



MANAGEMENT OF UNSTABLE PROXIMAL HUMERUS FRACTURES IN ELDERLY BY HACKETHAL'S BUNDLE NAILING TECHNIQUE AND ITS FUNCTIONAL OUTCOMES

Orthopaedics

Dr Nilesh Shravan Sakharkar*

*Corresponding Author

Dr Pankaj V Tathe

Dr Rohit Bhurre

Dr Chandan Arora

ABSTRACT

fracture of the proximal humerus is a common and debilitating injury occurring mainly in elderly females and accounts for 4-5% of all fractures. Patients with displaced, unstable proximal humerus fractures may have improved outcomes if managed operatively. To study the effect of using Hackethal's bundle nailing technique for the management of fractures of proximal humerus in elderly. This prospective study was conducted in tertiary care hospital on 28 subjects with proximal humerus fractures. As per Neer's classification, three and four-part fractures were included and prepared for Hackethal's bundle nailing technique. The results of the treatment were evaluated as per Neer's criteria. Patients were followed up for 12 months. Among 18 females and 10 males, 22 had 3-part fracture and 6 had 4-part fracture. Among patients with 3-part fractures 4 cases had excellent result, 12 had satisfactory result, 4 had unsatisfactory result and treatment failed in 2 cases. With 4-part fractures, 2 cases had satisfactory result and 4 cases had unsatisfactory result. Hackethal's bundle nailing technique is an alternative option for the treatment of proximal humerus fractures, especially in elderly patients with osteoporosis, showing excellent to good results in cases of Neer's type 3-part fractures.

KEYWORDS

proximal humerus, hackethal's bundle nailing technique

INTRODUCTION

Fracture of the proximal humerus is a common and debilitating injury occurring mainly in elderly females and accounts for 4-5% of all fractures. Typical age of fracture is between 65 and 75 years (1). There is a marked gender deference with 70-80% of fractures occurring in females. These fractures are due to low energy trauma in elderly persons and risk increases in sedentary individual's low mineral density, family history of osteoporotic fractures, frequent falls and evidence of impaired balance (2,3). The proximal humerus is uniquely adapted to allow wide range of motion of the shoulder. Mobility is gained at the expense of stability. In fracture of the proximal humerus, biomechanics of this joint is disturbed if fracture fragments are not properly reduced and fixed, as greater tuberosity is attached to supraspinatus muscle and lesser tuberosity to subscapularis muscle. Thus, these muscles try to pull fracture fragments away with them, so closed is difficult. Ultimately joint stability and movement is compromised (1,3).

Neer's classification scheme is most widely accepted and classifies fractures based on the number of parts and their displacement (4-7). The bone density of the proximal humerus is relevant to fracture fixation and, generally, the bone density of the subchondral bone just underneath the articular surface is strongest, while the bone of the central humeral head and neck is more porous. In general, the proximal undisplaced or minimally displaced humerus fractures are treated conservatively. Patients with displaced, unstable proximal humeral fractures may have improved outcomes if managed operatively (8-10). Primary hemiarthroplasty in the early period with the anatomic reconstruction of bone and soft tissues of the shoulder joint and long-term regular rehabilitation program are important factors. Displaced fractures are treated surgically by various methods like percutaneous pin or screw fixation, open reduction and internal fixation with plate and screw, locking plate and screw fixation, and intramedullary nailing and external fixation. Hackethal's bundle nailing technique is cost effective, easily applicable, light weight, and needs minimum number of instruments for application 12,13. The present study was conducted to study the effect of using Hackethal's bundle nailing technique for the management of 3-parts and 4-parts fractures of proximal humerus in elderly, so that, in a developing country like India, it can be popularized for the benefit of the population at a large.

MATERIAL AND METHOD

This prospective study was conducted in a tertiary care hospital with the consents from patients

Inclusion criteria- All patients attending Orthopaedics outpatient or emergency department with proximal humerus fracture (3-part and 4-part), open or closed without any neurovascular deficit were included.

Exclusion criteria- Patients with other varieties fracture of proximal humerus, patients with previous injuries that has already compromised function, movement of shoulder, and subjects having neurovascular deficit were excluded.

A total of 28 patients were included in this study. Among them, 18 were females (mean age 60 years) and 10 were males (mean age 65 years). Among them, 22 patients had 3-part fractures and 6 had 4-part fractures. Patients were operated within 2 weeks from the date of trauma after proper clinical and laboratory investigations and pre-anesthetic assessment. Road traffic accident was the commonest mode of injury in <60 years age group and fall on the ground in patients >60 years age group.

All patients were evaluated on admission. As per Neer's classification, 3-part and 4-part fractures were included and prepared for Hackethal's bundle nailing technique 12,13. The results of the treatment were evaluated as per Neer's criteria.

