

PEDIATRICS

Radial head subluxation: How long do children wait in the emergency department before reduction?

Philippe Toupin;* Martin H. Osmond, MD, CM;†‡ Rhonda Correll, HBScN, RN;†
Amy Plint, MD, MSc†‡

ABSTRACT

Objective: To describe the current emergency department (ED) wait times and treatment characteristics of children with radial head subluxation (RHS).

Methods: We performed a 2-year retrospective medical record review (April 1, 2004, to March 31, 2006) of all children who presented to our tertiary care pediatric ED with a discharge diagnosis of RHS, pulled elbow, dislocated elbow or nursemaid's elbow.

Results: We identified 501 cases of RHS in 427 children over a 2-year period. The mean age was 2.4 years (range 22 d–9.7 yr) and the injury was caused by a pull in 314 (62.8%) cases, a fall in 91 (18.2%) cases and a twist in 20 (4.0%) of the cases. The median time from triage to physician assessment was 1.3 hours, with 112 (23.5%) patients waiting > 2 hours and 33 (6.9%) waiting > 3 hours. The median time from triage to ED discharge was 1.7 hours, with 193 (41.2%) staying > 2 hours, 85 (18.1%) staying > 3 hours and 30 (6.4%) staying > 4 hours. Overall, 490 (99.2%) of these injuries were reduced in the ED: 98 (19.8%) were reduced prior to physician assessment and 309 (89.6%) were reduced on the first attempt. The technique used was pronation in 138 (52.7%), supination in 100 (38.2%), and pronation and supination in 24 (9.2%) cases.

Conclusion: This large cohort indicates that children with RHS often have long ED waits before reduction and discharge. The majority of children with RHS are treated successfully with 1 reduction attempt. The data from this study will be used in planning a prospective study to shorten ED visits for patients with RHS.

Key words: emergency department, children, radial head subluxation, pulled elbow, nursemaid's elbow, dislocated elbow, wait time

RÉSUMÉ

Objectif : Décrire les temps d'attente actuels à l'urgence et les caractéristiques de traitement des enfants qui ont subi une subluxation de la tête radiale (STR).

Méthodes : Nous avons procédé à une étude rétrospective sur deux ans (du 1er avril 2004 au 31 mars 2006) des dossiers médicaux de tous les enfants qui se sont présentés à notre urgence pédiatrique de soins tertiaires et chez lesquels on a diagnostiqué au congé une STR, une subluxation du coude, une luxation du coude ou une pronation douloureuse.

Résultats : Nous avons repéré 501 cas de STR chez 427 enfants sur une période de deux ans. Les enfants avaient en moyenne 2,4 ans (intervalle de 22 j–9,27 a) et le traumatisme avait été causé par une traction dans 314 (62,8 %) cas, par une chute dans 91 cas (18,2 %) et par une torsion dans 20 cas (4,0 %). La période écoulée entre le triage et l'évaluation par le médecin a été en moyenne de 1,3 heure; 112 (23,5 %) patients ont attendu plus de 2 heures et 33 (6,9 %), plus de 3 heures. La période médiane écoulée entre le triage et le congé de l'urgence a été de 1,7 heure;

From the *School of Human Kinetics, Faculty of Health Sciences, University of Ottawa, Ottawa, Ont., the †Children's Hospital of Eastern Ontario Research Institute, Ottawa, Ont., and the ‡Departments of Pediatrics and Emergency Medicine, University of Ottawa, Ottawa, Ont.

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la durée du séjour a été de plus de 2 heures pour 193 (41,2 %) patients, de plus de 3 heures pour 85 (18,1 %) patients et de plus de 4 heures pour 30 (6,4 %) patients. Dans l'ensemble, on a réduit 490 (99,2 %) de ces traumatismes à l'urgence : 98 (19,8 %) avant l'évaluation par le médecin et 309 (89,6 %) à la première tentative. On a utilisé comme technique la pronation dans 138 (52,7 %) cas, la supination dans 100 (38,2 %) cas et la pronation et supination dans 24 (9,2 %) cas.

Conclusion : Cette cohorte importante indique que les enfants qui ont subi une STR doivent souvent attendre longtemps à l'urgence avant que l'on réduise la luxation et qu'ils reçoivent leur congé. La majorité des enfants qui ont subi une STR sont traités avec succès au premier essai de réduction. Les données tirées de cette étude serviront à planifier une étude prospective visant à raccourcir la durée de la visite à l'urgence pour les patients qui ont subi une STR.

