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Noor Arshad
MS Orthopaedics, Department of
Orthopaedics, Index Medical
College, Indore, Madhya
Pradesh, India

Jibran Bashir
PG Dip, DNB Orthopaedics,
Department of Orthopaedics,
Asian Institute of medical
Sciences, Faridabad, Haryana,
India

Sumbul Bashir
Post Graduate Resident,
Department of Periodontics, DY
Patil Dental College, Pune,
Maharashtra, India

Corresponding Author:
Jibran Bashir
PG Dip, DNB Orthopaedics,
Department of Orthopaedics,
Asian Institute of medical
Sciences, Faridabad, Haryana,
India

Short term functional outcome of jess (Joshi's external stabilisation system) in proximal humerus fractures in adults: A prospective study

Noor Arshad, Jibran Bashir and Sumbul Bashir

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Abstract

Background and Objective: In patients older than 65 years of age, fractures of the Proximal humerus are the second most common in incidence pertaining upper extremity fracture and are only the third most overall common fracture, after hip fractures and the distal radial fractures. It is well known that Most of the minimally displaced fractures of proximal humerus can be treated conservatively. For displaced fractures, many surgical techniques have been described but no single technique is considered to be the standard care. Optimal reduction and fixation of three and four part fractures of proximal humerus remains a challenge well known. Also in most of the surgical techniques and conservative treatments of proximal humerus fractures, post-operative stiffness due to long periods of immobilization remains a challenging issue, even after fruitful union of the fractures. Our study was undertaken to evaluate the functional outcome of the proximal humerus fractures treated with JESS fixators followed by early range of motion exercises post operatively, to curtail the occurrence of stiff shoulder due to longer immobilization periods of other fixation modalities. The final results of the study was then compared to the data of retrospective studies of different modalities of treating proximal humerus fractures and the incidence of frozen shoulder in their studies.

Method: It was a Prospective study of 12months duration including 50 adult patients (>18 yrs) with fractures of the proximal humerus admitted to Hospital, and treated by Joshi's External Stabilization System(JESS) with early mobilization and start of range of motion and pendulum exercises, from post op day 3. Consequently the patients were evaluated till 2 month post-pin removal period, using Murley shoulder score at the time of Pin removal followed by a gap of two months and were followed up at the outpatient clinic.

Results: 50 patients were included in the study. The study had 15 (30%) females and 35 (70%) males. out of total 50 cases 18 (36%) patients had left side involvement and 32 (64%) had right side involvement. In 20 (40%) patients the injury to surgery interval was 1-3 days, in 15 (30%) patients the injury to surgery interval was 4-7 days and in 15 (30%) patients the injury to surgery interval was more than 7 days. Neer's classification was used for classifying the proximal humerus fractures in our study and 3 part fracture was the most common followed by 2 part fracture. Murley score 2 months after implant removal in relation to final outcome was 50.50 ± 5.62 days in excellent outcome group, 55.65 ± 5.69 days in good outcome group, 64.27 ± 7.93 days in fair outcome group and 71.00 ± 11.27 days in poor outcome group. As the duration of complete pin removal increased the final outcome shifted from excellent to poor.

Conclusion: In our study we found that proximal humeral fractures can be satisfactorily treated with JESS fixator which is a simpler and affordable method of proximal humerus fracture fixation, which also provides easy early shoulder mobilization and good gain of functionality in about four months since injury. Early mobilization and proper follow-ups with scheduled exercise regimes are of pivotal importance in bringing a better functionality and to decrease the post-operative incidence of frozen shoulder and these factors can be achieved by our modality.

Keywords: 65 years of age, outcome of jess, proximal humeral

Introduction

Proximal humeral fractures account for 5% of injuries to the appendicular skeleton and are the third most common fractures in the elderly. 51% of such fractures are displaced^[1]. Fractures with nominal displacement, irrespective of the number of fracture lines, can be managed with closed reduction and early mobilization, however anatomical reduction in displaced fractures is hard to attain and the occurrence of pseudoarthrosis is high^[2-5]. Open reduction and internal fixation involves an extensive surgical exposure and increases the risk of damaging the

vascular supply of the fragments along with surrounding neurovascular structures. Fixed angle locking plates permit fixation of many complex fractures⁵ although their long term functional outcomes remain unknown. Locked intramedullary nails can be inserted using a minimally invasive technique⁶ but involve the risk of proximal impingement.

