Investigation on 2331 cases of pulled elbow over the last 10 years

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Abstract

Pulled elbow is a common upper extremity injury in children. We present a retrospective study of 2331 pulled elbow cases examined in our hospital over the last ten years. All pediatric patients with a diagnosis of pulled elbow from January 2002 to December 2011 were retrospectively reviewed according to sex, age, affected arm, recurrence rate, mechanism of injury and treatment outcomes. There is no significant sex difference. The frequency of injury peaked for both boys and girls at 6 months and 2 years of age. The left arm was more affected than the right. The recurrence rate was 14%. In about 50% of cases, the cause of injury was forcible traction to the forearm. Almost all of the splinted patients, caused by severe pain or lack of mobility of the affected limb following reduction, recovered within 2 weeks, but 2 were later diagnosed with a fracture. For infants less than 1 year old, injury can often occur when rolling over. For children 1 year old or older the left arm is more commonly affected, and the frequency of injuries to the left arm increases with age, possibly because the left hand is commonly held by the guardian's dominant right hand and faster development of muscle strength in the child's dominant right arm works toward preventing injury to that arm with age.

Introduction

Pulled elbow is a common upper extremity injury in younger children, whereby a pulling force onto an extended elbow joint and pronated forearm results in radial head subluxation or entrapment of the annular ligament of the radius in the humeroradial joint or capsular tear.[1] This injury typically has been reported to occur between 1 and 4 years of age with a peak incidence between 2 and 3 years of age. Girls are more often affected than boys, and the left arm is more frequently involved than the right.[2,3] Few epidemiological reports on this injury are available in Japan. We carried out a retrospective study of 2331 cases of pulled elbow examined in our hospital over the last ten years.

Materials and Methods

The research protocol was approved by the institutional review board. Two thousand three hundred thirty-one patients, who were initially diagnosed with pulled elbow between January 2002 and December 2011, were included in this study. The diagnosis was confirmed by the history, the physical examination, and the observation that arm use returned after reduction with clicking based on the method described by Schunk (1990).[2]

Some cases of child abuse and patients who were later diagnosed with fracture were excluded. The reduction technique was either the flexion supination or extension pronation method. The treatment records, except cases of unknown treatment results, were reviewed to identify the presence of clicking after manual reduction or the occurrence of spontaneous reduction. In addition, we also investigated the records for splint application caused by severe pain or lack of mobility of the affected limb following reduction. The appropriate reduction technique was performed at the discretion of the physician in charge. We regard as a reduction success the cases of patients who improved their elbows' range of motion and pain following reduction.

The cases that met the criteria out of 2331 cases were reviewed retrospectively (Figure 1). Review was according to sex, age, affected arm, recurrence rate and mechanism of injury.

A comparison of the mechanism of injury was made for an under-1-year-old group and a 1-year-old or older group.

All parameters were evaluated with the nonparametric statistical analysis, including binomial test, χ^2 analysis and Bonferroni correction was performed using SPSS software (version 19; SPSS Inc., Chicago, IL, USA).

Results

The presence of clicking after reduction treatment is shown in Table 1. The medical records of 1817 patients, except 508 with unknown treatment results, showed that clicking after reduction was evident in 1307 cases (72%), whereas no clicking was evident in 221 cases (12%). The other 289 patients (16%) experienced spontaneous reduction before consultation. The clinical outcomes for the 1307 patients who experienced clicking after reduction are shown in Table 1. Of these patients, 13 (1%) required splinting for pain reduction. Of the 221 patients with no clicking after reduction, 35 (16%) required splinting. The 48 splinted patients were discharged and asked to return for a follow-up consultation. These patients had either recovered completely at follow-up or after re-reduction. While some failed to return for a follow-up, there appeared to be no intractable cases or cases requiring surgery.

Six of the patients, who were initially misdiagnosed with a pulled elbow, were diagnosed with a fracture by plain radiographs at a later date. There fractures were found to have occurred at the humeral supracondyle (n=1), humeral condyle (n=1), olecranon (n=1), forearm (n=1), and clavicle (n=2). All fracture patients were treated conservatively and had a complete recovery. No patient had multiple injuries that made us suspect child abuse or had any history of abuse in the medical record.

Out of the 1307 patients with the criteria, there were 653 (49.96%) males and 654 (50.04%) females with no significant sex difference (P=1.00). The age of the children ranged from 2 months to 9 years and 5 months with a mean age at the time of the injury of 6 months for children under 1 year old, and 2 years for children over 1 year old with no difference between boys and girls (Figure 2). Only 0.8% of the patients were over 7 years old at the time of the injury. The injury was on the left side in 748 elbows (57%) and on the right in 559 elbows (43%), with a statistically significant difference (P<0.01). The injury was bilateral in 1 child, and the side of injury was not recorded for 1 child (Table 2).

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Key words: pulled elbow, radial head subluxation, nursemaid's elbow, reduction, epidemiology.

Contributions: the authors contributed equally.

Conflict of interests: the authors declare no potential conflict of interests.

