

# Functional Outcome of Joshi External Stabilisation System for Proximal Humerus Fractures in Tertiary Care Centre

Tanay Goyal<sup>1</sup>, Mukesh Agrawal<sup>2\*</sup>, Sandeep Pangavane<sup>3</sup> and Ketan Gandhi<sup>4</sup>

<sup>1</sup>Former PG Resident, Department of Orthopedics, Dr. Vasanttrao Pawar Medical College, Hospital and Research Centre, Adgaon Nashik, Nashik – 422003, Maharashtra, India

<sup>2</sup>Associate Professor, Department of Orthopedics, Dr. Vasanttrao Pawar Medical College, Hospital and Research Centre, Adgaon Nashik, Nashik – 422003, Maharashtra, India; moagrwal1106@gmail.com

<sup>3</sup>Professor, Department of Orthopedics, Dr. Vasanttrao Pawar Medical College, Hospital and Research Centre, Adgaon Nashik, Nashik – 422003, Maharashtra, India

<sup>4</sup>Assistant Professor, Department of Orthopedics, Dr. Vasanttrao Pawar Medical College, Hospital and Research Centre, Adgaon Nashik, Nashik – 422003, Maharashtra, India

## Abstract

**Background:** Proximal humerus fractures account for 4-5% of all fractures. The treatment options for fractures of proximal humerus includes transosseous suture fixation, intramedullary nailing, open reduction and internal fixation using plate and percutaneous pinning. The ideal treatment of displaced proximal humeral fracture is still the centre of scientific debate. Various minimally invasive modalities have been on the rise for the past 10/15 years. This minimally invasive fixation method allows preservation of blood supply of the humeral head. The smaller K-wires used in JESS have lesser risk of soft tissue, neural, and vascular injury. **Aim and Objective:** To find the functional Outcome of JESS fixation for proximal humerus fracture in 33 patients. **Materials and Methods:** 33 patients with proximal humerus fracture were treated by JESS fixator and their functional outcome was studied. **Results and Conclusion:** The mean Constant Murley Score preoperatively was 29.09 which raise to 60.39 at 4 weeks post operatively, 69.97 at 8 weeks post operatively and 79.64 at 12 weeks post-operative. Thus JESS fixator is an affordable, cost effective alternative treatment option for proximal humerus fracture with minimal complications.

**Keywords:** Constant Murley Score, Functional Outcome, Joshi's External Stabilisation System (JESS)

## 1. Introduction

Proximal humerus fractures are a common injury accounting for approximately 5 percent of all fractures<sup>1,2</sup>, with increasing frequency in elderly patients over the age of 60 years with a female to male ratio of 3:1 in the above age group<sup>3</sup>. Eighty five percent of these injuries are minimally displaced and amenable to non-operative treatment. Rest of the 15% patients with significant displacement of fracture fragments requires operative treatment<sup>2</sup>. Accurate diagnosis and classification of the fracture are the first steps in the successful treatment of these injuries.

Operative treatment of proximal humerus fractures includes closed reduction and percutaneous pinning,

Open reduction and internal fixation using locked PHILOS plate, Trans-osseous suture fixation, Intra-medullary nailing Hemiarthroplasty and Reverse Total Shoulder Arthroplasty. Each of the method has its own merits and de-merits. Choice of surgical method used depends on the fracture type, patient's age, medical co-morbidities and surgeon's preference and comfort with the particular method. Closed reduction and percutaneous pinning has gained particular interest due to it being minimally invasive<sup>4</sup> and studying the functional outcome of this method is the aim of this study. Smooth or threaded K-wires are used which are linked together mutually by clamps and rods. Though complications like loss of reduction and migration of pin have been seen in the past<sup>5,6</sup>. Since we have used mutual linking of the

