

Management of Compound Comminuted Fractures in and Around Elbow Joint Using Across Elbow External Fixation Followed By Early Active Movement

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ABSTRACT:

BACK GROUND:

Compound comminuted fractures around elbow are one of the most common injuries in our country today due to high velocity missile injuries they present a great challenge to the orthopaedic surgeon and severe suffering to the patients as comminution makes anatomical reduction impossible and stiffness is a well known associate. This study was designed to evaluate the functional outcome for such injuries.

OBJECTIVE:

To evaluate the functional results of management of compound fractures in and around elbow joint using across elbow external fixation and early physiotherapy.

METHODS:

A case series study was designed, a (20) patients presented to the orthopaedic and trauma department in the Medical City / Surgical Specialties teaching Hospital / Baghdad/ during the last two years 2006-2007, with history of high velocity missile injury to their elbow or around it, all of them treated by early wound excision and application of across elbow external fixation followed up for 6 weeks till healing of their wounds then the external fixation was removed and active assisted movement were started, patients followed up for 6 months and assessed both clinically and radiographically.

RESULTS:

Good range of elbow movement and return to the original work of the patients were noted in 100% of the patients, and follow up for the first 6 weeks after removal of the external fixation shows that most of the patients (15) got functional range of elbow movement, According to Mayo elbow performance score nine patient got 95 points and eleven got 85 points.

CONCLUSION:

Functional range of elbow movement can be achieved in compound comminuted fractures in and around elbow by using external fixation across the joint then physiotherapy.

KEY WORDS: compound comminuted fractures around elbow/external fixation/early active physiotherapy.

INTRODUCTION:

The elbow joint is a very complicated structure; it is a synovial joint of the hinge variety between the lower end of the humerus and the upper end of radius and ulna, it communicate with the proximal radioulnar joint, the capitulum and trochlea of the humerus are articulate with the radial head and the olecranon, the shape of trochlea and the shape of the proximal end of the ulna are responsible for the normal carrying angle (10-15degrees valgus)⁽¹⁾ The lower end of humerus normally angulated forward 45 degrees on the shaft, and the medial

epicondyle in the same direction of the head of humerus⁽²⁾

The stability of the elbow joint depends on:

- 1-Ligaments (radial, ulnar collateral ligaments, anterior and posterior capsule).
- 2-Bony (mainly articulation between ulna and humerus).
- 3-Surrounding muscles⁽¹⁾

The joint allows flexion, extension (0-146 degrees), and pronation (71degree), supination (84degree)⁽³⁾

The elbow is the key joint for the upper limb, combining with the shoulder, forearm and wrist to place the hand on almost any position of the surface of the body, in particular for feeding, washing and toilet care through not only its hinge function but its collateral stability⁽³⁾

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Fractures involving the elbow joint often involve extensive soft tissue injury in addition to bony injury.

High velocity missile injuries do not obey any rule and cause compound fractures (modified Gustilo-Anderson classification Grade I, II, III)^{(4) (5)} (fig.1) it has a damaging effect to tissues including bone with different degrees of comminution beyond any reconstructive procedure and even near perfect anatomical reduction and internal fixation will end with severe stiffness and loss of function (fig.2, 3). The pronated forearm with semiflexed elbow gives the working position of the hand, restriction of pronation and supination of the forearm which prevents the palm being turned horizontally upwards (e.g. to hold money) is a great disability⁽³⁾ The force transmitted through the elbow when lifting one Kg in the hand was estimated by Walker (1977) to be about 450 Newtons or 46 times the lifted weight at 45 degrees of flexion and 200 Newtons or 20 times the lifted weight at 90 degrees of flexion with the forearm horizontal in both cases⁽³⁾

Limitation of motion is the most common cause of disability after these fractures and usually results because of one or more of the following circumstances:

- 1-Mechanical block.
- 2-Obliteration of olecranon fossa by bony, callus, or fibrous tissue.
- 3-Periarticular fibrosis resulting from trauma or poor surgical technique.
- 4-Infection.
- 5-Repeated stretching and tearing of adhesions by forceful manipulation of the elbow during convalescence.

6-Prolonged immobilization⁽⁶⁾

7-Elbow flexor spasm⁽⁷⁾

PATIENTS AND METHOD:

A 20 patients presented to the emergency department in Medical City with their primary injury was to the elbow joint (during two years 2006-2007) due to high velocity missiles.