Received for publication: 27 September 2013.
Revision received: 29 December 2013.
Accepted for publication: 30 December 2013.

Pediatric Reports 2014; 6:5090
doi:10.4081/pr.2014.5090

Patients were divided into 2 groups according to age, with an under-1-year-old and a 1-year-old or older group. A comparative analysis was made on the side of the affected arm in these 2 groups. Generally, a child starts standing and walking at about 1 of age, so the 1-year-old or older group has a higher physical activity level than the under-1-year-old group. For the under 1-year-old group, 43 injuries (47%) were on the left and 49 (53%) were on the right side with no significant difference (P=0.60). However, in the 1-year-old or older group, 705 injuries (58%) were on the left and 510 (42%) on the right side, showing that in this group the left side was injured more often (P<0.01). The percentage of affected left arms in each group is shown in Table 2. Figure 3 shows the frequency of recurrent injuries caused by pulled elbow. The number of patients excluded the same person from 1307 cases were 1109. Out of 1109 patients, 157 (14%) had a recurrence; however, these values do not include patients who were initially diagnosed at another institution and then referred to this hospital, perhaps with recurrence. The highest frequency of recurrent injury was six times, which was observed in one patient. She injured 4 times the left side and twice the right side, once by a pulling action, once by a fall, twice by rolling over during sleep and twice for unknown reasons from 1 to 4 years of age.

In 1307 patients the cause for the injury was i) a pulling action in 670 cases (51%), ii) a fall in 182 cases (14%), iii) rolling over during sleep in 81 cases (6%), and iv) a direct blow on the elbow in 31 cases (2%). In 26 cases (2%), the cause was different from those listed above

Table 1. Presence of clicking and reduction outcomes.

Clicking present	Reduction success	Splinting	No. of patients
Yes	1294	13	1307
No	186	35	221
Spontaneous reduction		289	
Unknown		508	

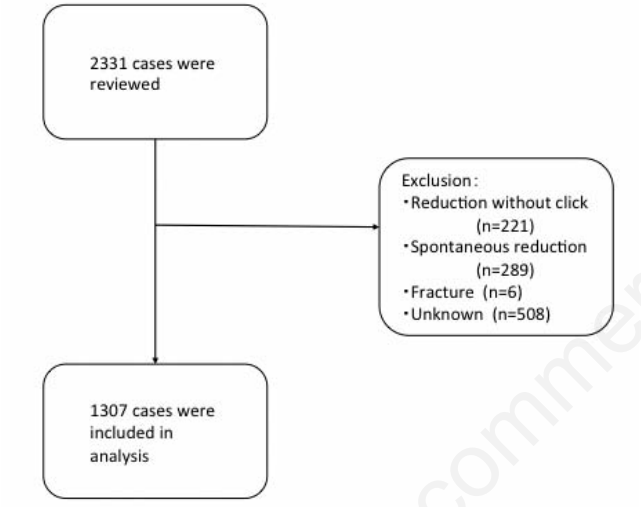

Figure 1. Flow chart of the patients reviewed in the study.

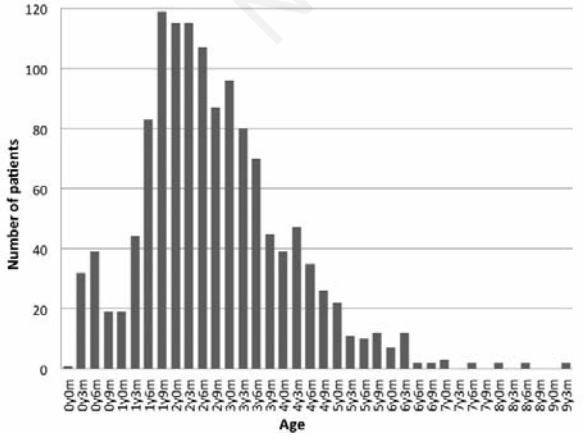

Figure 2. Age distribution of all patients with pulled elbow. There were a mean age of injury at six months under one year old, and at two years over one year old, and was consistent for both boys and girls.

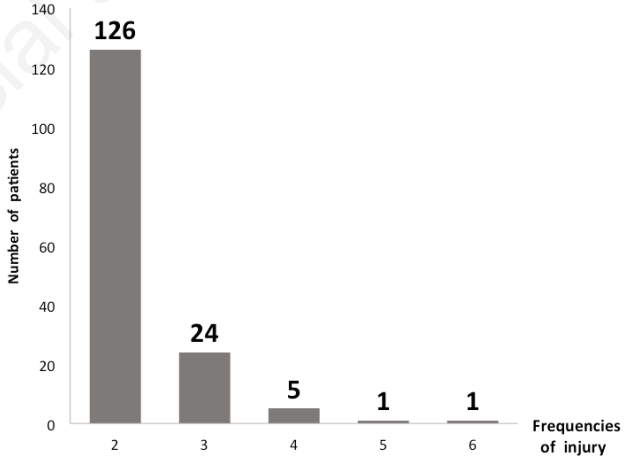

Figure 3. Frequencies of injury caused by pulled elbow per patient who had an injury more than once.

