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Comparison of hyperpronation and supination-flexion techniques in children presented to emergency department with painful pronation

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Abstract

Context: Radial head subluxation, also known as 'pulled elbow', 'dislocated elbow' or 'nursemaid's elbow', is one of the most common upper extremity injuries in young children and a common reason to visit Emergency Department (ED).
Aim: To compare supination of the wrist followed by flexion of the elbow (the traditional reduction technique) to hyperpronation of the wrist in the reduction of radial head subluxations (nursemaid's elbow) maneuvers in children presented to ED with painful pronation and to determine which method is less painful by children.
Settings and Design: This prospective randomize study involved a consecutive sampling of children between 1-5 year old who were presented to the ED with painful pronation.
Materials and Methods: The initial procedure was repeated if baseline functioning did not return 20 minutes after the initial reduction attempt. Failure of that technique 30 minutes after the initial reduction attempt resulted in a cross-over to the alternate method of reduction.
Statistical analysis used: Datas were analyzed using SPSS for Windows 16.0. Mean, standard deviation, independent samples *t* test, Chi-square test, and paired *t* test were used in the assessment of pain scores before and after reduction.
Results: When pain scores before and after reduction were compared between groups to determine which technique is less painful by children, no significant difference was found between groups.
Conclusions: It was found that in the reduction of radial head subluxations, the hyperpronation technique is more effective in children who were presented to ED with painful pronation compared with supination-flexion. However, there was no significant difference between these techniques in terms of pain.

Keywords: Child, emergency department, nursemaid′s elbow, pain, pulled elbow

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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 children and a common reason for Emergency Department (ED) visits. [1] The peak incidence of RHS occurs in children 2- 3 years of age, with a range from 6 months to 7 years. The injury is more common in girls than boys. Left- sided injury is more common, presumably because most caretakers are right- handed. The usual mechanism of injury is sudden axial traction on the arm with the elbow extended, such as that occurs when a child is pulled up by the arm, although up to half of injuries are associated with other mechanisms. [2],[3] Pulled elbow is usually treated by manual reduction of the subluxed radial head. Various maneuvers can be applied. Majority of textbooks recommend supination of the forearm, as opposed to pronation and other approaches. It is unclear which maneuver is most successful. [4] The present study was conducted to compare success rates of interventions using hyperpronation and supination-flexion (SF) maneuvers in children presented to ED with painful pronation and to determine which method is less painful for children by using Wong-Baker Faces Pain Rating Scale (WBFPRS) and Face, Legs, Activity, Cry, Consolability Scale (FLACCS). Because none of the previous studies were used by using pain scales other than with the child's own pain assessment. This is the first time the pain assessment was done by children and not by parents or doctors.

Materials and Methods

This prospective, randomize study involved a consecutive sampling of children between 1- 5 year-old who were presented to ED of Samsun Training and Research Hospital between June 2011 and March 2012. Two patients were excluded without attempting reduction as a result of a fracture was detected. We failed to achieve reduction by both techniques in these two patients, which were also excluded. As the inclusion criteria; children were enrolled if they were previously healthy, younger than 6 years old and presented with clinical findings (difficulty with moving elbow and painful pronation) suggestive of RHS. Presentation suggestive of RHS included favoring the upper extremity involved and holding the arm with a slightly flexed elbow and a pronated wrist. We did not use X-ray graphy to define RHS: point of tenderness, local ecchymosis or edema, deformity and persistent pain were criteria for exclusion.

