Title	Traumatic upper limb injuries during the men's Field Hockey Junior World Cup 2009
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ABSTRACT

This study was a prospective epidemiological investigation of upper limb injuries during the Men's Field Hockey Junior World Cup 2009. 324 players were observed in 58 matches of the tournament. 28 upper limb-related injuries were documented. The injury incidence was 0.48 per match and 19 per 1000 match hours. Most injuries were due to contact with the ball and left hand was the most commonly injured part. Contusion was the commonest type of injury. The odds ratio for hand and wrist injuries in players not wearing gloves was 4.01(95% CI, 0.52-30.62) and the relative risk of hand and wrist injuries in players wearing gloves was 0.26 (95% CI, 0.03-1.92). Male youth hockey players are at a high risk of upper limb especially hand and wrist injuries during major international tournaments and that use of protective gloves can provide significant protection against hand and wrist injuries in the sport.

Key words: Field hockey, upper limb injuries, elite youth player, international tournament

INTRODUCTION

Field hockey players are particularly vulnerable to hand and upper limb injuries owing to the grip placement position on the stick, low position of the stick during play and low trajectories of the ball hit at high velocity. Moreover, placing the stick low and parallel to the turf surface is a common technique to block a hit. This action places the hand, wrist, forearm and the elbow at a high risk of being struck by either the ball or the swinging stick of the opponent player. Not surprisingly therefore in field hockey, the hand and wrist have been reported to be the most frequently injured body parts in young players (Yard & Comstock, 2006) and the most commonly fractured site in female players (Dick et al., 2007; Murtaugh, 2000). As the sport requires skillful manipulation of the stick using hand and wrist in coordination with the other joints of the upper limb, injuries to the hand, wrist and other parts of upper limb could be quite disabling for a field hockey player.

Despite the vulnerability of the hand and wrist, the use of gloves remains infrequent in field hockey (Bowers, Baldwin, Sennet 2008). It has therefore been aptly stated that hand and finger injuries in field hockey are important as they may be underestimated in terms of severity and long-term sequelae. It is hence important to understand the relatively high rates of hand injuries in field hockey in order to develop appropriate preventive strategies (Dick, Hootman, Agel, et al., 2007). Therefore, upper limb injuries present a distinct area for injury surveillance studies in field hockey and it is critical to investigate the magnitude and risk factors of upper limb especially hand and wrist injuries in the sport to develop appropriate preventive strategies.

Injury surveillance studies in team sports are important as the information is of significance to the athletes, the sport's governing bodies, sports injury researchers and the medical support staff. Therefore, the key step in the sequence of injury prevention is ongoing injury surveillance (van Mechelen, Hlobil & Kemper, 1992). The priority of such studies should be to obtain a precise estimate of the injury load in terms of injury risks, incidence and patterns related to a sport in different age groups at different levels of performance. However, the most pervasive issues in sports injury reports are the injury definition and the methods of data collection and reporting.

While consensus statements on injury definitions and data collection procedures have been developed in team sports like soccer and rugby (Fuller et al., 2006; Fuller at al., 2007), apparently no such published consensus is available for injury documentation in field hockey. The most likely reason is the dearth of published descriptive injury data in the sport. Moreover, the available data is largely retrospective and limited to collegiate female players (Dick et al., 2007; Hendrickson, Hill & Carpenter, 2008; Murtaugh, 2000). Prospective data on different field hockey playing populations especially during major international tournaments have been rarely published (Junge et al., 2006; Mukherjee, 2012). Furthermore, field hockey has evolved over the years especially in terms of play rulings like rolling substitution, no off-side and 'self-pass from free hit' rule. Therefore, consensus injury definition from other team sports like soccer or rugby may not be entirely applicable in field hockey. Also, it has been suggested that risk of injury may vary according to the type of activity (van Mechelen, Hlobil & Kemper, 1992). Therefore, it is worthwhile to conduct injury surveillance studies in field hockey playing populations to generate adequate volume of data required for developing

consensus on the injury definition and methodological aspects of studies in the sport. Such developments are essential to stimulate further and better quality injury research studies in field hockey. Consequently, the purpose of the present study was to provide a descriptive epidemiological account of the upper limb injuries in male youth elite field hockey players during the Men's Junior World Cup (JWC) 2009 tournament.

