

## Original Article

DOI: 10.22114/ajem.v0i0.70

**Radial Head Subluxation: Possible Effective Factors on Time to Re-use the Affected Limb**Farhad Heydari<sup>1</sup>, Babak Masoumi<sup>1</sup>, Shiva Samsamshariat<sup>2\*</sup>

1. Emergency Medicine Research Center, Department of Emergency Medicine, Isfahan University of Medical Sciences, Isfahan, Iran.

2. Department of Emergency Medicine, Faculty of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran.

\*Corresponding author: Shiva Samsamshariat; Email: samsamshariat84@yahoo.com

Published online: 2018-01-05

**Abstract****Introduction:** Radial head subluxation (RHS) is a common disorder in children. Although it is not accompanied by any important short- or long-term sequel, it could make the parents worried about.**Objective:** The purpose of this study was to determine the possible effective factors that may influence time to use the affected limb.**Methods:** This cross-sectional study was conducted prospectively during the years 2014 to 2016. All children under the age of 6 years who visited the emergency department (ED) and were diagnosed as having RHS were eligible. The patients' baseline information was recorded. After the reduction, the time until the affected arm use returned was recorded. The possible relationship between the baseline data and time to re-use the affected limb was assessed.**Results:** During the study period, 112 children with a mean age of  $30.18 \pm 18.18$  months were evaluated (53% male). Among the children who visited the ED during the first 4 hours and thereafter, 84% and 60%, respectively, re-used their limb in less than 10 minutes after reduction ( $p = 0.004$ ). Also, 55% of children less than or equal to 24 months and 89% over the age of 24 months re-used the arm in 10 minutes ( $p < 0.001$ ). The success rate of the first reduction maneuver was significantly lower in children with a recurrent dislocation ( $p = 0.001$ ).**Conclusion:** It is likely that age less than or equal to 24 months and ED visit after 4 hours of the event lead to a longer duration for re-using the affected arm following reduction.**Key words:** Child; Elbow joint; Joint dislocations; Radius; Time perception**Cite this article as:** Heydari F, Masoumi B, Samsamshariat S. Radial Head Subluxation: Possible Effective Factors on Time to Re-use the Affected Limb. *Adv J Emerg Med.* 2018;2(2): e19.**INTRODUCTION**

Radial head subluxation (RHS), also called "pulled elbow" or "nursemaid's elbow," is a common disorder in children (1-4). Although it is not accompanied by any important short- or long-term sequel, it could make the parents worried about. Although most of the cases are seen in those under the age of 7 years, RHS has been reported in children younger than six months of age or even until the age of 18 years (5, 6). RHS is a frequent elbow injury in young children, affecting approximately 20,000 children per year in the United States (7, 8). Since there are cases of spontaneous reduction, it is difficult to determine its actual occurrence rate. This injury usually occurs in the left hand and is more common in girls (9, 10).

The most common mechanism is the pulling of the arm while the child's elbow is completely open and the forearm is rotated inwards. This mechanism usually occurs when the child is wounded by

parents or other caregivers. The mechanisms of RHS such as swinging the child by the arms, lifting the child, or wrestling may more often involve male caregivers while RHS caused by pulling away, tripping, or getting dressed appears to be associated more with female caregivers (7, 11, 12). As a result, a portion of the annular ligament over the radial head slips into the radiohumeral joint space, where it becomes locked in. Sometimes this ligament is torn and falls between the head of the radius and the capitellum (1, 3).

The child cries and does not use the affected arm and resists any attempts to move passively. The child holds the arm close to the body with his/her elbow in extension and the forearm pronated (10). The diagnosis of RHS can be made when the characteristic history, physical examination findings, and the position of the arm are present in a child (1, 2, 4). There is no focal bony tenderness, bruising, deformity, or swelling. RHS is a clinical

diagnosis, and radiologic investigation is usually not needed unless the history of injury is not clear, or attempts to reduce failed, or there is suspicion of child abuse, and if there is spontaneous improvement within 30 minutes. In such cases, radiographs are obtained to rule out a possible fracture (13, 14).

Most children are able to use the affected arm, early after reduction, but some are associated with delays in the use of the affected arm leading to repeated attempts at reduction. The purpose of this study was to determine the possible effective factors that may influence the time to use of the affected limb.

