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ORIGINAL ARTICLE

Nursemaid's elbow: diagnosis and treatment in emergency department

Pronación dolorosa: diagnóstico y manejo de urgencia

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What do we know about the subject matter of this study?

Pulled elbow is a frequent pathology in emergency services, which affects preschoolers as a result of traction of their upper extremity, generating great anguish to parents and caregivers. In expert hands and using known maneuvers, it can be effectively solved, with no patient sequelae.

What does this study contribute to what is already known?

This study provides a comprehensive view of the pathology, simplifying its understanding. It allows not only Pediatric Orthopaedic Surgeons knowledge, but also to extend it to other areas of medicine that are also in direct contact with pediatric patients.

Abstract

Painful pronation (PD), also known as "nursemaid's elbow", is a common injury caused by abrupt longitudinal traction of the hand while the forearm is pronated and the elbow extended. **Objective**: to describe a sample of patients diagnosed with painful pronation and the different reduction techniques used for this pathology. **Patients and Method**: retrospective study of patients who visited the emergency department of a referral hospital, from January 2018 to September 2019. Patients under 7 years of age consulting due to a condition compatible with PD were included. We recorded demographic data, sex, and age, number of previous episodes (defining recurrent as three or more episodes), affected extremity, mechanism of injury, diagnostic images, reduction maneuver used, and success obtained measured through the presence of "click" and decrease in pain. Patients who presented any sign of trauma or fractures were excluded from the study. **Results**: 172 patients were included, 57.6% were female, and a median age of 25.5 months. The most affected side was the left one and the main mechanism was traction of the extremity, followed by a same-level fall. The hyperpronation method was effective in 66% of the cases, and the remaining 34% required a supination maneuver.

Keywords:
Elbow Joint/Injuries;
Child;
Emergency Service;
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Conclusions: PD is a frequent reason for consultation in pediatric patients around the age of 2 years. The hyperpronation method was the most commonly used for its management. It is important to be aware of this pathology in the context of emergency care.

Introduction

Pulled elbow (PE), also known as "nursemaid's elbow", is a common pediatric orthopedic injury caused by abrupt longitudinal traction of the hand with the forearm pronated and the elbow extended. This maneuver is frequently used by adults (usually right-handed) to lift children off the ground after a fall or during play[1]. Kaplan and Lillis report that this phenomenon is caused by the ligament laxity in this age group, associated with the anatomy of the radial head[2]. There is a tear of the annular ligament of the radius, causing it to be trapped in the radiocapitellar joint, while the head of the radius does not move from its position[3](Figure 1).

In 1995, a study reported that 63% of children under 6 years of age who consulted an urban emergency department due to pain or inability to move an upper extremity had this injury as the final diagnosis[4]. Currently, it is believed to account for 20% of upper extremity conditions and is the most frequent pathology in the emergency setting in children under 6 years of age[2-5]. More specifically, it occurs between the ages of 1 and 4 years, with a higher prevalence in females, and affects more the left arm in both sexes, due to the mechanism of how the injury occurs[6]. The recurrence rate of this pathology, which can affect the same or the contralateral arm, is from 5% to 39% depending on the reference population studied[5-8].

The usual clinical presentation is characterized by severe pain in the forearm and limitation to move the limb at the elbow. The diagnosis is clinical with a compatible history and physical examination. For its management, there are two known reduction maneuvers, the supination-flexion maneuver and the hyperpronation (or forced pronation). The first consists of the patient sitting in front of the examiner, who takes the patient's elbow with one hand, and with the other one firmly grasps the distal forearm and applies supination of the forearm followed by flexion of the elbow (Figure 2A). The second maneuver consists of the examiner firmly grasping the affected elbow with one hand and holding the distal forearm with the other hand and then applying hyperpronation (Figure 2B). When performing these maneuvers, a "click" will be felt, indicative of recovery of normal anatomy[5]. As reported, hyperpronation appears to be less painful according to some publications[7]. However, a Cochrane review[9] found only low-quality evidence supporting the advantage of this technique versus supination-flexion.

Currently, there are no studies that address this pathology in the Chilean population. The objective of this study is to describe a sample of patients with a diagnosis of painful pronation and the different treatments (reduction techniques) used for this pathology.

