ZICKEL SUPRACONDYLAR NAILING FOR SUPRACONDYLAR FEMORAL FRACTURES IN ELDERLY OR INFIRM PATIENTS

A REVIEW OF 33 CASES

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We report 33 cases of femoral supracondylar fracture in elderly or debilitated patients treated by Zickel supracondylar nails.

Most of the patients were female and their mean age was 79 years. All had concurrent medical problems and only nine could walk unaided. The operating time averaged one hour and mean blood loss was 100 ml. Postoperative management was by mobilisation in a cast brace or plaster.

Six patients died before fracture union; all the others achieved union at an average of 12 weeks. The results were excellent in terms of pain relief, movement and function; there were no infections or nonunions. The locking screws backed out or broke in 26% but this did not prejudice the outcome.

Use of the Zickel system is recommended for this group of frail patients.

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Supracondylar fracture of the femur is usually seen in two groups of patients. In the younger group, comminuted, often intra-articular fractures result from high-velocity trauma and are best treated by anatomical reduction and stable internal fixation (Olerud 1972; Schatzker and Lambert 1979; Mize, Bucholz and Grogan 1982). By contrast, supracondylar fractures in elderly patients are often simple and caused by minor trauma. The osteoporotic bone and the patients' general health and poor mobility make treatment difficult.

Conservative management requires a long period of immobilisation, often fails to control the supracondylar fragment and leads to stiffness of the knee (Schatzker and Tile 1987).

Rigid internal fixation is often unsuccessful in osteoporotic bone (Moore et al 1987; Radford and Howell 1992). Intramedullary fixation may offer a solution as this can provide fracture stability without dependence on bone quality. Locking nails are either unsuitable for low supracondylar fractures or require insertion through the knee. Rush pins (Shelbourne and Brueckmann 1982) and Ender's nails (Kolmert, Egund and Persson 1983) have been advised, but the Zickel supracondylar nail (Zickel et al 1977) was designed specifically for these fractures. These nails (Howmedica (UK) Ltd, Park Royal, London, UK) are supplied as pairs, medial and lateral, with flexible tapered blades expanded at the condylar end into a cannulated block (Fig. 1). The block accepts a special cancellous screw with an integral circlip washer. The nails are available in three widths: 5 mm, 7.5 mm and 11 mm, but with a uniform 275 mm length.

PATIENTS AND METHODS

From January 1990 to May 1992, a total of 33 consecutive elderly or infirm patients with distal femoral fractures were treated by Zickel supracondylar nails at the Birmingham Accident Hospital or the Royal Hospital, Wolverhampton. Infirm patients were defined as having three or more significant intercurrent medical conditions (Table I). There were 29 women and four men; their mean age was 79 years (38 to 98; Fig. 2). The mechanisms of

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Fig. 1

A pair of Zickel supracondylar nails with locking screws in place.

Fig. 2

Age distribution of 33 patients with supracondylar fractures of the femur.

Table I. Pre-existing medical conditions and their incidence in 33 elderly patients with supracondylar fractures

Anaemia (iron-deficient and pernicious)	8	Atrial fibrillation	3
Congestive cardiac failure	10	Hypertension	6
Chronic renal failure	1	Hypothyroidism	1
Rheumatoid arthritis	3	Joint contractures	2
Osteoarthritis	9	Epilepsy	4
Vertebrobasilar insufficiency	1	Spinal stenosis	2
Diabetes mellitus	2	Dementia	5
Peptic ulceration	2	Blindness	1
Parkinson's disease	2	Malignancy	2
Cerebrovascular accident	3	Varicose ulceration	3

Table II. Mechanism of injury in 33 elderly patients with supracondylar fractures

	Number
Simple fall	25
Fall down steps or stairs	4
Pedestrian road-traffic accident	3
Moved in bed	1

Table III. Classification of 33 supracondylar fractures

	AO classification	Number
Simple/extra-articular	33-A1	21
Metaphyseal wedge/extra-articular	33-A2	2
Comminuted metaphyseal/extra-articular	33-A3	3
Simple metaphyseal/intra-articular	33-C1	5
Comminuted metaphyseal/intra-articular	33-C2	2

injury are shown in Table II: 75% had had simple falls. The mobility of the group was poor even before injury: only nine patients could walk unaided, 21 required walking-sticks or a frame and 15 of these were house-bound. Three were bedbound. There were significant concomitant medical problems in 75%, and 25% already had an implant in the femur for either previous trauma or arthritis.