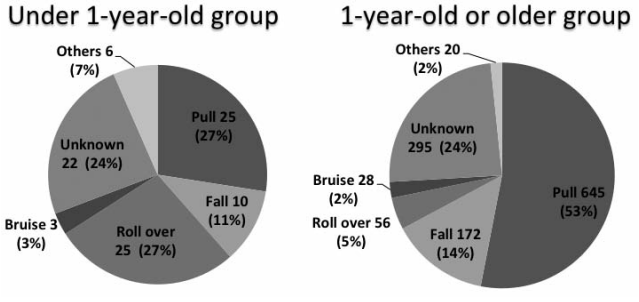

Figure 4. Mechanism of injury and number of patients: less than 1-year-old group/ 1-year-old or older group. ※only Roll over; P<0.008 The significance on χ^2 analysis with Bonferroni correction was defined as P<0.008.

Table 2. The rate of injury per affected arm/age group.

Age	Left (%)	Right (%)	P
<1	43 (46.7)	49 (53.3)	0.60
1	153 (58.0)	111 (42.0)	<0.05
2	237 (55.9)	187 (44.1)	<0.05
3	178 (61.2)	113 (38.8)	<0.01
4	84 (57.1)	63 (42.9)	0.10
5	34 (61.2)	21 (38.2)	0.11
6	13 (56.5)	10 (43.5)	0.68
7	1 (20.0)	4 (80.0)	0.38
8	3 (75.0)	1 (25.0)	0.63
9	2 (100)	0 (0)	-
Tot.	748 (57.2)	559 (42.8)	<0.01

and in 317 cases (24%) the cause was not known.

Figure 4 compares the mechanism of injury between the under-1-year-old group and the 1-year-old or older group. A significant difference between the 2 age groups was seen only in the percentage of injuries caused by rolling over during sleep, which was higher in the under-1-year-old group (P<0.008).

Discussion

Previous studies of pulled elbow concluded that the injury typically occurs between the ages of 1 and 4 years with a peak incidence between 2 and 3 years.[2,3] However, the results of this study indicate that it often occurs also in children who are less than 1 year old. The analysis of the under-1-year-old and the 1-year-old or older groups revealed a peak frequency of injury at 6 months and around 2 years of age, respectively. The analysis of injuries resulting from rolling over during sleep revealed a higher incidence for the under-1-year-old group. Rolling over during sleep begins at about 5 months of age. The injury may occur when the child rolls over without coordination, thereby trapping the limb underneath the body. For the 1-year-old or older group, walking and running begins from about 1 year of age with frequent falls. Thus, pulled elbow may result from falling, or because of a pulling force applied to the arm during a rescue from falling by a parent or guardian.

Before 7 years of age the radius has a shape similar to a pole without a head or neck, thus being prone to easy dislocations. Conversely, in children over 7 years of age, the radial head expands via epiphyseal growth above the radial neck, therefore dislocation becomes much more difficult.

Previous studies reported that girls are more often affected than boys;[2-5] however, this study did not identify any significant difference in terms of sex.

In this study, we found that the left arm is more commonly affected than the right and that the frequency of injuries to the left arm tends to increase with age (Table 2). Possible causes for this include the likelihood that in most cases parents or guardians hold the child's left hand with their dominant right hand, and also that faster development of muscle strength in the child's dominant right arm may have a preventive effect on this arm with age. The recurrence rate for pulled elbow was 14.2%, but it may be underestimated, because the study did not include patients who were initially diagnosed at another hospital and then referred to our hospital, perhaps with a recurrent injury. Therefore, the 14% recurrence rate reported here appears to be underestimated, because previous studies reported a recurrence rate ranging from 27 to 39%.[2-6] Immobilizing the elbow through splinting in a flexed and supinated position for 2 days after manipulative reduction is reported to prevent recurrence.[7] Clicking at the time of reduction was reported in 72% of cases, with fewer cases in the group requiring a splint. This result suggests that clicking indicates reduction success. While reduction can be done with the flexion supination or extension pronation method, it is reported that the extension pronation technique produces better treatment outcomes and is less painful than the other technique.[3,8-12] We don't analyze the relative success of the reduction methods, because of incomplete medical records.

Also cases of irreducible pulled elbow that required surgical reduction were reported;[13] however, in this study there were no cases that necessitated reduction surgery, and all patients had a favorable prognosis.

Conclusions

This study has some limitations. First, it is retrospective and non randomized. Second, we couldn't analyze some points sufficiently because of incomplete medical records or lack of radiographs.

Previous studies reported cases of elbow fracture that were initially been misdiagnosed as pulled elbow in which patients were unnecessarily exposed to reduction maneuvers.[14] Similar cases were identified in this study, stressing the importance of the initial differential diagnosis. Reduction may be attempted for the child with a typical history (pull or roll over). The cases injured with other histories have a low percentage of injuries in this study, and have the risk of fracture. Therefore radiographs should be obtained before reduction when the history shows no case of pull or roll over.

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