Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com/journal/sjams/home

OPEN ACCESS

Orthopaedics

Proximal Humerus Fractures Management with Hemiarthroplasty

Dr. Pramod Kumar S, Dr. K.V Santosh Reddy*

Senior Resident, Department of Orthopaedics, Government Medical College, Nizamabad, Telangana, India

Original Research Article

***Corresponding author**
Dr. K.V Santosh Reddy

Article History
Received: 16.12.2018
Accepted: 27.12.2018
Published: 16.01.2019

DOI:
10.36347/sjams.2019.v07i01.007

Abstract: Hemiarthroplasty is indicated in patients with four-part fractures and in elderly patients with osteoporotic bone who have fracture-dislocations. This study includes 20 patients, of which 14 were females and 6 males. The patients' mean age at the time of presentation was 64± 7.32 years. The time to follow up was 36 months. The right arm was involved in 8 and the dominant side in 12 patients. The mechanism of injury was a fall at home in 89%, and a road traffic accident in 11% of patients. The Neer monobloc prosthesis was used in 8 patients and the Global modular prosthesis in 12 patients. Constant scores were 54(32-78), Adl 15 (12-19), Rom 24 (10-38), pain 12(10-14), Strength 3(0-7), Total score 54 (32-78). Several complications resulted: 1 superficial wound infections, 1 proximally migrated prosthesis, 1 intraoperative fracture distal to the prosthesis, 4 late detachments of the tuberosities and 1 excessive heterotopic ossification.

Keywords: Hemiarthroplasty, shoulder fracture, complications, prosthesis.

INTRODUCTION

Proximal humerus fractures account for 4 %–5 % of all fractures and typically occur in a bimodal distribution in older women as a result of low-energy falls or in younger men as a result of high-energy trauma [1, 2]. With continued advancement of techniques and implants such as locking plates, surgical fixation of proximal humerus fractures has been increasing in popularity. However, the reported complication rates in humeral head preserving procedures continue to be high. In particular, the rate of osteonecrosis remains unchanged even with the most modern of techniques. It is clear that the prevalence of osteonecrosis after proximal humerus fractures increases over time. Proximal humeral fractures represent 4% to 5% of all fractures seen in accident and emergency departments [3]. Non-displaced two-part fractures, according to Neer's classification, are the most common and it is generally agreed that they have a good prognosis after conservative treatment [4]. The management of comminuted displaced fractures, however, remains controversial. Three- and four-part fractures account for 13–16% of the fractures of the proximal humeral epiphysis and approximately 20% require surgical management [5]. Thesurgical approach to three- and four-part fractures isdebated. Options include closed reduction and percutaneous pinning with or without isolated screws, open reduction and internal fixation (ORIF) with sutures, alone or combined with hardware, and plating. Fixed-angle plates have been introduced to provide a durable reduction, especially when there is concern over the quality of the bone [6].The aim of any operative intervention is to preserve the vascularity of the humeral head, avoiding avascular necrosis. Most of the humeral head is supplied by the anterolateral branch of the anterior humeral circumflex artery, which is commonly affected in four-fragment fractures. Although not all cases of avascular necrosis progress to collapse of the humeral head, the condition is associated with a significantly worse outcome [7].

Hemiarthroplasty is indicated in patients with four-part fractures and in elderly patients with osteoporotic bone who have fracture-dislocations. In both groups of patients, obtaining a secure stable reduction using internal fixation techniques is difficult, and the rate of osteonecrosis can range from 13% to 35% in four-part fractures. Hemiarthroplasty can also be considered in patients with three-part fractures and fracture-dislocations when bone quality is poor and the degree of conminution precludes satisfactory reduction and internal fixation. Headsplitting proximal humerus fractures in elderly patients also should be treated with hemiarhroplasty. Primary replacement can be considered in younger patients with four-part proximal

fractures if acceptable redution cannot be obtained.The important surgical principles when performing a hemiartroplasty for four-part proximal humeral fractures include the following: the use of a deltopectoral approach,allowing preservation of the deltoid origin and insertion; restoration of humeral length and retroversion; and secure fixation of the tuberosities to the prosthesis, to the shaft andto one another.

