



## Open intramedullary nailing of neglected femoral shaft fractures : Indications and outcome

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**The management of neglected femoral shaft fractures poses a challenge to the orthopaedic surgeon. We evaluated the outcome of open intramedullary nailing of neglected femoral shaft fractures at our centre. A total of 52 patients with 55 femoral shaft fractures, with a mean age of 39.6 years, were studied. The mean interval from injury to presentation was 24 weeks (range = 4-156). Mean time to achieve fracture union was 20 weeks (range : 14-48). The time to fracture union and weight bearing had a positive correlation with the time interval between injury and fracture fixation, development of deep wound infection and osteomyelitis. There is a need to make orthopaedic and trauma care accessible to underserved communities to avoid the adverse outcome of neglected fractures.**

**Keywords :** femoral shaft fractures ; delayed open nailing.

The standard treatment of femoral shaft fractures presently is closed locked intramedullary nailing (3,4).

However, there are situations where closed reduction and nailing may not be feasible. It is not uncommon in our setting, like in other developing nations, for patients with femoral shaft fractures to present for treatment months or even years after the injury. Some of these patients usually first seek unorthodox methods of treatment as a result of their poor socioeconomic situation (7,11) and ignorance. These neglected fractures (greater than four weeks post injury) pose a great challenge to the orthopaedic surgeon. Many present with malunion or nonunion. The soft tissues (muscles, vessels and

### INTRODUCTION

Femoral shaft fractures are common injuries, accounting for about 0.6% of all fractures (4) and are a major cause of morbidity and mortality in patients with lower limb injuries. The management of femoral shaft fractures continues to be a challenge to surgeons practicing in an underdeveloped environment. Over the years treatment has evolved from non-operative methods of immobilization, to open reduction and plate fixation, unlocked and subsequently locked intramedullary nailing (1,2,3).

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nerves) have usually adaptively shortened or contracted as a result of the pull of the powerful thigh muscles, in addition to stiffness of adjacent joints. These fractures are obviously not suitable for closed reduction and nailing.

Enough attention is not given to these cases in the literature. Yet these are the realities orthopaedic surgeons practicing in resource-poor environments have to face for some time to come.

This is a report of the outcome of patients with neglected femoral shaft fractures treated with open reduction and intramedullary nailing at our centre.

### PATIENTS AND METHODS

All patients with neglected femoral shaft fractures treated with open intramedullary nailing at the Department of Orthopaedic Surgery and Traumatology of our hospital from January 1999 to June 2007 who met the study criteria and had sufficient follow-up were entered into the study. Included were patients who presented more than four weeks after sustaining their injury. Excluded from the study were fractures in the distal third of the femoral shaft, patients who had plate and screw fixation of their fractures, patients with co-morbidities like diabetes mellitus and chronic renal failure and those with infected femoral shaft fractures at presentation.

Approval for the study was obtained from our institution's Ethics and Research Committee.

Information obtained from each patient were the age, sex, occupation, mechanism of the injury, time interval since injury, treatment received before presentation to our service and the source of referral. Each patient was examined clinically to assess the site of the fracture, the soft tissues for contracture, the range of motion of the adjacent joints and measure the limbs for any limb length discrepancy. Plain radiographs were used to confirm the site of fracture, and the type of union (nonunion or malunion). Before surgery, all the patients with malunion or nonunion with limb length discrepancy had two weeks of either skin or skeletal traction with trans-tibial Steinmann pin or Denham pin to stretch the contracted soft tissues and make intraoperative reduction of the fracture easier. Adequate care was taken to avoid overstretching the neurovascular structures of the lower limbs. The patients' physiologic conditions (especially the nutritional status and haemoglobin level) were optimized before surgery. We did not carry out osteotomy or osteoclast prior to the definitive fracture fixation in any of the patients. Every patient had perioperative antibiot-

ic with either cefuroxime or ceftriaxone (three doses). Anaesthesia was either general with endotracheal intubation or spinal.

