

THE SIGNIFICANCE OF ASSOCIATED LESIONS INCLUDING DISLOCATION IN FRACTURES OF THE NECK OF THE RADIUS IN CHILDREN

STEN LINDHAM & CLAES HUGOSSON

Department of Paediatric Surgery and Department of Paediatric Radiology, Karolinska Hospital, Sweden

A series consisting of 29 children with markedly dislocated fractures of the neck of the radius has been analysed. The method of measuring the angular dislocation is discussed. A true dislocation not exceeding 30° may be left unreduced. Associated skeletal lesions of the elbow imply a less favourable prognosis.

Key words: associated lesions; childhood; dislocation; fracture; radial neck

Accepted 13.ix.78

According to Blount (1955) 4.5 per cent of all elbow fractures in children affect the proximal radial epiphysis or the radial neck. Fractures through the head of the radius are less common.

Fractures of the radial neck occur with equal frequency in boys and girls (Jeffrey 1950, Henriksson 1969, Jones & Esah 1971), whereas most other fractures in childhood show male preponderance.

The mechanism of injury is a fall on the outstretched hand. An increased carrying angle is common in these patients (Henriksson 1969) and might be regarded as a predisposing factor. The trauma produces a compression force on the radial side and distraction on the medial side of the elbow joint (Jeffrey 1950). In fractures involving the neck of the radius the head may become tilted in any direction; lateral dislocation is, however, most common. The head may even become completely displaced. Fractures of the proximal part of the radius are often associated with other injuries of the elbow joint (Watson-Jones 1976).

The purpose of this investigation was to

establish the significance of the recorded dislocation of the head of the radius in children and to assess the prognostic implications of associated skeletal lesions in the same elbow.

PATIENTS AND METHODS

From January 1964 through June 1976, 1928 elbow fractures were treated at the Department of Paediatric Surgery, Karolinska Hospital. Of these, 141 or 7.0 per cent were fractures of the neck of the radius. Only one patient (not included in this series) sustained a fracture through the head of the radius. The films of the 141 patients were reviewed in order to reassess the dislocation recorded at the initial examination. In most cases films of the contralateral elbow had been exposed for comparison. The degree of dislocation was measured on the a-p and the lateral films of the elbow.

In children the normal angle between the long axis of the neck of the radius and the long axis of the upper part of the shaft amounts to 12-15°. This angle, measured on films of the contralateral elbow, was subtracted from the primary recorded angulation in order to give the true dislocation. Associated lesions of the injured elbow were also registered.

A corrected dislocation of less than 10° was found in 112 patients. Among them were 16 children with minor associated lesions, mostly fissures of the olecranon. All these 112 patients had been treated with immobilization for 3 weeks. They all recovered uneventfully according to the charts, and were therefore dismissed from further studies.

The remaining 29 patients, all with angular displacement of the neck of the radius exceeding 10°, were subjected to a follow-up study. There was no difference in sex distribution. Both elbows were affected with equal frequency. The mean age of the patients at the time of injury was 9 years and 4 months (range 6–14 years). In 16 of the 29 patients one or more associated lesions of the same elbow were radiologically demonstrable. All the 29 patients received questionnaires 1–10 years

Table 1. Degree of true angular dislocation and treatment given.

Dislocation		Treatment		
Degree	Number	Immobilization	Closed reduction	Open red.
10 - 30	13	8	2	3
31 - 45	4	2	2	0
< 45	12	0	2	10
Total	29	10	6	13

after the accident, in which inquiries were made about deformity, pain, sensibility disorders, weakness and/or limitations of movement in the injured arm.

Clinical and radiological follow-up examinations were performed in all patients who complained of any of these disabilities. The material is summarized in Figure 1.

