

Sports related fractures in children in north east England

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Abstract

Objective—To describe the epidemiology of fractures among children seen with sports injuries in a district general hospital accident and emergency department.

Methods—A prospective study of children aged 5 to 15 years who presented with sport related fractures from 1 September 1997 to 31 August 1998.

Results—The 255 children who had sport related fractures represent 20% of children seen with sport related injuries in the 5–15 years age group during the study period. The mean age was 12 and the male to female ratio was 2:1. Overall, football, rollerblading, cycling, and netball injuries were the commonest causes of the fractures. However, among the boys, football and rollerblading injuries, and among the girls rollerblading and netball injuries, were the commonest causes of the fractures. The most common place where the injuries were sustained was in residential areas (44%) while falls accounted for 59% of the fractures. The fractures involved the upper limb in 90% of the children and the wrist (43%) and finger (23%) were the commonest sites. Rollerblading and football injuries were the commonest causes of wrist and finger fractures respectively.

Conclusion—A fifth of children who are injured during sport sustain fractures. The various factors associated with an increased incidence of sport related fractures as well as possible preventive measures are discussed.

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Keywords: children; sport; fracture

Children are getting increasingly involved in sports.^{1 2 3 4 5} In addition to established sports such as football and basketball, children are also participating in newer sporting activities.² Sports related injuries account for a large number and substantial proportion of all injuries to children.³ About 15% to 26% of sports related injuries in children are fractures.^{5 6 7} There is however little information on the epidemiology of sports related injuries in children in general,⁸ as well as on childhood fractures in particular.⁹ The available studies are often difficult to compare because of lack of a standard method of reporting sports related injuries, differences in the definition of injury, study methodology, the age group studied.^{9 10}

Factors that influence whether or not an injured child attends hospital include the availability of other medical care facilities such as the general practitioners or health services of schools, proximity to hospital and the severity of injuries.^{5 7 9 11} Children who have sustained fractures are known to attend hospital irrespective of these factors.^{7 9}

The purpose of this prospective study is to determine the incidence of sports fractures among children who presented with sport related injuries to a district general hospital accident and emergency (A&E) department and to assess the frequency and severity of fractures related to each sport. The mechanisms of injury and the place where the sport was being played at the time of the injury were also studied. This information could provide a guideline for directing educational resources to related sports and for appropriate planning of services.

Methods

All children aged 5 to 15 years treated for sport related injuries in the A&E department of the Queen Elizabeth Hospital, Gateshead (QEH) over a one year period between 1 September 1997 and 31 August 1998 were studied prospectively. Information on age, sex, sports played, place where the injury occurred, the mechanisms of injury, injury sustained, and anatomical location of the injury, were documented. The place where the sport was played

Table 1 Sport related fractures by age groups

	Age (y)		Total
	5–9	10–15	
Number of sport injuries	329	926	1255
Number of sport fracture	66	189	255
Fracture rate (%)	20	20	20
Median ISS (for fractures)	4	4	4
Place of injury			
Residential	46	66	112
School	9	68	77
Public sporting places	3	24	27
Others	8	31	39
Mechanism of injury			
Fall	49	101	150
Struck by ball	11	42	53
Collisions	1	13	14
Struck by another player	3	10	13
Others	2	23	25
Location of fractures			
Fingers	9	50	59
Hand	3	28	31
Carpal bones	0	5	5
Wrist	42	67	109
Upper limb (proximal to the wrist)	7	18	25
Lower limb	4	21	25
Skull	1	0	1
Sports			
Football	15	76	91
Rollerblading	26	32	58
Cycling	14	15	29
Netball	—	13	13
Basketball	1	10	11
Others	10	43	53

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Table 2 Sports related to the fractures

Sport	Number of children with sport related injuries	Number of sport related fractures	Fracture rate of sport related injuries (%)	Median ISS of the fractures
Football	463	91	20	4
Rollerblading	119	58	49	4
Cycling	186	29	16	4
Netball	54	13	24	1
Basketball	70	11	16	1
Rugby	49	6	—	—
Iceskating	25	6	—	—
Gymnastics	36	6	—	—
Rollerskating	10	5	—	—
Others	243	30	12	—
Total	1255	255	20	4

