FRACTURES OF THE DISTAL FEMUR TREATED WITH THE AO DYNAMIC CONDYLAR SCREW

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We report the results of treatment with the dynamic condylar screw of 21 cases of supracondylar and intercondylar fractures of the femur in patients aged 22 to 91 years.

There were two nonunions and no deaths. We found the device easy to use and the good fixation allowed early patient mobilisation.

Fractures of the distal femur are difficult to treat. Apart from the usual problems of confining elderly patients to bed, conservative methods, at any age, may be complicated by knee stiffness, malunion and nonunion. Open reduction and internal fixation has been advocated using various implants including angle blade plates (Schatzker and Lambert 1979; Yang, Liu and Liu 1990) the Zickel device (Zickel, Hobeika and Robbins 1986), Rush rods (Shelbourne and Brueckmann 1982) and Ender's nails (Kolmert, Egund and Persson 1983). These devices are technically demanding and none combine interfragmentary compression with good purchase in osteopenic bone. Fixation with a modified supracondylar plate and a lag screw has been described (Hall 1978; Zimmerman 1979; Giles et al 1982; Pritchett 1984). A preliminary report of the AO dynamic condylar screw (Institut Straumann AG, Waldenberg, Switzerland) used to treat six supracondylar fractures showed satisfactory results (Schatzker et al 1989).

We report our experience with 21 distal femoral fractures treated with this implant (Fig. 1).

PATIENTS AND METHODS

From June 1988 to September 1990, 19 patients with 21 fractures of the distal femur were treated by open reduction and internal fixation with the AO dynamic condylar screw (DCS) at Addenbrooke's Hospital, Cam-

bridge. Of these, 18 fractures were acute; only three presented with delayed or nonunion.

The age range (Fig. 2) was 22 to 91 years (mean 62.8); there were five men and 14 women. In ten patients the fractures resulted from simple falls at home, seven were road traffic accidents, one patient was crushed by falling bricks and one fell 20 feet (6 m) from a balcony.

Fig. 1

The AO dynamic condylar screw.

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Fig. 2

Age distribution of patients treated with the DCS.

Fig. 3a

Fig. 3b

Figure 3a – A grade C2 distal femoral fracture with an ipsilateral upper femoral shaft fracture; b) treated with a DCS and a shortened intramedullary nail.

Two patients had bilateral fractures. There were no significant associated injuries, apart from one patient with a fracture of the upper third of the shaft of the same femur. This was treated by an intramedullary nail, locked at the upper end. A shortened nail was used to allow room for the DCS (Fig. 3).

The AO classification (Müller et al 1990) (Fig. 4) was used to grade the fractures (Fig. 5). Four of the fractures had Gustilo grade-I open wounds.

The operation. The general anaesthesia used in all cases gave no major problems. Broad-spectrum antibiotics were given before the tourniquet application and continued for 48 hours. The patient was supine on an

A Femur distal, extra-articular fracture

- A1 simple
A2 metaphyseal wedge
A3 metaphyseal complex

B Femur distal, partial articular fracture

- B1 lateral condyle, sagittal
B2 medial condyle, sagittal
B3 in the frontal plane

C Femur distal, complete articular fracture

- C1 articular simple, metaphyseal simple
C2 articular simple, metaphyseal multifragmentary
C3 multifragmentary

Fig. 4

The AO classification of fractures of the distal femur (reproduced with the permission of the publisher, Springer-Verlag AG).

Fig. 5

The number of fractures in each AO grade.

orthopaedic table, and image intensification was used. Open wounds were thoroughly irrigated and debrided prior to fixation.

The fracture and the distal femur are exposed through a lateral incision deepened between vastus lateralis and the lateral intermuscular septum, with retraction of quadriceps (Fig. 6). Intra-articular fractures are anatomically reduced and temporarily held with Kirschner wires, taking care that these will not interfere with the positioning of the plate and screw. A guide wire is then inserted parallel to the anterior and inferior planes of the reduced condyles to direct the cannulated reamer. A channel is then reamed to 10 mm short of the medial cortex and if necessary, the bone is tapped. The lag screw is then inserted and the DCS plate is fitted to it with a compression screw. Axial compression is provided by a tensioning device and the plate is fixed to the shaft of the femur with 4.5 mm cortical screws. Image intensification is used throughout to check correct positioning of the implant. The wound is then closed over a suction drain. Bone grafting was added only in cases with established nonunion.

Continuous passive motion started on the second postoperative day for four hours twice daily until application of a functional brace at about 14 days. Weight-bearing then began. Functional bracing was maintained until there was clinical and radiological evidence of union.

RESULTS

In the 18 acute fractures the average delay between injury and internal fixation was 12 hours. There were no peri-operative deaths. The average hospital stay was 28.7 days; most patients quickly regained their mobility.

Clinical and radiological union, when it occurred, took an average of 11.3 weeks (range 6 to 16). Full extension was achieved in all 21 knees; the average range of flexion was 112° (range 80° to 130°); 14 knees flexed to

Fig. 6

Diagram to show the exposure of the lower end of the femur.

Fig. 7a

Fig. 7b

Grade C1 fracture of the distal femur in an osteomalacic patient: a) correct initial position; b) five months later when the screw has cut out of the bone.

110° or more, six to between 90° and 100°, and one to only 80°.

Complications. There was one case of deep vein thrombosis, treated with warfarin and intravenous heparin. One incontinent patient developed an area of skin breakdown around the top of her functional brace: this healed after urinary catheterisation.

Two patients required delayed bone grafting. In the first, a grade C2 fracture in a 56-year-old diabetic man united after grafting at six months. The other case was that of a C1 fracture in a 30-year-old vegetarian Indian woman. The fracture failed to unite and the screw cut out through osteomalacic bone (Fig. 7). The implant was removed and grafting performed.

DISCUSSION

Fractures of the distal femur are often comminuted. Young patients have often sustained high velocity injuries and old patients have osteoporotic bone: both of these features make conservative treatment unsatisfactory and internal fixation difficult.

Angle blade plates have been reported to give good results (Yang et al 1990), but the technique is demanding and the need to hammer the implant into position risks separating the femoral condyles. The DCS makes accurate reduction and fixation easier, particularly when the fractures are intra-articular. The lag screw held well, even in osteoporotic bone, and was easy to place in good position over a guide wire inserted under image intensification. Since most surgeons are already familiar with the use of a compression screw in the treatment of hip fractures, the instrumentation is readily mastered. Both patients who failed to unite had coexisting conditions which compromised healing; one was a diabetic and the other had osteomalacia.

There were no wound infections in our series though this included four open fractures. The use of prophylactic antibiotics and adequate wound toilet are important. We recommend delayed wound closure for open fractures, and early surgery for closed fractures before tissue viability has been compromised by swelling.

No patient had decubitus ulceration or a chest infection. This may be due to the early mobilisation made possible by stable internal fixation augmented with functional bracing.

When a fracture is treated by rigid internal fixation, external bridging callus is usually suppressed; healing is

then dependent on medullary callus and direct osteonal penetration (McKibbin 1978). We found that this was not the case with fractures treated with the DCS. Substantial external callus was observed in all cases which united (see Fig. 3b) suggesting that the DCS does not provide rigid fixation, perhaps because a lag screw inserted into cancellous bone allows some movement at the fracture.

Conclusions. The AO dynamic condylar screw is an effective and technically undemanding method of treating supracondylar and intercondylar fractures of the femur.

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