Shoulder hemiarthroplasty (HA) is indicated in patients with displaced and comminute fractures, where avascular necrosis of the humeral head seems inevitable. According to Hertel *et al*. [8], the predictors of humeral head ischaemia are integrity of the medial hinge, length of the dorsomedial metaphyseal extension of the head fracture (calcar length) and fracture type. In the elderly, most displaced three- and four-part fractures, fracture-dislocations and fractures with a split or impacted humeral head with loss of greater than 40% of the articular surface can be managed by HA [9]. In younger individuals, if osteosynthesis cannot provide a stable anatomically reduced proximal humerus, replacement with a prosthetic head may be considered [10].

MATERIALS & METHODS

The operation was performed under general anaesthesia. The patient was placed in the beach-chair position on the edge of the table, with the arm being operated on hanging over the edge. This allowed full mobility of the limb. A deltopectoral approach was adopted in all patients, without detaching the anterior deltoid and the upper third of the pectoralis major. The long head of the biceps was used as a landmark to localize the tuberosities. The fracture line was slightly posterior to the bicipital groove in about 80% of cases. The humeral head was removed and its diameter measured. In patients with a three-part fracture, the lesser tuberosity, still attached to the head, was resected and the humeral head removed without detaching the subscapularis tendon. After isolation of the tuberosities, non-absorbable sutures were placed at the bone-tendon junction. All four patients with a glenoid fracture had involvement of the antero-inferior border of the articular surface; of these, 2 required screw fixation and in the remaining 2, the size of the bone fragment was negligible. The humeral canal wasthen reamed, and a trial stem was inserted to determine height and version (retroversion about 20_); in this phase, the Aequalis device requires an extramedullary guide for correct component positioning, using the preoperative X-rays of the contralateral arm as reference. The tuberosities were reduced, and the position and height of the implant checked by fluoroscopy. Stems were cemented, sparing the epiphysis to avoid affecting bone repair. A bone graft from the humeral head was placed between the tuberosities to restore humeral offset. The TESS Corolla was filled with spongy bone from the humeral head added with autologous growth factors. The tuberosities were then sutured to one another and to the humeral shaft with non-absorbable horizontal and vertical sutures. In the postoperative period, the arm was placed in an immobilizer in 15^{o} of abduction for 4 weeks. Passive mobilization and pendulum exercises were allowed immediately. Active mobilization was begun on the 5^{th} week and strengthening at 8 weeks, initially only with isometric exercises and later with elastic bands.

Patients' satisfaction was graded as very satisfied, satisfied and dissatisfied. Outcomes were assessed using the Constant-Murley score, which attributes 20 points for function (ADL), 15 for pain (subjective components), 40 for range of motion and 25 for strength (objective components); the highest total score is 100, indicating a healthy, asymptomatic joint; and the lowest is 0 [11].Statistical analysis was performed by standard methods. A value of P\0.05 was considered significant. The test used and the level of significance are reported for each finding.

RESULTS

This study includes 20 patients, of which 14 were females and 6 males. The patients' mean age at the time of presentation was 64± 7.32 years. The time to follow up was 36 months. The right arm was involved in 8 and the dominant side in 12 patients. The mechanism of injury was a fall at home in 89%, and a road traffic accident in 11% of patients. Before their hemiarthroplasty, 4 patients had undergone a previous open reduction and internal fixation (ORIF) of their fractures. The indications for hemiarthroplasty in the group with a previous ORIF were loss of reduction (1), avascular necrosis (1), nonunion (1) and malunion (1). A deltopectoral approach was used in all cases. The Neer monobloc prosthesis was used in 8 patients and the Global modular prosthesis in 12 patients. Of the prostheses, 15 were cemented. Sutures were used to reattach the tuberosities in 16 patients, and wires were used in 4 patients.

