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Injury, Int. J. Care Injured 31 (2000) 169–173

INJURY
INTERNATIONAL JOURNAL OF THE CARE OF THE INJURED

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Management of distal femoral fractures in elderly patients using retrograde titanium supracondylar nails

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Accepted 18 October 1999

Abstract

We present our experience with a retrograde supracondylar nail used for the management of fractures of the distal femur in elderly patients. Eighteen fractures of the distal femur in 18 patients were treated with AIM titanium supracondylar nails. Sixteen patients with a median age of 83 years (62–100 years) were finally available for review. All 16 fractures were classified as extra-articular type A according to the AO classification. The average operative time was 58 min. Follow up ranged between 4 and 35 months (average 20.4 months). Fifteen fractures (93.7%) united in an average duration of 3.6 months. The average range of motion achieved at the knee was 100.6°. There were no implant failures, knee sepsis or wound healing problems. One non-union and two stress fractures of the femur above the nail were the main complications in this series.

We concluded that the AIM titanium supracondylar nail is a useful alternative implant for the management of the osteoporotic fractures of the distal femur particularly the extra-articular AO type A fracture in the elderly population.

1. Introduction

Fractures of the distal femur in the elderly population are difficult to treat because of osteopenia and preexisting hip and knee disabilities which can also predispose to these fractures [1]. Stewart et al. and Neer et al. recommended conservative management because of the possibility of infection and inadequate fixation [2,3]. However, with improvement in techniques and instrumentation, surgical treatment has been recommended to reduce the period of immobilisation and morbidity [4]. Rigid internal fixation of osteoporotic fractures in elderly patients is difficult because of degree of comminution and poor bone stock [5–7]. The antegrade nailing can be technically difficult in an arthritic and stiff hip and can not be used in the presence of other implants in the proximal femur. Recently retrograde nailing has gained popularity in the management of these fractures for distinct advantages of preservation of the fracture haematoma, decreased blood loss, minimal soft tissue dissection, less operative time and reduced rate of infection [8–12]. Satisfactory results have been reported in elderly patients after using an interlocking retrograde supracondylar nail [10–12] and Zickel supracondylar nail [13] for distal femoral fractures. We present our results of using the AIM titanium supracondylar nail in the management of distal femoral fractures in elderly patients.

2. Materials and methods

Eighteen fractures of the distal femur in 18 patients were treated with the AIM titanium supracondylar nail (DePuy ACE) between July 1995 and April 1998. One patient died due to medical reasons before adequate post-operative follow up was completed; another patient failed to attend the clinic for final assessment being asymptomatic, leaving 16 patients for final

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0020-1383/00/$ - see front matter
PII: S0020-1383(99)00275-2

Table 1
Summary of fracture type, associated disabilities and results

SN	Sex	Age	AO	Preexisting disabilities	Union time (months)	ROM Knee	Complications
1	F	85	A2	3 months old ipsilateral # tibia & fibula	7	0–90	
2	F	86	A2	B/L THR	3	30–90	stress fracture
3	F	68	A2	–	4.5	5–120	–
4	F	62	A1	–	3	0–120	–
5	F	81	A2	–	–	0–130	non-union
6	F	100	A3	OA knees	3.5	10–100	–
7	F	82	A1	ipsilateral THR, B/L leg ulcers	7	5–90	stress fracture
8	F	92	A2	ipsilateral hemiarthroplasty	4	10–110	–
9	F	84	A1	–	3	10–110	–
10	F	88	A1	severe OA and B/L genu valgus	2	10–80	–
11	F	82	A2	OA knees	2	0–90	–
12	F	74	A2	–	4	0–130	–
13	F	92	A2	ipsilateral TKR	4	10–90	–
14	F	87	A2	Alzeihmer's disease	3	10–120	–
15	F	66	A2	–	2	0–130	–
16	F	82	A2	OA knee	3	10–120	–

review. Two patients died 6 months after the operation due to unrelated causes but since the fractures had united, they were included in this study. All 16 patients were females with a median age of 83 years (62–100 years). Low velocity trauma by minor fall was the cause of the fracture in all patients. Nine fractures involved the left leg and seven involved the right side. According to the AO classification [14], four fractures were classified as type A1, 11 as type A2 and one as type A3 fracture. There were no open fractures. No neuro vascular injury was noted in this series. A high prevalence of preexisting disabilities was noted in this series. Four patients already had an implant in the femur on the ipsilateral side (Table 1).

