

Original article

Risk factors for hamstring injuries in Australian male professional cricket players

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Abstract

Background: Injuries to the hamstring are relatively common in professional cricketers (as they are in many team sports) and have increased in incidence in the “T20 era” (introduction of 20-over matches) of cricket since 2006.

Methods: This study analyzed incidence of hamstring injury in the various elite male match types over a 20-year period (1995–1996 to 2014–2015 seasons). Risk factors for hamstring strain were assessed using a multivariate logistic regression analysis technique.

Results: There were 276 match time-loss hamstring injuries recorded over a 20-year period at the Australian state or national player level, of which 170 occurred in one of 40,145 player match sets. The overall rate of match onset rate was 22.5 hamstring injuries per 1000 team days. Fast bowling onset injuries were the highest subcategory at a rate of 10.9 injuries per 1000 team days, although batting onset injuries were particularly common in 50-over (one day) international matches. Significant risk factors in logistic regression analysis, in addition to hamstring injury history, were being a fast bowler relative risk (RR) 2.5 (95% confidence interval (CI): 1.3–4.5) and playing a match in Australia RR 2.3 (95%CI: 1.3–3.9).

Conclusion: Fast bowlers suffer more hamstring injuries than other playing roles in cricket, particularly in First Class (multi-day) cricket. Batsmen are more likely to get injured in 50-over (one day) cricket. Playing in Australia (compared to overseas venues) leads to increased risk of hamstring injury.

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Keywords: Cricket; Fast bowling; Fielding; Hamstring strains; Muscle strains; Sprinting

1. Introduction

Hamstring injuries have always been one of the highest frequency injuries in cricket and have increased in incidence since 2006.¹ This time period (since 2006) coincides with the increasing prominence of the T20 format. Traditionally, cricket has been a multi-day game where each team has 2 innings. At elite level the multi-day games are called “First Class” cricket and divided up into international matches (Test matches) and domestic matches. The number of overs (6 bowling deliveries per over) that each team can face in First Class cricket is unlimited—a team’s innings will continue until all 10 batsmen have been dismissed. This leads to potentially high workloads in the bowling unit, as the bowlers must keep bowling until they have dismissed the opposition.² In the 1970s a second form of

cricket emerged: one day (or 50-over) cricket, in which each team’s scoring was limited to 50 overs (300 balls). This was followed by T20 (or 20-over) cricket (which emerged in the early 2000s and became prominent at international level in 2006), in which each team’s scoring was limited to 20 overs (120 balls for each team). A T20 match takes approximately 3 h to complete (or half a day). The number of First Class and 50-over matches has essentially remained the same in the T20 era, with additional T20 matches meaning that there are more elite-level matches on the cricket calendar. Players can choose to play 1, 2, or all 3 formats of cricket, although the majority of players typically play in all 3 formats; hence, the domestic and international matches are scheduled so that generally only 1 format is being played at any given time.

The Cricket Australia injury surveillance system recorded all match time-loss injuries sustained by Australia professional cricket players in domestic and international matches since 1995–1996 season.¹ Considering the rapidly increased hamstring injury rate in T20 era since 2006, the purpose of this

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study was to assess the risk factors for sustaining hamstring injury in Australia male professional cricket players through an examination of hamstring injury incidences among various playing roles (batting, bowling, and fielding) for different format of cricket.

2. Methods

De-identified data were obtained from the Cricket Australia injury surveillance database. The Australian Government National Health and Medical Research Council Ethical Guidelines³ do not require ethics approval when using de-identified data (negligible risk of harm).

The dataset contained information on all hamstring injuries that resulted in missed playing time, which included date of onset, match type of onset, and player details (both primary role in team and role at the time of injury). Imaging such as magnetic resonance imaging of injuries were not included because imaging was only routinely performed in the last decade. Therefore, for the purposes of this study a hamstring injury was a clinical diagnosis made by relevant state or national medical personnel.

For match injury incidence, we considered match injuries from all playing roles combined (batting, bowling, and fielding) and the individual playing roles separately (including fast bowling versus spin bowling and wicketkeeping versus other fielding positions). We characterized all bowling as either fast or spin bowling, even though non-spin bowling is sometimes divided into fast, fast-medium, and medium pace bowling. That is, bowlers considered to be medium pace bowlers were considered fast bowlers in this analysis (and we have used the term fast bowling rather than pace bowling for clarity).

