Management of Toddler's Fractures in the Pediatric Emergency Department

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Objectives: To evaluate current practice in treatment of toddler's fractures, as well as subsequent healthcare utilization and complications.

Methods: Retrospective cohort study of children age 9 months to 3 years with a radiographically evident toddler's fracture diagnosed at a single academic pediatric emergency department (PED) from January 2008 to December 2012. Data collected included initial form of immobilization (if any), referral to orthopedic clinic, number of repeat radiographs obtained, presence of skin breakdown related to splinting or casting, and presence of other complications.

Results: Seventy-five patients were treated. Most patients were placed in splints or casts in the PED (66.7%) as opposed to controlled ankle motion (CAM) boot (24%) or no immobilization (9.3%). Splinted patients had a longer total duration of immobilization, higher rate of follow-up in orthopedic clinic, and greater number of repeat radiographs obtained than those in the CAM boot or no immobilization groups. Thirteen patients (17.3%) developed skin breakdown during their course of therapy; all of these patients had been placed in a splint or cast in the PED. No difference in PED return rates was observed between groups.

Conclusions: There is wide variation in management of toddler's fractures within this single tertiary care PED. Given that these fractures are unlikely to displace and that complications of splinting and casting are not insignificant, this study suggests that immobilization may not be necessary for acute management of toddler's fractures.

Key Words: toddler's fracture, spiral fracture, immobilization, skin breakdown

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The toddler's fracture was first described in 1964 by Dunbar et al[1] as an oblique, nondisplaced fracture of the distal one-third of the tibia occurring in children 9 months to 3 years of age. Over time, the term has come to be used to describe fractures of the proximal and midtibia as well.[2–4] Patients typically present with a complaint of refusal to bear weight on the affected leg, and although most caregivers report a history of mild trauma, some caregivers cannot identify the mechanism of injury.[5–7]

When the toddler's fracture was first described, standard practice was to immobilize the affected leg in a long-leg plaster splint.[1] Even as recently as 2001, Halsey et al,[8] advocated for the use of a long-leg cast or splint in the emergency department due to the risk of displacement but failed to provide examples of nonimmobilized patients who went on to have displacement requiring intervention. Since this time, some practitioners have highlighted that these fractures rarely displace bringing into question the need for prolonged immobilization, especially given that there is a known risk of skin breakdown with any type of splint or cast placement.[9] Current practice varies widely but typically involves some form of immobilization for relief of pain.[10]

The purpose of this study was to evaluate types of immobilization used, need for follow-up, and complications associated with various treatment modalities.

METHODS

Study Design

This is a retrospective cohort study of all patients age 9 months to 3 years presenting to the pediatric emergency department (PED) at Seattle Children's Hospital (SCH) between January 1, 2008, and December 31, 2012, with radiographic evidence of toddler's fracture. The SCH is a 254-bed tertiary care pediatric teaching hospital with almost 40,000 PED visits annually. The PED is staffed 24/7 by pediatric emergency physicians with a fast track area being staffed by general pediatricians in the evenings; both PEM physicians and general pediatricians were involved in the treatment of study patients.

For this study, patients were identified using the SCH radiology database, a searchable database of all imaging performed at SCH after January 1, 2003. Search limits were set to include all lower extremity radiographs ordered by PED staff between January 1, 2008, and December 31, 2012, in which the radiology report contained the term "fracture" as well as one of the following: "oblique," "spiral," "hairline," "toddler," or "nondisplaced". Each report was reviewed by the primary investigator (A.S.) to ensure that report reflected presence of a fracture rather than a negative report. Duplicate patients were removed (ie, patients who had multiple x-rays done for the same injury).

Medical records were then reviewed by the primary investigator (A.S.). Data abstracted include age, sex, mechanism of injury, initial form of immobilization (if any), and change in type of immobilization or addition of immobilization at clinic follow-up, total duration of immobilization, referral to orthopedic clinic and number of follow-up visits to orthopedic clinic, number of repeat x-rays obtained, presence of skin breakdown related to splinting or casting, and presence of other complications. Method of immobilization, orthopedic consultation in the ED, and referral to outpatient orthopedic clinic was at the discretion of the treating provider; in the case of patients who had orthopedic consultation in the ED, orthopedics determined the method of immobilization. Patients were excluded if they had a history of metabolic bone disease (including rickets and osteogenesis imperfecta), if the fracture was thought to be caused by nonaccidental trauma, if there was an associated fibular fracture or displacement requiring reduction by orthopedics, or if fracture was not diagnosed at the time of the patient's visit where the radiograph visualizing the fracture was initially obtained.