The AIM titanium supracondylar nail is available in two diameters of 10 and 12 mm and four lengths of 150, 200, 250 and 300 mm. Unlike other designs this nail has only two holes at each end for interlocking. Both proximal and distal interlocking can be carried out using a single jig, except for the longest nail where free hand technique is used for proximal interlocking.

3. Operative technique

The patient is positioned supine with the knee on the affected side flexed to 45–60° across a thigh support on a radiolucent table. A midline skin incision with medial parapatellar approach was used. The fracture was aligned anatomically by closed reduction and the fragments were allowed to impact into each other. An entry point was made in the intercondylar notch just anterior to the attachment of the posterior cruciate ligament. Under radiographic control, a guide wire was passed in the centre of the medullary canal to prevent angulation at the fracture site. The medullary canal was reamed only distally so as to accommodate the broad distal end of the nail. In all patients a nail of the thickest diameter (12 mm) was used to obtain a better alignment and stability. The nail was counter sunk 3–5 mm below the articular surface to avoid impingement during knee flexion. After interlocking the nail distally, the reduction and the alignment were checked again under an image intensifier and if required final adjustments were carried out. The reduction was maintained by firmly holding the jig till the nail was locked proximally. Distal screws were applied firmly but not tightly and advanced by an additional 5 mm for better purchase in the cortex. None of the patients underwent primary bone grafting. The average operative time was 58 min.

4. Post-operative management

All patients received three doses of intravenous antibiotic. Physiotherapy for the knee was commenced from the first post-operative day. Partial weightbearing was started as soon as the patient's general condition permitted. Eight patients with severe osteoporosis and those that found partial weightbearing difficult, were initially mobilised in a hinged cast brace for 2–4 months. Depending upon clinical and radiological progress, mobilisation was gradually progressed to full weightbearing, usually possible in 6–8 weeks. A fracture was considered united if there was no pain at the fracture site, the patient was able to full weightbear and the anteroposterior and lateral radiographs showed a four-quadrant bridging callus across the fracture site. If there was no callus and the fracture line was still visible at 6 months, it was regarded as non-union. The average follow up was 20.4 months

