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## PHILOS by Delto-pectoral or deltoid splitting approach: A comparative study

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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<sup>[1]</sup>. Majority of proximal fractures can be treated non-operatively, though surgical treatment is increasing with fracture reconstruction increasing at higher rate than prosthetic replacement<sup>[1-3]</sup>.

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

An extended anterolateral deltoid splitting approach has gained increasing popularity as a less invasive and more biologically sound approach<sup>[15-17]</sup>. 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<sup>[16, 18]</sup>.

### 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 inter-scapular 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 1-2cm lateral to coracoid process towards a point at midline of anterior arm 2cm 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 5cm 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**

	Delto-pectoral approach	Deltoid split
Excellent (86-100)	6	5
Good (71-85)	4	11
Fair (56-70)	6	6
Poor (0-55)	2	1
Total	18	23

p=0.7171

The Constant-Murley Score ranged from 48 to 89, with mean score of 72.22 and 73.70 in the Delto-pectoral and Deltoid-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.

Complications	Delto-pectoral approach	Deltoid split
Varus malunion	2	3
Non union		
Sub-acromial impingement	1	
Deep infection		
AVN	1	1
Superficial wound infection	1	2
Adhesive capsulitis		
Displacement of GT	1	
Axillary nerve injury		

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**

- Kim SH, Szabo RM, Marder RA. Epidemiology of humerus fracture in the United States: Nationwide emergency department sample, 2008. *Arthritis Care Res (Hobson)*. 2012; 64(3):407-414.
- Bell JE, Leung BC, Spratt KF *et al*. Trends and variations in incidence, surgical treatment and repeat surgery of proximal humeral fractures in the elderly. *J Bone Joint Surg Am*. 2011; 93(2):121-131.
- Roe SH, Melton LJ, Morrey BF *et al*. Epidemiological features of humeral fractures. *Clin Orthop Relat Res*.1982; (168):24-30.
- Aksu N, Gogus A, Kara AN *et al*. Complications encountered in proximal humeral fractures treated with locking plate fixation. *Acta Orthop Traumatol Turc*. 2010; 44(2):89-96.
- Bjorkenheim JM, Pajarinen J, Savolainen V. Internal fixation of proximal humeral fractures with a locking compression plate: A retrospective evaluation of 72 patients followed for a minimum of 1 year. *Acta Orthop Scand*. 2004; 75(6):741-745.
- Frankhauser F, Boldin C, Schippinger G *et al*. A new locking plate for unstable fractures of proximal humerus. *Clin Orthop Relat Res*. 2005; (430):176-181.
- Fazal MA, Haddad FS. Philos plate fixation for displaced proximal humerus fractures. *J Orthop Surg (Hong Kong)*. 2009; 17(1):15-18.
- Koukakis A, Apostolou CD, Taneja T *et al*. Fixation of proximal humerus fractures using the PHILOS plate: early experience. *Clin Orthop Relat Res*. 2006; 442:115-120.
- Laflamme GY, Rouleau DM, Berry GK *et al*. Percutaneous humerus plating of fractures of the proximal humerus: Results of prospective multicenter clinical trial. *J Orthop Trauma*. 2008; 22(3):153-158.
- Martinez AA, Cuenca J, Herrera A. Philos plate fixation

