Positional Related Injury in Elite Female Field Hockey Players

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Abstract

The aim of this paper is to examine injury patterns in elite female field hockey players, and to identify the injury rates of different playing positions so that preventative measures can be implemented. Based on available research it was hypothesised that goalkeepers and midfielders will have the highest rate of injury. However, after the Injury data was collected from the team's physiotherapist, post 2003 hockey season, it was found that within the distribution of injuries by position, forwards had the greatest percentage (44%), followed by those positioned in the midfield (23%), goals (18%), and back (15%). The most common type of injury was categorised as bruising or inflammation (27%), predominantly occurring in the lower limb with most of these cases reported as shin splints. Other prevalent types of injury included joint sprains (19%) and muscle hypertonicity (19%) occurring in the ankle and thigh areas. A greater percentage of injuries occurred to the lower limb in this study, when compared to others. This may be due to the use of elite hockey players. Leading to more advanced stick control and accurate hitting, combined with the flatter surface of artificial turf – which all play and training was executed on. If accurate and comprehensible injury data on injury patterns for particular positions were available, more attention could be made to tailoring training and rehabilitation programs for positions susceptible to specific injuries. Theoretically, this should eventually lead to minimising the prevalence and severity of injury.

241 words

Key words – Female, Hockey, Elite, Injury, Position

Introduction

Field hockey is one of the most popular team sports in the world. The International Hockey Federation has five continental associations and 119 member associations (NCAA, 1999). The success and associated exposure Australian hockey has achieved in the past three decades, with the women's team winning Gold at the 1988 Olympics and the men's Silver at Barcelona, it has contributed to increased popularity of this sport in Australia. It is important for players, coaches and trainers to be aware of the potential injury risks to players. Epidemiological studies in Australia and overseas have consistently indicated that injuries in hockey are numerous and can be serious. The available evidence suggests that the majority of serious injuries result from being struck by the stick or the ball (Murtaugh, 2001). Injuries to the eyes are infrequent, though tend to be severe (Sherker and Cassel, 1998). Overuse injuries to the ankles and lower back are also frequently reported. This category of injury tends to be painful and frustrating to the player. The type, frequency, intensity and duration of strain put on the body play a major role in the aetiology of overuse injuries (Parkkari, Kujala and Kannus, 2001).

Hockey is a physically demanding sport requiring specific training regimes and programs to be followed throughout preseason and in-season by all those at the elite level. Players are also expected to attend club and state training sessions, and to play competition and pre-season games. This workload indicates that overuse injuries could prove to be a complication to any player's hockey season.

There is a need to be aware of the occurrence and type of injuries, in order to provide appropriate treatment and management. This becomes increasingly important in elite athletes where the pressure to perform and to be at one's physical best is vital. The extent and nature of the injury problem needs to be clearly identified before effective measures or programmes aimed at preventing injury can be initiated.

The aim of this study was to investigate the injuries sustained by women in state level hockey, and to determine whether playing position had an influence on injury type and incidence.

Field hockey is played in 132 countries around the world. It is one of the most popular team sports, second only to soccer (NCAA, 1999). Research has consistently indicated hockey injuries are common and can be serious. It has been reported that the most frequent site of injury is the lower limb, followed by the head and face, upper limb, and finally the torso (Murtaugh, 2001; Powel and Barber-Foss, 1999; Rose, 1981). Most injuries presenting to hospital are to the face, hands, and lower limb. Being struck by an object, usually by the stick or ball, causes most of these injuries. Overuse injuries to the ankles and lower back are also frequently reported (Sherker and Cassell, 1998). Despite the sport's apparent popularity, there is limited data concerning the injury rates and patterns of injury among field hockey players.

