

A Retrospective Study on Elbow Function after Internal Fixation of Intercondylar Fracture of Adult Humerus

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Abstract

Between 1989 and 1993, 20 intercondylar fractures of the distal humerus were treated by open reduction, internal fixation and early postoperative mobilisation. One patient died on the third postoperative day as a result of multiple injuries, leaving 19 patients for evaluation. The mean follow-up period was 4.1 years (range 2.0 to 6.7 years). According to the Muller system, there were 7 type C1 and 12 type C2 fractures. Using the Jupiter criteria, 6 elbows were rated as excellent, 9 good and 4 fair. Complications included late ulnar neuritis in one patient and wound infection in another patient.

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Introduction

Intercondylar fractures of the distal end of the humerus present difficult problems of management. These fractures are relatively rare and consequently few surgeons will be able to attain extensive experience with the surgical treatment of these injuries. Anatomical restoration of the articular surface in displaced intra-articular fractures is mandatory. Anatomic reduction can only rarely be achieved or maintained through manipulative reduction alone. Furthermore, the elbow tolerates immobilisation poorly. Rigid osteosynthesis of the intra-articular fractures permits restoration of articular surface and early postoperative rehabilitation. Uniform fracture classification and criteria for grading results allow critical assessment of the outcome of operative treatment as well as accurate comparison with the experience of other surgeons. Using the Muller¹ classification of fracture pattern and Jupiter² grading criteria, we present the results of a consistent surgical treatment and controlled postoperative mobilisation at a single institution.

Materials and Methods

Between 1989 and 1993, 20 intercondylar fractures were treated with open reduction and internal fixation. One patient died on the third postoperative day from

multiple injuries, leaving 19 patients available for evaluation. The mean follow-up period was 4.1 years (range 2.0 to 6.7 years).

Seven fractures were caused by road traffic accident, 8 by fall from height, 3 by sport injury and 1 by accident at work. The average age at the time of injury was 38.3 years (range 13 to 80 years). There were 10 male and 9 female patients. Fifteen patients (13 to 56 years) had employment before injury and 4 elderly ladies (74 to 80 years) were not employed. Eleven fractures involved the right elbow and 8 affected the left. Associated injuries in 4 patients included ipsilateral distal radius fracture in 2, bilateral distal radius fractures in 1 and compression fracture of the twelfth thoracic vertebra and left inferior pubic ramus in 1. There were 14 closed fractures and 5 Gustilo and Anderson³ grade I open fractures. Using the Muller classification,¹ 7 were classified as type C1 and 12 as type C2 fractures. There were no type C3 fractures.

Operative Technique

Eleven elbows (5 open and 6 closed fractures) were operated on the day of injury. For these cases, the average time between injury and operation was 4.8 hours (range 3 to 7 hours) for the open fractures and 11.5 hours (range 8 to 16 hours) for the closed fractures. The

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other 8 closed fractures were operated at an average of 5.8 days (range 3 to 16 days) after injury. General anaesthesia was used in 8 patients and regional anaesthesia in 11. The patients were placed in lateral position with the affected elbow upwards and supported. A pneumatic tourniquet was used routinely.

A dorsal incision was used in all patients. A V-shaped distally-pointing Chevron osteotomy of the olecranon at the level of the trochlea was performed in 15 patients to improve the intra-articular exposure. Before the osteotomy was done, the proximal part of the ulna was predrilled with 2 parallel 1.5 mm drill bits for later Kirschner wire stabilisation by tension band fixation. In 4 patients, splitting the triceps tendon and muscle provided sufficient exposure of the fracture. The ulnar nerve was isolated and retracted in all patients and was transposed anteriorly in 6.

