International Journal of Research in Orthopaedics
Basavanagowda P et al. Int J Res Orthop. 2023 Sep;9(5):988-993
http://www.ijoro.org

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20232612

Original Research Article

Comparative study between deltoid split approach versus delto pectoral approach for proximal humerus fracture fixation

Prabhu Basavanagowda, Prerak Jain*, Jayanth Bisaleri, Bhupender Jakhar

Department of Orthopaedics, J. J. M. Medical College, Davangere, Karnataka, India

Received: 12 May 2023
Revised: 09 June 2023
Accepted: 14 August 2023

***Correspondence:**
Dr. Prerak Jain,
E-mail: prerakj30@gmail.com

ABSTRACT

Background: Proximal humeral fracture is defined as fractures occurring at or proximal to the surgical neck of the humerus. It affects 2.4% of women over the age of 75 years. It is the commonest fracture affecting the shoulder girdle in adults and its incidence is rising. For displaced fractures that meet surgical indications, deltopectoral approach is the most common approach for plate fixation of proximal humeral fractures. Deltoid splitting approach offers advantages of better exposure and implant placement for fixation of the fracture and early mobilization of the shoulder joint.
Methods: This is a comparative study of 30 cases of proximal humerus fractures treated by surgical fixation through deltoid splitting approach and 30 cases treated by delto pectoral approach. Patient of both sexes belonging to adult age group in general population presenting with proximal humerus fracture to the orthopaedic department of Bapuji Hospital and Chigateri General hospital attached to J.J.M. Medical College, Davangere. The period of survey extends from December 2020 to December 2022. The final results were evaluated using constant Murley score periodically. This constant Murley score ranges from 0 to 100 points representing worst and shoulder function respectively.
Results: No statistically significant difference was observed in outcome with regard to mechanism of injury, side of fracture and type of fracture with both deltoid splitting approach and delto pectoral approach.
Conclusions: The treatment of proximal humeral fractures with a proximal locking plate is reliable using both approaches. No significant difference found in functional outcome of proximal humerus fracture following deltoid split and deltopectoral approach on serial follow up.

Keywords: Deltoid splitting approach, Delto pectoral approach; surgical neck of humerus fractures, Proximal humerus fracture, Neer's score

INTRODUCTION

Fractures occurring at or proximal to the surgical neck of the humerus is known as proximal humeral fracture. It affects 2.4% of women over the age of 75 years.[4]

It is one of the commonest fracture affecting the shoulder girdle in adults and its incidence is rising. Studies of approximately 50 years ago showed that proximal humeral fractures comprised 4% of all fractures and approximately one-half of all humerus fractures.[5] The current fracture epidemiology shows that nowadays proximal humeral fractures account for almost 7% of all fractures and make up 80% of all humeral fractures. In patients above the age of 65 years proximal humeral fractures is the second most frequent fracture, and the third most common non vertebral osteoporotic fracture after proximal femur and distal radius fractures, accounting for >10% of fractures in this patient population.[6] Proximal humeral fractures have an increased risk for subsequent distal radius and proximal femur fractures. Patients with proximal humeral fractures have a greater than 5 times risk of suffering a hip fracture within 1 year than matched pairs without proximal humeral fractures.[7] Most of the proximal humeral fractures

are managed non-operatively. Although most studies support good outcomes of non-operative treatment of non-displaced fractures. However, surgical treatment is becoming more frequent, with fracture reconstruction increasing at a higher rate than prosthetic replacement. The rate of surgically treated fractures shows variability, ranging from less than 10% to 40% or more.[8]

Different types of surgical methods consist of K-wire, TBW, screws, IMIL nail, arthroplasty or plate. Most commonly used is the plate. The commonly used surgical approaches are deltopectoral approach and deltoid splitting approach.

Objective of the study was conducted to analyse fractures of proximal humerus that were treated with open reduction and internal fixation via deltoid splitting and delto pectoral approach and document their clinical and functional outcome.