Sports injuries:

Sports injuries are one of the most common injuries in modern western society (Parkkari, Kujala, Kannus, 2001). Treating sports injuries is often difficult, expensive and time consuming. Therefore, preventive strategies and activities are justified on medical as well as economic grounds. A number of intrinsic factors have been associated with sports injuries - running speed and acceleration, posture and body mechanics, muscle imbalances, weakness of the muscle groups that protect and stabilise joints, joint function, and signs of lack of full recovery from previous injury (Watson, 2001). Injury prevention programmes and pre-season conditioning are often based upon the assumption that improvements in the above factors will result in a reduction in the incidence of sports-injuries. Despite applying these injury-prevention practices, the role of playing position and its relationship with injury has received little investigation.

Hockey injury patterns:

The most prevalent injuries in field hockey are ankle sprains, hand fractures, and head or face injuries (Murtaugh, 2001). Murtaugh (2001) revealed that, not only is there a difference in the rate of injury between playing positions, but also in the types of injuries sustained at different positions. Most of these injuries are not severe. In fact, field hockey tends to have low injury rates when compared with other sports (NCAA, 1999). Research suggests that goalkeepers are at the highest risk of injury in field hockey (Murtaugh, 2001). This is likely to be attributed to the intense play that occurs in and near the striking circle. The goalkeeper, although wearing protective gear, comes into deliberate physical contact with the ball and is therefore playing a high-risk role. (Verow,1989). Verow (1989) found that capsular or rotator cuff strains are common in goal keepers, often sustained when attempting to make saves on the ground with an outstretched arm. It was also stated that an inflamed olecranon or trochanteric bursa is not an uncommon finding. This may be due to the pressure placed on these areas when lying horizontally across the goal to defend penalty corners.

Midfield players have the second highest rate of injury, especially to the head/face and upper limb (Murtaugh, 2001). It is possible that these injuries are due to midfielders spending more time at a higher physical intensity than other positions (Cibich, 1991). Fatigue, frequent tackling, the amount of time on the ball, and the type of defence that midfielders use may also contribute to the high injury rate of this position.

Another concern of hockey players is back pain. Over 50% of hockey players have experienced back pain predominantly in the lumbar region (Reilly and Seaton, 1990; Murtaugh, 2001). Dribbling the ball and moving quickly in a semi crouched posture, along with the asymmetry of playing with right-handed sticks, have been suggested as contributing factors to this prevalence. This altered locomotion has been found to cause physiological strain and spinal loading in excess of orthodox motion (Reilly and Seaton, 1990).

Artificial turf:

Hockey is now mostly played on artificial, as opposed to grass, surfaces. This means the game is played at a faster pace and the additional strains generated create overuse injuries especially of the lower limbs (Verow, 1989). There are practical advantages to the use of

synthetic surfaces in hockey such as a 'truer bounce'. However, Sherker and Cassell (1998) suggest that ankle inversion injuries, meniscal problems and the prevalence of shin soreness, knee pain and lower back problems have increased with the more widespread use of synthetic surfaces. Artificial turf allows hockey to be played at a faster pace with continuous play, along with decreased recovery periods. These factors may contribute to these injuries.

Recent injury reports on field hockey involve populations that still hold games and training sessions on natural grass surfaces. There is limited research with a focus on the role of position with injury reports, and also on any chronic injuries incurred with long periods of training and playing on the standard artificial turf. The type, frequency, intensity and duration of training play a major role in the aetiology of overuse injuries (Parkkari, Kujala and Kannus, 2001). Information that provides an understanding of the patterns of injury is crucial for developing conditioning and training programs that are specific for particular positions and useful for injury prevention.

Method

This was a retrospective study that involved all women hockey players selected for a 2002-2003 State Hockey Team (N=22). The head coach gave permission to involve the team in this study, and to access current injury data collected by the team physiotherapist. Each player signed a consent form, allowing the researcher access to injury data files compiled by the team physiotherapist. All data was de-identified before being collated.

Injury information was collected incorporating: age, playing position, anatomical site of injury, categories for the type of injury, whether the athlete could accurately recall if the same site had been injured previously, and whether the injury was acute or chronic in nature; would be included in the physiotherapists reporting methods. Each time a hockey related injury occurred to a member of the team throughout the hockey season, the injured player would report the injury to the team's physiotherapist to get treated or to gain management advice.

