Concussion in Ice Hockey: What's the Buzz?

A Medical and Psychosocial Perspective

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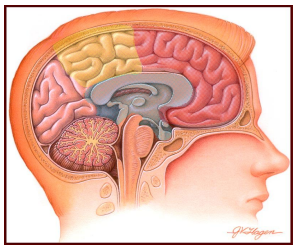

1. Background of Concussions

Concussions in ice hockey have been reported since 1890, but were often viewed as minor events described as "having your bell rung" [(1)]. Over time, our understanding of the mechanisms, neurobiology and consequences of concussion has dramatically improved.

A concussion is defined as a transient neurologic dysfunction resulting from a forceful impact [(2)]. The Center for Disease Control estimates between 1.6 and 3.8 million concussions occur in sport annually, but the true incidence is likely much higher. Approximately 54% of concussed athletes fail to report their symptoms due to a lack of recognition or fear of losing playing time. These figures speak to the need to address the importance of recognizing and properly treating concussions in athletes.

Forces transmitted to the head cause an electrical depolarization (the brain cells are stunned), followed by a serious alteration in: (1) neurotransmitter function, (2) potassium and calcium exchange, (3) glucose metabolism and (4) brain blood flow. The linear and rotational acceleration of the brain causes the tail of neurons (axons) to stretch, tangle or die.

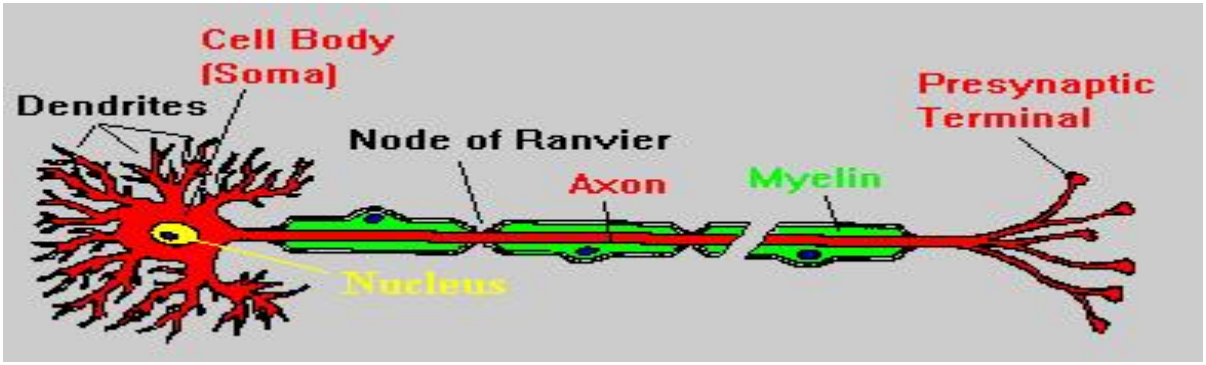

Diagram used with permission. "Image courtesy of Dr. Eric H. Chudler, Neuroscience for Kids, http://faculty.washington.edu/chudler/neurok.html"

This diagram depicts a normal brain cell (neuron). After repeated concussions and rotational acceleration the stretched, tangled, axons may lead to cognitive and behavioral changes.

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Repetitive head trauma from participation in activities such as boxing, football and ice hockey can lead to serious consequences such as memory loss or early Alzheimer's disease. In recent years, we have learned that concussion symptoms take longer to resolve in children.

2. Who Gets Concussed?

The prevalence of concussions in youth hockey is surprisingly similar to concussion estimates in the NHL (23 per 1000 player-game hours).[3] Concussions also frequently occur in high school and college hockey. In a recent Canadian study of 22,400 youth players, most concussions resulted from player to player contact. Half (11,200) were caused by illegal acts, such as checking from behind or hits to the head. Athletes who lost consciousness were sent for medical evaluation, but symptoms of amnesia, headache and dizziness were often ignored. According to trained observers, 71% of concussed athletes returned to play in the same game.