METHODS

The study was conducted for the entire period of the field hockey JWC 2009 that involved participation of twenty nations from the Asia-pacific, Europe, Africa and the Americas. A total of 58 matches including the semi-finals and the final were observed. Twenty eight matches from the preliminary round and 30 matches from the medals and ranking round were observed respectively. Each team played at minimum of four matches and at least two matches for each participating country were observed. A total of 324 (90%) of the 360 participating players were observed in the course of the study. The average age of the players was 19.2 (range 15-21) years. Approval for the study was obtained from the JWC Competitions Manager and the ethical clearance on non-interventional research on human participants was obtained from the Departmental Ethical Review Committee.

The injury-reporting system used in the present study was largely based on that previously used for injury documentation in team sports during international tournaments (Junge et al., 2006; Junge, Dvorak, Graf-Bauman & Peterson, 2004). However, as field hockey rules allow rolling substitution, the clause of player being

able/not able to return in the game following substitution was added to the injury reporting system.

In the context of the study, the definition of injury was adapted (Bowers, Baldwin & Sennet, 2008; Fuller, 1990; Fuller et al., 2006) as any physical complaint in the form of pain, discomfort or disability incurred due to match play-related activities irrespective of the need for medical attention, and irrespective of player being able/not able to continue with the match.

The severity of injuries was categorized based on the player time lost in the tournament. Category 1 included injuries following which player could continue in the game either with or without being substituted. Category 2 injuries were those that led to the player unable to continue in the game. Category 3 injuries were those causing the athlete from being unable to play the next match the tournament and Category 4 injuries rendered the player unable to play the subsequent two or more matches in the tournament. Traumatic and recurrent injuries were identified based on recommendations from other team sports (Fuller et al., 2006).

The primary step in injury documentation involved a direct on-location observation of each match done by two research team members with one being a trained sports medicine physician and the other being a university physical education lecturer and a National League field hockey player. The two observers were at diagonally opposite sides of the field and had a top down view of the play. For all the injuries documented, the information on player jersey number, time of the match, body part injured (hand, wrist, forearm, elbow, arm, shoulders), body side, type of injury,

cause of injury as whether non-contact, contact with stick, contact with ball or contact with another player, severity of injury and consequences of the injury were recorded. The information on the body part injured and the type of injury were then confirmed from the team doctor or physiotherapist after the match. All injury documentation was completed as soon as possible after the match. Further confirmation was done the subsequent morning and the form was updated in case some players reported injury late after the match or if any added information was provided by the team doctor. Also, a record of whether the injured athlete could play the subsequent matches was documented. Injuries sustained during non-match playing activities like training and player time lost due to such injuries were excluded.

The incidence of hand and upper limb injuries was expressed as the number of injuries per match and the number of injuries per 1000 match hours (Junge et al., 2006; Junge, Dvorak, Graf-Bauman & Peterson, 2004). The total hours of match play was computed with the assumption that each match involved 22 players and lasted for 70 minutes (22 x 70 minutes = 25.67 match hours). In addition, the number of hand and upper limb injuries per 1000 player matches and player hours respectively were also calculated using the method developed previously (Junge, Dvorak, Graf-Bauman & Peterson, 2004). The odds ratio and relative risk was also calculate to estimate the injury risk.

RESULTS

There were a total of 28 upper limb-related injury report forms from the 58 matches observed in the study. The upper limb injury incidence rates are presented in Table 1. The hand and wrist injury rates are separately presented.

Insert Table 1

Twenty seven injuries were identified as ‘traumatic’ and one injury (shoulder dislocation) was of ‘recurrent’ type. However, since the manifestation of the recurrent injury was due to a specific and identifiable event during match play, it was included in the study.

Fifteen (54%) of the injuries documented were during the preliminary round matches while 13 (46%) were during the medal/ranking round of the tournament. Fourteen (50%) of the injuries were due to the ball striking the body part and 10 (36%) were caused by stick impact (Figure 1).

Insert Figure 1

Contusion was the commonest injury followed by laceration and sprain (Figure 2).

Insert Figure 2

Ten of the 28 injuries (36%) occurred in the first half while 18 (64%) occurred in the second half of match play. Nineteen of the 28 injuries (68%) were to the left upper limb. The left hand was the most commonly injured part followed by the right hand (Figure 3).

Insert Figure 3

The match was stopped on 13 (46.4%) of the 28 occasions with the injured player requiring immediate on-field medical attention and was immediately substituted. For the other 15 incidents although the match was not required to be stopped but 9 of the 15 injured players were immediately substituted. Therefore, 22 of the 28 (78%) incidents resulted in time loss injuries. The team doctors/physiotherapists confirmed that the substitutions in all the occasions were due to the injury and not because of tactical reasons. This suggested that injury severity rather than the intention to keep the play going was the primary reason for the substitutions. In the remaining six incidents, the players could continue without the game being stopped or them being substituted. However, four of the six players not immediately substituted also required some medical attention either during the next substitution, half-time break or after the match. Thus, 26 of the 28 (93%) injuries required medical attention.