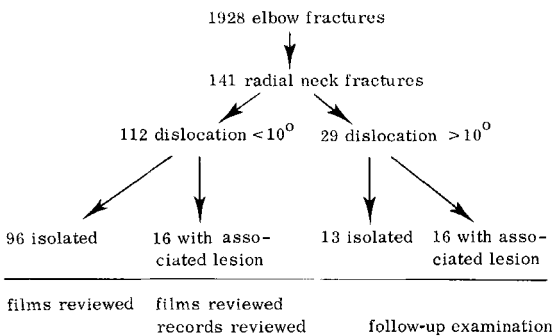


Figure 1. Summary of 141 radial neck fractures in the present investigation.

RESULTS

The true angular dislocation of the radial head among the 29 patients with dislocations exceeding 10° and their treatment are shown in Table 1. Ten patients were treated with immobilization only. In 13 closed reduction was attempted. It was successful in six, while open reduction had to be performed in seven. In six additional cases with severe dislocation open reduction was performed primarily. Internal fixation of the radial head was not utilized.

Table 2 illustrates the difference in angulation of the radial neck before and after treatment. The 22 associated lesions found in 16 patients are listed in Table 3. The four patients with dislocation of the elbow were treated with reduction. One of the seven fractures of the olecranon had to be treated with open reduction and osteosynthesis. The

Table 2. Dislocation before and after treatment.

BEFORE	Degree	10° - 30°	31° - 45°	> 45°	
Number		13	4	12	
		1 12	1 1 5		
		1 2	5 2		
AFTER	Degree	< 10°	10° - 30°	31° - 45°	> 45°
Number		7	19	3	0

Table 3. Associated lesions found in 16 children with dislocated radial neck fracture. Except for one fracture of the olecranon the associated fractures showed only minor or no dislocation.

Type of lesion	Number
Dislocation of elbow	4
Fracture of	
olecranon	7
medial epicondyle	6
lateral epicondyle	4
capitulum humeri	1
Total	22

remaining 17 associated lesions consisted of small fragments sheared from the epicondyles and infractions of the olecranon, the epicondyles or the capitulum humeri. None of these 17 injuries was given any specific treatment. All injured elbows were immobilized in plaster for 3-5 weeks. After immobilization active exercises but no passive stretching was employed.

The results were classified as excellent, good or poor. The result was excellent if the patient had a normal range of movement, no apparent deformity, no pain, sensibility disorder or weakness in the arm. The result was considered good if the patient had minimal subjective symptoms and restriction of motility less than 20° in either pronation, supination, flexion or extension. In cases with more marked limitation of motility, marked subjective symptoms or apparent deformity, the result was classified as poor.

In Table 4 the functional results are compared with the remaining angulation of the radial neck after treatment. No significant correlation could be established. Table 5 illustrates that a correlation was found

Table 4. Dislocation after treatment and results. No correlation was found.

Dislocation after treatment		Results		
Number	Degrees	Excellent	Good	Poor
7	10	2	3	2
19	10 - 30	9	4	6
3	31 - 45	2	1	0

Table 5. The results correlated with the presence of associated lesions.

Associated lesions	Results		
	Excellent	Good	Poor
Demonstrable	2	6	8
Not demonstrable	11	2	0

between the results and the presence of associated lesions demonstrated radiologically. The result was excellent in 11 out of 13 patients with an isolated fracture of the neck of the radius but in only 2 out of 16 patients with associated lesions.

DISCUSSION

Fractures of the proximal radius comprised 7 per cent of all elbow fractures in our department during the last 12 years. The therapeutic approach to this lesion, especially whether or not reduction should be performed, is still discussed in the literature. In children above the age of 8 Jones & Esah (1971) and Pollen (1973) considered 15° of angulation of the radial neck as the upper limit for treatment without reduction, while Blount (1955) and Salter (1970) accepted an angle of 40°, and Watson-Jones (1976) an angle of 45°. In cases with displacement exceeding the figures given above closed reduction and, that failing, subsequent open reduction has been recommended. All authors agree that removal of the radial head is contraindicated in children, because it results in severe deformity and reduced motility of the elbow joint.

