

Research Article

Lateral transdeltoid approach to proximal humerus fractures

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ABSTRACT

Background: The deltopectoral approach is the most commonly used approach for the reduction and fixation of proximal humerus fractures. But it provides inadequate access to the posteriorly displaced fragments in comminuted fractures and to the lateral surface where the plate is to be applied. These disadvantages can be obviated by a direct lateral transdeltoid approach. There have been concerns regarding postoperative axillary nerve palsy and deltoid dysfunction with this approach. This study had been conceptualized to assess the outcome of fixation of proximal humerus fractures with deltoid splitting lateral approach.

Methods: A total of 20 patients with Neer's type 2 and 3 fractures of proximal humerus were included in this study. Lateral transdeltoid approach was used for exposure, with either an extended incision or a "two window" less invasive incision, depending upon the fracture anatomy. Functional outcome was assessed using the Constant Murley shoulder score.

Results: The fracture was classified as Neer's type 2 in 30% and type 3 in 70% of the cases. The mean Constant Murley score at final follow up was 78 (range 64-84). Graded according to the Constant shoulder score grading criteria, the results were excellent in 60%, good in 35% and fair in 5% of the cases. No case of postoperative axillary nerve palsy was encountered.

Conclusions: The functional outcome was either excellent or good in 95% of the cases and no case of axillary nerve palsy was seen. Hence, Lateral transdeltoid approach is a convenient and useful approach to proximal humerus fractures.

Keywords: Deltoid splitting approach, Proximal humerus, Greater tuberosity fractures

INTRODUCTION

Fractures of the proximal humerus are the most common fractures of this bone and constitute 5-6% of the total fracture incidence in adults; and this incidence increases with age.¹ Complex fractures of the proximal humerus are often difficult to treat and result in considerable shoulder dysfunction unless adequately treated.² According to the Neer's criteria for the proximal humerus fractures, fractures with fragments separated more than 1 cm or with more than 45 degree angulation are considered as displaced fractures;^{3,4} and hence need open reduction and

internal fixation. Most of the surgeons are familiar with the traditional deltopectoral approach, which utilizes the internervous plane between the pectoralis major and the deltoid; and hence this is the most commonly used approach for proximal humerus fracture fixation.² But in certain fractures in which the fragments especially the greater tuberosity fragment is displaced, usually posterolaterally, reduction through this approach is difficult. In addition, the application of plates on the lateral surface of proximal humerus requires a lot of soft tissue dissection and retraction. Hence an access from the lateral aspect would be far more convenient in certain circumstances. The transdeltoid or the deltoid splitting

approach obviates some of these disadvantages of the deltopectoral approach and provides convenient access to the lateral surface of the proximal humerus.^{2,5-7} But there have been concerns regarding the use of deltoid splitting approach due to the potential of injury to the axillary nerve that traverses around the surgical neck of humerus, through the substance of the deltoid; and also because of the fact that splitting the deltoid could result in weakening of this muscle and resultant difficulty in shoulder movements, particularly abduction.

This study had been conceptualized to assess the outcome in cases of proximal humerus fractures treated with internal fixation through the deltoid splitting, lateral approach; and analyzing its results in terms of the functional outcome and complications, if any.

METHODS

This study was an uncontrolled, prospective study on 20 patients of proximal humerus fractures, admitted in the department of Orthopaedics of a tertiary level teaching hospital at Udaipur, from January 2013 to December 2014. Fractures of the proximal humerus classified as type 2 and type 3, according to the Neer's criteria, were included in this study. Cases with other fractures in the ipsilateral upper limb, scapula or clavicle, neurological deficit of the ipsilateral upper limb, bilateral fractures of proximal humerus and fractures associated with dislocation of the humeral head, were excluded from this study; since in the first three scenarios, results could be biased and in the fourth scenario, humerus head reduction could be better effected through the anterior deltopectoral access.

