

DISTAL TIBIA/FIBULA FRACTURES FOLLOWING CLUBFOOT CASTING REPORT OF FOUR CASES

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INTRODUCTION

The treatment of congenital talipes equinovarus (clubfoot) has evolved over the years, but most orthopedists have agreed that the initial treatment should be non-operative, and the preferred methods are manipulation and application of a plaster cast or physiotherapy started soon after birth. These are very gentle techniques, but there are potential complications. The most common are recurrence/persistence of the deformity and skin lesions/pressures sores. Additional less common complications include rockerbottom deformity secondary to spurious correction, and flattening of the talus. However, there is a paucity of literature describing the true incidence of these less observed complications.

The complication of lower extremity fracture associated with clubfoot treatment has recently been observed at our institution. Several different types of fractures can occur including torus fractures of the distal tibial metaphysis, anterior cortical compression fractures of the distal tibia, distal tibial metaphyseal spurs caused by injury and translation of the epiphyseal plate, and lastly distal fibula fractures. The majority of these fractures have been reported to occur during manipulation with application of forced dorsiflexion/eversion of the ankle usually using Kite's technique.^{8,9} We present four cases of distal tibia/fibula metaphyseal fractures that occurred during the bracing phase of clubfoot Ponseti treatment.

CASE #1

A 6 year 3 month-old female presented to our orthopaedic clinic for evaluation of severe bilateral lower extremity deformities. The parents adopted the patient from China two months prior to presentation. Upon initial evaluation, patient was found to have sacral agenesis, bilateral dislocated hips, left congenital knee dislocation, and bilateral clubfeet. No treatment had been provided

for any of the deformities. She was able to ambulate with assistance, however she was not an independent ambulator. Manipulation and casting for her bilateral clubfeet were recommended and performed on a weekly basis. A total of 13 casts were placed for the right foot deformity and 10 casts were placed on the left. Excellent correction was obtained. Due to persistent equinus contractures of the feet, the patient was indicated for bilateral heel cord tenotomies. Simultaneous left quadriceps tendon lengthening and retinacular releases were performed for treatment of the left knee dislocation. Bilateral long leg casts were placed following surgery. Four weeks following surgery, the casts were removed and bracing was initiated. Mitchell bracing was prescribed for 18 hours per day to prevent relapse of the clubfoot deformities. Bracing was tolerated very well. Five months following removal of the last set of casts, the patient sustained a buckle fracture of the distal left tibial metaphysis during an incident where a fellow student fell onto her left lower extremity while at school. She was placed into a short leg cast to the left lower extremity by a local orthopaedic surgeon. Upon return to our clinic, a short leg cast was applied on the right lower extremity to prevent any relapse of the corrected deformity. Short leg casts were removed at approximately 6 weeks following the injury. Radiographs revealed uneventful healing of the left distal tibia fracture. At latest follow-up, the patient was doing very well. She has maintained excellent correction of her clubfoot deformities, and is able to ambulate using the assistance of crutches or a walker. Her left lower extremity has been maintained in a KAFO for assistance with knee stability in flexion.

CASE #2

A 19 month-old female presented to our orthopaedic clinic for evaluation of bilateral clubfoot deformity. The child was adopted from China and presented to clinic several weeks following arrival in the United States. Upon initial examination, the patient had bilateral clubfoot deformities without any other musculoskeletal or neurologic abnormality. Manipulation and cast treatment of the clubfoot deformity were initiated. She underwent 5 manipulation and casting treatments followed by bilateral percutaneous Achilles tenotomies. Excellent deformity correction was obtained. Bracing using a

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Mitchell orthosis was initiated for 20 hours/day. Patient then sustained a nondisplaced tibia fracture (toddler's fracture) 2 months later following a fall off a chair. The parents were instructed to maintain her in the Mitchell brace at all times until the fracture healed. The fracture healed without event, and patient was allowed to weight bear beginning 4 weeks following the injury. The bracing scheduled was decreased to 20 hours/day followed by 14 hours/day over the next several months. Deformity correction has been maintained, and the patient recovered from her fracture without incident.

