Skate Blade Neck Lacerations: A Survey and Case Follow-up

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Objective: To learn about neck lacerations caused by skate blades in hockey.

Design: A retrospective Web-based survey and follow-up of registered USA Hockey players.

Setting: Three hundred twenty-eight thousand eight hundred twenty-one of 457 038 registered USA Hockey players with a current e-mail address were contacted and invited to participate in the survey.

Participants: Of 26 589 players (5.8% of all USA registered players) who responded to the survey, 247 were excluded due to incomplete data. Of 26 342 surveys analyzed, 23 199 respondents were men (88%), 3015 women (11.4%), and 128 (0.5%) did not designate gender.

Intervention: An original survey instrument was developed, formatted, and linked to a Mayo Clinic Web site.

Main Outcome Measures: Neck lacerations from a skate blade, including mechanism, severity, treatment required, and the type of neck protector worn.

Results: Of the 26 342 respondents, 11 935 (45.4%) currently wear neck protection and 485 (1.8%) have sustained a neck laceration. When the laceration occurred, 132 of the players (27%) were wearing neck protection. Interviews with 33 injured players established that lacerations were superficial: 20 (61%) required bandaging only, 11 were sutured, and 2 were glued.

Conclusion: Based on this survey, the currently available neck laceration protectors do not eliminate the risk of a neck laceration from a skate blade.

Key Words: skate blade, neck lacerations, hockey, neck laceration protectors

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INTRODUCTION

Injuries in ice hockey increase in parallel with player maturation and occur much more frequently in games than in practices.[1–4] Injury risk is influenced by individual playing time, contact forces, rule violations, and the absence of protective equipment.[5,6] Marked differences in head and facial injuries, including lacerations, have been reported as a function of full, partial, or no facial protection, even when controlled for individual playing time variation.[6] Although the risk of sustaining a facial laceration is less for players younger than 18 years due to use of facial protection, head injuries are more common in the younger age groups.[7] A neck laceration from a skate blade, defined as a cut to the neck area requiring medical attention, is a potentially catastrophic injury. Neck lacerations presenting to emergency departments in the United States are relatively rare, with no such injuries reported to the National Electronic Injury Surveillance System during 1996 to 1999.[8]

Neck lacerations occur while players are airborne, skating, standing, sitting, kneeling, or lying on the ice. Sharp skate blade contact in the neck region may injure the airway, nerves, or blood vessels. Neck lacerations have resulted in death,[9] including a high school player from the United States in 1975.[10] Recently, a neck laceration from a skate blade involving the carotid artery during a televised National Hockey League (NHL) game increased awareness and concern for players, parents, and medical personnel.[11]

In an effort to prevent neck lacerations, "neck guards" were developed. Because these devices are not designed to prevent throat injury from a puck or stick or prevent spinal cord injury from a force transmitted to the neck, the term "neck laceration protector" is more appropriate.[12,13]

Currently, neck laceration protectors (Figure 1) adhere only to the Bureau de normalization du Québec Standard.[14] Although laboratory testing may not represent actual on-ice mechanisms of injury, neck laceration protectors are currently mandatory for Hockey Canada and are recommended by USA Hockey.

To date, no study has described the prevalence or severity of neck lacerations from a skate blade, thus the effectiveness of neck laceration protectors is unknown.

METHODS

A Web-based 12-question survey was sent to all registered USA Hockey players with a current e-mail address to obtain basic demographic information such as age, gender,

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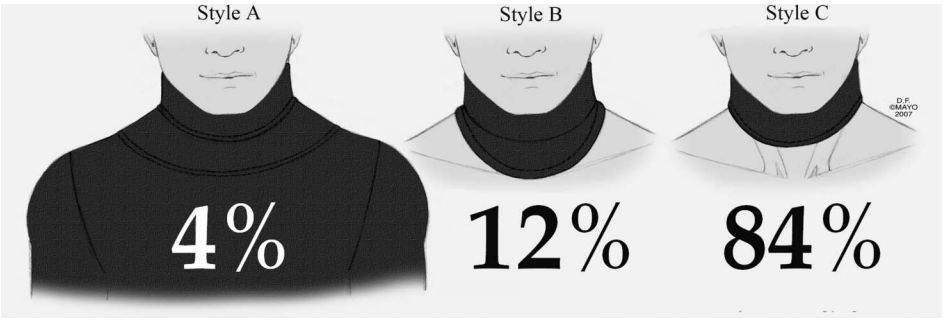