Statistical Analysis

Patient characteristics were summarized descriptively overall and by form of immobilization. Categorical variables were

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TABLE 1. Demographics of Study Population

	Overall (n = 75)	No Immobilization (n = 7, 9.3%)	CAM Boot (n = 18, 24.0%)	Splint or Cast* (n = 50, 66.7%)
Male sex, n (%)	48 (64.0)	3 (42.9)	11 (61.1)	34 (68.0)
Age in months, mean (SD)	21.3 (6.5)	19.3 (6.1)	22.2 (5.4)	21.2 (6.9)
Mechanism of injury, n (%)				
Caught leg on slide	27 (36.0)	3 (42.8)	7 (38.9)	17 (34.0)
Fall from standing	24 (32.0)	2 (28.6)	7 (38.9)	15 (30.0)
Fall from carrier/caregiver's arms	7 (9.3)	1 (14.3)	0 (0)	6 (12.0)
Fall from low elevation (bed/table/couch)	9 (12.0)	0 (0)	3 (16.7)	6 (12.0)
Fall from mid elevation (playground equipment)	2 (2.7)	0 (0)	0 (0)	2 (4.0)
Fall down stairs	1 (1.3)	0 (0)	0 (0)	1 (2.0)
Fall off bicycle	1 (1.3)	0 (0)	0 (0)	1 (2.0)
Unknown	4 (5.3)	1 (14.3)	1 (5.6)	2 (4.0)

*Includes 1 unknown.

summarized using frequency and percentage. Continuous variables were summarized using mean and standard deviation, or median and interquartile range for skewed variables. Differences in initial treatment associated with gender and age were assessed using Fisher exact test and analysis of variance F test, respectively. Treatment characteristics (number of orthopedic follow-up visits, change in therapy at follow-up, number of repeat radiographs, and total duration of immobilization) were summarized by form of immobilization as means and associated 95% confidence intervals, based on binomial or Poisson distributions as appropriate. Mean duration of immobilization and associated 95% confidence intervals were calculated by form of immobilization, and differences were assessed using Kruskal-Wallis test due to skewness. Complication rates (skin breakdown and return to the PED) were calculated along with 95% confidence intervals, and differences associated with form of immobilization were assessed by Fisher exact test. Data were analyzed using STATA statistical software (College Station, TX).

This study was approved by the SCH institutional review board.

RESULTS

A total of 75 patients met inclusion criteria (Table 1). The majority (88%) were treated by PEM-trained physicians and the remainder by general pediatricians. Among included patients, 9.3% were not immobilized, 24% were placed in a controlled ankle motion (CAM) boot, and the remaining 66.7% were immobilized in splints or casts (Table 2). Treatment did not differ significantly based on patient age ($P = 0.6$) or mechanism of injury ($P = 0.72$). Total duration of immobilization was significantly longer for patients who were initially immobilized in splints as compared to those who were not initially immobilized in the PED (27.3 days versus 4.1 days, $P = 0.01$). Some patients in the no immobilization group who followed up in orthopedic clinic and were subsequently immobilized.

Ten patients had an orthopedic consult while in the ED (13.3%), and all of these patients were placed in splints or casts. All other patients were managed exclusively by ED providers during their visit. Of patients who were not immobilized, 57.1% had follow-up in orthopedic clinic as compared to 98% of children who had splints placed in the PED ($P < 0.001$) (Table 2). Repeat radiographs were obtained in 70.2% of patients. Only 28.6% of patients who were not initially immobilized had repeat radiographs as compared to 38.9% of those placed in a boot and 88% of those who were splinted in the PED. Six patients returned to the PED after their initial visit with complaints of pain; 2 patients were found to have skin breakdown at the time of their return PED visit and 4 patients had ill-fitting splints/casts without skin breakdown. Of these, 5 children had been immobilized in a splint on their first visit and 1 child had been placed in a long leg cast; there was no statistically significant difference between groups in rates of return to the PED.

Overall, 17.3% (n = 13) of patients in our study population developed skin breakdown during their course of therapy (Table 2). Skin breakdown did not significantly vary between PEM-trained physicians and general pediatricians ($P = 0.61$). Nine of these patients were noted to have breakdown at their initial orthopedic appointment, whereas 4 patients did not have breakdown noted until cast removal several weeks later. All of the affected patients had been placed in either an Ortho-Glass (Tonawanda, NY) splint or cast while in the PED; no patients in the CAM boot group experienced skin breakdown. Four of the 9 patients who suffered skin breakdown due to splint placement were subsequently placed in a CAM boot, short leg splint, or windowed cast so that the wound could be easily monitored. One of these patients required treatment with antibiotics for cellulitis and wound care follow-up. For the remaining 5 patients, skin breakdown was not considered significant enough to preclude cast placement after application of extra padding.