- for proximal humeral fractures. *J Orthop Surg (Hong Kong)*. 2009; 17(1):10-14.
11. Papadopoulos P, Karataglis D, Stavridis SI *et al*. Mid-term results of internal fixation of proximal humeral fractures with the Philos plate. *Injury*. 2009; 40(12):1292-1296.
  12. Plecko M, Krauss A. Internal fixation of proximal humeral fractures using the locking proximal humerus plate. *Oper Orthop Traumatol*. 2005; 17(1):25-50.
  13. Lau TW, Leung F, Chan CF *et al*. Minimally invasive plate osteosynthesis in the treatment of proximal humeral fracture. *Int Orthop*. 2007; 31(5):657-664.
  14. Shahid R, Mustaq A, Northover J *et al*. Outcome of proximal humeral fractures treated with PHILOS plate internal fixation. Experience of district general hospital. *Acta Orthop Belg*. 2008; 74(5):602-608.
  15. Gardner MJ, Boraiah S, Helfet DL *et al*. The anterolateral acromial approach for fractures of proximal humerus. *J Orthop Trauma*. 2008; 22(2):132-137.
  16. Gardner MJ, Griffith MH, Dines JS *et al*. The extended anterolateral acromial approach allows minimally invasive access to the proximal humerus. *Clin Orthop Relat Res*. 2005; (434):123-129.
  17. Gardner MJ, Voos JE, Wanich T *et al*. Vascular implications of minimally invasive plating of proximal humeral fractures. *J Orthop Trauma*. 2006; 20(9):602-607.
  18. Edelson G, Kelly I, Vigder F *et al*. A three dimensional classification for fractures of the proximal humerus. *J Bone Joint Surg Br*. 2004; 86(3):413-425.
  19. Kristiansen B, Christensen SW. Plate fixation of proximal humeral fractures. *Acta Orthop Scand*. 1986; 57(4):320-323.
  20. Sturzenegger M, Fornaro E, Jakob RP. Results of surgical treatment of multifragmented fractures of the humeral head. *Arch Orthop Trauma Surg*. 1982; 100(4):249-259.
  21. Robinson CM, Kahn L, Akhtar A *et al*. The extended deltoid splitting approach to the proximal humerus. *J Orthop Trauma*. 2007; 21(9):657-662.
  22. Gardner MJ, Griffith MH, Dines JS *et al*. A minimally invasive approach for plate fixation of proximal humerus. *Bull Hosp Jt Dis*. 2004; 62(1-2):18-23.
  23. Smith J, Berry G, Laflamme Y *et al*. Percutaneous insertion of proximal humeral locking plate: An anatomical study. *Injury*. 2007; 38(2):206-211.
  24. Kumar GN, Sharma G, Sharma V, Jain V, Farooque K, Morey V. Surgical treatment of proximal humerus fractures using PHILOS plate. *Chin J Traumatol*. 2014; 17(5):279-284.
  25. Bulent K, Mustafa U, Bekir MC, Gurkan O, Huseyin D, Sercan A. Early results of treatment of proximal humerus fractures with the PHILOS locking plate. *Acta Orthop Traumatol Turc*. 2008; 42(3):149-153.
  26. Solberg BD, Moon CN, Franco DP, Paiement GD. Locked plating of 3- and 4-part proximal humerus fractures in older patients: the effect of initial fracture pattern on outcome. *J Orthop Trauma*. 2009; 23(2):113-9.
  27. Solberg BD, Moon CN, Franco DP, Paiement GD. Surgical treatment of three and four-part proximal humeral fractures. *J Bone Joint Surg Am*. 2009; 91(7):1689-97.
  28. Siwach R, Singh R, Rohilla RK *et al*. Internal fixation of proximal humeral fractures with locking proximal humeral plate (LPHP) in elderly patients with osteoporosis. *J Ital Soc Orthop Traumatol*. 2008; 9(3):149-53.
  29. Bjorkenheim JM, Pajarinen J, Savolainen V. Internal fixation of proximal humeral fractures with a locking compression plate: a retrospective evaluation of 72 patients followed for a minimum of 1 year. *Acta Orthop Scand*. 2004; 75(6):741-5.
  30. Wiggman AJ, Roolker W, Patt TW *et al*. Open reduction and internal fixation of three and four-part fractures of the proximal part of the humerus. *J Bone Joint Surg Am*. 2002; 84(11):1919-25.
  31. Egol KA, Ong CC, Walsh M *et al*. Early complications in proximal humerus fractures (OTA Types 11) treated with locked plates. *J Orthop Trauma*. 2008; 22(3):159-64.
  32. Esser RD. Treatment of three- and four-part fractures of the proximal humerus with a modified cloverleaf plate. *J Orthop Trauma*. 1994; 8(1):15-22.
  33. Lee CK, Hansen HR. Post-traumatic avascular necrosis of the humeral head in displaced proximal humeral fractures. *J Trauma*. 1981; 21(9):788-91.
  34. Gerber C, Werner CM, Vienne P. Internal fixation of complex fractures of the proximal humerus. *J Bone Joint Surg Br*. 2004; 86(6):848-55.
  35. Hawkins RJ, Bell RH, Gurr K. The three-part fracture of the proximal part of the humerus. Operative treatment. *J Bone Joint Surg Am*. 1986; 68(9):1410-4.
  36. Bastian JD, Hertel R. Initial post-fracture humeral head ischemia does not predict development of necrosis. *J Shoulder Elbow Surg*. 2008; 17(1):2-8.
  37. Gerber C, Hersche O, Berberat C. The clinical relevance of post-traumatic avascular necrosis of the humeral head. *J Shoulder Elbow Surg*. 1998; 7(6):586-90.
  38. Solberg BD, Moon CN, Franco DP *et al*. Locked plating of 3- and 4-part proximal humerus fractures in older patients: the effect of initial fracture pattern on outcome. *J Orthop Trauma*. 2009; 23(2):113-9.