

# Rink-Side Management of Ice Hockey Related Injuries to the Face, Neck, and Chest

Randy M. Cohn, M.D., Michael J. Alaia, M.D., Eric J. Strauss, M.D., and Andrew F. Feldman, M.D.

## Abstract

*Ice hockey is a fast paced sport with unique injury potential. A covering physician must be prepared to acutely manage injuries to the face, neck, and chest that are not common in orthopedic practice. Injuries about the face seen in ice hockey include facial fractures, lacerations, and eye and dental injuries. Neck trauma can result in lacerations and neurologic injury. Commotio cordis and sudden cardiac death are potentially fatal conditions seen in ice hockey. This review details the appropriate acute management of these conditions for the physician covering an ice hockey game. Knowledge of these conditions and appropriate rink-side management can be potentially life-saving.*

Ice hockey is a fast paced sport with unique injury potential. Players can skate up to 30 miles per hour, shoot pucks in excess of 100 miles per hour, and play with the constant possibility of colliding with another player, the puck, or rigid boards.<sup>1,2</sup> As a result, blunt trauma is the most common cause of injury in ice hockey, followed by fatigue and overuse.<sup>3</sup>

In 2010, there were almost 475,000 registered ice hockey players in the USA.<sup>4</sup> At the youth level, there is an estimated injury rate of 30 per 100 players per season or 4.13 injuries per 1,000 player hours.<sup>5</sup> The rate of injury increases dramati-

cally at the collegiate and professional levels.<sup>6-8</sup> From 1990 to 2006, 8,228 patients with ice hockey injuries presented to NEISS-affiliated emergency rooms in the USA, representing an estimated 302,000 ice hockey related injuries during that time period.<sup>1</sup>

At the collegiate level, 65% of ice hockey injuries occurred in the extremities, with 19% of injuries to the head and 9% to the back and spine.<sup>3</sup> In USA emergency departments, the most common diagnoses from ice hockey injuries are lacerations (27%), contusions or abrasions (17.3%), fractures (17.3%), and sprains or strains (16.9%).<sup>1</sup> Thus, the covering physician at an ice hockey game must be prepared to acutely manage a variety of orthopedic injuries, as well as potentially serious injuries to the face, neck, and chest. In the present review, we explore several common and potentially life threatening injuries that may occur during an ice hockey game and discuss the appropriate rink-side management of these injuries.

## Face

An orthopedic surgeon covering an ice hockey game must be prepared to recognize and acutely manage a variety of injuries about the face. The incidence and type of facial injuries likely to be seen is dependent on the type of facial protection worn by the players.<sup>9-12</sup> Stuart and coworkers in a study of elite amateur ice hockey players found an incidence of head, face, and neck injuries of 158.9 per 1,000 player-game hours in players wearing no facial protection versus 73.5 per 1,000 player-game hours with players wearing a half-face shield. Players wearing full facial protection experienced 23.2 head, neck, and facial injuries per 1,000 player-game hours.<sup>12</sup> In a prospective cohort observational study of NCAA division I players, Laprade and colleagues found a significant decrease in facial lacerations with use of full facial protection, compared to a historical cohort without a face mask.<sup>9</sup> At the collegiate level, a half-face shield is associated with a 9.9 times greater risk of dental injury than with use of a full-face shield.<sup>11</sup>

Randy M. Cohn, M.D., and Michael J. Alaia, M.D., are Residents in the Department of Orthopaedic Surgery, NYU Hospital for Joint Diseases, New York, New York. Eric J. Strauss, M.D., is an Assistant Professor of Orthopaedic Surgery, NYU Hospital for Joint Diseases, New York, New York. Andrew F. Feldman, M.D., is a Clinical Assistant Professor of Orthopaedic Surgery, NYU Hospital for Joint Diseases, and Team Physician, New York Rangers Hockey Club, New York, New York.

*Correspondence:* Randy M. Cohn, M.D., Hospital for Joint Diseases, Department of Orthopaedic Surgery, 301 East 17th Street, Suite 1402, New York, New York 10016; randy.cohn@nyumc.org.

