

# Acute badminton injuries

Fahlström M, Björnstig U, Lorentzon R. Acute badminton injuries. Scand J Med Sci Sports 1998; 8: 145-148. © Munksgaard, 1998

During 1990-1994, 1.2% of all sports injuries that required emergency care at the University Hospital of Umeå were caused by badminton. In 90.7% of the cases the patients described themselves as recreational players or beginners. There were 51.3% minor injuries (AIS 1) and 48.7% moderate injuries (AIS 2). The lower extremities were affected in 92.3% of the cases. Achilles tendon ruptures (34.6%) and ankle sprains and fractures (29.5%) were the most frequent. By the time of the follow-up (10-69 months), 52.6% of the players still had symptoms from the injuries and 39.5% had not been able to return to playing badminton. Our data indicate the importance of adequate treatment and rehabilitation after acute badminton injuries.

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Key words: badminton; injury; follow-up

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Accepted for publication 10 December 1997

Badminton is a popular sport in Sweden. Around 680 000 Swedes play badminton once a week or more, during the winter season (1). In a study of sports injuries in licensed sportsmen 1986-1990, published by a Swedish sports insurance company (2), badminton had a yearly injury frequency of 2-5 injuries per 1000 players. The yearly incidence of injuries was low compared to some other individual sports - for example squash (4-10 injuries/1000 players) and down-hill skiing (12-29 injuries/1000 skiers) (2). In badminton, overuse injuries (3) and injuries of the lower extremities are the most frequent (4, 5), but badminton is also associated with a high incidence of acute Achilles tendon rupture (4-9). Studies in northern Sweden during the one-year periods 1978-79 (7) and 1985-86 (5) reported that 3.1%, and 3%, respectively, of all acute sports injuries were badminton-related. Two more recent Danish studies have reported that 4.1%, and 5%, respectively, of all acute sports injuries were caused by badminton (4, 6).

According to the Swedish Badminton Association, the number of licensed badminton players seems to have been constant in Sweden during the last two decades, although several more badminton sports halls have become available for use. The elite training is more intensified and specific strength training and stretching have been introduced. However, there is little known about the incidence of badminton injuries in Sweden during recent years.

The University Hospital of Umeå has a catchment population of about 120 000 people. Since 1985 there has been a continuous registration of acute injuries in the Emergency Department by the Umeå Accident

Analysis Group. All acute injuries are recorded on an injury card with registration of the circumstances concerning the injury. Every year about 9000 injuries are reported, of which about 1300 are sports injuries. The variation in the number of sports injuries in the region during the years is small (5, 7), although some new sports, such as floorball, have shown a marked increase during the 1980s (10).

The purpose of this retrospective study was to describe the incidence, nature and consequences of the acute badminton injuries during recent years.

## Material and methods

During 1995, all Emergency Department registration cards (as described above) for the five-year period 1990-1994 were examined. All acute injuries reported as related to badminton were included. A letter was sent to all the injured patients where they were asked to fill in and return a follow-up questionnaire. Questions were asked for example about age, sex, height, weight, sports activity level before and after the injury. There were also questions about previous symptoms, medical treatment after the injury, when during the game the injury occurred, whether the player had warmed up and stretched and place where the injury happened. The patients also described their playing level - elite or recreational athletes. Individuals who only had very little experience in badminton and played occasionally were described as beginners.

The medical journals of the patients were also studied.

Mean values  $\pm$  SD were calculated by the com-

puterised SPSS-system. For statistical calculations, Student's *t*-test and Fisher exact test were used.

## Results

Eighty-one badminton-related injuries were recorded during the period. This represents 1.2% of all the registered acute sports injuries. Seventy-eight of the patients (96.3%) returned their follow-up questionnaires and were included in the study. The mean follow-up time was 35.2 months (median 34.5 months, range 10–69 months).

Sixty-seven of the patients (85.9%) were men and 11 (14.1%) were women. The range of age of the patients was 11–52 years, with a mean age for men of 32.9 years, and for women 25.8 years. Sixty-three patients (80.8%) were 40 years or younger. Mean body mass index (BMI) for men was 24.5, and for women 22.2.

Of the players, 9.3% described themselves as elite players, 82.7% as recreational athletes and 8.0% as beginners. During the time of the injury 70.5% described that they were training at their usual level, 19.2% were training more than usual and 10.3% less than usual. About one-third of the players (34.7%) played occasionally, the other two-thirds played one to six times a week (mean 1.9 times).

Since badminton in Sweden principally is a winter season indoor sport, most of the injuries (69.2%) happened during the winter months (October to March).

In 65 cases there were information about the place of playing. Altogether 27 different locations, with many different court surfaces, were described.

Of the players, 26.0% had noticed previous injuries or symptoms from the injury site before the current injury, and 74.0% had not.