Table-1: Demographic data

Parameter	Value
Age in year	64± 7.32 years
Sex M/F	6/14
Height	150.23±5.46cm
Weight	60.89±12.54 kgs

Table-2: Fracture types treated within 2 weeks of injury (acute) or more than 2 weeks after injury (late)

Fracture type	Acute	Late
2 part	1	1
3 part	5	2
4 part	6	2
Fracture dislocation	1	
Head split fracture	2	

Table-3: Constant scores

Constant score	Mean	Range
Adl	15	12-19
Rom	24	10-38
Pain	12	10-14
Strength	3	0-7
Total score	54	32-78

Table-4: Pain severity at final follow-up in primary versus secondary hemiarthroplasty

Pain	No of Patients
None	2
Slight	12
Moderate	2
Marked	1
Severe	1
After unusual activity	2

Patients who had previous ORIF of their fractures were found to have more pain and had less function as compared with those who had a primary hemiarthroplasty for their fractures. There was also a trend for patients with an uncemented prosthesis to function better than those with cement. Two patients in this study group were very satisfied, 14 patients were satisfied and 4 patients were dissatisfied. Pain was the main factor in patient satisfaction.The mean motion score was 24/40 (range 10–38), active anterior elevation was greater than 150^{o} in 6 patients, between 120 and 150 ^{o} in 20 and less than 120 ^{o} in the other 24; mean external rotation was 17^{o}, and internal rotation was prevalently at the level of L3. The mean ADL score was 15, this is an excellent outcome given the low functional demands of these patients, who are typically quite elderly. The most frequent impairments involved lifting weights, raising the arm above the shoulder, combing one's hair and sleeping on the affected side.

Several complications resulted: 1 superficial wound infections, 1 proximally migrated prostheses, 1 intraoperative fracture distal to the prosthesis, 4 late detachments of the tuberosities and 1 excessive heterotopic ossification One patient sustained a myocardial infarction 2 days after surgery. The complications did not adversely affect outcome scores

DISCUSSION

The main goals of treatment in these patients are a good functional result and pain relief. Neer was the first to advocate surgical treatment of three- and four-part fractures, due to the poor outcome of conservative management [12]. He treated three-part fractures by ORIF or HA and recommended total arthroplasty for four-part fractures,obtaining excellent or good results in at least 80% of patients.

Cazeneuve *et al*. [13] described the clinical and radiological outcome of 36 fractures at a mean of 6.6 years (1 to 16) in which the mean Constant score was 58.5 and was reduced to 53 points with the further follow-up. A total of 23 patients (63%) had radiological evidence of loosening of the glenoid component. Nevertheless, only one patient had aseptic loosening of the baseplate at 12 years' follow-up.

Kralinger *et al*. [14] described an Austrian multicentre study of 167 HA patients. At 1 year follow-up, healing of the tuberosities in anatomical position correlated with a better clinical outcome, 41.9% ofpatients being capable of active flexion. Outcomes appeared to be related to the experience of the individual centre. Kontakis *et al*. [15] reported the results of 28 procedures, where the Aequalis implant proved to be a safe and effective device. High rates of tuberosity healing were obtained, 24 patients being very satisfied or satisfied with the outcome and 18 achieving an active anterior elevation [The mean Constant score was 68.2].

Wall *et al*. [16] reported a series of 186 with 191 retained reverse total shoulder arthroplasty prostheses who were followed for an average of 39.9 months. Overall, the average Constantcore improved

from 23 points before surgery to 60 points at the time of follow-up and 173of the 186 patients were satisfied or very satisfied with the result.In the retrospective study of Gallinet et al [17], forty patients were treated by shoulder replacement for three- or four-part displaced fractures of the proximal humerus between1996 and 2004. Twenty-one had a hemiarthroplasty and 19 were treated by reverse prosthesis. The reverse prosthesis group showed better results in terms of abduction,anterior elevation and Constant score. Rotation was better in the hemiarthroplasty group.