FIGURE 1. The percentage of players who wear each type of neck laceration protector (n = 11 854; 45%) and a description of the protectors. Style A—Turtleneck (Itech): 100% Kevlar Neck guard; Armortex with abrasion resistant properties (label reads ''designed to reduce risk of direct laceration by skate blade in area covered''). Style B—Strap/Yoke (CCM Canada, Sport Maska, Inc): Ballistic Nylon Ballistique HT-830 SR (label reads ''designed to protect the neck and throat region from skate blade cuts''). Style C—Strap (Bauer Nike, Fabrique en Thailande): does not specify the fabric (label reads ''designed to reduce risk of direct laceration to area covered by the equipment [strap]'') (reprinted with permission from Mayo Foundation, 2007).

current level of play, and number of years played. The player age and years played questions had a drop-down menu that went from 1 to 19 years or 20 years and over. A similar drop-down menu for the level of play gave male players the option of selecting from: Mite, Squirt, PeeWee, Bantam, or Midget and over. Because level of play designation within USA Hockey differs for female players, they could select from: age 8 and under, age 10 and under, age 12 and under, age 14 and under, age 16 and under, or age 19 and over. The survey also captured specific information related to players' use of, or lack of, a neck laceration protector, whether they had personally sustained a neck laceration from a skate blade and whether they had personally witnessed a neck laceration from a skate blade. Participants were asked if the research team could contact them for some follow-up questions.

Completion of this voluntary survey implied consent to participate, and data safety monitoring board approval was unnecessary. Personal contact was attempted only for those respondents who sustained a neck laceration from a skate blade, agreed to a follow-up interview, and completed a Health Insurance Portability and Accountability Act authorization form. A co-investigator completed the interview, adhering to a telephone script approved by the institutional review board (IRB). This study was approved by the IRB at the authors' institution.

RESULTS

A total of 457 038 players were registered with USA Hockey during 2006 to 2007. An e-mail survey was sent to the 328 821 players who had provided a personal e-mail address. The survey was completed by 26 589 players, a response rate of 8.1% that represents 5.8% of all USA Hockey registrants.

A sample of 26 342 was analyzed after 247 respondents were excluded because of incomplete or erroneous data. Respondents included 23 199 men (88%) and 3015 women (11.4%). Gender was not reported by 128 players (0.5%).

Mean age for respondents was 13.6 years. Age group categories were ≤6 = 558 (2.1%), 7 and 8 = 2294 (8.7%), 9 and 10 = 4006 (15.2%), 11 and 12 = 4576 (17.4%), 13 and 14 = 4595 (17.4%), 15 and 16 = 3386 (12.9%), 17 and 18 = 1745 (6.6%), 19 = 225 (0.9%), and ≥20 years of age = 4829 (18.3%). One hundred twenty-eight participants (0.5%) did not report their age.

Of 26 342 respondents (45.4%) (mean age = 13.6 years, range 4-20+ years), 11 935 players (mean age = 11.7 years, range 4-20+ years) reported that they currently wore a neck laceration protector. The type, fabric, and percentages of players wearing specific neck laceration protectors are described in Figure 1. Of the population surveyed, 485 players (1.8%) (mean age = 14.8 years, range 5-20+ years) reported being cut in the neck area by a skate blade while playing hockey. Of those 485 players, 132 (27%) (mean age = 14.1 years, range 7-20+ years) indicated that they wore a neck laceration protector when the laceration occurred (Figure 2).

Thirty-three injured players (mean age = 13.8 years, range 7-20+ years) were contacted successfully and agreed to a telephone interview. All players interviewed said that their laceration was superficial and did not involve the airway, nerves, or major blood vessels. Based on the survey, all 33 individuals were wearing a neck laceration protector at the time of injury. Interestingly, only 28 of the injured players reported currently wearing a neck laceration protector. Twenty of the players contacted (61%) required only a bandage (mean age = 13.2 years, range 7-20+ years), 11 lacerations were repaired with sutures (mean age = 15.6 years, range 10-20+ years), and 2 with glue (mean age = 10 years, range 9-11 years). No injured players reported subsequent symptoms or permanent deficits.

