

COMPARISON OF DELTOPECTORAL APPROACH AND LATERAL TRANSDeltaTOD APPROACH IN SURGICALLY TREATED PROXIMAL HUMERUS FRACTURES IN RELATION TO PERI-OPERATIVE AND POST-OPERATIVE FACTORS

Orthopaedics

Dr. P. T. V. Kiran Kumar

Assistant Professor

Dr. K. Srinivas Rao Associate Professor

Dr. Swargam Jyothirmai*

Post Graduate. *Corresponding Author

ABSTRACT

Deltpectoral approach (DP) is the most widely used approach for open reduction and internal fixation (ORIF) of proximal humerus fractures. The deltoid-splitting (DS) or lateral transdeltoid approach is also favored by several authors since it allows a direct approach through the fracture site between the greater and lesser tuberosities. In this study, we have compared both the approaches in terms of operating time, anatomical reduction of fracture, post operative complications and functional outcome by Constant Murley Score. **Methods :** Over 30 patients with Neer's 3 part and 4 part fractures who met the inclusion criteria participated in this prospective randomised control trial from October 2020 to October 2022 at GOVERNMENT MEDICAL COLLEGE, SRIKAKULAM. **Results :** 30 patients in total were randomly assigned to the two groups (15 DS, 15 DP; mean ages for DS group is 53.33 years, and DP group is 43.93 years). Age, gender, and Neer fracture classification differences across the groups were statistically minimal. Intraoperative time was not significantly different ($p = 0.757$) between the two groups. With the DP method as compared to the DS method, the surgeons were able to accomplish a noticeably greater anatomical reduction in the immediate postoperative X-ray. ($p = 0.04385$, significant). We found 3 distinct complications in the DS group and 1 in the DP group. There is no significant difference in the functional outcome by Constant Murley Score in between 2 groups ($p=0.531948$). **Conclusion :** Based on our findings, both of the aforementioned approaches are thought to be reliable for treating proximal humerus fractures with PHILOS plate. The length of the operation is unaffected by the method chosen. However, Immediate postoperative X-ray results showed that individuals who underwent surgery using the DP technique did better in terms of achieving reduction.

KEYWORDS

Deltpectoral, Constant Murley Score, proximal humerus

INTRODUCTION

Fractures involving the proximal humerus constitutes about 4% of all fractures and nearly one-half of all humerus fractures^[1]. These are typically seen in adolescents and younger adults due to high-energy trauma. At the same time, in elderly people, it often results from osteoporotic injuries with limited energy^[2,3]. Consideration should be given to surgical treatment in younger or more active older people. Otherwise, the articular joint surface may more seriously impair sustained shoulder performance^[4]. ORIF of these fractures have become more common since closed reduction and external fixation have not been successful in maintaining reduction and correcting deformity^[5].

Two surgical approaches are commonly used to perform ORIF. These are the deltpectoral approach and the deltoid-splitting approach. Although, the deltpectoral approach is considered the workhorse for reconstructive shoulder surgery, it is not always apparent, especially in patients with muscle atrophy or previous surgery. Mobilizing the cephalic vein medially in DP approach allows for improved exposure by avoiding proximal tethering of the cephalic vein when lateral retraction of the deltoid is required. Careful soft tissue management is required to avoid devascularization of the fracture fragments in DP approach. The long head of the biceps tendon is identified on the anterior aspect of the proximal shaft, in proximity to the ascending branch of the ACHA. So, extensive dissection of this tendon should be avoided.

The deltoid-splitting approach is performed in the interval between the anterior and middle deltoid raphe. Longitudinal vertical 4 cm incision will be given starting at the anterolateral corner of the acromion^[6,7]. The axillary nerve can be identified by digital palpation on the undersurface of the deltoid traveling from posterior to anterior at an average of 5 cm distal to the acromion. A stay suture is placed at the inferior aspect of the split to avoid inadvertent propagation distally thereby protecting the axillary nerve.

