

## Original Research Article

# A prospective comparative study in the management of Neer's type II and type III proximal humerus fracture with proximal humerus nail versus proximal humerus internal locking system

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### ABSTRACT

**Background:** Proximal humerus fractures account for approximately 4-5 % of all the fractures and are next in occurrence to hip fractures and distal radius fractures in elderly population.

**Methods:** A prospective study of 40 patients with Neer's type II and type III proximal humerus fracture, among which 20 were treated with proximal humerus nail and 20 with proximal humerus internal locking system at two Hospitals attached to J.J.M Medical College Davangere, Karnataka, India between September 2015 to December 2016. At final follow up results were assessed with constant shoulder scoring system.

**Results:** In the PHN group, 8 patients (40%) showed excellent outcome, 8 patients (40%) showed good outcome and 4 patients (20%) showed fair outcome. Among the PHILOS group, 12 patients (60%) showed good outcome, 6 patients (30%) showed fair outcome and 02 patients (10%) with poor outcome.

**Conclusions:** Proximal humerus nail for Neer's type II and type III proximal humerus fracture has better results compared to proximal humerus locking plate system with increased range of movements and restoring better shoulder biomechanics.

**Keywords:** Neer's type II and type III, PHN, PHILOS

### INTRODUCTION

Proximal humeral fractures, defined as fractures occurring at or proximal to the surgical neck of the humerus. It is the commonest fracture affecting the shoulder girdle in adults and its incidence is rising.<sup>1</sup> The current fracture epidemiology shows that nowadays proximal humeral fractures account for almost 7% of all fractures and make up 80% of all humeral fractures. In patients above the age of 65 years proximal humeral fractures are the second most frequent upper extremity fracture, and the third most common non vertebral

osteoporotic fracture after proximal femur and distal radius fractures.<sup>2-6</sup>

In elderly individuals, over 90% of proximal humeral fractures result from a fall from a standing height. In younger individuals there is a higher incidence of proximal humeral fractures as a result of higher-energy trauma, such as a fall from a height, motor vehicle accidents (MVAs) and sports injuries.

The proximal humerus can fracture as a consequence of three main loading modes: compressive loading of the glenoid onto the humeral head, bending forces at the

surgical neck, and tension forces of the rotator cuff at the greater and lesser tuberosities. When the glenoid impacts on the humeral head during a fall in individuals with normal bone, the proximal humeral epiphysis appears to be able to resist local compressive loads. The energy is then transferred further distally, where the weaker metaphyseal bone may yield, resulting in a surgical neck fracture.<sup>7</sup> The main goal for the surgical treatment of these fractures is to restore the pre-fracture activity status and full range of movements.

**METHODS**

A prospective study of 40 patients Neer’s type II and type III proximal humerus fracture among which 20 were treated with proximal humerus nail and 20 with PHILOS plate at two hospitals attached to J.J.M Medical College Davangere, Karnataka, India between September 2015 and December 2016.

**Inclusion criteria**

Patients who attained skeletal maturity when assessed radiographically presenting with fresh cases of closed Neer’s two part/three part fracture of the proximal humerus who were medically fit for surgery.

**Exclusion criteria**

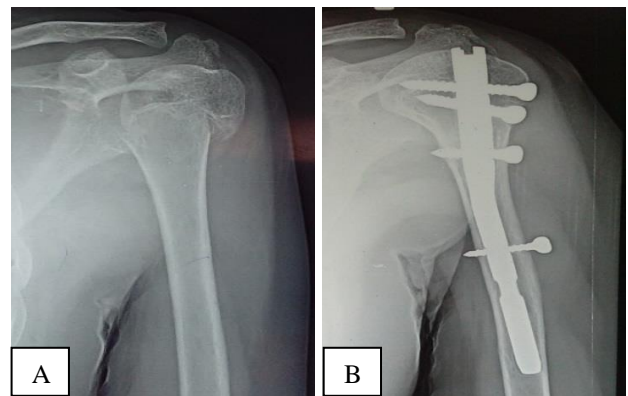
Patients who did not attain skeletal maturity when assessed radiologically, who are presenting with an open/comminuted fracture of proximal humerus, those cases which are associated with head injury, neurovascular injury, any pathological fractures and with any co existing acute infections. All cases of Neer’s four part fractures and humerus shaft fractures were excluded from the study.

