



ROLE OF MINIMALLY INVASIVE FIXATION FOR TWO-PART PROXIMAL HUMERAL FRACTURES (SURGICAL NECK) USING J-NAILS

Orthopaedics

Ankush Bhargava Assistant Professor, Department of Orthopaedics, PCMS & RC, Bhopal, MP, India

Raj Jaiswal* PG Resident, Department of Orthopaedics, PCMS & RC, Bhopal, MP, India.*Corresponding Author

Harish Rao Professor & Head, Department of Orthopaedics, PCMS & RC, Bhopal, MP, India

Atul Varshney Professor & Head, Department of Orthopaedics, ABVGMC, Vidisha, MP, India

ABSTRACT

Background- Proximal humeral fracture is one of the common fractures in the elderly population. Non-operative and operative treatment have their own advantages and disadvantages. Hence the present study was conducted to determine the role of minimally invasive fixation using J-NAILS in the surgical neck humerus fracture.

Objectives -To study the results of minimally invasive fixation using J-NAILS in the surgical neck humerus fractures and to study the complications if any.

Methodology- This non randomized prospective interventional study was done on cases presented with surgical neck humerus fractures. All cases were given initial first aid and were examined thoroughly. All preoperative investigation with Standard anteroposterior, Y-scapular and axillary roentgenogram of the affected site was taken, and the fracture was classified according to NEERS CLASSIFICATION and fixed using J-NAILS. Follow up visits were conducted at 2 weeks after surgery then every 4 weeks till 24th and at 30th week. Outcome was evaluated according to clinical method of functional assessment of the shoulder (Constant and Murley score).

Result- The patients had immediate pain relief and early mobilization was started. In this study we observed that minimally invasive technique of elastic fixation of surgical neck humerus fracture could be used as good alternative with minimal complications.

Conclusion- Being minimally invasive procedure, J-nail fixation is simple and associated with minimal pain and complications.

KEYWORDS

INTRODUCTION

Fractures of proximal humerus are one of the common fractures especially in elderly.^[1] Their incidence account for 4 to 5 % of all fractures.^[2] According to the Neer classification, two-part fracture are observed in approximately 28% patients and patients over 50 years old are affected the most.^[3] With the increase in incidence of road traffic accidents, the incidence of proximal humerus fracture is increasing. Other factor which is responsible for increase in incidence of proximal neck fractures is osteoporosis especially in elderly females which predispose to fractures even after trivial trauma.

Treatment of proximal humeral fractures remains a topic of debate, especially in older patients and much controversies exist in choosing amongst the various existing surgical modalities.^[4] Undisplaced or minimally displaced fractures of the proximal humerus could be treated by non-surgical management alone as complications are rare and healing time is short and chances of infection are minimal. Controversies exist for treatment of displaced fractures. Some literature favor the use of minimally invasive method while others prefer open reduction and rigid fixation.^[5] However these fractures are associated with multiple complications such as malunion, nonunion, avascular necrosis and sometime shoulder stiffness.^[5]

Though many studies have attempted to compare the treatments results between various surgical treatment available for treatment of proximal fracture neck humerus, no consensus has been reached.^[6] Each surgical methods is associated with certain advantages and disadvantages. Good anatomic reduction and rigid fixation has been achieved with fracture fixation using tension band wiring but it is associated with extensive soft tissue dissection and thus it is prone to complications of soft tissues as well as avascular necrosis of the humeral head.^[7] However Antegrade intramedullary pinning technique can provide fracture reduction fixation with minimal invasion, but it may split the supraspinatus tendon, resulting in weakness to the rotator cuff.^[8] Ender nail technique is known to cause little soft tissue damage around the shoulder joint as compared to plate fixation but it may cause restriction of elbow joint motion.^[9] The present study thus attempted to analyse the role of minimally invasive fixation for two-part proximal humeral fractures (surgical neck) using J-nails.

OBJECTIVES

- To study the results of minimally invasive fixation using J-NAILS

in two Part fracture of proximal humerus.

- To study the complications if any.

METHODOLOGY

The present study was designed as a non randomized prospective interventional study. All the patients with two part unstable proximal humerus fracture (surgical neck) under NEERS Classification of either gender between 18 to 80 years of age and giving consent were included in the study at fulfilling the inclusion criteria and giving consent for the study. Patients with other associated fracture in ipsilateral limb and patients medically unfit for surgery were excluded. The study could enroll 30 patients during the study period of 1 year (1 Jan 2018 to 31st December 2018).