Surgical technique- Kept the patient in supine position after general anesthesia so that the affected shoulder was clear off the table or used fluorescent table and could be imaged with a C arm machine. The ideal position of the patient achieved by either a beach chair or using a sand bag under the scapula and by keeping the C-arm base at the head end of the patient. Specific instruments requirements include bone elevators and bone hooks to manipulate the fragments and for the reduction of fractures. The necessary implants include 2 mm, 2.5mm, 3mm, 3.5mm and 4mm TENS nail (titanium elastic nailing system). Once the shoulder prepared and draped, checked the AP and axillary view obtained using C arm machine. Closed reduction should carry out before preparing the shoulder for further surgical procedure to confirm the feasibility of closed reduction. Closed reduction carried out by giving longitudinal traction in slight abduction and flexion of the arm to relax the pull of pectoralis major muscle, followed by posterior pressure on the humeral shaft to correct the angulation or anterior displacement of the shaft in relation to head. If reduction was satisfactory after confirming in AP and axillary C arm images, final sterile preparation should be done for pinning. The ideal point for lateral nail insertion is at least twice the distance from the top of the humeral head to most lower margin of the articular cartilage not distal to the deltoid tuberosity to avoid injury to the radial nerve. The ideal angle of pin insertion into the center of humeral head were determined by placing the k wire over the skin and confirming with the images. The trajectory should mark over the skin and stab incision was taken over predetermined starting point on lateral side of the arm, soft tissue retracted with artery forceps, an elastic nail inserted initially in horizontal direction to avoid skating over bone then along the

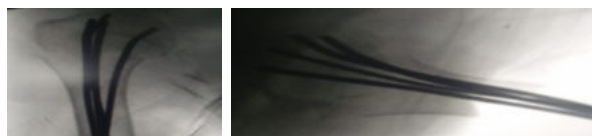
trajectory marked direction. Under C arm guidance the elastic nail advanced in posterior direction to neutralize the 20 degree of head retroversion up to the subchondral bone. The second nail was inserted in parallel to the to the first elastic nail so that there were separate by at least 1.5-2 cm in the head. Third elastic nail inserted from the anterior cortex protecting the long head of biceps muscle. Additional elastic nail inserted if required for additional stability of fracture. Last the elastic nail should bend and cut near the skin and sterile dressing was applied. The arm was supported in arm sling support. Pt should keep overnight in the hospital with prophylactic antibiotics administered for first 24 hrs. the arm supported in immobilizer for at least 4 weeks. Pendulum exercises started after 1 week of surgery. Elastic nail should remove after 4 to 6 evaluation of therapy program.

Shoulder x rays were taken on next postoperative day, after 7 days, after 4 weeks and at 6-8 weeks for evaluation of results and then at 4 weeks.

Neer's criteria for assessment of post-operative cases includes pain, function, range in motion, and anatomy (4-7).



Case no 1



Case no 2



Case no 3

RESULT

A total of 22 patients had 3-part fracture and 6 patients had 4-part fracture. Mean interval between injury and surgery was 10 days. Mean duration of Hackethal's bundle nailing technique was 10 weeks. Mean time of radiological union was 10 weeks. Follow up period ranged from 10 weeks to 6 months. Also, 4 of the 4-part fractures had nonunion and 2 had unsatisfactory shoulder function after fracture union as per Neer's criteria, one had nail tract infection and nail loosening. Two of the 3-part fractures had frank non-union. All other 20 3-part fractures united. Two of them had nail loosening and 2 had superficial infection. All superficial infected cases were treated with regular dressing. All pin tract healed after removal of pins within one week. Postoperative restriction of movement was treated with immediate mobilizing exercises in all cases, and shoulder mobility was satisfactory. All cases were estimated according to Neer's criteria. Thus, it was found that, among patients with 3-part fractures, 4 cases had excellent result, 12 had satisfactory result, and 4 had unsatisfactory result, and the treatment failed in 2 cases. With 4-part fractures, 2 cases had unsatisfactory result and 4 cases were failures. So 57% with 3-part fractures had excellent to satisfactory results. In 4-part fractures,

treatment results were not satisfactory (table 1).

Table 1: Results as per Neer's criteria in 3-part and 4-part fracture of proximal humerus.

classification	Result			
	Excellent	Satisfactory	Unsatisfactory	Failure
Three part	4 cases	12 cases	4 cases	2 cases
Four part			2 cases	4 cases

DISCUSSION

Treatment of proximal humerus fractures may be conservative or operative. Each procedure has some open internal fixation is difficulty in achieving rigid fixation in the osteoporotic cancellous bone of proximal humerus. Cortical bone in osteoporosis constitutes only a thin shell of bone and provides weak purchase for the screws. Presence of comminution offers difficulty in interval fixation. Internal fixation has been reported to have increased complication rates in these patients due to hardware loosening and pullout of the screws. In addition, the use of internal fixation device prolongs limitation and complications. A major disadvantage of non-operative treatment is failure to obtain early mobilization, which results in a high rate of shoulder stiffness and malunion or nonunion is likely with certain fracture types. (10-11). Disadvantage of use was hindered by increasing the risk of injury to soft tissue and limiting the space for application of multiple pins in different planes (7- 11). The smaller k-wires used in percutaneous pinning have lesser risk of soft tissue, neural, and vascular injury. Multiple k-wires used in different planes add to the rotational stability to reduced fractures. The principles of management for complex proximal humeral fractures are minimal soft tissue dissection to avoid the occurrence of avascular necrosis of the humeral head, adequate fixation to provide good stability for early rehabilitation, and an intact rotator cuff for an optimal functional outcome. Closed reduction and the use of Hackethal's bundle nailing technique achieve these principles adequately (11).

