Short reports

Injuries to riders in the cross country phase of eventing: the importance of protective equipment

Michael R Whitlock

Abstract

***Objectives*—To determine the distribution of injuries in the eventing discipline of equestrian sports and the effectiveness of the protective equipment worn.**

***Methods*—Data on all injuries sustained in the cross country phase over fixed obstacles were collected from 54 days of competition from 1992 to 1997. This involved 16940 rides.**

***Results*—Data on a total of 193 injuries were collected, which included two deaths. This represents an injury rate of 1.1%. Head and facial injuries represented the largest group (31%), with one third of these requiring treatment in hospital. All riders were wearing protective helmets and body protectors.**

***Conclusions*—Eventing is one of the most dangerous equestrian sports. Improved protective equipment, which is mandatory for 1999, should reduce the severity of these injuries.**

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Keywords: horse riding; eventing; protective equipment

Horse riding is known to be a dangerous pursuit, with an average of 16 deaths a year registered between 1982 and 1992.[1] Avery *et al*[2] noted that there were 98 deaths from horse related injuries between 1982 and 1998 compared with 86 for motor sports. Other studies have found that equestrian injuries amount to 4.3% of all sports related injuries.[3] Eventing is becoming increasingly more popular. Over 150 horse trials were run in England in 1997, with more fixtures organised each year.[4]

In professional riding, jockeys have an estimated 2.5% injury rate.[5] The wearing of a protective helmet has helped to reduce the severity of injuries.[6 7] Fox hunting in North America has been considered to be no more dangerous than other types of riding, despite no protective helmets being used by most riders.[8]

Head injuries have always been of concern, and several previous studies have highlighted this.[9–11] Barber[12] noted that many of the riders admitted to hospital for a head injury in Oxford were not wearing any form of helmet. When this survey was repeated by Chitnavis *et al*[13] 20 years later there was a decrease in the number of admissions following a head injury, and this was thought to be due to more of the riders wearing a helmet. In eventing it has been mandatory to wear a helmet that conforms to Bs4472, similar to that for professional jockeys.[14] The design has been criticised as not offering enough protection,[15] and the standard was amended in 1988.[16] After six deaths in eventing in 1993, four from a head injury, efforts have been made to improve the design of the helmet. For the 1998 season, the *British Horse Trials Rule Book*[17] has made it mandatory to wear a helmet to the specification PAS015[18], the standard CEN 1984,[19] or any other protective headgear as may reasonably be expected to offer a similar, or higher, level of protection.

The wearing of a body protector has been controversial since the introduction of a standard in 1991.[20] The Irish Jockey Club have noted fewer rib fractures since its introduction (Hayley M, personal communication), but as the main function is to reduce soft tissue injury, it has been difficult to quantify its effectiveness. The standard has also been amended several times, but a new European standard for body and shoulder protectors was published in 1998.[21] This will offer several classes of protection, related to the energy absorption of the material used.

There is no published detailed analysis on the number of injuries in eventing, although there is a voluntary reporting system for medical officers.[22] This study has investigated the number of injuries to event riders in England, before the introduction of improved safety equipment. A further study will be required to confirm whether the safety equipment reduces the injury severity.

Methods

The author attended as medical officer at 54 days of horse trials from 1992 to 1997. This involves several phases such as dressage, show jumping, and cross country which involves jumping over fixed obstacles. Personal experience has shown that the last of these produces most of the injuries. The standard of competition ranged from pre-novice to advanced Concors Complet International (CCI) events. This standard referred to the ability of the horse, and not necessarily that of the rider. Some of

Wellhouse NHS Trust, Barnet General Hospital, Barnet, Herts EN5 3DJ, United Kingdom
M R Whitlock

Correspondence to:
M R Whitlock.

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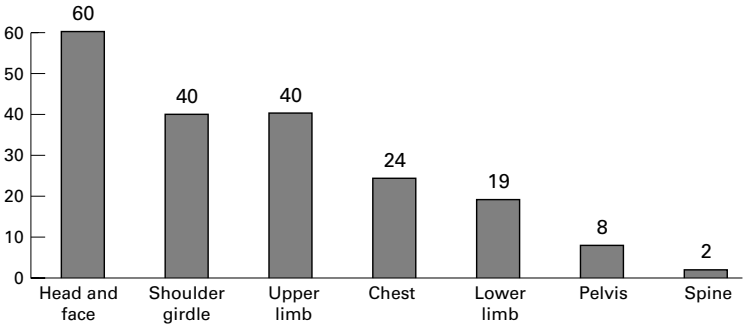

Figure 1 Anatomical distribution of eventing injuries.

the riders would compete with one horse in a novice class, for instance, and a different horse in the advanced section on the same day.

