

# A prospective study on the management of proximal humerus fractures treated with proximal humerus nail (PHN)

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## Abstract

**Background:** Proximal humeral fractures, defined as fractures occurring at or proximal to the surgical neck of the humerus is the commonest fracture affecting the shoulder girdle in adults and its incidence is rising. **Materials and Methods:** A prospective study of 25 patients with Proximal humerus fracture (16 cases of Neer's type II and 9 cases of Neer's type III) treated with Proximal Humerus Nail System, at two Hospitals attached to J.J.M Medical College, Davangere, Karnataka, India between April 2016 to May 2017. At final follow up, results were assessed with constant shoulder scoring system. **Results:** At 6 months final follow up, the results when analysed with constant shoulder scoring system showed 9 patients (36%) to have excellent outcome, 11 patients (44%) to have good outcome and 5 patients (20%) to have fair outcome. No cases were noted to have poor outcome or implant failure. **Conclusions:** Proximal humeral nail (PHN) as a surgical option for the treatment of proximal humerus fractures leads to good to excellent functional outcome in most of the patients with advantage of early recovery of normal range of movements

**Key Words:** Constant shoulder scoring system, Neer's type II and type III, PHN.

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## INTRODUCTION

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.<sup>2,3,4,5,6</sup> The current fracture epidemiology shows that nowadays proximal humeral fractures account for almost 7% of all fractures and make up to 80% of all humeral fractures.<sup>7</sup> Studies suggest that the average age of patients who present with proximal humeral fractures is also rising. In 2002 the average age of patients with proximal humeral fractures was 63 years<sup>8</sup>, but was increased to the average age to be 66 years in 2010-2011.

Men who present with proximal humeral fractures are on average 8 to 10 years younger than women<sup>9</sup> The average age of patients with displaced two-part surgical neck fractures is 72 years, and the vast majority of patients are 50 years or older.<sup>10</sup> In younger individuals there is a higher incidence of proximal humeral fractures as a result of higher-energy trauma, such as road traffic accidents (RTAs) and sports injuries. In elderly individuals, most of proximal humeral fractures results as a consequence of fall from a standing height. A. O. Adedapo *et al.*<sup>11</sup> evaluated the results of internal fixation of three and four part proximal humeral fractures with the polaris Proximal humerus nail (PHN). Twenty-three patients out of thirty four were available for the final review. The functional results were very good for the three part fractures with a median Neer score of 89 (range: 33–100). Similar scores for the four-part and the three and four-part fractures with shaft involvement, were 60 (range: 41–87) and 73 (range: 31–91) respectively, reflecting the greater severity of this injury. All patients, except one in the three-part group, could perform their activities of daily living independently. Peter v Giannoudis *et al.*<sup>12</sup> (2012) evaluated the functional outcome, union and complication rates after surgical treatment of unstable or displaced

proximal humeral fractures using the Polarus intramedullary nail (proximal humerus nail). 27 patients were treated operatively for proximal humeral fracture using the Polarus nail. Functional outcome was evaluated using the Constant Shoulder Score. The mean Constant score was 74.5. Patients under the age of 60 had a better functional outcome compared to patients >60 years of age ( $p < 0.05$ ). The aim of the surgical treatment of these fractures should be to achieve anatomical reduction, stable fixation and earlier recovery of normal range of movements.

## MATERIALS AND METHODS

A prospective study of 25 patients, 16 of Neer's type II and 9 of Neer's type III Proximal humerus fracture treated with Proximal Humerus Nail at Chigateri general hospital and Bapuji hospital attached to J.J.M Medical College Davangere, Karnataka, India between April 2016 to May 2017.

### Inclusion Criteria

Patients with age above 18 years, presenting with fresh cases of Neer's two parts, three part fracture of the proximal humerus which were closed injuries and those who were medically fit for surgery were included in the study.

### Exclusion Criteria

Patients whose age is less than 18 years or those who are presenting before skeletal maturity, patients 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 and all cases of Neer's four part fractures were excluded from the study.

### Operative technique

All patients received a prophylactic dose of 1gm cefoperazone + sulbactam intravenously preoperatively. The surgery was done in supine position, under brachial block or general anesthesia. For displaced two part, three part fractures, reduction was achieved either by traction and manipulation by adduction and rotatory movements of arm or by joystick maneuvering using k wires. Incision made by anterolateral deltoid splitting approach, deltoid muscle split. The rotator cuff is divided to expose the superior portion of the humeral head. The Entry Cuff Guard protective device was used to retract the soft tissue of the rotator cuff for visualization of the bone. The Cuff Guard provided a visual working channel, while protecting the rotator cuff and soft tissue during the

procedure. Entry point was made with the help of bone owl. Humeral head reaming was done with proximal reamer. The proximal humeral nail inserted with the help of mounted primary jig. Nail is advanced with rotatory motion. Each step was analysed under fluoroscopy. Reduction was once again after complete nail advancement, then proximal two lateral locking screws were put with help of primary jig. The required lengths of the locking head screws were determined with a direct measuring device. Proximal anterolateral and posterolateral locking was done by attaching secondary jig to the primary assembly. All proximal locking screws were placed in a unicortical fashion. AP (internal and external rotation) views and axillary views 90 degrees to each other were used to visualize screw placement. Finally distal locking done through the primary jig. Thorough wash given and Wound was closed in layers. (fig 1,2)

### Postoperative management

Shoulder was immobilised in a universal shoulder immobiliser after surgery. Appropriate antibiotics and analgesics were given. Immediate post operative check radiographs were taken to determine the alignment of the bone and maintenance of reduction. Sutures removal was done on 10<sup>th</sup> day.