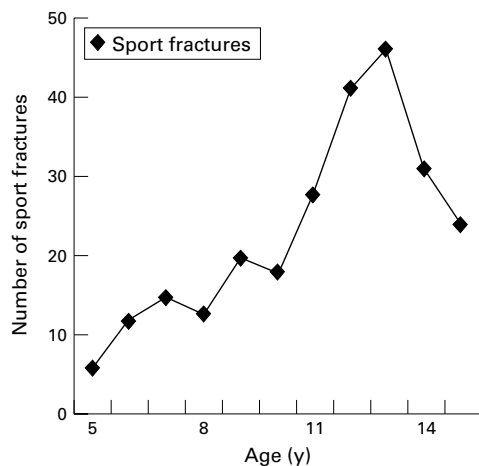


Figure 1 Sport fractures.

was classified as school, residential areas, public sporting place, main road, public park and others. School injuries include all injuries that occurred in the school ground during any sporting or recreational activities. Residential areas include driveways, gardens, footpath, pavement and roads in residential areas. Public sporting place include designated sporting/leisure areas.

A sport related injury was defined as a sudden external occurrence, while participat-

ing in a sporting activity, leading to a personal injury that resulted in presentation to A&E. The diagnosis of fracture had radiological confirmation in each case. All injuries sustained from participation, competition and recreational sports were included.

A total of 1255 children presented with sports related injuries during the study period. Of these 255 children sustained fractures. The Injury Severity Score (ISS) was calculated for each child who had a fracture. These data were analysed. Statistical analysis were carried out using χ^2 characteristics and difference regarded as significant at $p < 0.05$.

Results

Two hundred and fifty five children aged 5 to 15 years presented with sports related fractures to A&E during the one year study period. This figure represents 20% of the 1255 children in this age group treated for sports related injuries during this period.

The children had a median age of 13 years with a mean of 12 (SD =3) and a range of 5–15. Overall, the number of sports related fractures increased with age, reaching a peak at the age of 13 (fig 1). Among the children seen in the department with sport related injuries, children younger than 10 years had proportionately more wrist fractures ($p < 0.001$), and a lower incidence of hand and finger fractures ($p < 0.004$) compared with the older children. Similarly, there were proportionately more fractures sustained in residential areas ($p < 0.001$) and secondary to falls ($p < 0.004$), in children younger than 10 years compared with the older ones. Conversely more fractures occurred among the older children (10–15 years) from sports injuries sustained at school. There is significantly a higher proportion of fractures related to rollerblading ($p < 0.001$) and cycling ($p < 0.003$) in children aged 5 to 9 years compared with children aged 10 to 15 years. On the other hand there is a higher

Table 3 Places where injuries occur during play

	Place of injury					Total
	Residential areas	School ground	Public sporting place	Park	Others	
Number of sport injuries	462	478	156	48	111	1255
Number of sport fracture	112	77	27	12	27	255
Fracture rate (%)	24	16	17	25	24	20
Median ISS	4	1	4	4	4	4
Mechanism of injury						
Fall	85	28	11	9	17	150
Struck by ball	16	25	7	1	4	53
Collisions	5	6	1	—	2	14
Struck by another player	1	5	5	—	2	13
Others	5	13	3	2	2	25
Location of fractures						
Fingers	17	29	6	3	4	59
Hand	13	8	3	2	5	31
Carpal bones	2	1	2	—	—	5
Wrist	62	22	8	5	12	109
Upper limb (proximal to the wrist)	11	8	3	1	2	25
Lower limb	7	9	5	1	3	25
Skull	—	—	—	—	1	1
Sports						
Football	30	30	13	8	10	91
Rollerblading	50	1	1	3	3	58
Cycling	20	1	—	—	8	29
Netball	—	13	—	—	—	13
Basketball	2	8	1	—	—	11
Others	10	24	12	1	6	53