CASE #3

A 3 month-old male presented to our orthopaedic clinic for evaluation of recurrent bilateral clubfoot deformity. He was initially treated with manipulation and casting at an outside hospital beginning at the age of 8 days. Casts were changed weekly and bilateral Achilles tenotomies were performed at 3 months of age. Recurrence of the deformity was noted following cast removal several weeks after the procedure. The patient was referred to our Center for treatment of his recurrent clubfoot deformity. Upon initial evaluation, the patient was indicated for repeat manipulation and casting of his bilateral clubfoot deformity. He underwent 5 manipulation and casting treatments resulting in excellent deformity correction. Repeat tenotomies were not performed. Mitchell bracing was initiated at full-time and weaned slowly. The patient sustained a fracture of the distal left tibial metaphysis 2 months later following a fall from 4-5 feet (Figure 1). This was treated in a short leg cast to the left lower extremity and healed without incident. Radiographs of the contralateral leg were also obtained following the injury revealing no abnormalities. During his cast treatment, bracing was continued without interruption. He has maintained his deformity correction and healed his fracture completely.

CASE #4

A 22 month-old male presented to our clinic at the age for the treatment of bilateral clubfoot deformity. His medical history included arthrogryposis. He was adopted from China and received no treatment for his clubfeet as an infant. Prior to presentation at our Center, the patient underwent serial manipulation and casting at an outside hospital resulting in suboptimal deformity correction. Upon presentation, he was indicated for continued manipulation and cast treatment. At total of 5 sets of casts were applied followed by percutaneous Achilles tenotomies. Following adequate correction and transition to AFO bracing, the patient was found to have a slight recurrence of deformity. He was treated with another series of long leg casts followed by Mitchell

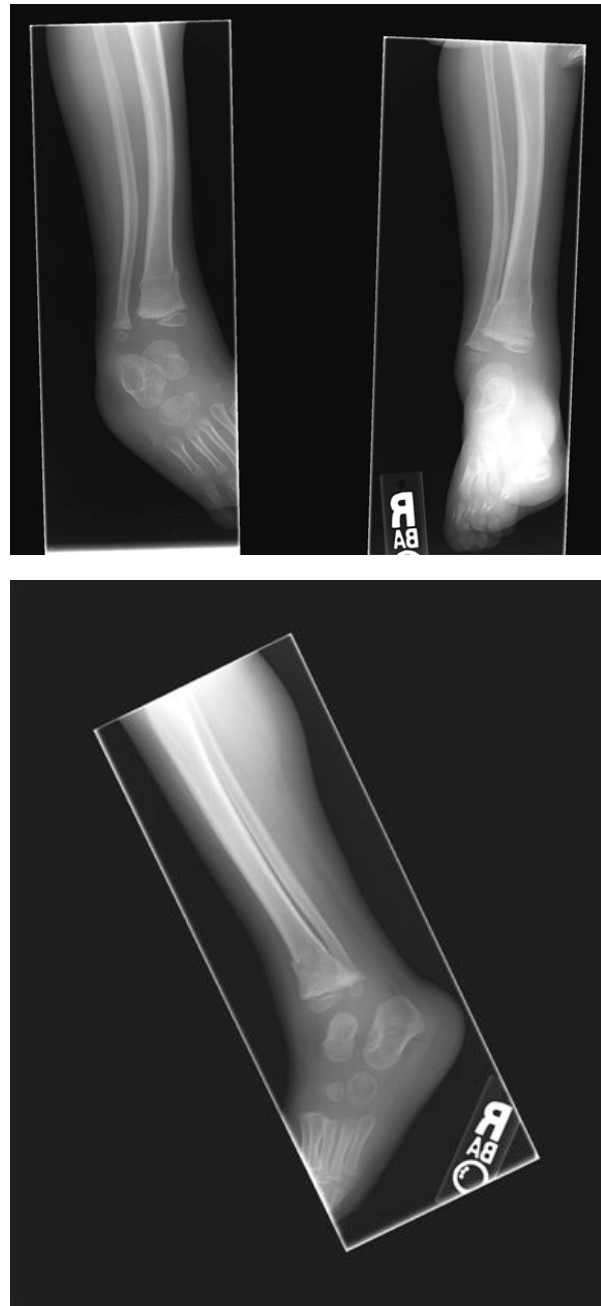


Figure 1. Case #3 AP/Oblique/Lateral views of right ankle taken at the time of injury.