DISCUSSION

This survey of USA Hockey players was conducted to learn more about neck lacerations caused by a skate blade. To our knowledge, no studies to date have addressed prevalence of neck laceration in relation to the number of players at risk.[6] Seemingly, a neck laceration protector is an important piece of equipment; however, its protective value has not been established. Although the survey respondent pool was small (26 342 hockey players), it represented the gender (88% men, 11.4% women) and age group profiles of USA Hockey players. The slightly higher proportion of survey respondents in the 13- to 18-year group and a lower proportion of players older than 18 years may have influenced the number of neck lacerations reported.

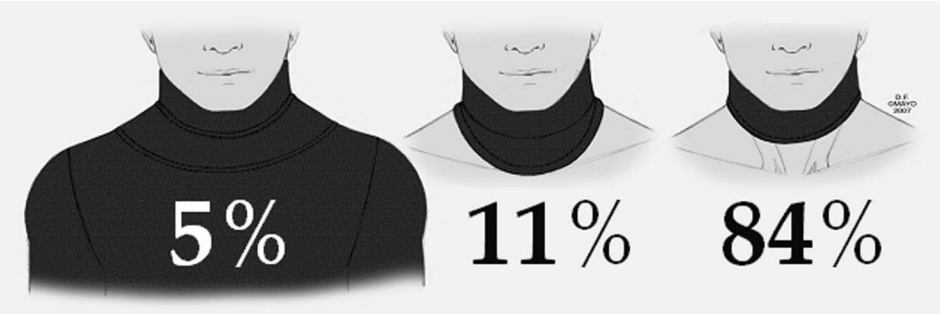

FIGURE 2. The percentage of players wearing each type of neck laceration protector at the time of their neck laceration (n = 132; 27%) (reprinted with permission from Mayo Foundation, 2007).

Although nearly half of all USA Hockey registered players who responded yes to "currently wear a neck laceration protector," it is important to note that 27% of the 485 players who reported a neck laceration while playing hockey reported wearing neck protection at the time of the injury. Fortunately, all reported lacerations were superficial without involvement of the airway or major neurovascular structures. Two-thirds of players required no treatment or only a bandage, and one-third required sutures or glue. No respondents experienced subsequent symptoms or permanent deficits.

Limitations of survey research are numerous. Our overall response rate is actually 5.8% if registrants without e-mail addresses are included. Although we are unaware of any catastrophic neck lacerations to USA Hockey players, data may be missing due to an absence of responses from players who are disabled or deceased as a result of laceration. In a voluntary survey, selection bias is possible because those affected by laceration may be more motivated to complete the survey than non-affected players. A survey result with an overall low response rate about a rare event is vulnerable to being inflated or deflated. In addition to the concerns described, some responses from telephone interviews raise questions about overreporting (false positives) because "lacerations" were typically very minor. Descriptive terms included a "slight scrape"; "just a red mark"; "not a cut, just an indentation"; "slight abrasion"; and "very minor returned to the game." Alternatively, even a close call, due to the potential for a catastrophic event, may prompt responsible reporting. A potential sampling error, as a result of interviewing only 33 of 485 players who sustained a neck laceration, is also a limitation.

USA Hockey does not govern high school, junior, college (National Collegiate Athletic Association), or professional (NHL or minor leagues) hockey; therefore, these populations were not sampled. The game intensity played at levels not surveyed may involve increased risk and severity of injury compared with the youth hockey and adult recreational players who were surveyed in this cohort. Nevertheless, it is concerning that one-fourth of the players who sustained lacerations were wearing a neck laceration protector at the time of the injury. In addition, several injured players implicated the neck laceration protector with comments such as "the blade deflected off the cuff," "cut the neck guard in half," and/or "cut through the neck guard." It was suggested that the neck laceration protector may actually deflect the skate blade toward the angle of the mandible where the neurovascular structures are closer to the skin surface. Although not proven, this mechanism could actually result in a more serious injury. A playing rule that mandates the use of a neck laceration protector may not necessarily reduce the risk of injury. The photograph (Figure 3) of a player wearing an acceptable "mandated neck laceration protector" during international competition graphically depicts poor coverage of the neck region. This player is vulnerable to a neck laceration, even though he is wearing the required equipment. Furthermore, players must be educated that these devices do not protect the throat or cervical spine from blunt trauma.[15]

