Acta Orthop Scand 57, 309–312, 1986

Elbow fractures in children

An epidemiological analysis of 589 cases

The radiographs of 589 elbow fractures in children under the age of 16 years were reviewed. The most common fractures were: supracondylar fracture of the humerus – 55 per cent, fracture of the radial neck – 14 per cent, and fracture of the lateral humeral condyle – 12 per cent. One fifth of all fractures of the olecranon were associated with another elbow fracture; most often a fracture of the medial epicondyle. The average annual incidence of elbow fractures in the age group studied was 12 per 10.000 (10.0 – 14.7) without a significant change of the incidence between 1950 and 1979. Supracondylar and lateral condylar fracture of the humerus and fracture of the olecranon occurred more often in boys. Fractures of the lateral humeral condyle were more often caused by higher energy levels than the other fracture groups.

Lennart A. Landin
Lars G. Danielsson

The University of Lund Department of Orthopedics at Malmö General Hospital, S-21401 Malmö, Sweden

Introduction

The incidence of elbow fractures in children has previously been calculated in an urban population in Göteborg, Sweden, covering the period 1930–1950 (Henrikson 1966). No change in the incidence took place during that time. However, in a survey of skeletal injuries in children 1950–1979 (Landin 1983), the risk of sustaining a fracture, apart from supracondylar fractures of the humerus, was found to double.

No comprehensive epidemiological investigation of elbow fractures in childhood and adolescence has been carried out and the prime purpose of this study was to describe the etiology and pattern of elbow fractures, to calculate the incidence of the different fracture types and to reveal secular changes in a population previously used for studies on fracture epidemiology. We also wished to investigate the relationship between the type of fracture and the severity of the trauma.

Patients and methods

More than 95 per cent of all radiographic examinations for trauma in the city of Malmö, with a population of 230.000, are carried out in the Department of Diagnostic Radiology, Malmö General Hospital. Since 1950 all examinations have been registered according to the diagnosis, which makes it possible to identify the fracture population. The record room at the hospital contains referrals and reports on each patient and all films are available. The age and sex distribution of the population in the city has been recorded every 5-year period since 1950 and annually since 1968.

In an epidemiological study of skeletal injuries in children (Landin 1983), information concerning all fractures in the age group 0–16 years was recorded for the years 1950, 1955, 1960, 1965, 1970, 1975–79. Non-residents were excluded. Altogether, this material consisted of 8.682 fractures from which all roentgen films of fractures in the elbow region were reviewed.

589 cases (7 per cent) were elbow fractures (Table 1). In cases with injuries to the proximal end of the radius with fracture lines close to the physis, but without dislocation of the epiphysis, we found it difficult or impossible to distinguish physeal from metaphyseal fractures in many cases. Therefore, the group of fractures of the radial neck includes injuries through the physis (Salter-Harris type I and II lesions) as well as metaphyseal fractures of the radial neck. The frequency of fractures in cases with dislocations of the elbow cannot be investigated with accuracy in this material, since attempts to reduce elbows with suspected dislocations might have been made prior to radiographic examination.

The severity of trauma was classified as slight, moderate or severe:

Slight – falling on the same level, falling from less than 0.5 metres (falling from chair or a bed) and most of the sports injuries, e.g. ball sports, skating, wrestling and gymnastics.

Moderate – falling from heights 0.5–3 metres, falling from a bunk bed, falling downstairs, from a bi-

Table 1. Elbow fractures in children.

Fracture type	N	%	Boys/ girls	Right/ left	Age (M, SD)
Supracondylar	320	55	1.5[a]	0.6[a]	7.4, 3.1
Radial neck	86	14	0.9	1	9.8, 3.1
Lateral condyle	67	12	2.9[a]	0.4[a]	8.7, 3.9
Medial epicondyle	48	8	1.7	1.4	12, 2.3
Olecranon	42	7	2.2[a]	0.8	10, 4.5
Combinations	10	1.7	4	2	11, 3.5
Radial head	9	1.6	1.3	0.8	14, 1.8
T or Y	4	0.7	0.3	0.3	8, 2.3
Intracondylar[b]	3	0.5	3/0	0.5	14, 1.5
Total	589				

[a] Inter-gender difference, side difference, $P < 0.05$, chi-square test. [b] Fracture – separation of either the medial or lateral condyle.

cycle and from swings and slides or similar playing equipment.

