



## Plate fixation of paediatric fractures of the distal tibia and fibula

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**The role of surgery in the management of paediatric long-bone shaft fractures remains a matter of debate. We present a series of paediatric patients with unstable fractures of the distal tibia and fibula, treated with titanium plate fixation. Excellent results were obtained after plate fixation.**

**Keywords :** paediatric fractures ; distal tibia and fibula fractures ; plate fixation.

### INTRODUCTION

Tibia fractures are the most common long bone fractures (3). Tibia fractures are generally associated with fibula fracture, because the force is transmitted along the interosseous membrane to the fibula.

The role of surgery in the management of paediatric long-bone shaft fractures remains a matter of debate. Although non-operative treatment is a mainstay of tibia and fibula fracture management in children with skeletal immaturity, surgical intervention is limited to special cases, including open fractures, fractures in older children, fractures associated with neurovascular injuries, fractures in patients with multiple injuries and fractures associated with soft-tissue injury, skin loss, compartment syndrome (9). It is also stated that unstable fractures as well as fractures in children > 10 years of age should be operated upon primarily (8).

Surgical stabilization can be accomplished with different implants and techniques ; the most common are open reduction with plate fixation or stabilization with intramedullary nails.

Elastic intramedullary nailing has been an easy surgical alternative for stabilising paediatric long-bone shaft fractures in school-age children (2), but this method is only suitable for diaphyseal fractures. The use of a flexible nail in the proximal and distal tibia is technically demanding (6) and provides limited stability (1). Besides, complications such as delayed union and nonunion, hypertrophic bone formation are not uncommon after flexible nailing (5).

Plate fixation has the advantages of stable fixation, direct visualization, protection of the nerve, and sparing of the adjacent joint from injury. Most importantly, plating is a more appropriate option in distal fractures compared to flexible nailing.

In this study, we present a small series of paediatric patients with unstable fractures of the distal tibia and fibula, fixed with titanium plates after reduction.

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**Fig. 1.** — Internal plate fixation can be used in the treatment of paediatric distal tibia and fibula fractures. **A** : Anteroposterior and lateral radiographs of a paediatric patient showing an unstable fractures of the lower third of the tibia and fibula ; **B** : Anteroposterior and lateral radiographs showing satisfactory fixation and alignment postoperatively ; **C** : After 5 weeks follow-up, union was achieved with satisfactory alignment.

## PATIENTS AND METHODS

During a period of 3 years (2006-2009), we treated 10 consecutive children – 7 boys and 3 girls with a mean age of 11 years 3 months (range : 10 to 14) – with open reduction and internal fixation with titanium plates for distal unstable fractures of the tibia and fibula. Two fractures were open, 8 were closed. Four were oblique, 6 were spiral (Fig. 1A). The criteria for instability were off-ended fractures, rotational malalignment and angulation of  $10^\circ$ .

Plate lengths were chosen based on bone size, and plates were contoured before operations. An anterior approach was used to expose the fracture sites. Reconstruction plates were set on the lateral aspect of the tibia and fibula respectively. The fracture of the fibula was fixed with a plate in all cases, through a separate approach. Two screws were placed in each fragment. In oblique fractures, screws were perpendicular to the fracture line (Fig. 1B). In open fractures, the wound was copiously irrigated and debrided without further damage to the periosteum. After the surgery, full leg plaster splints were used for 4 weeks, after which partial weight-bearing was started. Mobilisation was allowed from the first postoperative day. All the patients were followed up at 2-4-week intervals and progressive weight bearing was started based on the results of radiological and clinical evaluations. Clinical outcomes were evaluated using the modified criteria of Flynn *et al* (4).

## RESULTS

All fractures healed without requiring additional procedures. The wounds healed uneventfully. The mean hospital stay was 10 days. Clinical and radiological consolidation was achieved between 5 and 7 weeks (mean : 5.5 weeks) (Fig. 1C). No major complications such as malunion, implant failure or deep infection occurred. The plate was usually removed six months after the surgery. Further consultation two years later showed that no leg-length discrepancies occurred and the epiphysis developed normally. No case of plate breakage or re-fracture was encountered.

## DISCUSSION

Conservative treatment such as closed reduction and cast immobilisation is traditionally considered to be the standard treatment for fractures of the tibia and fibula in children. But “immobilization” seems to be very difficult to playful children. The lengthy cast immobilization usually obliges the patients to interrupt their education. Moreover, only stable fractures can be managed by cast immobilization with good prognosis for healing without complications. However, distal tibia and fibula fractures

usually lead to mechanical instability. From an anatomical viewpoint, the tibia lies eccentrically in the musculature and has a triangular cross-section, which may encourage valgus or recurvatum deformity. This is more frequently seen in older, heavier children (2). Due to the presence of a thick periosteum, an open physis and the rapid remodeling capacity of children, the majority of these fractures can be treated non-operatively with full restoration of function. However, these characteristics are present prominently in children younger than 10 years of age, but they diminish with age (7). The children in our study were all over the age of 10. In addition, many of them were overweight. The risk for instability was thus increased, with a risk for secondary displacement if conservative therapy was used.

The aim of any fracture treatment is to stabilise the fractures to allow restoration of bone continuity with the original length of the bone. We believe that the most basic condition of fracture healing is rigid fixation. As the indication for flexible nailing in the distal tibia is limited, the other way of surgical stabilization, that is open reduction with plate fixation, appears as the optimal choice.

In the present study, plate fixation was adopted, and excellent results were obtained. Plating significantly reduces the length of treatment and the inconvenience of prolonged bed rest, it eases parents' burden, and lets the children return to school earlier. Plate fixation usually provides excellent anatomical reduction for fracture healing.

Complications of plate fixation include refracture, failure of hardware, nerve palsy and infection, but none of these occurred in our study.

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