Closed reduction and percutaneous pinning has a low risk of neurovascular complications or interference with glen humeral joint motion⁷. Transcutaneous reduction and external fixator fixation achieves a satisfactory fracture stability once closed reduction is achieved, safer healing, superior functional result, low cost and less patient morbidity as compared to conservative treatment⁸.

The kind of fixation used depends on the patient's age, activity, bone quality, the fracture type, comminution and the surgeon's expertise. Fractures involving the articular surface carry a high risk of the humeral head necrosis and the treatment of same is more complicated and controversial. Conservative management may be associated with non-union, malunion and avascular necrosis resulting in painful dysfunction. A review of the most of the published results

suggest that there is no unanimously accepted method of the treatment.

In nearly all the treatment methods, post-operative stiffness remains a considerable problem owing to extended periods of immobilisation, particularly in elderly age group, until & unless stress is given on early mobilization and start of range of motion exercises early in the post-operative period.

In our study we evaluated and assessed the functional outcome of the fractures treated with external fixation by JESS and also assessed the rate of post-operative stiffness in the patients.

Materials and methods

A prospective study, the purpose of which was to observe the short term clinical and functional outcome with or without the occurrence of any post-operative stiffness in 50 adult patients with proximal humerus fractures admitted in the hospital. Fractures of the proximal humerus were classified using Neer's classification.

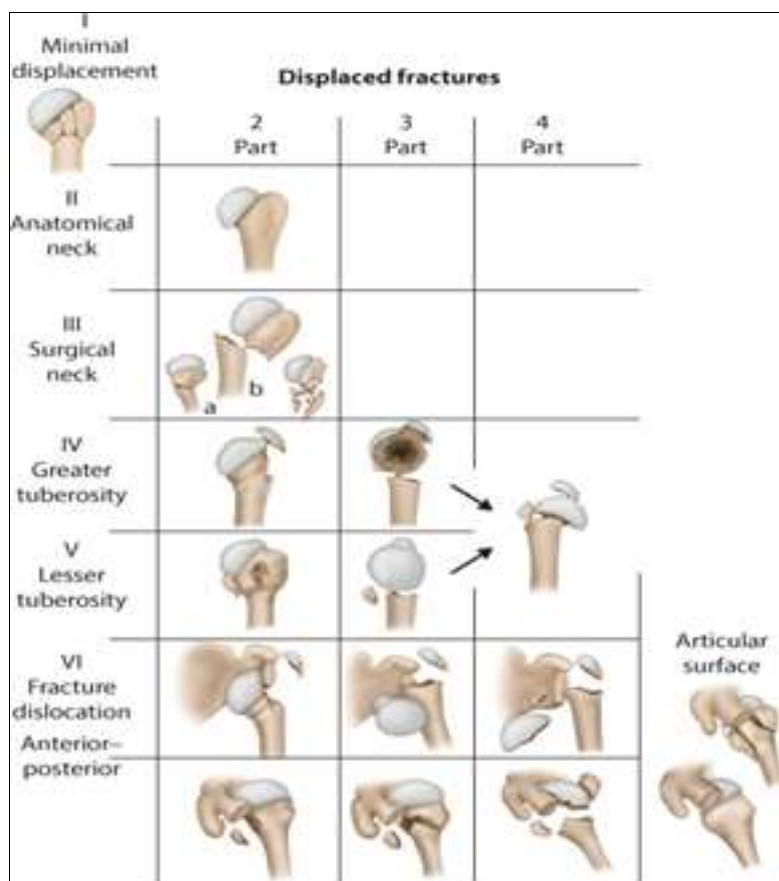


Fig 1: Neer's Classification of proximal humerus fracture

Routine investigation including pre-operative xrays was carried out and anesthetic fitness for surgery was attained as usual followed by explained written consent. Patients underwent JESS fixation for the sustained fracture under general anesthesia/interscalene block/ local anesthesia.

Post-operative physiotherapy was followed according to protocol, and early ROM exercises were started on day 3. Patients were followed up at bi-weekly interval until fracture union. Consequently the patients were evaluated till 2 month post-pin removal period, using Murley shoulder score at the time of Pin removal followed by a gap of two months and were followed up at the outpatient clinic.

