[Orthopaedic Surgery]

Incidence and Injury Characteristics of Medial Collateral Ligament Injuries in Male Collegiate Ice Hockey Players

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Background: Medial collateral ligament (MCL) injuries are the second most common injury resulting in player lost time in elite-level ice hockey.

Purpose: To determine the incidence and injury characteristics of knee MCL sprain in male collegiate ice hockey players.

Study Design: Case control.

Methods: Athlete exposure data demographics, mechanism of injury, player position, time of injury occurrence (game vs practice), grade of MCL sprain, concomitant injuries, and lost time for cases were extracted from a computerized injury database of 8 college hockey seasons at 1 university. MCL injury rates were calculated. Injury characteristics were descriptively summarized. Simple linear regression was utilized to determine the relationship between the grade of MCL injury and player lost time.

Results: There were 13 MCL injuries in 10 players. The overall incidence rate was 0.44 injuries per 1000 athlete exposures. Two players suffered reinjuries. Defensemen and forwards were equally represented. Contact with another player or the ice was the mechanism of injury in 77% of players. Grade 2 injuries were most common. The grade of injury predicted time lost from play ($P < 0.01$).

Conclusion and Clinical Relevance: The lost time relates directly to the severity of injury.

Keywords: medial collateral ligament; ice hockey; incidence; injury risk; lost time

Injury to the knee is common in elite amateur hockey; the medial collateral ligament (MCL) is the most commonly affected and is the second most common injury in National Collegiate Athletics Association hockey behind concussions.[1,3,10,13,15,16] MCL injuries result in substantial time lost from competition, ranking third behind syndesmosis sprains and concussions.[1,3,5,12,13] Over 3 seasons of elite Swedish hockey, MCL injuries represented 5 of 8 injuries resulting in more than 30 days lost from competition.[5] MCL injury prevalence is 9.2% (as a fraction of total injuries) in elite hockey; however, the actual incidence of injury has not been reported.[3,5,15,16] There is up to a 40% difference in the number of games played among players (Swedish and Finnish elite hockey, North American Junior A, and National Collegiate Athletics Association).[8,11,12,14,16]

The determination of risk factors associated with this injury, including player fatigue and position, is important for injury prevention.[3,10,12-14,16] Some data suggest that injuries may be more common at the end of a period and in the third period, when players are more fatigued.[5,12,14]

METHODS

All male ice hockey athletes on the roster of a Division I university varsity team during the 2003-2004 to 2010-2011 hockey seasons were included in this study. They were identified via database entries in SIMS (Sports Injury Monitoring System 5.2, Flantech, Iowa City, Iowa). Diagnoses were made by the team's athletic trainer and confirmed by 1 of 2 sports

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The following authors declared potential conflicts of interest: John A. Grant, PhD, MD, FRCSC, has stock in Stryker; and Asheesh Bedi, MD is a consultant for Smith Nephew, Endoscopy, BioMimetics & Therapeutics, Pivot Medical, and has stock in A3 Surgical.

DOI: 10.1177/1941738112473053

Table 1. Player lost time relative to medial collateral ligament injury severity[a]

Lost Time	Grade 1 (n = 5)	Grade 2 (n = 6)	Grade 3[b] (n = 1)
Days	2-4	10-19	127
Events	1-3	7-12	99

[a]Clinical severity grade was missing for 1 injury.
[b]Combined grade 3 medial collateral ligament and anterior cruciate ligament injury with anterior cruciate ligament reconstruction. Player returned later in the same season.

medicine fellowship-trained orthopaedic surgeons. Diagnoses were based on physical examination.

An injury was defined as any event that directly resulted in the athlete being unable to participate in 1 or more practices or games following the event.[3,5,9,10,16] Athlete exposure was defined as an officially scheduled on-ice practice or game in which the athlete at least partially participated. The mechanism of injury was categorized by impact with another player, ice, puck/stick, or board/goal or by noncontact acute injury.

Individual tracking of athlete participation at each session allowed for a direct calculation of athlete exposure.[7] The total number of qualifying injuries was then related to the number of athlete exposures resulting in an injury rate per 1000 athlete exposures over the entire study period (2003-2010) and for each individual season. Statistical analysis was performed with Intercooled Stata 6.0 (Stata Corp, College Station, Texas). Ethical approval was obtained from the university's medical institutional review board.

RESULTS

There were 79 players participating on the team over the 8 seasons, resulting in 203 player years. Thirteen MCL injuries occurred in 10 players. One player sustained an injury to the same knee in 2 separate years. Another player sustained 3 separate injuries. Two injuries occurred within the same year (the right and left knee on separate occasions, 1 month apart), and the third injury was 3 years prior.

MCL injuries were equally split between forwards and defense players (6 forwards and 5 defensemen; Fisher exact test, $P = 0.52$). The recurrent MCL injuries were sustained by forwards. Experience level demonstrated a bimodal pattern of injury. MCL injuries occurred in 5 players who were freshmen; 1 injury occurred in a sophomore; and 7 injuries occurred when players were seniors. There was no pattern of injury with respect to time of the injury occurrence. Three injuries occurred in practice; 6 injuries occurred in the first period of a game; and the remaining 4 injuries occurred in the third period. The practice and game MCL injury rates were 0.13 and 1.47 injuries per 1000 athlete exposures, respectively. Contact with another player was the mechanism of injury in 77% of the injuries (10 of 13), while an acute noncontact injury was the next most common mechanism (15%, 2 of 13). All grade 1 and 2 injuries were isolated to the MCL. The only grade 3 injury was associated with a concomitant anterior cruciate ligament injury. This was in a 21-year-old defensemen in his junior year.

