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RESULTS OF MODIFIED JESS AUGMENTATION FOR FRACTURE PROXIMAL HUMERUS STABILIZED WITH PERCUTANEOUS K-WIRES

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Abstract

Background: Proximal Humeral fractures are defined as fractures occurring at or proximal to surgical neck of Humerus1. Various methods are used for treating such conditions with mixed results. Closed reduction & percutaneous pinning with JESS augmentation with interconnecting double frames have been described for such fractures with satisfactory results. We aim to modify the same by mounting the JESS in a single frame with biplanar configuration review our results.

Material and Methods: Total 15 patients with proximal humeral fractures were treated from 2016 to 2017 by fixation with JESS & K-wires. There were 10 (62.5%) males and 5 (37.5%) females, with a mean age of 57.5 years. Road traffic accident (RTA) was the most common mode of injury in patients less than 60 years old (4 out of 7), while fall on the ground was the most common cause in fractures in elderly patients (age>60 years, i.e. 6 out of 8). Displaced (more than 45° of angulation or >1cm of displacement) 2 and 3 part fractures and patients of age >20 years were included in the study. The fixator was removed when there was clinical (subsidence of pain) and radiological signs of union (bridging callus in 3 out of 4 cortices). Shoulder function was assessed using Constant scoring system.

Result: 100 % union seen with duration ranging from 6weeks to 8 weeks followed by JESS removal. According to Constant score 3 cases (20%) showed excellent result, 9 cases (60%) showed good result, 2 cases (13.3%) showed fair result & 1 case(6.7%) showed poor result which may be due to non-compliance in physiotherapy & early pin loosening.

Conclusion: External fixation with JESS & K-wires is an alternative cost effective option to treat Neer's 2 & 3 part fractures, enables early mobilization & achieves safe healing with less soft tissue dissection.

Keywords: *Proximal humerus fractures, External fixator, JESS.*

Introduction

Proximal Humeral fractures are defined as fractures occurring at or proximal to surgical neck of Humerus[1]. They account for 4% of all fractures & approximately one-half of all Humeral fractures[2]. 80% of the proximal Humeral fractures are undisplaced or minimally displaced & usually treated conservatively but rest 20% of fractures are displaced & require operative fixation[345]. Moreover there is no definite consensus on the type of surgical fixation that should be used. Various methods such as closed reduction & percutaneous pinning, tension band wiring, intramedullary nailing, plate fixation & hemiarthroplasty have all demonstrated mixed results. The primary goal of treatment should be a construct sufficiently stable to begin early mobilization of the shoulder joint[6789]. Open reduction & internal fixation is an extensive procedure & there is risk of damage to vascular supply of the fragments. Locked intramedullary nails can be inserted using a minimally invasive technique but there is risk of proximal impingement[10]. Closed reduction and percutaneous pinning has a low risk of neurovascular complications or interference with glanohumeral joint motion but it is a less stable construct & there is often loss of reduction[11]. Joshi's External Stabilization System with K (Kirschner)-wires provide satisfactory fracture stability once closed reduction is achieved, provides superior functional result & early mobilization. Also there is less trauma to the soft tissues, blood loss and better preservation of fracture biology compared to other techniques.

Material and Methods

Total 15 patients with proximal humeral fractures were treated from 2016 to 2017 by fixation with JESS & K-wires. There were 10 (62.5%) males and 5 (37.5%) females, with a mean age of 57.5 years. Road traffic accident (RTA) was the most common mode of injury in patients less than 60 years old (4 out of 7), while fall on the ground was the most common cause in fractures in elderly patients (age>60 years, i.e. 6 out of 8). Fractures of proximal humerus were classified by Neer's classification system. Displaced (more than 45° of angulation or >1 cm of displacement) 2 and 3 part fractures and patients of age >20 years were included in the study. Neer's 4 part fractures, open fractures, fracture dislocation and those with other associated injuries, were excluded from the study. The procedure was performed with the patient under general/regional anesthesia in a supine position, using a sandbag to elevate the ipsilateral shoulder for ease of manipulation. Reduction was attempted by traction & counter-traction method. If reduction fails, a 2.0 mm K-wire placed in the proximal humerus 4-5 cm distal to fracture site perpendicular to axis & wire is subsequently attached to T-handle. The distal fragment which usually adducted, were pulled outwards to realign with the proximal fragment & checked under Image Intensifier guidance. This K-wire was later attached to final JESS unit.

Two 2.5 mm K-wires were put across the fracture starting at the lateral cortex of proximal fragment engaging the subchondral bone of head & resting on the calcar portion of neck thus providing 3 point fixation. Once the reduction was stabilized with these 2 calcer rested K-wires, we then proceed to remaining K-wires for fixation of JESS system. Two (2mm) more K-wires were placed obliquely from proximal to distal direction across the fracture & engaging the medial cortex of distal fragment. These K-wires were inserted lateral to acromion engaging head & greater tuberosity.