**Operative technique**

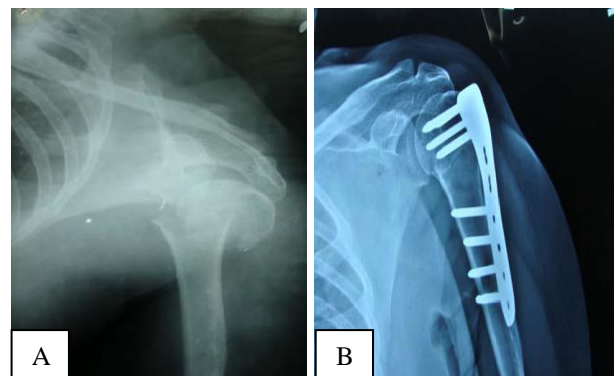
For PHN, patient was placed in supine position on the fracture table; fracture reduced under fluoroscopy and the limb is adducted and kept by the side of the chest. Incision of about 2 cm was made by anterolateral approach through the deltoid fibres and supraspinatus tendon to expose the humeral head. In cases where the humeral head was abducted or externally rotated as in cases of varus malaligned fractures, it was reduced by joystick technique before making the humerus entry point. Entry point is made medial to greater tuberosity and slightly lateral to the axis of the medullary canal on AP view and in line with humeral axis on the lateral view. After insertion of PHN with the help of attached jig, fluoroscopy was performed to evaluate the fracture situation. With the help of the jig multi-axial locking proximal locking and distal dynamic/static locking was done (Figure1).

For PHILOS, The patient was placed in supine position. Through delto-pectoral approach, the fracture was

exposed and reduced with minimal soft tissue dissection. Briefly, the anatomical relationship between humeral head and greater tuberosity was reduced and fixed temporarily with K wires. Reduction was checked under fluoroscopy. Definitive fixation with locking plate was done with plate positioned lateral to bicipital groove sparing tendon of long head of biceps and 1cm distal to greater trochanter. The screws were chosen according to preoperative planning, and all the four head screws were supposed to be inserted to the head fragment. The inferior screws supporting the humeral head were considered critical. Proximal locking screws were inserted to hold the humeral head, which are multidirectional screws with the tips of the screws staying 5–10 mm away from the articular surface. All proximal locking screws were placed in a unicortical fashion through an external guide and confirmed to be within the humeral head with intraoperative fluoroscopy. The distal shaft screws were placed bicortically. A minimum of three bicortical screws were used. In case of severe comminution or instability, the rotator cuff, the greater tuberosity, and the lesser tuberosity were fastened to the plate using non-absorbable sutures (Figure 2).



**Figure 1: (A) Preoperative X-ray of 19 year old female showing a (L) surgical neck humerus fracture, (B) 6 month follow up X-ray after fixation with proximal humeral nail (PHN), which shows complete union.**



**Figure 2: (A) Preoperative X-ray of 34 year old female showing a (R) surgical neck humerus fracture, (B) 1 year follow up X-ray after fixation with PHILOS, which shows complete union.**

Postoperative rehabilitation –isometric and pendulum exercises are initiated on the 3<sup>rd</sup> postoperative day and the patient's X-ray was reviewed. All the patients were followed up at 1<sup>st</sup>, 3<sup>rd</sup> and 6 months by clinical examination and by radiography. At final follow up results were assessed with Constant Shoulder Functional scoring system as excellent, good, fair and poor. The data was analyzed by student's unpaired t-test by SPSS 6 version software. The value of  $p < 0.05$  was considered for statistical significance.

## RESULTS

Among the 20 patients treated with proximal humerus nail (PHN), 12 were male and 08 were female. 13 patients in this group had right side involvement and 07 patients had left side involvement, of which 14 cases were of Neer's type II and 06 cases were of Neer's type III (Table 1).