Procedure :

All patients were initially given first aid in casualty and a thorough examination to find out associated injuries was conducted. Patients were then subjected to routine pre-anaesthetic investigations and additional investigations when indicated. Standard anteroposterior, Y-scapular and axillary roentgenogram of the affected site was taken, and the fracture classified according to NEERS classification.

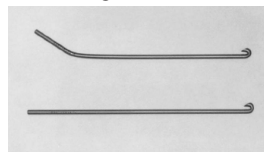


Figure 1- Photograph of J-nails. J-nail is prepared during surgery using a 2.4 mm diameter K-wire. The top of the nail is bent to approximately 30 degrees, and the tail is curved into a J-shape, which allows it to be grasped with an Ender nail holder.



Figure 2- Estimating the length of the J-nail. A K-wire 2.4 millimeters in diameter (A) is inserted a few centimeters into the bone cavity

through the entry hole to act as a marker. A graduated K-wire (B), which is previously bent, is placed over the anterior side of the upper arm, parallel to the humerus, where it could be viewed as an overlay in the fluoroscopic image. The tip of the graduated K-wire (B) is placed just below the articular surface of the humeral head under image control. The point of intersection made by these two K-wires (black arrow) is marked on the curved K-wire (B). The distance from the marked point to the tip on the curved K-wire is the final length of the J-nail to be inserted.

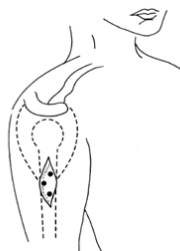


Figure 3- Entry holes for the nails on the lateral surface of the humerus. Three or four entry holes are made at an upward angle of 45 or 60 degrees from the humeral shaft. Each nail is inserted through its own hole. To avoid fractures, the position of these entry holes should not be drilled in a straight line or as a triangle with acute angles.

Surgical Techniques :

The standard operative technique taking all aseptic precautions was used in all patients. A one-inch longitudinal skin incision was made on the lateral side of the upper arm, just below the distal end of the deltoid muscle insertion. The first nail entry hole was made in the exposed cortex of the proximal humeral shaft, using a 2.8-millimeter-diameter drill bit. A K wire was inserted into the bone cavity through the entry hole to act as a marker. Another graduated K-wire was placed over the anterior side of the upper arm, parallel to the humerus. The point of intersection made by these two K-wires was marked on the curved graduated K-wire. The distance from the marked point to the tip on the curved graduated K-wire was the final length of the J-nail to be inserted. A 2.4millimeter K-wire was cut to the proper length with the smooth end of a K-wire designated as the proximal tip of the nail, and its tail bent into a J shape during surgery. The proximal part of the nail was bent at 30 degrees so the nail tip can maintain contact while sliding along the inner wall of the contralateral cortex. After satisfactory reduction of the fracture three entry holes were made, and three separate J-nails were inserted through each hole with their nails heads dispersed in any direction. After surgery the patient's arm was supported with a neck sling for one week. Implant removal was done between 24th to 30th week.

Patients were followed up daily in the hospital till discharge. After the discharge the follow up was conducted at 2 weeks and then every 4 weeks till 30th week. Roentogram was taken at 2nd week post operatively and in few patients repeat roentogram was taken according to patient's condition.

Outcome of the patients was evaluated according to the clinical method of functional assesment of the shoulder (Constant and Murley score). The Constant and Murley Score are the most commonly used scoring system for evaluation of various disorders of the shoulder. It is a 100 point scoring system to assesses subjective and objective shoulder function with respect to pain; activities of daily living; range of motion and strength.^[10] Complications occurred if any were noted and managed accordingly.

Data was compiled using MS Excel and analysed using SPSS 20.

OBSERVATIONS

The present study included only two part fracture according to NEER's Classification. The mean age of patients in present study was 68.3±12.5 years and majority of patients belonged to age group of 61 to 70 years (56.7%), followed by 51 to 60 years (33.3%). Out of 30 patients, 21 (70%) were females whereas only 3 (10%) were males.

The mean operating time was 55.2 ± 26.3 minutes and the mean total hospital stay was 7 days (range, 3–20 days).

