



Role of JESS Fixator in Intra-articular Distal end Humerus Fractures Associated with Severe Soft Tissue Injuries in Adults.

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ABSTRACT

TITLE: Role of JESS Fixator in Intra-articular Distal end Humerus Fractures Associated with Severe Soft tissue injuries in Adults.
Objective: The treatment of high-energy Intra/Juxtra-articular fractures which are associated with severe soft tissue injuries remains contentious and challenging. In this study, we assessed the results of Joshi's external stabilization system (JESS) for managing high-energy intraarticular distal end humerus fractures associated with severe soft tissue injuries.
Methods: This consecutive prospective study comprised of 10 cases of comminuted Intercondylar fractures of distal humerus, varying from grade I to grade III B Gustilo & Anderson classification, treated by JESS Fixator from June 2013 to December 2015.
Results: Average time of union was 13.8 weeks. The average hospital stay was 13 days (9 to 16 days). The average range of elbow flexion was 101 degree (range 100 to 120). The average extension loss of 17 degree was noted. Good range of motion was observed in majority of the cases. Commonest complication was pin tract infection (02 cases), while delayed union was also observed in one case. As per Mayo Elbow Performance Score (MEPS) excellent results were seen in 02 cases, Good in 04 and fair in 03 and poor results in one case.
Conclusion: JESS combines the benefit of traction, external fixation, and limited internal fixation, at the same time as allowing the ease of access to the soft tissue for wound checks, pin care, dressing changes, measurement of compartment pressure, and the monitoring of the neurovascular status. Thus we conclude that JESS is an excellent method for the management of comminuted intra/juxta articular fractures associated with severe soft tissue injury. It not only obviates the need of ORIF and/or POP cast but also gives better functional results.

KEYWORDS

Comminuted, Intra/juxta-articular fractures, Distal end Humerus, Open Fractures, Mayo Elbow Performance score.

INTRODUCTION: There is an increase in incidence of high velocity injury to lower end of humerus. These cases with compound comminuted intercondylar fractures present a challenge to orthopaedic surgeons (1,2). Controversies & challenges exist regarding management of compound comminuted intercondylar fracture distal end humerus. Dual locking anatomical or reconstruction plates have become a gold standard for open reduction & internal fixation (3,4,5) of closed distal humerus fractures. But, severe contamination of bone fragments, bone loss, surrounding soft tissue devitalization & contamination prevents usage of reconstruction plates for these compound intra-articular fractures. It requires extensive surgical exposure that leads to problems with wound healing and infection in the compromised soft tissue environment.

To overcome the drawbacks of nonoperative and other operative modalities, the minimally invasive technique of closed reduction by ligamentotaxis and fixation with percutaneous screws and K-wires has been developed and practiced. These techniques combine attributes of operative and nonoperative philosophies, are more biological and give excellent functional results.

We treated a series of 10 cases with compound, comminuted intercondylar distal humerus fractures with technique of JESS fixator. This fixator was applied immediately after doing extensive debridement of the compound fracture. This frame design allows dressing of open wound, rigid anatomical fixation of fracture fragments & very early mobilization of elbow even when the open

wound is still in process of healing.

MATERIAL & METHODS: 10 cases of compound intercondylar distal humerus fractures treated by early debridement & JESS fixator application from June 2013 to December 2015 were reviewed. Adult patients having high energy intercondylar fracture (Rise borough and Radin type III & IV) irrespective sex were included. Patients below age of 18 years, not medically fit for surgery and not willing to take part in the study were excluded. Riseborough and Radin Classification was used to classify these fractures (6).

Data were collected at the time of admission to elicit age, sex, type of fracture, mode of injury, date of injury and any other associated injuries. After careful physical examination and thorough initial debridement of the elbow an above elbow slab was applied with continuous attention to peripheral circulation of involved limb till definitive fixation.

Initial radiographs included anteroposterior and lateral views of involved elbow. Computed tomography with 3-D reconstruction was done to evaluate the degree of displacement whenever required. Comparison radiographs of the contra lateral extremity were useful for preoperative planning. Distal neurovascular status was checked before attempting any surgical intervention. Relevant investigations were carried and pre anaesthetic check up was done.

JESS (Joshi's External Stabilisation System): A simple, light, highly modular external fixator system which systematically addresses a wide range of complex problems in the management of open fractures. Invented by Dr. B.B Joshi from Bombay (7,8,9). This system has high safety profile and unparalleled ease of application. It can be applied easily by 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. The components of the JESS system included K-wire, 2 and 2.5 mm thick. Link joints, 3 x 3 size with two offset holes to which K-wires and connecting rods are clamped; connecting rods, 3 to 4 mm in diameter and of suitable lengths. Allen wrenches to tighten the link joints to K-wires and connecting rods. Wire cutter and benders to adjust the frame.

