

## Pediatric wrist buckle fractures: Should we just splint and go?

Amy C. Plint, MD;\* Jeffrey J. Perry, MD, MSc;† Jennifer L.Y. Tsang, MD‡

### ABSTRACT

**Objectives:** The objective of this study was to evaluate the utility of circumferential casting in the emergency department (ED), orthopedic follow-up visits, and radiographic follow-up in the management of children with wrist buckle fractures.

**Methods:** We performed a retrospective medical record review of all children < 18 years of age who presented to our tertiary care children's hospital between July 1, 2000, and June 30, 2001, and were diagnosed with a fracture of the wrist, radius or ulna. Based on the radiology reports, we identified buckle fractures of the distal radius, the distal ulna, or both bones. We excluded children who had other types of fractures.

**Results:** We identified 840 children with fractures of the wrist, radius, or ulna. Of these, 309 met our inclusion criteria. The median age of our study cohort was 9.2 years. Emergency physicians immobilized 269 of these fractures in circumferential casts; of these, 30 (11%) had cast complications. Of the 276 subjects who had orthopedic follow-up visits and radiographs, 184 (67%) had multiple visits and 127 (46%) had multiple radiographs performed. No subjects had fracture displacement identified on follow-up.

**Conclusions:** Orthopedic follow-up visits and radiographic follow-up may have minimal utility in the treatment of pediatric wrist buckle fractures. ED casting may pose more risk than benefit for these children. Splinting in the ED with primary care follow-up appears to be a reasonable management strategy for these fractures. A prospective study comparing ED splinting and casting for pediatric wrist buckle fractures is needed.

**Key words:** children; fracture, wrist; treatment

### RÉSUMÉ

**Objectifs :** L'objectif de cette étude était d'évaluer l'utilité de la pose de plâtres circonférentiels au département d'urgence, des visites de suivi en orthopédie et du suivi radiographique dans le cadre de la prise en charge des enfants ayant subi une fracture en motte de beurre au poignet.

**Méthodes :** Nous avons effectué une étude rétrospective des dossiers médicaux de tous les enfants < 18 ans reçus à notre hôpital pédiatrique de soins tertiaires entre le 1<sup>er</sup> juillet 2000 et le 30 juin 2001 chez qui des fractures en motte de beurre du poignet, du radius ou du cubitus avaient été identifiées. À partir des rapports de radiologie, nous avons identifié des fractures en motte de

\*Department of Pediatrics, University of Ottawa, Ottawa, Ont.

†Department of Emergency Medicine, University of Ottawa, Ottawa, Ont.

‡Faculty of Medicine, University of Toronto, Toronto, Ont. At the time of writing, Dr. Tsang was with the Faculty of Medicine, University of Ottawa, Ottawa, Ont.

This project was presented in part at the 2003 Annual Meeting of the Canadian Association of Emergency Physicians, Winnipeg, Man.

Received: Nov. 28, 2003; final submission: Sept. 3, 2004; accepted: Sept. 9, 2004

*This article has been peer reviewed.*

*Can J Emerg Med* 2004;6(6):397-401

beurre du radius distal, du cubitus distal ou des deux os. Nous avons exclu les enfants présentant d'autres types de fractures.

**Résultats :** Nous avons identifié 840 enfants atteints de fractures du poignet, du radius ou du cubitus. Parmi ceux-ci, 309 répondaient à nos critères d'inclusion. L'âge moyen de notre cohorte à l'étude était de 9,2 ans. Les médecins d'urgence immobilisèrent des fractures dans des plâtres circumférentiels chez 269 patients; parmi ceux-ci, 30 (11 %) connurent des complications avec leur plâtre. Parmi les 276 sujets ayant eu des visites de suivi orthopédique et des radiographies de suivi, 184 (67 %) firent des visites multiples et 127 (46 %) furent soumis à plusieurs radiographies. On n'identifia aucun déplacement de fracture lors des visites de suivi.

