Original Article

Difference between radiological and functional outcome with deltoid-splitting approach versus deltopectoral approach for the management of proximal humeral fractures with philos plate

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ABSTRACT

Background: Proximal humeral fractures are one of the common fractures of upper extremity. Good results by various studies have been reported for proximal humeral locking plate (PHILOS) fixation in proximal humeral fractures. We want to evaluate whether it is only the implant which has given good results or different surgical approach utilized for fixation of plate also affects result. **Materials and Methods:** A total of 57 patients with proximal humeral fractures were divided in two groups, in Group A, patient's classical deltopectoral approach utilized, while in Group B deltoid-splitting approach was used. All patients were managed by PHILOS plate fixation. Cases were followed up clinically as well as radiologically at 4-6 weeks after operation and thereafter at 10-12 weeks and then at 6 monthly for long-term complications. Functional outcomes of patient were accessed in terms Constant Scoring System, while radiological evaluation was done by taking x-rays to access quality of reduction and union of fracture. **Results:** All patients were followed for a minimum of 18 months. In Group B, reduction of tuberosities was better in 3 part and 4 part fractures. Mean Constant score in Group A at the end of 3 months was 56, while in Group B it was 62 and statistically significant ($P = 0.02$). At the end of 18 months, mean Constant score in Group A was 79, while in Group B it was 81 and statistically insignificant ($P = 0.72$). One patient in Group B showed axillary nerve paresis in postoperative period and recovered at the end of 3 months. **Conclusion:** We recommend that deltoid-splitting approach can be used in 3 part and 4 part complex proximal humeral fractures and in posterior fracture dislocation shoulder, which are difficult to approach with deltopectoral approach; however, care should be taken while inserting calcar screw in PHILOS plate fixation to avoid iatrogenic axillary nerve injury.

Keywords: *Deltoid-splitting approach, deltopectoral approach, proximal humeral fractures*

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Introduction

Proximal humeral fractures are one of the common causes of morbidity especially in elderly patients because of associated osteoporosis. About 80%-85% of the proximal humeral fractures are managed conservatively; only 15%-20% of complex, displaced fractures require operative treatment. Various surgical modalities ranging from percutaneous pinning to hemiarthroplasty are present in our armamentarium. Recently, trend has been shifted toward head-preserving surgeries because of the advent of locking plate.[1] Proximal humeral locking plate (PHILOS) provides stable angular fixation, particularly important for osteoporotic bones, and good preliminary results have been reported by various studies.[2-4] Two approaches are basically used for the exposure of proximal humeral fractures viz. classical deltopectoral and lateral deltoid-splitting approach. We want to evaluate whether it is only the implant which has given good results or different surgical approach utilized for fixation of plate also affects result.

Materials and Methods

A total of 57 patients with proximal humeral fractures, admitted in our department from April 2007 to March 2009, were recruited

in our study. Out of 57, 37 were males and 20 were females. All the patients were managed by open reduction and internal fixation by PHILOS plate and divided into two groups, Group A with 29 patients and all of them were being treated by utilizing deltopectoral approach and rest 28 in Group B managed through deltoid-splitting approach. Patients were divided in these two groups as per surgeon's preference toward the approach. All of the patients were classified as per Neer's classification.[5] In Group A, mean age of the patients was 56.9 years and out of 29, 4 patients have 2 part fracture, 11 patients have 3 part fracture, 9 have 4 part fracture, while rest 5 have anterior fracture dislocation. In Group B, mean age of the patients was 52.8 years and out of 28 patients, 5 patients have 2 part fracture, 12 patients have 3 part fracture, 9 have 4 part fracture, while rest 2 have posterior fracture dislocation.

All patients were operated by senior authors, in beach chair position using either deltopectoral or deltoid-splitting approach under image intensifier control. In deltopectoral approach,[6] incision started anteriorly from coracoids process and extending laterally toward the shaft. After cutting skin and subcutaneous tissue, deltopectoral groove is identified, using cephalic vein as a landmark. Deltoid is retracted laterally, while pectoralis major is retracted medially along with cephalic vein to expose the fracture site.

In deltoid-splitting approach,[6,7] patient was placed in beach chair position and incision started laterally from the tip of acromion process and extended distally. Fascia over deltoid muscle cut in line with skin incision and fibers of deltoid are splitted in same direction. After splitting deltoid fibers, fracture is exposed. In mini-invasive approach,[8] two incisions are made, one proximally above the course of axillary nerve and one distal to it. Axillary nerve is not explored in mini-invasive technique, from proximal incision fracture is reduced and after reduction plate was slided from proximal incision distally. Screws were passed in upper end through proximal incision, while from distal incision distal screws were locked. In fractures extending distally up to shaft or in fractures not reduced by proximal incision, incision extended distally. Axillary nerve is explored first then fibers of deltoid were splitted distally. After exposing fracture, reduction and preliminary fixation was done with K wires. PHILOS plate was applied on lateral surface, proximal and distal locking done under image intensifier control. Closure done in layers and arm was placed in sling postoperatively. Passive range of motion exercises started after first day as patients started tolerating pain. Active range of motion exercises started after 4 weeks.

Cases were followed-up clinically as well as radiologically at 4-6 weeks after operation and thereafter at 10-12 weeks and then at 6 monthly for long-term complications. Functional outcomes of patient were accessed in terms Constant Scoring System,[9] while radiological evaluation was done by taking x-rays to access quality of reduction and union of fracture.

