

Calcaneus fracture in the child

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We reviewed 80 fractures of the calcaneus in 78 children through a 30-year period. The fractures were more equally distributed between the sexes than in adults. In contrast to adults, intraarticular fractures of the calcaneus in children constitute less than half, probably because a lower proportion of children sustain the fracture as a result of a fall. Associated injuries were mainly encountered by children who were traffic accident victims. It is disputable that the calcaneus in children is more resistant to fracture than in adults. The rarity of the fracture in children is more likely the result of less exposure to trauma leading to calcaneal fractures and also that the fracture is often overlooked.

Fractures of the calcaneus are rare in children. Landin (1983) found an annual incidence of 0.41 per 10,000 below the age of 17. Jonasch (1979) estimated that they constitute 0.005 per cent of all fractures before age 15 to be compared with 1-2 per cent in adults (O'Connell et al. 1972, Slätis et al. 1979, Tanke 1982). The few and small series describing the injury in children seem to confirm this (Schmidt & Weiner 1982, Wiley & Profitt 1984, Kurz et al. 1984, Hahn & Stock 1984).

Calcaneal fractures in children are often overlooked because radiographically they exhibit different and more subtle features than in adults (Thomas 1969, Matteri & Frymoyer 1973, Schedl & Spangler 1979, Schmidt & Weiner 1982, Wiley & Profitt 1984). Axial radiographs are sometimes necessary to demonstrate even considerably displaced fractures. Starshak et al. (1984) found that only four of 10 fractures were visible on the initial radiographs, and Hahn & Stock (1984) recommended repeat radiographs after 10 days if the clinical findings indicated a fracture and the initial radiographs were negative.

We present 30 years of experience of calcaneal

fractures in children with regard to type, mode of injury, and associated lesions.

Patients and methods

In our radiology records from 1955-1984 inclusive, we identified 78 patients (19 girls below aged 13 and 59 boys below aged 16 years) with 80 calcaneus fractures. The fractures were primarily divided into intraarticular and extraarticular with regard to involvement of the facies articularis talaris posterior. The intraarticular fractures were subdivided into those with and without displacement. The extraarticular fractures were subdivided (Figure 1) according to Schmidt & Weiner (1982).

The hospital records of 65 patients were available, and the mechanism of injury and associated injuries were analyzed. Forty-four of the fractures, 11 extraarticular and four intrarticular, had initially been overlooked. During the same period, 872 fractures of the malleoli, 533 fractures of the fifth metatarsus, 762 fractures of the other metatarsal bones, and 89 fractures of the talus were diagnosed radiographically in children 0-14 years of age.

For statistical analysis the Poisson distribution and Fisher's fourfold table test were used. The age differences were compared with confidence limits of the median age according to the binominal distribution. Values for $P < 0.05$ were considered significant.

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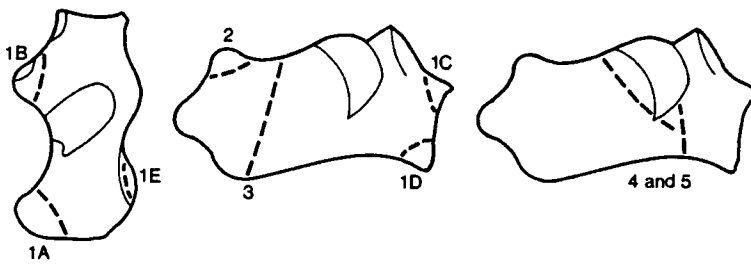


Figure 1. Classification of calcaneus fractures. Modified after Schmidt & Weiner (1982).

Extraarticular (not involving art. subtalaris)

Type 1:

A. Fracture of tuberosity or apophysis.

B. Fracture of sustentaculum tali.

C. Fracture of the anterior superior aspect.

D. Fracture of the anterior inferior aspect.

E. Avulsion of the body.

Type 2:

Fracture of the posterior aspect, superior to the tuberosity.

Type 3:

Fracture through the body without involving the art. subtalaris.

Intraarticular (involving art. subtalaris)

Type 4:

Fracture without significant displacement.