METHODS

This is a comparative study of 30 cases of proximal humerus fractures treated by surgical fixation through deltoid splitting approach and 30 cases treated by delto pectoral approach after obtaining ethical committee clearance.

Source of data

Patient of both sexes belonging to adult age group in general population presenting with proximal humerus fracture to the orthopaedic department of Bapuji Hospital and Chigateri General hospital attached to J. J. M. Medical College, Davangere. The period of survey extends from December 2020 to December 2022.

Patients of age more than 18 years irrespective of sex with proximal humerus fracture were considered in the study. Patients aged less than 18 years, patient with other associated humerus fracture, patient with other associated fracture around shoulder, fracture dislocation, patient with compound fracture, patient with pathological fracture were not included in the study.

Patients willing for surgery and fulfilling the selection criteria were informed about the nature of the study. The consent for surgery and anaesthesia was also taken from the patient and attendants after explaining the procedure and possible complications in their own vernacular language. Follow-up of patients was done at four weeks, three months and six months following the surgery.

Study type

It was a comparative type of study.

The final results were evaluated using constant Murley score periodically. This constant Murley score ranges from 0 to 100 points representing worst and shoulder function respectively.

Operative procedure

Patients were placed in supine position on operating table, injured shoulder was elevated by placing a sandbag underneath posterior chest. Arm was draped free, because it will have to be moved during the procedures.

In deltoid splitting approach, anatomical landmarks were marked, lateral border of the acromion, and lateral side of the proximal humeral shaft.

Incision starts at lateral end of acromion and extended vertically down. Exposure of the middle third (acromial) part of the deltoid muscle is done and the muscle is split between its fibers. But did not split it distally more than 5 cm from its origin to avoid damaging the axillary nerve and paralyzing the anterior part of the deltoid. Fracture site was visualized and fracture fixation was done with appropriate implant.

The delto pectoral approach consisted of a 15-cm skin incision being made from the coracoid process toward the deltoid. The cephalic vein was identified and the deltopectoral interval developed. The subacromial bursa was resected to allow placement of a Hohmann retractor under the deltoid just lateral to the acromion. A second Hohmann was placed under the deltoid along the humeral shaft, and a third was placed medially just distal to the subscapularis tendon but proximal to the pectoralis major insertion. The arm was abducted and internally rotated. Fracture site was visualized and fracture fixation was done with appropriate implant.

Shoulder was immobilized in a universal shoulder immobilizer after surgery. Appropriate antibiotics and analgesics were given. Immediate post-operative check radiographs were taken to determine the alignment of the bone and maintenance of reduction. Sutures removal was done on 10th day.

Passive range of motion started on post-operative day two. Pendulum exercises initiated on post op day five. Active range of motion was started at two to four weeks postoperatively, depending on stability of osteosynthesis. Active assisted movements started up to 90° abductions with no forced external rotation was started.

RESULTS

In our study the maximum patients were in 61-70 age group (40%). 26.6% in 51-60 years of age group, 13.3% in 41-50 years of age group, 13.3% in 31-40 years of age group, 6% in 21-30 years of age group. In our study there is wide distribution in age. The proximal humerus fracture is more common in females than in males. In our study 24 patients were male (40%) and 36 (60%) patients were female.

In our study 40 patients had right sided injury and 20 had left sided injury. In our study we have noted that the proximal fractures in young adults occurs as a result of high energy trauma like motor vehicle accidents and in older age group the cause is accidental self-fall. 26.6% (16 patients) sustained injury due to motor vehicle accidents and 73.3% (44 patients) sustained injury due to self-fall at home

We have observed that there was no Neer's type I fractures. There were 36 patients who were classified as type II accounted for 60%, 14 patients were classified as type III accounted for 23.3% and 10 patients were classified as type IV accounted for 16.6%. Worldwide, locking compression plate is the preferred treatment of choice in all age groups. Out of 60 patients, we have fixed 52 fractures with LCP (86.6%), 4 fractures with proximal humeral nail (6.6%) and 24 fractures with screw fixation (6.6%). In 30 cases deltoid splitting approach and rest 30 deltopectoral approach were used.