The sclerotic or fibrous ends of the fragments were excised and the medullary canal was opened. In patients with stiff knees, closed manipulation of the knees was done under anaesthesia after adequately mobilizing the fracture fragments. Reduction of the fractures, after open osteoclast, even in malunion with marked overlap of the fragments, was achieved at one session.

Intramedullary nailing of the femur was done using a Küntscher nail, after reaming the medullary canal (retrograde from fracture site to the piriformis fossa) 1 mm lower than the size of the Küntscher nail to ensure tight fit (Fig. 2a & b). This however resulted in jamming of the intramedullary nails intraoperatively on two occasions. The nails were extracted after some effort.

We used the adjacent callus (in hypertrophic non-unions) or grafts taken from the iliac crest to stimulate bone healing.

Some of the patients had their wounds drained with Redivac suction drain while others did not. All the patients had a program of supervised postoperative physiotherapy which included further mobilization of stiff knees. The patients were followed up in our outpatient orthopaedic clinic and with serial radiographs to assess healing until fracture union and resumption of full activities.

The outcomes that were assessed were : duration of surgery, estimated intra-operative blood loss, duration of wound healing, wound complications (presence or absence of infection as determined clinically and by microbiology of wound swab or biopsy), time to fracture union, time to full weight bearing, amount of shortening and complications of fracture union (nonunion, implant failure, osteomyelitis). Data analysis was done using the Statistical Package for Social Sciences (SPSS) software, version 11.0. Pearson correlation coefficient was used to calculate association between variables.

### RESULTS

A total of 52 patients with 55 femoral shaft fractures, with a mean age of 39.6 years (range : 23-74 years) met the study criteria. These consisted of 34 males and 18 females (M:F = 1.8:1). A road traffic accident was the cause of the femoral fracture in 42 (80.8%) patients, 9 fractures (17.3%) were caused by falls at home while 1 (1.9%) was as a result of gunshot injury. Thirty one (59.6%)



**Fig. 1.** — Femoral shaft non-union with marked overlap of the fragments, presenting after two years of treatment by unorthodox traditional bone setters.

patients had received treatment from traditional bone setters (unorthodox centers) before presentation (Fig. 1), 17 (32.7%) were referred from General Hospitals and 4 (7.7%) were referred from private health facilities. The mean time interval between the injury and presentation to our facility was 24 weeks (range : 4 weeks-3 years). Twenty (36.4%) of the fractures were in the proximal third (including the isthmus) and 35 (63.6%) were in the mid-shaft. Thirty four fractures (61.8%) were established nonunions, 12 (21.8%) were malunions while 9 (16.4%) were fractures 4 to 8 weeks old. The mean limb length discrepancy before the application of pre-operative traction (for 46 fractures with non-unions and malunions) was 4.7 centimeters (range : 1.5 cm to 8 cm) Twelve patients (23.1%) presented with fractures of other bones in addition to femoral shaft fractures. Surgery was under general anaesthesia in 40 patients (76.9%)

and spinal anaesthesia in 12 (23.1%) patients. All the three patients with bilateral fractures had their fractures fixed at the same surgery. The wound was drained with Redivac suction in 31 fractures (56.4%) while 24 wounds (43.6%) were not drained. The mean intraoperative blood loss was 332 ml (range : 200-1200) while the mean duration of surgery was 100 minutes (range : 80-205).