With the exception of Jeffery (1950), very little attention has been paid to the problems involved in the estimation of the angular dislocation of the fractured neck of the radius. In the frontal view of an uninjured arm, there is laterally an open angle between the long axis of the neck and the long axis of the upper part of the shaft of the radius. This angle represents a projection of the true neck-shaft angle on the a-p film and of course changes with rotation of the radius. It is closest to the true angle with the forearm in supination. In a large number of intact elbows we found this angle to have a mean value of 12° with the forearm in supination and to decrease to 5° when the forearm was pronated to midposition (Figure 2). The valgus strain caused by the typical

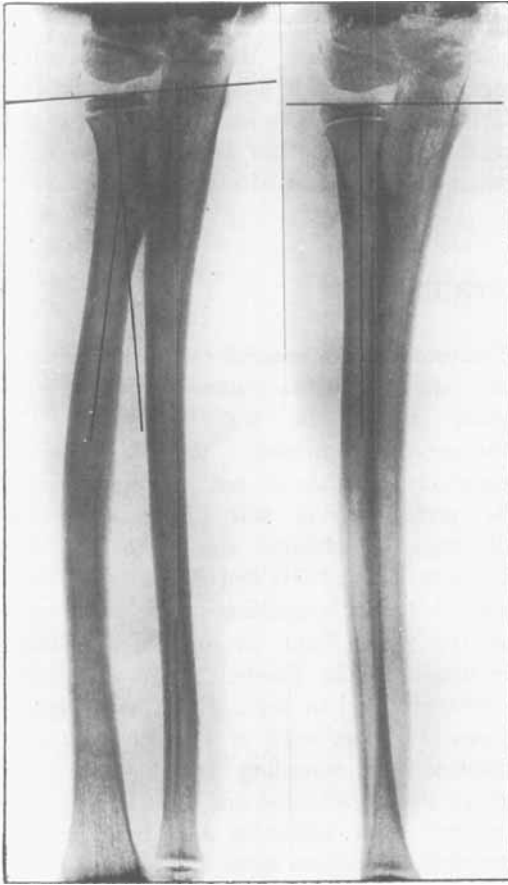


Figure 2. The normal appearance, on the a-p film, of the radius in (A) supination with a shaft-neck angle of 12° ; (B) midposition with a shaft-neck angle of 5° .

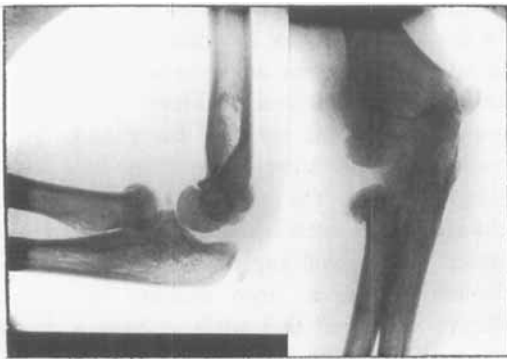


Figure 3. A-p and lateral view of the elbow. Direction of dislocation and true angular dislocation is not adequately shown.