Table 1- Constant Murley Score

Constant Murley Score	Total score	Mean score	SD
Pain	15	9.4	1.3
Activities of daily living	20	12.8	3.5
Range of movement	40	24.3	10.1
Strength	25	18.4	5.3
Total	100	64.9	20.2

The mean constant Murley score was 64.9±20.2 in present study. All patients had immediate pain relief.

Table 2-Distribution According To Range Of Movements

Movement	Mean	SD
Forward elevation	137	25
Abduction	131	22
Extension	63	12
External rotation	65	15
Internal rotation	77	12

The mean forward elevation, abduction, extension, external and internal rotation were 137±25, 131±22, 63±12, 65±15 and 77±12 respectively.

Table 3- Distribution According To Complications

Complications	Frequency	Percent
Superficial infection	3	10
Delayed union	2	6.7
None	25	83.3

In present study, no complications were observed in 83.3% patients whereas superficial infection was observed in 10% patients and delayed union was seen in 6.7% patients.



Figure 4- Surgical neck fracture of the right humerus in a female. **A:** Unstable surgical neck fracture of the humerus. The patient was injured by a fall down the stairs. The fracture was diagnosed as a two-part unstable surgical neck fracture. **B:** Radiograph of the shoulder two weeks after surgery. Surgery was performed using three J-nails bent at 30 degrees. The tips of each J-nail were dispersed in different directions, and relatively rigid fixation was achieved.

DISCUSSION

Various surgical modalities are available for treatment of displaced two part humerus fracture; some surgeons are reluctant to use antegrade IM and still prefer using locking plate and screw fixation, though they are associated with many complications.^[11] The mean age of patients was 68.3±12.5 years and maximum patients belonged to age group of 61 to 70 years (56.7%). Females constituted the maximum study population (70%) whereas only 30% patients were male. Plath JE et al in their study observed higher mean age of patients i.e. 75.6 years (60–92).^[12] In a study by Boileau P et al, the mean age at surgery was 57 years (range, 17-84 years) and they also observed female preponderance i.e. 25 female and 16 male.^[13] Court Brown CM et al concluded that about 85% occur in people older than 50, and the incidence peaks in the 60- to 90-year-old age-group with a female to male ratio of 70:30.^[14]

Immediate pain relief was observed in all patients in present study with the mean constant Murley score of 64.9±20.2. Marimuthu et al in their study observed The average Constant shoulder score was 67.28 (range, 38–92).^[15] Plath JE et al observed statistically significant improvement in Constant Murley score from 48 points (67%) at 3 months to 57 points (80%) at 6 months and 65 points (94%) at 12 months ($p < 0.001$).^[12] Mean constant Murley score of 68.4±13.0 was observed by Boileau P et al in their study on two part humeral fracture.^[13]

The mean range of forward elevation, abduction, extension, external and internal rotation were 137±25, 131±22, 63±12, 65±15 and 77±12 respectively in present study. Similar results were obtained by Takeuchi R et al, they observed the mean angles of active forward

elevation, abduction, extension, external rotation, and internal rotation for all patients were as follows: 138 ± 24 degrees, 132 ± 26 , 65 ± 13 , 66 ± 17 , and 81 ± 11 respectively.^[11] Average range of forward elevation, external and internal rotation were 146 ± 24.0 , 49.4 ± 19.0 and 6.2 ± 2.0 respectively in as study by Boileau P et al.^[13]

The present study observed superficial infection in 10% patients and delayed union in 6.7% patients however, no complications were observed in 83.3% patients thus minimally invasive surgery is associated with less complications. Takeuchi R et al observed no cases of deep infection, nerve injury, implant failure, or nail perforation that might have interfered with shoulder joint motion.^[11] Marimuthu et al concluded that minimally invasive surgery is associated with low complication rate.^[15] Sosef N et al observed major complications in 6 of the 23 patients, requiring revision surgery; they encountered 1 case of nonunion and 1 case of avascular necrosis of the humeral head. They concluded that one of the advantages of this minimally invasive intramedullary device is the possibility of early postoperative mobilization with minor pain.^[16]

CONCLUSION

Being a minimally invasive surgery, fixation for surgical neck humeral fractures using J-nails is associated with lesser complications and other disadvantage of muscle transfixation associated with other methods.

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