Supracondylar fractures were classified according to the AO system (Table III). Only one was compound (grade 1) and one pathological, from a myeloma deposit.

Operative technique. The anaesthetised patient is placed on a traction table with the injured leg draped to allow access to both sides of the involved knee. Under image-intensifier control, closed reduction is attempted. In the three cases in which this was not possible the lateral incision was later extended proximally to facilitate access for reduction.

A 5 cm incision is made over the lateral femoral

condyle and the cortex penetrated with an awl. The lateral nail is then introduced and advanced until it reaches, but does not cross, the fracture. Its position is checked by screening in two planes. The medial nail is then placed through a similar incision on the medial side of the knee and also checked.

Table IV. Modification by Wilde et al (1989) of the Neer scoring system for outcome

	Score	Definition
Pain	4	No pain in all ranges of motion
	3	Pain with normal daily activity
	2	Minimal activity gives pain
	1	Pain at rest
Movement (degrees)	4	Flexion > 100; no FFD
	3	FFD or flexion limited to 70 to 100
	2	Flexion to 30 to 70
	1	Flexion < 30
Function	4	Full weight-bearing, normal gait, no impairment of function
	3	Limp, no restriction of activity
	2	Requires walking aid
	1	Cannot walk because of fracture
Shortening (cm)	4	0 to 0.5
	3	0.5 to 2.5
	2	2.5 to 5
	1	> 5
Angulation (degrees)	4	None
	3	< 10
	2	10 to 15
	1	> 15

Table V. Mean final scores and range for 27 patients

	Mean	Range
Pain	3.5	2 to 4
Movement	3.3	2 to 4
Function	2.5*	1 to 4
Shortening	3.0	1 to 4
Angulation	3.5	1 to 4

* see text for discussion

At this stage the two nails usually have enough purchase on the distal fragment to allow the reduction to be completed. The nails are then advanced across the fracture and driven home. Holes are drilled into the metaphysis through each of the cannulated ends and screws of the correct length inserted. A final radiological check is made before the wounds are closed.

RESULTS

The mean time of anaesthesia was one hour (35 minutes to 115 minutes); operating time accounted for about half of this. The average blood loss was 100 ml (50 to 400). At about five days after the operation, patients who had

been mobile were fitted either with a cast brace (78%) or a plaster cylinder (13%). Those who had not been mobile (9%) continued in canvas splints or padded bandages.

Full or partial weight-bearing was allowed at the discretion of the physiotherapists, but we preferred partial weight-bearing where this was possible. The plaster or cast brace was retained for 3.5 to 18 weeks (mean 12) and an average of 7 weeks (1.5 to 16) was spent in hospital. Most of the patients were discharged to residential or nursing homes.

Six of the 33 patients (18%) died before fracture union and were excluded from assessment of the clinical and radiological outcome. The mean time to union in the 27 remaining patients was 12.4 weeks (5 to 22).

Outcome measurement. Outcome was assessed using the Wilde modification of the Neer scoring system (Wilde et al 1989; Table IV), since this was more appropriate for our elderly, retired population. A total of 20 points was divided equally into five categories: these were pain, movement, function, shortening and angulation. The mean score for the group was 16; details are shown in Table V.

Pain. No patient had tenderness at the fracture site, but 11 (41%) already had arthritic knee pain which had been present before the injury. Four (15%) reported that knee pain had increased in severity by the time of their review; three of these had intra-articular fractures (type C1). None of the other seven, who had no increase in knee pain, had an intra-articular fracture.

Fig. 3

The range of knee movement at final review in 27 patients.

Movement. The mean range of movement was 89.5° (40 to 120); 64% achieved knee flexion beyond 90° (Fig. 3). There was a mean fixed flexion deformity (FFD) of 12.5° (5 to 20) in 24%. One patient had an FFD of 80° in both legs before operation, with a range of 40°. This did not deteriorate after surgery and therefore was not included in the calculation of mean FFD.

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Versatility of Zickel supracondylar nails. Figure 4 – Shortened for use in an achondroplastic dwarf. Figure 5 – Shortened to treat a supracondylar fracture below a cemented total hip arthroplasty. Figure 6 – Nails passed up around the screws of a Dynamic Hip Screw plate. Figure 7 – Inserted above the condylar component of a total knee arthroplasty.

Function. The mean score of 2.5 appears to be poor, reflecting the numbers of patients requiring walking aids, but only nine of the surviving patients (33%) had unrestricted mobility before their fracture. In these nine, the mean function score was 3.3, and four regained their prefracture level of activity. Three were mobile but with a limp or loss of walking distance and two required sticks. None of them needed to use a frame.