Table 4 Mechanisms of injury

	Mechanisms of injury					Total
	Fall	Struck by ball	Collision	Struck by another player	Others	
Number of sport injuries	621	210	103	97	224	1255
Number of sport fracture	150	53	14	13	25	255
Median ISS (fractures)	4	1	4	1	4	4
Fracture rate (%)	24	25	13	13	11	20
Place of injury						
Residential	85	16	5	1	5	112
School	28	25	6	5	13	77
Public sporting places	11	7	1	5	3	27
Park	9	1	—	—	2	12
Others	17	4	2	2	2	27
Location of fractures						
Fingers	14	38	2	2	3	59
Hand	17	2	3	4	5	31
Carpal bones	3	—	1	—	1	5
Wrist	90	12	3	1	3	109
Upper limb (proximal to the wrist)	19	1	2	1	2	25
Lower limb	6	—	3	5	11	25
Skull	1	—	—	—	—	—
Sports						
Football	32	30	8	11	10	91
Rollerblading	56	—	1	—	1	58
Cycling	27	1	1	—	—	29
Netball	3	8	1	—	1	13
Basketball	2	8	—	—	1	11
Others	30	6	3	2	12	53

incidence of football related fractures among the children aged 10 to 15 years ($p < 0.02$) (table 1).

The male to female ratio was 2:1. There are no differences in the anatomical distribution, severity and place of occurrence of the fractures between boys and girls. However, the commonest sports associated with fractures were football (49%), rollerblading (18%) and cycling (12%) among the boys, and rollerblading (33%), netball (12%) and cycling (9%) among the girls. The proportion of fractures related to rollerblading is much higher in girls compared with boys ($p < 0.005$).

Of the 26 different sporting and recreational activities that caused fractures among the children, football, rollerblading, cycling, netball and basketball were responsible for fractures in 79% ($n=202$) of the children. Football injuries caused 35% of all sport fractures while rollerblading injuries caused 23%. However, the fracture rate among children with football related injuries was only 20% compared with 49% for rollerblading injuries, $p < 0.001$ (table 2). Both football related fracture and rollerblading associated fractures had median ISS of 3. However, the mean ISS for football related

fractures was only 3 compared with 4 for rollerblading fractures, $p < 0.001$.

The most common place where the injuries were sustained was residential areas, where 44% (112) of the fractures occurred (table 3). Both the incidence of fractures ($p < 0.004$) as well as the mean ISS of the fractures ($p < 0.004$) resulting from sports injuries were higher for sport injuries sustained in residential areas compared with those sustained in school.

A fall was the accident causing sport related fractures in 59% of the children. More falls occurred in residential areas compared with the other locations $p < 0.03$, and more wrist fractures resulted from a fall than from the other mechanisms. Falls occurring in residential areas accounted for 33% of all fractures. Sport fractures resulting from fall have higher ISS than by other mechanisms ($p < 0.001$). In 53 (21%) of the children the fracture resulted from being struck by a ball. The incidence of fractures attributable to fall decreases with age while those attributable to being struck by a ball increases with age. Collisions (with another person or object) and being struck by another player was encountered almost exclusively among boys older than 10 years (table 4).

The fractures involved the upper limb in 90% of the children. The overall median ISS was 4, with a mean of 3 with a range of 1 to 9. When each anatomical region is considered separately, the wrist—that is, distal radius and distal ulna (43%) and fingers (23%)—was the most common site of fracture (table 5). Football related fractures were fairly evenly distributed between the fingers, hand, wrist and the lower limb. On the other hand, 81% of rollerblading fractures involved the wrist while 75% of netball and basketball fractures involved the fingers. The incidences of finger, hand and lower limb fractures increases with age.

Table 5 Anatomical sites of fracture

Site of fracture	Number of children with the fracture
Phalanges (fingers)	59
Metacarpal	31
Carpal bones	5
Distal radius and/or distal ulna	109
Radius and/or ulna shaft	5
Neck of radius	2
Distal humerus (supracondyles)	7
Humeral shaft	1
Acromium	1
Clavicle	9
Skull	1
Phalanges (toes)	7
Metatarsals	5
Ankle (lateral malleolus 3, talus 1)	4
Tibia and/or fibula	8
Patella	1
Total	255

