ULTRASONOGRAPHY OF PULLED ELBOW

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We used ultrasonography in ten children with pulled elbow to compare measurements of the radiocapitellar distance (RCD) on the affected and the unaffected sides. Similar measurements were made in a group of ten age-matched normal children. The mean RCD in pronation of the affected and normal sides in the patients with pulled elbows was $7.2 \text{ mm} \pm 0.7$ and $3.8 \text{ mm} \pm 0.5$, respectively ($p < 0.0001$). In the normal children the mean RCD in pronation was $4.5 \text{ mm} \pm 0.5$.

We conclude that ultrasonography is of value for documenting pulled elbow in children.

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Pulled elbow is a common injury among infants and children. The diagnosis is usually made from the history and clinical findings and the radiograph is always normal.

We report, for the first time, the use of ultrasonography for documenting pulled elbow in children.

PATIENTS AND METHODS

We examined ten children with pulled elbow and ten normal children aged from 2 to 5 years. There were seven boys and three girls in each group. The pulled elbows were diagnosed from the history, physical examination and the satisfactory results of manipulation.

Ultrasonography. A real-time apparatus with a 3.5 MHz convex transducer was used (Hitachi, EUB 405, Japan). This is more suitable for imaging superficial structures but the images of the bones were improved by the use of a gel pad.

The children were examined lying supine with the elbow flexed (Fig. 1). Both groups were examined in pronation and in supination. The pulled elbows were examined in pronation *before* they were manipulated (since this is the position in which the affected elbow lies) and in supination *after* manipulation. The injured elbows were not examined in pronation after manipulation, in case this caused a recurrence of the subluxation.

The transducer and gel pad were placed on the lateral aspect of the elbow and the radial head and capitulum were identified (Fig. 2). The distance between them, the radiocapitellar distance (RCD), was measured on the ultrasonogram. The images were stored on videotape (Panasonic AG 6200) after deleting the measurement markers. The records were later retrieved and remeasured by an independent examiner who did not know the diagnosis.

RESULTS

In the normal children the mean RCD in pronation was $4.5 \text{ mm} \pm 0.5$ and in supination it was $6.5 \text{ mm} \pm 0.4$. The RCD on the affected and the unaffected sides in the children with pulled elbows is given in Table I.

The mean RCD of the pulled elbows in pronation differed significantly from that of the contralateral elbows ($p < 0.0001$) and from that of the normal elbows ($p < 0.0001$).

The mean RCD of the pulled elbows in supination

Table I. Ultrasonic measurements of the radiocapitellar distances (mm) in ten pulled elbows, in supination and in pronation. On the affected side the measurements in pronation were made before manipulation and those in supination after manipulation

Cases	Pronation		Supination	
	Normal side	Affected side	Normal side	Affected side
1	5.0	6.5	6.3	6.1
2	4.2	6.0	6.0	6.0
3	3.5	7.5	5.5	6.0
4	3.0	8.0	6.3	6.0
5	4.0	6.6	5.8	5.5
6	3.5	7.5	5.5	5.7
7	4.5	7.0	6.5	7.0
8	3.2	7.5	7.2	7.0
9	4.0	8.0	6.0	5.7
10	3.5	8.0	6.2	6.0
Mean	3.8*	7.2*	6.1	6.0
SD	0.5	0.7	0.5	0.5

* $p < 0.0001$

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Fig. 1

Fig. 2a

Fig. 2b

Figure 1 – The position of the child and the examiner during ultrasonography of the elbow. Figure 2 – Ultrasonograms in pronation of a normal (a) and a pulled elbow (b). The capitellum and the radial head are highly echogenic (RAD = radial head, HUM = capitellum).

(after reduction by manipulation) did not differ significantly from that of the contralateral elbows and of the normal elbows ($p > 0.05$).

The correlation coefficients for interobserver variation were 0.85 in the children with pulled elbows and 0.89 in the normal children.

DISCUSSION

In a pulled elbow the annular ligament slips over the radial head when the forearm is pronated (Stone 1916; McRae and Freeman 1965). The pathological anatomy has been demonstrated in cadavers (Ryan 1969; Salter and Zaltz 1971) but our study is the first to confirm the pathogenesis of pulled elbow in living subjects.

We found that the distance between the radial head and the capitellum was increased in cases of pulled elbow probably due to the interposition of the annular ligament. The reliability of the observations is shown by the high

correlation coefficient between the two observers and the statistical significance of the measured differences.

We conclude that ultrasonography can be used to document and confirm the diagnosis of pulled elbow in children.

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