Eighteen (82%) of the 22 injured players substituted could return to play while the other four (18%) could not continue in the match. The injuries that caused the players to be unable to continue were lacerated wound left hand (n=2), contusion left wrist (n=1) and left shoulder dislocation (n=1). However, none of the injuries caused the players to miss more than one match. Therefore, 24 injuries (85.7%) were category 1 and four injuries (14.2%) were category 2 injuries. In none of the matches observed did the goalkeepers suffer any hand or upper limb injuries.

Fifty-four (16.67%) of the 324 players observed wore gloves either on the left hand or both hands. Nineteen of 20 hand and wrist injuries documented were in players not wearing gloves in either hand. Based on this finding, the odds ratio for hand and wrist injuries in players not wearing gloves was 4.01(95% CI, 0.52-30.62). The relative

risk of hand and wrist injuries in players wearing gloves was 0.26 (95% CI, 0.03-1.92). This meant that relative risk for the players not wearing gloves was 1/0.26 = 3.8.

DISCUSSION

The present study was a descriptive epidemiological investigation of upper limb injuries in men's elite youth field hockey players during the Men's Field Hockey JWC 2009 jointly hosted by Singapore and Malaysia. The results showed that the elite youth field hockey players are exposed to a high risk of upper limb especially hand and wrist injuries during major international tournaments.

Despite the risk of hand and wrist injuries in the game, the use of protective gloves continues to be an uncommon practice in field hockey at the youth elite level even during major international tournaments. An odds ratio of 4.01 and the relative risk of 3.8 were strongly suggestive of the increased risk of hand and wrist injury in players not using gloves for protection. This finding corroborates the evidence from a previous study that ungloved players in field hockey are at a significantly higher risk of injuries compared to gloved players in stick handling sports (Bowers et al., 2009).

Injury risk to the hand and wrist has been reported to be of concern in field hockey (Dick et al., 2007; Murtaugh, 2000; Yard & Comstock, 2006; Bowers, Baldwin & Sennet, 2008). However, these studies were predominantly on collegiate-level female athletes. Seemingly, the only study reporting specific field hockey injuries during an international event (Junge et al., 2006) reported that during the 2004 Olympic Games the upper limb injuries accounted for 20% of the total injuries and the hand and wrist injuries accounted for 44% of the upper limb injuries. However, even with both men and

198 women's injuries combined in this study, the incidence rates of total upper limb (0.17 vs
199 0.48 per match & 6.62 vs 19 per 1000 match hours) as well as hand and wrist injuries
200 (0.07 vs 0.34 per match & 2.72 vs 13.24 per 1000 match hours) were significantly
201 higher ($\chi^2 = 7.778$; $p<0.05$) in the current study. This needs to be interpreted with
202 caution as the 2004 Olympic Games study included only medical attention injuries.
203 However, when only the medical attention injuries from both studies were compared,
204 the difference was still significant ($\chi^2 = 6.475$; $p<0.05$). This suggested that elite youth
205 field hockey players are exposed to a significantly greater risk of upper limb especially
206 hand and wrist injuries than their adult counterparts during the major international
207 tournaments. This is contrary to other team sports where the injury risk for junior (under-
208 20) players has been reported to be significantly lower than senior players (Fuller &
209 Molloy, 2011).

210 Further comparison of data from the current study is limited by the paucity of
211 studies during international tournaments in field hockey. Moreover, it has been
212 suggested that the injury data between playing populations at different levels of
213 participation in field hockey may not be directly comparable as there may be true
214 variations in injury rates between elite and non-elite levels of participation (Dick et al.,
215 2007). In addition, the differences in the injury surveillance and reporting methods and
216 also in the injury risk and incidence variables used between season-based studies and
217 tournament-based studies add to the limitations of comparison. However, the results of
218 the current study do provide further insights into the risks, patterns and consequences
219 upper limb especially hand and wrist injuries in elite male youth field hockey players
220 during a major international tournament.

It has been recommended that for sports involving the possibility of injury by an object like stick or a ball, a differentiation of contact with a player or object should be made to gain greater insights into the injury mechanism (Junge et al., 2006). In this study, contact with the ball and stick were responsible for 86% of the total upper limb injuries and 61% of the hand and wrist injuries whereas player contact was responsible for only 11% of the upper limb injuries. This finding is significant with the implication that despite the rules not requiring the players to wear protective gloves, using them might offer significant protection to the hand and wrist in field hockey. During the observed matches in the JWC 2009, only one injury could be attributed to player contact. As the field hockey rules completely prohibit player contact, this was indicative that at least with respect to the upper limb injuries, this rule was not violated on majority of the occasions.

