

FRACTURES OF THE ADULT DISTAL HUMERUS

ELBOW FUNCTION AFTER INTERNAL FIXATION

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We reviewed 57 adult patients at an average of 37 months after early internal fixation for displaced fractures of the distal humerus. Two-thirds had intercondylar (Müller type C) fractures, and one-third had articular comminution (type C3). A chevron olecranon osteotomy was used, with early active movement after fixation.

Results were good or excellent in 76% with an average range of movement of 115°. Early stable fixation by an experienced surgeon is recommended for these fractures.

In the past, considerable disability has been considered to be unavoidable after intercondylar humeral fractures. The traditional view was that internal fixation, despite apparent radiographic success, did not necessarily give functional benefit, and occasionally resulted in gross stiffness (Apley 1977). In contrast, some authors reported very good results from stable internal fixation followed by early active movement (Jupiter et al 1985). Considerable personal experience is said to be needed to succeed with this method (Wadsworth 1982). We now report the results of treatment by stable internal fixation in a busy trauma unit.

PATIENTS AND METHOD

From 1980 to 1986, a total of 62 patients aged 13 years or more had internal fixation for displaced fractures of the distal humerus at the University Hospital, Nottingham. Their average age was 36.2 years: 19 females had an average age of 42.4 years (13 to 83) and 43 males averaged 33.4 years (13 to 72). Two patients died, one of pneumonia after severe multiple injuries and the other, with a fracture due to a secondary deposit, died of his malignancy. Three other patients could not be traced, so 57 patients (88%) were re-examined.

We used the AO or Müller et al (1979) classification of fracture pattern (Fig. 1), recording type C3 when articular comminution was seen at operation even if this was not obvious on the radiographs. The distribution of fractures is shown in Figure 2. Two-thirds (38) of the fractures were intercondylar and only four were extra-articular. Eight patients had multiple injuries, and half of the elbow fractures were due to relatively 'high energy' trauma, while 13 fractures were technically compound with a relatively clean puncture wound. Twenty-five injuries occurred in simple falls.

Table I. Criteria for grading results (Jupiter et al 1985)

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

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0301-620X/90/3033 \$2.00
J Bone Joint Surg [Br] 1990; 72-B: 362-5.

Operative technique. Internal fixation was performed within 24 hours of admission in 75%, but two operations were delayed for five days or more. The exact technique varied with the fracture pattern. The patient was prone and a tourniquet was usual, at least initially. Careful pre-operative plans were drawn for most cases (Holdsworth 1989).

In the few patients with isolated condylar fractures

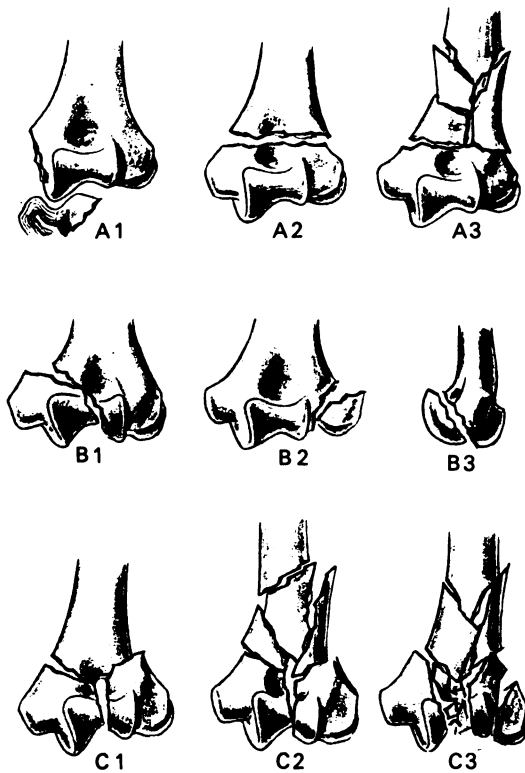


Fig. 1

The AO classification of distal humeral fractures (reproduced by permission, from Müller et al 1977).

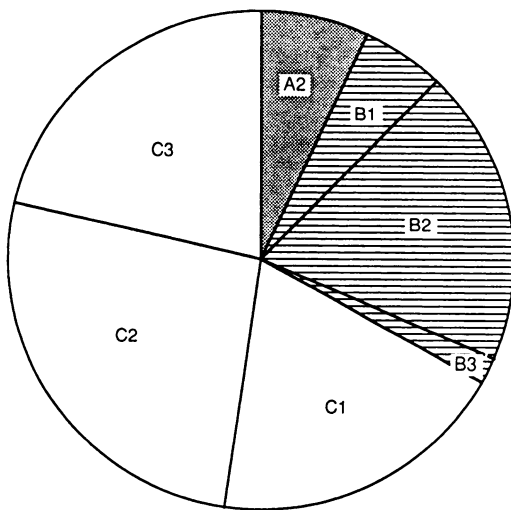


Fig. 2

The distribution of the types of fracture (see Figure 1).