Stabilisation of the fracture was begun by flexing the elbow to 140 degrees to obtain a good view of the fracture. The articular fragments were carefully inspected and cleared of haematoma. Attention was next directed to the careful anatomical restoration of the trochlea and its relationship to the olecranon. Before reduction of the bicondylar fragments, a hole was predrilled from within the fracture using a 2 mm drill bit for a 4 mm cancellous screw. Reduction was performed and temporary stabilisation of the articular fragments was achieved by a pointed reduction forceps or Kirschner wires. One 4 mm cancellous screw was carefully placed under direct vision to rigidly stabilise the articular fragments. The supracondylar component of the fracture was then reduced and the articular reconstruction was temporarily stabilised to the distal end of the humerus with Kirschner wires. Two plates (medial and lateral) were used to rigidly fix the fracture in 13 elbows and a single plate (lateral) was used in 6. 3.5mm reconstruction plates were used. The fixation technique was directed towards achieving sufficient stability to allow early mobilisation. The osteotomy of the olecranon was secured with parallel Kirschner wires and tension band wire. The wound was closed over 1 or 2 suction drains and the elbow was supported in a dorsal splint for 3 days. The average operative time was 2.1 hours (range 1.6 to 2.9 hours). Active motion of the elbow was started on the fourth postoperative day under the supervision of a physiotherapist. The patients were seen at the physiotherapy department twice a week. The patients performed the range of motion exercises at home daily. Passive stretching was strictly forbidden. Heavy lifting was forbidden for 3 months.

All 19 patients were evaluated clinically and radiographically by one author at an average of 4.1 years after operation. Each patient completed a comprehensive written questionnaire regarding occupational capabilities, residual symptoms, existing disabilities and

complications. Elbow movements were measured using a goniometer and compared with the normal arm. Ulnar nerve function was carefully assessed. Anteroposterior and lateral radiographs of the injured elbow were made. The results were rated according to the Jupiter criteria² (Table I).

TABLE I: CRITERIA FOR GRADING RESULTS²

	Range of movement		Pain	Disability
	Loss of extension	Flexion		
Excellent	< 15°	> 130°	None	None
Good	< 30°	> 120°	Slight	Minimal
Fair	< 40°	> 90°	With activity	Moderate
Poor	< 40°	> 90°	Variable	Severe

TABLE II: FUNCTIONAL RESULTS OF TYPE C INTERCONDYLAR HUMERAL FRACTURES

	Our series	Holdsworth and Mossad ⁴	Jupiter et al ²
Excellent	6	14	13
Good	9	15	14
Fair	4	6	4
Poor	0	3	3
Total	19	38	34

Results

All the fractures united at an average time of 3.2 months (range 3.0 to 4.9 months). Six elbows were rated as excellent, 9 good and 4 fair. Table II compares our results with those of Jupiter et al² and Holdsworth and Mossad.⁴

Eleven patients returned to their original employment without limitation at an average of 3.6 months (range 3 to 4.5 months) after operation. The other 4 patients returned to work after an average interval of 3.8 months (range 3.5 to 5 months) but required job modifications and their results were rated as fair. The 4 unemployed elderly patients were able to perform their daily activities without limitation.

Complications included late ulnar neuritis due to loosening of a screw stretching the ulnar nerve in 1 out of 13 patients with no transposition of ulnar nerve and wound infection in 1 out of 14 patients with closed fracture. There were no cases with post-traumatic arthritis or non-union of olecranon osteotomy.

Anterior transposition of the ulnar nerve was indicated in 6 patients. Four were due to contusion of the ulnar nerve from the original trauma and in 2, the implants would likely cause mechanical irritation of the ulnar nerve. In 1 patient where anterior transposition was not performed, late ulnar nerve palsy developed 2

months after operation. The ulnar nerve was stretched by a loosened screw from the medial plate. The screw was replaced and the nerve was transposed anteriorly. The ulnar nerve function recovered fully six months after the second operation and the result was rated as fair. In retrospect, the ulnar nerve should have been transposed anteriorly during the first operation as it was lying behind the plate.

All the 5 open fractures healed without infection. Thorough wound debridement and rapidity of surgical intervention at an average of 4.8 hours after injury probably contributed to the absence of infection in the open fractures. Three open fractures had good results and 2 had fair results. Superficial wound sepsis developed on the fifth postoperative day in a 74-year-old lady with a closed fracture. The wound infection was managed with drainage and irrigation. *Staphylococcus aureus* was cultured from the wound. The infection resolved with 6 weeks of Cloxacillin treatment and the result was rated as fair.