Before playing, 16.9% had both warmed up and stretched, 50.6% had warmed up but not stretched, 3.9% had stretched but not warmed up and 28.6% had neither warmed up nor stretched. There was no significant difference in warming up and stretching habits between men and women or between players with and without previous symptoms.

The injury frequencies are described in Table 1.

The group "ankle sprains/fractures" contained 21

sprains without signs of fracture and 2 malleolar fractures – one lateral and one bimalleolar.

The main diagnosis in the knee injury group was sprain ( $n=8$ ). Other diagnoses were ACL-rupture ( $n=2$ ), medial menisc rupture ( $n=1$ ), patellar dislocation ( $n=1$ ) and patellar fracture ( $n=1$ ).

In the miscellaneous group there were one each of 11 different injuries of which the most severe were scaphoideum fracture, tibia fracture and shoulder dislocation.

The lower extremities were affected in 92.3% of all cases. There was no obvious difference between injury frequencies in men and women.

Of the injuries, 18.2% occurred at the beginning of the planned badminton game or training, 40.3% in the middle and 41.6% at the end. Table 2 shows that there seemed to be differences between the four main diagnoses, though no statistical evaluation of the frequencies was made. This was due to the fact that these three different parts of the planned playing time did not represent specified or equal time periods.

A comparison between the most common injury – Achilles tendon rupture – and the other injuries showed that the patients with Achilles tendon rupture were significantly older ( $P<0.01$ ) than the players with other injuries (mean age 36.0 versus 29.7 years). Other compared parameters – height, weight and mean BMI – showed no significant differences.

Medical treatment of different kinds (surgery, plaster, NSAID etc) was given to 66.7% of all the patients. By the time of the follow-up, 52.6% still had symptoms from the injury, while 47.4% had not. Of the players, 60.5% reported that they had returned to playing badminton, while 39.5% had not. Only 52.0% had returned to the same sports activity level as before the injury. Sick-leave absence showed certain variations. Of the patients, 28.2% were not sick-listed at all, while the rest (71.8%) were sick-listed from 2 to 180 days with a mean of 42.5 days. There were certain differences between the most common types of injuries, shown in Table 3.

The injuries were also graded according to the Abbreviated Injury Scale (AIS) (11). The injuries in this study were classified as AIS 1 (minor injuries, such

Table 1. Main type of injury and frequency in 78 acute badminton injuries

Injury	<i>n</i>	%
Achilles tendon ruptures	27	34.6
Ankle sprains/fractures	23	29.5
Knee injuries	13	16.7
Gastrocnemius strains	4	5.1
Miscellaneous	11	14.1
Total	78	100

Table 2. Injury occurrence during the planned badminton play of the four main diagnoses groups. The injuries are described in per cent of the total number of each injury type. It should be noted that the three described parts of the planned playing time do not represent specific or equal time periods

Injuries (%)	Beginning	Middle	End
Achilles tendon ruptures	7.4	25.9	66.7
Ankle sprains/fractures	13.0	52.2	34.8
Knee injuries	23.1	53.8	23.1
Gastrocnemius strains	0	50.0	50.0

Table 3. Follow-up time consequences in the four main diagnoses groups of acute badminton injuries

Diagnosis	Days of sick-leave	Remaining symptoms (%)	Return to badminton (%)	Same sports activity level (%)
Achilles tendon rupture ( <i>n</i> =27)	60.6 (2–180)	48.1	40.0	20.8
Ankle sprain/fracture ( <i>n</i> =23)	23.8 (0–65)	56.5	82.6	73.9
Knee injuries ( <i>n</i> =13)	21.2 (0–90)	61.5	46.2	38.5
Gastrocnemius strains ( <i>n</i> =4)	26.0 (0–50)	0.0	100.0	75.0

as superficial wound, sprain of the ankle) or AIS 2 (moderate injuries, such as undislocated fracture of the ankle, rupture of the Achilles tendon). There were 40 (51.3%) minor injuries (AIS 1) and 38 (48.7%) moderate injuries (AIS 2). The differences in treatment and long-time results between minor and moderate injuries are shown in Table 4.

## Discussion

In badminton, overuse injuries (3) and injuries in the lower extremities are generally the most frequent (4, 5). This report focuses only on the acute badminton injuries that caused the players to consult the Emergency Ward. Due to the local medical care organisation, players with minor injuries and overuse injuries often consult their general practitioner, and therefore are not described in this material.

There are similarities and differences between our results and results from other studies on acute badminton injuries (4–7, 12). Since previous studies have different populations, designs or data handling, it is possible to discuss the different findings, but not to make epidemiological evaluations nor direct comparisons between the results in the studies, including differences in the incidence of badminton injuries.

The players in our study had a mean age of 31.9 years and 90.7% were recreational players or beginners. Höy et al. (6) and Hensley & Paup (12) described populations with about the same age, but with 55%, and 100% organised players, respectively, which probably influences the injury frequencies, while recreational badminton players seem to have a higher frequency of injuries (3).

