Treatment of nonunion around the olecranon fossa of the humerus by intramedullary locked nailing

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Nonunion of fractures of the olecranon fossa of the humerus presents a difficult surgical problem. The distal fragment is usually small and osteoporotic and stable fixation is not easy to achieve. We describe a modification of the technique of locked nailing by which the distal aspect of the nail is placed in the subchondral region of the trochlea. Good results were obtained in seven out of eight patients with this technique.

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Ununited fractures of the distal humerus are often painful and unstable, and there may be considerable functional disability. Satisfactory surgical management is difficult.^{1,2} Fixation with a plate and bone grafting may give satisfactory results if there is sufficient bone stock,³⁻⁵ but this technique may fail.^{6,7} The outcome of revision surgery may be adversely affected by stiffness of the elbow, scarring from previous surgery and the fact that the distal fragment is small and osteoporotic.^{2,4,8}

Neither arthrodesis of the elbow nor excision arthroplasty is a satisfactory salvage procedure.^{4,6,9,10} Despite some good results in elderly patients⁶, elbow arthroplasty is not suitable for the treatment of post-traumatic conditions because of the high incidence of loosening of the humeral component.^{4,11-14} The long-term results of cadaver elbow allografts are not known.^{7,10} Satisfactory placement of the pin in the small distal fragment is difficult when external

fixators are used. Revision surgery with double or triple plating has the risks of further devitalisation and avascular necrosis of the distal fragment.⁵ The intramedullary locked nail is gaining acceptance for the treatment of fractures and nonunion of the shaft of the humerus,¹⁵⁻²⁰ but it has not been recommended for supracondylar lesions since the end of the medullary canal is proximal to the olecranon fossa.¹⁶

Patients and Methods

Between March 1995 and September 1996 we treated eight patients aged from 20 to 62 years who had nonunion around the region of the olecranon fossa, seven following fracture and one after osteotomy for cubitus varus after a supracondylar fracture. One patient (case 2) developed nonunion after pathological fracture following biopsy of an eosinophilic granuloma. Table I gives the details of the patients. Four had marked stiffness of the joint and four gross instability (Fig. 1). At least one, and in most cases two previous attempts at internal fixation and bone grafting had failed.

Operative technique. We use a transolecranon approach to the distal humerus. The ulnar nerve is exposed and protected as is the radial nerve for the more proximal cases. Previous implants are removed. Arthrolysis of the elbow is performed as described by Morrey.²¹ A 3.2 mm drill is used to perforate the trochlear notch and advanced proximally across the olecranon fossa into the intramedullary canal. A guide wire is introduced in an antegrade fashion from the shoulder to the elbow (Fig. 2). The canal is then reamed with a flexible reamer which is passed across the site of nonunion and the olecranon fossa under direct vision and stopped just before the articular cartilage. An intramedullary humeral nail (Biomet Inc, Warsaw, Indiana) of appropriate length is inserted in an antegrade manner after removal of the distal 8 mm of the nail. This allows the distal locking to be performed at the widest condylar area (Fig. 3). The screws supplied are too short for this site, and we therefore use 4.5 mm AO cortical screws. Proximal locking is performed in the usual manner and autogenous cancellous bone graft is added. The olecranon is reattached. Active mobilisation of the elbow without splintage is encouraged after operation.

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Fig. 1a

Fig. 1b

Fig. 1c

Case 7. Figure 1a – Photograph showing the unstable upper limb. Figures 1b and 1c – Anteroposterior (b) and lateral (c) radiographs of the elbow before operation showing non-union and the broken Siedel nail.

Fig. 2

Photograph showing the guide wire passing through the olecranon fossa (►, ulnar nerve; →, guide wire; ►, proximal fragment; and *, trochlea (distal fragment)).

Fig. 3

Diagram of the intramedullary nail with the target device to show the position of the two distal locking screws in the widest condylar area.

Results

Seven of the eight patients achieved bony union (Fig. 4) and improvement of movement of the elbow (Table I). One patient (case 3) with considerable associated soft-tissue and

neurovascular damage (Gustilo IIIB) has a stiff elbow with only a 'jog' of movement, but is painfree. Two patients required further bone-grafting and one of these has persistent nonunion. There were no other complications except for a broken screw (case 6).

Fig. 4a

Fig. 4b

Case 7. Anteroposterior (a) and lateral (b) radiographs at 22 months showing solid bony union.

Table I. Details of the eight patients with nonunion of the olecranon fossa

Case	Age (yr)	Gender	Cause	Previous surgery	Symptoms	Duration (yrs)	Range of elbow movement (degrees)		Follow-up (mth)	Nonunion healed	Fixation failure	Number of bone grafts
							Preop	Postop				
1	56	F	Fall	DCP plate 3 attempts	Pain Stiffness	5	45 to 60	0 to 130	41	Yes	No	1
2	23	M	Biopsy (eosinophilic granuloma)	DCP plate 3 attempts	Pain Stiffness	5	45 to 90	0 to 130	39	Yes	No	1
3	20	M	RTA* Compound fracture Neurovascular damage	DCP & recon plates 2 attempts	Instability Pain	3	FFD† 90 Nil	80 to 90	39	Yes	No	2
4	62	F	Fall	Two 1/3 tubular 2 attempts	Pain Stiffness	3	45 to 60	15 to 130	36	Yes	No	1
5	50	F	Fall	Two recon plates 1 attempt	Pain Instability	2	45 to 80	30 to 130	36	Yes	No	1
6	20	M	Osteotomy	Screw and wire 1 attempt	Gross instability	8	Nil	0 to 90	22	No	Yes	2
7	38	M	RTA	Siedel nail 1 attempt	Gross instability	2	Nil	0 to 120	22	Yes	No	1
8	36	M	Fall	2 plates 2 attempts	Pain Stiffness	2	FFD 45 Nil	45 to 90	22	Yes	No	1

* road-traffic accident

† fixed flexion deformity

Discussion

Bone grafting and plating are an accepted method of managing supracondylar nonunion in the humerus,⁵ but a significant percentage of patients (27%) requires further procedures.¹³ All our patients had had one or more previous attempts at fixation. Jupiter and Goodman⁵ advocated triple plating, bone grafting and elbow arthrolysis and reported good results in five out of six patients but with one case of avascular necrosis. Total elbow arthroplasty has been used to treat nonunion of fractures of the distal humerus, but Mitsunaga et al¹³ and Figgie et al⁴ reported unsatisfactory results. Morrey and Adams⁶ found total elbow replacement to be a valuable operation in elderly patients but emphasised that it is not appropriate for younger patients or for post-traumatic conditions. Our technique of intramedullary locked nailing is a suitable method of treatment for this problem particularly in younger patients.

Fixation using an intramedullary locked nail is biomechanically superior to that with a plate,²² but it has not been considered suitable for the supracondylar region because the medullary canal ends proximal to the olecranon fossa. Using our technique, it is possible to create a track which allows the nail to be seated as far distally as the subchondral region of the trochlea. The most distal locking screw is placed in the widest condylar area and this construct, combined with elbow arthrolysis, may restore movement of the elbow. In three patients the distal fragment was slightly extended (Fig. 4b).

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