The left hand and wrist injuries accounted for 53% of the total upper limb injuries suggesting that they are the most vulnerable upper limb parts in elite male field hockey players. This finding is contrary to the hypothesis stated in a previous study on collegiate female hockey players (Bowers et al., 2009). All field hockey sticks are constructed to be held with the left hand on the top and right hand variably positioned at a lower position on the stick. The left hand forms the anchor grip while the right hand serves as the manipulative grip. This exposes the dorsum of the left wrist and hand over the stick while these parts are behind the shaft on the right side. Moreover, in the event of a perceived injury risk, the right hand although closer to the ground, is taken off the stick more frequently as a reflex reaction while the left hand continues to hold the stick making it relatively fixed and more vulnerable to injury by the ball or the opponent's stick. Therefore, wearing the left hand glove in itself can reduce the risk of injury in field

hockey and the players should seriously consider the use of protective gloves to safeguard them from potentially disabling injuries and prolong their sports participation.

The teams in the JWC tournament played four matches each in the preliminary round and at least four matches in the medal/ranking round. Therefore, each match accounted for 25% of the match hours in each phase of the tournament and inability to play even one game can amount to a significant time loss in terms of match hours. With 78% of the injuries leading to time loss, this may have decisive implications for the team especially in the medal/knockout phase of the tournament. It is also noteworthy that all the injuries that caused the player unable to return to the game were on the left side with the left hand and wrist accounting for 75% of those injuries. This evidence provides further support the vulnerability of the left hand and wrist in field hockey and that the use of protective wear can minimize the risk, incidence as well as severity of injuries.

One of the issues faced by the sport of field hockey is a lack of consensus in injury definition. This is rather surprising given that a consensus definition has already been developed in other popular team sports like soccer and rugby. The injury definition should be inclusive of aspects like physical complaints sustained as a result of match or training participation, the need for medical attention and time loss as a consequence of injury. To develop a sport-specific definition of injury, both prospective and retrospective data are essential. In addition, injury data from both season and tournament-based studies needs to be analysed to include contextually relevant aspects into the injury definition and to categorise the severity of injury. The majority of existing sports injury data in field hockey is retrospective and season-based. Only a few studies have reported prospective tournament-based injury data (Junge et al., 2006; 2009; Mukherjee,

2012). While there may be common elements between different team sports to which these aspects of injury definition may apply, an injury definition in field hockey also needs to factor in the clause of rolling substitution, i.e., if the player could return to the game after being substituted for medical attention. The present study has contextualized the injury definition in field hockey by including the clause of rolling substitution. In addition, this study being prospective and tournament-based, categorized the injury severity criteria based on the implications of time loss taking into account the ruling of rolling substitution.

The present study provides evidence that the elite youth field hockey players have a high risk of hand and upper limb injury during major international tournaments that may affect their long-term sports participation. Furthermore, our data make it increasingly clear that wearing protective gloves, even just on the left hand can offer significant protection to the field hockey athlete. Despite the risk and suggestive evidence, use of protective gear in field hockey remains infrequent. In our experience with field hockey athletes of different age groups, the most common reason cited for not using protective gloves was discomfort and feeling of uneasiness. This presents a critical area for player education especially during the developmental years. The youth coaches should encourage the awareness and adoption such safe practices in the athletes, discourage high-risk play and get the players habituated to the use of protective gear in the game. Moreover, taking into consideration the evidence from the present and the previous studies (Bowers et al., 2009; Hendrickson et al., 2008; Yard & Comstock, 2006) on risks and consequences of hand and wrist injuries at elite as well as non-elite level of performance, the governing body of the sport should recognize the

increased injury risk and infrequent use of protective gear by the athletes. It may hence be worthwhile to consider revision of rules for injury prevention and safeguarding the athlete.