OPERATIVE TECHNIQUE: Tourniquet was applied in all cases but inflated only if required. This helped in appropriate debridement & removal of devitalized, avascular tissue. A sterile sheet roll was kept below elbow to improve the exposure. After adequate soft tissue debridement, fractured bone edges were curetted. Contaminated very small fragments without soft tissue attachment were discarded. Pulsatile lavage with normal saline, povidone iodine, and H2O2 solution was done to sterilize the wound as possible.

The bony fragments containing the articular surface were realigned and reduced achieving a good reconstruction of trochlea. A thin K wire was introduced from lateral epicondylar area to medial epicondylar area, after holding the fragments with large reduction forceps & stabilization with K-wire, a 4.5 mm or 5 mm cannulated cancellous screw was used whenever required to secure the fragments rigidly. C-Arm assistance was used to confirm reduction. After this, remaining fragments were rearranged to reconstruct the medial & lateral column.

Palpation and direct visualization under C-Arm (Image intensifier) were used to confirm accurate reduction. K-wires were used to temporarily stabilize the fragments checking the varus & valgus position of elbow. Two cross K-wires & two horizontal wires were used to stabilize the distal humerus fracture & uniplanar bilateral frame constructed to rigidly hold the anatomically aligned fragments. If the sterilization of wound is adequate, wound is closed over closed suction drain or the wound is left open for regular dressing for delayed secondary closure or skin grafting or flap coverage if required.

POST OPERATIVE TREATMENT: Arm sling pouch was used for support & no post-operative Plaster of Paris slab support was used. Gradual passive mobilization was started on 3rd day as pain & swelling subsided. Patient was discharged after 7 to 15 days depending on the condition of wound. At the time of discharge, patients were advised active assisted mobilization & maintenance of sling support in between. First few follow up visits were at weekly interval & then at 6th, 10th, 14th, 18th, 24th week when clinico-radiological evaluation was done. Dynamization of the frame was done between 8 to 10 weeks. Around 4 weeks after dynamization frame was removed in OPD. The final clinical evaluation was done at 6 months. The elbow & forearm movements were measured. The functional results were assessed by the use of Mayo's elbow performance score which includes separate evaluations of pain, range of movement, stability of fracture site & functional outcome.

Observation & Results: There were 10 patients, 7 male and 3 female with average age 36.1 years (18 to 65 years) who were treated by JESS Fixator.

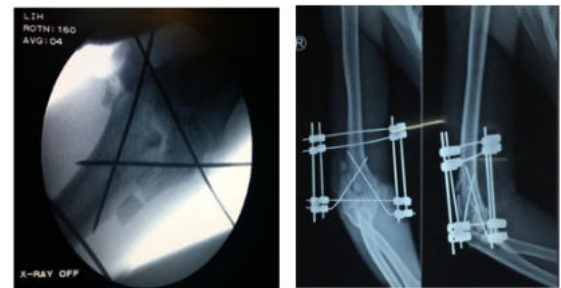
02	65Y	M	RTA	III and Open Gr III A	10 hours	5 Days	16 Days	20-110	14	70 Fair
03	20Y	M	RTA	III and Open Gr III A	02 hours	2 Days	14 Days	15-110	12	75 Good
04	37Y	M	RTA	IV and Open Gr III B	2 Days (48 hrs)	5 Days	13 Days	25-100	16	55 Poor
05	18Y	F	RTA	III and Open Gr III A	2 Days (48 hrs)	3 Days	10 Days	10-120	12	80 Good
06	38Y	M	RTA	IV and Open Gr III A	12 hours	2 Days	13 Days	20-100	14	70 Fair
07	30Y	M	RTA	III and Open Gr II	04 hours	2 Days	9 Days	10-120	12	90 Excellent
08	45Y	F	RTA	III and Open Gr III A	3 Days (72 hrs)	5 Days	14 Days	25-100	14	70 Fair
09	26Y	M	RTA	III and Open Gr III A	10 hours	2 Days	12 Days	15-115	14	90 Excellent
10	60Y	F	RTA	IV and Open Gr III A	2 Days (48 hrs)	4 Days	14 Days	15-100	16	80 Good

Case-1



(Pre-Operative Radiograph)

(Clinical Photograph)



(Intra-Operative C-Arm Image)

(Post-Operative Radiograph)



(Follow-up Radiograph)

(Final Radiograph)

