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### **Brain contusion with aphasia following an ice hockey injury**

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#### **Abstract:**

Head injuries are relatively common in ice hockey, with the majority represented by concussions, a form of mild traumatic brain injury. More severe head injuries are rare since the implementation of mandatory helmet use in the 1960's. We present a case of a 27 year-old male who sustained a traumatic intraparenchymal hemorrhage with an associated subdural hematoma resulting after being struck by a puck shot at high velocity. The patient presented with expressive aphasia, with no other apparent neurologic deficits. Acutely, he was successfully treated with observation and serial neuroimaging studies ensuring an absence of hematoma expansion. After a stable clinical picture following 24 hours of observation, the patient was discharged and managed with outpatient speech therapy with full resolution of

symptoms and return to play 3 months later. We will outline the patient presentation and pertinent points in the management of acute head injuries in athletes.

**Keywords:** traumatic brain injury, intraparenchymal hemorrhage, subdural hematoma, ice hockey, sports medicine

### **Case**

A 27 year-old, right-hand dominant professional ice hockey player was participating in a game when he was struck with a hockey puck shot at high velocity. The puck struck him in the left frontotemporal region of his helmet, as evidenced by local swelling and ecchymosis. There was no associated loss of consciousness, but he had immediate pain and skated off the ice under his own power. He was noted to have expressive aphasia immediately upon return to the sideline and was removed from the game and brought to the emergency department for assessment. It should be noted that prior to participation in the game, he had received an intramuscular injection of toradol for an unrelated injury.

Upon arrival, the patient was evaluated by the emergency room physician. Neurological examination revealed mild dysarthria and expressive aphasia with word-finding difficulties. The remainder of the examination was normal, with pupils measuring 3 mm and responding equally to light. There were otherwise no

appreciable cranial nerve or motor deficits, no ataxia or other localizing features. Glasgow Coma Score was normal at 15. Due to the observed dysarthria and aphasia, a neurosurgical consultation was requested while a CT scan of both the head and neck were ordered.

A CT scan was performed which revealed a left inferior frontal intraparenchymal hemorrhagic contusion, measuring 11mm x 13mm, with a 2 mm overlying subdural hematoma extending over the left temporal lobe (Figure 1a). Additionally, there was a non-displaced left temporal bone fracture in close proximity to the middle meningeal artery (Figure 2).

The patient was admitted to the Neuro-ICU for hourly neuroassessments with repeat imaging. Mean systolic blood pressure was kept below 150 mmHg. Desmopressin (dd-AVP) was given in an attempt to reverse the coagulopathic effects of the anti-inflammatory he had received to prevent progression of the intraparenchymal hemorrhage (IPH). dd-AVP works by initiating the secretion of von Willebrand factor which activates platelets and encourages clot formation..

Upon repeat CT scan 6 hours later the aphasia and dysarthria had progressed slightly, however there was no change in size of the subdural hematoma. There was slight increase in the hemorrhagic contusion (Figure 1b). In addition to the aphasia, there was slight right-sided facial and hand numbness and right-sided facial weakness with tongue deviation. Both findings were consistent with the expanding region of the contusion. Subsequent magnetic resonance imaging demonstrated a stable IPH (Figure 3a). Follow-up CT scans were negative for progression of the

subdural hematoma or hemorrhagic contusion (Figure 1c). Serial neurologic assessments in the ICU revealed a stable, resolving, clinical picture.

The patient was subsequently transferred to the floor and eventually discharged home after 48 hours with a resolving hemorrhagic contusion. Speech therapy and outpatient neurology follow-up were arranged at the time of discharge. With subsequent visits, it was noted that he had full clinical resolution of symptoms by 6 weeks. Repeat MRI at 6 weeks demonstrated a resolving hemorrhagic contusion and hematoma (Figure 3b). He was cleared to return to play at 3 months.

