Risk factors for hamstring injuries in community level Australian football

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Methods: A total of 126 community level Australian football players participated in this prospective cohort study. To provide baseline measurements, they completed a questionnaire and had a musculoskeletal screen during the 2000 preseason. All were monitored over the season. Injury surveillance and exposure data were collected for the full season. Survival analysis was used to identify independent predictors of hamstring injury.

Results: A hamstring injury was the first injury of the season in 20 players (16%). After adjustment for exposure, increasing age and decreased quadriceps flexibility were identified as significant independent predictors of the time to sustaining a hamstring injury. Older age (>23 years) was associated with an increased risk of hamstring injury (RR 3.8; 95% confidence interval (CI) 1.1 to 14.0; p = 0.044). Players with increased quadriceps flexibility (as measured by the modified Thomas test) were less likely to sustain a hamstring injury (RR 0.3; 95% CI 0.1 to 0.8; p = 0.022).

Conclusions: The findings of this study can be used in the development of hamstring injury prevention strategies and to identify Australian football players at increased risk of hamstring injury.

Musculoskeletal assessment

Tests were selected on the basis of previous research, common clinical use for the assessment of hamstring injuries, ability to test at a variety of training locations, and requiring inexpensive equipment for testing.13 14 23–26 Interrater and intrarater reliability were established if not previously described.27 Table 2 provides an overview of the musculoskeletal tests selected to measure the potential hamstring injury risk factors of hamstrings flexibility, quadriceps flexibility, iliopsoas flexibility, lumbar spine range of movement, dorsiﬂexion range of movement, hip rotation range of movement, and neural mobility.

All musculoskeletal screening was performed by four trained testers (three qualiﬁed physiotherapists and one postgraduate student with experience in musculoskeletal...
Outcome measures

Data on injury surveillance and exposure (hours of match and training participation) were collected prospectively over the course of the season using previously published methods. Injuries resulting in missed participation time and/or treatment from a health professional were captured by the surveillance system. Details on the mechanism, nature, specific body region, and provisional diagnosis were collected by the club’s physiotherapist or medical staff. Exposure time was collected by a member of the club’s coaching staff. The major outcome of interest was a hamstring injury diagnosed by physical examination using the criteria:

- sudden onset posterior thigh pain;
- tenderness on palpation;
- with or without pain on stretch of the hamstring muscle group;
- with or without pain on contraction of the hamstring muscle group.

Data management and analysis

Injury, exposure, and baseline assessment data were coded and double entered on a personal computer. Statistical analyses were performed using SPSS for Macintosh (version 10) (SPSS Inc, Chicago, Illinois, USA).

Cox proportional hazards regression was used to identify independent predictors of hamstring injury. The time to first injury was considered important because of the potential for baseline assessment factors to change after injury. Therefore if the hamstring injury was the subject’s first injury, it was considered to be a hamstring case. All other subjects were considered censored, with the point of censorship defined as the end of the season for injury-free players or the time of injury for those for whom a hamstring injury was not the first sustained. Days to injury was chosen as the time variable. The model was adjusted for exposure (total training and match time). Each continuous variable was dichotomised (according to the mean or median) for analysis to separate the cohort into groups based on test performance. The model selection strategy was that recommended by Collett. The adjusted relative risk (RR) and 95% confidence interval (CI) were calculated, and Kaplan-Meier curves used to compare subgroups.

RESULTS

Of a possible 148 players, 126 (85.1%) participated in this project. Twenty (15.9%) sustained a total of 26 hamstring injuries during the season, an incidence of 4.0 injuries per 1000 player hours. For all players, a hamstring injury was the first sustained for the season. Most hamstring injuries were sustained during competition (76.9%), the remainder occurring during club training sessions. Rapid acceleration during running or sprinting was the primary mechanism (80.8%). The remainder occurred when the player kicked the football (19.2%).

Six variables were identified as independent predictors of the time to sustaining a hamstring injury through the survival analysis (table 3).
none
What is already known on this topic

Prospective studies on a variety of potential risk factors for hamstring injury in sport are lacking. Previous studies of elite Australian football players have identified age, injury history, and aboriginality as predictors of hamstring injury.

What this study adds

This study of community level Australian football players confirms increasing age, but also identifies decreased quadriceps flexibility, as independent predictors of hamstring injury in this group of athletes.