Introduction

Radial head subluxation (RHS), also known as pulled elbow, dislocated elbow or nursemaid's elbow, is one of the most common upper extremity injuries in young children¹ and a common reason for an emergency department (ED) visit. The injury usually occurs when forceful longitudinal traction is applied to an extended and pronated arm.² While children may sustain this injury up to about 7 years of age, typically they are between the ages of 1 and 3 years.³⁻⁵ Children with RHS are usually easily recognized by their clinical presentation and rapidly treated by a simple reduction technique involving pronation, supination, or both pronation and supination of the injured arm.^{3,6-9}

Despite the relative ease of diagnosis and treatment of RHS, it has been our experience that children with this condition often wait several hours in a pediatric ED for a reduction that takes only a few minutes. While many factors are associated with parental and patient satisfaction in the ED, it appears that early treatment¹⁰ and short waiting times correlate with both patient and parent satisfaction.¹¹ Currently, wait times in the pediatric ED for children with RHS are unknown.

The objective of our study was to determine the wait times that children with RHS experience in a pediatric ED. We also sought to describe the characteristics and treatments used for this group of patients. Our long-term plan is to investigate whether triage nurses can be trained to identify RHS and reduce the dislocation thus shortening ED length of stay for such patients, compared with standard physician-delivered treatment.

Methods

We conducted a retrospective medical record review of all patients presenting to a tertiary care pediatric ED with RHS over a 2-year period between April 1, 2004, and March 31, 2006. This review was conducted at the Children's Hospital of Eastern Ontario (CHEO), in Ottawa, Canada. CHEO serves a population of approximately 1.5 million

people in eastern Ontario and western Quebec, and has approximately 55 000 ED visits per year. The CHEO Research Ethics Committee approved the study protocol.

We reviewed the charts of all patients discharged from the hospital ED with a diagnosis of RHS, pulled elbow, dislocated elbow or nursemaid's elbow. Cases were identified using the injury section of the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10-CA). All cases with a final ED discharge diagnosis consistent with RHS were included in the study; cases of elbow dislocation and/or fracture were excluded.

To improve accuracy and minimize inconsistencies in the chart review, we incorporated medical record review strategies recommended by Gilbert and colleagues.¹² The review was performed by one of the investigators using a standard data abstraction form to extract the following variables: age, sex, ED times, time of injury, history of RHS, mechanism of injury, arm injured, ED investigations, ED treatment and recommended follow-up. If there was no record of these variables, they were recorded as being "not documented." All variables on the data abstraction form were discussed and defined by the study team prior to the chart review. A second investigator reviewed all data abstraction sheets for accuracy and thoroughness.

Ten percent of the charts were randomly selected and reviewed by a second trained chart abstractor to evaluate interrater agreement. To maintain consistency, regular meetings were held to discuss and resolve any problems.

Data analysis was performed using SPSS 14.0 for Windows (SPSS Inc., Chicago, Ill.). Descriptive statistics and frequencies were used to analyze the variables. In addition to the first 20 data abstraction sheets, 10% of the data abstraction sheets were randomly chosen and reentered in SPSS to ensure the precision of the data entry. Kappa statistics were generated to determine the interrater reliability of the data abstraction.

Results

During the 2-year study period, there were 546 patients

with a discharge diagnosis of RHS, pulled elbow, dislocated elbow or nursemaid's elbow. On review of these patient records, we identified 501 cases of RHS in 427 children. Of the remaining 45 patients, 25 (55.6%) were diagnosed with a dislocated elbow, 4 (8.9%) with a fracture, and 10 (22.2%) with a dislocated elbow and a fracture; 3 (6.7%) patients presented no clinical indications of RHS, 2 (4.4%) left the ED without being seen by a physician, and 1 chart could not be located.

Figure 1 shows the age distribution of the study cohort of 501 patients. The mean age was 2.4 years with a range

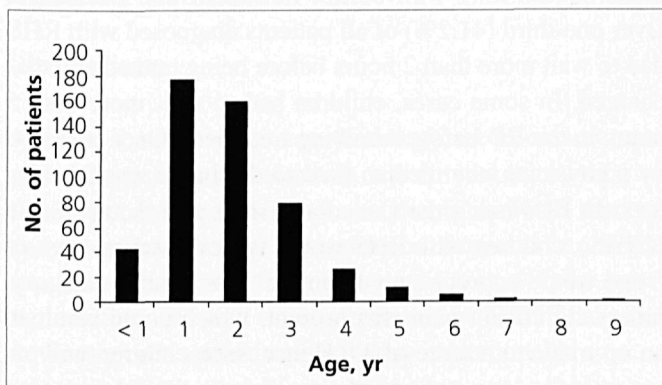


Fig. 1. Age distribution of the 501 patients with radial head subluxation.