Children and adolescent hockey players are more susceptible to concussion because of a larger head size to body size ratio; weaker neck muscles and less stability on skates when checked or pushed. Videotape analysis of Bantam players identified on-ice skating characteristics that helped explain why certain players sustain concussion. These players tended to skate with their heads down watching the puck, positioning themselves in the "danger zone**",** which is between 8-16 feet from the boards, and didn't optimally position their body to receive a check. Thus, when checked, these players were more often flung into the boards. Collisions too often occurred when their heads were down.

3. What are the Symptoms and Signs of a Concussion?

Parents and coaches may witness a deliberate or accidental "impact" between players, a player and the boards, ice, or a goal post. They should be alert to a players complaints or problems that range in time of onset and severity.

- **Symptoms:** headache, nausea, dizziness, fatigue, sleep disturbances, feeling slow
- **Physical signs:** loss of consciousness, amnesia (loss of memory), vomiting, balance problems, visual disturbances, light or noise disturbances
- **Behavioral changes:** irritability, nervousness, drowsiness, sadness
- **Cognitive impairment:** slowed reaction times, fogginess

We should all be particularly cognizant of the player with a concussion who sustains additional minor head trauma and reports an escalation of symptoms. More information is available on the CDC website: **http://www.cdc.gov/ncip3/tbi/getoolkit/coaches** [6].

4. What to do when a Concussion Occurs?

Should concussed players return to the game or practice? No! The following recommendations emanated from a recent International Symposium on Concussion in Sport conference (or of medical experts, neurosurgeons?) in Zurich in 2008. [2]

If a player shows ANY symptoms of a concussion:

- The player should be medically evaluated on site using standard emergency management principles, excluding an associated neck (cervical spine) injury.
- The player should be safely removed from the practice or game, evaluated by a health care provider on site and/or referred to a physician.
  - ✓ Assessment is made using a sideline protocol to evaluate factors such as cognition and balance.
  - ✓ The player is monitored every 15-30 minutes for the first several hours after injury.

Concussion symptoms may not appear for several hours after the injury and worsening of symptoms requires an emergent medical consultation. A more detailed evaluation with neuropsychological (ImPACT) [7] and balance testing [8] is also helpful, especially if preseason baseline data is available for comparison.