This study has a number of strengths. The prospective design enabled the identification of potential causal relations, and a large number of potential risk factors were studied. All injuries resulting in missed participation time were captured by the surveillance system, and complete exposure data were collected for all 126 subjects. Sufficient information for the application of survival analysis methods was collected, enabling a more sophisticated approach to predicting the onset of hamstring injury. Rather than just comparing the injured with uninjured players, we considered the time to injury onset, and therefore adjustment for exposure time was possible.

Limitations to this study also exist and must be acknowledged. Hamstring injury was a relatively common event, with 16% of the cohort sustaining at least one. However, the number of cases in the multivariate modelling (20) was relatively small, limiting the power of the study and the ability to identify all but the largest effects. Although potential causal relations—that is, risk factors—could be identified using the prospective study design described, causality itself could not be established. Further studies are required to establish whether changes to the risk factors identified do result in altered hamstring injury risk.

The diagnosis of hamstring injury was made using clinical criteria, rather than imaging. Imaging, such as ultrasound or magnetic resonance, was not used because of the cost and the fact that these techniques are not yet standard protocol for diagnosis of hamstring injuries. Whether other injuries were included as hamstring injuries because of the diagnostic criteria used could not be determined. However, all diagnoses were made by qualified health professionals, and the findings of this study should hold true for injuries meeting the stated criteria.

The study could be considered a cluster design because of the recruitment of clubs from a single league. Potentially, the use of a cluster sample leads to a greater homogeneity of the population studied, further increasing the difficulty of identifying subtle causal relations. However, although this is a possibility, a similar study found the design effect to be close to one, suggesting no clustering. Therefore data were not analysed to account for a cluster effect.

The possibility of selection bias cannot be ignored, as not all players could be recruited at baseline because of injury and non-attendance at preseason training sessions. These groups may warrant further investigation to determine whether the risks of hamstring injury are different in those who sustain injuries in the preseason period and those who fail to complete a preseason training period.

CONCLUSIONS

This study was undertaken to address the paucity of information on risk factors for hamstring injury, particularly in Australian football at the community level where these injuries are both common and costly to clubs and players.

Overall, despite the relatively small number of hamstring injuries sustained by the cohort, the study identified a number of potential causal relations between baseline factors and hamstring injury. In particular, age and quadriceps flexibility were the only two significant independent predictors of time to hamstring injury. Although age itself cannot be altered, the findings of this study clearly identify older Australian football players as a key target group for hamstring injury prevention activities, and suggest that further research to identify the mechanisms by which increasing age leads to greater hamstring injury risk is required. In contrast with age, quadriceps flexibility can be directly manipulated through stretching programmes in an attempt to reduce hamstring injury risk. However, identification of the best programmes to improve flexibility of this muscle group is necessary, and a randomised controlled trial of developed programmes is warranted to determine their effectiveness at reducing hamstring injury risk.

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REFERENCES

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ELECTRONIC PAGES

Online case reports

The following electronic only articles are published in conjunction with this issue of BJSM (see also pages 69 and 101)

Propagation of stress fracture of the patella M A A Crowther, A Mandal, P P Sarangi

Anterior knee pain in athletes is common and usually self limited. There should be a high index of suspicion and low threshold for special imaging in cases with acute onset and specific tenderness. The risk of propagation of stress fracture of the patella in athletes is highlighted. The case report presented illustrates the potential sequence of events.


Kleine-Levin syndrome: a unique cause of fatigue in an athlete C M J Conklin, J E Taunton

Kleine-Levin syndrome (KLS) is a rare disorder characterised, most notably, by periodic episodes of hypersomnolence and hyperphagia. Associated features of the disorder include a lack of concentration, mood changes, and anxiety. Laboratory tests may show slight changes in the electroencephalogram. However, clinical presentation and laboratory tests are normal during asymptomatic intervals. KLS most often presents in adolescent males, with complete recovery by the 3rd to 4th decade of life. Possible precipitating factors include excessive workload, febrile illness, and respiratory infections. Presented is a classical case of KLS in an adolescent male athlete. The patient’s history, complete laboratory results, and symptoms are discussed. Possible treatments for this disorder are also mentioned, along with diagnostic criteria.


False aneurysm of the common femoral vein in a footballer M Karahan, S Isbir, F Baltacyoglu, et al

Traumatic false aneurysm of the femoral vein has never been reported in the English literature. The case is here reported of a footballer with a traumatic false aneurysm of the common femoral vein which was initially misdiagnosed as an arterial pseudoaneurysm. This is a very rare clinical condition, but this diagnosis should be among those considered for posttraumatic unexplained thigh pain after trauma.