The criterion for an injury was that the rider required medical assistance and was considered unfit to continue riding that day. Hospital records were obtained in relevant cases, but no attempt was made to determine the final outcome. Injuries in the other phases of the competition, such as show jumping, were excluded.

Results

In the 54 days of cross country, 16940 horses competed. There were 193 injuries and two deaths. This represents an injury rate of 1.1% per ride. Both of the deaths occurred in a CCI event, the highest level of the competition. One death was due to a head injury sustained when the horse fell on top of the rider, and the other was due to massive chest injuries incurred also when the horse fell on the rider.

Figure 1 shows the anatomical distribution of the injuries. Most of the injuries were to the head and face (31.1%), with the shoulder girdle being second in frequency (20.7%). Twenty four riders were admitted to hospital, 20 with a head injury. Fifty five of the riders with a head injury were wearing a helmet to Bs4472 standard and five to the PAS015 specification. In two cases the rider was wearing a PAS015 helmet when the horse fell, crushing the head. Both riders were admitted to hospital and discharged within 24 hours.

There were two fractures to the spine, due to direct impact falls on to the ground. One case involved a fracture of T12, as well as several fractures to the transverse processes of the lumbar vertebrae. No riders were partially or permanently paralysed. No soft tissue injuries to the neck were recorded, although it was known that some riders were unable to ride the next day because of neck pain.

All riders were wearing a body protector to a BETA standard, but none of those who sustained a shoulder girdle injury were wearing a shoulder protector to any standard. In comparison there were 20 falls where the rider was wearing a shoulder protector to CEN class 3 standard. These were witnessed falls where the rider might be expected to have sustained a severe injury, but all were able to continue the competition.

Discussion

The results show that there were a large number of head and shoulder injuries, and protection to these areas should be given a high priority. The helmet is designed to withstand direct impacts and not from the rotational element of a head injury. When the Bs4472 standard was amended in 1988 to improve coverage around the sides, the manufacturers produced a more flexible lightweight helmet which was less likely to withstand crush injuries. Although rare, a crush injury, where the horse rolls on the rider, often has a fatal result. Some situations, in which the rider was wearing the more rigid PAS015 helmet, suggest that the severity of injury was reduced, but further studies will be needed to see if the overall severity of head injuries will be reduced by wearing this type of helmet. The PAS015 committee has already noted these findings, and has proposed a modification of the specification to include a simple lateral deformation test.[23] This will ensure that the helmet will be able to withstand some of the crushing effect when a horse rolls on top of the rider's head.

In all cases the rider was wearing some form of body protector, yet 24 chest injuries were recorded, one fatal. The protector is still in the developmental phase and has been improved every year. It is designed to reduce soft tissue injury and possibly provide some protection to the chest and spine from a fall or kick. It may also reduce the severity of injury from a kick to the upper abdomen. No rider who sustained a chest or spinal injury was wearing a protector that conformed to the BETA Class 3 or prEN 13158 standard. It is only when riders wear such garments that an accurate evaluation will be possible. Shoulder protectors have only been recently introduced as part of the standard. There have, however, been 20 witnessed falls where a shoulder injury was expected and the rider was wearing a shoulder protector. In all instances the rider was able to continue the competition. None of the riders who sustained a fracture to the shoulder girdle was wearing any form of protection to that area.

This paper has emphasised the importance of using the highest possible level of safety equipment in the cross country phase of eventing. This is reflected in the requirements for the wearing of helmets in competitions in the United Kingdom, under British Horse Trials Rules. It does not, however, insist on class 3 body protectors, nor shoulder pads. For international competitions, held in the United Kingdom and abroad, the requirements for wearing helmet and body protectors are lower. Perhaps the International Equestrian Federation should consider changing them, in view of the potential risks for riders.

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Take home message
There is a relatively high risk of sustaining an injury during the cross country phase of eventing. This can be reduced by using PAS015 helmets and body/shoulder protectors to the prEN 13158 standard.