Severe – falling from heights exceeding 3 metres, all traffic accidents – except bicycle accidents – and injuries caused by a moving heavy object.

Since this was a retrospective study the degree of violence was difficult or impossible to evaluate in many instances.

Results

The majority of fractures of the lateral humeral condyle were transphyseal (Salter-Harris 1963, Type IV) intraarticular lesions, but there were also eight cases with avulsion of a bony fragment from the metaphysis, not to be confused with the apophysis of the lateral humeral condyle which ossifies at the age of 11–14 (Blount 1955). There were three cases with osteochondral fractures of the lateral condyle occurring at the age of 14–16, and another three cases with fractures separating the condyles in children with closed distal humeral physes.

Fracture of the olecranon was encountered in nine of ten cases with combinations of fractures (Table 2), thus 1/5 of all fractures of the olecranon was associated with another elbow fracture. There were no cases with fracture separation of the distal humeral epiphysis as described by De Lee et al. (1980) and Holda et al. (1980) or triplane fracture of the distal humeral epiphysis, which has recently been reported by Peterson (1983).

Falls constituted the mechanism of injury in the majority of cases and falls from height were encountered in 23 per cent. Bicycle accidents contributed 8 per cent. No clearly defined environmental factor was associated with any specific type of fracture. Traffic accidents with involvement of motor vehicles caused only 2 per cent of the fractures. Ten per cent of the fractures were sustained during sports activities, especially gymnastics and ball games.

The evaluation of the severity of trauma was possible in 90 per cent of the cases. Slight, moderate and severe trauma accounted for 55, 32 and 2 per cent of the injuries, respectively. When the moderate and severe trauma groups were combined and compared with the group of slight trauma, fractures of the lateral humeral condyle were found to be more often ($0.05 > p > 0.02$) caused by higher energy levels than the other fracture groups. The distribution of the different degrees of trauma was the same in the cases with a combination of fractures as in those with a single fracture.

More than twice as many fractures occurred during summer than in winter ($p < 0.01$, Figure 1). The average annual incidence of elbow fractures in the age group 0–16 was 12 (10–15) per 10.000 (Figure 2). No significant change had taken place over the years when the period 1950–65 was compared with 1970–1979. Sports activities and falls from horse back have recently become more common as causes of fracture, but no dramatic change in the pattern of trauma or severity of injury has taken place over the years.

Discussion

The frequency, age and sex distribution of the various fracture types in this study corre-

Table 2. Combinations of fractures.

Olecranon and medial epicondyle	4
Olecranon, medial epicondyle and radial neck	1
Olecranon and radial neck	2
Olecranon and lateral humeral condyle	1
Olecranon and supracondylar region of the humerus	1
Medial epicondyle and lateral condyle	1
Total	10

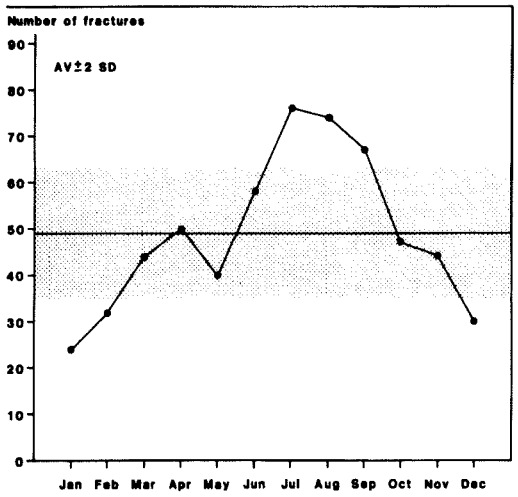

Figure 1. The seasonal variation of elbow fractures 1950–1979.

sponded well with other reports on elbow injuries (Henrikson 1966, Tachdjian 1972). However, fractures of the neck of the radius were encountered in 14 per cent compared with 6 per cent in the material from Göteborg (Henrikson 1966). As in the studies by Jones & Esah (1971) and Henrikson (1969), there was no difference in the sex incidence of this fracture type.

