

ORIGINAL RESEARCH

TO DETERMINE THE FUNCTIONAL OUTCOME OF SHOULDERS NEER'S PROSTHESIS FOR FOUR PART FRACTURE DISLOCATION OF SHOULDER

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ABSTRACT

Aim: To determine the functional outcome of shoulder Neer's prosthesis for a four part fracture dislocation of shoulder.

Methods: This prospective research was carried out in the Department of Orthopaedics. The research covered patients with comminuted four component fractures with humeral head as a distinct fragment, older individuals, osteoporotic fractures, lesser tuberosity and larger tuberosity as separate pieces.

Results: Females made up 57.5 percent of the study population. The majority of patients (47.5 percent) were between the ages of 65-75, with those over 75 accounting for the remaining 25%. The mean age was 72.73 ± 7.77 years, the mean forward flexion was $128.45^\circ \pm 13.25$ degrees, the mean internal rotation was $46.95^\circ \pm 5.77$ degrees, the mean external rotation was $25.9^\circ \pm 2.11$ degrees, the mean ASES score was 79.36 ± 3.74 , the mean VAS score was 1.5 ± 0.48 degrees, and the mean Constant-Murley score was 82.1 ± 4.61 .

Conclusion: A patient who presents with a four-part fracture dislocation of the proximal humerus is unlikely to restore his or her pre-injury shoulder, particularly if the patient is old. The treatment method chosen is therefore one that most consistently and predictably recovers a range of usable mobility, improves the patient's daily comfort as quickly as feasible, and provides the patient with a pain-free, stable, functionally mobile shoulder.

Keywords: Four part fracture dislocation humerus, Neer's prosthesis, Proximal humerus, Shoulder hemiarthroplasty

INTRODUCTION

Proximal humerus fractures are the third most frequent appendicular bone fracture in individuals over the age of 65, with a greater prevalence in the female population.^{1,2} The great majority of patients may be treated conservatively, however some difficult fractures need surgery. The objective of surgical therapy is to retain prior levels of activity and autonomy while preserving shoulder function. Different fixation procedures (percutaneous pinning,³ intramedullary nailing, plating) and shoulder arthroplasty are surgical possibilities. The surgery should be chosen with numerous local (fracture pattern, bone quality, rotator cuff condition) and general (comorbidities, functional demands, treatment adherence) variables in mind. Unfortunately, there is no information to make simple recommendations, and the wide diversity in clinical practise among orthopaedic surgeons indicates a lack of agreement on the best way to treat these fractures.^{4,5}

When severe comminution and poor bone quality imperil the odds of success of any fixation approach, shoulder replacement is commonly advised for the therapy of proximal humeral fractures in older individuals. There are two types of implants available for this purpose: anatomical hemiarthroplasty (HA) and reverse total shoulder arthroplasty (RTSA) (RTSA). The first was pioneered and popularised in the 1950s by Charles Neer, who used a monobloc prosthesis particularly developed for fractures.⁶ Paul Grammont developed modern RTSA in the 1980s to treat arthritic shoulders with extensive cuff destruction;⁷ indications for this implant extended over time, including acute proximal humeral fractures.^{8,9}

The purpose of this research was to examine the short-term impact of shoulder hemiarthroplasty for four part fracture dislocations of the humerus, to address the surgical precautions and problems in hemiarthroplasty, and to analyse the prevention of complications.

METHODS AND MATERIAL

After receiving clearance from the protocol review committee and the institutional ethics committee, this prospective research was carried out at the Department of Orthopaedics of tertiary care. The research covered patients with comminuted four component fractures with humeral head as a distinct fragment, older individuals, osteoporotic fractures, lesser tuberosity and larger tuberosity as separate pieces. This research involved 40 participants. The research excluded compound shoulder fractures, pre-existing rotator cuff arthropathy, neuropathy causing atrophy of left shoulder muscles (eg, Brachial plexus palsy), and local skin infection.

For 12 months after hemiarthroplasty of the shoulder, 4 part fracture dislocation of the humerus was assessed. Forward elevation, internal rotation, external rotation, VAS score 10, American society of shoulder and elbow score 11, and Constant-Murley score were used for clinical and functional assessment. 12, 13 Anteroposterior and axillary lateral positions of the injured shoulder were included in routine radiography. CT images were used to acquire insight into the fracture and the degree of rotator cuff injury was determined by magnetic resonance imaging.