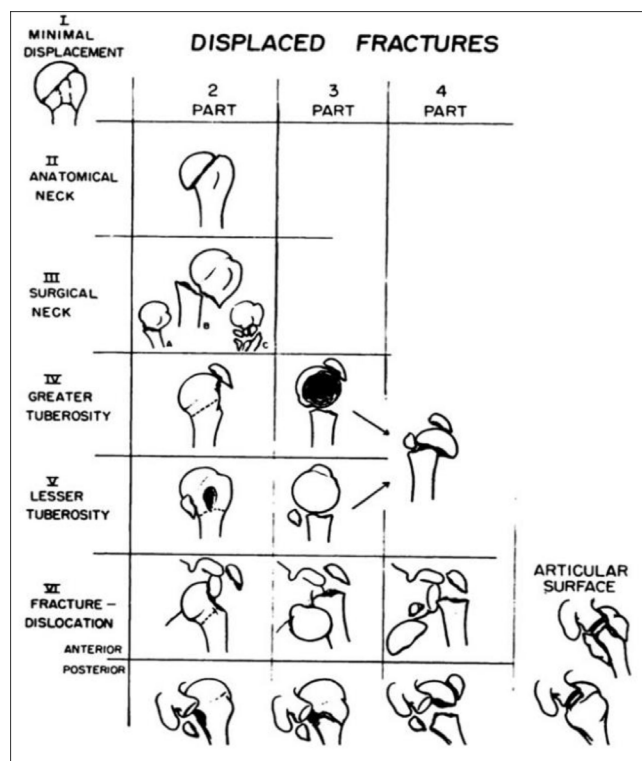
\*Author for correspondence

pins externally, chances of migration of pins has reduced drastically.

Most commonly, mechanism of injury for a proximal humerus fracture is fall on an outstretched arm usually in an elderly patient with osteoporotic bone<sup>1</sup>.

A thorough history should have age, hand dominance of the patient, mechanism of fall and velocity of injury along with medical co-morbidities the patient has. Any previous shoulder surgeries, any paraesthesia, any elbow, wrist or hand pain of the affected extremity should also be checked<sup>7,8</sup>.

Sufficient amount of information can be obtained for assessment and classification of a proximal humerus fracture by the True AP, Scapular Y view and Axillary Lateral View (Figure 1).



**Figure 1.** Displaced fractures.

As shown in the figure alongside; Neer utilised Codman's idea of four possible fracture fragments when he developed his classification system which was published in 1970<sup>9</sup>. He attempted to identify which fracture types were best treated with open reduction and which required prosthesis because of higher chances of avascular necrosis<sup>10,11</sup>.

Conservative method involves functional bracing of the humeral shaft and has shown to have good functional

outcome in un-displaced proximal humeral fractures in low demand patients with gross medical co-morbidities.

Surgical methods commonly used are closed reduction with percutaneous pinning (JESS fixation), Locked Intramedullary nailing, Trans-osseous suturing, Open Reduction and Internal Fixation using Locking plates, Hemi-arthroplasty, Total Arthroplasty and Reverse Shoulder Arthroplasty. The decision here lies on the fracture type, patient's age and surgeon's comfort and familiarity with the involved procedure as all the treatment methods have their pros and cons.

A simple light highly modular mini external fixator system which systematically addresses a wide range of complex problems in the management of forearm and hand. Invented by Dr. B.B. Joshi from Bombay. This system has high safety profile and unparalleled ease of application. It can be applied easily by any surgeon in even the most remote areas with minimum instrumentation. It provides a simpler alternative to the presently available modalities of treatment. It allows minimum invasive techniques and early physiotherapy<sup>12-15</sup>.

## 2. Aim and Objective

To study the functional Outcome of JESS fixation for proximal humerus fracture in study participants

## 3. Materials and Methods

Study Design: Prospective Study

Study Setting: Department of Orthopaedics, MVP Nashik

Study Duration: June 2017 to October 2019

Study Participants: 33 Patients

Any patient above the age of 18 years with proximal humerus fracture was included.

Dislocations, open fractures and those with other associated injuries were excluded from the study.

JESS fixator was applied within 3 days of injury under general anaesthesia. Physio-therapy was started from Post-Operative Day 1.

Functional assessment was done at 4 week, 8 week and 12 week follow up using constantmurley score<sup>16</sup>.

### Surgical Procedure

The procedure was performed with the patient under general/local anaesthesia in a supine position, using a sandbag to elevate the shoulder. The important structures

at risk are the axillary nerve and the posterior humeral circumflex artery from the greater tuberosity pins, the anterior branch of the axillary nerve from the proximal lateral pins, and the cephalic vein, biceps tendon, and musculocutaneous nerve from the anterior pins. The fixator wires were used as joysticks to obtain a reduction before attaching the frame. Aim of reduction was to bring the fragment in an acceptable position. All the pins were connected to the external fixator bars using beta clamps to form a solid construct.