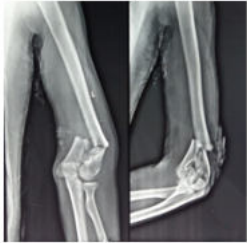


(Clinical Photograph)

S.No	Age	Sex	Mode of Injury	Type of Fracture	Injury and Admission Time Interval	Injury and Surgery Time Interval	Duration of Hospital Stay	ROM at 06 Months	Weeks required for complete union	MEP S
01	22Y	M	RTA	III and Open Gr III A	04 hours	1 Day	15 Days	15-120	14	80 Good



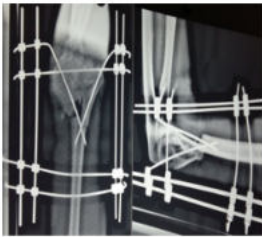
(Clinical Photograph)



(Pre-Operative Radiograph)



(Clinical Photograph)



(Post-Operative Radiograph)



(Clinical Photograph)



(Clinical Photograph)



(Final Radiograph)



(Clinical Radiograph)



(Clinical Photograph)



(Clinical Photograph)

In our study the mode of injury was Road Traffic Accident in all cases. Out of 10 cases 7 cases were of type III and 3 cases were of type IV Fractures according to Riseborough and Radin classification. Average time interval between injury and admission was 25.8 hours (04 hours to 3 days) and average time interval between injury and surgery was 3 days (1 day to 5 days). Average time of hospital stay was 13 days (09 to 16 days).

In our study average 13.8 weeks were required for complete radiological and clinical union of fracture. External fixator was removed at the completion of fracture union. Aggressive active assisted physiotherapy was started after complete fracture union.

The average range of movements achieved at six months after active aggressive physiotherapy at home which was supervised during the routine regular hospital visits was 92.5 degree range of elbow flexion and extension. Complete painless return of supination and pronation movement comparable to uninjured opposite elbow, was achieved in all patients in six weeks as pop slab immobilization was not used.

Clinical evaluation of elbow functions was done at sixth month using Mayo elbow score where 20% excellent, 40% good, 30% fair and 10% poor results were obtained.

Pin tract infection, loss of soft tissue cover, and resultant delayed wound healing resulted in elbow stiffness in two cases where fair and poor results according to Mayo's elbow score were obtained.

DISCUSSION: Riseborough and Radin type III and IV compound fractures of distal humerus are difficult to manage even after availability of many advanced anatomical fixation plates for distal humerus fracture. The management algorithm for these fractures is appropriate debridement with multiple K wires for temporary stabilization along with above elbow slab application till at least three weeks till the wound heals and the tissues become relatively free of infection. This immobilization period results in intraarticular and periarticular adhesions and resultant joint stiffness.

After this definitive plating with anatomical or reconstruction plates is done by posterior approach under cover of long term antibiotic therapy to prevent recurrence of infection. But the end results are never satisfactory in such cases for surgeon as well as patient in spite of two surgeries and increased monetary expenses and hospital stay.

But in our study we have achieved good results with one stage surgery with fewer expenses, less antibiotics, early post op mobilization from 3rd day onwards after surgery. After meticulous debridement good compression across fractured surfaces along with rigid fixation was achieved by cannulated cancellous lag screw for fixing inter-condylar articular fragments and the uniplanar bilateral JESS external fixator frame which span across the medial and lateral column fractures with its bent and pre-tensioned thick K wire construct compressing the fractures. Minimum metal implant in the injured area assured least chances of deep infection. Regular dressings and even secondary closure could be done without disturbing the fixator.

Checking the articular surface alignment and prevention of any K wire or bony fragment obstructing the olecranon fossa was important to achieve good intra-op and post op range of movements. In only two cases, patient had pin tract infection, which resolved with dressings and antibiotics.

Functional status of the patient was assessed from whether he was able to return to his regular employment or employment was restricted. Majority of our patients (80%) were able to return to their regular employment, only two patients had restricted employment and this was due to significant loss of muscle strength.

Conclusion: Management of comminuted intra/juxta articular fractures has always posed a challenge to the orthopaedic surgeon in the terms of reduction of fracture, maintenance of reduction while the fracture unites and mobility of joint after the fracture union. Post union functioning of the joint is the most difficult part of the management of the comminuted intra/juxta fractures. Patient's expectations are very high and good results are not always possible due to severity of injury, soft tissue damage and the periarticular fibrosis that result in the process of healing. This technique of fixing compound intraarticular distal humerus

fractures with JESS external fixator without spanning and immobilizing the elbow joint has shown good results, good patient acceptance, least complications in our series of ten cases. We recommend this fixation technique with JESS construct to give good results in such difficult cases.

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