Type 5:

Fracture with displacement.

Table 1. Children with fractures of the calcaneus

Age	Boys	Girls	Total
1-5	9	7	16
6-10	20	8	28
11-15	30	4 ^a	34
Total	59	19	78

^a 11-12 yrs.

Table 2. Calcaneal fracture types in children

Fracture type	Boys	Girls	Total	Mean age (range)
1A	10	3	13	10 (2-15)
B	2	0	2	10 -
C	2	1	3	13 (8-15)
D	7	1	8	11 (2-15)
E	7	5	12	11 (4-15)
2	1	0	1	15 -
3	6	2	8	5 (2-9)
<i>Subtotal, extra-articular</i>	<i>35</i>	<i>12</i>	<i>47</i>	<i>10 (2-15)</i>
4	5	2	7	9 (1-15)
5	18	2	20	9 (2-15)
<i>Subtotal, intra-articular</i>	<i>23</i>	<i>4</i>	<i>27</i>	<i>9 (1-15)</i>
Unclass.	3	3	6	10 (7-13)
Total	61	19	80	9 (1-15)

Results

The incidence of a calcaneus fracture increased with age in boys, but not in girls (Table 2). The median age of children with intraarticular fractures was lower than of those with extraarticular fractures. Type 1 fractures were predominately seen in the older patients, whereas type 3 fractures were only observed in patients under aged 9 years (Table 2). There was an increase in the number of fractures in the second half of the studied period.

Six fractures could not be classified according to the adopted system. Three of these were

combinations of extraarticular fractures (1c and 1d, 3 and 1e, 1a and 1d). In 2 children the radiographs showed several fracture lines in the whole posterior part of the calcaneus. In the last patient a small avulsion from the facies articularis posterior could be observed on the lateral view. The intraarticular fractures showed considerable variation in the fracture displacement. The tongue-type and the central depression-type fracture described by Essex-Lopresti (1952) were observed.

Thirty-one children sustained their fracture because of a fall, usually about 2 meters, resulting in 17 of the intraarticular fractures (Table 3). The two bilateral fractures resulted from a fall.

Traffic accidents were the second largest cause of the injury, with 14 fractures, and other causes of fractures were blows, entrapment injury, and distortions (Table 3). Distorsion produced 1c, 1d, and 1e fractures, and occurred in the older age-group.

Twenty of the 65 children with available records had associated injuries, usually other fractures and lacerations of the same extremity. Ten of the patients with associated injuries were traffic accident victims, whereas only about a third of the other patients had associated injuries. Associated injuries were equally common among patients with intraarticular and extraarticular fractures.

Table 3. The mechanism of injury in calcaneal fractures in children

Fracture	Fall	Traffic accident	Blow, crushing	Distorsion	Other	Unknown
Extraarticular	16	9	6	5	3	8
Intraarticular	17	3	2	0	1	4
Unclassified	0	2	1	2	0	1
Total	33	14	9	7	4	13

Discussion

Fractures through the body of the calcaneus without involvement of the posterior articulation of the talus constitute a large proportion of the fractures encountered in children below the age of 10 years (Schmidt & Weiner 1982), which is in contrast to adults (Essex-Lopresti 1952, Slätis et al. 1979). Thomas (1969) found that in young children the primary fracture line extended behind the posterior articulation. A second less distinct fracture passes forward to the sulcus calcanei. It is possible that some of the type 3 fractures in reality are intrarticular, but the intraarticular component is not revealed on the radiographs.

Lindsay & Dewar (1958) found an average fall height of over 5 meters in adults with calcaneal fractures. Wiley & Proffitt (1984) found an average fall height of 1 meter in children below aged 10 years and 4 meters in children over aged 14 years with calcaneal fractures. In our study, calcaneal fractures were encountered from a fall height of less than 1 meter. It is therefore disputable that the calcaneus in children is more resistant to fracture than in adults, as proposed by Schedl & Spangler (1979) and Jaschke & Heimer (1983). The rarity of the fracture in children is more likely the result of less exposure to trauma and that the fracture is often overlooked.

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Acknowledgements

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