Study design

Enrollees were randomly assigned to begin the protocol with either the hyperpronation or the supination technique via a randomization table [Table 1]. The 88 patients who underwent reduction were divided into 2 groups as follows; patients who underwent reduction by hyperpronation technique (n = 40) [Figure 1] and those who underwent reduction by SF technique (n = 38) [Figure 2]. Both reduction techniques were attempted twice where the second attempt was performed 10 minutes after first failed attempt. If both attempts were failed in reduction, the alternate reduction technique was performed 15 minutes after failure of baseline technique. WBFPRS and FLACCS scoring systems were used to assess pain before and after reduction. If a child was able to communicate, the child was asked to indicate how painful was the experience by using the WBFPRS (n = 40) [5] [Figure 3]. Research assistants pointed to each of the six faces and described each face using the brief word instructions provided with the scale. Children were asked to circle the face that best represented their level of pain severity. WBFPRS scores, ranging from 0-10. Face 0 represents being very happy as the child was not hurt at all. Face 2 represents hurt just a little bit. Face 4 hurts a little more. Face 6 hurts even more. Face 8 hurts a whole lot. Face 10 hurts as much as you can imagine, although the child does not have to be crying to feel thats bad. The assistant asked the child to choose which face that best describes his feeling. If a child was unable to communicate, FLACCS scoring system [Table 2] was used (n = 38). [6] Research assistants scored patient's facial expression, leg movements, activity, the extent to which they are crying, and the extent to which they can be consoled on a scale from 0-2 to generate a total score ranging from 0 (no pain/distress) to 10 (maximum pain/distress). Pain scores were recorded before and 5 minutes after reduction by the clinician who performed intervention in a similar manner and pain response to reduction was assessed. Statistical analyses were performed to compare success rates between groups and to determine less painful technique.

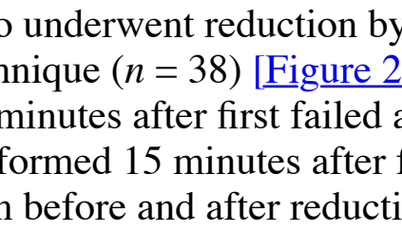

Figure 1: Hyperpronation at the wrist

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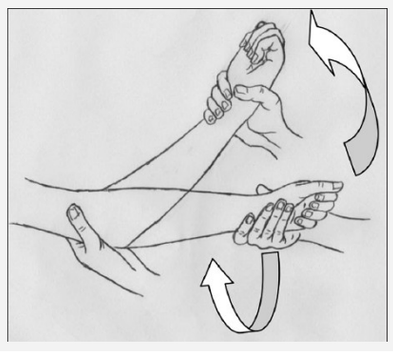

Figure 2: Supination at the wrist followed by flexion at the elbow

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Figure 3: Wong-Baker Faces Pain Rating Scale

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	Hyperpronation (n:40)	Supination (n:38)
Gender (%)		
Female	21 (56.8)	19 (50)
Male	19 (43.2)	19 (50)
Median age (month)	28	32
Number of patients with failed reduction (%)	1 (2.5)	6 (15.8)

Table 1: Demographic features of patients

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Categories	Scoring		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant frown, clenched jaw, quivering chin
Legs	Normal position or relaxed	Uneasy, restless, tensed	Kicking, or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tensed	Arched, rigid, or jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or being talked to, distractable	Difficult to console or comfort

Each of the five categories (F) Face; (L) Legs; (A) Activity; (C) Cry; (C) Consolability is scored from 0-2, which results in a total score between zero and ten

Table 2: The faces, legs, activity, cry and consolability scoring system

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Statistical analysis

Datas were analyzed using SPSS for Windows 16.0. Mean, standard deviation, independent samples *t* test, Chi-square test, and paired *t* test were used in the assessment of pain scores before and after reduction.