METHODOLOGY

The surgical site was cleansed with betadine the night before surgery, then covered with a sterile pad and wrapped. Intravenous antibiotics (third generation cephalosporins) were given once the night before (12 hours before operation) and again 30 minutes before incision. Ten minutes before surgery, the operative site's skin hair was removed. Under general anaesthesia, the patient was placed in a beach chair position, with the arm and shoulder prepped and draped, and the arm being operated on dangling over the side. The anterior deltoid and upper part of the pectoralis major were not detached during the deltopectoral approach. The long head of the biceps was found after releasing the clavipectoral fascia, which served as a marker in identifying the tuberosities. The bigger and lesser tuberosities were detected, the gap between the supraspinatus and subscapularis tendons was opened, and the rotator cuff insertions were tagged with 5-0 ethibond non absorbable sutures.

The greater and lesser tuberosities were separated to reveal the humeral head, which was removed without separating the subscapularis tendon. A trial stem was placed into the canal of the humerus shaft to establish height and version (approximately 300). Using an image intensifier- sized prosthesis, the tuberosities were decreased and the location and height of the prosthesis were evaluated. The prosthesis's stability and tightness were evaluated and determined to be good. Tuberosities were sutured together and then decreased around the stem's neck using 5-0 ethibond non-absorbable sutures, and a cancellous bone graft was put around the tuberosities to aid healing. Closure was accomplished in layers over a drain. Post-operative protocol-Intravenous third generation cephalosporins were administered for 24 hours after surgery, followed by oral antibiotics for 3 days. After 48 hours, the drain was removed. The shoulder was immobilised using a shoulder immobiliser. On the first post-operative day, the shoulder pendulum was trained, and vigorous elbow, wrist, and finger motions were initiated. At two weeks, the sutures were removed. Passive function exercises were begun for the first three weeks, followed by active aided mobility of the shoulder for the following three weeks, and active activities began at six weeks.

STATISTICAL INVESTIGATION

Data from patients who met the inclusion criteria were compiled in an electronic spreadsheet and analysed using SPSS 23.0.

RESULTS

Table 1: Sex distribution of the patients

Sex	Number	Percentage
Males	17	42.5
Females	23	57.5

Females made up 57.5 percent of the study population (Table 1). The majority of patients (47.5 percent) were between the ages of 65-75, with those over 75 accounting for the remaining 25%. (Table 2).

Table 2: Age of patients

Age (years)	No. of patients	Percentage
below 55	4	10
55-65	7	17.5
65-75	19	47.5
above 75	10	25

Table 3: Various result parameters

Parameter	Mean±SD
Age in years	72.73±7.77
ASES (100)	79.36±3.74
VAS (10)	1.5±0.48
Constant-Murley score (100)	82.1±4.61
Forward flexion	128.45°±13.25
Internal rotation	46.95°±5.77
External rotation	25.9°±2.11

Shoulder joint range of motion, American Society of elbow and shoulder (ASES) score (out of 100), Visual Analogue score (VAS) (out of 10), Constant-Murley score (out of 100), and imaging examination were used to assess patients clinically and functionally. The mean age was 72.73±7.77 years, the mean forward flexion was 128.45°±13.25 degrees, the mean internal rotation was 46.95° ±5.77 degrees, the mean external rotation was 25.9° ±2.11 degrees, the mean ASES score was 79.36±3.74, the mean VAS score was 1.5±0.48 degrees, and the mean Constant-Murley score was 82.1±4.61. (Table 3).

COMPLICATIONS

At the time of the follow-up, no further problems such as infection, stress fracture, or tuberosity displacement were noted. On the first postoperative day, three patients developed axillary nerve injury with paresthesia on the lateral border of the shoulder, which recovered completely after six weeks with neurotropic drugs and physiotherapy, and three diabetic patients with poor compliance to oral hypoglycemic drugs developed a superficial skin infection, which healed completely with oral antibiotics and dressing.

