Aetiology of handball injuries: a case–control study

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This article presents the results of a case–control study regarding the background to handball injuries among players of 12 years and older. Data were collected by means of a written questionnaire on the nature, location and direct causes of the injuries as well as information on risk factors. Injured players (n = 130) are compared with non-injured players (n = 512). The response for the cases was 67% and for the controls 75%. These injuries are frequently located at the lower extremities (54% of injuries), especially the ankle, and the majority involve distortions (35%) and strains (26%). Players >20 years have a significantly greater risk of injury than players <20 years (odds ratio 1.9). Several factors seem to increase the injury risk, although not significantly: having >5 years experience, not doing stretching exercises and not wearing tape or bandages. Another factor, not wearing elbow protectors, appears to decrease the injury risk significantly. It is advisable to interpret the results of this study with some caution, as selection and information bias might have influenced the validity to some extent. Furthermore, the reliability of the data is limited due to the relatively small number of injured players in the study. Some guidelines for future studies are formulated.

Keywords: Sports injuries, handball, case–control study, risk factors

Handball is a fast, explosive sport and unfortunately, sometimes injuries occur. Epidemiological studies presenting reliable data about the incidence and aetiology of these injuries are rare. Most available studies described handball injuries without studying the population of uninjured players[1–3]. The choice of the material (injuries or players) and method (questionnaire or data search in clinics or insurance companies) determines the quality of the conclusions to a large extent. The literature about handball injuries reveals a lack of valid aetiological studies[4]: a control group is rarely studied; often only a specific population is chosen and an 'injury' rarely defined. Despite these limitations, the incidence rate appears to be substantial. The injuries are located mostly at the upper extremities[1,5–10], with finger injuries and distortion of the ankle joint the injuries reported most frequently[4]. Although several risk factors are mentioned and some preventive guidelines are formulated, no consensus exists in the literature.

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In order to clarify the aetiology and injury pattern among handball players above the age of 12 years a study was conducted to obtain information on the location, mechanisms and kinds of injury, as well as on the risk factors involved. To identify risk factors a case–control group design was chosen to compare the prevalence of putative risk factors between injured and uninjured handball players. First, the research methods of the study will be described and demographic aspects presented (site and nature of lesion). Second, data on risk factors are presented. Finally, the findings are discussed and compared with other available literature on the subject.

Methods

The cases were selected from the Home and Leisure Accident Surveillance System (PORS) set up by the Consumer Safety Institute in the Netherlands. The 14 Dutch hospitals in which home and leisure accidents are recorded constitute a sample taken from 139 general and university teaching hospitals in the Netherlands which have an Accident and Emergency department offering a 24-h service[11]. This sample is stratified according to size of hospital and level of urbanization.

During competition (a 5-month period from October 1988 to February 1989) 206 handball injuries affecting handball players >12 years of age were registered, defined as an injury that occurred while playing handball during a game or training in a club. These players were asked to fill in a questionnaire, and reminders were sent after 2 weeks.

The controls (uninjured handball players) were obtained from the Dutch Handball Association, comprising 647 handball organizations (clubs). Clubs were selected at random (every sixth club), and a total of 107 clubs was invited to participate in the study. A final total of 60 clubs provided names, ages and addresses of their members whose family name started with R or S (letters chosen at random). To increase the potential number of responses two letters were chosen. The names of 681 handball players >12 years were randomly selected from these lists, each player receiving a questionnaire, and reminders were sent after 2 weeks. Information on most of the potential risk factors mentioned in scientific and popular literature was collected in the same way for controls and patients. In addition, injured patients were questioned about the circumstances of their injury.

Data analysis was performed with SPSS/PC software[12], adjusting for confounding by age. Odds ratios were calculated as a weighted average over three strata using the Mantel–Haenszel method with the corresponding 95% confidence intervals following the test-based method of Miettinen[13]. Given a low incidence, the odds ratio can be interpreted as a relative risk: an odds ratio of 1 means that the factor is not associated with injury risk; a ratio of 0–1 indicates that the factor is associated with a low injury risk, while a ratio >1 points to an elevated risk associated with the factor at issue[14].