Inclusion criteria

- All adult (>18) patients who had sustained post traumatic proximal humeral fractures.

Exclusion criteria

- Children and adolescent patients who have not gained epiphyseal fusion
- All patients with metal allergies.
- Patients not willing to give consent.
- Pathological Fractures

Upon admission a careful history was elicited from the patients of injury and the severity of trauma. The patients were then assessed clinically to evaluate their general condition and the local injury and to rule out fractures at other sites. The local examination of injured shoulder was done for swelling, deformity loss of function. Local neurologic deficit of axillary nerve was assessed. Radiograph of proximal humerus i.e., antero-posterior view and axillary view were taken and fractures were classified according to Neer's classification. Next the limb was immobilized in U-slab and arm-pouch and The patient was taken for surgery after routine investigation and after obtaining physician fitness towards surgery. If there are any co-morbid conditions barring the

patient from getting fitness can be taken for surgery under local anesthesia.

- The investigations are as follows: Hb%, urine for sugar, FBS, blood urea, serum creatinine, HIV, HbsAg and ECG.
- The consent for surgery was also taken from the patient and attendants after explaining the procedure and possible complications.
- Limb was shaved from shoulder to hand including axilla 1 day before the surgery.
- Antibiotics were given 1 hour preoperatively.



Fig 2: Components of JESS



Fig 3: Follow up Xray of JESS Fixation

Observations and Results

There were 12 (24%) patients in the age group 21-40 years, 20 (40%) patients in the age group 41-60 years and 18 (36%) patients in the age group 61-80 years. There were 15 (30%) females and 35 (70%) males in our study, showing a male preponderance in comparison to females. In 18 (36%) patients left side was affected and in 32 (64%) patients right side was affected.

In 32 (64%) the mode of injury was fall and in 18 (36%) patients the mode of injury was RTA. In 20 (40%) patients the injury to surgery interval was 1-3 days, in 15 (30%) patients the injury to surgery interval was 4-7 days and in 15 (30%) patients the injury to surgery interval was more than 7 days.

Table 1: Distribution according to type of fracture (N=50)

Type of fracture	Number	Percentage
2 part	12	24
3 part	32	64
4 part	6	12
Total	47	100

Neer's classification was used for classifying the proximal humerus fractures in our study. 12 (24%) patients had 2 part fracture, 32 (64%) patients had 3 part fracture and 6 (12%) patients had 4 part fracture. 3 part fracture was the most common followed by 2 part fracture.

Table 2: Distribution according to complications (N=50)

Complications	Number	Percentage
None	44	88
Pin tract infection	1	2
Delayed union	1	2
Pin change due to loosening	2	4
Loosening	1	2
Varus deformity	1	2
Varus malunion	0	0
Wrist drop	0	0

In 44 (88%) patients no complications were seen. In 1 (2%) pin tract infection was seen, in 1 (2%) each delayed union, in 1 (2%) pin change due to loosening was seen, in 1 (2%) each varus deformity, loosening was seen.

Table 3: Comparison of Murley Score between immediate postoperative and 2 months postoperative (N=50)

Parameter	Mean ± SD
Immediately after implant removal	48.81 ± 8.94
2 months after implant removal	78.45 ± 12.11

Table 4: Comparison of mean duration of pin removal (N=50)

Parameter	N	Mean ± SD
Partial	16	46.91 ± 4.66
Complete	34	57.55 ± 8.72

Unpaired ‘t’ test applied. P value < 0.05 was taken as statistically significant

Partial pin removal was done in 16 patients. The mean duration of partial removal was 46.91 ± 4.66 days.

Complete pin removal was done in all 34 patients. The mean duration of complete removal was 57.55 ± 8.72 days.

Table 5: Comparison of mean duration of complete pin removal in relation to final outcome (N=50)

Parameter	N	Mean \pm SD
Excellent	10	50.50 ± 5.62
Good	23	55.65 ± 5.69
Fair	14	64.27 ± 7.93
Poor	3	71.00 ± 11.27
Total	50	

One-Way ANOVA applied. P value < 0.05 was taken as statistically significant

The mean duration of complete pin removal in excellent outcome was 50.50 ± 5.62 days, the mean duration of pin removal in good outcome was 55.65 ± 5.69 days, in fair

outcome was 64.27 ± 7.93 days and in poor outcome was 71.00 ± 11.27 days. As the duration of complete pin removal increased the final outcome shifted from excellent to poor.