18 patients were males, 2 females, in 8 cases the right elbow and 12 cases the left elbow was the injured side (table 1 and 2).

18 patients were grade II and two patients were grade III (Gustilo classification).

Radiological study shows different degrees of comminution of the lower end of humerus and proximal end of radius and ulna (fig.3).

Under general anesthesia good wound excision and irrigation was done with application of fixed angle external fixation (HoffmannII) across elbow in almost normal relations between shoulder, elbow and forearm, two pins in the humerus and two pins in the proximal and middle thirds of ulna, with elbow flexion of 110 degrees for the right side and 80 degrees for the left side (fig.4).

Another look for the wound was done after three days; all patients got clean wounds and delayed primary suturing done for some and transfer the rest to the plastic surgery unit for wound cover.

Shoulder and hand exercises were started post operatively.

The first visit after four weeks showed that the entire wounds healed satisfactorily.

At 6 weeks the external fixation was removed and the patient starts active and assisted active flexion extension pronation and supination exercise.

And follow up was continued monthly for four months.

Table 1: Number of patients and sex

Grade of fracture(Gustilo)	male	Female
I	0	0
II	16	2
III	2	0

Table 2: Number of patients and the side involved

Grade of fracture(Gustilo)	Right elbow	Left elbow
I	0	0
II	6	12
III	2	0

We use Mayo Elbow performance scoring system to assess our patients after four months from the injury.

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Mayo elbow performance score

Function

Pain (max., 45 points)

None (45 points)

Mild (30 points)

Moderate (15 points)

Severe (0 points)

Mean

Range of motion (max., 20 points)

Arc > 100 degrees (20 points)

Arc 50 to 100 degrees (15 points)

Mean

Stability (max., 10 points)

Stable (max., 10 points)

Moderately unstable (5 points)

Grossly unstable (0 points)

Mean

Function (max., 25 points)

Able to comb hair (5 points)

Able to feed oneself (5 points)

Able to perform personal hygiene tasks (5 points)

Able to on shirt (5 points)

Able to put on shoes (5 points)

Mean

Mean total (max., 100 points)

Morrey BF, An KN, Chao ETS: Functional evaluation of the elbow. In the Elbow and Its Disorders, edited by B.F. Morrey Ed. 2, pp. 86-89. Philadelphia, W.B. Saunders, 1993.

RESULTS:

All patients got good elbow movements with return to their original work (20 patients), 15 patients after 6 weeks and 5 patients after 12 weeks from removal of external fixation and physiotherapy.

Range of elbow flexion extension (40-120 degrees), supination (40-60 degrees) and pronation (40-60 degrees) so we achieved a functional range of elbow movement.

Two of our patients got pin site infection treated by dressing and oral antibiotics.

But all our patients (20) had varying degree of elbow stiffness.

According to Mayo elbow performance score nine patients got 95 points and eleven got 85 points, patient's understanding and cooperation were very important in our study because the rehabilitation depends mainly on that so we got high scores with cooperative and understanding patients and rapid return to social life and the others (5 patients) need double the time to get back to their normal life.

DISCUSSION:

The goal of therapy in all patients with severely traumatized extremities is the restoration of near normal function with minimal morbidity in a reasonable time interval⁽⁵⁾, and there is insisting on cost effective care with proven acceptable outcome because limb salvage sometimes leads to prolonged and highly morbid functional deficits⁽⁵⁾. Open injuries require early aggressive debridement of the soft tissue followed by skeletal stabilization. The use of external fixator of the elbow is growing in popularity yet there is no context of specific pathological conditions, so a limited spectrum of soft tissue injuries about the elbow can be managed with a laterally applied half pin external fixation.⁽⁸⁾ In this study the external fixation acts as an external splint to disimpact the comminution and provide a ligamentotaxis like effect to keep the comminuted pieces in acceptable position and the action of physiotherapy acts on bag of bones technique to mould the fractured joint in to a functioning one we can get an acceptable bony

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alignment (fig.5) and a functional range of movement, patients should continue to exercise their elbow to regain a good muscle power (fig.6, 7).