At the completion of the 2002-2003 hockey season, injury information was gathered from the player's physiotherapy files and entered onto a database.

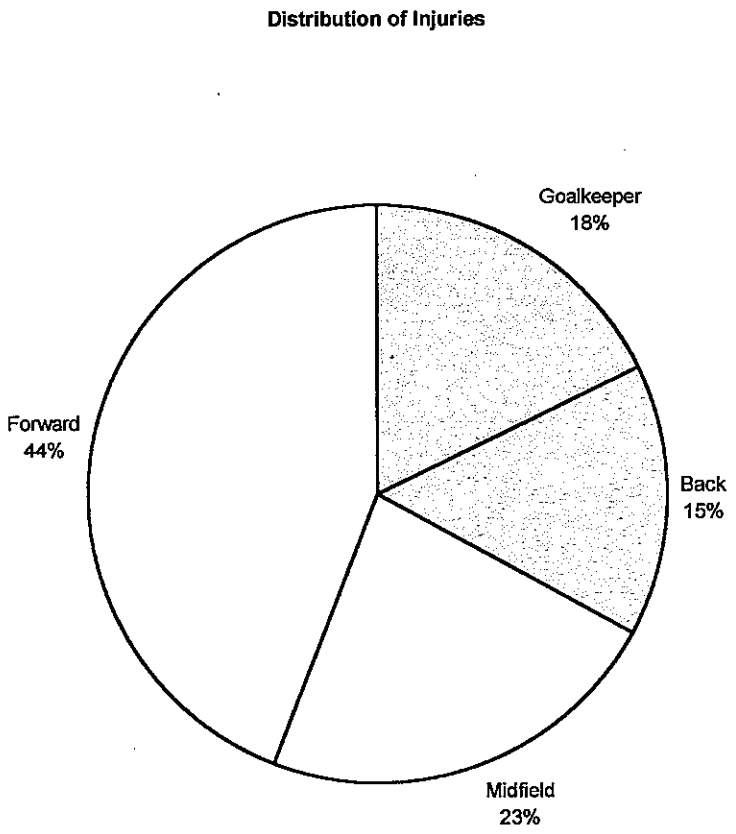
Statistical Analysis - All results were analysed using Microsoft Excel, and were expressed as percentages of total number of respondents, playing position, or injuries, depending on which statistics were being correlated. All results were tabulated and graphed. Chi square analysis using SPSS version 11 was also completed to determine whether one playing position combination was more likely to sustain a particular injury during the season.

Results

Of the total playing population (N=22), all sustained at least one injury during the 2002-2003 season.