## METHODS

### **Study design**

A cross-sectional study was conducted prospectively during the years 2014 to 2016. It was performed at the emergency department (ED) of Ayatollah-Kashani Hospital, Isfahan, Iran. The study protocol was approved by the ethics committee of Isfahan University of Medical Sciences, and the code 395035 was assigned.

### **Study population**

All children under the age of 6 years who visited the ED and were diagnosed as having an RHS were eligible. In the absence of specific diagnostic features, the diagnosis was performed on the basis of a characteristic history and physical examination, but the diagnosis was confirmed based on the child using the affected arm after the reduction. Children with deformity, swelling, edema, and ecchymosis in the elbow area as well as children with multiple traumas and patients diagnosed with any other injury during the study were excluded.

### **Reduction method**

Different methods are used for reduction. One of the treatments is the supination/flexion method. The examiner supinates the forearm and flexes the elbow by applying pressure on the radial head by the opposite hand. The other method is the hyperpronation method wherein the examiner hyperpronates the forearm and applies pressure with the other hand on the radial head. A click may be felt by the finger over the radial head, or a pop may be heard by the examiner when the displacement is reduced (15, 16).

### **Data gathering**

The patients' baseline information including age and sex, chief complaint, mechanism of injury, time of injury, side of injuries, previous history of trauma, and the number of similar injuries were recorded. After the reduction, the reduction

method, the presence or absence of a heard click, the number of reduction attempts, and the time until the affected arm use returned were recorded in a pre-prepared checklist.

Patients were visited by emergency medicine residents and were treated by the hyperpronation method. If the child did not use his/her arm within 15 minutes after the maneuver, the reduction was re-suspended by the emergency medicine specialist using the same reduction method, and if he/she did not use the arm after 15 minutes, another method was used to reduce it. When the affected arm use returned, it was considered as a successful reduction. Three failed maneuvers were considered as a treatment failure. If the child did not use the arm after trying the maneuver two times or after 30 minutes, a radiograph was requested.

### **Statistical analysis**

The statistical analyses were performed using SPSS-20 software. The data were analyzed using Chi-square and Kruskal-Wallis tests.

## RESULTS

During the study period, 112 children were brought to the ED by their parents due to elbow pain and lack of use of the upper limbs. The mean age of the children was  $30.18 \pm 18.18$  (range from 7 to 71) months, and the age of a majority of them (65%) ranged from 21 to 46 months. The baseline characteristics of the studied patients are reported in table 1. Of these children, 59 were boys (53%), and 53 were girls (47%), indicating a higher incidence in boys. In 67 children (60%), the left hand was involved. Ten children had swelling, ecchymosis, and edema of the elbow and were excluded from the study. The other children were treated based on the diagnosis of RHS, history and mechanism of injury, and physical examination findings. Sixteen patients with a previous history of RHS (18.8%) were referred for recurrent dislocation, and 76% of them experienced a dislocation in the same limb. Although the most prevalent mechanism identified was pulling of the forearm (51.0%), there were some other causes such as direct trauma or fall. After reduction, 56% of the children used the affected arm immediately or within 5 minutes.

According to the results, among the children who visited during the first 4 hours, 84% used their limb within 10 minutes after reduction and 16% after 10 minutes, and among the children who visited after 4 hours, 60% used their limb within 10 minutes after reduction and 40% after 10 minutes. These

**Table 1:** Baseline characteristics of the studied patients

Variable	Number (%)
<b>Age (month)</b>	
≤24	49 (43.7)
>24	63 (56.3)
<b>Sex</b>	
Boy	59 (52.7)
Girl	53 (47.3)
<b>Involved side</b>	
Left	67 (59.8)
Right	45 (40.2)
<b>Recurrent RHS*</b>	
Yes	21 (75/2)
No	91 (24.8)
<b>Mechanism of injury</b>	
Limb pulling	57 (50.9)
Fall down	26 (23.2)
Other cases	4 (3.6)
Unknown	25 (22.3)
<b>Performed maneuver (time)</b>	
1	101 (90.2)
2	9 (8.0)
3	2 (1.8)
<b>Time to visit (hour)</b>	
≤4	64 (57.1)
>4	48 (42.9)
<b>Time to re-use (minute)</b>	
<5	62 (56.3)
5-30	46 (41.1)
>30	4 (3.6)

\* Radial head subluxation

results indicate that there was a significant relationship between the time of referral and the time of using the arm after reduction ( $p = 0.004$ ).