Complications encountered by internal fixation with Hackethal's bundle nailing technique of fractures of proximal humerus are k-wire loosening, pin tract infection, malunion, and shoulder stiffness. The use of the partially threaded k-wire increases the pullout strength. The undue tension on skin should be avoided to prevent pressure necrosis (11).

CONCLUSION

Thus, in the study, it was found that percutaneous pinning is an alternative option for the treatment of proximal humerus fractures, especially in elderly patients with osteoporosis showing excellent to good results in many cases of Neer's type 3-part fracture.

The use of percutaneous pinning in the management of proximal humeral fractures has become popular in the past decade. The idea of minimal fixation now lends to the fact that the blood supply to the head of the humerus is preserved.

REFERENCES

- Courr-Brown CM, Garg A, McQueen MM. The epidemiology of proximal humerus fractures. *Acta Orthop Scand* 2001;72:365-71.
- Kannus P, Palvanen M, Neimi S, Parkkari J, Jarvinen M, Vouri I. Osteoporotic fractures of proximal humerus in elderly Finnish persons. Sharp increase in 1970-1998 and alarming projection for the new millennium. *Acta Orthop Scand* 2000;71:465-70.
- Esen E, Dogramaci Y, Gultekin S, Devci MA, Suluova F, Kanatli U, et al. Factor affecting results of patients with humeral proximal end fractures undergoing primary hemiarthroplasty: A retrospective study in 42 patients. *Injury* 2009;4-0:1336-41.
- Neer CS. Displaced proximal humeral fractures. I. Classification and evaluation. *J Bone Joint Surg Am* 1970; 52:1077-89.
- Neer CS. Displaced proximal humeral fractures. II. Treatment of three part and four-part displacement. *J Bone Joint Surg Am* 1970;52:1090-103.
- Neer CS. Four segment classification of proximal humeral fracture. Purpose and reliable use. *J Shoulder Elbow Surg* 2002; 11: 389-400
- Bernstein J, Adler LM, Blank JE, Dalsey RM, Williams GR, Iannotti JP. Evaluation of the Neer system of classification of proximal humeral fractures with computerized tomographic scans and plain radiographs. *J Bone Joint Surg Am* 1996; 78:1371-5.
- Kristiansen B, Andersen UL, Olsen CA, Varmarken JE. The Neer classification of fractures of the proximal humerus. An assessment of interobserver variation. *Skeletal Radiol* 1988; 17:420-2.
- Kristiansen B, Kofoed H. Transcutaneous reduction and external fixation of displaced fracture of proximal humerus. A controlled clinical trial. *J Bone Joint Surg Br* 1988; 70:821-24.
- Patil YM, Patil AB, Balemane S. A prospective study, to study the surgical outcomes in three- and four-part proximal humerus fracture with PHILLOS plate. *J Sci Soc* 2012; 39:12-6.
- Gupta AK, Gupta M, Sengar G, Nath R. Functional outcome of closed fractures of proximal humerus managed by Joshi's external stabilizing system. *Indian J Orthop* 2012;46:216-20.
- Pospula W, Abu Noor T. Hackethal bundle nailing with intramedullary elastic nails in the treatment of two- and three-part fractures of the proximal humerus: initial experience at Al Razi Hospital, Kuwait. *Med Princ Pract*. 2009;18(4):284-8. doi: 10.1159/000215725. Epub 2009 Jun 2. PMID: 19494535.

13. Margad O, Boukhris J, Sallahi H, Daoudi M, Azriouil O, Koulali K. Place de l'embrochage fasciculé selon Hackethal dans le traitement des fractures de l'humérus: à propos de 80 cas [Role of Hackethal bundle nailing in the treatment of humerus fractures: about 80 cases]. *Pan Afr Med J.* 2016 Jul 19;24:253. French. doi: 10.11604/pamj.2016.24.253.9794. PMID: 27800106; PMCID: PMC5075468.
14. Khodadadyan-Klostermann C, Raschke M, Fontes R, Melcher I, Sossan A, Bagchi K, Haas N. Treatment of complex proximal humeral fractures with minimally invasive fixation of the humeral head combined with flexible intramedullary wire fixation - introduction of a new treatment concept. *Langenbecks Arch Surg.* 2002 Jul;387(3-4):153-60. doi: 10.1007/s00423-002-0286-x. Epub 2002 Apr 25. PMID: 12172860.