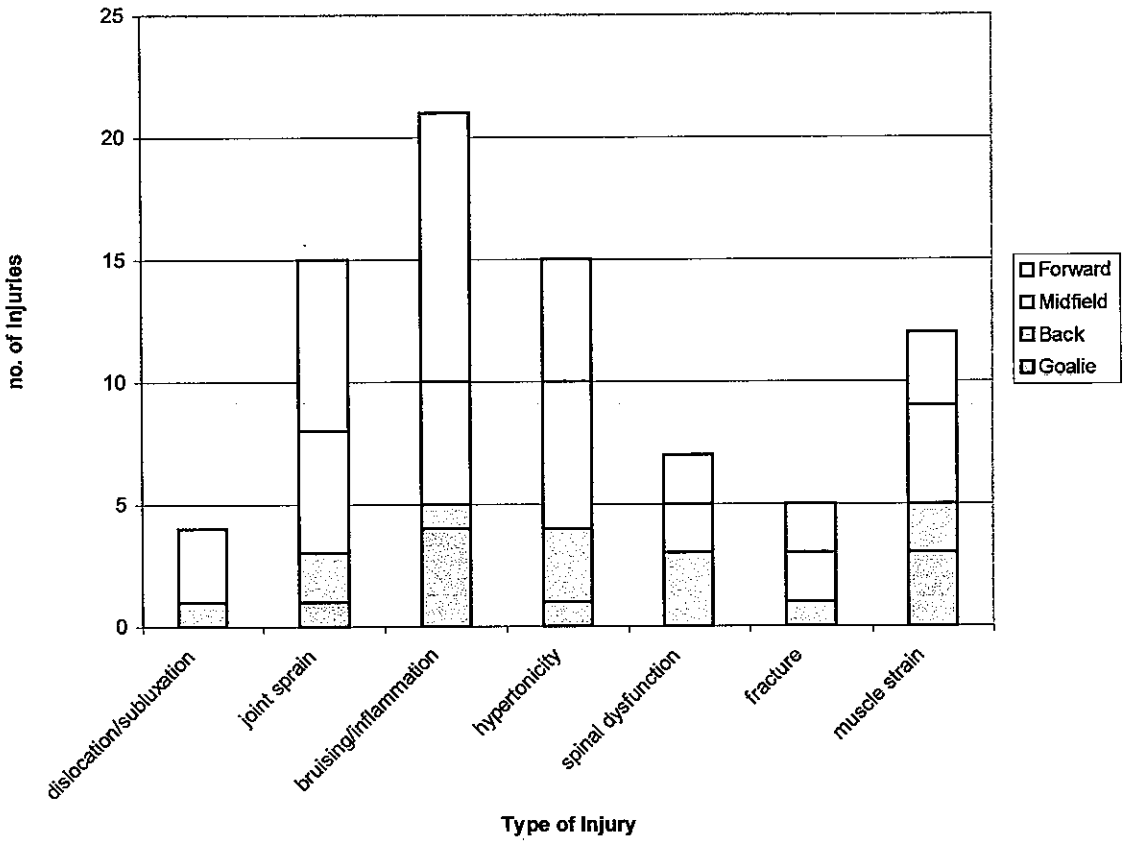
Of this distribution of injuries, 44% occurred to players positioned as a forward.

Graph 1



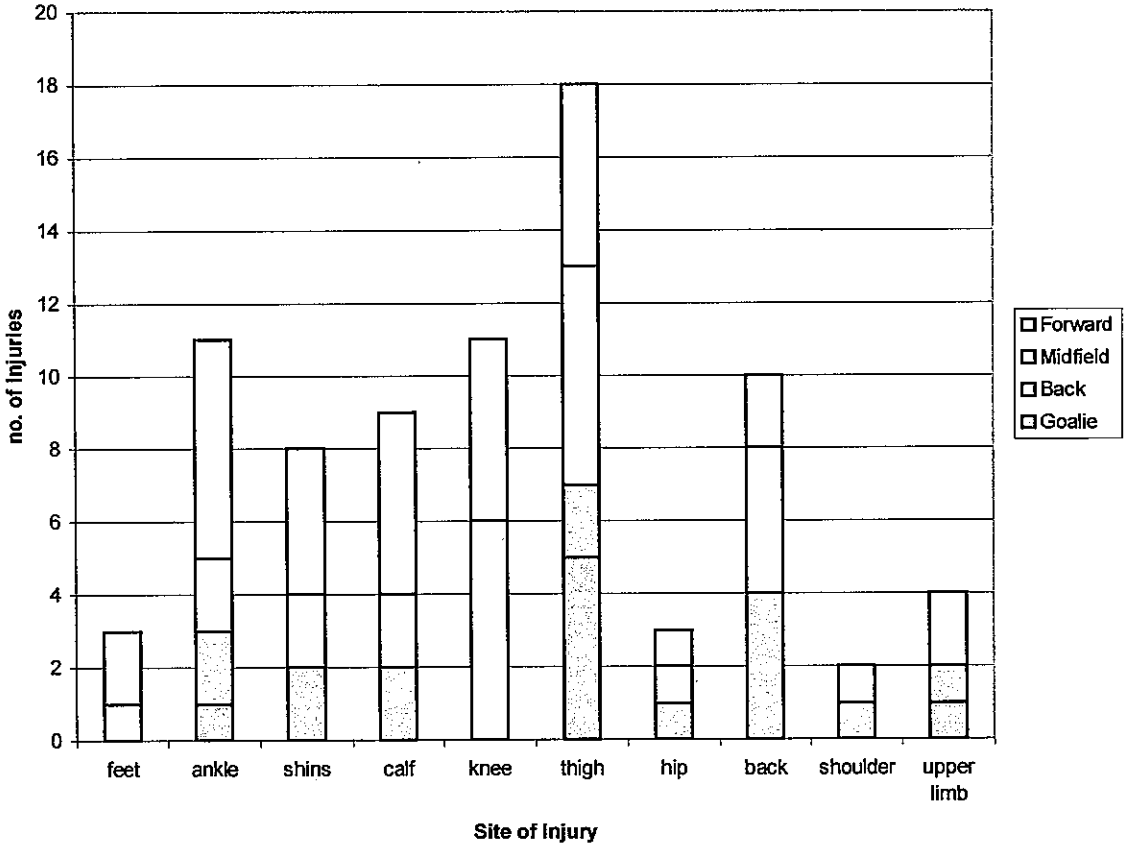
The most common type of injury was categorised as an inflammation or bruising process (n=21). These injuries predominantly occurred in the lower limb with most cases reported as shin splints. Other prevalent types of injury included joint sprains (n=15) and muscle hypertonicity (n=15) that most commonly occurred as an ankle sprain or thigh hypertonicity. Most muscle strains (n=12) also occurred to the thigh area, and included all of the quadriceps, hamstring and adductor muscle groups.

