDER ARTHROPLASTY IN FOUR PART FRACTURE OF PROXIMAL HUMERUS IN ELDERLY PATIENTS

Orthopedics

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ABSTRACT

Majority of Neer's 4-part fracture of proximal humerus in elderly population with osteoporosis, complex fracture pattern, and tuberosity comminution are unsuitable for internal fixation, owing to the high incidence of avascular necrosis [1,2]. Hemiarthroplasty although recommended in such scenario, results have been unreliable. Reverse shoulder replacement has been advocated as alternative with promising results, as functional recovery is possible without anatomic tuberosity healing or intact rotator cuff [3,7]. We used reverse shoulder arthroplasty in 16 consecutive patients with a mean age 54.2 year. The mean active anterior elevation was 154° (130°- 175°), mean active lateral elevation was 150° (125°-170°); mean active external rotation in adduction was 42°. Pre-operatively, the mean Constant score of the contralateral shoulders were 82.5 (74-90). Postop, mean Constant score was 62, mean pain score 14.3, mean activity score was 2, mean mobility score 30.8, and mean strength score 4.4. Mean ASES score was 72 and mean DASH score was at 35 out of 100. 1 case developed heterotopic ossification and 2 had scapular notching. More long-term and higher level randomized studies to compare with hemiarthroplasty and ORIF are needed in future to draw any firm conclusion.

KEYWORDS

Reverse shoulder arthroplasty, Four-part proximal humeral fracture

Introduction

Proximal humeral fractures are the third most common fracture, after hip fractures and distal radial fractures, in patients older than 65 years. Elderly age, high-energy trauma, and osteoporosis in elderly contribute to complex pattern, comminuted fractures, devascularisation of the humeral head and high incidence of rotator cuff tears. Conservative treatment has disadvantages of improper reduction, subsequent loss of achieved reduction, long term immobilization, pain affecting daily activities and functional limitation, avascular necrosis, and osteoarthritis.

Fixation aims to restore joint congruency, alignment and anatomical contact between tuberosities and humeral head. Transosseous suture fixation, closed reduction and percutaneous pinning, open reduction and internal fixation with conventional and locking plate are the spectrum of techniques available. Disadvantages are large surgical exposure, iatrogenic avascular necrosis, axillary nerve damage, secondary dislocation and inaccuracy of reduction. Data in the literature is inconsistent and does not conclude any technique to be better.

Hemiarthroplasty has been advised by many authors for most 4-part fractures. It is a complex surgery and results are inconsistent, hence better kept for situations like osteoporotic bone, severe comminution, articular involvement, elderly patients posing difficulty with a strict rehabilitation protocol, even after failure of conservative treatment, or following failure of fixation. Success depends upon correctly restoring the humeral height, version and tuberosity. As per available literature functional outcomes with shoulder hemiarthroplasty is unpredictable and poor when compared with reverse prosthesis in similar population. Reverse arthroplasty in trauma, is an extension of its traditional indication of irreparable cuff arthropathy, is a recent concept, specific for elderly population with osteoporotic bones, complex fracture pattern and tuberosity comminution. A fair functional recovery is possible without too much reliance on anatomic tuberosity healing or a functional rotator cuff [8]. Our study aims to evaluate the results of Reverse shoulder arthroplasty in four-part fracture of the proximal humerus by means of Constant score, DASH score, and ASES score, and assess the complications.

Material and methods

Prospective study was undertaken in the Department of orthopedics,

SCB medical college, Cuttack, during July 2015 to Sept 2017. Inclusion criteria were, age > 55, 4-part fracture of the proximal humerus, with informed written consent. Cases with axillary nerve injury, deltoid atrophy were excluded. 16 patients with recent fracture of the proximal humerus (within 20 days of injury) were treated with reverse shoulder prosthesis (Depuy). 2 had a displaced 3-part and 13 had displaced 4-part fracture, out of which, 2 had dislocation. X-ray radiograph of shoulder joint AP, Lateral views, and CT scan MRI of the affected shoulder, routine and special blood tests; sickling test, BT, CT, PT, APTT, INR, ESR etc were done.