A healed stiff elbow will be easier to salvage than a non healed elbow particularly in patients with complex fractures⁽⁹⁾ Also aggressive rehabilitation including early social integration is crucial for a good functional outcome⁽⁵⁾

An important finding was that external fixation had been used to try to restore equal arm length in the face of formidable soft tissue wounds this point is important in our patient to mould the bony fragments but upper limb discrepancy is not important as in lower limb injuries⁽¹⁰⁾

Morrey et al 1981, 1985 have suggested that fixed flexion deformity of 30 degrees in the elbow with flexion to 130 degrees and a range of rotation from 40 degree of pronation to 40 degrees of supination allow performance of 90% of activities of daily living⁽³⁾

Ring discussed the use of hinged external fixation in a study of thirteen patients who had persistent instability two or more weeks after an elbow fracture dislocation. The average arc of ulnohumeral motion was 99 degrees after follow up of average 57 months. And the average Mayo elbow performance score was 84 points⁽¹¹⁾

Mader evaluated the effectiveness of a dynamic external fixator for treatment of post traumatic elbow stiffness 20 patients with a mean preoperative arc of total motion of 36 degrees were managed with intraoperative distraction followed by a subsequent relaxation phase and then by mobilization under distraction for seven weeks with use of the dynamic external fixation after a minimum duration of follow up of five years there where seven excellent results the mean arc of total motion was 105 degrees and the mean Mayo elbow performance score was 91 points, all but one patients had a stable elbow and two patients had development of moderate ulnohumeral degenerative changes⁽¹¹⁾

External fixation is the least invasive form of surgical skeletal fixation and widely accepted form of treatment for the severely traumatized extremities it provides skeletal stabilization and excellent soft tissue access⁽⁵⁾

So we can get a better Mayo elbow performance score by using our method as a primary procedure in the treatment of compound comminuted fractures of elbow, nine patients got 95 points and eleven got 85 points.

Although there is a wide range of reported results following this severe injury, a review of articles describing outcomes following the surgical repair of intra-articular distal humerus fractures using modern techniques and implant reveals that the average patient can expect a relatively pain free, functional 105 degrees arc of motion⁽¹²⁾.

CONCLUSION:

The cornerstone of this case series is that the functional range of elbow joint after compound fractures can be achieved by application of a cross elbow external fixation to rest the injured structures and help to reconstruct the soft tissue then physiotherapy in the form of active and assisted active exercise.

- 1-Stiffness is inevitable complication in compound comminuted fractures around elbow due to missile injuries but in our study we get functional range of movement in spite of stiffness.
- 2-External fixation could be used as a procedure resembles ligamentotaxis in such injuries.
- 3-Good early wound excision, irrigation and perfect surgical technique in application of external fixation with preservation of almost normal carrying angle and anatomical orientation of shoulder, elbow, and wrist will assist in the success of this procedure.
- 4-Avoid passive forces to correct the remaining stiffness.
- 5-Patient compliance and understanding need clear explanation of the procedure, its benefit, follow-up and complications this play a major role in success of treatment.



Figure 1: Gustilo IIIA compound fracture.



Figure 2: Severe comminuted fracture.

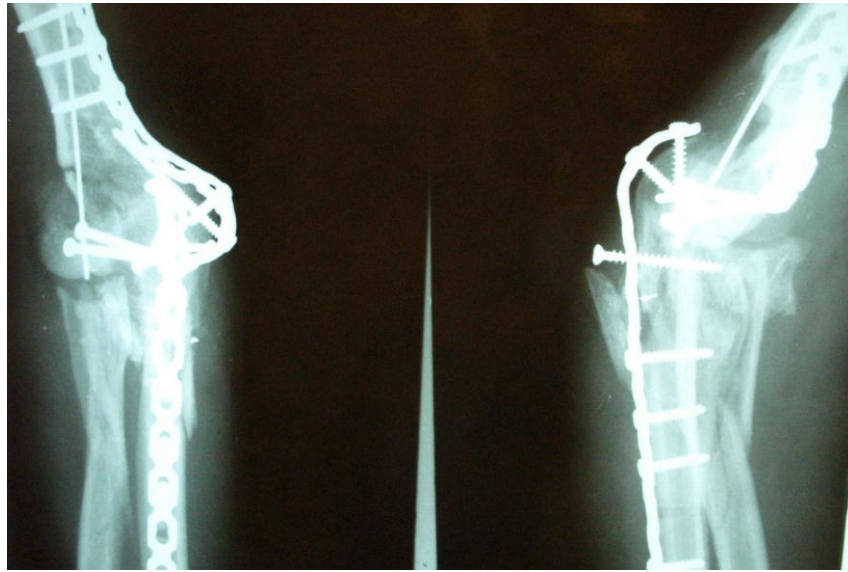


Figure 3 :Internal fixation may lead to severe loss of function.