Shortening. All but one of the 27 surviving patients had some shortening. This was 0.5 to 2.5 cm in 85% and 4 to 6 cm in 15%. All those with over 4 cm who had been mobile before injury were offered a compensatory shoe raise.

Angulation. Taking 7° valgus as normal, 54% of the fractures united without angulation. In 21% there was a valgus deformity (mean 14°, range 10 to 20) and in the remaining 25%, a varus deformity (mean 1°, range 0 to 5).

Complications. There were no cases of infection, non-union or perioperative death. Seven locking screws backed out (three medial and four lateral); one medial screw broke. Successful treatment was by removal of the screws under local anaesthesia. No nails backed out or broke.

One patient developed a plaster sore under a cast brace at ten weeks: the cast was removed but this did not adversely affect the final result. One fracture redisplaced as the patient was being moved off the operating table. Remanipulation was successful and union was uneventful.

Technical problems. The Zickel system was found to be easily adaptable for difficult fractures, abnormal femora, or those containing a previous implant.

Simple intercondylar extensions of the fracture were reduced closed and held by a single, cannulated, intercondylar cancellous screw before placement of the nails. Nails were shortened before insertion in an achondroplastic dwarf with a short femur (Fig. 4) and for use below a cemented total hip replacement (Fig. 5). In one case, the nails were passed up alongside the screws securing a plate to the upper femur (Fig. 6). At the lower end they can be inserted above a surface total knee replacement (Fig. 7).

DISCUSSION

Management of supracondylar fractures in elderly patients presents considerable technical and medical problems, but we could find no previous paper reporting specifically on this challenging group. The aims of painfree union and restoration of previous mobility are difficult especially in elderly women with osteoporosis who cannot tolerate prolonged or extensive surgical procedures.

Kolmert and Wulff (1982) found that 84% of supracondylar fractures were in patients aged over 50 years, with a female to male ratio of 3.5 to 1. Only 13% of fractures occurred in men aged over 65. Most reports on the internal fixation of these fractures in general deal with predominantly male populations with a mean age of under 60 years (Olerud 1972; Schatzker and Lambert

1979; Moore et al 1987; Yang, Lui and Liu 1990; Radford and Howell 1992). Our patients had a female to male ratio of 7 to 1 and a mean age of 79 years. This group probably represents those that account for the poor results in published series of wider populations.

Radford and Howell (1992) report a number of disastrous failures of fixation due to the difficulty in achieving anatomical reduction and stable internal fixation in osteoporotic bone. Schatzker and Lambert (1979) also noted more frequent failure of rigid internal fixation in patients aged over 50 years, and they concluded that for some elderly, osteoporotic patients this method was "clearly beyond the surgeon's ability".

We believe that anatomical reduction and fixation often means that there is no bony support at the fracture site, so that increased stress at the implant-bone interfaces leads to implant failure. Paradoxically, failure of rigid internal fixation often results in secondary healing by callus formation, similar to that reported by Pemberton and Evans (1993) after fixation with flexible carbon-fibre plates. The Zickel supracondylar device controls angulation and rotation but allows axial impaction. Such impaction implies shortening, but we consider that this is desirable for union of these fractures and is the probable reason for the 100% rate of union. Osteoarthritic knee pain was sometimes exacerbated, usually when there had been an intercondylar component of the fracture, but residual pain at the fracture site was not a problem.

The Zickel device requires much less soft-tissue disturbance than other methods and so causes less operative morbidity, muscular scarring and loss of knee flexion. Moore et al (1987) cite nonunion and knee stiffness as the major reasons for the fact that almost 50% of patients who had previously been freely mobile failed to regain this. Loss of mobility is potentially disastrous for elderly patients, often resulting in life in an institution. Of the 15 patients in our series who had been independently mobile outdoors before their fracture, 80% retained this ability. We consider that shortening is acceptable if it is associated with high rates of union and does not prevent return to prefracture levels of activity.

One minor problem is the backing out of locking screws. This was seen in 7 of 54 screws (13%) and did not appear to be related to the type of fracture, either nail or the patients' level of activity. It was not prevented by the integral circlip washers which snap into the nail. These failures never prejudiced the final results because the screws appeared to remain in place long enough to prevent migration of the nail.

Conclusions. The Zickel supracondylar nail system is versatile, technically simple and associated with minimal operative morbidity. We obtained consistently good results in terms of fracture healing and mobility with no serious complications.

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