Full facial protection is now required in American collegiate ice hockey and all minor hockey worldwide.<sup>9,13</sup>

From 1990 to 2006, facial lacerations were the most common ice hockey injury to present to the emergency department in the USA, representing 16.4% of all ice hockey-related ER visits.<sup>1</sup> In the acute setting, facial lacerations should be irrigated with sterile saline and explored for the presence of foreign bodies or damage to underlying structures.<sup>14</sup> Direct pressure should be used to obtain hemostasis. Simple lacerations can be closed with sutures or tissue adhesives such as octyl-2-cyanoacrylate (Dermabond™, Ethicon Inc, Somerville, NJ). A randomized controlled study showed improved cosmesis with tissue adhesives over sutures in simple lacerations less than 4 cm.<sup>15</sup> If sutures are used, a 7-0 monofilament nylon suture with a subcuticular closure is recommended.<sup>14</sup> Lacerations associated with underlying facial fractures or injury to soft tissue structures should be covered with moist gauze to prevent drying and referred to the local emergency department for evaluation. Lacerations to the eyelid, nasal alar rim, vermilion border of the lip, or helical rim of the ear should only be repaired by a highly experienced practitioner to prevent poor cosmetic results.<sup>14</sup> Facial abrasions should initially be cleaned with antimicrobial soap and water, followed by irrigation with sterile saline. For all facial lacerations, tetanus prophylaxis should be administered if not up-to-date.

Facial fractures are a potentially devastating ice hockey injury but relatively rare with use of the appropriate facial protection.<sup>11</sup> Orbital blowout fractures are the result of blunt trauma and can be due to collision with the boards, puck, or another player. Common signs and symptoms include diplopia, enophthalmos, infraorbital hypoesthesia, and decreased extraocular movements. If an orbital fracture is suspected, a player should be referred to the emergency department for a CT scan and evaluation by the appropriate specialist.<sup>14</sup> Maxillary fractures represent a very high energy injury pattern and warrant emergent evaluation by the appropriate subspecialist. They may present with a step-off deformity of the palate, a loose palate, or movement of the nasal bones or zygomatic bones with manipulation of the palate. Severe maxillary fractures may also lead to airway compromise. Mandibular fractures may present with swelling, numbness, and intraoral lacerations. The covering physician should check for malocclusion by having injured athlete bite down on a tongue plate or similar device. If a mandibular fracture is suspected, the player should be referred to the emergency department for evaluation by the appropriate specialist. The covering physician should be aware that mandibular fractures may result in airway obstruction from bleeding, tooth avulsion, or posterior displacement of the tongue. A Barton's Bandage should be placed to stabilize the mandible prior to transport.<sup>14</sup> Nasal fractures represent 4.4% of all head, face, and neck injuries in Junior A ice hockey players.<sup>16</sup> Visible deformity, tenderness, and epistaxis are usually present. Epistaxis can generally be managed by applying pressure to the distal nasal bones and

by using nasal packing and nasal decongestant spray.<sup>17</sup> If these measures do not control bleeding, the athlete should be transferred for evaluation by the appropriate subspecialist. At the initial setting, the athlete should be instructed to apply ice and keep the head elevated to decrease edema. Clear rhinorrhea, sweet taste, or a complaint of postnasal drip should raise suspicion for a cerebrospinal fluid leak. Appropriate management can reduce the incidence of nasal deformity and need for secondary reconstruction.<sup>18</sup>

A cohort study of 282 elite amateur ice hockey players found a 4.7 times decreased risk of eye injury with use of a half face shield compared to no face shield, and no eye injuries occurred in players using full facial protection.<sup>12</sup> Prompt assessment is essential for all eye injuries to prevent secondary damage.<sup>19</sup> The initial evaluation of a patient with eye trauma should begin with gross examination for laceration, swelling, or orbital rim step-off along with palpation of the globe. The covering physician should also check visual acuity, extraocular eye movements, pupil size, and visual fields. A light source should be used to check for pupillary response, and a player should be asked if light is perceived as brighter from one eye versus the other, as a sign of optic nerve injury.<sup>14</sup> Some minor injuries can be managed rink-side. Discrete subtarsal foreign bodies can be removed by everting the eyelid and sweeping with a cotton bud. More diffuse conjunctival foreign material can be removed with irrigation. If a serious injury is suspected, the player should be transferred to a local emergency department for appropriate ophthalmological evaluation. During transport, the head should be kept still, and the injured eye covered with a plastic cup or shield that avoids putting pressure on the globe.<sup>19</sup>

Dental injuries accounted 11.5% of all ice hockey related injuries in one Finnish series and are directly related to use of face protection and mouth guards.<sup>20,21</sup> These injuries are permanent and often cause complications later in life.<sup>22</sup> An avulsed tooth should be gently rinsed with saline and placed back in its socket, if possible, and held in place by having the player bite down gently on gauze. If this is not possible, the tooth should be placed in Hank's solution, if available, or in saline, saliva, or milk for transport.<sup>14,20</sup> The tooth should be handled by the crown to avoid damage to the root and periodontal ligament. A tooth fracture that involves the enamel only does not require urgent dental evaluation. However, if the tooth is air sensitive, the player should have an urgent dental referral. Intrusive luxations, where the tooth is driven into the alveolar socket, should not be repositioned in the acute setting and require dental evaluation. Appropriate management of dental injuries is essential, as reimplantation of a tooth within 30 minutes results in a 90% chance of tooth survival, while a delay of 2 hours decreases tooth survival to less than 5%.<sup>14</sup>