(type B) a lateral approach was adequate. Supracondylar fractures were exposed by a triceps-splitting approach. For bicondylar (type C) fractures, a transolecranon approach was used with a chevron or transverse osteotomy. The chevron, pointing distally, was cut with an oscillating saw and completed with a fine chisel and

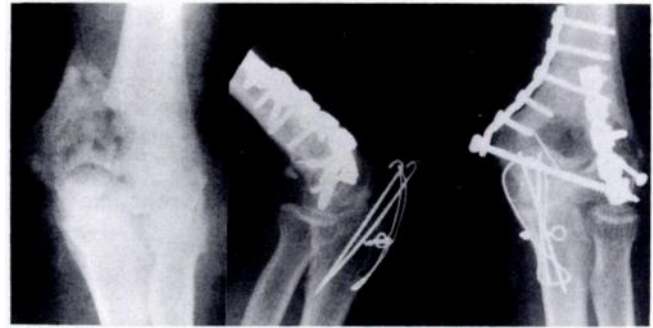


Fig. 3

A typical type C fracture showing the method of fixation.

Table II. Functional results

	All fractures	Type C fractures (intercondylar)	
		Nottingham	Jupiter et al 1985
Excellent	26	14	13
Good	18	15	14
Fair	9	6	4
Poor	4	3	3
Total	57	38	34

at the end of the operation the osteotomy was fixed by a standard wiring method (Fyfe, Mossad and Holdsworth 1985).

The fixation of intercondylar fractures varied but stability was reliable with two plates, usually of the 3.5 mm Dynamic Compression Type or sometimes 'pelvic reconstruction plates', plus interfragmentary screws (Fig. 3). Nineteen different surgeons were involved and two-thirds of the operations were performed by 'residents', usually senior registrars.

Follow-up. Any symptoms were noted, and the patients were examined clinically and radiographically. Elbow and forearm movements were measured using a standard large goniometer, recording extension of the elbow with the forearm in maximal supination. Ulnar nerve function was carefully assessed. Double-exposure photographs showed the range of elbow movement, and loss of flexion-extension was expressed by comparison with the normal arm. We used the criteria of Jupiter et al (1985) to assess the results (Table I).

RESULTS

Average follow-up was 37.2 months (6 to 85), 12 patients being reviewed at between six and 12 months and 19 at four years or more. No patient had lost significant forearm rotation and the combined loss of flexion and extension was proportional to the severity of the fracture

(Fig. 4). The arcs of flexion achieved by the patients with the worst (type C3) fractures are shown in Figure 5, which gives some idea of the extent of functional recovery.

Age was another factor: no patient over 45 years of age regained more than 120°. Figure 6 shows the functional results for each type of fracture, while Table II compares our results for all distal humeral fractures, and for intercondylar fractures, with those of Jupiter et al (1985).

Complications. One type C3 fracture required bone grafting and refixation on two occasions, but eventually united. This patient had no pain, but a 'poor' result due to stiffness. Early in our series, four patients had protective plaster casts for several weeks; this resulted in permanently reduced range of movement. No later patients had any plaster support.

Transient neurapraxia of the ulnar nerve was common, due to its mobilisation before the olecranon osteotomy. Tingling and hypo-aesthesia occurred in 29 patients, but without obvious weakness, and only two patients still had tingling and slight reduction of light touch sensation at latest review.

Three plates, all of the one-third tubular type, broke during active exercise before bony union was complete. Of 27 olecranon osteotomies, three showed delayed or fibrous union. One was symptom free; the other two settled after removal of the wires. Two other patients required removal of the wires.

Myositis ossificans was seen in only one patient, after operation had been delayed for three weeks because of a severe head injury and local lacerations. This patient had the worst result in the series with only 70° of flexion, but declined further treatment as he had already returned to lorry driving. The only other 'late' internal fixation was for persistent dislocation secondary to a very comminuted lateral condylar fracture, which at first was thought to be inoperable. After reconstruction of the condyle using bone grafts, the range of movement was only 60°, but the patient was satisfied with the restoration of stability and had only minimal pain.

Only one patient became infected; this involved only the olecranon bursa and settled without further surgery. It did not compromise the result.

DISCUSSION

Our average result was very good, with a range of 115° of flexion/extension and full forearm rotation. Of the intercondylar (type C) fractures 76% were rated excellent or good, using quite stringent criteria. This compares with the 78% of similar cases reported by Jupiter et al (1985). Our patients were somewhat younger but our follow-up was shorter. Our results did not appear to be related to the seniority of the surgeon, perhaps because the more experienced surgeons undertook the most difficult cases.

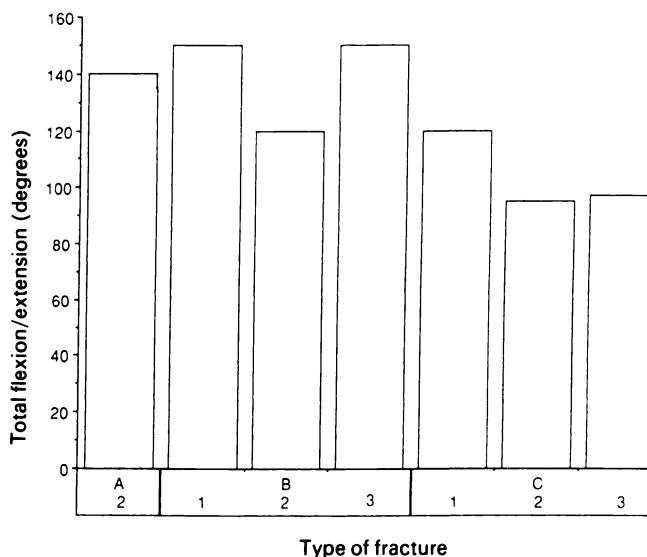


Fig. 4

Average range of movement achieved in each type of fracture.