Table 6: Comparison of mean Murley score immediately after implant removal in relation to final outcome (N=50)

Parameter	N	Mean \pm SD
Excellent	10	56.30 ± 3.23
Good	23	51.48 ± 4.29
Fair	14	43.00 ± 5.46
Poor	3	24.67 ± 4.04
Total	50	

One-Way ANOVA applied. P value < 0.05 was taken as statistically significant

The mean Murley score in excellent outcome was 56.30 ± 3.23 , in good outcome was 51.48 ± 4.29 , in fair outcome was 43.00 ± 5.46 and in poor outcome was 24.67 ± 4.04 . Higher Murley score was seen in excellent outcome and low Murley score was seen in poor outcome.

Table 7: Comparison of mean Murley score 2 months after implant removal in relation to final outcome (N=50)

Parameter	N	Mean \pm SD
Excellent	10	91.70 ± 2.83
Good	23	82.13 ± 2.55
Fair	14	67.36 ± 2.69
Poor	3	46.67 ± 1.53
Total	50	

One-Way ANOVA applied. P value < 0.05 was taken as statistically significant

The mean Murley score in excellent outcome was 91.70 ± 2.83 , in good outcome was 82.13 ± 2.55 , in fair outcome was

67.36 ± 2.69 and in poor outcome was 46.67 ± 1.53 . Higher Murley score was seen in excellent outcome and low Murley score was seen in poor outcome.



Fig 4: Intra-op JESS fixator application

Discussion

The operative management of the proximal humeral fractures provides orthopaedic surgeon with a therapeutic challenge. Most of the displaced proximal humeral fractures can be treated conservatively, but the functional outcome of such patients remains debatable, in some studies, the objective functional results of conservative treatment have been unsatisfactory. We included even displaced fractures into our study to achieve early mobilization with the help of jess and improve functional outcome. Many studies have shown that the displaced fracture of the proximal humerus have a poor

functional prognosis when left untreated because of severe displacement of fragments. Various orthopaedicians have described the various surgical treatment for the displaced proximal humeral fractures which account for about 20% of fractures.

In our study, the union was confirmed with the help of AP and Axial roentgenograms before complete implant removal, and the shoulder function was assessed on the basis of constant Murley score. The scores of 86 and above were considered as excellent outcome on both functional and pain criteria, the scores of 71-85 were considered as good results

and the score between 51-70 were accounted as fair results, while score below 50 were taken as poor results as functionality, and were categorized as stiff shoulders i.e. Frozen shoulders.

Rose SH *et al.*, in their study of proximal humerus fractures, epidemiological study have reported, in 80% of cases the mode of injury was minor fall in patients aged above 40 years and especially in osteoporotic females^[9].

Herbert Resch *et al.* in their study of 27 patients with 3 part and four part fracture, 24 patients had history of high energy trauma^[10]. In our study of 50 patients, 32 (64%) the mode of injury was fall and in 18 (36%) patients the mode of injury was RTA Among 32 patients with fall, 20 patients sustained 3-part fracture while 10 patients had 2-part fracture and 2 patient suffered from 4-part fracture. On the other hand, 12 out of 18 patients with the history of RTA had 3-part fracture and 4 patients had 2 part fracture, and 2 patients had 4-part fracture. In Herbert Resch *et al.* study, the operation was done within first 4 days^[10].

In our study 20 (40%) patients the injury to surgery interval was 1-3 days, in 15 (30%) patients the injury to surgery interval was 4-7 days and in 15 (30%) patients the injury to surgery interval was more than 7 days. The duration between injury and surgery is significant in our study as we emphasize on early ROM exercises to reduce the incidence of post-operative stiffness of shoulder.

In 2004, Gerber C. *et al.* in their study of 34 patients found 2 patients with 2-part fracture and 15 patients with 3-part fracture, while most of the patients i.e. 16 patients were found with 4 part fractures^[11].