Graph 2



Graph 2 gives an indication of the relationship between playing position and injury type. Whereas Graph 3 allows us to identify the site of injury and it's association with playing position.

Graph 3



Overall, those positioned as a forward were most susceptible to be injured in the ankle area (n=6) with bruising and inflammation most likely to be the type of injury to occur. Whereas midfielders were predominantly injured in the thigh (n=6) and knee areas (n=6), with hypertonicity being the main type of injury.

Only 45.5% of players were treated for back pain. The majority of these players were most often positioned in either the midfield - a position that spends the most time at a higher physical intensity with a higher percentage of time dribbling the ball- or as a back, where the researched players had the highest average age group (27.6 yrs) (Table 1).

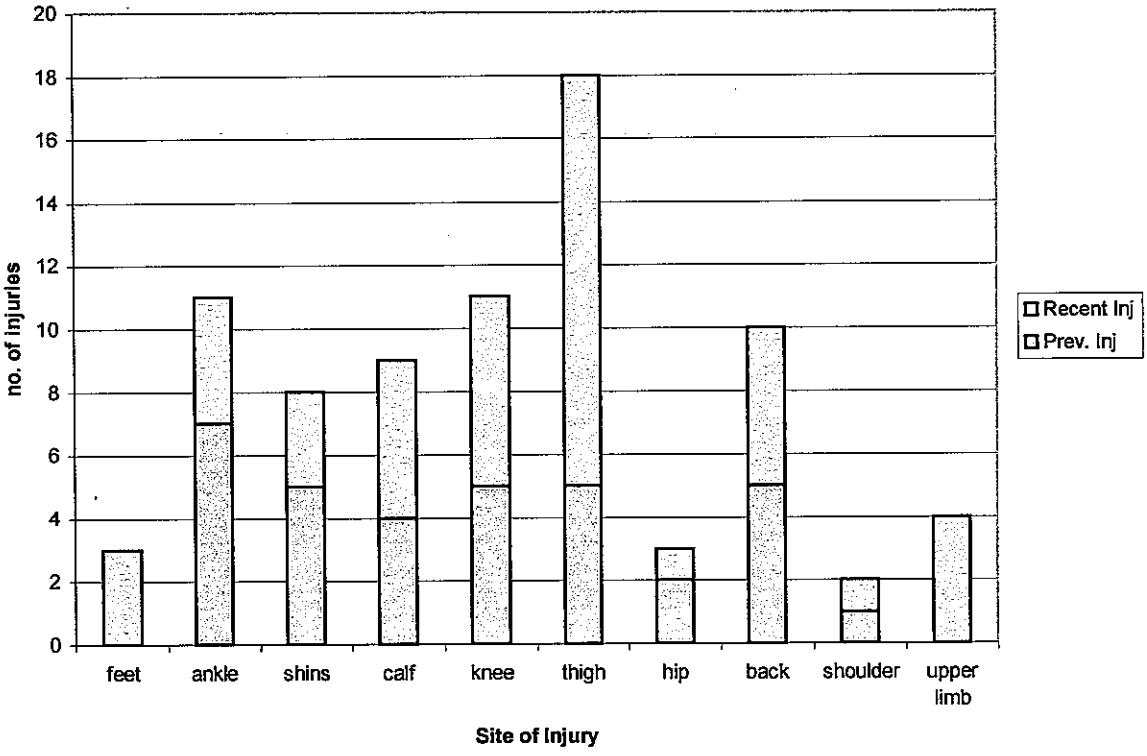
Table 1

Position	Average Age
Forward	26.4 (3.49)
Midfield	24.8 (1.28)
Back	27.6 (3.50)
Goalie	23 (2.16)

Standard deviations are in parentheses next to each mean value

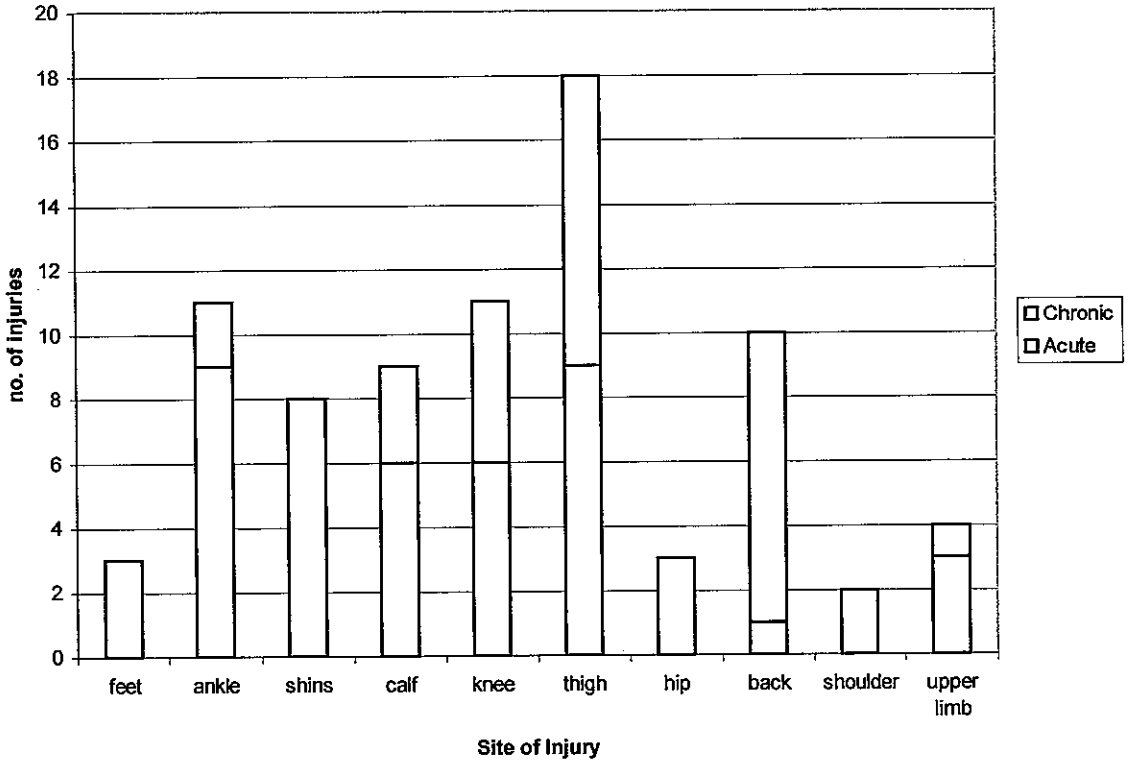
43% (n=33) of all injuries sustained occurred in a region that had been injured previously. The ankle area was the most likely to have a recurring injury at 21% (n=7).