Since the axillary nerve crosses the anterior raphe as a single branch, innervation of the anterior deltoid can be preserved by protecting it during dissection. The deltoid-splitting approach has two major disadvantages. In anteroinferior fracture dislocations, the humeral head fragment may not be accessible through this approach. In addition, the terminal anterior branch of the axillary nerve may be

inadvertently damaged thereby leading to potential deltoid dysfunction.

Keeping the advantages and disadvantages of these 2 approaches in mind and by preventing complications in best possible way in our institution, a randomized control study was done and results were assessed based on operating time, anatomical reduction of fracture, post operative complications and functional outcome by Constant Murley Score.

MATERIALS AND METHODS:

Type Of Study :

prospective randomized control study

Study Period :

October 2020 to October 2022.

Place Of Study:

Government Medical College, Srikakulam.

Sample Size :

30 patients

Inclusion Criteria :

1. Adult patients (age >20 years) 2. Neer's 3 part and 4 part fractures 3. Who are fit for surgery 4. Who are treated with ORIF with PHILOS plating

Exclusion Criteria :

1. Age <20 years 2. Open fractures 3. Fractures with distal neurovascular deficit 4. Pathological fractures 5. Unfit for surgery

Method Of Randomisation :

computer-generated method

Preoperative Work Up :

All the patients who were diagnosed with Neer's 3 part and 4 part fractures and satisfying the inclusion criteria were explained about the aim of the study. Only those patients who have given consent for participation in the study were included here. For all the study population, soon after admission, necessary blood investigations and cardio-respiratory assessment was done. These cases were posted for

surgery after pre- anesthetic check up and randomisation for surgical approach was done on the day before surgery.

All the cases were done in supine position under ipsilateral Brachial plexus block with sandbag beneath the medial border of ipsilateral scapula to bring the ipsilateral shoulder forward and allowing the ipsilateral arm to fall backward for adequate opening of anterior opening of shoulder joint and proximal humerus. Skin incision was given according to the allocated approach. Out of 30 patients, 15 were treated with ORIF using DP approach and remaining 15 were treated with ORIF using Transdeltoid approach.



Figure 1 : Deltpectoral Approach



Figure 2 : Transdeltoid Approach

Surgical Technique :

After adequate visualization of proximal humerus along with shoulder joint under fluoroscopy, the fracture site is exposed. Initially, the tuberosities are reduced to the head with rotator cuff sutures and shaft is manipulated to reduce surgical neck and fixed temporarily with k-wires. Transdeltoid approach allows easier reduction of greater tuberosity fragment which was displaced posterosuperiorly when compared to deltpectoral approach. After checking the adequacy of fracture reduction in AP and lateral views, plate is positioned about 5-8mm distal to tip of greater tuberosity, along the axis of humerus shaft and 2-4mm posterior to bicipital groove to prevent loss of fracture reduction and subacromial impingement. Though Transdeltoid approach allows proper and easier positioning of plate when compared to deltpectoral approach which requires extensive soft tissue dissection, it carries a potential risk of damage to axillary nerve.

After proximal and distal screw fixation, the stability of reduction is checked under fluoroscopy. Deltoid splitting approach carries high risk of axillary nerve damage with drain placement after fracture fixation. These cases were followed up at 6 weeks, 3months, 6 months. None of the cases were lost to follow up.

Perioperative And Postoperative Factors For Evaluation:

1. Time taken for surgery - From skin incision to skin closure.
2. Anatomical reduction of fracture - Paavolainen radiological method^[8].

Anatomical Reduction by Paavolainen method

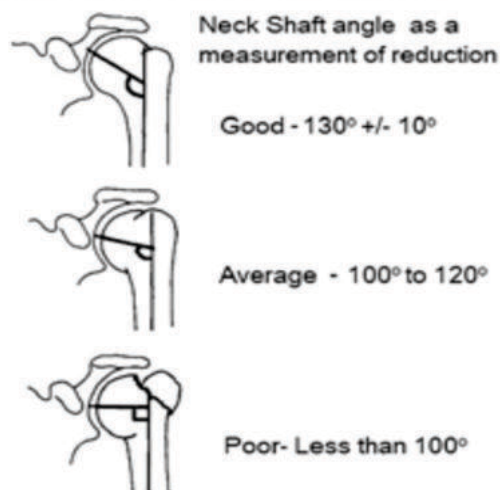


Figure 3: Paavolainen method.