According to the results, among the children less than or equal to 24 months of age, 55% used their arm within 10 minutes after reduction and 45% after 10 minutes, and among the children over the age of 24 months, 89% used their arm within 10 minutes after reduction and 11% after 10 minutes. These results indicate that there is a significant relationship between the age and time of re-using the arm after reduction ( $p < 0.001$ ).

In 11 children, more than one attempt was made for reduction. In two cases, three attempts were made for reduction. The association between the number of reduction attempts and the number of previous dislocations was investigated. The success of the first reduction maneuver was significantly lower in children with recurrent dislocation of the arm ( $p = 0.001$ ).

The feeling or hearing of a click during reduction is an important finding that, according to the study, had a 91% sensitivity, 84% specificity, 96% positive predictive value, and 67% negative predictive value.

Radiography was requested in six children among whom two children did not use the arm after attempting the maneuver twice, and four children did not use the arm even after 30 minutes. All the

children had a normal radiograph and had no problems in the following week. Meanwhile, these children used their arms before being discharged from the ED.

## DISCUSSION

In the current study, the age of the child and the time period from the event to visiting the ED corresponded to a longer duration for re-using the affected arm following reduction.

A majority of the children's age was in the range of 21-46 months, which is similar to that reported by other studies (1, 3, 4). The minimum age was 7 months, and no child under 6 months of age was seen.

RHS was more common in boys (53%), which is different from the results of most of the prior studies conducted in other countries but similar to another study carried out in Iran (9, 17, 18). According to the earlier studies, the left hand was most commonly affected, whose possible cause is the dominant right-handed parenthood, in which case the child's left hand is usually held.

Similar to other studies, the most common mechanism for dislocation was pulling the arm (1, 3). Recurrent dislocation was seen in about 19% of the cases. The chance of recurrent RHS in various studies has been reported to be from less than 5% to about 30%-39% (1, 10).

There is a controversy about the time of re-using the affected arm after the reduction and is reported to be from 30 minutes to later (10, 19). According to a study, 56% of the children were able to use the affected arm immediately and within 5 minutes of reduction, and this number was 74% before 10 minutes. In only 4% of children, the time to re-use the limb was more than 30 minutes.

Often, one of the possible factors affecting the delay in re-using the injured limb is the delay in referral (more time from dislocation to maneuvering). According to this study, a delay of more than 4 hours from dislocation to reduction maneuvers had a direct relationship with the time taken to use the affected arm. On the other hand, a lower age of the child affected the increase of this time. Of course, this may be because of the unwillingness of younger children to move their limbs and, consequently, leading to later detection. This finding contrasts with some earlier studies and is consistent with that of a number of other studies (20, 21).

Different causes have been mentioned for the success of the first reduction maneuver, one of which is the type of maneuver. Hyperpronation method has a greater chance of success (18). Therefore, in this study, the affected arms of all children were reduced by this method. Based on the results, repeated subluxation had an effect on the success of the first maneuver. Also, a delay of more than 24 hours in referral to the ED also had an effect on the failure of the first maneuver (19-21). Although the cause is unclear, this could be due to the increased swelling and damage around the annular ligament.

Radiography was requested in six children, two of whom did not use the arm after attempting the maneuver twice, and four did not use the arm after 30 minutes. All children had a normal radiograph and had no problems in the following week.

## REFERENCES

1. Krul M, van der Wouden J, Koes B, Schellevis F, van Suijlekom-Smit L. Nursemaid's elbow: Its diagnostic clues and preferred means of reduction. *J Fam Pract.* 2010;59(1):E5-7.
2. Kim M, Eckhardt B, Craig C, Kuhns L. Ultrasonography of the annular ligament partial tear and recurrent "pulled elbow". *Pediatr Radiol.* 2004;34(12):999-1004.
3. Krul M, van der Wouden JC, Kruithof EJ, van Suijlekom-Smit LW, Koes BW. Manipulative interventions for reducing pulled elbow in young children. *Cochrane Database Syst Rev.* 2017;7:CD007759.
4. Sevcencan A, Aygun U, Inan U, Omeroglu H. Pulled elbow in children: a case series including 66 patients. *J Pediatr Orthop B.* 2015;24(5):385-8.
5. Brown D. Emergency department visits for nursemaid's elbow in the United States, 2005-2006. *Orthop Nurs.* 2009;28(4):161-2.