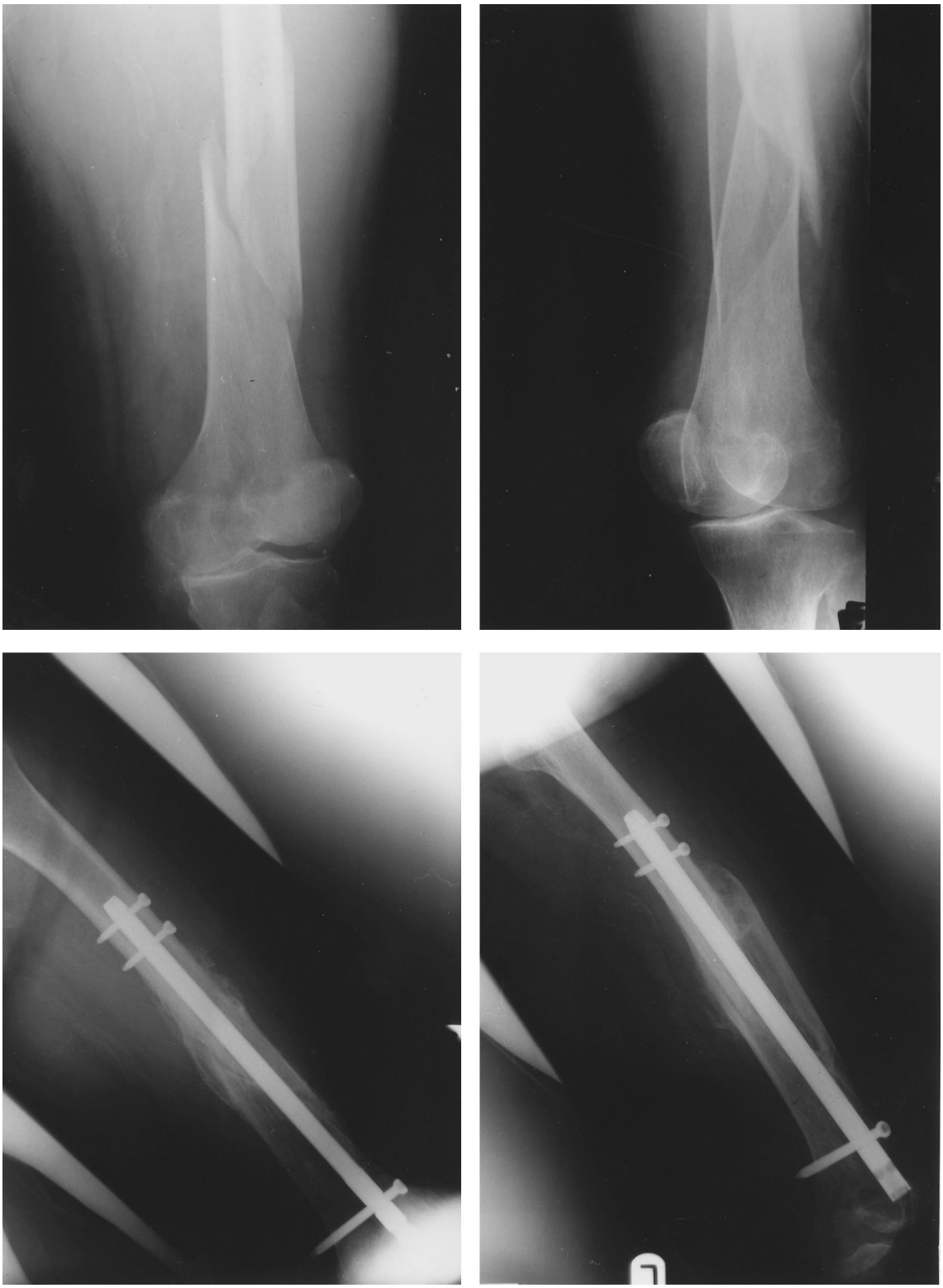

Fig. 1. AP and oblique view: a long spiral fracture of the distal femur in a 82 year old lady (top). AP and oblique view: 5 months post-operative showing complete union (bottom).

with a range of 4–35 months. On final examination all fractures had either progressed to union or were declared as ununited.

5. Results

In eight fractures early callus was seen within the first 3–6 weeks after surgery. Fifteen of 16 fractures, united in an average duration of 3.6 months (2–7 months). None of the patients required any secondary procedure to achieve union. The average range of motion at the knee was 100.6°, with an average extensor lag of 6.9°. None of the fractures united with an angulation of more than 10° at the fracture site. There was an average shortening of 1.4 cm. One patient had a shortening of 4 cm following malunion of a conservatively treated stress fracture of the femur above the nail, whereas other patients had a shortening in the range of 0–2.5 cm. There were no implant failures, knee sepsis or wound healing problems. There was loosening of a distal screw in one patient 4 weeks after the operation. The radiographs showed good early callus and the screw was removed under local anaesthesia which did not affect the final outcome (Fig. 1). One patient had some tenderness at the site of insertion of a distal screw.

Immediate post-operative complications included chest infection in one patient which resolved with intravenous antibiotics; congestive cardiac failure in another patient which was also treated successfully.

There was one non-union and two stress fractures of the femur. The patient with the non-union was mobilising without any pain with a single stick and refused any surgical intervention. Two patients sustained fracture of the shaft of the femur just above the nail while the original distal fractures were still uniting. Both patients had a preexisting ipsilateral total hip replacement. In one patient, the fracture was treated with open reduction and internal fixation with plate and screws. The fracture united in 15° of varus angulation after the plate showed signs of loosening. The original supracondylar fracture united in satisfactory alignment within 3 months of the injury. The second patient had very restricted mobility because of ischaemic ulcers over both ankles and a painful hip on the same side. She was treated conservatively in a hinged cast brace and the fracture united in 25° of valgus angulation. The original supracondylar fracture took 7 months to heal, but again in good alignment.