Operative technique

Under general anesthesia, patient is placed in beach chair position. Deltopectoral approach is used in all. Subscapularis is incised 1 cm medial to the lesser tuberosity. Rotator interval is incised, antero-inferior capsule is released from the humerus. Darrach retractor placed in the joint and gently externally rotate, adduct, and extend the arm to deliver the humeral head. We prepared the humeral canal, using the humeral axis to reference the osteotomy by extramedullary referencing, using the axis of the forearm as the reference point. With the cutting guide pinned into position at 30 degrees of retroversion, recheck the cutting angle and confirm. It is imperative to confirm proper position of the broaches in 30 degrees of retroversion to prevent component malposition. Summit of the tuberosity should be between 5 to 10 mm below the summit of the prosthetic head for correct height.

Glenoid Base plate is placed as low as possible. Guide pin was placed around 10mm from inferior glenoid rim with a 10° interior tilt. Inferior glenoid is more reamed leaving a crescent shape of exposed subchondral and cancellous bone. This appearance corresponds to neutral or 10° interiorly tilted reamed surface. Screw trajectory is along three major columns of bone in scapula – the base of the coracoids process, scapula spines, and lateral pillar [7]. Anterior and posterior compression screws were first drilled to compress base plate to glenoid. Base plate was cleared up all soft tissue circumferentially before inserting glenosphere.

Next humeral component was trialed, the thinnest polyethylene to be used. The top of the polyethylene should reach the top of the greater tuberosity. The quality of final reduction can be estimated by comparing proximal medial edge of humeral trial component to the equator of glenosphere. Adequate deltoid tension is established when medial edge of polyethylene component is 1-2mm off the centre of

glenosphere. If deltoid is over tensioned, resection of metathysis to be done. If tension is less, the thicker polyethylene component or spacer can be used. With a thumb on the lesser tuberosity, the humeral head pushed posteriorly and then released. Posterior excursion with immediate "bounce back" of the humeral head is optimal. During insertion of final components, version must be continually checked. Shoulder is then reduced with flexion, distraction and internal rotation. Tight closure of the rotator interval and the subscapularis is done with heavy nonabsorbable suture. A drain is placed and closed it with No.0 sutures. The skin is closed in standard fashion and the arm placed in a soft sterile dressing and an abduction brace while the patient was still upright and before being aroused from anesthesia.

Post op rehabilitation

Full time shoulder abduction orthosis for 4 weeks and to wear out of home for additional 2 weeks. Initially pendulum exercises and elbow, wrist and hand range of motion started. Physical therapy begins at 6 weeks post-op; passive stretching, active assist motion. Strengthening begins at 12-week point.

Follow up

The patients were reviewed 3 monthly by the Constant and Murley, the American Shoulder and Elbow Surgeons (ASES) and Disabilities of the Arm, Shoulder and Hand (DASH) scores compared with contralateral shoulder. Inferior scapular notching was recorded and classified according to Sirveaux et al on radiographs. Radiographs of contralateral shoulder served as a reference to assess the position of the center of the shoulder and glenoid inclination angle.

Statistical analysis was done by student t test. The correlation between the inclination of the glenoid component and notching was studied using the Spearman correlation coefficient.

Results

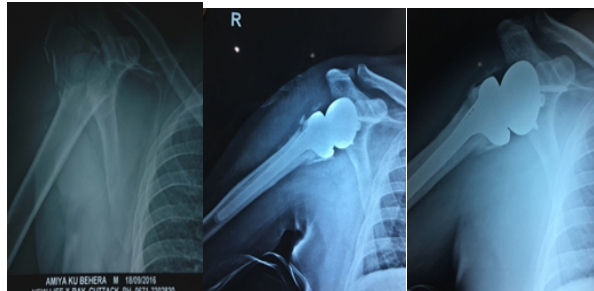
Mean follow up was 28 months (14 to 38). There were total 16 with 4 women and 12 men and mean age of 54.2 years. 10 surgeries on the dominant shoulder. The findings are detailed in Table 1.

Complications occurred in 3 patients. One patient developed myositis ossificans at one and a half month of follow up. Heterotopic ossification was seen to be developing on the undersurface of deltoid shadow on AP radiograph. He was treated with indomethacin and progression was halted on subsequent follow up. Scapular notching was observed in 2 (12%), Sirveaux grade 2. Notching did not widen in that patient followed up for nearly 2 years now.