DISCUSSION

Plate osteosynthesis provides good initial reduction in patients with four part fracture dislocation of the proximal humerus, but there is a risk of secondary loosening in osteoporotic bones or humeral head necrosis leading to catastrophic functional impairment and reintervention, especially when the humeral head is small and as a separate fragment.¹⁰⁻¹⁷ A detailed understanding of shoulder anatomy is required for patient selection and providing the best possible result following hemi-arthroplasty. The prime candidates for Neer's hemiarthroplasty of the shoulder are elderly patients with displaced fractures and poor bone quality.¹⁸⁻²⁰ In our series, the average age was 72.73±7.77 years. Tian et al discovered that the average age was 71.9 years.¹⁷ Shah et al discovered that the average age was 72.2 years.¹⁹ Kontakis et al discovered that the average age was 67.7 years.²²

In our investigation, the mean forward elevation was $128.45^{\circ} \pm 13.25$. Tian et al discovered a mean forward elevation of 132.5° .¹⁷ Shah et al discovered that the average forward elevation is 85.1° .¹⁹ Mighell et al discovered a mean forward elevation of 128° .¹⁸ Pascal et al discovered that the mean forward elevation is 135° .²⁰ Goldman et al discovered that the average forward elevation is 107° .²³ Kontakis et al discovered a mean forward elevation of 105.7° .²²

In our investigation, the average internal rotation was $46.95^{\circ} \pm 5.77$. Tian et al discovered that the mean internal rotation is 47.1° .¹⁷ Mighell et al discovered that the mean internal rotation was till the L2 vertebrae.¹⁸ Pascal et al colleagues discovered that the mean internal rotation extends till the L5 vertebral level.²⁰ Goldman et al discovered that the mean internal rotation occurs at the L2 vertebral level.²³

In our investigation, the average exterior rotation was $25.9^{\circ} \pm 2.11$. Tian et al discovered that the mean external rotation is 29.5° .¹⁷ Mighell et al discovered that the mean exterior rotation is 43° .¹⁸ while Pascal et al discovered that the mean internal rotation is 24° .²⁰ Goldman et al discovered that the mean internal rotation is 31° .²³

In our research, the mean ASES was 79.36 ± 3.74 . Tian et al.¹⁷ discovered that the average ASES is 88.8. Shah et al¹⁹ discovered an ASES of 67.1. Mighell et al¹⁸ discovered a mean ASES of 76.6.

In our investigation, the mean VAS score was 1.5 ± 0.48 . Xu tian et al¹⁷ discovered a mean VAS score of 0.8. In our investigation, the average Constant Murley score was 82.1 ± 4.61 . Tian et al¹⁷ discovered that the mean Constant Murley score is 89.1 Pascal et colleagues²⁰ discovered a mean Constant Murley score of 64. Anjum et al²¹ discovered a mean Constant score of 47.5.²¹ Kontakis et al²² discovered a mean Constant Murley score of 56.63. Hartog et colleagues²⁴ discovered a mean Constant Murley score of 66.5.

In our investigation, three patients suffered from axillary nerve damage and three others from superficial skin infection. Mighell et al found that the most prevalent problem in their research was larger tuberosity malunion.¹⁸ Kontakis et al reported superficial infection in 1.58 percent of their patients and profound infection in 0.64 percent.²² For such severely comminuted fractures, hemi-arthroplasty using Neer's prosthesis results in a great functional and clinical outcome, allowing the patient to continue out everyday activities. Post-operative function and satisfaction were good in patients who had this operation. Earlier surgical intervention in these fractures with shoulder hemi-arthroplasty reduces complications and optimises function in these patients, allowing them to do everyday activities without pain or discomfort.

CONCLUSION

A patient who presents with a four-part fracture dislocation of the proximal humerus is unlikely to restore his or her pre-injury shoulder, particularly if the patient is old. The treatment method chosen is therefore one that most consistently and predictably recovers a range of usable mobility, improves the patient's daily comfort as quickly as feasible, and provides the patient with a pain-free, stable, functionally mobile shoulder.

