



## Missed elbow fractures misdiagnosed as radial head subluxations

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Over a 36-month period, 11 children were treated in our department for fractures about the elbow which initially went undiagnosed, as they had first undergone reduction maneuvers for a suspected radial head subluxation, without prior imaging. The most frequent final diagnosis was supracondylar humerus fracture (n = 4). A fall was reported for six children (54.5%); the mechanism of injury remained unknown in four children (36.4%). In four of eleven children (36.4%) there was moderate or major soft tissue swelling at the time of first presentation, which is uncommon in radial head subluxation. Reduction of a suspected radial head subluxation without any prior radiological investigation can be recommended exclusively when the typical history of an abrupt traction by an (adult) attending person is positively reported. In every other case, radiographs should be done prior to any attempt at reduction.

**Keywords:** radial head subluxation; pulled elbow; missed fracture.

the humeroradial joint, which can be confirmed by sonography findings (5,6). This interposition leads to radial head subluxation (1). It is furthered by the immature form of the radial head (16) and a certain laxity of the annular ligament up to the sixth year of life (21). The typical mechanism of injury is a sudden, abrupt traction on the hand of the extended arm ("pulled elbow"), most often performed by an adult. There is no intention to harm the child and frequently the incident is not recognized as an injury at this time (10). Falls and sporting activities are less frequently reported as causes for a radial head subluxation (19,20).

The peak of age of this injury is in infants of 2 to 4 years (14,17,19,20); only 2.4% of those concerned are older than 6 years (3). Children show the typical clinical image of the palsy-like hanging pronated forearm. There is no significant pain at rest and there is a mild soft-tissue swelling at most.

### INTRODUCTION

Subluxation of the radial head is frequent in children; it represents about 1% of all musculoskeletal injuries in this age group (2,3,18). Up to 27% of injuries of the elbow region are radial head subluxations (17). They appear under various synonyms: pronation douloureuse, Chassaignac's palsy, nursemaid's elbow or pulled elbow. The pathophysiology is not yet well known (19). It is suspected to be an interposition of parts of the annular ligament into

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Treatment is reduction by supination and flexion or forced pronation, respectively, both performed without any anaesthesia (8,9,12). In case of failure of the maneuver, a short immobilization and subsequent clinical re-evaluation is recommended (13).

The aim of the current report is to show that there may be severe injuries, some of which may require operative treatment, in cases with an atypical or unclear history. Besides inflammatory diseases of the elbow and wrist joints, various fractures in the elbow region may clinically masquerade a radial head subluxation (14).

### PATIENTS AND METHODS

The clinical study covered a 36-month period. The first four cases were included retrospectively; the following cases were included prospectively. All children included in the study had undergone a reduction maneuver because of a suspected radial head subluxation without any prior radiographic examination, and were subsequently diagnosed with a fracture of the upper extremity. Two further cases were excluded from the study because the initial radiographs did show the fracture, but were not correctly interpreted. Age, gender, mechanism of injury, number of reduction attempts and time to correct diagnosis were recorded. As more than 50% of the cases identified were referred from other regions, it was not possible to establish a solid epidemiological grounding. The percentage of missed fractures in children with suspected radial head subluxation over the study period was therefore impossible to estimate.

### RESULTS

Eleven children with fractures of the upper extremity were treated after having undergone a reduction attempt for a suspected radial head subluxation within the three-year study period. There were 6 boys and 5 girls aged 2-7 years (mean: 3.7 years). They had undergone from two to five (mean: 2.5) reduction attempts over up to three consecutive days. The correct diagnosis was made by plain radiographs in nine children and by MRI in two others. Until correct diagnosis, 1-19 days (mean 3.9) days had elapsed. Four children had received plaster cast immobilization before final diagnosis, because of persisting complaints.

The most frequent final diagnoses were supracondylar humerus fracture (n = 4), lateral condyle fracture (n = 3) and radial neck fracture (n = 2). Furthermore there was one case each of olecranon fracture and metaphyseal distal forearm fracture. A conservative treatment in a long arm plaster cast was performed in eight of eleven children (72.7%) with undisplaced or slightly displaced fractures. In one case of supracondylar fracture with mild ante-curvature there was no more need for immobilization, as the fracture was healed at the time of final diagnosis; the angulation was anticipated to fade with further growth, considering the girl was only two years of age. Two patients needed operative treatment. These were a three-year-old girl with a displaced fracture of the lateral condyle and a seven-year-old boy with a severely displaced supracondylar fracture.

