

Fractures of the distal end of humerus treated with joshi external stabilizing system

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Abstract

Fracture of the distal humerus is a common and debilitating injury and accounts for 2% of all adult fractures. Patients with displaced, unstable distal humeral fractures may have improved outcomes if managed operatively.

Objectives: The objectives were aimed to study the results of using Joshi's external stabilizing system (JESS) for the management of fractures of distal humerus.

Materials and Methods: This prospective study was conducted in GGHGulbarga on 15 subjects with distal humerus fractures. As per AO classification, C type fractures were included and prepared for JESS fixation. The results of the treatment were evaluated as per Cassebaum functional criteria. Patients were followed up for 12 months.

Results: Among 15 patients, 9 males and 6 females, 6 had C1, 6 had C2, and 3 had C3. Mean duration of JESS application was 8 weeks. Among 15 patients, 10 had excellent, 3 had satisfactory result, and 2 had unsatisfactory result.

Conclusion: JESS is an alternativesimple and easyoption for the treatment of distal humerus fractures, showing excellent to good results in cases of AO C1, C2, and C3 fracture.

Keywords: Distal humerus intracondylar, Joshi's external stabilizing system.

Introduction

Distal humerus fractures are uncommon, comprising approximately 2% of all fractures and one-third of all humeral fractures[1]. As life expectancy increases, the incidence of distal humeral fractures is raising[1, 2, 3], particularly in developed countries. This is mainly due to the rising incidence of osteoporotic fractures from low-energy falls in the elderly. Open reduction and internal fixation with plating are well accepted as the standard treatment for these fractures for good anatomical reduction and early mobilization. However, this technique may result in inferior post-operative results and a higher risk of infection in both open fractures as well as close fractures[1, 2, 3, 4, 5]. External fixation with Joshi's external stabilizing system (JESS) external fixator appears to be an alternative option because good anatomical reduction can be achieved with minimal denudation and less soft-tissue dissection. Removal of this fixator is also not requires any surgery. This prospective study was conducted in Civil Hospital, Gulbarga, India, within a time period of 3 years from March 2012 to May 2015. Inclusion criteria are patients with close fracture distal humerus, and exclusion criteria are patient aged <25 years old or

more than 60 years old, concomitant limb injury, associated neurovascular deficit, or when fractures were more than 1 weeks old. A total of 15 cases of fractures of the distal humerus were included in our study. Among them, 9 were men (mean age 36), and 6 were women (mean age 50). The patients had sustained trauma after road traffic accident (7 cases) and fall (8 cases). All fractures were classified according to AO classification (Fig. 1). Fractures were classified as C1 - 6, C2-6, and C3- 3. All cases were operated within 3 days of admission after proper clinical and laboratory investigation and preanesthetic checkup. Treatment outcome evaluated as per Cassebaum functional rating system (Table 1).

Initial radiographs included an anteroposterior and lateral view of the elbow (Fig. 2). Traction radiographs were used to better delineate the fracture pattern. Distal neurovascular status was checked before attempting any surgical intervention. Relevant investigations were carried, and preanesthetic checkup was done. A simple, modular mini external fixator system JESS takes care of a wide range of complex problems in the management of the short and long bones invented by Dr. B. B. Joshi from India. It has very good safety profile and ease of

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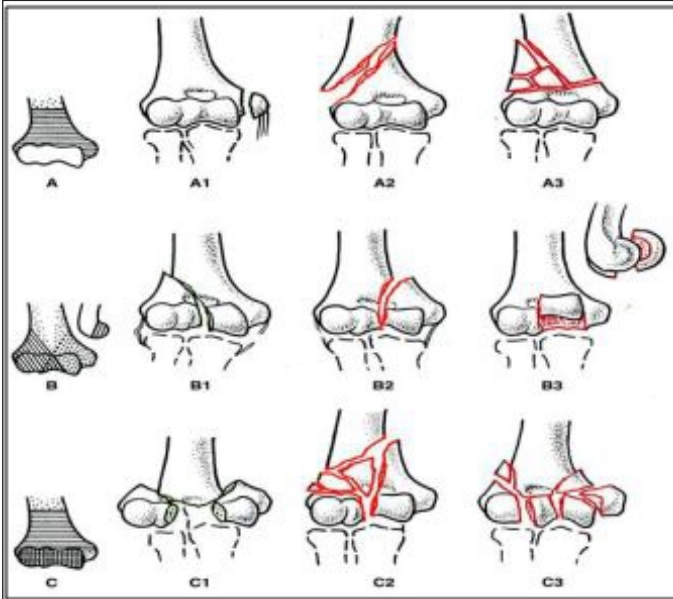


Figure 1: AO classification.



Figure 2: Pre-operative X-ray.