REFERENCE

1. Court-Brown CM, Caesar B. Epidemiology of adult fractures: A review. *Injury* 2006;37:691-7.
2. Calvo E, Morcillo D, Foruria AM, et al. Nondisplaced proximal humeral fractures: high incidence among outpatient-treated osteoporotic fractures and severe impact on upper extremity function and patient subjective health perception. *J Shoulder Elbow Surg* 2011;20:795-801.
3. Rosa MA, Maccauro G, Nizegorodcew T, et al. Percutaneous elastic fixation of proximal humeral fractures: operative indications, techniques, results and complications. *J Orthop Traumatol* 2002; 2:157-64.
4. Murray IR, Amin AK, White TO, Robinson CM. Proximal humeral fractures: current concepts in classification, treatment and outcomes. *J Bone Joint Surg Br* 2011;93:1-11.
5. Piccioli A, Maccauro G, Rossi B, et al. Surgical treatment of pathologic fractures of humerus. *Injury*. 2010; 41:1112-6.
6. Neer CS. Articular replacement for the humeral head. *J Bone Joint Surg Am* 1955;37-A:215-28.
7. Grammont P, Trouilloud P, Laffay J, Deries X. Study and development of a new shoulder prosthesis. *Rhumatologie* 1987;39:407-18
8. Murray IR, Amin AK, White TO, Robinson CM. Proximal humeral fractures: current concepts in classification, treatment and outcomes. *J Bone Joint Surg Br*. 2011;93:1-11.
9. Piccioli A, Maccauro G, Rossi B. Surgical treatment of pathologic fractures of humerus. *Injury*. 2010;41:1112-6
10. Paavolainen P, Bjorkenheim JM, Slati P, Pauku P. Operative treatment of severe proximal humeral fractures. *Acta Orthop Scand*. 1983;54:374-9.
11. Hessmann M, Baumgaertel F, Gehling H, Klingelhoefffer I, Gotzen H. Plate fixation of proximal humeral fractures with indirect reduction: surgical technique and results utilizing three shoulder scores. *Injury*. 1990;30:453-62.
12. Adedapo AO, Ikpeme JO. The results of internal fixation of three and four part proximal humeral fractures with the Polarus nail *Injury*. 2001;32:115- 21.
13. Kralinger F, Schwaiger R, Wambacher M, Farrell E, Chiari W, Lajtai G. Outcome after primary hemiarthroplasty for fracture of the head of the humerus A retrospective multicentre study of 167 patients. *J Bone Joint Surg*. 2004;86:217-9.
14. Bigliani LU. Fractures of the proximal humerus. In: Rockwood CA, Matsen FA, editors. *The shoulder*. Philadelphia: W.B. Saunders. 1990:278-334.
15. Bigliani LU, McClusky GN. Prosthetic replacement in acute fractures of the proximal humerus. *Semin Arthroplasty*. 1990;1:129-37.
16. Compito CA, Self EB, Bigliani LU. Arthroplasty in acute shoulder trauma. *Coordination*. 1994;307:27- 36.
17. Tian X, Xiang M, Wang G, Zhang B, Liu J, Pan C, et al. Treatment of complex proximal humeral fractures in the elderly with reverse shoulder arthroplasty. *Orthop Surg*. 2020;12:1372-9.
18. Mighell MA, Kolm GP, Collinge CA, Frankle MA. Outcomes of hemiarthroplasty for fractures of the proximal humerus. *J Shoulder Elbow Surg*. 2003;12(6):569-77.

19. Shah N, Iqbal HJ, Brookes-Fazakerley S, Sinopidis C. Shoulder hemiarthroplasty for the treatment of three and four part fractures of the proximal humerus using Comprehensive® Fracture stem. *Int Orthop*. 2011;35(6):861-7.
20. Boileau P, Alta TD, Decroocq L, Sirveaux F, Clavert P. Reverse shoulder arthroplasty for acute fractures in the elderly: is it worth reattaching the tuberosities? *J Shoulder Elbow Surg*. 2019;28(3):437-44.
21. Anjum SN, Butt MS. Treatment of comminuted proximal humerus fractures with shoulder hemiarthroplasty in elderly patients. *Acta Orthop Belg*. 2005;71(4):388-95.
22. Kontakis G, Koutras C, Tosounidis T, Giannoudis P. Early management of proximal humeral fractures with hemiarthroplasty: a systematic review. *J Bone Joint Surg Br*. 2008;90(11):1407-13.
23. Goldman RT, Koval KJ, Cuomo F, Gallagher MA, Zuckerman JD. Functional outcome after humeral head replacement for acute three- and four-part proximal humeral fractures. *J Shoulder Elbow Surg*. 1995;4:81–86.
24. Hartog D, Haan J, Schep NW, Tuinebreijer WE. Primary shoulder arthroplasty versus conservative treatment for comminuted proximal humeral fractures: a systematic literature review. *Open Orthop J*. 2010;4:87-92