In 8 cases we encountered shoulder stiffness as a complication. The stiffness gradually improved with aggressive rehabilitation and regular follow up. These patients were aged >60 years, so rehabilitation is difficult. In our study, we didn't encounter any regimental batch of anesthesia (due to axillary nerve involvement). We encountered 2 case of head implant loosening and 4 cases of malreduction of fracture as a complication. While in deltopectoral approach, in 7 cases we encountered shoulder stiffness as a complication. The stiffness gradually improved with aggressive rehabilitation and regular follow up. These patients were aged >60 years, so rehabilitation is difficult. In our study, we didn't encounter any regimental batch of anesthesia (due to axillary nerve involvement). We encountered 3 case of head implant loosening and 6 cases of malreduction of fracture as a complication.

Table 1: Age wise distribution (n=60).

Age (in years)	Number of patients	Percentage
21-30	4	6
31-40	8	13.3
41-50	8	13.3
51-60	16	26.6
61-70	24	40

Table 2: Sex distribution (n=60).

Gender	Number of patients	Percentage
Male	24	40
Female	36	60

The functional outcome was measured using constant Murley score at 4 weeks, 3 months and 6 months postoperatively. The score improved as aggressive rehabilitation progressed. In deltoid splitting approach, 2 patients (6.6%) had poor functional outcome at 6 months. 6 patients (20%) had fair functional outcome at 6 months. 14 patients (46.6%) had good functional outcome at 6 months. 8 patients (26.6%) had excellent functional outcome at 6 months. While in deltopectoral approach, 3 patients (10%) had poor functional outcome at 6 months. 5 patients (16.6%) had fair functional outcome at 6 months. 13 patients (33.3%) had good functional outcome at 6 months. 9 patients (30%) had excellent functional outcome at 6 months.

Table 3: Side distribution (n=60).

Side	Number of cases	Percentage
Right	40	66.6
Left	20	33.3

Table 4: Mode of injury distribution.

Mode	Number of cases	Percentage
RTA	16	26.6
Self-fall	44	73.3

Table 5: Distribution according to Neer's type.

Type	Number of cases	Percentage
I	0	0
II	36	60
III	14	23.3
IV	10	16.6
V	0	0

Table 6: Distribution according to fixation modalities.

Modalities	Number of cases	Percentage
Locking compression plate	52	86.6
Nail	4	6.6
Screw	4	6.6

Table 7: Complications.

Complica-tions	Deltoid splitting		Deltopectoral	
	No. of patients	**%**	**No. of patients**	**%**
Stiffness	8	26.6	7	23.3
Head implant loosening	2	6.6	3	10
Infection	0	0	0	0
Malreduction	4	13.3	6	20
Osteonecrosis	0	0	0	0
Non union	0	0	0	0

Case illustrations

Case 1: 32-year-old male patient with diagnosis of traumatic left Neer's type 2 proximal humerus fracture - deltoid splitting approach.

Pre op X-ray

It is shown in Figure 1.

Figure 1: Plain radiograph of left shoulder anteroposterior view showing left Neer's type 2 proximal humerus fracture.

Table 8: Range of motion.

Follow ups	Distribution (n=60)	
	Mean (deltoid split approach)	Mean (delto pectoral approach)
Follow up at 6 weeks (1st follow up)		
Flexion	89	86
Abduction	104	99
External rotation	45.5	42
Internal rotation	49	43
Follow up at 3 months (2nd follow up)		
Flexion	111	110
Abduction	122	110
External rotation	55	50
Internal rotation	56	55
Follow up at 6 months (3rd follow up)		
Flexion	126.5	120.5
Abduction	133.5	130.5
External rotation	66	60
Internal rotation	59	55

Table 9: Distribution according to functional outcome.

Outcome	Deltoid splitting		Deltopectoral	
	No. of patients	%	No. of patients	%
Poor	2	6.6	3	10
Fair	6	20	5	16.6
Good	14	46.6	13	43.3
Excellent	8	26.6	9	30

Post op X-ray

It is shown in Figure 2.