Results

Response

Response rates were 67% for the cases and 75% for the controls, and 130 injured players and 512 uninjured players were included in the analysis. A rather large difference in age was found between patients and controls: the uninjured players tended to be younger (mean 22.1 years) than the injured players (mean 24.1 years). Because age is probably associated with most other putative risk factors the data were stratified in three categories (13–20, 21–30, >30 years) and all odds ratios presented are pooled over these strata. No significant difference was found between both groups regarding sex: in both groups 35% were males and 65% females.

Injuries

Injuries may be classified by their nature (distortion, sprains, etc.) and by site on the body. The nature of the injuries, as reported by the injured players, is shown in *Table 1*.

The percentage of distortions is high (35%), followed by strains and fractures. *Table 2* indicates location of the injuries. Most injuries appear to be located on the lower extremities (54%), especially the ankles (35%) and knees (16%). Most of the ankle injuries appeared to be distortions. Injuries to the upper extremities predominantly consist of injuries to fingers and thumb.

About 75% of the injuries originated during a game and the remainder during training. The last quarter of the game seemed to be the period when many players sustain injury: the time spent training or playing was not ascertained. The direct cause of more than one-third of the injuries appeared to be contact with an opponent, followed by contact with the floor or goalpost (*Table 3*). It is remarkable that in 84% of the injuries no violation of the game rules occurred.

Table 1. Nature of injury sustained by 130 handball players

Nature of injury	*Number*
Distortion	46(35.4)
Strain	33(25.4)
Fracture	16(12.3)
Rupture of ligaments	18(13.8)
Wound	7(5.4)
Other	10(7.7)
Total	130(100)

Values in parentheses are percentages

Table 2. Location of injury in 130 handball players

Site	*Number*
Foot	5 (4)
Ankle	46 (35)
Knee	16 (12)
Upper leg	3 (2)
Elbow	4 (3)
Wrist	4 (3)
Finger	21 (16)
Hand, thumb	11 (9)
Trunk	6 (5)
Other	14 (11)
Total	130(100)

Values in parentheses are percentages

Table 3. Direct causes of injury sustained during handball (%)

Direct cause	
Contact with team member	12
Contact with opponent	40
Contact with ball	22
Contact with floor, goalpost	24
Other	14

Values are percentages: cases could mention more than one direct cause

Risk factors

Age

About 66% of the injured handball players were over 20 years old, in contrast to only 49% of the uninjured players (*Table 4*). The 95% confidence interval for this association does not include the value 1, which means that the difference is significant at the 0.05 level (two-sided). Being older than 20 years seems to increase injury risk by 90% (odds ratio 1.9).

Stratification on age was performed in calculating all the odds ratios, because age is probably related to other factors such as experience, and could therefore be a confounder of the associations between other factors and the injury risk.

Table 4. Ages of handball players in study

Age (years)	*Injured (n = 130)*	*Uninjured (n = 512)*
>20	66	49
≤20	34	51

Odds ratio = 1.9; 95% confidence interval = 1.3–2.9. (Weighted average over three strata of age (Mantel–Haenszel) followed by a test-based 95% confidence interval).
Values are percentages

Table 5. Comparison of experienced and inexperienced players

Experience (years)	*Injured players (n = 130) (%)*	*Uninjured players (n = 512) (%)*	*Odds ratio**	*95% CI*
<2	7	9	1.0	
2–5	16	21	1.2	0.4–2.6
6–10	25	30	1.4	0.4–2.2
>10	52	40	1.4	0.2–1.3

*Weighted average over three strata of age (Mantel–Haenszel) followed by a test-based 95% confidence interval (CI)

Experience

The experience of a player appears to have a negative effect on the injury risk: the more the experience, the greater the risk of injury (*Table 5*). This effect is in addition to the age risk, thus the older a player gets, the greater the experience and the risk of injury.

