



## Treatment of distal femoral fractures in elderly diabetic patients using minimally invasive percutaneous plating osteosynthesis (MIPPO)

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**The aim of this study was to evaluate the results of minimally invasive percutaneous plate osteosynthesis (MIPPO) of distal femoral fractures in elderly diabetic patients with osteoporotic bone. Thirteen supracondylar or intercondylar femoral fractures were treated by MIPPO with a locked plate without bone grafting. All fractures healed, with only one delayed union in a patient who had deep infection. Results were evaluated using Schatzker and Lambert's criteria; all patients had excellent, moderate or good results except one with a poor result. Minimally invasive percutaneous locked plating provided favorable results in the treatment of distal femoral fractures in this geriatric population.**

**Key words :** distal femur ; minimally invasive percutaneous plating ; elderly ; diabetic.

### INTRODUCTION

Fractures of the distal femur represent 4-6% of all femoral fractures (5). The traditional concept of internal fixation which requires an extended approach to the fracture fragments is presently being challenged by a more biological, atraumatic approach with careful handling of the soft tissue envelope and without bone grafting.

The ultimate aim in treating these fractures in a geriatric population is to achieve rapid bony union and allow early mobilisation, thus minimizing such side effects as joint stiffness, muscle wasting and deep vein thrombosis (6). Recent studies have re-

ported that indirect reduction and biological fixation using percutaneous plating can restore the length and alignment with rapid union of the comminuted fracture without direct manipulation of the fracture fragments (7,13).

### PATIENTS AND METHODS

Between March 2006 and March 2009, 13 diabetic patients older than 60 years with closed distal femoral fractures were treated by one surgeon in our department with a percutaneous locked plate. This study included one male and twelve female patients. Their mean age was 67 years with a range from 62 to 74 years. All patients but one had non-insulin dependent diabetes mellitus. Associated comorbidities included hypertension in 7 patients, ischaemic heart disease in 5 patients and diabetic nephropathy in 5 patients. Glycaemia control was achieved preoperatively. Most patients suffered a

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low-energy injury. According to the AO classification, six patients had type A, three type B and four type C fractures. All fractures were closed, without major soft tissue damage. All patients were treated surgically within one week from the injury.

### Surgical technique

All operations were performed under spinal anaesthesia. Antibiotic coverage was achieved with parenteral cefotaxime for 5 days. The patient was placed in a supine position on a radiolucent operating table. A supporting pad was placed under the knee in 30° flexion with the patella pointing upward. Small proximal and distal incisions were made over the lateral aspect of the thigh with deep dissection down through the ilio-tibial tract and vastus lateralis muscle in line with their fibres to the plane between the periosteum and the vastus lateralis muscle. The lateral cortex of the femur was exposed using two Hohmann retractors, one ventral and one dorsal, in both incisions. The locked plate was introduced submuscularly under fluoroscopy to check its correct position. The fracture was reduced accurately with manual traction, a percutaneous clamp or a femoral distractor. The plate was then held temporarily by K-wires. Distal fixation was performed first, then proximal fixation from the proximal incision and through stab incisions over the thigh.

Postoperatively, patients were allowed to perform hip and knee motion as tolerated. Protected weight bearing was allowed for 8-12 weeks, with gradual increase in weight-bearing as fracture union was seen to progress. Radiographic evaluation was performed every six weeks until complete healing.

Clinical union was considered satisfactory if the progressive consolidation process made the fracture site stable and pain free. Roentgenographic union was considered satisfactory when plain radiographs showed bony trabeculae or cortical bone crossing the fracture site (12).