The median duration of wound healing was 20 days (range : 14-380). Forty two wounds (76.4%) had no wound infection, 8 (14.5%) had superficial wound infection and 5 (9.1%) had deep wound infection. The mean length of hospitalization was 24 days (range : 21-36). The mean time to fracture union was 20 weeks (range : 14-48). The mean time to unprotected weight bearing was 24 weeks (range : 16-60). The time to fracture union and time to unprotected weight bearing positively correlated with the time interval between injury and fracture fixation ( $r = 0.72$ ), development of deep wound infection ( $r = 0.80$ ) and chronic osteomyelitis ( $r = 0.45$ ). The patients were followed up for 28 weeks to 2.5 years. Forty three fractures (78.2%) had satisfactory union without shortening (Fig. 3) while six (10.9%) united with a shortening that ranged from 2 cm to 5 cm. All the fractures with shortening were atrophic non-unions with sclerotic and tapering ends which had to be excised to open the medullary canal for reaming (Fig. 1). These were treated with a shoe raise. Two fractures (3.6%) had nail migration and had to be re-operated with plate and screw fixation. Four fractures (7.3%) developed chronic osteomyelitis necessitating the removal of the Kuntscher nail combined with sequestrectomy after the fractures had united and patients were bearing full weight on the injured limb.

## DISCUSSION

Femoral shaft fractures in this study most commonly affected patients in their productive life. This demographic distribution had earlier been reported from our center (9). A common pattern in our setting, as in other underdeveloped environments (7,11), is late presentation to the hospital. While orthopaedic surgeons in the western industri-



**Fig. 2.** — Midshaft femoral fracture fixed with intramedullary nailing (a : proximal part ; b : distal part).



**Fig. 3.** — Radiograph taken three years after intramedullary nailing, showing radiologic union.

alized world pursue excellence, their colleagues in developing countries have to make do with limited facilities. About two-thirds of the world do not have access to orthopaedic care because they live in an ‘orthopaedic desert’ (13). It is therefore not surprising that many patients still present with mal-united or non-united fractures. Open femoral nailing is obviously the method of choice in patients who present late when an adequate reduction cannot be achieved by closed means. Even when patients present with fresh fractures many centers do not have fracture tables, image intensifier fluoroscopy and appropriate instrumentation, necessities for closed nailing of femoral shaft fractures. A mini open method in such cases has been found to shorten operating time and minimize intra-operative blood loss (10). Furthermore, some studies actually

showed that a judicious use of open reduction techniques during intramedullary nailing of closed fractures appeared to have a minimal risk of infection (6,8,14,15).

Our infection rate of 9.1% was rather high when compared with an infection rate of 3.3 % in fresh fractures in a comparable setting (14). This may be due to the inclusion of patients who may have sustained initially open fractures which apparently healed before presentation. The long duration of operation was also a contributory factor (5,12). Postoperative wound infection and osteomyelitis are the major drawback of open reduction and internal fixation of fractures (12,15). The intraoperative blood loss was also high. This is expected considering the amount of tissue dissection required to mobilize the fracture fragments and the osteoclasia

that may be necessary in mal-unions and non-unions. This is in contrast to the minimal blood loss experienced during fixation of fresh fractures by either closed or open nailing.

The mean time to fracture union and time to weight bearing were longer than reported by other workers, especially in fresh fractures (8,9,11). Some of the fractures took almost a year to heal. Factors contributing to delay in fracture union in our patients were the time interval between injury and presentation, and development of deep wound infection and osteomyelitis.

Another common outcome following treatment of malunion and nonunion of femoral shaft fractures is limb length discrepancy. Many patients in our setting (83.6% in this study) usually have this complication at presentation. We have found pre-operative traction (for one to two weeks) very useful in stretching the soft tissues that have adaptively contracted to the new length of the limb as a result of malunion with marked overlap of the fragments. This makes mobilization of the fracture fragments easier and obviates the need for a staged procedure. All the fractures in this series were reduced and nailed at one session. At the last follow-up only six fractures (10.9%) had significant shortening.

The treatment of non-unions and mal-unions of femoral shaft fractures resulting from delay in presenting to the appropriate facility is a big challenge to orthopaedic surgeons practicing in resource-poor environments. The outcome of these neglected femoral shaft fractures is usually not as good as that of fresh fractures. It is important for any surgeon coming to work in this kind of setting to be familiar with these challenges. There is a need to make orthopaedic care accessible to the poor and improve facilities for prompt closed nailing of femoral shaft fractures in resource constrained environments.

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