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PHALANGEAL FRACTURES OF THE HAND

An analysis of gender and age-related incidence and aetiology

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The incidence and aetiology of 6,857 phalangeal fractures of the hand have been reviewed in a series of 235,427 patients, looking for an age-specific vulnerability to fracture. We found sports to be the main cause of fracture in the 10–29 years age groups and accidental falls to be the leading cause in those aged 70 years or older. We made a new observation that the highest incidence occurs in the male 40–69 age group and machinery was the dominant cause of fracture in this group. Recognition of the frequency of industrial trauma is needed, and public expenditure should be invested in its prevention and treatment.

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Hands are regularly exposed to all kinds of injuries and the phalanges are very vulnerable to trauma, and the most common site of fractures in the hand (Barton, 1979; Crick et al, 1987). Furthermore, hand fractures are probably the most common fractures sustained by children (Hastings and Simmons, 1984; Worlock and Stower, 1986). The importance of hand fractures is frequently underemphasized, yet a seemingly small phalangeal fracture can result in lasting impairment and may threaten range of motion if neglected. Little attention has been paid to the incidence rates in the population at risk, and the nature of the injuries most likely to cause phalangeal fractures. Only a few epidemiological articles with specific reference to incidence and aetiology of hand fractures in children have appeared in the English language literature (Hastings and Simmons, 1984; Worlock and Stower, 1986). No major study has focused on the cause of phalangeal fractures of the hand and their distribution in all age groups.

The purpose of the present study was to analyze the aetiology of phalangeal fractures of the hand during a 23-year period, looking at the incidence rates and causes of fractures among specific age groups. Reliable incidence rates are essential to quantify the population at risk and to set up prevention strategies and improve hospital management.

PATIENTS AND METHODS

This 23-year retrospective review involved all the phalangeal fractures of the hand seen at the Emergency Unit of the Department of Traumatology at the Groningen University Hospital, a 1,056-bed hospital that holds the largest trauma centre in the northern region of the Netherlands and serves a population of approximately 2 million people. The Groningen area represents one-third of the total surface area of the Netherlands. The period studied was from 1970–1992.

The admission data were obtained from clinical and radiological assessment and the patient's history at the time of first consultation. The results were found in the trauma discharge register on the hospital computer.

We defined the population as the total of patients

admitted to our hospital during the study period of 23 years. Injury was defined according to the N-code of the 9th revision of the International Classification of Diseases (phalangeal fractures of the hand: N816.0). We used the Supplementary Classification of External Causes of Injury (E-code) to evaluate the cause of injury. The presented types of injury events were categorized by combining the various related causes. In addition, since the ICD-8 E-code does not have a specific code for sport-related injury and injury by compression between objects (machinery excluded), supplementary codes for sports and compression were employed, enabling us to reveal a more refined analysis about the cause of phalangeal fractures.

In 1982, the ICD-8 E-code was upgraded by the ICD-9 E-code. To make an accurate comparison with the preceding years (1970–1981) we converted the ICD-9 E-code into the ICD-8 E-code. We found no significant fluctuations in the proportion of the various causes during the transition years. The age-specific phalangeal fracture rates and causes for both men and women in our sample were analyzed. A comparison was made between the injury rates of the population and patients with phalangeal fractures. Measures of statistical significance were obtained using binomial test statistics.

RESULTS

Fracture incidence

During the 23-year period, a total of 235,427 patients was admitted to the Emergency Unit of our hospital. The male:female ratio was 1.8:1. Figure 1 shows the age and gender specific incidence rates for the population. The male incidence rates are predominantly higher than the females rates across the life-span. For those aged 60 and older, female rates exceeded those of the males.

Of the 235,427 patients admitted, 6,867 patients sustained respectively one (98.6%) and multiple (1.4%) fractures involving the phalanges of the hand. A large proportion of the fractures of the phalanges occurred in the male 10 to 19 and 20 to 29 groups (Fig 2). 36.4% were men aged 10 to 29. In women we found a much

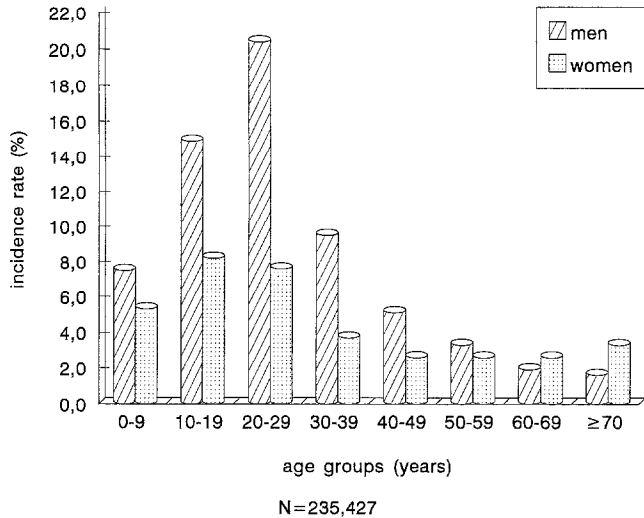


Fig 1 Age- and sex-specific incidence rates for the population (men + women = 100%).