### Post operative care and rehabilitation

A triangular sling was applied for comfort and patients were encouraged to begin active mobilization of the involved extremity from post-operative day 1. The pins were cleaned twice a day with hydrogen peroxide and Betadine solution. Wire and pin tract infections were classified according to the Dahl classification and were treated accordingly. Physical therapy was started immediately, beginning with pendulum exercises progressing to unrestricted range of motion by 6–7 weeks after fracture fixation. External fixator was removed after assessing for radiological union and functional progress of the patient.

Patients were followed at 4,6,8 and 12 weeks looking for clinical and radiological union.

At every follow up, Constant Murley score was used to evaluate the functional outcome of the patient (Figure 2).

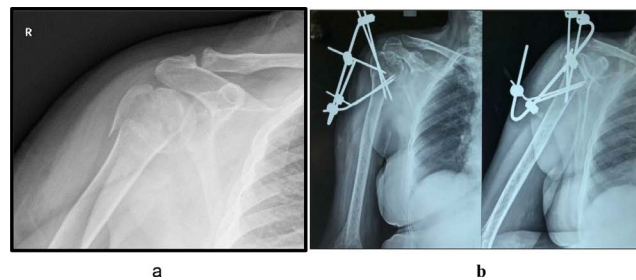
## 4. Results

We evaluated 33 patients with proximal humerus fractures. All of them were operated within 3 days of injury.

The mean Constant Murley Score preoperatively was 29.09 which raise to 60.39 at 4 weeks post operatively, 69.97 at 8 weeks post operatively and 79.64 at 12 weeks post-operative (Table 1).

**Table 1.** Mean Constant Murley Score of study participants

Constant Murley Score	Mean	SD
Pre-op	29.09	6.37
Post op 4 weeks	60.39	7.53
Post op 8 weeks	69.97	7.63
Post op 12 weeks	79.64	11.82



**Figure 2.** a. Pre-operative xray, b. Union seen at 8 week xray.

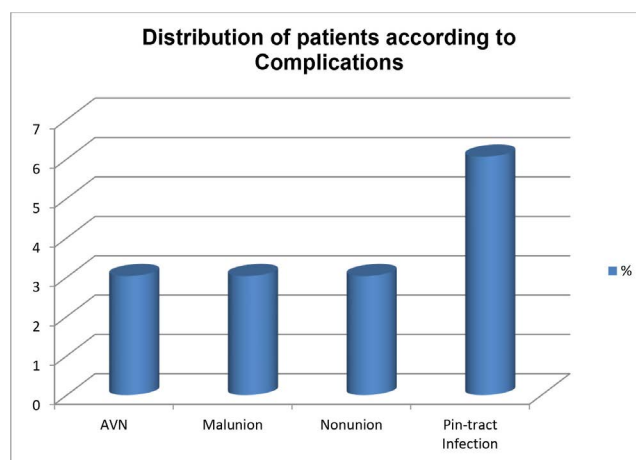
The p value is <0.005 when compared between preoperative score and post-operative score at 4 weeks, 8 weeks and 12 weeks; Thus, making it highly significant.

There was 1 patient with mal union with good constant score, 1 with nonunion and 1 with avascular necrosis which was managed by shoulder hemi arthroplasty; 2 with pin tract infection very well managed by oral antibiotics (Figure 3 & 4).

## 5. Discussion

Proximal humerus fractures are fairly common in elderly population with wide variety of treatment options offered for closed fractures ranging from minimally invasive percutaneous pinning to hemiarthroplasty. Each treatment modality has its own pros and cons.

Non operative treatment has a major disadvantage of delayed mobilisation associated with joint stiffness further complicated by increased chances of malunion and non-union.