Graph 4



Most of the injuries treated by the team physiotherapist were of a chronic presentation (n= 43, 54%)

Graph 5



The ankle and thigh areas both had the highest rate of acute injury presentation (n=9), with the thigh and back areas with the highest rate of chronic injury presentation (n=9).

Chi square analysis of playing position compared to injuries sustained revealed a non-significant result (χ^2=17.2, p=0.509). This indicates that there were no significant differences between types of injuries and the position played.

Discussion

The injury incidence of 100% recorded for this population was higher than the 74.7% incidence reported by Murtaugh (2001). However, studies, such as Murtaugh (2001), analysed data on back pain, and acute injuries, and excluded chronic injuries such as stress fractures, shin splints and tendinopathies that commonly occur in the hockey population. The data in the present study indicates that greater than a half of the injuries presented to the team's physiotherapist were of a chronic nature (54%). Acute injuries, commonly sustained by stick or ball, with a hospital emergency department presentation, would not necessarily be seen to by the team's physiotherapist. These injuries have not been included in this study; and apart from changing game rules or wearing more protective equipment these are not the preventable injuries this study has focussed on. Previous studies have also reported injuries from a range of clubs and levels of hockey, where the players studied did not have the same predisposition to injury from many years of intense training, increased exposure time, or the need to take risks such as those taken by elite players.

If injury findings from this study were grouped into regions of the body, as in previous studies, the general pattern of field hockey injuries presented in this study supports the findings of other authors that the lower limb is the most frequent site of injury (Murtaugh, 2001; National Collegiate Athletic Association, 1999; Rose, 1981). However, this study reports a far greater percentage of injuries falling under the category of the lower limb, with the spine and upper limb areas being injured far less frequently. This may have been due to this study being specific to more experienced hockey players combined with the fact that all play and training was executed on artificial turf, as opposed to grass. The skill level and advanced equipment of elite players allows greater stick control and accurate hitting. This factor combined with the flatter surface of artificial turf, may account for the decrease in head and upper limb injuries reported in studies involving a sample of club level players.

Hockey players execute different movement patterns according to their positional requirements, and as such have different physiological demands imposed upon them (Boyle, Mahoney & Wallace, 1994). This study indicates that players who were most often

positioned as a forward had the greatest injury rate (44%), followed by those positioned in the midfield, goals and back respectively. Fox (1981) suggested that the most injured field players would be forwards. Forwards spend the most time near the goal area where the number of tackles and the intensity of play is increased in urgency for a goal. In fact, up to 20% of field hockey injuries have been attributed to tackling (Graham & Bruce, 1977).

Reilly and Borrie (1992) reported that the speed and ability to accelerate, as denoted in vertical velocity findings, along with the power and strength necessary in attacking play was a good combination of characteristics for forward players to perform their field duties. These requirements, of high intensity bursts of activity involving acceleration, deceleration and turning movements, along with high intensity play in the goal circle, may attribute to the high number and types of injuries sustained by players in the forward position. However data from the present study does not indicate that one position is more likely to incur a specific type of injury (χ^2=17.2, p=0.509). This may be due to the low number of injuries sustained by this playing group.

Boyle, Mahoney and Wallace (1994) measured the exercise intensity of field hockey players during match-play and reported that the centre midfield position demanded the greatest degree of energy expenditure (83.3 kJ/kg/min). It is possible that the high percentage of injuries to midfielders (23%) in the present study was due to greater fatigue or the type of defence that midfielders tend to use during play (Murtaugh, 2001). However as the present study did not record data about how the injury occurred or when it occurred, this is only speculation, but would seem consistent with previously reported research.

