

Management of toddler's fractures

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Abstract

Question A 2-year-old boy presented to my office 2 days after he started limping. The history, physical examination, and radiology assessment revealed a toddler's fracture (TF). I understand that there is considerable variation in practice regarding management of TF. What is the best method to confirm the diagnosis? What method should be used to immobilize the affected limb and for how long? Is follow-up with a pediatric orthopedic surgeon needed?

Answer Toddler's fracture, also called *childhood accidental spiral tibial fracture* or *CAST fracture*, is a fracture unique to ambulatory infants and young children. It is caused by a twisting injury while tripping, stumbling, or falling. Children usually present limping or refusing to walk. Tenderness at the fracture site is common but is at times hard to elicit in young children. Toddler's fracture is diagnosed clinically and frequently can be documented with radiographs. Treatment of both confirmed TF and presumed TF is conservative with immobilization. A controlled ankle motion boot or a short leg back slab are preferred because they are associated with fewer complications and can be removed by the family or the family physician. For most children, no orthopedic follow-up is needed.

Limping in a child is concerning for both the child's family and for health care providers who need to consider a diagnosis of toddler's fracture (TF). Toddler's fractures occur in young ambulatory children, usually between 9 months and 3 years of age. The mechanism of injury is usually rotational force through the tibia with the foot and ankle fixed, while the proximal leg rotates internally. This mechanism usually occurs when a toddler trips while walking or running, or when falling from a height.^{1,2} *Toddler's fracture* was first coined by Dunbar et al in 1964 as a nondisplaced spiral or oblique fracture of the distal third of the tibia extending downward medially.³ The nomenclature was changed in the 1990s to *childhood accidental spiral tibial fracture* or *CAST fracture* to encompass a more comprehensive definition including children up to age 8.⁴ The incidence of TF varies between reports and ranges from 2.5 per 1000 children each year at the Royal Hospital for Sick Children in Edinburgh, Scotland, to 1 per 1000 children at Scotland's Royal Aberdeen Children's Hospital.^{5,6} Over the years several guidelines have recommended pathways for treating TF; however, a recent e-mail survey of all members of the Pediatric Emergency Research Canada network suggested considerable practice variation in management of TF.⁷

Clinical assessment

Diagnosis of TF is frequently difficult at the initial evaluation, as there is often no history of injury, and examination might elicit crying without clear localization of pain. While Tenenbein et al from Manitoba reported that 35 of 37 cases of TF in a 10-year period had a definite history of injury,¹ another series of 39 cases found no particular differentiating characteristics among infants with a presumptive diagnosis of TF, whether they were found to have TF on follow-up radiography or not.⁸ Inability to bear weight was considered a "cardinal sign" when TF was first described by Dunbar

et al,³ and while it is sensitive (82%) for TF, it is not very specific (30%).⁹ Local tenderness was found to be almost as sensitive (71%) and much more specific (67%).⁹ Gentle attempts to stress the tibia by axial torsion might elicit a response that can assist in diagnosing TF; however, this test is not helpful if the child is crying and resistant.⁹

Diagnosis

Radiologic evidence of a broken bone helps confirm fracture, but in the case of TF it is frequently difficult to see a line of fracture on initial x-ray films. Presumptive diagnosis helps secure timely treatment, and a repeated x-ray scan after 10 to 14 days helps confirm a diagnosis if a fracture line can be seen.⁵ Imaging should include at least 2 views (anteroposterior and lateral),⁸ and adding an internal oblique view helped detect 2 out of 7 (29%) missed TFs in one series.¹ However, pain associated with secondary limb positioning for the additional x-ray scan should be considered.