Results

All patients were followed for a minimum of 18 months. In Group A, all patients except one showed union at mean of 11.6 weeks, while in Group B patients showed union at mean of 11.4 weeks. In Group B, reduction of tuberosities was better in 3 part and 4 part fractures. Mean operating time in Group A was 84 min, while in Group B it was 72 min. Mean Constant score in Group A at the end of 3 months was 56, while in Group B it was 62 and statistically significant ($P = 0.02$). At the end of 18 months, mean Constant score in Group A was 79, while in Group B it was 81 and statistically insignificant ($P = 0.72$). Outcomes in Group A [Table 1] was excellent in 14%, good in 45%, fair in 34%, and poor in 7%, while in Group B [Table 2] it was excellent in 18%, good in 43%, fair in 32%, and poor in 7%. Three patients showed avascular necrosis, two in Group A and one in Group B. Two patients in Group B showed superficial infection and responded well to antibiotics. One patient in Group B showed axillary nerve paresis in postoperative period and recovered at the end of 3 months.

Discussion

Deltopectoral approach is classically used for management of proximal humeral fractures. Deltopectoral approach[6] involves retraction of deltoid laterally while pectoralis muscle medially and allows direct visualization of fracture. Deltopectoral approach is practically more useful for lesser tuberosity fracture and in fractures with anterior dislocation; however, in complex displaced fractures, in which greater tuberosity migrates postero-superiorly, are sometime difficult to manage with deltopectoral approach. Author felt difficulty in reducing widely displaced tuberosities with deltopectoral approach. In posterior fracture, dislocations deltopectoral approach provides poor access for reduction and proved to be inferior as compared to deltoid-splitting approach.

Table 1: Functional outcome in group A patients

Results-group A (%)	No. of patients (%)			
	2-part ($n = 4$)	3-part ($n = 11$)	4-part ($n = 9$)	Fracture-dislocation ($n = 5$)
Mean constant score				
Excellent (14)	2 (50)	2 (50)		
Good (45)	2 (15)	6 (46)	3 (23)	2 (15)
Fair (34)		3 (30)	5 (50)	2 (20)
Poor (7)			1 (50)	1 (50)

Table 2: Functional outcome in group B patientsm

Results-group B (%)	No. of patients (%)			
	2-part ($n = 5$)	3-part ($n = 12$)	4-part ($n = 9$)	Fracture-dislocation ($n = 2$)
Mean constant score				
Excellent (18)	2 (40)	3 (60)		
Good (43)	3 (25)	6 (50)	3 (25)	
Fair (32)		3 (38)	5 (63)	1 (13)
Poor (7)			1 (50)	1 (50)

In deltoid-splitting approach [Figure 1],[6,7,10,11] deltoid fibers are splitted in anterior and middle half to allow exposure of fracture and lateral aspect of shaft. Posterosuperior migration of tuberosity and posterior fracture dislocation are efficiently managed through this approach. Fractures extending distally in shaft can also be managed through this approach effectively by extending incision distally. Axillary nerve exploration is required for managing such fractures. Theoretically, axillary nerve is at the risk as it comes after piercing quadrangular space from posterior aspect to anterior along with posterior circumflex artery. Although it is rare and most of the reported series[7,8,10,12] have reported negligible incidence. but we have observed axillary nerve paresis postoperatively, in one of our case that recovered at 3 months. Usually, these are traction nerve injuries and of neuropraxia type. Axillary nerve [Figure 2] is also at risk while placement of medial calcar screw in PHILOS plate fixation, calcar screw is important as it prevent varus collapse, great care must be taken while inserting calcar screwas most of the time its hole directly lie beneath axillary nerve.

In our study, at the most recent follow-up, we have not observed any significant difference in radiological and functional outcome

Figure 1: Deltoid-splitting approach

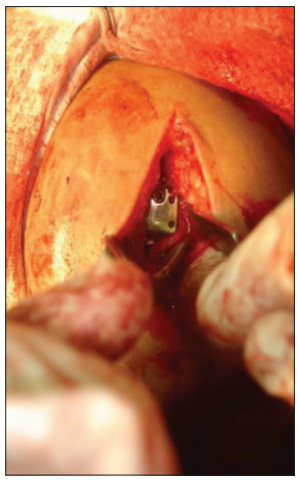

Figure 2: Axillary nerve at risk while placing calcar screw

in patients treated with either approach. Wu *et al*.,[13] in his series of 63 patients also found no statistically significant difference in clinical, radiographic, and electrophysiological outcomes between the deltopectoral approach and deltoid-splitting approach while surgical treatment of proximal humeral fractures.

Isiklar *et al*.,[14] in his study observed better radiological and functional outcome with deltoid-splitting approach and recommended deltoid-splitting approach in management of AO (Arbeitsgmeinschaft fur Osteosynthesefragen) types B and C proximal humeral fractures.

Robinson *et al*.,[10] in his study suggested that deltoid-splitting approach is effective alternative approach for management of complex proximal humeral fractures as well as for posterior fracture dislocation of shoulder. Similar findings have been reported by Gardener *et al*.,[15] also. However, Hepp *et al*.,[16] in his study observed better functional results with deltopectoral approach and concluded that choice of approach affects the functional outcome in management of proximal humeral fractures.[17]

Conclusion

We recommend that deltoid-splitting approach can be used in 3 part and 4 part complex proximal humeral fractures as it provides better visualization and reduction of tuberosity's and in posterior fracture dislocation shoulder, which are difficult to approach with deltopectoral approach; however, care should be taken while inserting calcar screw in PHILOS plate fixation to avoid iatrogenic axillary nerve injury.

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