Discussion

The majority of sport injuries are minor with only about 30% seeking any form of medical treatment.^{5 11 12} Among the children that present to hospitals, over two thirds have only minor abrasions, bruises and sprains.^{1 2 3 4 6 7 13} These injuries are associated with lesser degrees of morbidity and, arguably, are an integral part of participation in sports. Though fractures only account for 15% to 27% of sports related injuries^{5 6 7} they often have significant morbidity.^{8 14 15} Recently the proportion of childhood fractures caused by sport and recreational activities has been increasing.⁹ Indeed some reports have indicated that sport and recreational activities are now the commonest causes of childhood fractures.¹⁶

Being a hospital based study, this report does not represent all sport injuries that occurred in the community during the study period. The majority of injured children do not go to hospital for treatment of their injuries. Distance from hospital, availability of primary care in the community and severity of such injuries are among factors that influence whether or not the injured child presents to hospital for treatment.^{5 11 12} However, children who sustained fractures do present to hospital irrespective of these factors.⁹ Thus, although our study would have missed the children who did not come to hospital, these are likely to be those with relatively minor injuries associated with minimal morbidity. The government's stated intention of reducing childhood injuries by 20% (of the 1996 baseline) by the year 2010 only targets those injuries that lead to a hospital visit or consultation with a general practitioner.¹⁷ Furthermore, children with fractures who initially consult their general practitioners will almost certainly be referred to a hospital. Bearing all these points in mind, the purpose of this study was to specifically describe sport related fractures because of their greater significance, rather than to describe all sports related injuries that occurred during the study period.

The overall fracture rate among the children with sport injuries of 20% in this study is consistent with previous reports.^{4 15 18} When assessed individually, the fracture rates of individual sport injuries varies from 16% each for cycling injuries and basketball injuries to 49% for rollerblading injuries. The number of sport related fractures increases with age similar to the pattern of childhood fractures from all causes.^{8 16}

As may be expected, the established sports such as football, cycling, netball and basketball were among the commonest sports associated with fractures. However, rollerblading was only second to football as the sport most commonly associated with fractures. The proportion of fractures related to rollerblading is much higher in girls (among whom it is the commonest activity associated with fractures) compared with boys, and in children under the age of 10 years compared with older ones. The recent increase in rollerblading injuries and the very high fracture rate of these injuries have been earlier reported from this and other centres.^{19 20}

The most striking finding was the very high (90%) proportion of fractures involving the upper limb. This is much higher than the 66% to 68% reported by Kopjar and Wickizer⁸ and by Landlin¹⁶ for childhood fractures from all causes. The wrist and finger were the two most common sites of fractures. Forty four per cent of the wrist fractures resulted from falls while rollerblading in residential areas.

Football injuries were the commonest cause of finger fractures, and together with netball and basketball were responsible for over two thirds (68%) of finger fractures. Football related injuries alone caused more finger fractures than net ball and basketball injuries combined. Finger fractures resulted from direct contact with the ball in 60% and falls in another 25%.

This study has shown that the incidence of fractures among children presenting to the A&E department with sports injuries sustained in residential areas was significantly higher than for sports injuries sustained in school grounds as well as in public sporting areas. It is possible that the lower incidence of fracture among children who sustained sport injuries in school as well as in public sporting places is attributable to supervision and the use of appropriate facilities and surfaces. As nearly half of children who had hand fractures secondary to being struck by ball occurred at school, hand protection during ball games, should further reduce the incidence of sport fractures occurring at school. The question of whether the higher incidence of sport related fractures sustained in residential areas is attributable to a lack of supervision and appropriate facilities or simply a reflection of the greater length of time spent in play in these locations can be best assessed by a community based study.

Sport fractures are an important and increasing subgroup of childhood fractures that are amenable to targeted preventive measures. Overall among children seen in A&E with sport related injuries, factors associated with higher incidence of fracture include falls, injuries sustained in residential areas, rollerblading and injuries involving the wrist. While minor bruises, strains and sprains may be regarded as an unavoidable part of sport participation, studies have shown that the more serious injuries are preventable.²¹ Strategies to reduce the incidence of sport related injuries in residential areas must centre on modification of the behaviour of both children and their parents. This can be achieved by health education not only to increase the awareness of the risk of injury to children around the home but also to emphasise the importance of personal protective equipment. Epidemiological information such as this can be invaluable to schools for providing guidance. Furthermore, local authorities can be encouraged to use this information for future planning and designing sporting and leisure facilities.

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