Inclination of the glenoid component was a mean of 15° greater than the contralateral side. The shoulder centre had a mean medialization of 20 mm. The mean active anterior elevation was 154° (130°- 175°); when compared to the contralateral side, the difference was significant with p value of 0.03. Mean active lateral elevation was 150 (125°-170°); p value 0.02 and the mean active external rotation in adduction was 42°; p value 0.01.

Pre-operatively, the mean Constant score of the contralateral shoulders were 82.5 (74-90). Post op, the mean Constant score was 62. The mean pain score was 14.3, the mean activity score was 2, the mean mobility score 30.8, and the mean strength score 4.4. The mean ASES score was 72 and the mean DASH score was at 35 out of 100, differences were statistically significant.

RADIOGRAPHS



Pre-op.

Heterotopic ossification at 1½ Month.

Progression halted with indomethacin.

Results

Table 1

Mean values	Delta shoulder	Contralateral shoulder	P Value
Active anterior elevation (°)	154	165.9	0.03
Active abduction (°)	150.9	164	0.01
Active external rotation (°) (with the arm at the side)	42	83	0.01
Constant score for pain (points)	14	15	0.15
Constant score for activity	8.3	30.8	0.01
Constant score for mobility	30.8	38.3	0.02
Constant score for strength	4.4	12.8	0.01
Constant score total (points)	62	82.5	0.03
ASES score (points)	71.6	90.8	0.01
DASH score (points)	35	22.6	0.01

Discussion

Reverse shoulder arthroplasty has now become a popular choice for displaced 3 part and 4 part fractures of proximal humerus [7,8]. It gives better result than partial shoulder replacement in terms of function [11].

The mean anterior elevation of 154° in our study was better than most of the other studies in trauma [2,3,14]. The value was 165° in the opposite shoulder with p value of 0.03. Goldman reported a mean anterior elevation of 93° in >70-year age category [8]. Wretenberg and Ekelund had a mean active anterior elevation of 55° in >75-year age [15]. Cazeneuve and Cristofari obtained better anterior elevation, which in all cases was more than 120° in their 16 patients [3].

Relief from pain was significant which is in accordance with other reports [3,8]. Boileau found a low rate of dislocation of 7%, [2], where as we had no dislocation. Dislocation is a common complication, with rates upto 31%; more following tumor resection around proximal humerus and reconstruction with reverse prosthesis, De Wilde et al [5]. It must be ensured that the axillary nerve and deltoid are functioning prior to surgery as denervation of the deltoid would result in limited function and tendency to dislocate [2,7]. We encountered no case of dislocation probably because we dealt with fractures.

Walch and colleagues found significant levels of component loosening in their study with a minimum follow-up of 60 months [15]. In our study, we yet did not find a single case of component loosening, may be attributed to shorter follow up duration. Two cases developed notching of the scapula on radiograph; it did not progress on subsequent follow ups and did not affect function. Whereas, other case series showed a higher notching rate [13]. Though definite conclusion demands longer follow-up. Heterotopic calcification, which is also reported in other studies, is very rare and in our single case it was halted after indomethacin intake without affecting function.

Observations with the longest follow-up find reverse arthroplasty in elderly patients with complex fracture of proximal humerus is satisfactory; it gives excellent pain relief, and better and easier functional recovery, because decreased immobilization and rehabilitation is needed for successful outcome particularly in elderly with physiologic or psychologic limitations [3]. Our study results were in accordance to it with encouraging shoulder scores.

Although in other studies, tuberosity repair has been found to improve functional outcome [2]. In our study, anatomical reconstruction of tuberosity was attempted in all, successfully achieved in 11 patients (68.7%), but the effect on the Constant score could not be established statistically, which is in accordance of results of Klein et al. [9]

The length of follow-up was only 28 month which is relatively less for more thorough assessment. We admit these are the relative drawbacks of this case study.

Conclusion

In elderly patients with fracture patterns less likely to benefit from internal fixation, after counselling about benefits and risks, the option for reverse replacement is reasonable. We feel that the use of the reverse shoulder prosthesis added with attempts at tuberosity reconstruction, have several advantages over a classical hemi- or total shoulder arthroplasty. Patients have good active mobility of the upper limb. Joint is stable during movement, and strength is mildly

affected. The resultant fixed and medialized center of rotation minimizes the torque on glenoid and improves the power of deltoid to provide a functioning shoulder. Besides an early functional recovery is possible without too much reliance on anatomic tuberosity fixation.

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