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Abstract

Introduction: Proximal humerus fractures is the most common fracture in shoulder girdle in adults. Surgical treatment is increasing with PHILOS using Delto-pectoral or Deltoid splitting approaches.

Aims: To compare the outcome of PHILOS using the two approaches.

Materials and methods: Patients (n=41) with proximal humerus fractures, analysed prospectively, managed surgically using the two approaches, delto-pectoral (n=18) and Deltoid split (n=23). Results analysed on the basis of Constant-Murley Score at minimum follow-up period of 12 months (range 12 to 35 months).

Results: The mean Constant-Murley Score in Delto-pectoral group is 72.22 compared to 73.70 in Deltoid split group (p=0.717). The time to union in the two groups being 11.7 and 11.9 weeks respectively.

Conclusion: Outcome of the two approaches are comparable, can be used as per surgeons preference.

Keywords: PHILOS, delto-pectoral, deltoid split, proximal humerus

1. Introduction

Fractures of proximal humerus includes fractures at or proximal to surgical neck of humerus. It is the most common fracture in shoulder girdle in adults [1]. Majority of proximal fractures can be treated non-operatively, though surgical treatment is increasing with fracture reconstruction increasing at higher rate than prosthetic replacement [1-3].

Several clinical studies have shown higher rates of healing and functional outcomes with proximal humerus locking plate [4-14].

An extended anterolateral deltoid splitting approach has gained increasing popularity as a less invasive and more biologically sound approach [15-17]. Deltoid split approach allow more direct access to greater tuberosity and to the area between the greater and lesser tuberosities, just lateral to bicipital groove also allowing direct manipulation of the humerus head, as well as allowing plate and screw placement in line with the incision [16, 18].

2. Materials and methods

41 patients were included having proximal humerus fracture, who underwent open reduction and internal fixation with proximal humerus locking plate during period 2012 to 2015 at Nil Ratan Sircar Medical College & Hospital. Minimum follow-up period being 12 months.

Adult Patients were included with closed fractures and 2, 3 or 4 part fracture as per Neer Classification. Those with Humeral head fractures, open or pathological fractures, those with failed conservative treatment were excluded.

There were 15 male (36.6%) and 26 female (63.4%) patients with age ranging 34 to 69 years (mean age 43). Fracture was caused by road traffic accident in 16, physical assault in 2, while 23 had trivial fall.

As per Neer Classification, 6 had two part fracture, 15 had three part, while 20 had four part fracture pattern.

All were operated under general anesthesia in supine position with a small bump in interscapular region. 18 were operated with delto-pectoral approach and 23 with deltoid- splitting approach. Image intensifier was used intra-operatively with fixation using PHILOS plate in all patients. Non-absorbable Polyester suture (Ethibond) no. 5 used to augment fracture fixation as per fracture anatomy.
Standard surgical approaches as per literature were used. Deltopectoral approach, classically described as incision starting over coracoid process and advanced over the deltopectoral groove with lateral reflection of cephalic vein. It can be modified with incision starting over the clavicle directed over 1-2 cm lateral to coracoid process towards a point at midline of anterior arm 2 cm distal from the axillary crease, allow improved exposure. Advantage of working through internervous plane with wide exposure. But require significant soft tissue dissection to gain access to lateral aspect of proximal humerus for fracture reduction and plate fixation, which may affect humerus head vascularity [19-20].

In Deltoid splitting approach, longitudinal incision is given at the raphe between anterior and middle deltoid. This interval is divided with a vertical 4 cm incision starting at the anterolateral corner of acromion. The axillary nerve can be identified at an average 5 cm distal to acromion. As the nerve crosses the anterior raphe as single branch, innervations of anterior deltoid can be preserved by protecting it during dissection. Once identified, the raphe may be further split distal to the nerve to allow access to the lateral shaft for plate placement. The deltoid split approach has two major disadvantages. In antero-inferior fracture dislocations, the humerus head fragment may not be accessible, other is chance of Axillary nerve injury [9, 15, 16, 21-23].

PHILOS plate was placed about 5 to 10 mm distal to the tip of greater tuberosity (confirmed under image intensifier) and just lateral to bicipital groove [24].

Post-operative care: Patients followed-up at 2 weeks, 6 weeks, 12 weeks after surgery. Immobilized for 6 weeks in sling with active range-of-motion exercises of elbow, wrist and hand encouraged. Depending upon fracture pattern and stability that was achieved, passive range of motion started between 2 and 4 weeks after surgery with forward elevation, external rotation and pendulum exercises. If healing progressed adequately both clinically and radiologically at 6 weeks active assisted range of motion is started. Patients were evaluated on Constant-Murley Score at final follow-up, ranging 12-35 months, mean 19 months.

### 3. Results and Discussion

#### 3.1 Constant-Murley score

<table>
<thead>
<tr>
<th>Complications</th>
<th>Delto-pectoral approach</th>
<th>Deltoid split</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varus malunion</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Non union</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-acromial impingement</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Deep infection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVN</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Superficial wound infection</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Adhesive capsulitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Displacement of GT</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Axillary nerve injury</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>p = 0.7171</th>
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<tbody>
<tr>
<td>Excellent (86-100)</td>
<td>6</td>
</tr>
<tr>
<td>Good (71-85)</td>
<td>4</td>
</tr>
<tr>
<td>Fair (56-70)</td>
<td>6</td>
</tr>
<tr>
<td>Poor (0-55)</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
</tr>
</tbody>
</table>

The Constant-Murley Score ranged from 48 to 89, with mean score of 72.22 and 73.70 in the Delto-pectoral and Delto-oid-split approaches respectively, the difference being statistically insignificant (p = 0.7171). Bulent et al reported mean Constant-Murley score 75.5 (range 51 to 93), with no significant difference between scores of patients undergoing the deltopectoral and deltoid split approaches (p > 0.05) [25]. Solberg et al and Siwach et al reported Constant-Murley Scores between 61 to 80 [26-28]. The mean time for union in delto-pectoral and deltoid split approaches was 11.7 and 11.9 weeks.

Varus malunion was seen in 5 patients (12.19%). Kumar et al reported 8.16% varus malunion in their series, while Bjorkenheim et al reported 26.3% [24, 29]. Two patients (4.9%) underwent avascular necrosis of head of humerus. In several studies, incidences of AVN have been reported in a wide range, 4%-75% of cases [30-38]. In our study, follow-up was short term, more cases of AVN could potentially arise with longer observation. Three patients had superficial infection which was managed with antibiotics as per sensitivity reports. One patient had displacement of Greater tuberosity which led to sub-acromial impingement.

### 4. Conclusion
The results in the two groups were comparable. Any of the two approaches can be chosen as per surgeons preference, technically we found deltoid splitting approach better for reduction of tuberosities in 3 or 4 part fractures.

### 5. References
10. Martinez AA, Cuenca J, Herrera A. Philos plate fixation