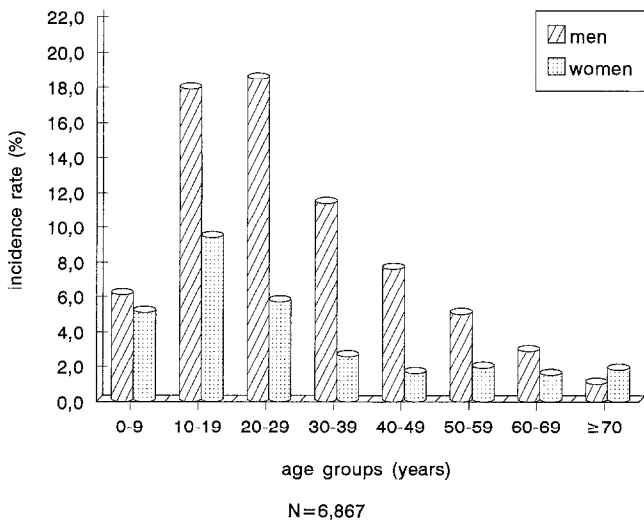


Fig 2 Age- and sex-specific incidence rates for phalangeal fractures of the hand (men + women = 100%).

smaller variation in rates by age. Compared with the incidence distribution of the population, the age and sex-specific rates follow essentially the same pattern. That is, in both the population and the phalangeal fracture group, the highest incidence rates are found in the male 10 to 19 and 20 to 29 groups.

The total mean annual incidence of phalangeal fractures was 2.9%, 3.2% for men and 2.4% for women. The age group 40 to 49 showed the highest male: female ratio (5.4:1). On the average, men are affected 2.5 times as often as women: a significant increase in comparison with the population ratio of 1.8 ($P < 0.01$). The incidence rates by age group are calculated by measuring the number of patients with phalangeal fractures by age group and gender, as shown in Figure 3. Male incidence

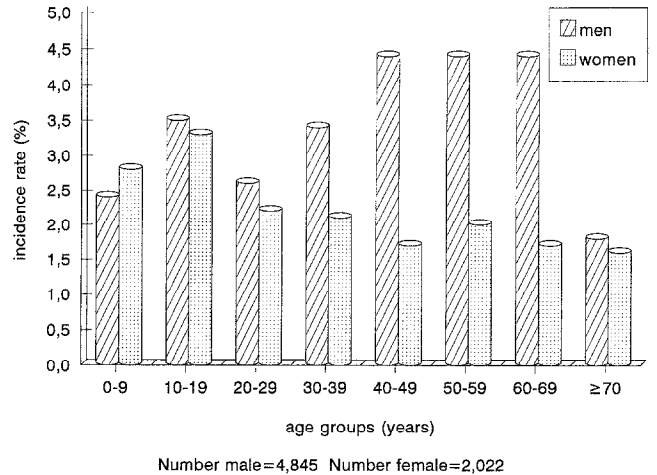


Fig 3 Annual sex-specific incidence rates by age for phalangeal fractures of the hand.

rates were up to 4.5% compared with the mean incidence rate of 2.9% and the female rates were lower. Figure 3 also shows that the rates among men reach their maximum between 40 and 69 years and then rapidly decline, whereas the rates among women reach their maximum between 10 and 19 years, then level off. The highest female incidence rates were found in the age group 10 to 19 years. Since both girls and boys in the age group 10 to 19 years exceeded the mean annual incidence rate, they should be considered high incidence groups.

The incidence of phalangeal fractures did not differ significantly over the years in any specific age group; rates show an almost steady pattern for both sexes during the 23-year study period.