Patients and Method

We conducted a retrospective study of patients who consulted the emergency department at a referral hospital from January 2018 to September 2019. Patients under 7 years of age who consulted due to a condition compatible with PE were included. All patients presenting any sign of trauma and fractures (edema, ecchymosis, and deformity) were excluded from the study.

Demographic data such as sex and age, number of previous episodes (defining recurrent as three or more episodes), side involved, mechanism of injury, the request for diagnostic imaging during care, the reduction maneuver used, and its success (measured through the presence of "click" and decrease in pain in children) were recorded.

In all patients, the first reduction attempt was performed with the hyperpronation maneuver, which was selected because the literature reports that it would cause less pain in the patient[7]. If a satisfactory reduction was not obtained in the first attempt, the supination-flexion technique was performed. The reductions were performed by traumatologists in training or by specialist traumatologists.

For the description of categorical variables, we used absolute and relative frequency, for numerical variables we evaluated normality with the Shapiro-Wilk test and used median and interquartile range (IQR) when the variables did not have a normal distribution. Statistical significance was considered a $p < 0.05$ at a 95% confidence interval. Statistical analyses were performed with STATA software.

This work was approved by the Scientific Ethics Committee of the Southeast Metropolitan Health Service on July 4, 2018.

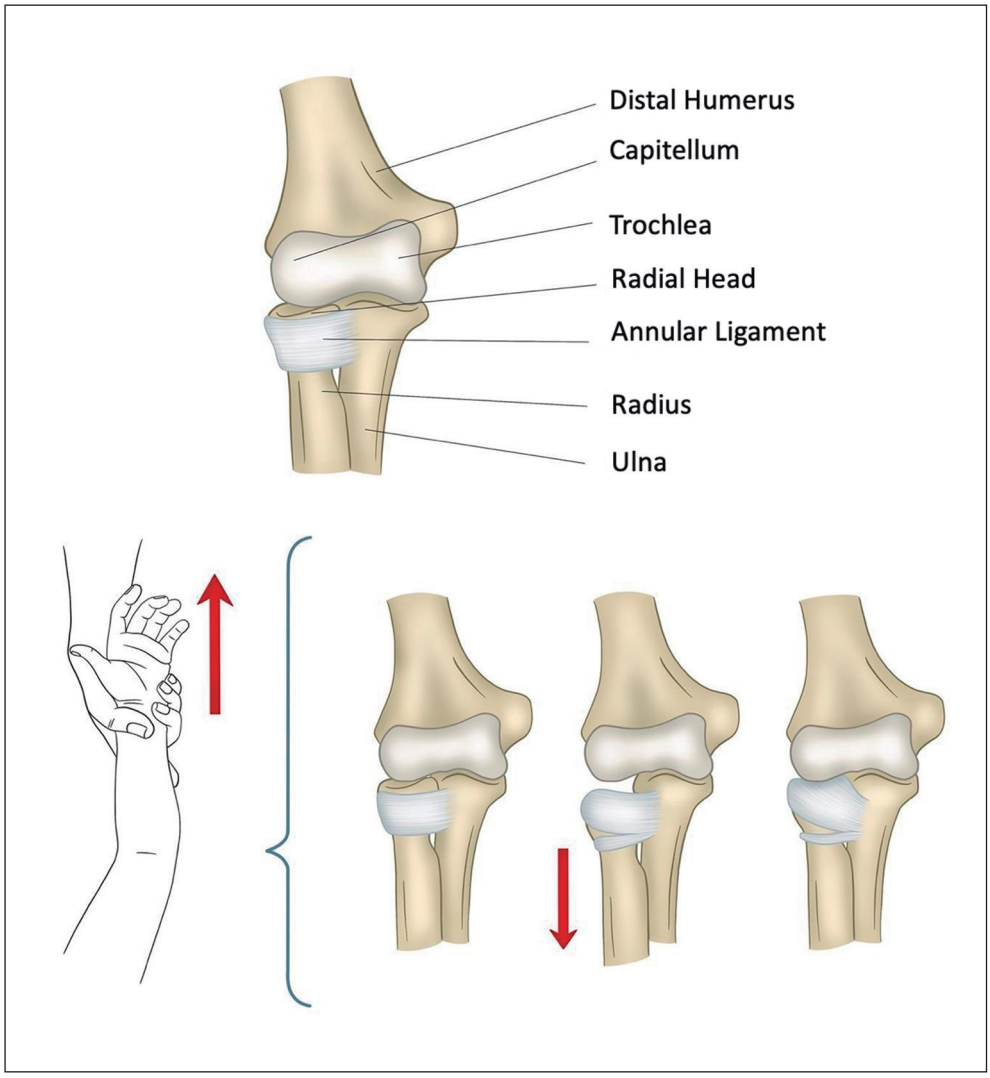

Figure 1. Pulled Elbow mechanism of injury.

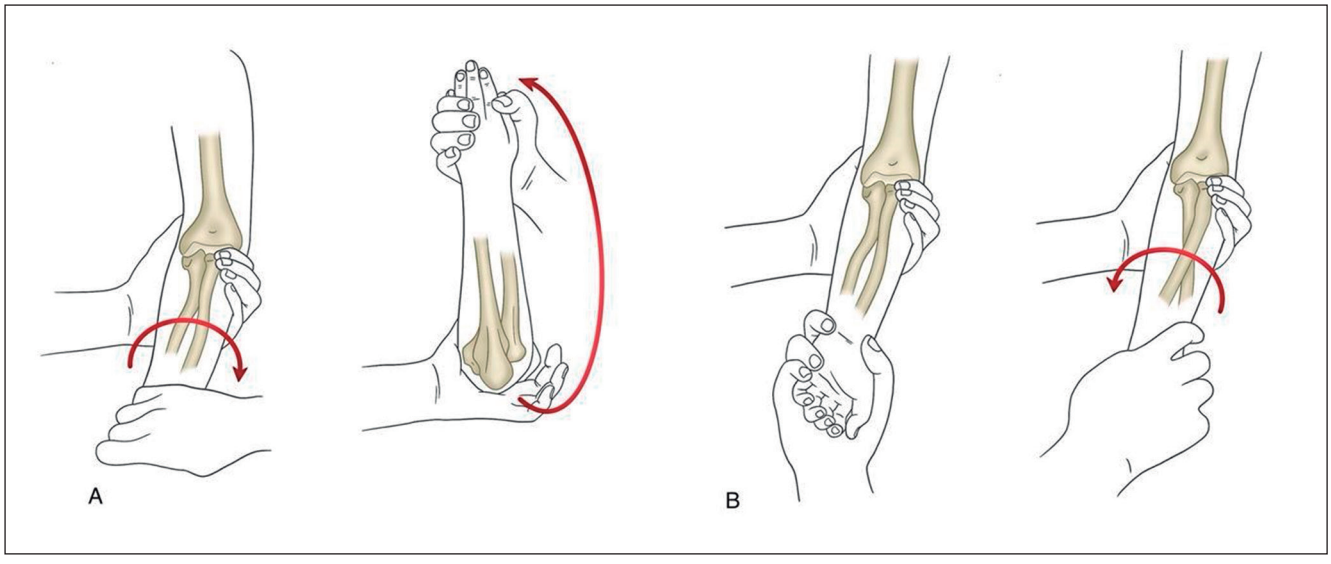

Figure 2. Pulled Elbow reduction methods. **A** Supination-flexion maneuver. **B** Hyperpronation maneuver.

Results

172 patients were included. Table 1 shows the main results, grouped by sex. The most affected side was the left one (58.7%) and the main mechanism was traction of the extremity which occurred in 117 patients (68%), followed by falls on the same level in 41 patients (23.8%). Patients who consulted early (less than 24 hours) accounted for 85.47% (147) and those who consulted late accounted for 14.53% (25). 59.3% (102) of the consultations were the first episode, whereas 23.8% (41) of patients had history of dislocation. 16.8% (29) of the consultations were for recurrent pronation. The median age of patients who relapsed was significantly older (31 months) than the median age (24 months) of those who did not ($p = 0.0296$).

12% of patients required radiographic (XR) evaluation. The number of patients evaluated with XR was significantly higher (10 out of 31) among those who suffered PE as a result of a fall ($p = 0.0191$), giving this mechanism a higher chance of needing an XR in their evaluation (OR 3.8; CI 95% 1.40 - 10.67).