### RESULTS

This study included 13 patients with distal femoral fractures. According to the AO/ASIF clas-



*Fig. 1.* — 75-year-old woman with C<sub>1</sub> fracture of the distal femur.

sification, there were six patients with type A (simple) fracture patterns, three with type B (wedge), and four with type C (complex). All patients were treated using a distal femoral locked plate. The average operative time was 100 minutes. All fractures were followed up at least until fracture union. Average follow-up was 22.4 months (range : 14-28 months). Fracture union was achieved after 5 months in 9 patients, after 8 months in 3 patients, and after 13 months in one patient. There were two cases with a wound complication : one patient with non-insulin dependent diabetes mellitus developed superficial infection and another patient with poorly controlled insulin-dependent diabetes mellitus developed deep infection ; they were treated with parenteral antibiotic and wound washouts. The patient with deep infection had a type C fracture ; infection subsided in response to the previous measures with close monitoring of the blood sugar level but he had delayed union and a 15° varus mal-



**Fig. 2.** — Same patient as fig 1 ; radiograph 7 months post-operatively, showing good fracture union.

alignment. The functional results were rated using Schatzker and Lambert's criteria (10), and graded as excellent in six (46%) patients, good in three (23%), fair in three (23%) patients and poor in one (8%).

## DISCUSSION

Fractures of the distal femur are difficult to treat ; operative treatment is usually recommended to

achieve a favourable outcome (2). Problems with conventional open reduction and internal plate fixation include infection, delayed union and non-union. Osteoporotic bone further complicates the problem because of poor implant anchorage in bone.

In a good review study of fracture fixation problems in osteoporosis Strømsøe (11), concluded that osteoporotic bone retains its capacity for fracture healing and the problem in these patients is mainly a fixation problem. Minimally invasive approaches and indirect reduction techniques using percutaneous locked plates can achieve the difficult goal of fixing these osteoporotic fractures. The plate acts as an internal fixator, not crushing the periosteum and thereby preserving the blood supply. The proximal end of the plate is shaped to allow easy submuscular insertion, with less dissection than for traditional implants.

The distal screws are convergent and lock into the plate. The plate/screw combination acts as a fixed-angle device. This makes it very resistant to pull out. The screws have also been modified, with a thicker core to provide more resistance to axial load and a shallower thread to reduce cut-out in osteoporotic bone in the elderly (3). Retrograde intramedullary nails, although less invasive, are not ideal for stabilizing fragmented articular fractures (12). The fixation provided in the distal fragment by interlocking bolts is poor, due to their large

Table I. — Clinical and radiological data of the patients studied.

Cases	Age (yrs)	Gender	Fracture type	Schatzker & Lambert Criteria	Follow-up period (months)	Radiological union (weeks)
1	65	—	C2	Good	28	42
2	62	—	A3	Excellent	28	25
3	67	—	A3	Excellent	26	26
4	70	—	B3	Good	27	20
5	61	—	B3	Moderate	25	23
6	64	—	A3	Excellent	24	15
7	73	—	C3	Poor	26	60
8	65	—	B3	Excellent	22	21
9	68	—	C3	Good	19	41
10	72	—	A3	Moderate	19	18
11	74	—	A2	Excellent	18	22
12	63	—	A3	Excellent	16	24
13	66	—	C2	Moderate	14	42

core diameter and small thread size (1). Krettek *et al* (4) have emphasized the need to obtain relative rather than absolute stability of the fracture by internal fixation. This concept was familiar in relation with intramedullary nails. They also suggested minimal interference with the zone of injury. This was achieved by sliding plates in the submuscular plane on the lateral side of the femur. Minimally invasive percutaneous plate osteosynthesis (MIPPO) was carried out in this study on elderly diabetic patients in whom there was an increased risk for unstable fixation and infection. The overall result was satisfactory. All fractures united and the outcomes were good.

Adjustment of the diabetic status and early operative treatment with MIPPO are crucial for these geriatric patients to allow early mobilization and to avoid serious complications from prolonged recumbency. In type C fractures, open reduction of the articular surface is inevitable to prevent deformity and to allow early motion.