## Neck

While the incidence of neck injuries is less in ice hockey as compared to American football, the covering physician

must be prepared to acutely manage potentially devastating injuries to the neck and spine.<sup>23</sup> From 1990 to 1999, 105 fractures and dislocations of the cervical spine resulting from ice hockey injuries presented to emergency rooms in the USA.<sup>23</sup> Moreover, a Canadian registry has shown that spinal injuries are most common at the juvenile level.<sup>24</sup> Acute management of a suspected spinal injury should initially be handled like any other emergent situation, with an assessment of the airway, breathing, and circulation. For access to the airway, the facemask should be removed with the helmet and shoulder pads left in place, as removing the helmet has been shown to increase the lordosis of the subaxial spine in immobilized hockey players.<sup>25</sup> If there is bony tenderness, neurologic deficit, or any suspicion of a cervical spine injury, the player should be immobilized and transported to an emergency room for definitive care.

Transient neurologic events (stingers) can result in ice hockey when a collision with another player or the boards results in a stretch injury to the brachial plexus. This most commonly occurs at the C5 and C6 spinal roots, with affected players experiencing burning, numbness, or tingling in the neck and possibly radiating to the hands.<sup>26</sup> Players will frequently elevate the affected limb or flex the neck in order to decrease compression at the affected nerve root. It is essential for the covering physician to differentiate between a stinger, which is usually an isolated benign injury, from a more serious spinal cord injury. The cervical spine should be palpated for gross deformity and to illicit bony tenderness. Sensory and motor status should be evaluated with the contralateral limb as a reference point. Localized tenderness, neck stiffness, apprehension to active cervical motion, bilateral symptoms, or lower extremity symptoms should alert the physician to a potential spinal cord injury, necessitating full spinal precautions.<sup>26</sup> A player can return to competition following an initial stinger if full recovery is demonstrated within 15 minutes. However, a player should be removed from competition and formally evaluated following a repeat event.<sup>27</sup>

In a survey of all levels of hockey players in the USA, Stuart and coworkers found a 1.8% prevalence of neck laceration from a skate blade. Injuries of the carotid arteries, jugular veins, and subclavian veins have been reported, although these injuries are rare.<sup>28,29</sup> Initial management should consist of applying direct pressure to the wound while maintaining a patent airway. The wound should not be explored rink-side. Significant bleeding from a laceration in proximity to a major vessel should lead to concern for vascular injury and warrant emergent transport to a hospital with vascular surgical capabilities.<sup>29</sup> Superficial lacerations can be bandaged or sutured rink-side or referred for definitive care.

## Chest

Comotio cordis is defined as a cardiac concussion with significant electrical disturbance when force is applied

to the thorax during a vulnerable phase of ventricular repolarization. This can occur when a projectile strikes the chest at wide range of velocities.<sup>30</sup> Hockey accounts for approximately 10% of all cases, according to the United States Comotio Cordis Registry.<sup>31</sup> A hockey player who collapses after a blow to the chest requires immediate CPR and defibrillation. Any delay in treatment can significantly impact survival. Once stabilized, the player should be transported to the hospital for appropriate cardiac monitoring. If a player is struck in the chest but does not collapse, a cardiac contusion should be suspected. Such players should be transported to the hospital for cardiac monitoring, serum troponin studies, and a transesophageal echocardiogram to evaluate cardiac function.<sup>31</sup>

Sudden cardiac death results when exercise acts as a trigger for a lethal arrhythmia given the susceptibility imposed by underlying cardiac disease. Hypertrophic cardiomyopathy is the most common cause in the USA, accounting for one-third of the cases.<sup>30</sup> Again, emergent CPR and defibrillation are critical to athlete survival. At present, cardiac screening recommendations in the USA consist of a thorough history and physical examination only, whereas the incidence of sudden cardiac death has been decreased in other countries with the routine use of screening electrocardiograms.<sup>32</sup>

## Conclusion

The covering physician at an ice hockey game must be prepared to acutely manage injuries to the face, neck, and chest in the acute situation. While management of injuries such as facial lacerations and fractures, eye injuries, and dental trauma are not generally considered part of orthopedic care, an orthopedist covering an ice hockey game must be prepared to acutely manage these injuries to minimize cosmetic deformity and functional deficit. Additionally, life threatening injuries such as neck lacerations, cervical spine trauma, and commotion cordis, although rare, have been reported in ice hockey games. Knowing where to find and how to use emergency equipment like a back board and defibrillator is essential to any physician covering a hockey game and can be lifesaving.<sup>20</sup>

## Disclosure Statement

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