Figure 2: Plain radiograph of left shoulder anteroposterior and axial view showing left Neer's type 2 proximal humerus fracture with PHILOS plate via deltoid splitting approach.

Clinical images

It is shown in Figure 3.

Figure 3: Significant range of abduction with external rotation, flexion and extension with internal rotation at left shoulder respectively at 6 months of follow up.

Case 2: 45-year-old female patient with diagnosis of traumatic left Neer's type 3 proximal humerus fracture - deltopectoral approach.

Pre op X-ray

It is shown in Figure 4.

Figure 4: Plain radiograph of left shoulder anteroposterior view showing left Neer's type 3 proximal humerus fracture.

Post op X-ray

It is shown in Figure 5.

Figure 5: Plain radiograph of left shoulder anteroposterior view showing left Neer's type 3 proximal humerus fracture with PHILOS plate via deltopectoral approach.

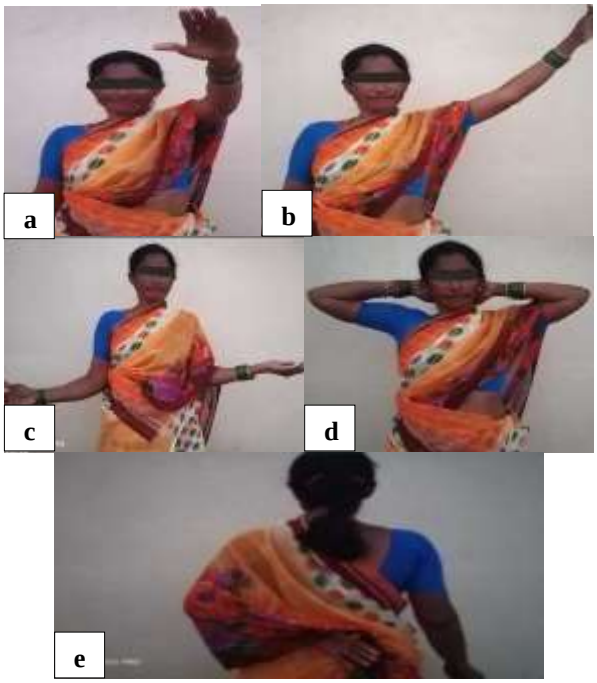

Figure 6: Pictures showing significant range of movements at left shoulder at 6 months of follow up (a) flexion, (b) abduction, (c) and (d) external rotation, and (e) internal rotation.

DISCUSSION

The functional outcome mainly depends on age, type fracture, approach used for the fracture fixation, fracture reduction and rehabilitation. The deltoid splitting approach is very good option for treating Neer's type 2,3,4 and repair rotator cuff is also feasible. The disadvantage is that fracture dislocation is difficult to manage and it requires most of the time deltopectoral approach. The complications associated with deltoid splitting approach is minimal and incidence of malreduction is negligible. The repair of rotator cuff also adds to better outcome in this approach.

We found no difference between both approaches with respect to the total complication rate. Although not statistically significant, we found a different distribution of complications between the deltoid split and the deltopectoral. All complications in the deltoid-split group affected the head region, whereas the majority of complications in the deltopectoral group was loosening of the plate in the shaft region. This may indicate that adequate reduction and fixation of the fracture is more difficult through the small incision of the deltoid-split approach.[9]

Fixation on the shaft, however, might be easier with deltoid split less invasive approach. On the other hand, in a small nonrandomized study, Wu et al. found no radiological differences with respect to reduction of the fracture postoperatively and the head displacement during followup.[10] Röderer et al found higher incidences of intraarticular screw perforation (deltoid-split 17.0% versus deltopectoral 12.8%) but lower rates of proximal screw loosening (deltoid-split 1.9% versus deltopectoral 1.3%) as compared with our results without differences between the different approaches.[11] Finally, Hepp et al found also the same complication rates with both approaches. By contrast to our results, they did not find loosening of the plate in the shaft either using the deltoid-split or the deltopectoral approach.[12]

It is observed that young adults mostly males have better functional outcome than old age patients. Mostly because of early reporting to hospital, good bone stock, no comorbidities and good patient compliance in rehabilitation follow up. In old age group functional demands are less and they can well manage with an outcome of fair to good. The simpler the fracture pattern and early reduction using this approach gives excellent results.