**Figure 3.** Distribution of patients according to complications.



**Figure 4.** Clinical Pictures of follow up at 12 weeks.

Joshi External Stabilisation System fixator application in our study allowed good fracture union with good to excellent functional outcome. The procedure took less than 30 minutes in most cases, is cost effective and had minimal complications and need for re-surgery. Though this percutaneous method of fixation allowed suboptimal reduction anatomically; functional outcome was good to excellent<sup>17,18</sup>. Several studies confirm the aforementioned statement. There are other techniques working on the same principle of percutaneous fixation<sup>19</sup> along with prevention of migration of pins by use of a locking device applied to the pins<sup>4,20</sup>.

There was nil to minimal blood loss. We found very few complications in the study group at 6 weeks which was similar to other study conducted by Utkal Gupta *et al.*<sup>21</sup>. There was one case each with malunion, non-union, avascular necrosis and pin-tract infection. All were treated successfully.

Open Reduction and Internal Fixation using PHILOS plate has been studied and proven good in terms of functional outcome but comes at the cost of increased operative time, greater expenditure and more blood loss.. Early mobilisation in geriatric population is difficult (due to pain at suture site); leading to prolonged immobilisation and capsular adhesions which make it difficult to achieve good range of motion later despite of a rigid fixation.

Hemiarthroplasty and Reverse Total Shoulder arthroplasty are expensive procedures requiring better surgical skill and tertiary health care level facilities which are generally difficult to achieve at all places in our country. This requires adequate strength of Rotator Cuff muscles.

Intramedullary Nailing is an alternate method opted upon by several orthopaedic surgeons. Shoulder Pain is a common complaint after this due to iatrogenic rotator cuff damage while insertion of the nail<sup>22,23</sup>. A more medial approach has been proposed<sup>23</sup> but this puts the articular cartilage at the risk.

## 6. Conclusion

We concluded from this study that JESS fixation for proximal humerus fracture is a semi-rigid, cost effective technique which allows early mobilisation, requires minimal implants and has a short operative time and hospital stay with good to excellent functional outcome determined by Constant Murley Score with very few complication rate.

## 7. References

1. Browner BD, Levine AM, Jupiter JB, Trafton PG, Krettek C. Editors. *Skeletal Trauma*. 4<sup>th</sup> Ed. Philadelphia: Saunders; 2009.
2. Rockwood CA, Matsen FA, Wirth MA, Lippitt SB. editors. *The Shoulder*. 4<sup>th</sup> Ed. Philadelphia: Saunders; 2009.
3. Krisitansen B, Barfod G, Bredsen J, et al. Epidemiology of proximal humerus fractures. *Acta Orthop Scand*. 1986; 57:320-333.
4. Bogner R, Hubner C, Matis N, Auffarth A, Lederer S, Resch H. Minimally-invasive treatment of three- and four-part fractures of the proximal humerus in elderly patients. *J Bone Joint Surg Br*. 2008; 90:1602-1607. <https://doi.org/10.1302/0301-620X.90B12.20269>. PMID:19043132.
5. Pientka WF, 2nd, Bates CM, Webb BG. Asymptomatic migration of a kirschner wire from the Proximal aspect of the humerus to the thoracic cavity: A case report. *JBJS Case Connect*. 2016; 6:e77. <https://doi.org/10.2106/JBJS.CC.16.00032>. PMID:29252654.
6. Zacharia B, Puthezhath K, Varghees I. Kirschner wire migration from subcapital humeral fracture site, causing hydropneumothorax. *Chin J Traumatol*. 2016; 19:305-308. <https://doi.org/10.1016/j.cjtee.2015.12.010>. PMID:27780515 PMID:PMCID:PMCID5068143.
7. Levine WN, Marra G, Bigliani LU. Editors. *Fractures of the Shoulder Girdle*. New York: Marcel Dekker; 2003.
8. Kocher T. Beiträ" Gezur Kenntnis Einiger Praktisch Wichtiger Frakturformen. Basel: Carl Sallmann; 1896.
9. Neer CS. Displaced proximal humeral fractures. Part I. Classification and evaluation. *J Bone Joint Surg*. 1970; 52(6):1077-1089. <https://doi.org/10.2106/00004623-197052060-00001>.
10. Neer CS. Displaced proximal humeral fractures. Part II. Treatment of three-part and four-part displacement. *J Bone Joint Surg*. 1970; 52:1090-1103. <https://doi.org/10.2106/00004623-197052060-00002>.
11. Jakob RP, Miniaci A, Anson PS, Jaberg H, Osterwalder A, Ganz R. Four-part valgus impacted fractures of the proximal