**Conclusions :** Les visites de suivi en orthopédie et le suivi radiographique sont probablement de peu d'utilité dans le cadre du traitement des fractures en motte de beurre du poignet chez les enfants. La pose de plâtres au département d'urgence présente plus de risques que d'avantages pour ces enfants. La pose d'attelles au département d'urgence accompagnée d'un suivi en soins primaires semble constituer une stratégie de prise en charge raisonnable pour ces fractures. Une étude prospective comparant la pose d'attelles et de plâtres au département d'urgence pour les fractures en motte de beurre du poignet chez les enfants s'impose.

## Introduction

Emergency physicians commonly diagnose pediatric buckle fractures of the wrist. Unfortunately, few articles have been published regarding the treatment or outcome of these familiar fractures.<sup>1-5</sup> Standard orthopedic textbooks recommend 2 to 4 weeks of immobilization in a short arm cast.<sup>6</sup> A recent Canadian survey, however, suggested that this management approach is not universally accepted.<sup>4</sup> Among those who believe the fractures need to be immobilized, concern for refracture or displacement was frequently cited.<sup>4</sup> Although orthopedic texts and several articles refer to buckle fractures as inherently stable,<sup>1,3,6-8</sup> one study did suggest that 7% of patients with buckle fractures had subsequent displacement.<sup>9</sup> A refracture rate of 2% has been quoted for all forearm fractures,<sup>8</sup> but the risk of refracture for wrist buckle fractures remains unknown.

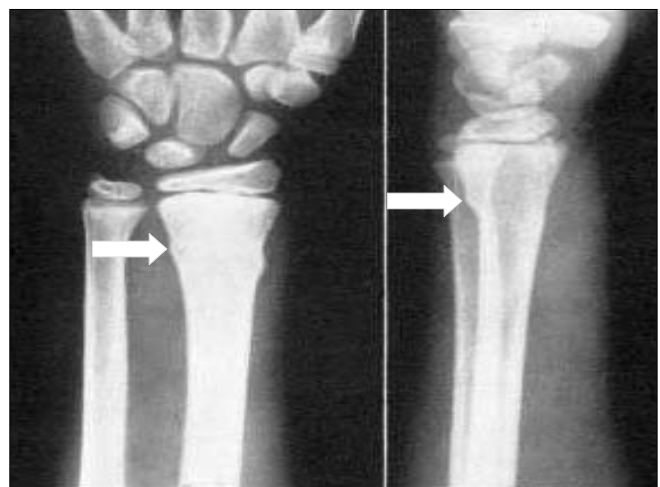
The objective of our study was to evaluate the utility of circumferential casting in the emergency department (ED), orthopedic follow-up visits, and radiographic follow-up in the management of children with wrist buckle fractures. We will describe the characteristics of patients with these fractures, their initial management, management at follow-up, complications associated with treatment, and the risk of refracture and displacement.

## Methods

We performed a retrospective medical record review of children <18 years of age who presented to the Children's Hospital of Eastern Ontario (CHEO) between July 1, 2000, and June 30, 2001. CHEO is an academic tertiary care children's hospital with an annual ED census of 57 000 visits per year. Searching our institution's electronic data-

base, we initially identified all children with fractures of the wrist, radius, or ulna (ICD-9-CM codes 813 and 814). We then reviewed the radiology reports to identify buckle fractures (Fig. 1). We excluded children with other types of fractures, including those with wrist buckle fractures who had an additional upper extremity fracture requiring immobilization.

Using a standardized data collection form, we extracted the following data from each medical record: age, gender, date of visit, date of injury, bone fractured, referral route, hospital service initiating treatment, initial treatment rendered, number of return visits, subsequent treatments and investigations (such as number of cast changes, splint changes, and x-ray studies), and clinical outcomes (such as pain, range of motion, strength, fracture displacement, and re-fracture). Two investigators (A.C.P., J.L.Y.T.) and 1 research assistant, who were not blinded to the study objec-



**Fig. 1. Buckle fracture of the distal radius. Arrows indicate location of fracture.**

tives, extracted the data from the medical records. The principal investigator further reviewed 30% of all charts to assess interobserver reliability. Interrater reliability between the principal investigator and other reviewers was assessed for key variables, including the treatment initiated in the ED, length of immobilization, number of return visits, repeat x-rays, refracture and displacement rates.