Meanwhile, these children used their arms before being discharged from the ED. In other words, in children whose history and physical examination indicate RHS, it is possible to avoid x-ray for the child by observing the child for more time.

## Limitations

The baseline characteristics were chosen based on expert opinion. A better search would be more valuable for being considered in the checklist of the study. The performed statistical analysis is not conclusive and just report the possibility of the influence of some factors on time to re-use the affected limb. We strongly suggest other investigators to prepare a comprehensive checklist or use data-registry if available.

## CONCLUSIONS

In the current study, age less than or equal to 24 months and visiting ED after 4 hours of the event lead to a longer duration for re-using the affected arm following reduction.

## ACKNOWLEDGEMENTS

The authors appreciate the insightful cooperation of Medical Sciences and the staffs of the emergency department of Ayatollah-Kashani Hospital, Isfahan, Iran.

## AUTHORS' CONTRIBUTION

All the authors met the standards of authorship based on the recommendations of the International Committee of Medical Journal Editors.

## CONFLICT OF INTEREST

None declared.

## FUNDING

None declared.

6. Rudloe TF, Schutzman S, Lee LK, Kimia AA. No longer a "nursemaid's" elbow: mechanisms, caregivers, and prevention. *Pediatr Emerg Care*. 2012;28(8):771-4.
7. Welch R, Chounthirath T, Smith GA. Radial Head Subluxation Among Young Children in the United States Associated With Consumer Products and Recreational Activities. *Clin Pediatr (Phila)*. 2017;56(8):707-15.
8. Makhni MC, Makhni EC, Swart EF, Day CS. Radial Head Subluxation (Nursemaid's Elbow). *Orthopedic Emergencies*: Springer; 2017. p. 431-2.
9. Vitello S, Dvorkin R, Sattler S, Levy D, Ung L. Epidemiology of Nursemaid's Elbow. *West J Emerg Med*. 2014;15(4):554-7.
10. Irie T, Sono T, Hayama Y, Matsumoto T, Matsushita M. Investigation on 2331 Cases of Pulled Elbow Over the Last 10 Years. *Pediatr Rep*. 2014;6(2):5090.
11. Rodts MF. Nursemaid's elbow: a preventable pediatric injury. *Orthop Nurs*. 2009;28(4):163-6.
12. Lewis D, Argall J, Mackway-Jones K. Reduction of pulled elbows. *Emerg Med J*. 2003;20(1):61-2.
13. Eismann EA, Cosco ED, Wall EJ. Absence of radiographic abnormalities in nursemaid's elbows. *J Pediatr Orthop*. 2014;34(4):426-31.
14. Wong K, Troncoso AB, Calello DP, Salo D, Fiessler F. Radial Head Subluxation: Factors Associated with Its Recurrence and Radiographic Evaluation in a Tertiary Pediatric Emergency Department. *J Emerg Med*. 2016;51(6):621-7.
15. Makin CW, Vinson DR. A literature-based algorithm for the treatment of children with radial head subluxation who fail to respond to initial hyperpronation. *Am J Emerg Med*. 2017;35(9):1365-7.
16. Hung O, Nelson L. *Tintinalli's emergency medicine: a comprehensive study guide*. 8th edition ed. New York: McGraw-Hill; 2016. p. 983-4.
17. Heydari F, Samsam Shariat S, Majidinejad S, Masoumi B. The use of ultrasonography for the confirmation of pulled elbow treatment. *JEPT*. 2018;4(1):24-8.
18. Asadi K, Mardani M. Comparison the Method of wrist Supination with Elbow Flexion as Classical Method with Hyperpronation Method in Reduction of Radial Head Subluxation in Less than 7 Years Old Children. *J Guilan Univ Med Sci*. 2011;20(77):55-60.
19. Kaplan RE, Lillis KA. Recurrent nursemaid's elbow (annular ligament displacement) treatment via telephone. *Pediatrics*. 2002;110(1 Pt 1):171-4.
20. Dixon A, Clarkin C, Barrowman N, Correll R, Osmond MH, Plint AC. Reduction of radial-head subluxation in children by triage nurses in the emergency department: a cluster-randomized controlled trial. *CMAJ*. 2014;186(9):E317-23.
21. Macias CG. Radial head subluxation. *Acad Emerg Med*. 2000;7(2):207-8.