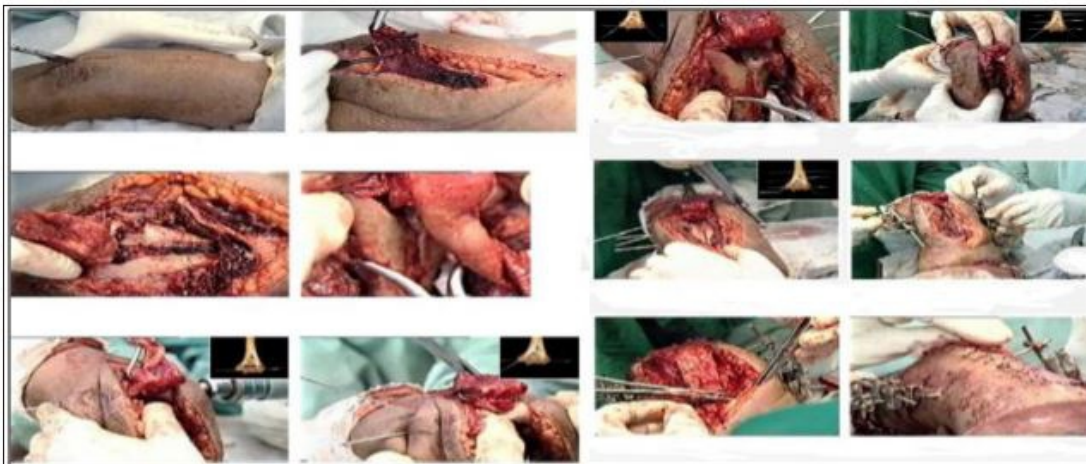


Figure 3: (a and b) Operation pictures.

It allows minimum invasive techniques. The construct of JESS frame was planned. The components of the JESS system include k-wires, 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, 3-4 mm in diameter and of suitable lengths; allen wrenches to tighten the link joints to k-wires and connecting rods; and wire cutter and benders to adjust the frame. The operative procedures were performed under regional or general anesthesia. The patient was placed in a lateral decubitus position. The arm was held outright, and the elbow supported on a well-padded attachment to the operating table with pneumatic tourniquet maximum duration of 90 min. A midline skin incision was made on the posterior aspect of the distal arm, curving



Figure 4: Post-operative X-ray.



Figure 5: Range of movement.

medially around the tip of the olecranon and extending to the subcutaneous border of the proximal ulna. The tongue shape incision was carried to the triceps aponeurosis, and deep muscular

application. It can be applied easily by any surgeon by virtue of its easy technique with minimum instrumentation. It provides a simpler alternative to the presently available various modalities of treatment.

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Figure 6: .Range of movement.



Figure 7: Healed X-ray.

prevent tension during wound closure. Oblique k-wires, reconstructing the pillar, were bent just outside the skin surface to make them parallel to the rest of the wires. All k-wires were cut outside the skin surface at the optimum length (3-4 cm) so that they could be attached to the connecting rods (two on either side) with the help of link joints (Fig. 2). Thus, a bilateral uniplanar external fixator assembly was created. The skin edges of all open wounds were approximated without tension at the suture line.

Surgical wounds were closed in a routine fashion over a drain, and a dressing was applied. The limb was kept elevated in the immediate post-operative period. The drain was removed after 48 h. Intravenous antibiotics were administered for 5 days postoperatively. Active and passive elbow motion was initiated on the 7th post-operative day after the subsidence of swelling which was feasible in all cases, as the limb was elevated and immobilized in extension for the initial post-operative period. Suture removal was carried out on the 12th post-operative day. The pin-tract dressing was done with antiseptics alternative day for 2 weeks and later twice a week. Patients were followed up at 2-, 6-, and 12-week, 6-month, and 1-year intervals after surgery (Fig. 3, 4, 5, 6]. Radiographs were taken at 2, 8, and 12 weeks postoperatively.

R`jc / 8A qcc` sk aj qqga rgn for elbow ROM	
Cvacjjcl r	Djcvgnl </ 1.° and extension deficit <15
Emb	Djcvgnl </ 0.° and extension deficit <40
Dgp	Djcvgnl </ / .° with any extension deficit
Nmp	Djcvgnl : / / .
PMK 8Range of motion	

ÇÄÜ¼ ¼ AO classification of 15 cases.	
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/ ¼	¼
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tissue is dissected bluntly till bone. Beforehand, ulnar nerve was identified and retracted with vessel loop. Reduction of the intercondylar region was achieved primarily after satisfactory exposure, and sometimes, it was achieved with cannulated cancellous screw (4 mm). Care was taken not to denude the bone fragments of the soft tissue attachments as the k-wires need minimal purchase area. The intercondylar fragments were reduced under compression with a bone clamp and fixed with a k-wire from medial to the lateral side. Subsequently, the intercondylar fragment consisting of the medial and lateral condyle was reduced to the metaphysis. Two crossed k-wires were passed obliquely upward, one from each condyle crossing the fracture site, taking purchase in the opposite cortices proximal to the fracture. Once fixation was secured, and the elbow was checked for the range of motion and stability of the construct. Finally, two k-wires were introduced proximal to the fracture site in the distal humerus, perpendicular to the shaft of the humerus by carefully entering the skin, after blunt soft tissue dissection under direct vision, to avoid radial nerve injury. The wires were then advanced through the medial soft tissues, without injuring the dissected ulnar nerve. These K-wires were kept protrude of the skin on either side. All k-wires inserted through the skin, and special attention was paid to relax the skin every time, a k-wire was passed to