- Distance of GT from articular surface (ideal - 5-8mm).
 - Radiographic indicators for poor outcome are varus angulation with NSA <120°, superior displacement of GT above AS, the presence of medial gap >4 mm, and absence of calcar specific screw. This "terrible triad" of proximal humerus fracture should be avoided during operative fixation
3. Post operative complications.
 - Surgical site Infection
 - Loss of reduction
 - Axillary nerve injury
 - Subacromial impingement
 4. Functional outcome by Constant Murley Score.

Statistical Analysis :

The Chi-square test was used for categorical data for the two groups. A p-value of less than 0.05 was considered statistically significant. The SPSS Statistics software (IBM Corp., Armonk, NY) was used for the statistical analysis. The result is significant at $p < 0.05$.

RESULTS:

Table 1 : Evaluation Of Pre Operative Factors

PREOPERATIVE FACTORS :					
Category	Types	DP approach	Transdeltoid approach		p-value
Age		Mean 43.93yrs	Mean 53.33 yrs	Mean + SD48.63 + 16.98	0.1259 Not Significant
Gender	Male	11	10	21	0.690 Not Significant
	Female	4	5	9	
Side	Right	11	8	19	0.255704 Not Significant
	Left	4	7	11	
Fracture pattern	Neer 3 part	7	8	15	0.715001 Not Significant
	Neer 4 part	8	7	15	

Table 2: Evaluation Of Peri Operative Factors

Post-operative Complications:			
Surgical site Infection	0	1	
Loss of reduction	1	0	
Axillary nerve injury	0	1	
Subacromial impingement	0	1	

Constant Murley Score For Functional Assessment:				
Excellent	100-86	10	6	0.531948 Not Significant
Good	71-85	2	4	
Satisfactory	70-56	2	3	
Worse	<56	1	2	

Table 3: Evaluation Of Post Operative Factors

Peri-operative Factors :				
Time taken for surgery		Mean 49.14	Mean 45.75	Mean + SD 47.52 ± 10.77
NSA	Good	10 cases	4 cases	0.04385 Significant
	Average	4 cases	5 cases	
	Poor	1 cases	6 cases	

DISCUSSION

In this present study, several variables had been compared in ORIF of proximal humerus fractures by deltopectoral approach and transdeltoid lateral approach. In RCT conducted by Zhao et al. study^[9] (2017) in China, 17 cases were treated with deltoid splitting approach and 19 cases were treated with deltopectoral approach. Mean age is 64.3 ± 6.7 (years) in DS group and 63.6 ± 5.0 (years) in DP group. Out of 17 cases with DS approach, 9 were males and 8 were females. Out of 19 cases with DP approach, 12 were males and 7 were females. All these 36 cases were followed up for duration of 2 years. Mean operating time in DS group is 53.6 ± 7.3 (mins) and in DP group is 61.4 ± 7.0 (mins).

In our study, 15 cases were treated with DS approach and 15 cases were treated with DP approach. Mean age is 53.33 yrs in DS group and 43.93 years in DP group. Out of 15 cases with DS approach, 10 were males and 5 were females. Out of 15 cases with DP approach, 11 were males and 4 were females. All these 30 cases were followed up for minimum duration of 6 months. Mean operating time in DS group is 45.75 mins and in DP group is 49.14 mins.

Anatomical reduction measured by neck shaft angle in post operative x-rays was compared between the cases done by these 2 approaches in Kishore et al study (2022)^[10]. In their study, out of 22 cases done by DS approach, 6 cases got good, 8 cases got average and 8 cases got poor anatomical reduction. But in DP group, out of 20 patients, 11 cases got good, 8 cases got average and 1 case got poor anatomical reduction. Their study revealed a statistically significant difference (p= 0.032) with more favourable reduction with DP approach. In our study also, we have observed statistically significant difference with p value of 0.04385 in between groups inferring DP approach to be the most preferred approach for favourable anatomical reduction.