**Table 1: Demographic data proximal humerus nail (PHN) group and PHILOS group.**

Groups	Demographic data		
<b>(PHN) group</b>			
<b>Age in years</b>	Male n (%)	Female n (%)	Total n (%)
<b>18-27</b>	2 (16.6)	0(0.00)	2(10)
<b>28-37</b>	1 (08.3)	1(12.5)	2(10)
<b>38-47</b>	2 (16.6)	0(0.00)	2(10)
<b>48-57</b>	2 (16.6)	3(37.5)	5(25)
<b>57 and above</b>	5 (41.6)	4(50)	9(45)
<b>Total</b>	12(60)	8(40)	20(100)
<b>PHILOS group</b>			
<b>18-27</b>	3(21.4)	0(0.00)	3(15)
<b>28-37</b>	1 (7.14)	0(0.00)	1(05)
<b>38-47</b>	2 (14.2)	2(33.3)	4(20)
<b>48-57</b>	3(21.4)	1(16.6)	4(20)
<b>57 and above</b>	5 (35.7)	3(50)	8(40)
<b>Total</b>	14(70)	6(30)	20(100)

**Table 2: Clinical outcome of patients treated with PHN and PHILOS at 6 month follow up.**

Constant shoulder score				
	Excellent	Good	Fair	Poor
<b>PHN</b>	8(40%)	8(40%)	4(20%)	-
<b>PHILOS</b>	-	12(60%)	6(30%)	02(10%)

Among the 20 patients treated with PHILOS, 14 were male and 06 were female. 11 patients had fracture of right humerus and 09 had fracture of left humerus with 11 patients having fracture of Neer's type II and 09 patients of Neer's type III (Table 1).

The average operation time was 50 minutes and average blood loss was 100 ml for PHN group and the average operating time was 90 minutes and average blood loss was 220 ml for PHILOS group. At 6 month follow up, results were assessed with constant shoulder score. Among the PHN group, 8 patients (40%) showed excellent outcome, 8 patients (40%) showed good outcome and 4 patients (20%) showed fair outcome. Among the PHILOS group, 12 patients (60%) showed good outcome, 6 patients (30%) showed fair outcome and 02 patients (10%) with poor outcome. All fractures healed by 6 months in PHN group and 9 months in PHILOS group (Table 2).

At 6 month follow up, the average range of shoulder abduction in PHN group was  $136 \pm 8$  degree, where as in PHILOS group it was  $117 \pm 4$ , P value ( $< 0.001$ -HS).

In our study, 90% of cases in PHN group united within 3 months and rest 10 % within 5 months, where as in PHILOS group 78 % of cases united within period of 3 months, 17% cases united within 6 month period.

### Complications

In the PHN group, we noticed a proximal screw loosening in 1 patient (5%), this was an incidental radiological finding at 3month follow up, the patient was however symptomless. Rotator cuff impingement and restriction of movement was seen in 1 case (5%). There were no cases of superficial skin infection in the PHN group.

In the PHILOS group, superficial infection was the most common complication, seen in 4 patients (20%) who were treated with antibiotics and regular dressings varus malunion and stiffness were noticed in 2 patients (10%). There were no cases of avascular necrosis in both the study groups (Table 3).

**Table 3: Complications.**

Complications	PHN group	PHILOS group
Proximal screw loosening	1(5%)	0(0.00%)
Infections	0(0/00%)	1(5%)
Rotator cuff impingement	1(5%)	0(0.00%)
Varus malunion	0(0.00%)	1(5%)
Stiffness	1(5%)	1(5%)

## DISCUSSION

Proximal humerus fractures may present with many different configurations in patients and hence the treating surgeon must understand the fracture pattern, the quality of bone and other patient related factors to achieve the best functional outcome and to minimize the complication.

Current treatment options range from non-operative treatment with physical therapy to fracture fixation using closed/percutaneous or open techniques to arthroplasty reconstructions. Even if the injury is thoroughly analyzed and the literature is understood, treatment of displaced fracture or fracture dislocation is difficult.

The incidence of proximal humerus fracture is high in women. Women are affected two to three times as often as men.<sup>8</sup> In the present study majority that is 12(60%) in PHN group and 14 (70%) in PHILOS group were male, suggesting male preponderance. Also there are other studies which had reported male preponderance(in PHILOS group) with male to female ratio of 1.7:1 and 1.35:1.<sup>9,10</sup> The higher male to female ratio can be explained by the involvement of day to day activities compared to females.