Limitations of the study

Despite being apparently the first study of its kind to report upper limb injury incidence, risks and patterns in elite male youth field hockey players during a major international tournament, there were a few limitations in the study. Firstly, we did not record whether the stoppage of the games was due to injury or foul play. This would have helped us better elucidate the risk element in play behavior of the athletes. Nevertheless, all stoppages required immediate medical attention to the injured player on the field. Moreover, the non-contact nature of most injuries strongly suggests that they were incurred during play-related activities and most likely in accordance with the game rules. Therefore, even within restriction of the rules, the upper limb especially hand and wrist injury risk is high in elite field hockey. Secondly, we did not sub-divide the hand into fingers, thumb, metacarpals and phalanges. Although such categorization would have allowed comparison of injury data with previous studies, it was not likely to affect the implications of the evidence of the current study in terms the field hockey players being as a high risk of hand and upper limb injuries and that the use of protective gloves should be a serious consideration. Lastly, as this study was on Junior elite players, there was a likelihood overuse injuries in the athletes. However, as the overuse injuries occur without a specific identifiable event and their characteristics of presentation make it difficult to be documented using the current methods of injury registration. Moreover, the presentation of overuse injuries may be insidious and

transient. In addition, many athletes also come up with compensatory adaptive alterations in movements and techniques further making the difficult to detect these injuries. Therefore, this study essentially is limited to documentation of traumatic upper limb injuries during the JWC 2009.

CONCLUSION

The risk of upper limb especially hand and wrist injuries is high during major international tournaments. Despite the vulnerability, the use of protective gloves is not a common practice among male elite youth field hockey players. With the evidence from the present study, the field hockey governing bodies should acknowledge the risk of injuries and the infrequent use of protective gear by the athletes. Also, the player at the developmental stages should be educated on the evidence of injury risks and consequences and encouraged to adopt safe practices in the sport. Future studies are desirable on elite hockey playing populations during international tournaments and also on the prevalence of the use of protective gear in field hockey and the extent to which it can safeguard the athlete in the sport.

REFERENCES

1. Bowers, A.L., Baldwin, K.D., & Sennett, B.J. (2008). Athletic hand injuries in intercollegiate field hockey players. *Medicine and Science in Sports and Exercise*, 40, 2022-2026.
2. Dick, R., Hootman, J.M., Agel, J., Vela, L., Marshall, S.W., & Messina, R. (2007). Descriptive epidemiology of collegiate women's field hockey injuries: National

College Athletic Association surveillance system, 1988-1989 through 2002-2003. *Journal of Athletic Training*, 42, 211-220.

3. Fuller, M.I. (1990). A study of injuries in women's field hockey as played on synthetic turf pitches. *Physiotherapy in Sport*, 12, 3-6.
4. Fuller, C.W., Ekstrand, J., Junge, A., Andersen, T.E., Bahr, R., Dvorak, J., *et al*. (2006). Consensus statements on injury definitions and data collection procedures in studies of football (soccer) injuries. *British Journal of Sports Medicine*, 40, 193-201.
5. Fuller, C.W., & Molloy, M.G. (2011). Epidemiological study of injuries in men's international under-20 Rugby union tournaments. *Clinical Journal of Sports Medicine*, 21, 356-358.
6. Fuller, C.W., Molloy, M.G., Bagate, C., Bahr, R., Brooks, J.H.M., Donson, H., et al. (2007). Consensus statements on injury definitions and data collection procedures for studies of injuries in rugby union. *British Journal of Sports Medicine*, 41, 328-331.
7. Hendrickson, C.D., Hill, K., & Carpenter, J.E. (2008). Injuries to head and face in women's collegiate field hockey. *Clinical Journal of Sports Medicine*, 18, 399-402.
8. Junge, A., Dvorak, J., Graf-Bauman, T., & Peterson, L. (2004). Football injuries during FIFA tournaments and the Olympic Games, 1998-2001. Development and implementation of an injury reporting system. *American Journal of Sports Medicine*, 32(suppl): 80S-89S.

9. Junge, A., Langevoort, G., Pipe, A., Peytavin, A., Wong, F., Mountjoy, M. et al. (2006). Injuries in team sports tournaments during the 2004 Olympic Games. *American Journal of Sports Medicine*, 34, 565-576.
10. Mukherjee S. (2012). Head and face injuries during the men's field hockey Junior World Cup 2009. *American Journal of Sports Medicine*, 40 (3), 686-690.
11. Murtaugh, K. (2000). Injury patterns among female field hockey players. *Medicine and Science in Sports and Exercise*, 33, 201-207.
12. Van Mechelen, W., Hlobil, H., & Kemper, H. (1992). Incidence, severity, aetiology and prevention of sports injuries: a review of concepts. *Sports Medicine*, 14, 82–99.
13. Yard, E.E., & Comstock, D.R. (2006). Injuries sustained by pediatric ice hockey, lacrosse, and field hockey athletes presenting to United States Emergency Departments, 1990-2003. *Journal of Athletic Training*, 41, 441-449.