

MESTRADO INTEGRADO EM MEDICINA

Retrospective video analysis of injuries during the 2018 Field Hockey World Cup

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Resumo

Objetivos: Recolher dados epidemiológicos atualizados sobre Hóquei em Campo de alta competição e identificar possíveis fatores de risco para lesões agudas durante os jogos.

Design: Análise retrospectiva dos 36 jogos do Campeonato do Mundo de 2018 de Hóquei em Campo.

Métodos: Os 36 jogos da competição selecionada foram visualizados na sua totalidade e os frames correspondentes a potenciais lesões foram selecionados para serem avaliados. Foram consideradas lesões agudas qualquer nova queixa musculoesquelética que originou paragem no tempo de jogo ou assistência médica.

Resultados: Foram registadas 44 lesões, resultando numa média de 1.2 lesões/jogo e numa incidência de 55.8 lesões/1000 horas-jogador. As contusões perfazem 68.2% de todas as lesões. 16 lesões resultaram de contacto com a bola (36.4%), 13 de contacto com o stick (29.5%), 4 de contacto com um adversário (9.1%) e 11 lesões não tiveram qualquer tipo de contacto (25%). Os membros inferiores foram afetados por 21 lesões (47.7%). A maioria das lesões ocorreu durante a segunda parte dos jogos (70.5%). Os avançados sofreram 8 lesões na cabeça (47.7% das lesões sofridas pelos avançados), todas resultantes de contactos com a bola, stick ou adversário.

Conclusão: A media de lesões por jogo e a incidência por hora-jogador foram semelhantes a estudos prévios. O tipo mais comum de lesão é a contusão. O número de lesões aumenta com a progressão do jogo no tempo. Os avançados sofrem mais contusões na cabeça do que qualquer outro jogador. Não foi encontrada nenhuma relação entre o número de lesões e a localização onde ocorreram no campo ou com a qualidade das equipas.

Palavras-chave: Hóquei em Campo; Lesões desportivas; Prevenção de lesões; Vídeo-análise

Abstract

Objectives: Collect up-to-date data on elite-level field hockey in-game acute injuries epidemiology and establish possible in-game risk factors for acute injuries in competition.

Design: Retrospective video analyses of the 36 complete matches of the 2018 world cup.

Methods: The 36 matches of the selected competition were view in full and the injury clips were selected by the researcher to be analyzed. Acute injuries were considered as any new musculoskeletal complaint leading to time stoppage or medical assistance.

Results: 44 Injuries were recorded resulting in 1.2 injuries/match and 55.8 injuries/1000 player match hours (PMH). Contusions accounted for 68.2% of total injuries. 16 injuries resulted from a ball hit (36.4%), 13 from contact with the stick (29,5%), 4 from contact with an opponent player (9.1%) and 11 had no contact (25%). 21 injuries affected the lower limbs (47.7%). Most injuries occurred in the second half (70.5%). Strikers suffered 8 head injuries (47% of the total injuries suffered by strikers) all contusions resulting from contact with the opponent, the ball, or the stick.

Conclusions: The number of injuries per match and per player match hours was similar to previous studies. The most common type of injury is contusion. The total number of injuries increases with the duration of the game (higher in late quarters). Strikers suffer more head contusions than any other players. No relation was found between the number of injuries and the location on the pitch or the quality of the teams.

Keywords: Field Hockey; Athletic Injuries; Injury Prevention; Video-analysis.

Lista de Abreviaturas

FIH – International Hockey Federation

JSAMS - Journal of Science and Medicine in Sport

PMH – Player Match Hours

Índice

Resumo.....	i
Abstract.....	ii
Lista de Abreviaturas.....	iii
Introduction	1
Methods	3
Results	4
Discussion.....	6
Conclusion	8
Practical Implications:	8
Acknowledgments	9
References.....	10
Tables	11
Figures	12

Esta dissertação/ tese de mestrado tem como base um artigo de investigação submetido à revista Journal of Science and Medicine in Sport (JSAMS) e como tal, a sua estrutura e formatação seguem as regras de publicação da mesma. O documento relativo às regras de publicação do JSAMS pode ser consultado em:

https://www.elsevier.com/wps/find/journaldescription.cws_home/707423?generatepdf=true

Introduction

According to the International Hockey Federation (FIH), there are 136 national associations and one adherent member (Great Britain) partners with FIH spread through 5 continents, and approximately 30 million players (data from 2018) which showcase the popularity of the sport worldwide.

Some studies have shown that field hockey has a relatively high incidence of injuries when compared to other sports^{1,2} with incidence rates ranging from 3.7 to 90.9 injuries per 1000 player match hours³⁻⁷ and field hockey players will suffer from at least one acute injury during their careers⁸. Studies in other sports show that the risk of injury increases when several matches are played in a short interval⁹, as seen in most field hockey tournaments.

A difference in the incidence rate of injuries between sex has also been demonstrated, i.e. 29.1/1000 player match hours in women and 48.3/1000 player match hours in men⁶. Nevertheless, there are not many studies concerning elite male field hockey players.