Table 1. Characteristics of patients with radial head subluxation*

Characteristic	No. (and %) of patients
Sex	
Female	285 (56.9)
Male	216 (43.1)
Time from injury to ED presentation, h (n = 292)	
< 6	228 (78.1)
6–12	19 (6.5)
13–24	36 (12.3)
> 24	9 (3.1)
History of RHS (n = 213)	
Yes	134 (62.9)
No	79 (37.1)
Mechanism of injury (n = 500)	
Pull	314 (62.8)
Fall	91 (18.2)
Twist	20 (4.0)
Arm struck	7 (1.4)
Unknown	60 (12.0)
Other	8 (1.6)
Arm injured (n = 495)	
Left	306 (61.8)
Right	189 (38.2)

RHS = radial head subluxation.

*Mean age of patients = 2.4 years (standard deviation 1.2); range 0.06–9.7.

of 22 days to 9.7 years. Table 1 shows the characteristics of the children in the study; 56.9% of all RHS patient visits were for females. The majority of patients had a pull (62.8%) or fall (18.2%) as the mechanism of injury, and the left elbow was injured most frequently (61.8%).

The ED waiting times of children with RHS are shown in Figure 2. The median waiting time from triage to physician assessment was 1.3 hours (interquartile range [IQR] 0.7–2.0), with 23.5% ($n = 112$) waiting more than 2 hours and 6.9% ($n = 33$) waiting more than 3 hours. The median waiting time from triage to discharge from the ED was 1.7 hours (IQR 1.1–2.6), with 41.2% of children ($n = 193$) waiting more than 2 hours, 18.1% ($n = 85$) waiting more than 3 hours and 6.4% ($n = 30$) waiting more than 4 hours.

Table 2 shows the management and disposition of patients with RHS. The ED outcome was documented for 494 subjects with RHS. The large majority of pulled elbows (99.2%) were reduced during the ED visit. A radiograph was performed on approximately one-quarter of the subjects and 6.3% of radiographs showed a joint effusion. On discharge, 8 patients (1.6%) were provided with either a sling ($n = 5$) or a splint ($n = 3$) as treatment. Physician follow-up was advised for 8 patients; 4 to their family doctor and 4 to an orthopedic surgeon.

There were 4 patients who were unable to have their RHS successfully reduced in the ED. They were discharged with either a splint or a sling. Three were scheduled to follow-up with an orthopedic surgeon, and the fourth patient was told to return to the ED if his arm did not return to normal. None of the 4 patients returned to the ED or attended their scheduled follow-up appointment with orthopedics. Three of the 4 children had normal radiographs and the fourth was never imaged.

The concordance rate for interobserver reliability between the chart reviewers showed extremely high interrater agreement on all variables (kappa statistics ranging be-

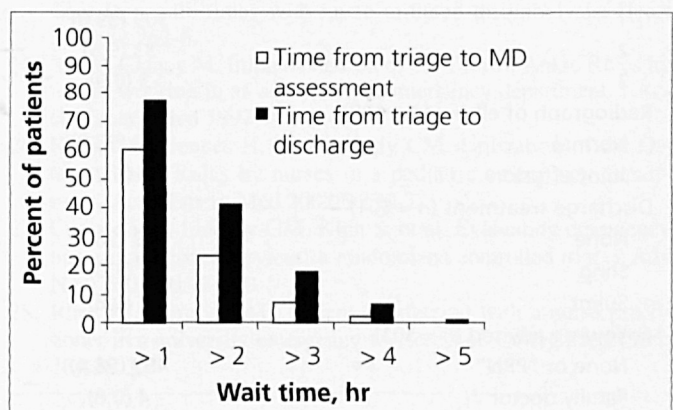


Fig. 2. Emergency department waiting times of patients with radial head subluxation.

tween 0.82 and 1.00), with the exception of 1 variable (number of reduction attempts) that showed a moderately high interrater agreement ($\kappa = 0.73$).¹³

Discussion

To our knowledge, this is the largest study of RHS published to date, and the first study to specifically examine the ED wait times of patients with RHS. We found that children often have a long wait in the ED before reduction and discharge by a physician. The time to discharge is over 2 hours in almost one-half of the children, and is frequently greater than 3 hours. The majority of children with RHS had a pull as the mechanism of injury and were successfully treated with 1 reduction attempt by a physician.

Although previous studies have found that patients with RHS range in age from 0.2 to 7 years,^{5-7,14-16} we found that children as young as 22 days and as old as 9.7 years are diagnosed with RHS. The highest incidence of RHS was observed between the ages of 1 and 2 years (35%). Similar to other studies,^{6,7,15} the majority of children in our study had a pull (62.8%) or fall (18.2%) as the mechanism of injury.