Causes of fracture

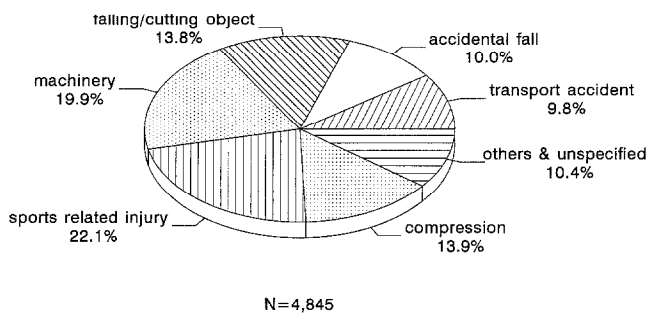
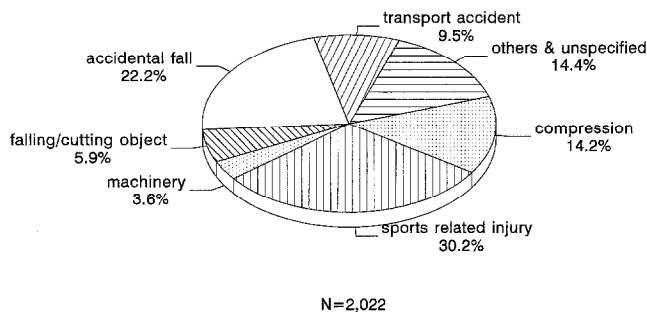
In both sexes, sport-related injury is the major cause of phalangeal fractures. Table 1 shows that sports injuries form the largest group of fractures in the 10 to 19 age group, 43.0% being due to sports. Injuries sustained in sport account also for most of the fractures in the third and fourth decades of life (27.8 and 21.6%). In the youngest age group, 0 to 9 years, crushing between objects is responsible for the largest group of fractures (41.8%).

Machinery is an important determinant cause of phalangeal fractures in men (Fig 4), being responsible for nearly one fifth of male fractures. The large contribution of machinery in the 40 to 60 age group is shown in Table 1; 27.1% of phalangeal fractures among men in this age group are caused by machinery. Falling or cutting objects are also commonly observed.

Both machinery and falling or cutting objects are minor causes of phalangeal fractures among women (3.6% and 5.9%), while falls cause 22.2% (Fig 5). 45.5% are due to falls in patients over 70 years (Table 1).

Table 1—Aetiology of admissions for phalangeal fracture. The percentage of the determinants by age group (1970–1992)

Cause per age group	0–9	10–19	20–29	30–39	40–49	50–59	60–69	≥70
Transport accident	5.5%	13.0%	9.6%	7.2%	8.1%	9.4%	12.1%	10.6%
Accidental fall	12.5%	13.7%	8.5%	12.1%	13.6%	15.6%	24.3%	45.5%
Falling/cutting object	14.2%	5.8%	12.9%	14.0%	15.0%	16.2%	11.1%	7.5%
Machinery	3.4%	7.2%	17.6%	19.1%	26.7%	27.8%	26.9%	8.6%
Sports related injury	9.0%	43.0%	27.8%	21.6%	12.5%	5.6%	3.0%	0.0%
Compression	41.8%	6.8%	9.9%	15.3%	14.3%	14.4%	16.9%	13.5%
Others and unspecified	13.6%	18.8%	13.7%	10.7%	9.2%	11.0%	3.5%	3.6%
Column total	100%	100%	100%	100%	100%	100%	100%	100%
Column n =	767	1863	1657	961	633	475	305	198
Missing n = 8								

**Fig 4** Aetiology of male phalangeal fractures of the hand admissions: the percentage of the type of injury.**Fig 5** Aetiology of female phalangeal fracture of the hand admissions: the percentage of the type of injury.

DISCUSSION

In this retrospective series of nearly 7,000 hospital admissions for phalangeal fractures we found no significant change in incidence in any specific age group during the study period. There were three main patterns of injury across the life-span. Sport was the leading cause of fracture in the 10 to 29 year age group and falls predominated in those over 70 years. In men the 40 to 69 age group had the highest incidence and machinery was the dominant cause in that group. Previous studies in children have shown an increased incidence of hand fractures in the second decade, with male preponderance (Hastings and Simmons, 1984; Worlock and Stower, 1986). The latter found falls (37.5%) and sports (22.8%)

to be the most common causes of fracture among a group of 136 children under 13, but no discrimination was made between phalangeal and metacarpal fractures. The phalangeal epiphyses are usually injured in torsional stress, whereas metacarpals are resistant to torsional stress but easily fractured by axial forces (as in a punch) or by direct stress (Grad, 1986; Torre, 1988). Hastings and Simmons (1984) found two peaks in the distribution of hand fractures among 354 children under 18, one in the early years, caused by crush injuries and a second in teenagers due to contact sports. We also found compression between objects (such as a door) to be the main cause of phalangeal fractures among children under 10 years (41.8%), with sports playing a minor role.

The incidence of falls has also been shown to increase exponentially with age (Ryynanen et al, 1991) and osteoporosis may contribute to the increased incidence of fractures in the elderly. The high incidence of machinery-related injuries in the male 40 to 69 group may reflect a decreased ability to operate industrial equipment safely, and a decline in visual and hearing faculties and reactive power could contribute to this. The increased vulnerability of specific groups of phalangeal fractures should be taken into account when planning prevention strategy.

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