Krishnan *et al*. [18] described four factors guiding in the choice of the treatment approach: age, bone quality, fracture pattern and timing of surgery. Although patients older than 70 years are candidates for arthroplasty, chronological age is not an indication in itself, since patient activity level, the presence of osteoporosis and the fracture pattern are more important. Patient age has been shown to be predictive of outcome. Younger patients have improved results, gaining more range of motion and a higher level of functional return. These improved results are attributed, in part, to motivation and compliance with postoperative rehabilitation and a more structurally intact rotator cuff. Instability following hemiarthroplasty also can be a significant problem. Instability may result if the humeral component is placed too high or too low, resulting in secondary impingement or poor soft-tissue tension, respectively. Improper placement of the component in excessive anteversion or retroversion may lead to dislocation and tuberosity failure [19].

HA is contraindicated in patients who cannot undergo surgery because they are medically unstable, in young, active patients, and in those with infection or axillary nerve palsy. Reports of patient satisfaction vary widely, from 58% to 92, %, in part because of the numerous scales used to mesure outcome and satisfaction. High satisfaction rates seem to correlate more with pain relief than with range of motion or functional outcomes. Even studies with poor functional results report high patient satisfaction if pain relief is acceptable [20].

Pain relief is the most predictable outcome following hemiarthroplasty for four-part proximal humerus fractures. Many authors have supported this finding, with 61% to 97% of patients reporting complete patiens reporting pain relief. Significant resifual pain generally tends to be associated with moderate activity; minimal pain occurs at rest. Even when motion and functional results are limited, pain relief is reported to be consistent [20].

In a randomized controlled trial, Agorastides et al. [21] conclude that late mobilization after HA for proximal humeral fracture is as safe as early mobilization. Rehabilitation in our patients was influenced by socioeconomic status, since those who consistently followed their programme achieved better results, further confirming the central role of postoperative rehabilitation following shoulder surgery.

The best range of motion has been reported to occur if the tuberosity is between 10 and 16 mm below the humeral head. Although these results differ somewhat, a nonanatomic final positiion of the tuberosity generally is believed to interfere with rotator cuff function and compromise range of motion and function. Lesser tuberosity malunion has received much less attention as a factir affecting outcome and does not appear to be as significant as greater tuberosityposition [22].

Complications following hemiarthroplasty for acute proximal humerus fractures include infection, neurologic injury, preiprosthetic fracture, instability, tuberosity malunion and nonunion, rotator cuff tear, heterotopic ossification, glenoid erosion, and stiffness. Although the incidence of any specific complication is relatively low, the cumulative incidence represents at least 15% [23].

Hemiarthroplasty was considered as one the best method for treatment of multiple shoulder fracture.

REFERENCES

1. Green A, Norris T. Proximal humerus fractures and fracture dislocations. In: Browner B, Jupiter J, Levine A, Trafton P, editors. Skeletal trauma: basic science, management and reconstruction. 3. Philadelphia: Saunders. 2003. pp. 1532–1624.
2. Court-Brown CM, Garg A, Mc-Queen MM. The epidemiology of proximal humeral fractures. Acta Orthop Scand. 2001;72(4):365–371.
3. Horak J, Nilsson BE**.** Epidemiology of fracture of the upper end of the humerus. *Clin Orthop*. 1975;112:250-3.
4. Jacob RP, Kristiansen T, Mayo K, Ganz R, Muller ME. Classification and aspects of treatment of fractures of the proximal humerus. In:Bateman JE, Welsh RP. *Surgery of the shoulder*. Philadelphia: BCDecker Inc. 1984:330-43.
5. Horak J, Nilsson BE. Epidemiology of fracture of the upper end of the humerus. Clinical orthopaedics and related research. 1975 Oct(112):250-3.
6. Moonot P, Ashwood N, Hamlet M. Early results for treatment of three-and four-part fractures of the proximal humerus using the PHILOS plate system. The Journal of bone and joint surgery. British volume. 2007 Sep;89(9):1206-9.
7. Gerber C, Werner CM, Vienne P. Internal fixation of complex fractures of the proximal humerus. The Journal of bone and joint surgery. British volume. 2004 Aug;86(6):848-55.
8. Hertel R, Hempfing A, Stiehler M, Leunig M. Predictors of humeral head ischemia after intracapsular fracture of the proximal humerus.