bracing. The deformities recurred one additional time requiring remanipulation, casting, and repeat bilateral percutaneous Achilles tenotomies. Mitchell bracing was prescribed once again after his full course of treatment for the recurrent deformity. He was brought to the ER approximately 2 months following removal of his last

set of casts, for evaluation of left lower extremity pain after a fall from standing height. Radiographs revealed a nondisplaced left tibia/fibula fracture. The patient was treated in bilateral long casts to provide immobilization and prevent a relapse. Casts were kept in place for three weeks to allow adequate fracture healing. Brace treatment was then reinitiated. Patient was last seen 2 months following his injury. His deformity correction has been maintained and his fracture has healed without further event.

DISCUSSION

Only a few studies have reported on distal tibial/fibula metaphyseal fractures associated with nonoperative management of clubfoot deformities. Grayev reported on 8 patients with a total of 14 distal tibia fractures treated with manipulation and casting. They noted that these metaphyseal fractures closely mimic injuries seen in instances of child abuse, however they found definite association between the injuries and forced dorsiflexion and eversion of the ankle during manipulation. Of note, 3 of the 8 patients presented with underlying neuromuscular disorders including spina bifida and arthrogryposis.¹⁰ Clubfeet in association with these disorders are typically more rigid and may require more aggressive manipulation predisposing to possible metaphyseal fracture. Weseley reported on the complications of 300 congenital clubfeet treated both nonsurgically and surgically. In his review, he notes that tibia/fibula fracture can occur during manipulation and casting of clubfeet, however he did not report the incidence and details regarding these iatrogenic injuries.⁸

These cases describe three instances of metaphyseal distal tibia fractures and one toddler's fracture following completion of nonoperative treatment for clubfoot deformity. Three of these fractures occurred within 6 months of final cast removal. All occurred during the period of abduction bracing used for maintenance of deformity correction. It is not felt that these fractures occurred at the time of manipulation of the ankle into dorsiflexion/abduction. None of these patients described or demonstrated pain during the treatments. The parents of each patient in this case report described mechanisms of injury that could easily justify the fracture type and location. Child abuse was not suspected in any case. Each case was treated with immobilization and protection of the injured extremity as well as repeat casting or bracing of the contralateral extremity to prevent recurrence of the deformity. All fractures healed uneventfully.

Further thought regarding the cause of fracture in these cases leads us to consider disuse osteopenia and nutritional status as contributing factors. There have been no reports of suspected osteopenia following cast-

ing for clubfoot deformity. Houde et al described change in bone mineral density in the forearm after immobilization. They found a significant loss in bone density of the distal forearm and ulna after only 4.9 weeks of immobilization. Increases in bone density were noted about 4.7 weeks after remobilization.¹² Numerous other studies have reported the effects of disuse and inactivity on bone density in both animal and human models.^{13,14,15,16} Three of our four cases involve adopted children from China, which has prevented us from obtaining adequate information regarding maternal use of prenatal vitamins and provision of adequate nutrition prior to arrival in the United States.

In summary, metaphyseal fractures can result during nonoperative management of clubfoot deformity. The treating physician must take care to avoid excessive dorsiflexion and eversion at the ankle to prevent iatrogenic fracture. The four cases in our study describe mechanisms of injury not secondary to our manipulation and casting. These children may be predisposed the extremity injury due to altered gait mechanics or other neuromuscular conditions. One may also consider the association of these fractures with prolonged periods of casting that may result in disuse osteopenia of the lower extremity long bones. Nutritional status resulting in metabolic bone disease in children adopted from other countries must also be considered.

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