A detailed retrospective chart review was done for each child regarding the mechanism of injury and the clinical symptoms presented at the first visit. The mechanism of injury remained unknown in four children (36.4%). One girl was injured while playing with her same-aged mates. A fall was reported in a further six children (54.5%). In four of eleven children (36.4%) there was moderate or major soft tissue swelling at the time of first presentation, which is uncommon in radial head subluxation. Individual data are summarized in table I.

### DISCUSSION

The diagnosis of a radial head subluxation is based on the history and clinical presentation. In typical cases, radiographs are most often unnecessary (9,14). In up to one third of cases however, a typical history is missing, and there is a trend towards using a radiological diagnostic workup (15). Many authors recommend plain radiographs in cases with a history that is atypical or unknown (4,7,9,20); however, Sacchetti *et al* (15) reported a similar rate of successful reduction maneuvers in groups with typical and non typical anamnestic data in their study. Macias *et al* found 2.9% and 5.5% of fractures, respectively, in two investigations in children who had undergone a

Table I. — Data of eleven cases of suspected radial head subluxation and missed elbow fracture.  
SHF : supracondylar humeral fracture. Classification according to von Laer (5)

Case No.	Age (years)/gender	Accident	Clinical presentation	Reduction attempts	Actual diagnosis	Days to diagnosis	Final treatment
1	4/m	Unknown	No swelling	3	Radial neck fracture	1	1 week, long arm plaster cast
2	3/m	Fall from tricycle	Moderate swelling	5	Grade I SHF	3	3 weeks ,long arm plaster cast
3	3/f	Play with same-aged	Moderate swelling	1	Lateral condyle fracture	3	Open reduction, screw fixation
4	4/m	Fall	No swelling	2	Lateral condyle fracture	2	3 weeks, long arm plaster cast
5	7/m	Unkown	Major swelling	3	Grade III SHF	1	Closed reduction, K-wire fixation
6	2/f	Fall from high sleeper bed	Mild swelling	2	Lateral condyle fracture	1	3 weeks, long arm plaster cast
7	3/m	Fall	No swelling	2	Olecranon fracture	6	2 weeks, long arm plaster cast
8	4/f	Unknown	Mild swelling	3	Grade I SHF	2	3 weeks, long arm plaster cast
9	5/m	Unknown	No swelling	3	Radial neck fracture	3	5 days, long arm plaster cast
10	2/f	Fall from swing	Moderate swelling	2	Grade II SHF	19	none
11	4/f	Fall in playground	No swelling	2	Distal forearm fracture	3	3 weeks, long arm plaster cast

reduction maneuver for suspected radial head subluxation (11,12).

The observations reported here show that up to four times a year, children have to be treated in a paediatric trauma center, after having undergone a painful and unsuccessful reduction maneuver for suspected radial head subluxation, although their history was not typical or was unknown. In at least some of these cases, a detailed analysis of history (7,14) and clinical findings (1,4,20) could have avoided these procedures. Same-aged mates are not able to apply the typical abrupt traction to the arm, which is necessary to trigger radial head subluxation (case 3). Radial head subluxation in a 7-year-old boy is so uncommon that a reduction maneuver should not be considered without prior diagnostic investigation (case 5). Even when little children sometimes are not able to exactly specify the loca-

tion of their pain, it should be possible to differentiate distal forearm from elbow injuries (case 11). Furthermore, a soft tissue swelling rated more than “mild” is atypical for radial head subluxation (11,14,17,20).

Considering these findings, reduction of suspected radial head subluxation without any prior radiological investigation can exclusively be recommended, when the typical history of an abrupt traction by an (adult) attending person is positively reported. In any other case, i.e. when the mechanism of injury is unknown and there has been no explicitly reported fall, radiographs should be done prior to any attempt at reduction. The current study shows that this treatment algorithm is justified even though, based on literature, the reported risk of more severe injuries being present is relatively low (12,15).