Initiatives other than equipment have been implemented with the goal of protecting the head and spine. Teaching mutual respect, via Fair Play,[16,17] is essential. Body control skills that emphasize keeping your head up in anticipation of contact with the boards (Heads Up Hockey) along with penalizing dangerous tactics such as checking from behind and head checking are critical in preventing traumatic brain and spinal cord injuries.[17]

Based on this survey, neck lacerations from a skate blade occur very infrequently and are usually not severe. The

FIGURE 3. A photograph of a player wearing a ''neck laceration protector'' as mandated by the International Ice Hockey Federation (IIHF) for players younger than 18 years who compete in international competition.

currently available neck laceration protectors do not eliminate the risk of injury. Future research is needed to determine if players who wear these designs are in fact protected. In addition, testing of improved designs and materials may lead to a more protective device. Because some protection is likely provided by the existing designs, we agree with the USA Hockey position statement and recommend that all players wear a neck laceration protector, choosing a product that covers as much of the neck area as possible.

REFERENCES

1. Stuart MJ, Smith AM. Principles of ice hockey injury research. In: Ashare AB, ed. *Safety in Ice Hockey: Third Volume, ASTM STP 1341*. Philadelphia, PA: American Society for Testing and Materials; 2000:19–31.
2. Smith AM, Stuart MJ, Wiese-Bjornstal DM, et al. Physical and psychosocial predictors of injury in male high school ice hockey players: emphasizing fatigue. *Am J Sports Med*. 1997;25:500–507.
3. Benson BW, Meeuwisse WH. Ice hockey injuries. *Med Sci Sports Exerc*. 2005;49:86–119.
4. Stuart MJ, Dajani KA, Crawford BJ, et al. A synthesis of the world literature of ice hockey injuries: epidemiologic principles and future directions. *J ASTM Int*. 2008;5(10):1–45.
5. Benson BW, Mohtadi NG, Rose MS, et al. Head and neck injuries among ice hockey players wearing full face shields vs half face shields. *JAMA*. 1999;282:2328–2332.
6. Stuart MJ, Smith AM, Malo-Ortiguera SA, et al. A comparison of facial protection and the incidence of head, neck and facial injuries in junior A hockey players: a function of individual playing time. *Am J Sports Med*. 2002;30:39–44.
7. Hostetler SG, Xiang H, Smith GA. Characteristics of ice hockey–related injuries treated in US emergency departments, 2001-2002. *Pediatrics*. 2005;115:1448–1449.
8. Delaney JS, Al-Kashmiri A. Neck injuries presenting to emergency departments in the United States from 1990-1999 for ice hockey, soccer, and American football. *Br J Sports Med*. 2005;39:e21.
9. Vergis A, Räsänen T, Hernefalk L. Neck injuries from skate blades in ice hockey: a report of three cases. *Scand J Med Sci Sports*. 2007;6:352–354.
10. Hockey fatality. *Daily Northwestern*. December 2, 1975:18, column 1.
11. Zednik in stable condition after having surgery on cut neck. http://sports.espn.go.com/nhl/news/story?id=3240117. Accessed February 11, 2008.
12. Maron BJ, Poliac LC, Ashare AB, et al. Sudden death due to neck blows among amateur hockey players. *JAMA*. 2003;290:599–601.
13. Odelgard B. The development of head, face and neck protectors for ice hockey players. In: Castaldi CR, Hoerner EF, eds. *Safety in Ice Hockey, ASTM STP 1050*. Philadelphia, PA: American Society for Testing and Materials; 1989:220–234.
14. Bureau de normalisation du Québec (BNQ). http://www-es.criq.qc.ca/pls/owa_es/bnqw_norme.liste_certif_pour_norme?p_lang=en&p_no_norm=9415-370. Accessed January 29, 2007.
15. Reid SR, Losek JD. Factors associated with significant injuries in youth ice hockey players. *Pediatr Emerg Care*. 1999;15:310–313.
16. Roberts WO, Brust JD, Leonard B, et al. Fair play rules and injury reduction in ice hockey. *Arch Pediatr Adolesc Med*. 1996;150:140–145.
17. Smith AM, Jorgenson M, Sorenson M, et al. Hockey Education Program (HEP): a statewide measure of Fair Play, skill development, and coaching excellence. *J ASTM Int*. 2009;6(4):1–14.