6. Discussion

Fractures of the distal femur in the elderly population are difficult to manage as these patients cannot tolerate prolonged immobilisation and operative intervention is associated with risk of anaesthetic and surgical complications. The main objective of surgery in elderly patients is early ambulation and achieving a stable painless weightbearing limb with preservation of knee function [1]. Rigid internal fixation is often difficult in an osteoporotic bone and some studies have shown less satisfactory results with stable internal fixation in elderly patients [5–7]. Schatzker and Lambert suggested closed reduction and early cast bracing to treat distal femoral fractures in elderly patients [5]. Benum suggested the use of bone cement to improve fixation when using an angled blade plate because of frequency of pull out [15]. The extensive approach and prolonged exposure required to fix these fractures with lateral devices can lead to increased chances of infection [16,17], especially in a debilitated elderly patient with poor resistance to infection [1]. There were no cases of knee sepsis or wound healing problems in this series.

In the osteoporotic fractures anatomical reduction of the fragments is often difficult and can result in shortening [13,16,17]. We allowed the fracture ends to impact against each other maintaining the alignment between two fragments which resulted in an average shortening of 1.4 cm. Primary bone grafting has been suggested with extramedullary devices to enhance the bone union in the osteoporotic fractures [5,16,17]. None of our patients underwent bone grafting and the morbidity from the bone graft site was avoided. A union rate of 93.7% achieved in an average period of 3.6 months is comparable to the union rate of 87–100% reported by other authors using a retrograde intramedullary nail in the same age group [10–13]. There was one non-union where slight distraction at the fracture site was noted on the first post-operative radiograph. This was attributed to a technical error rather than an implant problem. Good results have been reported after internal fixation using an angled blade plate and dynamic condylar screw [16–18]. The mean ages in these series were 47, 47.2 and 59 years, respectively and for this reason comparison of our results with those reported in these series should be made with caution.

The retrograde femoral nail has been found to be mechanically similar to a 95° blade plate in clinically important loading modes, i.e. varus compression loading in laboratory studies [19]. However, a nail with multiple holes spaced throughout the length can undergo fatigue fracture through one of the holes [8,9,12]. There were no cases of bent or broken nails in our series. This nail being a titanium nail has the advantage of better strength, better biocompatability and high corrosive resistance compared to stainless steel and Co–Cr alloy implants [20]. There were no cases of loss of fixation or reduction except loosening of a dis-

tal screw in one patient 4 weeks after surgery. The screw was removed which did not affect the final outcome.

In this series, two of the four patients who had a preexisting implant in the femur sustained fracture of the femoral shaft just above the nail without significant trauma. Both patients had a femoral prosthesis from previous total hip arthroplasty. Similar complication has been reported previously after using lateral devices [17,18] and a retrograde nail [8] in the absence of other implants in the femur. Though titanium has a modulus of elasticity close to the bone, as compared to other alloys, an area of high stress concentration between two intramedullary implants caused the fracture of the shaft of the osteoporotic femur. Although good results have been reported after using a supracondylar nail in the management of femoral fractures in the presence of other femoral implants [11], we recommend caution after using this implant in such cases.

At the latest follow up, the majority of the surviving patients were satisfied with the functional outcome after surgery. A satisfactory average range of motion of 100.6° was achieved considering that elderly patients gain significantly less knee flexion than younger patients [21]. Only one patient, who had bilateral severe osteoarthritis with genu valgum, failed to achieve a knee flexion of 90° but the movement achieved was similar to the opposite uninjured knee. We have not used any rating scale to measure the functional outcome after surgery, as none of these scales take into account the age of the patient, the fracture subtype, associated injuries and preexisting conditions which can affect the functional outcome [5]. Therefore, a comparison among various studies becomes difficult.

In conclusion, we believe that a retrograde supracondylar nail, in this case the AIM titanium nail, is a useful alternative implant for the management of the osteoporotic fractures of the distal femur, particularly the extra-articular AO type A fracture in the elderly population. Further studies with a larger number of patients and different types of fractures are recommended.

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