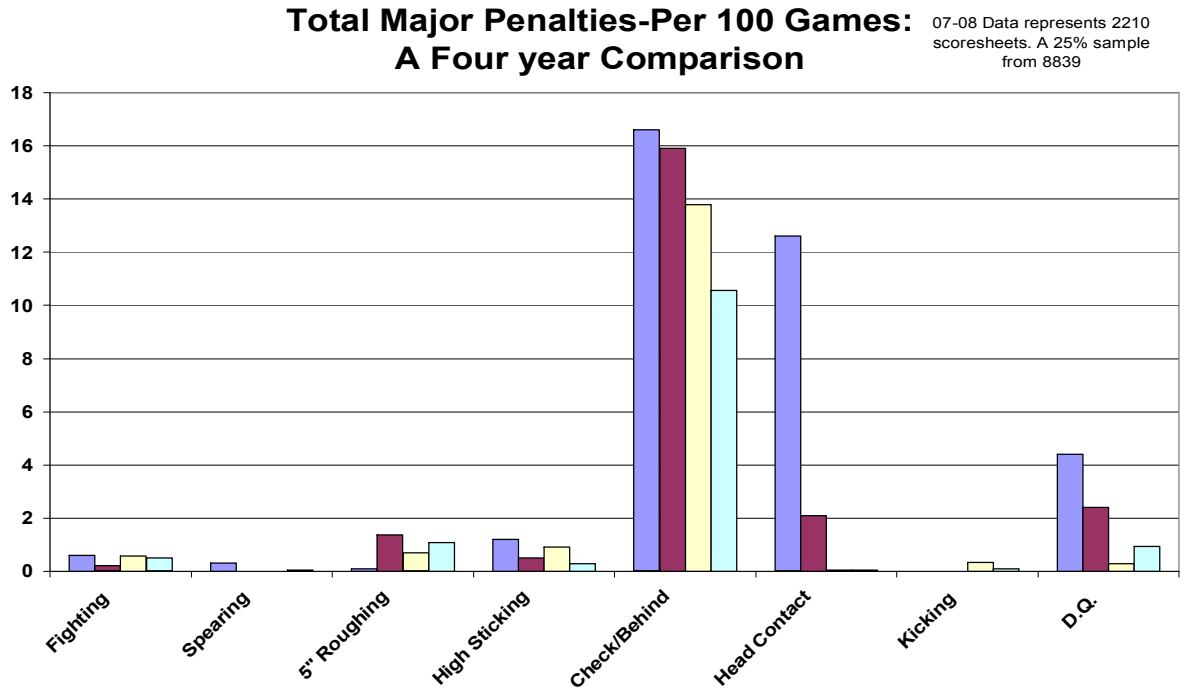
Obtaining Baseline Data

In the Mayo Clinic Sports Medicine Center, baseline data has been obtained for Rochester, MN male varsity and junior varsity football and ice hockey players and female varsity ice hockey players for the past four years. Baseline assessment includes neuro-cognitive testing (ImPACT) [7] and balance testing [8] that provides a reference point in the event players experience head trauma during the season. In the absence of baseline data, obtaining input from the parents and/or significant others as promptly as possible is helpful to obtain input on signs or symptoms that differ from the player's norm. Parents should consider establishing a baseline for their children prior to starting any physical activity or contact sport as it may be helpful in diagnosing and treating a concussion.

6. <u>Educational Programs to Prevent Concussions</u>

a. Hockey Education Program (HEP) [9]

Minnesota Hockey and the Mayo Clinic Sports Medicine Center developed a program to decrease violence in youth hockey while promoting sportsmanship and skill development. HEP incorporates Fair Play, a program that rewards sportsmanlike behavior with a point in each game for teams that do not exceed a specified number of penalty minutes. The teams' Fair Play point is forfeited if players, coaches or team parents behave in an unsportsmanlike manner. After the first four years, state-wide analysis of HEP data revealed approximately a 30% reduction in potentially dangerous infractions such as checking from behind and hits to the head.



b. **Heads Up Hockey**

Heads Up Hockey has long been promoted by USA Hockey in an attempt to reduce the risk of cervical spine injury (www.usahockey.com). The Rochester Youth Hockey Association (RYHA) produced a video in 2008, to instruct players to keep their head up when sliding into the boards. (http://ryha.pucksystems2.com)

c. **Larger Ice Surfaces**

A recent study of ice hockey injuries, including concussions in World Junior Ice Hockey Championships compared risk according to the size of the ice surface. Injuries were less frequent on the larger ice surface when players of similar age, size and skill competed under otherwise identical rules and regulations.

d. **High School Hockey Concussion Task Force**

Concussions in youth and high school hockey are frequent enough and the consequences so grave that medical professionals felt obligated to take action. A task force of sports medicine physicians and sport scientists organized by Dr.Aynsley Smith and Dr. Michael Stuart, recently participated in a teleconference to discuss the necessary steps to reduce concussion occurrences. Members of the task force included Drs. Joel Boyd, Rob LaPrade, Bill Roberts, Diane Weise-Bjornstal and Maureen Weiss. The Task Force's initial efforts will be directed toward accountability and enforcement of existing rules in high school hockey for the 2009-2010 season. The prevalence of concussions will be tracked in specific areas and the results will be considered following the hockey season.

7. Congratulations to MN Hockey and the MN Wild

The action being taken jointly by Minnesota Hockey, under the leadership of Executive Director Mike Snee, and the Minnesota Wild in developing and implementing the Respect and Protect Program is to be applauded. Hopefully, players will grow up playing a safer game, knowing that their respectful behavior is supported by their youth hockey association, the Minnesota Wild and all of us who love the great game of hockey.

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