

Success Rates for Reduction of Pediatric Distal Radius and Ulna Fractures by Emergency Department Physicians

Bryan Kaye^{1,2}, Kristy Putnam, MD, MPH³, Pamela Garcia-Filion, PhD, MPH⁴, M. Wade Shrader, MD⁴ and Blake Bulloch, MD⁴. ¹Maricopa Integrated Health Services; ²Current Address is University of Arizona College of Medicine – Phoenix; ³Rady Children’s Hospital San Diego; ⁴Phoenix Children’s Hospital

Introduction

Forearm fractures of the distal radius and/or ulna are common childhood injuries. Often, minimally displaced or angulated fractures are successfully immobilized in the ED without reduction. Emergency physicians are also trained in urgent reduction techniques in the ED, particularly closed fractures necessitating immediate manipulation for neurovascular compromise. Furthermore, many institutions do not have readily available in-house Orthopedic specialty support.



Figure 1: Distal forearm fracture



Figure 2: X-ray of distal forearm fracture

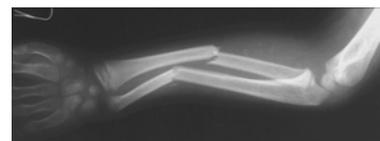


Figure 3: X-ray of midshaft forearm fracture

Results

All reductions were performed by Board certified/eligible PEM physicians or PEM fellows. There were a total of 15 different PEM faculty and 10 PEM fellows that were involved in the fracture reductions during the study period. There were 295 forearm fractures reduced in the ED during the study period. The mean age was 8.27 years (median 8 years; range 1 to 16) and males comprised 69.2% (n=204) of the study group. A total of 225 (76.3%) fractures were of the distal forearm and 70 involved the midshaft (23.7%). All but 67 (22.7%) patients returned for their orthopedic follow up exam. A total of 33 (14.5%) of all patients required re-manipulation at follow up; 24 in the distal forearm fracture group (22 were closed reductions and 2 ORIF), versus 9 in the midshaft group (7 closed reductions and 2 ORIF).

Table 1: Patient characteristics

Study sample	295 subjects
Mean Age (years)	8.2 +/- 3.5 years
Male	69.2%
Fractured radius only	20%
Fractured ulna only	3.1%
Fractured both radius and ulna	76.9%
Fractured distal radius +/- ulna	n=225
Fracture displaced	75.6%
Fracture angulated	92.4%
Fractured midshaft radius +/- ulna	n=70
Fracture displaced	44.3%
Fracture angulated	91.4%
Fracture involving growth plate	12.5%
Remanipulation required	33
Closed reduction	87.9%
Open reduction internal fixation	12.1%
Unscheduled ED visits	6.1%
Complications	36.8%
Pain	5.5%
Limited range of motion	16.9%
Decreased strength	0.9%
Fracture displacement	18.7%
Re-fracture	0.5%
Sensory deficit	0%
Compartment syndrome	0%

Limitations

There are several significant limitations to our study. This was a retrospective study and the patients were not randomly assigned. As no study of this kind had previously been performed at a Level I trauma center; we thought our design was best for an initial study. The other limitation is that there were relatively few pediatric emergency medicine physicians and fellows performing the reductions, which is why a multicenter trial would have been ideal. This study was based on data collected at a large Level I trauma center where PEM physicians and fellows are exposed to a high number of fractures requiring reduction so our results may not be generalizable to other smaller hospitals or clinics where physicians may have less exposure to fracture reductions.

Table 2: Amount of angulation/ displacement at initial ED visit

Distal radius +/- ulna	Mean anteroposterior angulation: 24.5 degrees
	Mean anteroposterior displacement: 72.0%
	Mean lateral angulation: 34.1 degrees
Midshaft radius +/- ulna	Mean lateral displacement: 80.2%
	Mean anteroposterior angulation: 15.7 degrees
	Mean anteroposterior displacement: 48.4%
	Mean lateral angulation: 26.3 degrees
	Mean lateral displacement: 49.5%

Conclusion

The literature reveals that between 7% and 39% of children who have fracture reductions in the ED by orthopedics will require re-manipulation. Our rate of 14.5% is consistent within that range. With training, pediatric ED physicians have similar success rates as orthopedists in the reduction of forearm fractures.

Future Directions

While our study had promising results, we recommend that a multicenter prospective randomized control trial be performed to assess if emergency medicine physicians are as successful at reductions as orthopedic surgeons. Prospective studies could also be done to evaluate the quality of splint/cast immobilization and also distinguish which types of splints/casts minimize the risk of loss of reduction.

References

- Marx JA, et al. Wrist and Forearm: Pediatric Forearm Fractures. Rosen's Emergency Medicine, 7th Ed. Mosby/Elsevier; Philadelphia, 2010.
- Al-Ansari K, et al. Minimally angulated pediatric wrist fractures: is immobilization without manipulation enough? *CJEM Canadian Journal of Emergency Medical Care.* 9(1):9-15, 2007 Jan.
- Price CT. Surgical management of forearm and distal radius fractures in children and adolescents. *Instructional Course Lectures.* 57:509-14, 2008.
- Ho CA, Wilson PL. A comparison of fracture reductions performed by physician extenders and orthopaedic residents in the acute pediatric orthopaedic practice. *Journal of Orthopaedic Trauma.* 24(4):244-9, 2010 Apr.
- Pershad J et al. Pediatric distal radial fractures treated by emergency physicians. *Journal of Emergency Medicine.* 37(3):341-4, 2009 Oct.
- Mahviya A, Tsintzas D, Mahawar K, Bache CE, Gilthorpe PR. Gap index: a good predictor of failure of plaster cast in distal third radius fractures. *J Pediatr Orthop B.* 2007;16:48-52.1648 2007.

Objective

To quantify the success rates for reduction of pediatric distal radius or ulna fractures by emergency physicians.

Methods

Retrospective study of children <18 years of age who presented to an urban free standing children's hospital between January 1, 2009 and December 31, 2010 with a fracture of the radius and/or ulna. Patients were excluded if they had an open fracture, were taken directly to the OR without attempted ED manipulation, or had additional fractures besides isolated radius/ulna fractures. The primary endpoint was the proportion of successful reductions of closed forearm fractures in the ED at the first orthopedic follow up visit.