Preventive measures

Not stretching out before a game seems to be another factor which increases the risk of injury (odds ratio 1.5; 95% confidence interval 0.71–3.11), but this association was not statistically significant. Not warming up before playing did not influence the risk of an injury (odds ratio 1.1). Players were asked whether they had been wearing tape or bandages during the training or the game: of the injured players 94% admitted that they had not worn any; the odds ratio of 2.0 indicates that this factor seems to increase the risk of an injury (not statistically significant).

It was surprising to find that *not* wearing elbow protectors decreased the risk of injury (odds ratio 0.01, 95% confidence interval 0.002–0.42); however, only a small number of handball players wore elbow protectors (*Table 6*).

Discussion

The best way to study the risk involved by playing handball is by means of a randomized trial comparing groups of players exposed or not exposed to the risk factor at issue[15]. However, due to ethical and financial considerations, a clinical trial of the risks of handball playing cannot be executed. In this study a case–control design was used to study the aetiology of handball injuries because this was the most feasible of the non-experimental designs available. There have been no other case–control studies about risk factors involving handball injuries. Case–control studies are to some extent open to information and selection bias and uncontrolled confounding[13,14]: information bias relates to whether the information is gathered in a comparable way between injured and uninjured handball players. There could be selective non-response: why did 25% of the population chosen not answer the questionnaire? Although we stratified for age, uncontrolled confounding may to some extent still be a threat to the internal validity of the study. Despite these limitations, the relative risks (odds ratios) of handball injury from this study may be interpreted with more certainty than those from case reports or case series reported in the literature[4].

Table 6. Comparison of players who did and did not wear elbow protectors*

	Injured (n = 32)†	*Uninjured (n = 506)†*
Not wearing	94	99
Wearing	6	1

*Odds ratio 0.009; 95% confidence interval 0.002–0.4, weighted average over three strata of age (Mantel–Haenszel) followed by a test-based 95% confidence interval.
†Data not available for all participants in study – no reply was received from 98 members of the injured group and six of the control group.
All values are percentages

Before any valid conclusions can be drawn regarding the absolute risk of injury to handball players, figures on participation in, and the amount of time spent playing, the game are required. It is not possible to calculate incidence rates from these data, and it should be noted that this study comprised handball players who were treated for injury at the emergency department in a hospital, thus only the more severe cases are included. This means that the results are an underestimate, and that the population value of the relative risk will increase if all injuries are investigated.

Site and nature of the injuries in this study confirm the results from other studies. The knees, ankles and fingers are most frequently injured[1,3,6,10,11]. Distortions are most frequently seen in ankles and knees. From the literature[1,3,7] an equal amount of injuries at upper and lower extremities could be expected, but in this study 54% of the injuries were located at the lower extremity and 31% at the upper.

The most clear risk factor seems to be age: players over 20 years have a greater risk of injury than younger players. This may partly be due to the fact that experience grows with age and more experience appears to increase the risk. This effect holds even when controlled for age. Not stretching out before a game also increases the risk of injury, and handball players who do not wear tape or bandages have a greater risk of injury.

Not wearing elbow protectors seems to have a preventive effect; however, this finding should be interpreted with some caution because the number of players who wear elbow protectors is small. From the literature these risk factors are often mentioned as preventive measures without empirical data to support them[1–3,7]. Prevention of handball injuries is not as easy as it is thought to be; clearly evidence for certain risk factors is still not available.

Future studies should focus on a valid estimation of incidence rates and on more extensive methods of data collection. For example, in this study only acute injuries are included and overuse injuries are not investigated. Also the strange finding that not wearing elbow protectors decreases the risk needs further investigation.

Furthermore, it would be advisable to include sufficient handball players in the study to enable a multivariate analysis in order to adjust the results for multiple confounders simultaneously.

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