Results

According to AO classification, 15 cases are shown in Table 2. The mean duration of JESS application was 10 weeks. The mean follow-up was 10 months (range - 7-14 months). All 15 of the intercondylar fractures united, 1 delayed union at the lateral column of supracondylar region, but the intercondylar fragments united well. Delayed union was defined as a fracture with little or inadequate evidence of healing after 3-month radiological and clinical evidence of union at 12-18 weeks (mean - 14 weeks). The fixator assembly was removed after radiologic evidence of union was found (Fig. 7). Pin-tract infection was observed in 2 cases and subsided with oral antibiotics and daily dressings. There were no instances of nerve palsies or heterotrophic bone formation. The ultimate functional outcome was evaluated by the use of Cassebaum functional rating system. C1 fractures (6 cases) showed excellent results, C2 fracture (6 cases) showed good results, and C3 fractures showed 2 good and one fair. C1 fracture (6 cases) (40%) showed excellent result, C2 fracture (6 cases) showed good result (40%), and C3 fractures (2 cases) showed fair (13%) and 1 case (7%) shows poor results.

Discussion

Articular anatomy of the distal humerus and poor bone stock for internal fixation presents difficulty to the most of surgeon. Substantial damage to the distal humerus usually results in some limitation of motion, pain, weakness, and sometimes instability. The surgical goals of fixation of distal humeral intercondylar fractures are

to reconstruct the articular surface of the distal humerus. It has been noted that stable fixation and appropriate post-operative rehabilitation yield good-to-excellent results in 75-80% of patients [1, 2, 3, 4]. In our study, the bilateral uniplanar construct was used to impart stability to the construct and permit early mobilization without compromising fracture stability. Thick (2-2.5 mm) k-wires were used, depending on the thickness of the distal humerus and their respective cortices. All k-wires were introduced under direct vision after blunt dissection to avoid nerve damage. JESS-external fixator offers the advantage of removal in basic setup, without the use of anesthesia, removal of implants fixed with open reduction internal fixation, which requires an anesthetic and extensive dissection and may lead to additional problems associated with a second surgical procedure. JESS fixation technique is a segmental fixation with a simple construct, thus technically less demanding which can be learned by a relatively junior consultant. Safoury and Attéyain 2011 [3] treated eight patients for post-infection non-union of the supracondylar area of the humerus with the Ilizarov method and followed up for 3 years. All had undergone at least 2 previous failed operations. The patients were evaluated radiologically and clinically with an outcome survey using the Disabilities of the Arm, Shoulder, and Hand score. Solid union was achieved in all patients. None had recurrence of infection. Ilizarov treatment for post-infection non-union of the supracondylar humerus was shown to be effective and reliable. It may be kept in reserve as a last resort for chronic, unyielding fractures, or infected cases, rather than for primary management of open intercondylar fractures of the distal humerus. The JESS-external fixator frame in the form of a bilateral uniplanar construct with thick k-wires, as used in our patients, appears to be good construct. In terms of complication, 2 cases showed pin-track infection. None of the patients showed complication such as heterotrophic bone formation and nerve palsy, though these complications are common in various studies on management of intercondylar fracture humerus by open reduction and internal

fixation with plates [3, 5, 6, 7, 8]. 184 patients of intra-articular fractures of distal humerus were operated by posterior transolecranon approach by the study of Babhulkar and Babhulkar in 2011 [1]. Initially, in the first part, Chevron intra-articular osteotomy was done, and later, extra-articular olecranon osteotomy was routinely performed. Both columns were stably fixed by orthogonal methods; in 10 patients with severe comminution with bone loss, stabilization was achieved by parallel plating. The osteotomy was routinely stabilized by tension band wiring with two parallel k-wires introduced up to the anterior ulnar cortex. The results were evaluated by the staging system of Caja et al. at a minimum follow-up of 2 years. The results were excellent-to-good in 12 patients (80%). The high rate of union can be achieved in complex intra-articular fractures of distal humerus if the proper principles of stable fracture fixation are followed, i.e., a posterior transolecranon approach and dual fixation of both columns and restoration of the continuity of articular surface. Internal fixation is very demanding technically and difficult to hold in osteoporotic bones with comminuted fractures [2, 3]. Conservative management does not give good results in such cases. The JESS external fixation system is a definitive and simple method in managing of these cases. The fixator system is less cumbersome to the patient because of the low profile of the components, which can be removed easily without the need for anesthesia. It is better to check intraoperatively that elbow motion is unrestricted, ensuring that stability is restored, and introducing all k-wires under direct vision. Pin-track infection and pin loosening can lead to loss of fixation, alter the course of management, and potentially affect the ultimate functional outcome of the procedure. Hence, the importance of meticulous care of pin tract cannot be overlooked.

Conclusion

JESS-external fixation technique represents an alternative reliable, cost-effective, and less technically demanding option in the management of intercondylar fractures of the distal humerus.

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