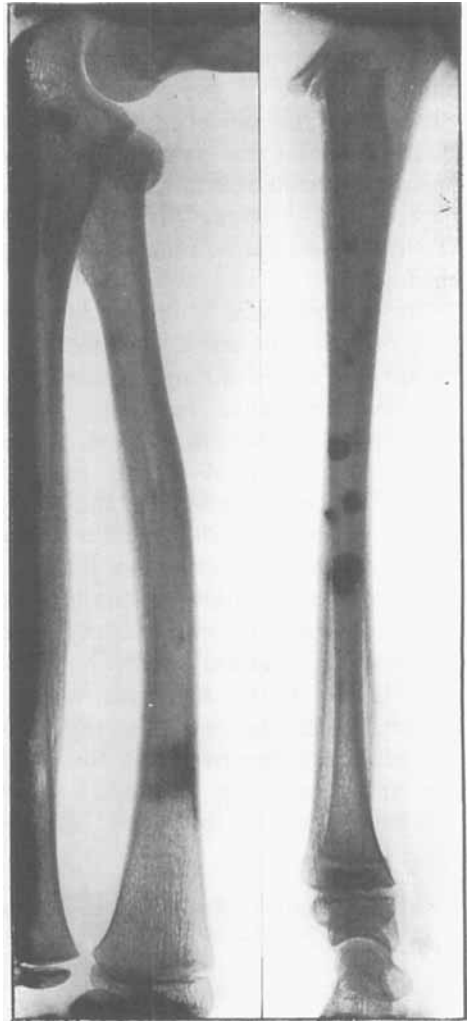


Figure 4. Same case as Figure 3. A-p and lateral views of the forearm demonstrate both the direction of dislocation and the true angle of the fracture (49°).

mechanism of injury tilts the radial head in a lateral direction. If the forearm is supinated at the moment of impact the ensuing dislocation is a truly lateral one. However, with the forearm pronated at the time of the valgus strain, the head will be tilted towards the facies dorsalis of the radius. Thus, the true angular dislocation can only be estimated when attention is paid to the normal neck-shaft angle as well as to the direction in

which the dislocation has occurred. We recommend the use of a-p and lateral views of the forearm instead of the routinely used a-p and lateral views of the elbow which have not proved sufficient for the assessment of the true angular dislocation (Figures 3 and 4).

On the basis of our experience we feel that a true tilting of less than 30° may be left unreduced with impunity. In cases with more marked dislocation closed reduction should be tried. If unsuccessful, open reduction is recommended. In cases where the head of the radius is completely avulsed and the angular dislocation approaches 90° we have refrained from attempts at closed reduction in order to avoid further damage to the epiphysis. The technique for closed and open reduction has been described in the literature by several authors (Jeffery 1950, Blount 1955, Judet et al. 1962 and Watson-Jones 1976). Internal fixation was not necessary in any of our cases.

As shown in Tables 4 and 5 the result of treatment was poor in 8 of our 29 patients, although the dislocation after treatment in all cases was less than 30°. In all these patients, however, one or several associated injuries of the elbow were seen. In the literature, there are very few comments on the clinical importance of associated skeletal injuries of the ipsilateral elbow in children with radial neck fractures. Most of the associated lesions in the present series were considered to be minor injuries. We feel that the associated lesions should be considered as an indication of a violent trauma to the elbow joint and the

surrounding soft tissues. Thus the presence of associated skeletal injuries is a premonition of a less favourable prognosis. At the follow-up radiological examination the development of spurs could be demonstrated only in patients with associated lesions. Occasionally the head of the radius appeared enlarged with somewhat irregular contours. This feature, equally frequent in patients who had been treated with closed or open reduction, did not, however, influence the functional result.

REFERENCES

- Blount, W. P. (1955) *Fractures in children*, pp. 56–57. Williams and Wilkins Co., Baltimore.
- Henriksson, B. (1969) Isolated fractures of the proximal end of the radius. *Acta orthop. scand.* **40**, 246–260.
- Jeffery, C. C. (1950) Fractures of the head of the radius in children. *J. Bone Jt Surg.* **32-B**, 314–324.
- Jones, E. R. L. & Esah, M. (1971) Displaced fractures of the neck of the radius in children. *J. Bone Jt Surg.* **53-B**, 429–439.
- Judet, J., Judet, R. & Lefranc, J. (1962) Fracture du col radial chez l'enfant. *Ann. Chir.* **16**, 1377–1385.
- Pollen, A. G. (1973) *Fractures and dislocations in children*, pp. 68–74. Churchill Livingstone, Edinburgh and London.
- Salter, R. B. (1970) *Textbook of disorders and injuries of the musculoskeletal system*, p. 431. Williams and Wilkins Co., Baltimore.
- Watson-Jones, R. (1976) *Fractures and joint injuries*. Vol. 2, 5th ed., pp. 515–517. Churchill Livingstone, Edinburgh, London and New York.