Because our data are not normally distributed, we present our descriptive statistics as medians and interquartile ranges (IQRs). Data analysis was performed using the statistical package SPSS-PC Version 11.0.1. Our Institutional Research Board deemed this study exempt from formal review. All personal identifiers were kept confidential.

## Results

During the study period, 840 children were seen with fractures of the wrist, radius, or ulna, and 309 met the study inclusion criteria by having buckle fractures identified in the radiology report. Of the remaining 531 subjects, 523 had other types of upper extremity fractures and 8 with buckle fractures were excluded because they had an additional fracture of the same limb that required immobilization. Figure 2 shows that median age in the study cohort was 9.2 years (IQR, 5.5–11.5 yr; range 0.82–17.5 yr). There were 158 boys (51%) and 151 girls (49%). Two hundred and forty-five (79%) patients sustained an isolated radius fracture, 3 (1%) sustained an isolated ulnar fracture and 61 (20%) sustained fractures of both the radius and ulna.

The time from injury to hospital presentation was documented for 277 subjects. One hundred sixty-three (59%) presented the same day as the index visit, 70 (25%) pre-

sented 1 day, 24 (9%) presented 2 days, and 20 (7%) presented to the hospital 3 or more days after the date of injury. Seventy-six subjects (25%) initially presented to an outside facility and were transferred to CHEO. Of the 309 subjects studied, 299 (97%) were initially treated by an emergency physician (or resident), and 10 (3%) were initially treated by an orthopedic surgeon or orthopedic trainee. Of those treated by emergency physicians and their trainees, 259 (87%) underwent casting and 40 (13%) underwent splinting. All of the patients managed by the orthopedic service underwent casting. Two hundred and ninety-one (94%) subjects were referred to our institution's orthopedic service for follow-up, 12 (4%) were referred to their family doctor, and 6 (2%) who did not reside in our catchment area were referred to services in their own community.

Follow-up data were available for 276 (89%) subjects, all of whom had been referred to our orthopedic service (Table 1). In this group, the immobilization period was highly variable, with a median of 25.4 days (range, 9–59 d). Two-thirds of these subjects had more than 1 follow-up visit with an orthopedist and nearly half of these subjects had more than 1 radiograph obtained (Table 2). In addition, 32 subjects (12%) had an unplanned ED visit because of cast- or injury-related problems. Of these, 30 (94%) were for wet, damaged or tight casts; 2 (6%) were for broken splints. Among the 142 patients for whom ROM (range of movement) was reported at their final follow-up visit, 114 (80%) had normal ROM and 32 (22.5%) had decreased ROM. Three subjects (1%; 95% confidence interval [CI], 0%–3%) were seen during the following year for re-fracture of the same bone. No subjects had subse-

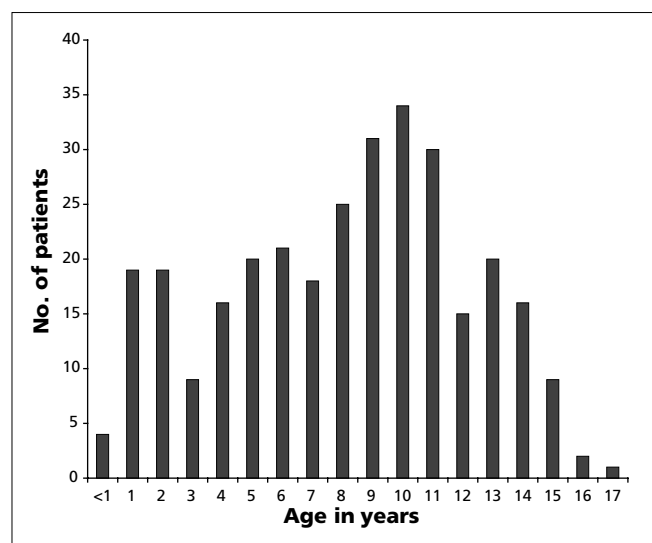


Fig. 2. Age distribution of patients.