Results

A total of 78 patients were enrolled in the study. of 82 cases, in which 7 patients failed the entire protocol. Two were removed for the further analysis as the reduction was failed in both techniques. Additional 2 patients were also excluded, as a fracture was detected. In other 2 cases in which reduction was failed by both techniques, no fracture was detected by X-rays; thus, they were discharged after immobilizing the arm by scheduling an orthopedic examination. There were type I supracondylar humerus fracture in 2 patients who were discharged after immobilizing the arm by scheduling an orthopedic examination. A successful reduction was achieved in 39 patients in hyperpronation group ($n = 40$) by hyperpronation technique, whereas in 32 patients in SF group ($n = 38$) by SF technique. Thirty-six of 40 patients (92%) were reduced by hyperpronation on the first attempt, compared with 25 of 38 patients (78%) reduced by SF on the first attempt. The SF technique required a greater number of attempts to reduction than did the hyperpronation technique. Among 40 patients randomized to hyperpronation, 3 patients (8%) required 2 attempts at reduction, but reduced successfully and 1 patient required 2 attempts at reduction and crossed over to the SF technique. Seven patients (22%) from SF group required 2 attempts at reduction but were reduced successfully, and 6 patients required 2 attempts at reduction and crossed over to the hyperpronation technique. When success rate of reduction was compared, it was found that hyperpronation technique was more successful ($P = 0.04$) [Table 3].

	Succesful reduction		Failed reduction		*P*
	n	%	*n*	%	
Supination-flexion group (*n*:38)	32	84.2	6	15.8	<0.05
Hyperpronation group (*n*:40)	39	97.5	1	2.5	(0.04)

Table 3: Successful reduction rates in groups

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When pain scores before and after reduction were compared between groups to determine which technique is less painful, no significant difference was found between groups ($P = 0.462$) [Table 4].

Groups	Before reduction	Indpendent samples *t* test	After reduction	Indpendent samples *t* test
Supination-flexion	6.7±1.7	*P*>0.05 (0.922)	3.9±1.6	*P*>0.05 (0.462)
Hyperpronation	6.6±1.6		3.7±1.7	

Table 4: Distribution of pain scores before and after reduction according to technique used

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Ages ranged from 9- 60 months, with a mean of 30 months, and with no significant difference in two groups ($P = 0.922$). Around 47 females and 31 males were enrolled with no significant difference in the proportion of females and males. In the hyperpronation group, there were 21 girls (56.8%) and 18 boys (43.2%). In the SF group, there were 19 boys (50%) and 19 girls (50%). There was no significant difference in the distribution of gender between groups ($P = 0.814$). The injury was left-sided in 48, and right-sided in 40 of the patients. When mechanism of injury was considered, it was pulled arm in 35 patients; fall in 21 patients; and strain in 6 patients. The mechanism of injury was unclear in the 26 patients.

Discussion

In previous studies, both reduction techniques were compared in RHS. Some authors found that pronation technique is more successful. [3],[7],[8],[9] In our study, hyperpronation technique was found to be successful when the success rates of both techniques were compared ($P = 0.04$). In recent years, there are limited number of studies performing pain assessment for reduction techniques including the study by Green *et al*. and McDonald *et al*. [7],[8] The children were randomized consecutively to SF or hyperpronation, and parents, doctors and nurses used the visual analogue scale to assess pain before, during and one minute after reduction. Results showed that there were no difference in pain rated by doctors, but that of parents and nurses recorded where hyperpronation was significantly less painful. [7] A completely reliable and valid measurement of pain intensity by self-report is unattainable. Specifically, a gold standard self-report pain scale for use with all children is not available. [10],[11],[12],[13] The unique feature of this study is, that this is the first time the pain assessment is done by children not by parents or doctors. We concluded that WBFPRS and FLACC are feasible in our study. In this study, FLACC pain score was used in children who were unable to communicate, whereas WBFPRS was used in children who were able to communicate. No statistical difference was found between both pain scoring system in pain ($P = 0.462$). Although earlier studies report that; hyperpronation technique is less painful, in our study there has not been any determined significant difference between the two methods in terms of pain.

Conclusion

Although there was no significant difference between these two techniques in terms of pain, hyperpronation technique can be preferred as the choice of reduction technique in children presented with painful pronation as it is more successful. The unique feature of our study is; that the first time pain scales were used to compare the effectiveness of pain reduction in the children using the two reduction methods of radial head dislocation in the children.

We think that this study may further lead to randomized studies with larger sample size.

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Figures

[Figure 1], [Figure 2], [Figure 3]

Tables

[Table 1], [Table 2], [Table 3], [Table 4]

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