The hyperpronation method was effective 66% of the time and the remaining 34% required the supination maneuver. With both maneuvers, 100% recovery was achieved, evaluated as pain relief. The proportion of patients with PE reduced by hyperpronation was higher in women (73.7%) than in men (54.7%) ($p = 0.01$).

Discussion

Our results show that the average age is 2 years 5 months, it occurs predominantly in females, the left side is the most affected, the hyperpronation method was effective in at least two-thirds of patients, and a smaller percentage of patients required XR for diagnosis.

The literature describes a predominance in female patients of up to 60%, with an average incidence at 28.6 months of age[6], similar to those observed in this study. The same occurs when comparing the incidence of this injury in the left extremity compared with the right since the literature describes a 60% of predominance of the left arm.

According to the literature, hyperpronation has a higher percentage of success as the first reduction technique compared with the supination technique (85% vs. 53%)[5]. The difference between what is described and the findings in this study (85% vs. 66%) can be because the maneuvers are operator-dependent and require experience and improvement in the technique. In this study, some maneuvers were performed by Orthopaedic Surgeons in training and others by Pediatric Orthopaedic Surgeons , which could explain the lower success rate in the first reduction technique. In addition, it should be noted that in contrast to what has been described in the literature[10,11], the proportion of reductions with hyperpronation in women was significantly higher than in men.

The diagnostic role of XR in this pathology is debatable since in many cases the image is normal, without evidence of an abnormal position of the radial head[12]. Given a history that coincides with painful pronation and a suggestive physical examination, the use of XR would not be necessary to confirm the diagnosis and the image does not change the management of the patient[13]. The use of XR as a diagnostic method is considered in cases of suspected fracture or when the mechanism of injury is unclear. The literature describes that anteroposterior and lateral XRs of the elbow are taken in 23-61% of patients, most of them with history of associated traumatic mechanism[5]. In this study, only 12% of patients required imaging evaluation, 32% of which had a history of fall. This corroborates that the diagnosis of PE is essentially clinical.

One of the strengths that we can identify in this work is that there are no studies in the Chilean population that report epidemiological data on PE. In addition, it is a study that includes a sample obtained from a health service referral hospital, covers a significant period, and includes multiple variables, making it of interest in the pediatric and trauma fields.

However, the study also has several limitations that should be considered. An important limitation is that the study was carried out only in one hospital, which may interfere with its external validity for the rest of the country's healthcare centers. In addition, the local population has specific characteristics that may differ from the general Chilean population. Since the sample included children of a wide age range, it suggests that older children may be able to report more reliably the decrease in pain than younger children who have fewer tools to communicate. Finally, the heterogeneity of the treating physicians due to the inclusion of Orthopaedic Surgeons in training and not only specialist traumato-

Table 1. Main characteristics of the sample according to sex

	Male	Female	Total
Cases (%)	73 (42.4%)	99 (57.6%)	172
Age in months (AIM)	24 (18-41)	27 (19-36)	25.5 (18-36.5)
Relapsing *	6 (8.2%)	23 (23.2%)	29 (16.85%)
Late Consultation	8 (10.9%)	17 (17.1%)	25 (14.5%)
Succesful Hyperpronation*	40 (54.7%)	73 (73.7%)	113 (65.70%)

*$p < 0.05$.

logists is also considered a limitation that may have an influence.

In conclusion, PE is a frequent reason for consultation in the pediatric age group. It presented mainly in female patients around the age of 2 years. The hyperpronation method was successful in at least two-thirds of the patients. Knowledge of this pathology is important because the general practitioner, Family Physician, Pediatrician, Orthopaedic Surgeons , or any Physician in a pediatric emergency department should be able to resolve it.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed according to the Declaration of Helsinki and the World Medical Association regarding human experimentation developed for the medical community.

Data confidentiality: The authors state that they have followed the protocols of their Center and Local regulations on the publication of patient data.

Rights to privacy and informed consent: This study was approved by the respective Research Ethics Committee, which, according to the study's characteristics, has accepted the non-use of Informed Consent.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

Financial Disclosure

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