Table 1. Management of 276 children at first orthopedic follow-up visit

Management type	No. (and %)
<b>Patients initially casted in the ED (n = 248)</b>	
Cast remained, no change needed	74 (27)
Cast replaced with a new cast	97 (35)
Cast removed in clinic, no further treatment	70 (25)
Cast removed in clinic, splint placed	6 (2)
Cast removed by patient prior to visit, no further treatment	2 (1)
<b>Patients initially splinted in the ED (n = 28)</b>	
Splint remained, no change needed	1 (0.3)
Splint replaced with new splint	1 (0.3)
Splint removed in clinic, cast placed	22 (8)
Splint removed in clinic, no further treatment	3 (1)
Splint removed by patient prior to visit, no further treatment	1 (0.3)

quent displacement of their fracture (0%; 95% CI, 0%–1%).

The concordance rate for interrater reliability between the principal investigator and other reviewers for key variables, including the treatment initiated in the ED, length of immobilization, number of return visits, repeat x-rays, refracture and displacement rates, was 100% (kappa 1.0) for all variables, indicating perfect agreement.

## Discussion

All of the children in this study cohort had good outcomes whether they were immobilized with a splint or a cast. They typically underwent multiple follow-up physician visits and radiographic evaluations, yet required no reductions or orthopedic interventions, suggesting minimal utility for scheduled orthopedic follow-up. Our findings are similar to those from a smaller study that examined 70 children with distal radius or ulna buckle fractures.<sup>3</sup> In this study, the mean number of follow-up visits was 2. More than a third of their subjects had repeat radiographs in the ED following cast application, and most had at least 1 radiograph during clinic follow-up. All children in this study had uncomplicated fracture healing.

In a subsequent survey of pediatric orthopedic surgery directors,<sup>3</sup> none reported routinely advising a post-cast film in the ED. The mean number of follow-up films obtained in clinic was 1 (range 0–3). Those who obtained follow-up studies in their clinics suggested the need to document healing and to confirm that the fracture was a buckle fracture rather than a greenstick fracture. Similarly, a recent survey revealed that 11% of British orthopedic surgeons routinely repeat radiographs after changing a treatment (i.e., from splint to cast) and 17% repeat films at the end of treatment.<sup>2</sup>

In addition to the multiple scheduled follow-up visits, 12% of the patients in our study had unscheduled repeat ED visits because of cast-related problems, typically a broken or wet cast. Scheduled and unscheduled follow-up visits add to health care costs and are time-consuming for the patient and their family. Interestingly, although North American preference appears to be casts for immobilization,<sup>3,4,6</sup> several studies from Britain have suggested that treatment with splints is more common.<sup>1,2</sup> This challenges the notion that casts are superior to splints in the immobilization of pediatric wrist buckle fractures. One study has attempted to address this question by comparing children managed with casts versus splints. At 3 weeks there appeared to be no difference in clinical or radiological outcome.<sup>2</sup> However, methodological problems such as the lack of a sample size calculation, inadequate definitions of the outcome measures, and inadequate randomization make acceptance of the authors' conclusions difficult. In another study involving 87 patients immobilized in a splint for 3 weeks following a buckle fracture of the wrist, a comparison was made between one group who removed the splint at home and another group who had their splint removed under physician supervision in a clinic.<sup>1</sup> All parents preferred to remove the splint at home. Interestingly, a common theme in these studies and in our cohort is that a fair number of patients are lost to follow-up before there is any record of cast or splint removal. Presumably these patients remove their cast or splint at home. Although the outcome is obviously unknown for these patients, we would suggest it is unlikely they had significant pain or functional limitation or they would have returned for follow-up.