### Rehabilitation

Passive range of motion started on post operative day two. Pendulum exercises initiated on post op day five. Active range of motion was started at two to four weeks postoperatively, depending on stability of osteosynthesis. Active assisted movements started up to 90° abduction with no forced external rotation. Shoulder immobiliser is discontinued after three to four weeks. By fifth to sixth week-full range of movements with active exercises started. At the end the patients were examined clinically and radiologically, assessed for range of motion and bony union and for any complications.

## OBSERVATIONS AND RESULTS

**Table 1:** Association of outcome with type of fracture

Outcome	Type Of Fracture				Total	
	2-Part		3-Part			
	No.	%	No.	%	No.	%
EXCELLENT	7	77.77	2	22.22	9	100
GOOD	6	54.54	5	45.45	11	100
FAIR	1	20.00	4	80.00	5	100
POOR	0	0.00	0	00.00	0	0.00
Total	14	56.00	11	44.00	25	100



Figure 1(A)

Figure 2(A)

**Figure 1(A)** Preoperative X-ray of 64 year old male showing a (R) 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 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.

In this study, among the 25 patients treated with Proximal humerus nail (PHN), 14 were male and 11 were female with male to female ratio of 1.2:1. Maximum number of patients (11, 44%) were from the age group of 60 years and above, with a mean age of 65.4 years among them. Least number of cases were from the age group 18-30 years (2,8%). 16 (64%) patients in this group had Right side involvement and 9 (36%) patients had Left side involvement, of which 14 (56%) cases were of Neer's type II and 11 (44%) cases were of Neer's type III. Nature of injury was self fall in 19 (76%) cases, motor vehicle accidents in 5(20%) cases and assault in 1(4%) case. Average duration from time of admission to surgery was 3 days. The average duration of surgery was 45 minutes and average blood loss was 90 ml for PHN group. In this study, clinical and radiological union was observed in all the patients at 6 months follow up, with a mean radiological union time of 14 week. At six month final follow up, results were assessed with constant shoulder score, 9 patients (36%) showed excellent outcome, 11 patients (44%) showed good outcome and 5 patients (20%) showed fair outcome. No cases were noted to have poor outcome or implant failure. At 6 month follow up, the average range of shoulder abduction was  $131 \pm 6$  degree. The complications encountered in this study were, there were superficial skin infection present in 2 patients (8%), proximal screw loosening in 1 patient (4%), this was an incidental radiological finding at 3month follow up, the patient was however symptomless. There was rotator cuff impingement and shoulder stiffness noted in 1 patient (4%). There were no major complications like avascular necrosis of humeral head or implant failure.

## DISCUSSION

Proximal humeral fractures occur frequently and when displaced, mostly mandates surgical treatment. Fracture

configuration and quality of the bone are the two important determinants for implant selection, which along with other patient related factors influences the final functional outcome. Treatment options for displaced proximal humerus fractures include open reduction and internal fixation with locking plates and screws, percutaneous pinning, staples and wires, intramedullary nails, and shoulder hemiarthroplasty<sup>13,14,15,16,17</sup>. There is lack of adequate data regarding evidence-based decision making for the management of displaced or unstable proximal humeral fractures<sup>18</sup>. Until now no single operative technique and fixation device has been demonstrated to be superior or without complications<sup>20</sup>. Recently, wide varieties of proximal humerus nails are being manufactured, in view to promote the much less invasive methods of fixation of proximal humerus fractures. The advantages of proximal humeral nail being, stable fixation could be achieved with minimal deltoid splitting incision, minimal soft tissue dissection, less periosteal stripping thereby avoiding vascular insult, less intra operative time and blood loss and early recovery of range of movements. In our study, excellent and good results with regard to functional outcome (Constant score) was noted in the majority of the patients (80%). Sosef *et al.*<sup>21</sup> found a more than satisfactory shoulder function by recording a median Constant score of 89 (range 39–100). Rajasekhar *et al.*<sup>22</sup> measured a median Constant score of 75 (25–88) points for patients aged over 60 years, and 70 (34–100) points for those younger than 60 years, in 25 patients treated with the Polarus proximal humerus nail. In a study conducted by Yoichi Koike, Tatsuro Komatsuda and Katsumi Sato<sup>23</sup> investigated the clinical and radiographic results of the internal fixation using Polarus proximal humeral nails (PHN) for fractures of the proximal humerus. They observed that all the shoulders after osteosynthesis obtained bone-union. There was no osteonecrosis of the humeral head. Functional outcome

measured by JOA score averaged 81 points. Our study results were par with the above mentioned study, with no single incidence of osteonecrosis of humeral head. Also, there were no incidence of varusmalunion or greater tuberosity deformities. Two cases of superficial skin infections were treated successfully with good local wound care and oral antibiotics. Rotator cuff impingement and shoulder stiffness noted in 1 patient (4%), physiotherapy was initiated and continued for 5 weeks and patient was symptomatically better at 9 months follow up. The occurrence of rotator cuff impingement and proximal screw back out are expected to be reduced with the use of straight proximal humeral nail when compared to the presently used humeral nail with a proximal angulation and with the use of proximal cancellous locking screws respectively.

## CONCLUSIONS

Fractures of the proximal humerus are challenging to treat and need a proper selection of implant based on fracture pattern. Proximal Humerus Nail for proximal humerus fractures has various advantages over open surgical techniques with less failure rates and restoring better shoulder biomechanics.

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