DISCUSSION

This study demonstrates the wide variation in management of toddler's fractures while highlighting the potential harm done by unnecessary splinting and casting. The incidence of skin breakdown related to splinting and casting was a concerning finding.

Toddler's fractures are generally considered to be stable fractures, but early studies advocated casting for relief of pain and discomfort.[1] A retrospective review by Halsey et al[8] in 2001 proposed treating patients even with no radiographic evidence of the toddler's fracture with long leg immobilization; this is due to "pain and irritability associated with an untreated fracture." More recently, Mashru et al[9] noted that radiographic evidence of healing is often complete at 4 weeks post-injury and suggested that prolonged immobilization may not be necessary.

Our study is consistent with the idea that toddler's fractures are stable as there were no cases of displacement noted in the study population. Our findings suggest that it may be safe to

TABLE 2. Follow-Up Characteristics by Initial Treatment Group, Mean (95% CI)

	No Immobilization	Walking Boot	Splint or Cast	*P*
No. ortho follow-up visits	0.9 (0.3, 1.9)	1.2 (0.8, 1.9)	2.1 (1.7, 2.5)	<0.001
Change in therapy at follow-up, %*	50.0 (6.8, 93.2)	27.3 (6.0, 61.0)	10.4 (3.5, 22.7)	0.04
No. repeat radiographs	0.4 (0.1, 1.3)	0.5 (0.2, 0.9)	1.3 (1.0, 1.6)	<0.001
Total duration of immobilization in days†	4.1 (2.8, 5.9)	27.0 (23.5, 30.9)	27.5 (26.0, 29.1)	<0.001
Return to ED after initial treatment, %	14.3 (0.4, 57.9)	0 (0, 18.5)	8.0 (2.2, 19.2)	0.3
Skin breakdown, %*	0 (0, 60.2)	0 (0, 28.5)	26.5 (15.0, 41.1)	0.1

*For n = 4, 11, and 49 patients with orthopedic follow-up visit in each group, respectively.

†For n = 7, 8, and 43 patients in each group, respectively, for whom immobilization duration was documented.

manage these fractures conservatively with no immobilization or a prefabricated boot. Concerns over pain control in nonimmobilized patients are important. In this cohort, we did not find a difference in PED return rate among patients who were not immobilized versus those who were placed in a splint or cast. None of the patients who were not immobilized returned for pain concerns versus 9.6 % of those who were immobilized during their initial PED visit. This suggests that pain may not be a significant issue for those who were managed conservatively as has been feared in the past.

An additional argument for conservative management is the known risk of skin breakdown and pressure sores associated with splinting and casting.[11] In our study population, 33.3% of patients who were immobilized in a fiberglass splint developed skin breakdown as opposed to 0% of those who were placed in a boot or not immobilized despite the fact that the majority of our patients were treated by PEM-trained physicians. One of these patients required treatment with systemic antibiotics and a wound care consult which adds additional risks and overall cost to the course of therapy.

Limitations to the study include lack of pain score data, lack of follow-up in patients who were not splinted or did not have orthopedic follow-up, and the small study population. Previous studies have advocated for splinting of toddler's fractures to limit pain caused by the patient bearing weight on the fractured leg.[1,8] Because of the retrospective nature of the study, we do not have access to post-visit pain scores to compare patients who were splinted versus those who were not and felt that phone follow-up several years post-injury would be unreliable secondary to recall bias. A prospective study examining patient pain scores at the time of PED visit as well as post-visit would be helpful in advising management of toddler's fractures in the future. Another potential limitation is for patients who were initially evaluated in the PED to be lost to follow-up by seeking orthopedic care elsewhere or additional care in another ED. We feel that this is unlikely to be a significant limitation as our hospital employs 1 of only 2 groups of pediatric orthopedic specialists in the area; the other is located approximately 40 miles away. Additionally, review of orthopedic notes did not reveal any mention of second opinions obtained in other EDs after the initial visit at our institution.

Toddler's fracture management is variable. Complications of splinting and casting are important and not insignificant. This small study suggests that immobilization may not be necessary for management of toddler's fractures. Further research is needed to identify the role of immobilization in pain control in these fractures.

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