Table 2. Management and disposition of patients with radial head subluxation

Variable	No. (and %) of cases
Reduction attempted in the ED (<i>n</i> = 494)	
Successful reduction in the ED	490 (99.2)
Reduced prior to MD assessment	78 (15.8)
Reduced by MD	387 (78.3)
Reduced in radiology department	25 (5.1)
Unsuccessful reduction in the ED	4 (0.8)
Reduction technique used (<i>n</i> = 262)	
Pronation only	138 (52.7)
Supination only	100 (38.2)
Pronation and supination	24 (9.2)
Number of reduction attempts (<i>n</i> = 345)	
1	309 (89.6)
2	33 (9.6)
3	3 (0.9)
Radiograph of elbow (<i>n</i> = 128)	
Normal	120 (93.8)
Joint effusion	8 (6.2)
Discharge treatment (<i>n</i> = 501)	
None	493 (98.4)
Sling	5 (1.0)
Splint	3 (0.6)
Follow-up advised (<i>n</i> = 501)	
None or "PRN"	493 (98.4)
Family doctor	4 (0.8)
Orthopedics	4 (0.8)

ED = emergency department; PRN = as circumstances may require.

Virtually every case of pulled elbow (99.2%) was successfully and easily reduced in hospital. Of the cases identified, 15.8% had spontaneously reduced before physician assessment. If the child required a reduction, only 1 attempt by the physician was required in 89.6% of cases. Other studies have found that 8%–10% of all RHS cases spontaneously reduce^{14,17} and that 74%–88% of reductions are successful on the first attempt.^{1,6-8,18} These findings demonstrate that the great majority of pulled elbows are easily reduced in the ED setting.

We found that children presenting to the ED with RHS often have a long wait before treatment and discharge. Over one-third (41.2%) of all patients diagnosed with RHS had to wait more than 2 hours before being treated and discharged. In some cases, children had to wait more than 5 hours in the ED before receiving treatment. Once assessed by a physician, the median time to discharge was 24 minutes. In EDs using the Canadian Triage and Acuity Scale (CTAS), children with RHS would typically score 4 out of 5 and would appropriately be in the "less urgent" category, unless significant pain was present, which could result in an up-triage to a score of 3.¹⁹ Hence, such children will often wait for long periods of time despite the relative ease and rapidity of the diagnosis and treatment. We believe that there may be an opportunity to improve wait times for children with RHS by training nurses to recognize and treat RHS soon after presentation to the ED, and we intend to pursue further research initiatives with this in mind.

While no studies that examine the success of nurse initiated treatment of RHS have been published, there are many reasons to believe that this would be feasible. We are aware of at least 2 Australian children's hospitals where reduction of RHS is routinely provided by a nurse soon after presentation at triage (Dr. Matthew O'Meara, personal communication, 2005). In addition, parents whose children frequently experience RHS are often taught how to reduce a pulled elbow at home should it recur in the future. A recently published case series reports 2 children whose physician diagnosed RHS over the phone and successfully instructed the caregivers (who had no medical experience) to reduce this injury.²⁰ The use of nurse initiated treatments or "critical care pathways" is common within many EDs. Several studies have demonstrated that nurse-initiated treatments can be beneficial in the management of ED patients.²¹⁻²⁶ Furthermore, patient satisfaction appears to be unchanged or improved when ED care for minor injuries is provided by nurse practitioners rather than physicians.^{27,28} While many factors are associated with parental and patient satisfaction in the ED, it appears that early treatment¹⁰ and short waiting times are correlated with patient and parent

satisfaction.¹¹ Before adopting a practice change, however, a prospective study is required to examine whether ED nurses can successfully and safely diagnose and reduce RHS.

In the setting of a convincing history and typical physical examination, radiographs are not required to diagnose or manage a patient with RHS. The medical literature indicates that the number of patients with RHS who are evaluated radiographically varies between 24% and 61%.^{1,7,15,16} In our study, 26% of RHS patients were imaged, with only a small number ($n = 8$) demonstrating a joint effusion. None of these patients had their care altered as a result of undergoing radiography.

Limitations

Owing to the retrospective methodology, the information extracted from the medical charts was limited by missing or incomplete data in some cases. Another limitation is that our study only describes the circumstances that exist at a single location. Although our findings are consistent with the existing literature, ED wait times of patients with RHS have not previously been studied and may vary institutionally.

Conclusion

This large study demonstrates that children with RHS often have long waits in the ED before reduction and discharge. The majority of children with RHS have a pull as the mechanism of injury and are treated successfully with 1 reduction attempt by a physician. The data collected from this study will assist in planning and implementing a prospective study to shorten ED visits for patients with RHS.

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Competing interests: None declared.

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Correspondence to: Dr. Martin Osmond, Division of Emergency Medicine, Children's Hospital of Eastern Ontario, 401 Smyth Rd., Ottawa ON K1H 8L1; osmond@cheo.on.ca

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