Journal of shoulder and elbow surgery. 2004 Jul 1;13(4):427-33.
9. Solberg BD, Moon CN, Franco DP, Paiement GD. Surgical treatment of three and four-part proximal humeral fractures. JBJS. 2009 Jul 1;91(7):1689-97.
10. Kontakis G, Koutras C, Tosounidis T, Giannoudis P. Early management of proximal humeral fractures with hemiarthroplasty: a systematic review. The Journal of bone and joint surgery. British volume. 2008 Nov;90(11):1407-13.
11. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. Clinical orthopaedics and related research. 1987 Jan(214):160-4.
12. CHARLES S NEER II. Displaced proximal humeral fractures: Part II. Treatment of three-part and four-part displacement. JBJS. 1970 Sep 1;52(6):1090-103.
13. Cazeneuve JF, Cristofari DJ. The reverse shoulder prosthesis in the treatment of fractures of the proximal humerus in the elderly. J Bone Joint Surg. 2010;92(4):535-9.
14. Kralinger F, Schwaiger R, Wambacher M, Farrell E, Menth-Chiari W, Lajtai G, Hu¨bner C, Resch H (2004) Outcome after primary hemiarthroplasty for fracture of the head of the humerus. A retrospective multicentre study of 167 patients. J Bone Jt Surg[Br] 86:217–219
15. Kontakis GM, Tosounidis TI, Christoforakis Z, Hadjipavlou AG. Early management of complex proximal humeral fractures using the Aequalis fracture prosthesis: a two-to five-year follow-up report. The Journal of bone and joint surgery. British volume. 2009 Oct;91(10):1335-40.
16. Wall B, Walch G. Reverse Shoulder Arthroplasty for the Treatment of Proximal Humeral Fractures. Hand Clin. 23,2007:425-430.
17. Gallinet D, Clappaz P, Garbuio P, Tropet Y, Obert L. Three or four parts complex proximal humerus fractures: hemiarthroplasty versus reverse prosthesis: a comparative study of 40 cases. Orthop Traumatol Surg Res. 2009 Feb;95(1):48-55.
18. Krishnan SG, Bennion PW, Reineck JR, Burkhead WZ. Hemiarthroplasty for proximal humeral fracture: restoration of the Gothic arch. Orthopedic Clinics of North America. 2008 Oct 1;39(4):441-50.
19. Voos JE, Dines JS, Dines DM. Arthroplasty for fractures of the proximal part of the humerus. J Bone Joint Surg Am. 2010 Jun;92(6):1560-7.
20. Young TB, Wallace WA. Conservative treatment of fractures and fracture-dislocations of the upper end of the humerus. J Bone Joint Surg Br. 1985;67:373-377.
21. Agorastides I, Sinopidis C, El Meligy M, Yin Q, Brownson P, Frostick SP. Early versus late mobilization after hemiarthroplasty for proximal humeral fractures. Journal of shoulder and elbow surgery. 2007 May 1;16(3):S33-8.
22. Zuckerman JD, Sajadi KR. Proximal Humerus Fractures: Hemiarthroplasty for Four- Part Fractures. Advanced Reconstruction Shoulder. AAOS 2007:30:283-98.
23. Plausins D, Kwon YW, Zuckerman JD. Complications of humeral head replacement for proximal humeral fractures. AAOS Instruc Course. 2005;54:371-380.