Several studies, both in hockey and other sports, classify injuries based on either physical complaint, the necessity of medical intervention^{2,4,10,11}, or loss of playing time^{6,7}.

Recently, a systematic review was published collecting data from previous studies about field hockey injury incidence rates, severity, and characteristics according to injury type, mechanism, and location¹². In 2020 another article with a new methodology came out in which the authors concluded that using video analyses to observe and collect injury data is a useful method providing results consistent with previous articles¹³. In 1992, Van Mechelen published a study saying that injury prevention would benefit from monitoring injury incidence rates. Highlighting the importance of having up-to-date descriptive injury epidemiology.¹⁴

Identifying injury mechanisms will help both researchers and health professionals to develop injury prevention strategies¹⁴. Therefore, several previous studies point out that the incidence and severity rates of injuries are the first step to achieve better injury prevention¹⁴⁻¹⁶.

Our study aims to gather new injury-related data during an elite male international tournament such as incidence, location, mechanism, and body part. Furthermore, we seek to establish a relation between the risk of developing an injury and the prior mentioned variables, so that in-game risk factors for developing an injury can be tackled.

Methods

Video recordings of the 2018 men's world cup were analyzed. Acute injuries were defined as any new musculoskeletal complaint leading to time-stoppage or medical assistance. The complete video of every match was analyzed by the investigator and screened for acute injuries and penalty corners. Furthermore, every card received by a player was recorded as the amount of game time lost by the respective player. The identified injury sequences were reviewed, and data were collected according to a standardized protocol which included injury demographics such as the age of the injured player, time of injury during the match, injury location on the pitch, injury type, injury mechanism, and injured body part. Other statistical information (number of goals scored and suffered per team and number of wins defeats and draws per team) was obtained through the official website of the tournament ¹⁷.

The average number of injuries per match and the number of injuries per 1000 PMH were calculated using a 95% confidence interval. Total player match hours were calculated as follows: number of games multiplied by 22 players multiplied by playing time (regular playing time in international field hockey is 1 hour per match) and then subtracted the amount of playing time lost with the cards received by the players.

Data are presented as mean (standard deviation). Confidence intervals and comparison of groups were assessed by the t-test. Pearson and Spearman correlation coefficients were used to assess the relations between quantitative variables. Categorical variables were studied using the Chi-square test. A cluster analysis was performed using the Euclidian squared distance. The methods used are an adaptation of the methodology already used in 2020 by Theilen ¹³ . The study was approved by the Hospital Board and Ethics Committee with the approval number 2021.048(038-DEFI/039-CE).

Results

A total of 36 games were analyzed with 44 injuries observed among the 16 participant teams (295 participant players total) over 19 days.

The injury incidence rate during this tournament was 55.8/1000 PMH (95% C.I. 41.3 – 74.8). There were 1.22 injuries per match (95% C.I. 0.87 – 1.58), the minimum was 0 and the maximum was 4. There was an average of 2.75 injuries per team (95% C.I. 1.77 – 3.73), the minimum was 0 and the maximum was 6.

The average age of the participant players was 26.4 years old (95% C.I. 25.9-26.8); the minimum was 18 and the maximum 39. The average age of the oldest team was 29.8 years old (95% C.I. 27.3-32.3) and the average age of the youngest team was 23.7 years old (95% C.I. 22.2-25.1). The minimum number of games played by a single team was 3 and the maximum was 7.

The average age of the injured players was 26.7 years old (95% C.I. 25.4-28.0); the minimum was 20 and the maximum was 35.

The most common type of injury was contusion (68.2%) and the frequency of injuries in each type of injury was significantly different ($p<0.001$).

The most affected injured body part by contusion was the head (46.7%).

The most common mechanism of injury was “ball hit” (36.4%).

The lower limbs were the most affected body part overall (including feet, lower leg, knee, and upper leg) (47.7%) and the frequency of injuries by body part was significantly different ($p<0.001$).

Defenders were the most affected group (45.5%) by injuries, with most injuries to the lower limbs (70.0% of their injuries). This was followed by the forwards (38.6%), who were injured more frequently on the head (47.1% of their injuries). The affected injured body part is independent of the player’s position ($p=0.051$). The type of injury is not independent of the

players' age ($p=0,045$). 70.5% of the 44 injuries occurred during the second half of the matches. A summary of the descriptive analysis of the qualitative injury-related variables is displayed in Table I.

The following variables were not independent of the number of injuries: Quarter ($p=0.010$) and player position ($p=0.042$). The location on the field, where injuries occurred showed to be independent of the number of injuries ($p=0.376$). The Player's age was independent of the number of injuries, but not independent from the type of injury ($p=0.045$), whereas older players were more associated with contusions, whereas younger players suffered more from muscular injuries.

The cluster analysis resulted in the formation of four groups based on variables used to define teams' performance (goals scored, goals conceded, number of wins, defeats, and draws, and total games played). The cut was made at the most natural point for the researchers (distance 5). There was no difference in the incidence of injuries among the analyzed groups. The dendrogram showing the groups created is available in figure 1.