The importance of physical rehabilitation cannot be ignored. The strict rehabilitation protocol should be followed. Even if there is minor malreduction, with proper rehabilitation good functional outcome can be achieved. The patients who will develop stiffness during the course of treatment can be rehabilitated with aggressive physiotherapy. We found that proximal humeral fractures can be effectively treated with a proximal locking plate through either the deltoid-split or the deltopectoral approach. Based on our result, a definitive recommendation for one of these approaches cannot be given. For clarity, further studies with appropriate sample sizes are necessary.

Limitations

The study had the following limitations: small sample size, single centric study, and short follow up duration.

CONCLUSION

No significant difference found in functional outcome of proximal humerus fracture following deltoid split and deltopectoral approach on serial follow up.

Recommendations

Deltoid splitting approach is viable and easy approach for proximal humerus fracture fixation. Provides minimal soft tissue injury, enhanced surgical exposure, good access for reduction, implant placement and early range of motion at shoulder joint. This approach is associated with low incidence of malreduction.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Canale ST, Beaty JH. Campbell's Orthopaedic surgery 14th edition. Elsevier - Health Sciences Division. 2020.
2. Tornetta P, Ricci W, Court-Brown CM, McQueen MM. RockWood and Green's fractures in adults 9th edition. Wolters Kluwer Health. 2019.
3. Muller ME, Allgöwer M, Schneider R, Willenegger H, Schatzker J, Bandi W, et al. AO Manual of internal fixation 2nd edition. Springer. 2012.
4. Lee SH, Dargent-Molina P, Breart G. Risk factors for fractures of the proximal humerus: results from the EPIDOS prospective study. J Bone Miner Res. 2002;17(5):817-25.
5. Horak J, Nilsson BE. Epidemiology of fracture of the upper end of the humerus. Clin Orthop Relat Res. 1975;112:250-3.
6. Baron JA, Barrett JA, Karagas MR. The epidemiology of peripheral fractures. Bone. 1996;18(3):209S-13S.
7. Olsson C, Nordqvist A, Petersson CJ. Increased fragility in patients with fracture of the proximal humerus: a case control study. Bone. 2004;34(6):1072-7.
8. Bell JE, Leung BC, Spratt KF, Koval KJ, Weinstein JD, Goodman DC, Tosteson AN. Trends and variation in incidence, surgical treatment, and repeat surgery of proximal humeral fractures in the elderly. J Bone Joint Surg Am. 2011;93(2):121-31.
9. Buecking B, Mohr J, Bockmann B, Zettl R, Ruchholtz S. Deltoid-split or Deltopectoral Approaches for the Treatment of Displaced Proximal Humeral Fractures? Clin Orthop Relat Res. 2014;472(5):1576-85.
10. Wu CH, Ma CH, Yeh JJ, Yen CY, Yu SW, Tu YK. Locked plating for proximal humeral fractures: differences between the deltopectoral and deltoid-splitting approaches. J Trauma. 2011;71(5):1364-70.
11. Röderer G, Erhardt J, Kuster M, Vegt P, Bahrs C, Kinzl L, Gebhard F. Second generation locked plating of proximal humerus fractures--a prospective multicentre observational study. Int Orthop. 2011;35(3):425-32.
12. Hepp P, Theopold J, Voigt C, Engel T, Josten C, Lill H. The surgical approach for locking plate osteosynthesis of displaced proximal humeral fractures influences the functional outcome. J Shoulder Elbow Surg. 2008;17(1):21-8.

Cite this article as: Basavanagowda P, Jain P, Bisaleri J, Jakhar B. Comparative study between deltoid split approach versus delto pectoral approach for proximal humerus fracture fixation. Int J Res Orthop 2023;9:988-93.