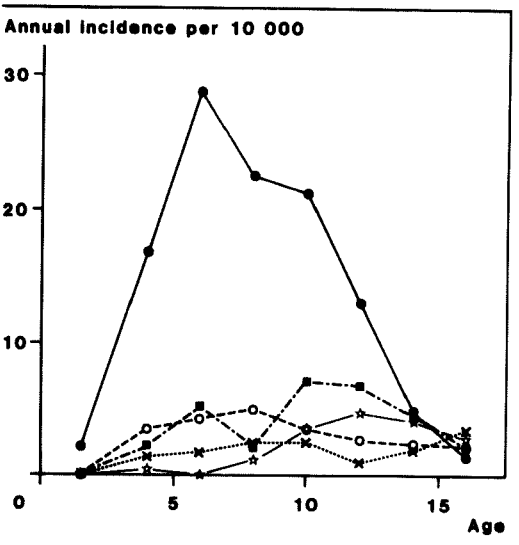

Figure 2. Age specific incidence of elbow fractures. ●—●, Supracondylar fracture of the humerus, ■·—·■, Radial neck fracture, O---O, Fracture of the lateral humeral condyle, ☆——☆, Fracture of the ulnar epicondyle, x.....x, Fracture of olecranon.

Like Henrikson (1966) we found a lower frequency of elbow fractures during the winter. Additionally, a decreasing incidence of all fractures has been found during the summer months in the same population of children involved in the present study (Landin 1983). This is a constant finding in Scandinavian surveys of childhood accidents and includes injuries other than fractures (Kølle-Jørgensen 1971, Nathorst-Westfelt 1982). It is usually attributed to the fact that many children leave the city during the summer holidays. However, this alone cannot explain the pattern of seasonal variation (Landin 1983) and there are apparently seasonal variations in the occurrence of different fracture types.

No change in the etiology of elbow fractures has taken place over the years. An increasing incidence might have been expected since the incidence of fractures of the distal end of the forearm, which are usually produced by the same trauma mechanism, increased between 1950 and 1979 (Landin 1983).

Henrikson (1966) found an unchanged incidence of elbow fractures in children from 1930 to 1950 in Göteborg; the average annual incidence of elbow fractures per 10,000 children 0–14 years was 12.7. The corresponding incidence in Malmö 1950 in the same age groups was 12.6, indicating that the risk of sustaining an elbow fracture in the Swedish urban childhood population has remained unchanged during the last five decades.

References

Blount, W. P. (1955) *Fractures in children.* The Williams & Wilkins Co., Baltimore.

DeLee, J. C., Wilkins, E. R., Rogers, L. F. & Rockwood, C. A. (1980) Fracture-separation of the distal humeral epiphysis. *J. Bone Joint Surg.* **62-A,** 46–51.

Holda, M. E., Monoli, A. & Lamonet, R. L. (1980) Epiphyseal separation of the distal end of the humerus with medial displacement. *J. Bone Joint Surg.* **62-A,** 52–57.

Henrikson, B. (1966) Supracondylar fracture of the humerus in children. A late review of end-results with special reference to the cause of deformity, disability and complications. *Acta Chir. Scand.* Suppl. 369.

Henrikson, B. (1969) Isolated fractures of the proximal end of the radius in children. Epidemiology, treatment and prognosis. *Acta Orthop. Scand.* **40**, 246–269.

Jones, E. R. W. & Esah, M. (1979) Displaced fractures of the neck of radius in children. *J. Bone Joint Surg.* **53**-B, 429.

Kølle-Jørgensen, P. (1971) Child accidents. A medico-social study of 4.820 accidents. Thesis, Munksgaard, Copenhagen.

Landin, L. A. (1983) Fracture patterns in children. Analysis of 8.682 fractures with special reference to incidence, etiology and secular changes in a Swedish urban population 1950–1979. *Acta Orthop. Scand.* **54**, Suppl. 202.

Nathorst-Westfelt, J. Å. R. (1982) Environmental factors in childhood accidents. A prospective study in Göteborg, Sweden. *Acta Paediatr. Scand.* Suppl. 291.

Peterson, H. A. (1983) Triplane fracture of the distal humeral epiphysis. *J. Pediatr. Orthop.* **3**, 81–84.

Salter, R. B. & Harris, W. R. (1963) Injuries involving the epihyseal plate. *J. Bone Joint Surg.* **45**-A, 587–622.

Tachdjian, M. O. (1972) *Pediatric Orthopedics*, W. B. Saunders, Philadelphia.