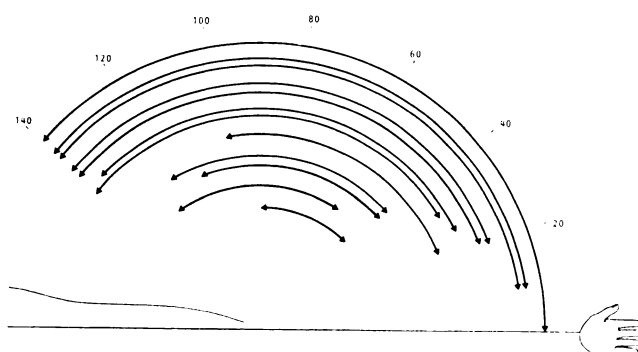


Fig. 5

Range of movement in each of the 12 most severely comminuted fractures (type C3).

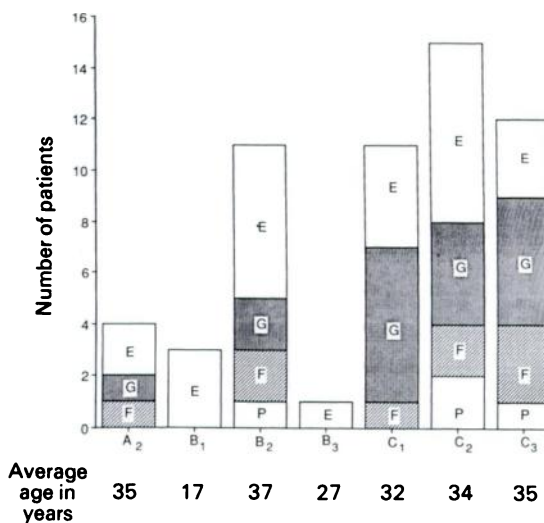


Fig. 6

The overall results, graded as excellent (E), good (G), fair (F) and poor (P), with the average age of each group.

Several authors have claimed good results from conservative treatment, but have used much less exacting criteria (Reich 1936). Brown and Morgan (1971) reported an average range of 98° after the 'bag of bones' method, as against our average range of 115°.

The correlation we found between the functional results and the type of fracture confirms the prognostic value of the AO classification. In our series, elderly patients regained less movement, but none of them had instability or very painful and stiff elbows. Unless the bone texture is very poor, old age is not a contra-indication to operation.

The three olecranon osteotomies with delayed union were all transverse as opposed to chevron, and had all been fixed by a cancellous screw and a tension band wire. Jupiter et al (1985) had similar problems, and we have shown the method to be unreliable in the laboratory (Fyfe et al 1985). We therefore strongly advise chevron osteotomy, with fixation by tension band wiring with two tightening loops. Olecranon osteotomy involves disturbing the ulnar nerve: we commonly found tingling in ulnar nerve distribution, even after prophylactic anterior transposition. We now advise that the nerve is returned to its normal course at the end of the operation, but stress that its position must be clearly recorded so that it can be protected at any later procedure.

In our technique, the lateral or radial plate is posterior, and therefore at right angles to the medial or ulnar plate; this enhances stability, and is possible because the articular surface of the capitellum is entirely anterior and distal. We found that semi-tubular plates were not strong enough and have abandoned their use. The posterolateral plate requires little contouring and a small dynamic compression plate is usually ideal. The medial plate often needs to be very heavily contoured in two planes; for this reason the 'pelvic reconstruction' plate, though slightly less strong, is often useful. We have not removed implants as a routine, unless their prominence in thin patients causes complaint.

The importance of close postoperative supervision cannot be overemphasised. Active flexion and extension exercises, at first in a horizontal plane to exclude gravity, should be started within two days. Passive stretching is

strictly forbidden, and although physiotherapists may supervise the active exercises they must not be tempted to 'help' the patient by applying injudicious force. We are evaluating the role of continuous passive motion, and it seems possible that it may reduce some of the damaging spasm, especially in the biceps, but it was not used in the series we report and is certainly not mandatory. Heavy lifting was forbidden for at least 10 weeks: full recovery often takes several months.

A scrupulous technique, including careful pre-operative planning, can give a very good functional result in most patients. We therefore support the view of Jupiter et al (1985) that, given an experienced surgical team using good operating theatres, the treatment of choice for these very challenging fractures is stable internal fixation and early active movement.

We are grateful to the orthopaedic consultants of the University Hospital, Nottingham for allowing us to study their patients. We also thank the staff of the audio-visual department for their great patience.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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