## REFERENCES

1. **Bretland PM.** Pulled elbow in childhood. *Br J Radiol* 1994 ; 67 : 1176-1185.
2. **Chambers HG, Wilkins KE.** Dislocation of the joints of the elbow. In : Rockwood CA Jr, Wilkins KE, Beaty JH (eds). *Fractures in Children*. 4<sup>th</sup> Ed. Lippincott-Raven, Philadelphia. 1996, pp 840-1020.
3. **Jonasch E, Bertel E.** [Injuries in children up to 14 years of age.] (in German). *Hefte zur Unfallheilkunde* 1981 ; 150 : 1-180.
4. **Haxhija E, Weinberg AM.** [Traumatic dislocation of the radial head (Pronatio dolorosa).] (in German). In : Weinberg AM, Tscherne H (Hrsg.). *Unfallchirurgie im Kindesalter Vol. 1*. Springer, Heidelberg, Berlin. 2006, pp 295-299.
5. **Kim MC, Eckhardt BP, Craig C et al.** Ultrasonography of the annular ligament partial tear and recurrent pulled elbow. *Pediatr Radiol* 2004 ; 34 : 999-1004.
6. **Kosuwon W, Mahaisavariya B, Saengnipanthkul S et al.** Ultrasonography of pulled elbow. *J Bone Joint Surg* 1993 ; 75-B : 421-422.
7. **Kraus R, Berthold LD, von Laer L.** [Efficient imaging of elbow injuries in children and adolescents.] (in German). *Klin Paediatr* 2007 ; 219 : 282-289.
8. **Krul M, van der Wouden JC, van Suijlekom-Smit LW et al.** Manipulative interventions for reducing pulled elbow in young children. *Cochrane Database Syst Rev* 2009 ; 4 : CD007759.
9. **Krul M, van der Wouden JC, Koes BW et al.** Nursemaid's elbow : Its diagnostic clues and preferred means of reduction. *J Fam Pract* 2010 ; 59 : E2.
10. **Kunckler CE.** Did you check your nursemaid's elbow ? *Orthop Nurs* 2000 ; 19 : 49-52.
11. **Macias CG, Bothner J, Wiebe R.** A comparison of supination/flexion to hyperpronation in the reduction of radial head subluxation. *Pediatrics* 1998 ; 102 : e10.
12. **Macias CG, Wiebe R, Bothner J.** History and radiographic findings associated with clinically suspected radial head subluxations. *Pediatr Emerg Care* 2000 ; 16 : 22-25.
13. **Newman J.** Nursemaid's elbow in infants six months and younger. *J Emerg Med* 1985 ; 2 : 403-404.
14. **Pring M, Wenger D, Rang M.** Elbow – Proximal radius and ulna. In : Wenger D, Pring M (eds). *Rang's Children's Fractures*. 3<sup>rd</sup> Ed. Philadelphia. Lippincott Williams & Wilkins. 2005, pp 119-135.
15. **Sacchetti A, Ramoska EE, Glasgow C.** Nonclassic history in children with radial head subluxations. *J Emerg Med* 1990 ; 8 : 151-153.
16. **Salter RB, Zaltz C.** Anatomic investigations of the mechanism of injury and pathologic anatomy of pulled elbow in young children. *Clin Orthop Relat Res* 1971 ; 77 : 134-143.
17. **Schmittenebecher PP.** [Proximal radius and olecranon.] (in German). In : Marzi I (Hrsg.). *Kindertraumatologie*. Steinkopff, Darmstadt, 2006, pp 181-199.
18. **Steen K.** [Subluxation of the radial head.] (in Norwegian). *Tidsskr Nor Laegeforen* 2000 ; 120 : 1323-1325.
19. **Toupin P, Osmond MH, Correll R et al.** Radial head subluxation : how long do children wait in the emergency department before reduction ? *Canad J Emergency Med* 2007 ; 9 : 333-337.
20. **von Laer L.** *Pediatric Fractures and Dislocations*. Thieme, Stuttgart, New York. 2004.
21. **Walcher K, Keyl W, Backe HH.** [Observations on the aetiology of Pronatio dolorosa.] (in German). *Arch Orthop Unfall Chir* 1972 ; 74 : 197-204.