The prevalence of chronic knee injury in triathletes

Kirstie Clements, Ben Yates, Michael Curran

Abstract
***Objectives*—To add to the area of triathlon research by providing much needed prevalence data on knee injury in triathletes.**
***Method*—An incidental "in field" sampling technique was used to interview 58 triathletes aged between 15 and 55 years about knee injury during a triathlon event. The sample comprised 46 men and 12 women.**
***Results*—Most knee injuries occurred during the running event (72%) and affected the lateral side of the knee (38%). In all, 78% of the sample sought treatment from a healthcare professional.**
***Conclusion*—The study has provided much needed prevalence data on chronic knee injury in triathletes.** (*Br J Sports Med* 1999;**33**:214–216)

Keywords: triathlon; knee; Q angle

University College Northampton, Nene Centre for Healthcare Education, Park Campus, Boughton Green Road, Northampton, United Kingdom
K Clements
B Yates
M Curran

Correspondence to:
M Curran, 5 Dover Close, Manor Farm, Rushden, Northants NN10 0RQ, United Kingdom.

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Triathlon began in Honolulu in 1978 and involves three events, running, cycling, and swimming. According to Williams *et al*,[1] despite ever increasing interest in the sport, research in this area has lagged far behind that into other sports. The amount of literature available detailing aspects of injury and training regimes is small. Studies have focused on incidence of injury, types of injury suffered, and physiological response to swimming, cycling, and running.[1–7]

In a study of 72 triathletes by Wilk *et al*,[8] three quarters sustained triathlon related musculoskeletal injuries during training as the result of overuse.

Collins *et al*[9] surveyed 600 finishers in the Seafair Triathlon in 1986 with a 45% return rate. They reported that 49% of the respondents suffered a training related injury which caused them to stop training for at least one day. Some 70% of the injuries were related to running, and the knee, shoulder, and ankle were the most vulnerable. The investigators noted that higher training mileage for swimming, cycling, and running did not lead to a significantly higher incidence of injury.

A study by Korkia *et al*[10] also found that the injury incidence was unrelated to the mean amount of weekly training, competition, intensity, or frequency of training in 155 British triathletes over an eight week period. At least one injury was reported by 58 (37%) of the participants. The most affected areas for these triathletes were the ankle/foot, thigh, knee, lower leg, and back. Most (84%) of these injuries were minor, and 83% of the respondents did not have to miss a planned competition.

Ultraendurance triathletes who competed in the 1986 Hawaii Iron Man Triathlon were studied by O'Toole *et al*.[11] It was found that 91% of participants had sustained at least one soft tissue injury during the preceding year, and 84% of participants reported knee/thigh injuries.

Cipriani *et al*[12] surveyed 118 triathletes and found that knee injuries were the most common.

Table 1 Location of knee injury in relation to triathlon stage

Area of knee affected	*Run*	*Cycle*	*Run and cycle*
Lateral	33.3	5.5	0
Medial	16.6	5.5	5.5
Anterior	11.1	5.5	0
Anterior/lateral	11.1	0	0
Medial/lateral	0	5.5	0
Posterior	0	0	0

Values are percentages.

Only 42% of the triathletes sought medical treatment, and 43% had to stop training.

Epidemiology studies noted that most triathlon related injuries occur during run training.[8 10 11 13]

Method

SUBJECTS

An incidental "in field" sampling technique was used to interview 58 triathletes aged between 15 and 55 years during a triathlon event. The sample comprised 46 men and 12 women.

PROCEDURE

A structured questionnaire to be administered by an interviewer was designed to assess injuries to the knee sustained during triathlons. The 27 closed ended questions sought to (*a*) show the prevalence of knee injury within a sample group of triathletes, (*b*) identify the most common location of knee injury, and (*c*) determine from which healthcare professionals triathletes sought treatment. Before inclusion in the survey each subject had to meet certain inclusion/exclusion criteria. The inclusion criteria were: aged between 15 and 55; actively training/racing in triathlon for at least one year; participating in all three disciplines; when injury occurred, it was sustained between 1994 and 1997; injury was sustained through training/racing in a triathlon related sport. The exclusion criteria were: previous surgery to the knee; participation in another sport; suffering any debilitating disease. All questions were administered by one of the authors.