### **Review of the Literature**

Head injuries in ice hockey are unfortunately one of the leading causes of injury. The vast majority are concussions, or mild traumatic brain injuries (mTBI), while more extensive brain injuries are exceedingly uncommon [1, 5]. Intraparenchymal hemorrhage, or hemorrhagic contusions, are rare and present with variable symptoms, largely dependent on the region of the brain that is affected [4]. In this particular case, the frontal and temporal lobes were affected, resulting in dysarthria and expressive aphasia. The primary concern associated with these injuries is the risk of enlargement, causing delayed clinical deterioration. Here, this was further complicated by the fact that the patient had received anti-inflammatories prior to competition, adding an additional risk factor for further bleeding prompting admission for observation, repeat imaging and administration of ddAVP. If clinical guidelines, such as the Canadian CT head rules, were followed, this patient may not have required a neurosurgical consultation as he did not have

any high risk factors for neurological intervention, however we felt this complicating factor of NSAID administration warranted expert consultation[7].

Recent studies have attempted to determine whether routine admission to an ICU and repeat imaging are necessary following such injuries[2, 8]. While these studies found that most patients do well, with few (6%) developing injury progression, specific criteria were associated with progression or late deterioration including anticoagulant use, advanced age (>65 y.o.) and large size (>10 mL) of the intracranial hemorrhage [8]. Additionally, Chang et al. identified a risk for progression of the IPH when associated with a subarachnoid hemorrhage, subdural hematoma or large size (>10 mL). They recommended observation with repeat imaging in these scenarios, consistent with the treatment in this study. Additionally in this study, the proximity of the temporal bone fracture to the middle meningeal artery, where injury could cause a sudden life-threatening epidural hematoma, also encouraged admission for serial observation to detect and treat this complication.

Emergent sideline management of athletic head injuries should initially focus on the ABC's, ensuring there are no impending airway concerns. Protective equipment, such as helmets and shoulder pads, should be left in place, while facemasks can be carefully removed [4, 6]. Following this, focus should be on determining the extent of the injury expediently to determine if urgent transport to a level-1 trauma facility is required. Generally speaking, responsive patients with only slight alteration of their GCS (i.e. 14 of 15) can be transported by ground to the hospital for further assessment. Those with moderate or severe traumatic head

injuries (GCS 9-13 or <9, respectively) should be transferred to a high-volume trauma center with neurocritical and neurosurgical care where appropriate life-support measures and neuroimaging can take place[6].

Upon arrival to the hospital, continued resuscitative measures should be performed while neuroimaging is obtained. Further care is dependent on the identified injuries. For patients with less severe injuries, close observation with serial imaging studies may be required to ensure no progressive injury develops. Neuropsychological testing can be performed once the injury has been deemed stable [4]. Subsequently, monitoring for post-concussion symptoms should be performed, including nausea, headache, vomiting, memory impairment or disorientation. For patients with more severe injuries, observation with neuromonitoring in an intensive care unit may be required [3]. Depending on the severity of the contusion or presence of intracranial bleeding, intracranial pressure monitoring may also be performed in consultation with the neurosurgical team.

### **Clinical Recommendations**

While most traumatic brain injuries in athletes are mild, with concussions comprising the majority of injuries, more severe injuries to the brain do occur, as highlighted by the intraparenchymal hemorrhage and associated subdural hematoma identified in this case. Consequently, any significant trauma to the head should be managed cautiously with close evaluation by the team physician and a period of observation if concern for a progressive injury exists, particularly if recent

anti-inflammatory use has occurred. Neuroimaging studies followed by observation in a hospital setting are recommended in such scenarios.

### ***Financial and competing interests disclosure***

*The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.*

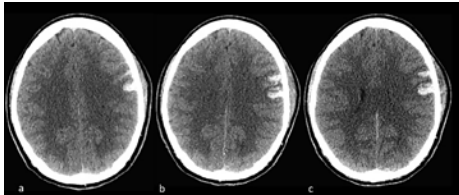
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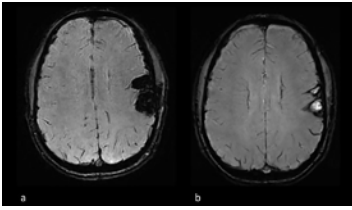


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**Figure 1.** Evolution of the intraparenchymal hemorrhage. a) CT within 1 hour of injury, b) serial CT 6 hours later, c) serial CT 12 hours later



**Figure 2.** Undisplaced temporal bone fracture



**Figure 3.** MRI demonstrating evolution of the intraparenchymal hemorrhage on susceptibility weighted imaging protocol a) post-injury day 1, b) post-injury day 42



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