In Isiklar, Z., et al study (2010)^[11], at 6th months follow up, the difference between Constant scores was not significant, 85.9 vs 85.2 (p> 0.05) in between 2 approaches. In our study, there is no significant difference statistically (p= 0.531948) in between 2 groups.

During follow up in A Bandalović, et al. study^[12], none of the patients developed superficial or deep infection, intraarticular screw placement was seen in 1 patient (DP approach), displacement in greater tuberosity fragment was seen in 1 case (DP approach), head was fixed in the varus position (2 cases in transdeltoid approach, 1 case in DP approach). In our study, 1 case developed superficial surgical site infection in transdeltoid approach, for which regular dressings with oral antibiotics was given, which healed uneventfully.

In our study, 1 case in DP approach lost reduction into varus post operatively and 1 case in minimally invasive transdeltoid approach had Subacromial impingement. 1 case of axillary nerve injury is seen in minimally invasive transdeltoid approach.

CONCLUSION

Even though statistically there is no significant difference in factors like Time taken for surgery (p= 0.757) and functional outcome by Constant Murley Score (p= 0.028173) in between 2 groups, we have observed significant difference in anatomical reduction measured by neck shaft angle (p= 0.04385) in our study.

REFERENCES

1. Rockwood and Green's Fractures in adults tenth edition chapter 35 page 1865-1867.
2. Xie L, Zhang Y, Chen C, Zheng W, Chen H, Cai L. (2019). Deltoid-split approach versus deltopectoral approach for proximal humerus fractures: a systematic review and meta-analysis. *Orthop Traumatol Surg Res.*, 105:307-16.
3. Aggarwal S, Bali K, Dhillion MS, Kumar V, Mootha AK. (2010). Displaced proximal humeral fractures: an Indian experience with locking plates. *J Orthop Surg Res.*, 5:60.

4. Tietge RA and Cuiollo JV. (1982). C.A.M axillary Xray. Exhibit to the academy meeting of AAOS: OrthoTrans. 6:451.
5. Gerber C, Werner CM, Vienne P. (2005). Internal fixation of complex fractures of the proximal humerus. *JBJS, Br.*, Jun. 87(6): 84.
6. Gardner MJ, Griffith MH, Dines JS, et al. (2004). A minimally invasive approach for plate fixation of the proximal humerus. *Bull Hosp Jt Dis.*;62(1-2):18-23.
7. Laflamme GY, Rouleau DM, Berry GK, et al. (2008). Percutaneous humeral plating of fractures of the proximal humerus: Results of a prospective multicenter clinical trial. *J Orthop Trauma.*;22(3):153-158.
8. Bahrs C, Kühle L, Blumenstock G, Stöckle U, Rolauffs B, Freude T. (2015). Which parameters affect medium- to long-term results after angular stable plate fixation for proximal humeral fractures?. *J Shoulder Elbow Surg.*, 24:727-32. 10.1016/j.jse.2014.08.009
9. Zhao, Li, et al. (2017) "Minimal invasive percutaneous plate osteosynthesis (MIPPO) through deltoid-pectoralis approach for the treatment of elderly proximal humeral fractures." *BMC Musculoskeletal Disorders* 18 : 1-6.
10. Kishore, Janapamala V., et al. (2022) "Intraoperative Parameters of Comminuted Proximal Humerus Fractures: A Comparison Between Deltoid-Split and Deltopectoral Approaches." *Cureus* 14.6.
11. Isiklar, Z., et al. (2010). "Comparison of deltopectoral versus lateral deltoid split approach in operative treatment of proximal humeral fractures." *Orthopaedic Proceedings*. Vol. 92. No. SUPP_II. Bone & Joint.
12. Bandalović, Ante, et al. (2014). "The results of internal fixation of proximal humeral osteoporotic fractures with PHILOS locking plate." *Psychiatria Danubina* 26.suppl 2 : 20-25.