DEFINITION OF INJURY

Injury was defined as any musculoskeletal ailment that caused the athlete to reduce, or refrain from, training for at least two days during the period 1994–1997.

DATA ANALYSIS

To facilitate comparisons, the sample was divided into an injured and non-injured group which were compared using descriptive methods.

Results

The triathletes sought treatment as follows: 27% from a physiotherapist; 11% from a general practitioner; 17% from a podiatrist; 6% from a chiropracter/physiotherapist; 17% from a general practitioner/chiropracter; 22% did not seek treatment.

The average age was 31 years; 79% were men and 21% women. They could be broken down into age groups as follows: aged 15–20, three; aged 21–25, five; aged 26–30, 23; aged 31–35, 12; aged 36–40, six; aged 41–45, five; aged 46–50, three; aged 51–55, one.

Table 2 A breakdown of injured and non-injured triathletes

	No of triathletes	*No of injured*	*No of non-injured*
Athletic status			
Novice	7	1	6
Club	17	7	10
Age group	26	9	17
Elite	7	3	4
Do not compete	1	0	1
Duration of participation (years)			
>1	13	3	10
2–5	20	6	16
6–8	16	7	9
9–10	6	2	4
11+	3	2	1
Running surface			
Off road	4	1	3
Road	19	5	14
Grass	6	4	2
Treadmill	1	0	1
Mixed	28	10	18

Table 3 Formal diagnosis of knee injury

Formal diagnosis	*Number of cases*
Idiopathic	4
Poor patellae tracking	4
Iliotibial band friction syndrome	2
Abnormal pronation	4
Chondromalacia patellae	3
Osgood-Schlatters disease	1

In all, 34% (20/58) of all the athletes interviewed claimed to have suffered a knee injury between 1994 and 1997.

Table 1 shows the prevalence of knee injury, and the area, in relation to the sport. No knee injuries were reported to have occurred during the swimming stage. Cycling produced knee injuries in 22% (4/18); the lateral, medial, and anterior aspects of the knee were affected. Some 65% (13/20) reported an injury to the knee during the running stage; most of these occurred on the lateral side of the knee. A further 6% stated that injuries had occurred to their knees through a combination of running and cycling.

Table 2 is a summary of injured and non-injured triathletes.

A previous formal diagnosis of knee injury was made in 18 cases (table 3).

Discussion

A comparison between male and female athletes did not show any large differences. The predominance of male trialthletes compares with other studies.[11]

The average age of the triathletes in the study was 31 years, which is comparable with subjects in a study by Bailey *et al*,[7] but slightly lower than in a study by Massimino *et al*,[6] most triathletes in our study being in the 25–30 years bracket (39%) and the 30–35 years group (21%).

In all, 78% of the sample sought treatment in this study, compared with only 51% in a study by Korkia *et al*[4] and 42% in one by Cipriani *et al*.[12] In both the latter studies treatment was sought primarily from a physiotherapist. However, it should be noted that the time lapse

between injury and the athlete seeking medical attention was not looked at in our study.

Knee injuries sustained during running were the highest at 72% compared with 22% incurred while cycling. These results are comparable with those of Massimino *et al*[6] who found that 58% of knee injuries were caused through running and 20% by cycling. Cipriani *et al*.[12] also found a high incidence of knee injury.

Diagnostic tests were not attempted in this study. Diagnosis was based on what the subject recalled as the diagnosis.

This study found that lateral knee pain had the highest prevalence. This is different from previous studies conducted on runners, in which anterior knee pain was the most common finding.[14 15] Most injuries were sustained through running and affected the lateral side of the knee. Despite the fact that many authors related pain in this area to iliotibial band friction syndrome during long distance running,[16–19] only two triathletes in our study had been diagnosed with this condition.

The highest number of injuries was observed in athletes who ran on a mixture of terrains (50%; 10/20). The group who trained solely on roads or tarmac surfaces accounted for 25% of the injured athletes. The fact that a large number of athletes remained uninjured despite training only on roads indicates that training on hard surfaces does not always predispose the triathlete to injury.

This study has highlighted the need for further research within the area of multidisciplinary events, in particular the relation between intrinsic and extrinsic factors that predispose to injury.

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Take home message

Prevalence data for knee injury in triathletes are provided. Most injuries occurred in the running event and affected the lateral side of the knee.