The fractures were evaluated by anteroposterior and axillary view radiographs of the shoulder; and in some cases, 3-D reconstruction CT scan of the shoulder was also done. Preoperative blood investigations and ECG was done for the purpose of pre anaesthetic assessment. Preoperatively, intravenous injection of Cefuroxime was given 1 hour before surgery. The patients were operated in supine position. The fracture was exposed using the deltoid splitting lateral approach to proximal humerus.⁵ Incision was given starting from the tip of acromion down the lateral aspect of humerus. The length of the incision depended upon the type of fracture and the length of plate needed to fix it. In some cases, a single long incision was given; deltoid split in the line of skin incision and axillary nerve was explored and secured under vision. In other cases, a less invasive approach was used in which instead of a single long incision, two windows of skin incision were made in line, leaving an island of skin of at least 2cm in between, corresponding to the position of axillary nerve relative to the tip of acromion.⁸⁻¹² In such cases, the length of incision for the proximal window was 4cm.⁸ Vertical split of the deltoid fibres was done in line with the incision for around 4 cm from the tip of acromion. Subacromial bursa was then incised. A finger was then inserted along the

undersurface of deltoid to feel for the axillary nerve. Usually, this nerve lies at a distance of around 5-7 cm from the acromion;⁹⁻¹² and is felt as a circumferential band on the undersurface of the deltoid. The fracture fragments were maneuvered and reduced under image intensifier guidance; and provisionally fixed with k-wires in some cases, as necessary. After feeling for the axillary nerve, or under direct vision in cases where the incision was a single long one and nerve had been explored amongst the deltoid fibres, a phlos plate was then slid beneath this nerve on the lateral surface of humerus. Internal fixation was done after checking the reduction of fracture fragments under image intensifier. Post operatively, patient was advised an arm sling pouch and pendulum shoulder exercises were started the next day. Patients were followed up in Orthopaedic OPD at 6 weeks, 3 months and 6 months postoperatively. They were evaluated for any axillary nerve dysfunction and their shoulder functions were evaluated using the Constant-Murley shoulder scoring system.¹³ The functional results were graded as excellent, good, and fair or poor by assessing the difference of the Constant Murley shoulder score between the affected and the normal shoulder.¹⁴

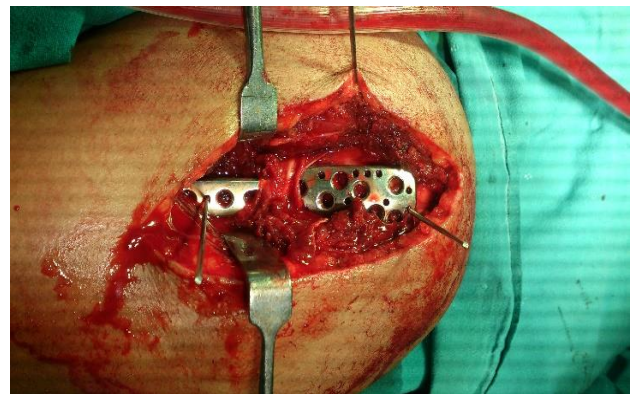


Figure 1: Intraoperative photograph showing the explored axillary nerve and a plate slid beneath it.

RESULTS

Out of a total of 20 patients included in this study, 14 were male and 6 were female; with a mean age of 45.9 years (range 28-62yrs.). In 70% (n=14) of the patients, the fracture of the proximal humerus was classified as type III; while 30% (n=6) had type II fracture, according to Neer's classification. The dominant limb was involved in 65% of the cases. The mean duration from admission to surgery was 2 days. Depending upon the fracture anatomy and the need for exposure, the skin incision was a continuous long incision in 7 cases, with complete exploration of axillary nerve in the substance of deltoid; while in 13 cases, fixation was done using two separate skin windows. Axillary nerve was digitally palpated on the undersurface of deltoid in the latter group and was not completely explored under vision.

The mean follow up period was 26 weeks (range 18-32 weeks). The average time to radiological union was 14 weeks (range 12-20 weeks).



Figure 2: Preoperative X-ray of a case with displaced greater tuberosity.



Figure 3: Post-operative X-ray of the same case.

In the early postoperative period, in one case who was diabetic, there was serosanguinous wound discharge for which cultures were obtained and appropriate antibiotics started; and it resolved in around 3 weeks.

At final follow up, there were no cases of nonunion. There were 2 cases (10%) with varus malunion of the head fragment, and 1 case (5%) of acromial

impingement. Axillary nerve palsy or deltoid dysfunction was not seen in any of the patients. The mean Constant-Murley score of shoulder function, at final follow up, was 78 (range 64-84). Graded according to the Constant shoulder score grading criteria, by calculating the difference of score between the involved shoulder and the uninvolved shoulder, 60% patients (n=12) had excellent, 35% (n=7) had good and 5% (n=1) had fair functional results.