It has been suggested that the importance of the aerobic system in field hockey is emphasised by some relatively high VO_{2max} values (61.8 ml/kg/min) (Boyle, Mahoney, & Wallace, 1994). The same study states that the mean heart rate of 158.6 beats/min is indicative of the high physiological requirements of the game, with midfield play being the most physiologically demanding (165 beats/min). The training regimen of a midfielder must, therefore, reflect the high aerobic demand of elite play with great emphasis being placed upon the development of aerobic capacity. The increased speed of movement demanded by

synthetic surfaces would indicate that the majority of aerobic training needs to be done over shorter distances at high pace, or using interval sessions with high intensity 800 to 400m repetitions (Reilly & Borrie, 1992). With the intense pre-season training of this nature, along with match play at least twice weekly, it is obvious why the lower limb is frequently injured with muscle strains and hypertonicity - often chronic in nature, when positioned in the midfield

Studies opposing the positional results obtained from this study stated that goalkeepers had the highest injury risk in field hockey by either direct trauma from sticks and balls (Verow, 1989), or due to contact with another player, the ground, or the goal itself (Murtaugh, 2001). With modern technologies available to meet the requirements of this high performance sport, such as hi-tech goalkeeper protective equipment and specialised training for flexibility and proprioception, the incidence of goalkeeper injuries is lower (18% v 33%) than that reported by Murtaugh (2001).

Back pain continues to be a common complaint of field hockey players. Current data suggests that 45.5% of players were treated for back pain, with the most common site of pain being the lower back. These results are similar to previous reports (Murtaugh, 2001; Reilly, Seaton, 1990). Reilly and Seaton have attempted to attribute low back pain to stresses on the spine that are unique to field hockey when dribbling the ball or moving in a semi-crouched posture.

It may seem as if 45.5% of athletes reporting back pain is a high proportion in such a young and active group. However, other sources have indicated that back pain is prevalent in the general population (60%-80%) and among athletes (50-85%) (Sward, Hellstrom & Peterson 1988). Furthermore, by the age of 18, in the general population over 50% of girls have experienced at least one episode of low back pain (Leboef-Yde, and Kyvik, 1998). There are also indications that all the pre-season training of back strength, stability, and flexibility may have a protective role to play in attenuating the risk of back injury to hockey players (Reilly, Borrie, 1992). Thus, the possibility exists that the number of players being treated for back

injury cannot be directly attributed to the sport, but further research would be required to support or refute such a suggestion.

Watson (2001) suggests previous injury is a predictor of future injury. However, it is not known whether re-injury is due to insufficient treatment and rehabilitation of the original injury or whether it is due to inherent characteristics of the subject. 43% of injuries sustained in this study occurred in a region that had been injured previously. Ankle injuries were reported to have the highest percentage of recurrence at 20.6%. However, whether one plays hockey or not, ankle sprains have been reported as one of the most frequently occurring injuries to the musculoskeletal system (Balduini and Tetzlaff 1982; Garrick and Requa 1988).

As stated by a review on field hockey injuries and countermeasures for prevention (Sherker and Cassell, 1999), further controlled research is needed to determine the exact mechanism of ankle injury and whether taping or bracing can prevent ankle sprains in hockey. Another study reviewing methods to prevent sports injuries suggests that knee injuries are of concern since they may progress to osteoarthritic changes in later life. This study proposes that regular ankle wobble board training might be the most promising strategy to prevent both ankle and knee injuries (Parkkari, Kujala and Kannus, 2001). These authours suggest that for the shin and thigh area, a slow progression of training gives time for various mechanisms of the tissues to gradually adapt to increasing loads, and is the basis for the prevention of recurring injuries.

Conclusion

Despite the wide adoption of such intrinsic injury-prevention practices, few prospective studies have been undertaken on the relationship of the physiological demands of certain playing positions and the predisposition to injury these may place on the body. By focussing on the demands that certain field hockey positions place on particular areas of the body, and what types of injury these positions are predisposed to, this study provides additional injury prevention information to further reduce the incidence of field hockey injuries.

This study demonstrated that in a population of elite hockey players the most prevalent injuries are ankle sprains, followed by shin splints, thigh muscle hypertonicity and back pain. It also revealed that, not only is there a difference in the rate of injury between playing positions, but also in the types of injuries sustained at different positions. Of the distribution of injuries forwards were the most likely to be injured, followed by the midfielders, backs and goalkeepers.

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