The recent trend is to use less invasive procedures for reduction and fixation of the fracture. The lesser invasive the procedure, some of the operative pre requisites to achieve better functional results are good bone stock, minimal comminution of the tuberosity and patient willing to participate in postoperative physiotherapy regimes.

Sturzenegger et al reported a 34% incidence of AVN in a series of 17 patients treated with T plate.<sup>11</sup> The extensive exposure of the fragment for plate fixation was thought to compromise blood supply to the fracture fragments in his series. In this comparative study we have

observed that there is no insult to the vascular supply of the fracture as the soft tissue envelope is not disturbed and hence there is less chance of osteonecrosis in the PHN group.

In PHN group, the incidence of proximal screw loosening (5%) was comparable to other reports ranging from 4 to 20%.<sup>12,13</sup> It may be due to the absence of proximal cancellous locking option in the proximal humerus nail.

## CONCLUSION

In our study, 16 out of 20 patients had excellent to good outcomes with Proximal humerus nail with early achievement of complete range of movements (3 months) when compared to the PHILOS group, in which 18 patients achieved good to fair outcomes.

In this study, the advantages of PHN observed over PHILOS are limited exposure and less soft tissue damage, preservation of periosteal blood supply, less operating time and finally early restoration of shoulder movements.

Thus proximal humerus nail for Neer's type II and type III proximal humerus fracture has better results compared to proximal humerus internal locking system with increased range of movements and restoring better Shoulder biomechanics.

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## REFERENCES

1. Nordqvist A, Petersson CJ. Incidence and causes of shoulder girdle injuries in an urban population. *J Shoulder Elbow Surg.* 1995;4(2):107–12.
2. Baron JA, Barrett JA, Karagas MR. The epidemiology of peripheral fractures. *Bone.* 1996;18(3):209–13.
3. Baron JA, Karagas M, Barrett J, Kniffin W, Malenka D, Mayor M, et al. Basic epidemiology of fractures of the upper and lower limb among Americans over 65 years of age. *Epidemiology.* 1996;7(6):612–8.
4. Calvo E, Morcillo D, Foruria AM, Redondo-Santamaría E, Osorio-Picorne F, Caeiro JR, et al. Nondisplaced proximal humeral fractures: High incidence among outpatient-treated osteoporotic fractures and severe impact on upper extremity function and patient subjective health perception. *J Shoulder Elbow Surg.* 2011;20(5):795–801.
5. Lee SH, Dargent-Molina P, Breart G. Risk factors for fractures of the proximal humerus: results from the EPIDOS prospective study. *J Bone Miner Res.* 2002;17(5):817–25.

6. Maravic M, Le Bihan C, Landais P, Fardellone P. Incidence and cost of osteoporotic fractures in France during 2001. A methodological approach by the national hospital database. *Osteoporos Int.* 2005;16(12):1475–80.
7. Streubel PN, Sanchez-Sotelo J, Steinmann SP. Proximal humeral fractures. In: Rockwood and green's fractures in adults. Chapter 37. 8th edition. 1341-1425.
8. Court-Brown C, Ceasar B. Epidemiology of adult fractures: A review. *Injury.* 2006;37(8):691-7.
9. Aggarwal S, Bali K, Dhillon MS, Kumar V, Mootha AK. Displaced proximal humerus fractures: an Indian experience with locking plate. *J Orthop Surg Res.* 2010;5:60.
10. Gerber C, Schneeberger AG, Vinh TS. The arterial vascularisation of the humeral head. *J Bone Joint Surg.* 1990;72:1486-93.
11. Sturzenegger M, Fornano E, Jakob RP. Results of surgical treatment of multifragmented fractures of humeral head. *Arch Orthop Trauma Surg.* 1982;100:249-59.
12. Rajashekhar C, Ray PS, Bhamra MS. Fixation of proximal humerus fractures with polarus jumeral nail. *Shoulder Elbow Surg.* 2001;10:7-10.
13. Agel J, Jones CB, Sanzone AG, Camuso M, Henley MB. Treatment of proximal humerus fractures with Polarus nail fixation. *J Shoulder Elbow Surg.* 2004;13:191-5.

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