- humerus. *J Bone Joint Surg Br.* 1991; 73:295-298. <https://doi.org/10.1302/0301-620X.73B2.2005159>. PMID:2005159.
12. Hodgson S. Proximal humerus fracture rehabilitation. *Clin Orthop Relat Res.* 2006; 442:131-138. <https://doi.org/10.1097/01.blo.0000194677.02506.45>. PMID:16741478.
  13. Koval KE, Gallagher MA, Marsicano JG, Cuomo F, McShinawy A, Zuckerman JD. Functional outcome after minimally displaced fractures of the proximal part of the humerus. *J Bone Joint Surg Am.* 1997; 79:203-207. <https://doi.org/10.2106/00004623-199702000-00006>. PMID:9052540.
  14. Hodgson SA, Mawson SJ, Stanley D. Rehabilitation after two-part fractures of the neck of the humerus. *J Bone Joint Surg Br.* 2003; 85B:419-422. <https://doi.org/10.1302/0301-620X.85B3.13458>. PMID:12729121.
  15. Bertoft ES, Lundh I, Ringqvist I. Physiotherapy after fracture of the proximal end of the humerus. Comparison between two methods. *Scand J Rehabil Med.* 1984; 16:11-16.
  16. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. *Clinical Orthopaedics and Related Research.* 1987; 214:160-164. [PubMed] [Google Scholar]. <https://doi.org/10.1097/00003086-198701000-00023>.
  17. Jaberg H, Warner JJ, Jakob RP. Percutaneous stabilization of unstable fractures of the humerus. *J Bone Joint Surg Am.* 1992; 74:508-515. <https://doi.org/10.2106/00004623-199274040-00006>. PMID:1583045.
  18. Chen CY, Chao EK, Tu YK, Ueng SW, Shih CH. Closed management and percutaneous fixation of unstable proximal humerus fractures. *J Trauma.* 1998; 45:1039-1045. <https://doi.org/10.1097/00005373-199812000-00011>. PMID:9867045.
  19. Hohloch L, Eberbach H, Wagner FC, Strohm PC, Reising K, Sudkamp NP, et al. Age- and severity-adjusted treatment of proximal humerus fractures in children and adolescents-A systematical review and meta-analysis. *PLoS One.* 2017; 12:e0183157. <https://doi.org/10.1371/journal.pone.0183157>. PMID:28837601 PMCID:PMC5570290.
  20. Carbone S, Tangari M, Gumina S, Postacchini R, Campi A, Postacchini F. Percutaneous pinning of three- or four-part fractures of the proximal humerus in elderly patients in poor general condition: MIROS(R) versus traditional pinning. *Int Orthop.* 2012; 36:1267-1273. <https://doi.org/10.1007/s00264-011-1474-5>. PMID:22252413 PMCID:PMC3353076.
  21. Utkal Gupta, Saurabh Chaudhary, Gaurav Aggrawal, Apser Khan, V. P. Pathania, Arjun Gandotra. Surgical management of proximal humerus fracture by Joshi's external stabilizing system. *Journal of Evolution of Medical and Dental Sciences.* 2014; 3(18):5032-5041. <https://doi.org/10.14260/jemds/2014/2550>.
  22. Baltov A, Mihail R, Dian E. Complications after interlocking intramedullary nailing of humeral shaft fractures. *Injury.* 2014; 45(Suppl1):S9-S15. <https://doi.org/10.1016/j.injury.2013.10.044>. PMID:24262669.
  23. Dilisio MF, Nowinski RJ, Hatzidakis AM, Fehringer EV. Intramedullary nailing of the proximal humerus: evolution, technique and results. *J Shoulder Elb Surg.* 2016; 25:e130- e138. <https://doi.org/10.1016/j.jse.2015.11.016>. PMID:26895601.

**How to cite this article:** Goyal, T., Agrawal, M., Pangavane, S. and Gandhi, K. Functional Outcome of Joshi External Stabilisation System for Proximal Humerus Fractures in Tertiary Care Centre. *MVP J. Med. Sci.* 2021; 8(1): 94-98.