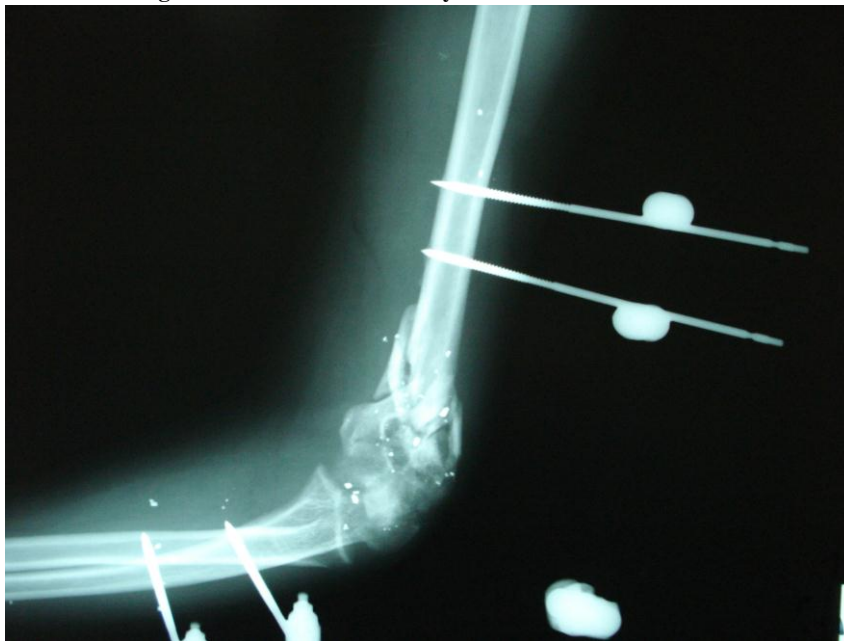


Figure 4 : Postoperative X-ray.

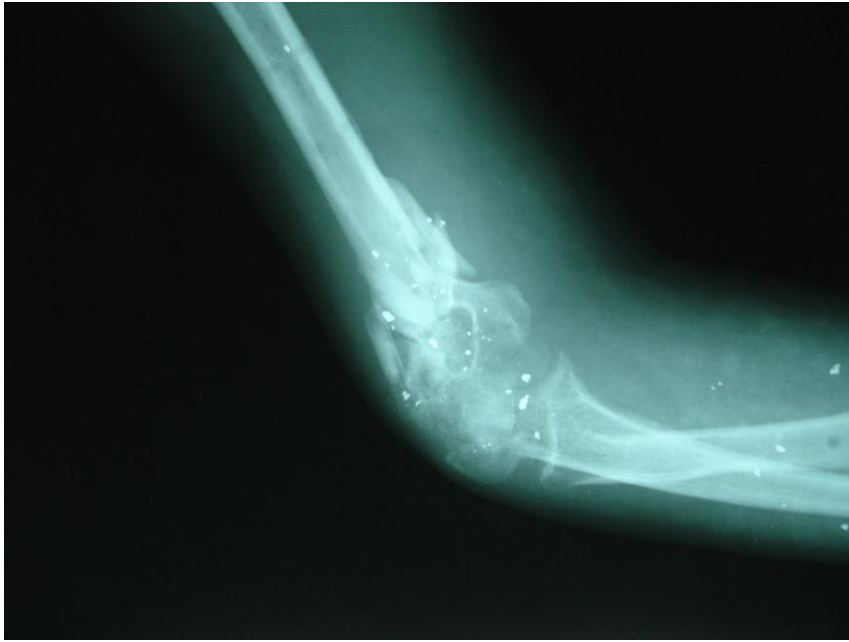


Figure 5: United fracture.



Figure 6: Elbow in extension post injury.



Figure 7: Elbow in flexion.

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