Discussion

Intercondylar fracture of the humerus is one of the most difficult of all fractures to manage. Recommendations for treatment have ranged widely, from essentially no treatment to operative reduction and internal fixation.⁵⁻¹² As the overall number of reported cases have been small, the fractures have been classified by varying criteria and the results being judged by a wide range of methods of functional evaluation, accurate comparisons between operative and non-operative treatment remain difficult.

78.9% of our patients treated by open reduction and rigid internal fixation were rated as having excellent and good results. Excellent and good results were reported in 79.4% of Jupiter's series² and 76.3% of Holdsworth's series.⁴ Nineteen out of 34 cases (55.9%) in Jupiter's series and 12 out of 57 cases (21.1%) in Holdsworth's series were type C3. There were no type C3 fractures in our series.

All our patients were placed in a lateral position with the affected elbow upwards and supported. It allowed the surgeon and assistant to stand on either side of the arm. Another assistant could stand facing the elbow and flex the elbow to 140 degrees to obtain a good view of the fracture.

V-shaped distally pointing Chevron osteotomy of the olecranon was performed in 15 elbows. It allowed better intra-articular exposure and facilitated both anatomical reduction and bone union of the osteotomy by virtue of the greater contact of the bone surfaces.

Following fixation of the bicondylar fragments, a dorsal plate on the lateral column was used to fix the supracondylar component. Usually a 3.5 mm recon-

struction plate was used and contoured so that the distal fragment could take two screws. The fixation was assessed intraoperatively and another plate was used on the medial column if the fixation by a single lateral column plate was inadequate. The second plate would be placed at a right angle to the first plate to achieve better stability (Fig. 1). Our goal of fixation is always directed towards achieving sufficient stability to allow early active mobilisation.

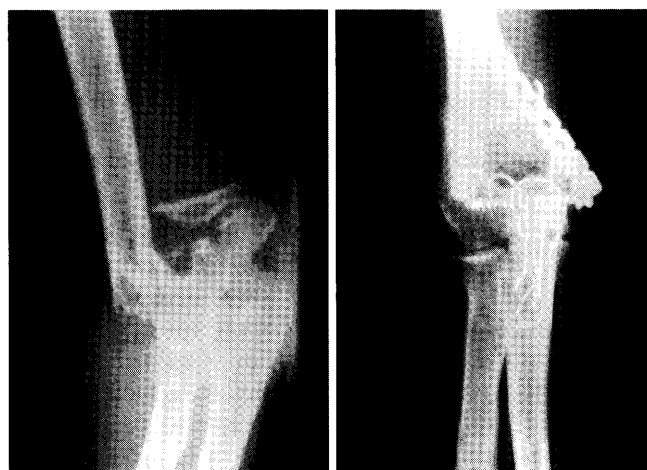


Fig. 1.

(a) Antero-posterior radiograph showing a Type C1 intercondylar fracture.

(b) The condylar fragments were fixed with a 4 mm cancellous screw. The supracondylar component was fixed with two plates and a Kirschner wire.

Anterior transposition of the ulnar nerve should be performed if the ulnar nerve is contused or the implants are directly behind the nerve which may cause mechanical irritation. In four elbows with contused nerve, there was no ulnar nerve palsy. In one case with no transposition of the nerve, the late ulnar nerve palsy was due to mechanical irritation by a loosened screw. In retrospect, the nerve should have been transposed during the first operation.

The avoidance of infection in open fractures is probably due to the low grade of open fractures in the upper extremity, timing of surgery and thorough wound debridement.

The authors have no experience with type C3 fractures. If the comminution of the fracture is not too severe and large articular fragments are available, open reduction and rigid internal fixation will be recommended as restoration of the articular surface of displaced intra-articular fragments and early active mobilisation reduces the incidence of post-traumatic elbow arthrosis and stiffness. However, if the fractures are not amenable to surgical reconstruction due to severe comminution, traction with either Dunlop or Kirschner wire olecranon traction or the bag of bones method ("consci-

entious neglect”) may be used.

Conclusion

With uniform classification of fracture pattern and criteria of grading results, we present our results of operative treatment of these relatively uncommon fractures and compared them with the experience of Jupiter et al² and Holdsworth and Mossad.⁴ With a meticulous technique, careful preoperative planning and an experienced surgical team, the treatment of choice for these very challenging fractures is stable internal fixation and controlled early active mobilisation.

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