There were 5 grade 1 injuries, 6 grade 2 injuries, and 1 grade 3 MCL injury. The injury grade was missing for 1 occurrence (Table 1). Simple linear regression demonstrated that the injury severity predicted lost time ($R^2 = 0.998$, $P < 0.01$). All players wore braces for return to play following an MCL injury.

DISCUSSION

The rate of new MCL injury in collegiate male ice hockey was 0.42 injuries per 1000 athlete exposures. These injuries generally result in a few days to weeks of lost time before return to play. There were no specific player characteristics that identified risk factors for injury other than no injuries occurred in goaltenders. Complete tears of the MCL were rare, and the time for return to play was directly related to the severity of the injury.

In the current study, the majority of injuries (77%) occurred because of contact with another player. Players typically get checked into the boards, which may result in a fall to the ice. At any of these points, the skate could get stuck, tangled with the other player, or caught under the player, resulting in a valgus load and an MCL injury. The increased intensity of competition, frequency of checking, and intensity of checking may be at least partially responsible for the disparate injury rates. Most studies report that between 60% and 76% of injuries occur in games.[2,3-6,8,11-14,16]

The experience level of players sustaining injury in this study followed a bimodal pattern. The majority of injuries (12 of 13) occurred when players were either freshmen or seniors. College freshmen may be more at risk given the substantial increase in the volume of training, intensity of play, and the increased range of ages and experience of players in competition. Freshmen may be playing against opponents who are up to 5 years older and more experienced at the collegiate level. Seniors should be well accustomed to the intensity and level of competition but may sustain more injuries because of increased exposure.

It is conceivable that a player who is fatigued is more likely to be in an awkward position or situation or be less physically able to brace himself against a check or a fall. These situations may certainly result in an increased risk of injury.

The accuracy of the study data is directly related to the consistency of data input on a prospective basis to prevent interobserver variability and recall bias.

CONCLUSION

Over 77% of the injuries were related to contact with another player. Injury prevention efforts should be directed to sport-specific aerobic and anaerobic fitness, strengthening, and neuromuscular control to help players withstand the unavoidable, forceful, and sometimes unexpected contact with other players, unyielding boards, or the ice surface.

REFERENCES

1. Agel J, Dompier TP, Dick R, Marshall SW. Descriptive epidemiology of collegiate men's ice hockey injuries: National Collegiate Athletic Association Injury Surveillance System, 1988-1989 through 2003-2004. *J Athl Train.* 2007;42(2):241-248.
2. Agel J, Harvey EJ. A 7-year review of men's and women's ice hockey injuries in the NCAA. *Can J Surg.* 2010;53(5):319-323.
3. Flik K, Lyman S, Marx RG. American collegiate men's ice hockey: an analysis of injuries. *Am J Sports Med.* 2005;33(2):183-187.
4. Kuzuhara K, Shimamoto H, Mase Y. Ice hockey injuries in a Japanese elite team: a 3-year prospective study. *J Athl Train.* 2009;44(2):208-214.
5. Lorentzon R, Wedren H, Pietila T. Incidence, nature, and causes of ice hockey injuries: a three-year prospective study of a Swedish elite ice hockey team. *Am J Sports Med.* 1988;16(4):392-396.
6. McKnight CM, Ferrara MS, Czerwinska JM. Intercollegiate ice hockey injuries: a three-year analysis. *J Athl Train.* 1992;27(4):338-343.
7. Meeuwisse WH, Love EJ. Development, implementation, and validation of the Canadian Intercollegiate Sport Injury Registry. *Clin J Sport Med.* 1998;8(3):164-177.
8. Molsa J, Airaksinen O, Nasman O, Torstila I. Ice hockey injuries in Finland: a prospective epidemiologic study. *Am J Sports Med.* 1997;25(4):495-499.
9. Noyes FR, Lindenfeld TN, Marshall MT. What determines an athletic injury (definition)? Who determines an injury (occurrence)? *Am J Sports Med.* 1988;16(suppl 1):S65-S68.
10. Pelletier RL, Montelpare WJ, Stark RM. Intercollegiate ice hockey injuries: a case for uniform definitions and reports. *Am J Sports Med.* 1993;21(1):78-81.
11. Pettersson M, Lorentzon R. Ice hockey injuries: a 4-year prospective study of a Swedish elite ice hockey team. *Br J Sports Med.* 1993;27(4):251-254.
12. Pinto M, Kuhn JE, Greenfield ML, Hawkins RJ. Prospective analysis of ice hockey injuries at the Junior A level over the course of one season. *Clin J Sport Med.* 1999;9(2):70-74.
13. Rishiraj N, Lloyd-Smith R, Lorenz T, Niven B, Michel M. University men's ice hockey: rates and risk of injuries over 6-years. *J Sports Med Phys Fitness.* 2009;49(2):159-166.
14. Stuart MJ, Smith A. Injuries in Junior A ice hockey: a three-year prospective study. *Am J Sports Med.* 1995;23(4):458-461.
15. Tegner Y, Lorentzon R. Evaluation of knee braces in Swedish ice hockey players. *Br J Sports Med.* 1991;25(3):159-161.
16. Tegner Y, Lorentzon R. Ice hockey injuries: incidence, nature and causes. *Br J Sports Med.* 1991;25(2):87-89.