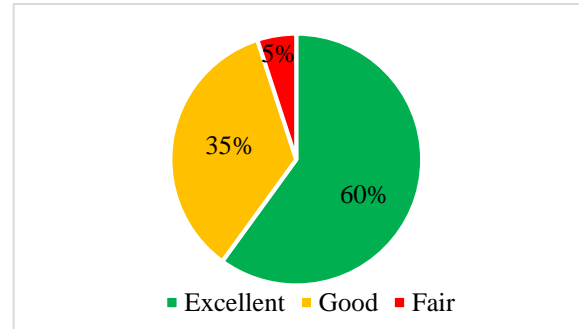


Figure 4: Post-operative outcome with lateral transdeltoid approach using Constant Murley shoulder score grading criteria.

DISCUSSION

The traditional deltopectoral approach serves as the “work horse” for most of the proximal humerus fractures due to the familiarity with this approach but there are certain limitations of this approach. In cases of fractures involving the greater tuberosity, the access to the posteriorly displaced tuberosity fragment is very limited through the deltopectoral approach.⁵ In addition, the soft tissues need to be retracted quite a lot; and the already comminuted fracture fragments need to be stripped of their attachments, in order to enable fixation of the plate on to the lateral surface in comminuted proximal humerus fractures. In contrast, an approach from the lateral side provides a convenient access to the displaced fragments and also for plate fixation on the lateral surface.⁶ Many recent studies have shown excellent functional results with the lateral approach, whether extended or minimal, with no incidence of any axillary nerve palsy or any other significant complications.^{7,15} In fact, most studies involving comparison of the functional results between the deltopectoral and deltoid splitting approaches have come out with better functional scores using the deltoid splitting approach. Gardner et al used this approach in 16 patients of proximal humerus fractures and found it to be safe and very useful in the treatment of such fractures.¹⁵ Isiklar et al in their comparative study on 42 patients of proximal humerus fractures demonstrated significantly better constant scores at an earlier time, in patients operated with the deltoid splitting approach than those operated using the deltopectoral access.² They were of the view that the transdeltoid approach enabled better control and hence better reduction of the head and tubercular fragments in comminuted proximal humerus fractures.

No case of axillary nerve palsy was encountered with lateral approach in their series. Robinson et al. were of the view that deltopectoral approach provided a limited access to the posterior aspect of the shoulder; and hence recommended the deltoid splitting approach for the internal fixation of comminuted proximal humerus fractures.⁵ A study by Liu et al on 91 patients of proximal humerus fractures demonstrated greater range of motion in 2 part and 3 part fractures with the minimally invasive lateral approach, while the conventional deltopectoral approach gave better results in 4 part fractures; and they declared minimally invasive lateral approach as the “optimal alternative” in Neer’s type 2 and 3 fractures.¹⁶

In this study, the deltoid splitting approach was used as an extended one in some cases, while in others, it was used in a minimally invasive manner using two windows, depending upon the need of exposure to reduce and fix the fragments. In the extended deltoid split, the axillary nerve was secured by exploring the nerve directly under vision. In case of minimally invasive or a “two window” approach, the area traversed by the axillary nerve was secured by leaving a bridge of skin in between. Most of the studies suggest that the axillary nerve lies at a distance of 5-7 cm from the tip of acromion.⁸⁻¹¹ Abhinav et al, in cadaveric dissection of thirty shoulders, calculated the mean acromion-axillary distance as 6.0 cm with a range of 4.5-6.5 cm. Therefore, they recommended that the maximum deltoid split in the proximal window should not be more than 4.2 cm; and that splitting the deltoid should be avoided in abduction since the nerve comes closer to acromion by 1.5 cm, in this position.⁸

The present study also shows excellent or good functional results in 95% of the patients, as determined by the Constant shoulder score grading; and no postoperative axillary nerve palsy or deltoid muscle dysfunction was encountered in any of the cases. Since similar results have been reported in the literature without any significant complications, it can reasonably be concluded that the lateral transdeltoid approach to proximal humerus is a very useful approach without any clinically significant adverse effects. The findings of this study can be further validated by a comparative study with other surgical approaches, using a larger sample.

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Ethical approval: Not required

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