Sonographic diagnosis of TF in the emergency department was proposed by Lewis and Logan after plain radiographs failed to confirm the diagnosis, and they used the fracture hematoma for guidance.⁷

Treatment

Practice variation in management of TF was recorded in the United States¹⁰ and Canada.⁸ A survey of members of the Pediatric Emergency Research Canada network with a 73% (153 of 211) response rate revealed considerable variation among Canadian emergency physicians in the management of TF.⁸ For *confirmed* TF, 7 centres (50%) elected the above-knee (AK) circumferential cast for immobilization, 3 centres (21%) managed with a below-knee (BK) circumferential cast, and 2 centres (14%) opted for a BK posterior splint. For *presumed* TF, 8 centres (57%) managed without casting, 3 centres (21%) used a BK splint, and

2 centres (14%) immobilized with an AK circumferential cast. Almost all (95%) physicians surveyed chose to immobilize *confirmed* TF. The most common strategies were an AK circumferential cast (39%) followed by a BK circumferential cast (27%). For *presumed* TF, many of the respondents suggested that they preferred to manage the child without casting (44%). If immobilization was done, a BK splint (22%) or an AK circumferential cast (14%) were most common.⁸

Several retrospective studies examined the management of TF and its outcomes. A chart review comparing management of patients with radiologically evident TF (12 of 29; 41%) and those with a presumptive diagnosis (17 of 29; 59%) reported nearly double the rate of casting among those with confirmed TF (92% vs 47%, respectively, $P=.02$).⁶ Another recent retrospective study reported a significantly faster return to weight bearing if *initial* immobilization was done with a boot rather than a short leg cast (2.5 vs 2.8 weeks, respectively, $P=.04$); however, this difference was not significant after switching children from one type of immobilization to a different type.¹¹ Further, regardless of immobilization technique, nearly all children were able to bear weight earlier than 4 weeks after the injury.¹¹

In a recent retrospective study from the Hospital for Sick Children in Toronto, Ont, with 184 children 0 to 4 years of age with nondisplaced tibial fracture on initial radiographs, the authors determined that orthopedic surgeons' involvement was not needed and that parents could remove the immobilization at home, saving time for a clinic visit for removal of a cast and saving health care dollars.¹²

Among 75 children 9 months to 3 years of age presenting to a pediatric emergency department in Seattle, Wash, who were found to have radiographic evidence of TF, 9% were not immobilized, 24% were placed in a controlled ankle motion (CAM) boot, and the remaining 67% were immobilized in a splint or a cast. Those not immobilized needed fewer orthopedic follow-up visits (mean of 0.9 for no immobilization vs 1.2 for a walking boot and 2.1 for a splint or cast [$P<.001$]) and fewer radiographs (mean of 0.4 for no immobilization vs 0.5 for a walking boot and 1.3 for a splint or cast [$P<.001$]). While not statistically significant, possibly owing to a small sample size, skin breakdown was documented in 17% of children, all in the splint or cast group.¹⁰

Immobilization ranged from 3 to 4 weeks.¹² Schuh et al found that children with TF ambulated earlier ($P<.001$) if not immobilized, after a mean of 4.1 (95% CI 2.8 to 5.9) days compared with those immobilized by CAM boot and cast or splint (mean of 27.0 and 27.5 days, respectively).¹⁰

Investigating TF injury

Malignancy, infectious processes, and inflammatory bone conditions should be considered in the differential diagnosis,¹³ as should the possibility of nonaccidental injury.¹⁴ Clear understanding of events surrounding isolated spiral tibial fracture is required, but the fracture itself should not be considered pathognomonic of nonaccidental trauma.¹⁴ An abstract reported a correlation of tibial fracture characteristics and patient demographic characteristics with risk of nonaccidental injury. Lack of injury mechanism, age less than 18 months, infants who had yet to walk on their own, and an unmarried or single parent were associated with increased risk of nonaccidental trauma ($P<.005$); these factors should be documented in every patient's chart.¹⁵

Conclusion

Toddler's fractures might follow a minor injury such as a fall or tripping, but a clear description of injury might be absent. Two or 3 radiographic views are recommended, and once diagnosed it is recommended that the child's leg be immobilized with a CAM boot or a short leg back slab, but not with a cast. Removal of the splint by the family or by the family physician should follow within 3 to 4 weeks. 🌿

Competing interests

None declared

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