In a Danish epidemiological study (3), 28% of all examined players were playing with an ongoing in-

jury. In our material, previous symptoms from the injured area were reported in 26.0% of the cases. About one-half of all the players also still had symptoms from their injuries by the time of the follow-up.

Eye injuries of different frequencies and severity are reported by other authors (4, 6, 12–14). In our study we found no eye injuries at all.

Other authors have described that in badminton injuries of the lower extremities are the most frequent (4, 5). Also in this study, most of the acute injuries were localised in the lower extremities, with more than one-third Achilles tendon ruptures. Similar incidences are reported by Björnstig & Stålnacke (20%), and Lorentzon et al. (17.1%), who investigated the same catchment area, but some years earlier (5, 7). The former of these studies also reported frequencies of a similar kind concerning ankle injuries (29%) and knee injuries (24%). In an American study of badminton injuries some years earlier Hensley and Paup found a frequency of only 2.6% Achilles tendon ruptures. The players were about the same age, but all of them were competition players (12).

Except for age, there were no significant differences between players with Achilles tendon ruptures and the players with other injuries concerning sex, BMI, previous symptoms or warming up and stretching habits in our study.

As a contrast to the acute ankle and knee injuries, the Achilles tendon ruptures and gastrocnemius strains seemed to occur late in the game. Similar results are reported by Kaalund et al. (15) and Inglis and Sculco (16). An important reason for this finding may be fatigue, with impaired neuromuscular function and co-ordination of the triceps surae muscle (15, 16). Specific training of muscular strength, endurance and co-ordination in the lower extremities

Table 4. Follow-up time consequences of the injury in the two groups with different AIS-grades (9)

	Minor injuries AIS 1 ( <i>n</i> =40)	Moderate injuries AIS 2 ( <i>n</i> =38)	<i>P</i>
Medical treatment (%)	37.5	97.4	<0.0001
Sick-listed (%)	55.0	89.5	0.0009
Mean sick-leave (days) ( $\pm$ SD)	20.0 ( $\pm$ 17.8)	57.8 ( $\pm$ 43.4)	<0.0001
Remaining symptoms (%)	50.0	53.3	n.s.
Return to badminton play (%)	77.5	41.7	0.0021
Same sports activity level (%)	72.5	28.6	0.0002

should be an adequate prevention. Since badminton play contains many starts and stops, eccentric training is probably of great importance.

The injuries occurred on several different court surfaces. In our material it was not possible to register or analyse any obvious pattern concerning certain court floor surfaces and injuries. We also do not have any data concerning shoe quality. However, since 92.3% of the injuries were localised in the lower extremities and almost two-thirds (64.1%) in the feet, hypothetically court surfaces and appropriate shoe-wear are probably of the highest importance. These extrinsic factors have been discussed by other authors (7, 14, 17, 18), but no studies have specifically investigated shoes and court surfaces. This is an important area for further studies.

We found significant differences between minor and moderate injuries concerning the need of medical treatment and sick-leave and also the number of days of sick-leave. There were also significant differences in sports activity level by the time of the follow-up, though there were no differences concerning remaining symptoms from the injury – around 50% in both groups. In the cases of the moderate injuries (AIS 2), i.e. Achilles tendon ruptures, fractures and serious knee injuries, treatment and rehabilitation had obviously not been successful enough to permit the players to come back to their previous sports activity level.

In comparison, long-term results in other Scandinavian studies of Achilles tendon ruptures, showed that 29.1–57.1% (8) and 54% (15) returned to the same activity level, while a follow-up study of Achilles tendon overuse injuries reported that three of four athletes had no symptoms, but that only one athlete of five had returned to the previous activity level (19). Höy et al. reported that 12% of the badminton-injured patients gave up sport after the injury (6).

## Conclusion

We have retrospectively studied acute badminton injuries, causing the players to consult the Emergency Ward. In the study, most players were beginners or recreational players.

We found that 51.3% of the injuries were of minor grade and needed medical treatment in about one-third of the cases. The other injuries (48.7%) were of moderate grade and needed further medical treatment in all cases except one (97.4%). These moderate injuries – especially the Achilles tendon ruptures – had considerable consequences with a long period of

sick-leave and a low frequency of players returning to their previous sports activity level.

Considering these findings, the importance of adequate treatment and rehabilitation after badminton injuries must be stressed. This is further underlined by the fact that more than one-fourth of all the players (26.0%) had noticed previous injuries or symptoms from the injury site before the current injury, and that about 50% of the players still had symptoms by the time of the follow-up.

Adequate muscular training of the lower extremities is probably necessary to prevent badminton injuries. Shoe-wear and playing court surfaces are important factors for further studies.

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