Another 2 mm K-wire was placed perpendicular to axis 8-10 cm distal to fracture site. Now all the 4 wires were attached to a single JESS unit where the connecting rod was bent in a J- shaped manner proximally. Fracture was then inspected under continuous fluoroscopic guidance to check stability.

Pin tract dressing done & an arm sling was applied for patient's comfort. On 2nd or 3rd day once the patient was out of perioperative pain, pendulum exercises were started. By 2nd week passive abduction was started with progressive increase in range of motion exercises. Patients were followed up at 4 weeks, 6 weeks, 8 weeks, & then 4 weekly intervals looking for clinical & radiological union. The fixator was removed when there was clinical (subsidence of pain) and radiological signs of union (bridging callus in 3 out of 4 cortices). Shoulder function was assessed using Constant scoring system consists of four variables that are used to assess the function of the shoulder i.e. pain, activities of daily living, range of motion and strength. Altogether there are 100 points. Constant score divides the outcome of patients into four categories, i.e. excellent having a score >85, good having a score between 71 and 85, fair having a score between 61 and 70, and poor outcome with a score of 60 or less.

Result

100% union seen with duration ranging from 6weeks to 8 weeks

followed by JESS removal. According to Constant score 3 cases (20%) showed excellent result, 9 cases (60%) showed good result, 2 cases (13.3%) showed fair result & 1 case(6.7%) showed poor result which may be due to non-compliance in physiotherapy & early pin loosening. The surgical time ranges from 30 min to 45 min. 4 patients (26.7%) cases had pin tract infection in the 2nd week which was managed by oral antibiotics & regular pin tract dressing. 1 patient (6.7%) had K-wire loosening but none had avascular necrosis, neurovascular injury or joint penetration.

Table- 1: Patients characteristics, mode of injury, Neer's type[15], Constant Score[19] and complications.

Pat no	Sex/age (years)	Mode of injury	Neer's Classification[15]	Time of removal of JESS	Constant score[19]	Shoulder function	Complication
1.	F/50	Fall on ground	2-part	6	82	Good	Pin tract infection
2.	F/70	Fall on ground	3-part	8	60	Poor	k-wire loosening
3.	F/50	RTA	2-part	6	80	Good	none
4.	M/67	Fall on ground	3-part	6	86	Excellent	none
5.	F/55	RTA	2-part	6	92	Excellent	pin tract infection
6.	M/24	RTA	3-part	8	84	Good	none
7.	M/36	RTA	2-part	6	72	Good	none
8.	M/66	RTA	3-part	6	65	Fair	none
9.	F/67	Fall on ground	2-part	8	66	Fair	pin tract infection
10.	M/62	Fall on ground	3-part	6	75	Good	none
11.	M/62	RTA	3-part	8	78	Good	none
12.	M/32	Fall from height	2-part	6	79	Good	none
13.	M/69	Fall from height	3-part	6	82	Good	none
14.	M/61	RTA	2-part	8	80	Good	none
15.	M/66	Fall on ground	3-part	8	94	excellent	pin tract infection

Discussion

Proximal humeral fractures are still a controversial subject. Non-operative management is appropriate for majority of them. In treating patients with displaced fractures, multitude of options exist, with no clear advantage of any one for particular fracture type. Non-operative treatment has its disadvantages like failure to obtain early mobilization, leading to higher incidence of shoulder stiffness and adhesive capsulitis. So to start early mobilization, various methods of fixation are recommended like K-wires, cannulated screws, open reduction & fixation with plates (Philos). K-wires & only screws provide questionable stability. Whereas ORIF with Plate & screws requires large exposure & blood loss & increased risk of avascular necrosis of humeral head[12,13,14,15]. Moreover most of these fractures usually occur in osteoporotic bones. To combat all these issues, JESS with K-wires fixation has gained popularity over recent years. Here there is minimal soft tissue dissection so less chance of avascular necrosis of head & provides adequate stable fixation for early mobilization & optimal functional outcome.

The results of our study were compared with studies done by Gupta et al[16].(2012), Anil et al[17].(2010) & Kristiansen et at[18].(1987) as shown in Table 2

Table- 2 : Comparison with other published studies.

Constant score	Our study	Gupta et al[16] (2012)	Anil et al[17] (2010)	Kristiansen et al[18] (1987)
Excellent	20%	22.22%	18.75%	8.69%
Good	60%	44.44%	62,5%	43.48%
Fair	13.3%	22.22%	18.75%	43.48%
Poor	6.7%	11.11%	-	4.35%
Duration of union (weeks)	6.8	9.33	6.5	9.3

Limitations of our study is that we included Neer's 2 & 3-part fractures only with small sample size and moreover it is a retrospective study with short duration of follow up.

Conclusion

External fixation with JESS & K-wires is an alternative cost effective option to treat Neer's 2 & 3 part fractures, enables early mobilization & achieves safe healing with less soft

tissue dissection.

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