In 2009, Felix Brunner *et al.* in there series of 157 cases 49 patients sustained 2-part fractures, 70 patients had 3-parts fractures while the remaining 38 had 4-part fractures^[12].

In our present study of 50 cases we found that mostly 12 (24%) patients had 2 part fracture, 32 (64%) patients had 3 part fracture and 6 (12%) patients had 4 part fracture.

In our study the mean constant score we obtained was 78.45 with a standard deviation of 12.11 on the 2 month follow-up after complete pin removal.

The mean Murley score in excellent outcome was 91.70 ± 2.83 , in good outcome was 82.13 ± 2.55 , in fair outcome was 67.36 ± 2.69 and in poor outcome was 46.67 ± 1.53 . Higher Murley score was seen in excellent outcome and low Murley score was seen in poor outcome.

The mean duration of union i.e. duration of complete pin removal was 57.55 days while partial pin removal was needed in 11 patients at a mean duration of about 46.91 days. The mean constant murley score at the time of pin removal was 48.81 days with a standard deviation of 8.94 days, while in a period of two months with regular follow-ups and exercises the gain in constant score was upto 30 points and the mean score two months post implant removal was 78.45.

Gerber C. *et al.* in their study of proximal humerus fractures treated with philos plate had a mean constant score of 78^[11].

In Felix Brunner *et al.* study of proximal humerus fractures also treated with PHILOS plate had a mean constant score of 72^[12]. In the study of A.K. Gupta *et al.* in 2010 they treated their patients with the constant score of 78.1 on a 6 month follow-up^[13].

In or study, score of 50 and less were categorized as stiff shoulder, we came across 3 patients(6.4%) which were lower than 50 in score, also all of the low scores were associated with post-operative complications. In 2004 Gerber C in their study of proximal humerus treated with PHILOS found 12% cases as stiff shoulders^[11].

In 2009, Felix Brunner *et al.* in their study of treatment of proximal humerus fractures with percutaneous K-wires had 2.53% cases as frozen shoulders^[12].

In our study of 50 patients with proximal humerus fractures we encountered no complication in 44 patients. Pin loosening was the most common complication encountered in 2 cases, delayed union was encountered in 1 case. In various studies Savie *et al.*, Gerber C. *et al.* and Felix Brunner *et al.* incidence of avascular necrosis of head of humerus ranged from 8.22% to 35%, we had no cases of avascular necrosis.

Pin tract infection was a common complication as stated by Felix Brunner *et al.* and Aksu N. *et al.* in their study, we also encountered the problem in 2% of the cases, but pin tract infection and loosening were addressed by pin site change and readjustment, which acts as an advantage in using JESS as the modality. Varus inclination and malunion was seen in 2% cases in our study while it was reported in 8% cases in the studies of Ramchander Siwach *et al.* and Akshu *et al.* both and about 2.53% in Felix Brunner *et al.* study.

Conclusion

The current study was done to relate and assess functional outcome and incidence of post-operative stiffness of shoulder and other complications following the management of proximal humeral fractures by JESS fixation.

Proximal humerus fracture is common in elderly people, more commonly in males with right sided dominance in our study. Fall is the most common mode of injury followed by road traffic accidents. In our study we established that proximal humeral fractures can be fittingly managed with JESS fixator which is a modest and affordable approach of proximal humerus fracture fixation, which also makes easy early shoulder mobilization and good gain of functionality possible. Early mobilization and proper follow-ups with scheduled exercise regimes are of pivotal importance in bringing a better functionality and to decrease the post operative incidence of stiffness and these factors can be achieved by our modality.

According to our study JESS is beneficial due to its low cost, can be performed under local anesthesia with minimal expertise and availability of advanced infrastructure. JESS fixation is also a good procedure in retaining the vascularity of head of humerus. Maximum of the two and three part fractures in young people treated with JESS can gain excellent functionality with ROM exercises. JESS is beneficial in elderly and osteoporotic patients also but follow-up care should be taken in four part fractures to maintain proper alignment and to avoid stiffness of shoulder. JESS is not indicated in severely comminuted fractures where other modality should be used for treatment. Also, cosmetically conscious female patients do not accept JESS. Most common Complications that we come across were of Pin track infections and delayed unions in some cases.

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