We had identified in our earlier study<sup>4</sup> that physicians were concerned regarding the risk of displacement or refracture. In this regard, our data are reassuring. None of the fractures in our study displaced and the refracture rate was below that previously reported for forearm fractures in general.<sup>8</sup> We question whether the high displacement rate quoted in an earlier study in fact represents displacement of greenstick fractures rather than buckle fractures.<sup>9</sup> Other studies of wrist buckle fractures have also shown no evidence of fracture displacement.<sup>1–3</sup>

## Limitations

This study reflects data from a single site, and its retrospective nature means that there was missing data. Of note, 11% of patients were lost to follow-up, and it is possible that some of these patients had complications not seen in the study cohort, including fracture displacement. If this was true, and if such patients required subsequent manipu-

**Table 2. Follow-up visits and radiological investigations in 276 children\***

Follow-up	No. (and %)
<b>No. of follow-up visits</b>	
1	92 (33)
2	176 (64)
3	8 (3)
<b>Total no. of x-ray studies†</b>	
1	149 (54)
2	89 (32)
3	36 (13)
4	2 (1)

\*The children seen in follow-up at our institution.  
†Includes initial x-ray study (done either in the ED or by referring physicians).

lation or operative intervention, this would support the role for orthopedic follow-up and repeated imaging. Our experience and the existing literature,<sup>1-3</sup> however, suggest that this is quite unlikely.

## Conclusions

In this study, most children with buckle fractures had repeated orthopedic follow-up visits and multiple radiographs, yet none had subsequent fracture displacement or required therapeutic intervention. More than 12% of our subjects returned to the ED with cast-related problems. Given the low risk of fracture displacement and the relatively high rate of complications from casting, emergency physicians should reassess our current management strategies. Appropriate care may involve splinting and family physician follow-up to identify those rare cases with complications. A prospective study of optimal immobilization methods would help delineate the most appropriate care for children with wrist buckle fractures.

**Competing interests:** None declared.

**Acknowledgements:** Dr. Plint is the recipient of a Junior Clinical Investigator Award from the Children's Hospital of Eastern Ontario Research Institute.

## References

1. Symons S, Rowsell M, Bhowal B, Dias JJ. Hospital versus home management of children with buckle fractures of the distal radius. A prospective, randomised trial. *J Bone Joint Surg Br* 2001;83(4):556-60.
2. Davidson JS, Brown DJ, Barnes SN, Bruce CE. Simple treatment for torus fractures of the distal radius. *J Bone Joint Surg Br* 2001;83(8):1173-5.
3. Farbman KS, Vinci RJ, Cranley WR, Creevy WR, Bauchner H. The role of serial radiographs in the management of pediatric torus fractures. *Arch Pediatr Adolesc Med* 1999;153(9):923-5.
4. Plint A, Clifford T, Perry J, Bulloch B, Pusic M, Lalani A, et al. Wrist buckle fractures: a survey of current practice patterns and attitudes toward immobilization. *Can J Emerg Med* 2003;5(2):95-100.
5. Solan MC, Rees R, Daly K. Current management of torus fractures of the distal radius. *Injury* 2002;33(6):503-5.
6. Lawton LJ. Fractures of the distal radius and ulna. In: Letts MR, editor. *Management of pediatric fractures*. New York: Churchill Livingstone; 1994. p. 345-68.
7. Armstrong PF, Joughlin VE, Clarke HM. Pediatric fractures of the forearm, wrist, and hand. In: Green NE, Swiontkowski MF, editors. *Skeletal trauma in children*. Philadelphia: Saunders; 1998. p. 157.
8. Harbison JS, Stevenson TM, Lipert JR. Forearm fractures in children. *Aust N Z J Surg* 1978;48(1):84-8.
9. Schranz PJ, Fagg PS. Undisplaced fractures of the distal third of the radius in children: An innocent fracture? *Injury* 1992;23(3):165-7.

---

**Correspondence to:** Dr. Amy Plint, Division of Emergency Medicine, Children's Hospital of Eastern Ontario, 401 Smyth Rd., Ottawa ON K1H 8L1; 613 738-3237, fax 613 738-4852, plint@cheo.on.ca