We reported incidence in the unit of injuries per 1000 team days of play. For example, 22 injuries per 1000 team days would mean a team of 11 players could expect 22 match time-loss injuries (i.e., injuries occurring in a match that resulted in a player being unable to perform their normal role) per 1000 team days. This would convert to 2 injuries per 1000 player days, or 20 injuries per 10,000 player days if a team was considered to be 11 players.⁴

We considered 5 different formats of match. Each of First Class and 50-over cricket formats were separated into international and domestic levels each, which resulted in 4 formats. T20 cricket was considered a combined category (both domestic and international matches pooled together) as in many years

the number of international T20 matches is very small, which would give an unreliable incidence rate.

Occasions on which players sustained a hamstring strain during a survey match were compared to those player matches in which no hamstring strain occurred, with risk factors used to predict these occurrences analyzed with a multivariate logistic regression analysis in the SPSS Version 16 (SPSS Inc., Chicago, IL, USA) program. The method used was forwards stepwise with a $p < 0.05$ to enter and a $p > 0.10$ to remove. The risk factors analyzed (in discrete rather than continuous categories) were (1) player age, (2) primary player role, (3) history of recent hamstring injury (earlier in the same season), (4) history of past hamstring injury (not in the same season), (5) match type, and (6) year.

3. Results

There were 276 match time-loss hamstring injuries, of which 170 occurred during a match under survey. The other 106 injuries occurred either during training sessions, warm-ups, lower level matches not under survey, or had an insidious onset.

The overall match hamstring injury incidence was 22.5 injuries per 1000 team days (Table 1). When incidence was calculated in team days, 50-over cricket had the highest hamstring injury incidence (42.8 and 67.0 injuries per 1000 team days for domestic and international matches, respectively) followed by T20 cricket (30.9 injuries per 1000 team days) and then First Class cricket (12.7 and 21.5 injuries per 1000 team days for domestic and international, respectively). The incidence ranking was the same if player days was used as the unit of incident, but T20 cricket was ranked higher than 50-over cricket if player hours was the unit of injury incidence. If the unit chosen was player or team matches then First Class international cricket matches would have ranked highest (as these matches last for up to 5 days). An hour of cricket led to more hamstring injuries in the shortest format (T20 cricket), in which play was most intense, but a day of cricket was riskiest at the 50-over format, particularly at international level, given the combination of intensity and duration.

Fast bowling had the highest incidence of hamstring injury compared to the other roles in First Class cricket, which is the longest format of cricket. Batting and fielding had substantially higher incidence of hamstring injury compared to fast bowling in T20 cricket. Batting, fast bowling, and fielding had substantially higher incidence of hamstring injury compared to other roles in 50-over cricket. The incidence of hamstring injury was

Table 1
Match injury incidence (hamstring injuries per 1000 team days) by type of match and cricket specific role.

Match	Batting	Fast bowling	Spin bowling	Fielding	Wicketkeeping	All ^a
T20	17.2	5.1	0	8.6	0	30.9
50-over domestic	10.2	20.5	0	10.2	0.9	42.8
50-over international (ODI)	31.3	15.6	0	13.4	0	67.0
First Class domestic	2.2	9.3	0	1.1	0	12.7
First Class international (Test)	6.1	9.2	0	4.1	0	21.5
Overall	6.6	10.9	0	4.0	0.1	22.5

^a Including those injuries with activity not specified, as a small number of hamstring injuries occurred during matches but with activity onset uncertain. Abbreviation: ODI = one day international.

Table 2

Significant risk factors for 170 hamstring strains occurring in 40,145 player matches in 20 years from 1995–1996 to 2014–2015 seasons, revealed by logistic regression analysis.

Category	Risk factor	RR (95%CI)
Primary role	Fast bowler compared to spin bowler	2.5 (1.3–4.5)
Match location	Match played in Australia compared to overseas	2.3 (1.3–3.9)
Season	After 2006 compared to before 2006	1.5 (1.1–2.2)
Injury history	Recent history of hamstring injury compared to no history of hamstring injury;	3.7 (2.5–5.5)
	Past history of hamstring injury compared to no history of hamstring injury	2.7 (1.9–3.7)

Abbreviations: CI = confidence interval; RR = relative risk.

minimal for spin bowling and wicketkeeping. Batting and fielding appear to have higher incidence of hamstring injury in international matches compared to domestic matches (Table 1).