Bone graft is rarely required, biology is maintained, which is beneficial in this group of patients to minimize surgical time and avoid donor site morbidity (10). The small incision proximal to the fracture is important to prevent malposition of the proximal end of the plate. If the plate is not central on the bone, the screws will lock into the plate, but will have inadequate bone purchase, resulting in poor hold and possible pull out (8). The use of longer plates (7-9 holes) is recommended as they provide a longer working length and as result, a more stable construct.

A persistent problem with comminuted supracondylar fractures involving the medial column is varus collapse. In our series, only one patient with a type C fracture who developed early infection ended up with a 15° varus malalignment. The infection rate in this series was low. As regards time to fracture union, our observations are comparable to those reported by Wong *et al* also in elderly patients (14). Despite its limitations – the small sample size and intermediate term follow-up – the results of the present study support the use of MIPPO in this particular group of geriatric patients.

## REFERENCES

1. **Firoozbakhsh K, Behzadi K, DeCoster TA, Moneim MS, Naraghi FF.** Mechanics of retrograde nail versus plate fixation for supracondylar femur fractures. *J Orthop Trauma* 1995 ; 9 : 152-157.
2. **Giles JB, DeLee JC, Heckman JD, Keever JE.** Supracondylar intercondylar fractures of the femur treated with supracondylar plate and lag screw. *J Bone Joint Surg* 1982 ; 64-A : 864-870.
3. **Kregor PJ, Stannard J, Zlowodzki M, Cole PA, Alonso J.** Distal femoral fracture fixation utilizing the Less Invasive Stabilization System (L.I.S.S.) : the technique and early results. *Injury* 2001 ; 32 Suppl 3 : SC32-47.
4. **Krettek C, Schandelmaier P, Miclau T, Tschern H.** Minimally invasive percutaneous plate osteosynthesis (MIPPO) using the DCS in proximal and distal femoral fractures. *Injury* 1997 ; 28 Suppl 1 : A20-30.
5. **Martinet O, Cordey J, Harder Y et al.** The epidemiology of fractures of the distal femur. *Injury* 2000 ; 31 Suppl 3 : C62-63.
6. **O'Brien PJ, Meek RN, Blachut PA, Broeknuyse HM.** Fractures of distal femur. In : Buchholz RW, Heckman JD (eds) *Rockwood and Green's Fractures in Adults*, 5th ed. 2001, Lippincott Williams & Wilkins, Philadelphia, pp. 1731-1773.
7. **Oh CW, Kyung HS, Park IH, Kim PT, Ihn JC.** Distal tibia metaphyseal fractures treated by percutaneous plate osteosynthesis. *Clin Orthop Relat Res* 2003 ; 408 : 286-91.
8. **Schandelmaier P, Partenheimer A, Koenemann B, Grün OA, Krettek C.** Distal femoral fractures and LISS stabilization. *Injury* 2001 ; 32 Suppl 3 : SC55-63.
9. **Schatzker J, Lambert DC.** Supracondylar fractures of the femur. *Clin Orthop Relat Res* 1979 ; 138 : 77-83.
10. **Schütz M, Müller M, Krettek C et al.** Minimally invasive fracture stabilization of distal femoral fractures with the LISS : a prospective multicenter study. Results of a clinical study with special emphasis on difficult cases. *Injury* 2001 ; 32 Suppl 3 : SC48-54.
11. **Strømsøe K.** Fracture fixation problems in osteoporosis. *Injury* 2004 ; 35 : 107-113.
12. **Whittle AP.** Fractures of the lower extremity. In : Canale ST, Beatty JH, eds. *Campbell's Operative Orthopaedics*. 11th ed. Mosby Elsevier, Philadelphia, Pa ; 2007, chap 51.
13. **Wiss DA.** What is new in orthopaedic trauma ? *J Bone Joint Surg* 2001 ; 83-A : 1762-1772.
14. **Wong MK, Leung F, Chow SP.** Treatment of distal femoral fractures in the elderly using a less- invasive plating technique. *Int Orthop* 2005 ; 29 : 117-120.