Discussion

Field Hockey is an intense sport, that has unlimited substitutions (contributing to its intensity), and several rules that are important to interpret the findings of this study.

The results obtained in this study regarding the incidence of injuries (55.8/1000 PMH) were congruent with the incidence interval range reported in previous studies ^{3,6,7,13}.

This study showed, as expected, that there is a correlation between the number of injuries and the quarter being played ($\chi^2_{(3)}=11.455$, $p = 0.01$). Previous studies^{6,13} had already risen this question, showing a higher number of injuries as time progressed during a match. This can be attributed to both the higher levels of fatigue and the rise in aggressiveness resulting from being close to the end of the match in a tournament where most games were eliminatory. Previous studies also showed a relation between the number of injuries and the location on the field, claiming injuries to happen more frequently inside the circle¹³, an association this study did not find.

This study also showed that the most affected body part is the lower limbs and contusion is the most common type of injury. Penalty applies if the ball hits the feet, therefore it is encouraged to the players to shoot the ball at the defensive players' feet to gain a penalty from the opposing team.

Among the studied types of injuries, contusions should be the easiest to decrease or minimize by adding/improving protection to the players' basic equipment. Regarding muscular injuries and sprains, the work to prevent them should be more focused on the players' training.

Although the affected injured body part showed to be independent of the player's position ($p=0.051$), this low p-value suggests that for a larger population there might be a dependent relationship between these two variables. Regarding contusions, this study found the strikers to be more prone than any other players to suffer from head contusions. These findings might indicate the need for specific strategies to prevent these types of injuries in strikers. It would

be important to evaluate the severity of the reported injuries as well as the presence of concussions resulting from the contusions, which is not possible using video analyses.

Different results were found for the defenders which despite being the most affected group by injuries showed fewer head contusions than the strikers. These findings might be explained by the players' role and functions being different, resulting in defenders being injured mostly on the lower limbs.

Concerning players' age, this study found a relation to the type of injury with younger players being more prone to suffer from muscular injuries. This finding was not expected or reported in previous studies known by the author showing that some factors related to youth can be a contributing factor to players making more injury-prone moves (aggressive changes in direction, rotations, and others).

The cluster analysis resulted in three groups based on the quality of teams' performance and an odd team (England), mostly because it shared some variables that indicate a good performance (high number of games played, indicating that this team went far in the competition) also a bad performance (a lot of goals conceded and almost no goals scored in the final two matches). Although we were able to separate these teams based on their performance at this level of competition (the higher in the world) there is no evidence that the quality of the teams has a relation to the incidence of injuries. Nevertheless, quality cannot be ruled out as a possible injury-related factor if we increase the difference between the teams' quality (for example, teams playing in the first division of any country compared to third division teams of the same country, which was not possible during this competition).

Conclusion

There is a clear association between the number of injuries and the quarter being played highlighting the importance of correct evaluation of players' fatigue levels by the coaches. Prevention efforts should target contusions, as it is by far the most frequent type of injury, and in certain cases possibly prevented by protective gear, especially in strikers, where the greatest number of head contusions was recorded. Despite previous studies' data, no relation was found between location on the pitch and the number of injuries. Younger players showed to be more prone to muscular injuries, underlining the importance of specialized training in specific groups of players.

Injury severity cannot be accessed by this method, therefore different injury evaluation tools should be combined in future research to get a more detailed analysis.

Practical Implications:

- New types of protective gear should be considered and tried out (especially for the head) to prevent contusions.
- Rules should be constantly improved to increase players' safety.
- Individual training to prevent muscular injuries should be carried out especially with younger players.

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Tables

Table I – Summary of the qualitative variables` analysis					
Period	Frequency (percentage)	Mechanism of injury	Frequency (percentage)	Injured body part	Frequency (percentage)
1 st Quarter	8 (18.2%)	Ball hit	16 (36.4%)	Head	14 (31.8%)
2 nd Quarter	5 (11.4%)	Contact with stick	13 (29.5%)	Trunk	3 (6.8%)
3 rd Quarter	11 (25%)	Contact with player	4 (9.1%)	Upper limbs	6 (13.6%)
4 th Quarter	20 (45.5%)	No contact	11 (25%)	Lower limbs	21 (47.7%)
$\chi^2_{(3)} = 11.455, p = 0.01$		$\chi^2_{(3)} = 7.091, p = 0,069$		$\chi^2_{(3)} = 18, p < 0,001$	
Location of the injury on the pitch	Frequency (percentage)	Type of injury	Frequency (percentage)	Injured players` position	Frequency (percentage)
Inside the circle	12 (27.3%)	Sprain	3 (6.8%)	Defender	20 (45.5%)
Inside the 23-yard line	13 (29.5%)	Muscular injury	11 (25%)	Midfielder	7 (15.9%)
Mid field	19 (43,2%)	Contusion	30 (68.2%)	Forward	17 (38.6%)
$\chi^2_{(2)} = 1.955, p = 0.376$		$\chi^2_{(2)} = 26.227, p < 0.001$		$\chi^2_{(2)} = 6.318, p = 0.012$	

Figures