There were 40,145 player matches analyzed at the domestic or international level, of which 170 (0.4%) led to a hamstring injury (Table 2). The other hamstring injuries either occurred at a lower level match or a training session or had a gradual or uncertain pattern of onset. The risk for fast bowlers to sustain hamstring injury was 2.5 times higher compared to that for spin bowlers. Batsmen, wicketkeepers, and spin bowlers did not have a significant difference in incidence of hamstring injury. There was a 3.7-time higher risk of hamstring injury in those who had previously suffered a hamstring injury earlier in the season, and 2.7-time higher risk for those who had history of hamstring injury in previous seasons. Matches being played in Australia (either international or domestic) led to a higher risk (2.3 times) of hamstring injury than matches being played overseas. The vast majority of the overseas matches were international level matches (i.e., only a very small number of domestic matches were played outside of Australia). There was a higher incidence (1.5 times) of hamstring injury in matches played after 2006 (in T20 era) compared to matches played before 2006. Player age did not enter the equation as a significant risk factor once the other factors were taken into account.

4. Discussion

Although fast bowling is the activity most associated with sustaining a hamstring injury, the T20 era has seen an increase in hamstring injuries related to fielding and batting. The incidence of hamstring injuries in this study correlates quite well with numbers of sprinting efforts when measured by Global Positioning System (GPS) in cricket.^{5,6} Fast bowlers—assessed in this study as having the highest incidence of hamstring strain—sprint more often than other roles in cricket.⁵ Batsmen sprint more often in T20 and 50-over cricket than in multi-day.⁵ In multi-day cricket, the higher rate of fielding hamstring injury in First Class international cricket seen in this study (compared to domestic level matches) correlates with the higher number of sprint efforts seen in international First Class matches.⁶

Sudden increases in workload have been associated with increase in fast bowling injury in cricket.^{7,8} This study poses the question of whether increased rates of batting and fielding ham-

string injuries in short form (50-over and T20) cricket is related purely to higher intensity of play.^{5,6} Alternatively, the risk in these activities may relate to change in intensity of running speed when players transition from longer to shorter formats of the game. That is, do hamstring strains in short form cricket occur more readily if a player has recently been playing more longer form cricket and is perhaps not conditioned to higher intensity running? Such a phenomenon has been recently reported in Australian Football.⁹

Spin bowlers had lower injury incidence of hamstring injury compared to fast bowlers, which appears to be related to speed of the run-ups indicated by GPS data in previous studies.^{5,6} However, it must be considered that spin bowlers have to also bat and field, so while they are relatively immune from hamstring strain during their primary role, they are exposed in the other activities of the game in which they participate.

One of the unexpected risk factors revealed is playing in Australia (domestic or international matches) compared to playing overseas. A possible explanation for this is that Australian fields may be larger when compared to other countries. Smaller fields tend to lead to a higher ratio of runs being scored through boundaries. The minimum length of a field is 120 m but the vast majority of Australian fields are 160 m long.^a Many of the Australian cricket fields are also used by Australian Football games at the same venue, which is a sport played on a much bigger field than the other football codes. Probably not coincidentally, Australian Football has a very high rate of hamstring injury compared to other football codes.¹⁰ The larger playing field probably allows players to reach higher running speeds, which possibly expose them to injury.⁹

An alternative explanation for the higher incidence of hamstring injury in Australia is that fast bowlers tend to bowl more overs than spin bowlers in Australian conditions. As they are already the group with the highest risk of hamstring injury, the greater percentage of overs bowled by this group may lead to the higher injury incidence.

There was a higher risk of hamstring strain in those who had previously suffered a hamstring strain earlier in the season and in previous seasons. This is in keeping with hamstring strain risk factors in other sports¹⁰ and in contrast to oblique abdominal injury in fast bowlers, in which recent injury is not a significant risk factor.¹¹

5. Conclusion

This study reveals some risk factors for hamstring injury similar to those observed in other sports (past and recent history of hamstring injury). There are some risk factors revealed that are unique to the sport of cricket: being a fast bowler, playing in Australia (on larger grounds), and playing in shorter-form games. These additional risk factors all seem to relate somewhat to the degree of sprinting intensity in the circumstances described. That is, the more often sprinting occurs, the greater the risk of hamstring injury.

^a http://www.sporttaco.com/rec.sport.cricket/Is_The_Oval_the_largest_ground_in_England_3876.html

Authors' contributions

JWO is the injury surveillance coordinator for Cricket Australia under the supervision of AK and undertook the statistical analysis for the paper; AK helped to write this paper; KS was primarily in charge of paper revisions and response to reviewers; all authors contributed substantially to the writing of the original manuscript. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

Competing interests

The authors declare that they have no specific competing interests, other than their declared affiliation with Cricket Australia.

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