Hyoid Dislocation Following Subacute Fracture in an American High School Football Athlete

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Informed consent was obtained from the patient and parent for use of his information and imaging. The study was reviewed by our institution’s institutional review board and was deemed to not qualify as human subject research.

The patient was a 15-year-old high school sophomore who sustained a direct blow to the anterior neck by the helmet of a teammate during contact drills at practice. At the time of injury, the patient was in full pads, with his appropriately fitted helmet in place and secured with a hard-shell chinstrap. Following the collision, he was able to stand and walk off the field with no loss of consciousness. He presented to the athletic trainer complaining of headache, throat pain, and amnesia to the event. During physical examination, the athletic trainer noted confusion, slowed speech, and right upper extremity weakness to the deltoid, infraspinatus, and subscapularis graded as 4 out of 5 strength on examination. The patient complained of odynophagia; however, no dysphonia or stridor were detected. Intense pain was elicited with palpation of the anterior aspect of the neck at the level of the thyroid cartilage, but no pain was elicited with cervical range of motion testing in all planes. Out of concern for concussion, throat pain, and weakness, he was advised to go to an emergency room for further examination.

Following arrival to the emergency department 2 hours after injury, the patient continued to complain of throat pain, dizziness, and confusion. Vital signs were normal, and...
on physical examination, the neck was symmetric in appearance with no ecchymosis or cervical edema. On palpation, point tenderness was noted over the right upper midline of the neck at the level of the thyroid cartilage, although no crepitus, masses, or lymphadenopathy was present. The hyoid was mobile during swallowing, even though the player continued to report odynophagia. He also continued to demonstrate right upper extremity weakness to the shoulder, scored as 3 out of 5 strength by the emergency department physician.

During examination, the player reported a similar injury 6 weeks prior, during a game in which he was tackled and the opponent’s helmet was driven into his upper chest, causing his hard-shell chinstrap to hit his throat. He reported having had minor difficulty breathing and odynophagia following the injury but was able to complete the game. He also reported having minor neck pain on palpation and odynophagia following the injury, which gradually resolved after 4 weeks. He did not cite this injury or symptoms to the athletic trainer, coach, or team physician, and he missed no games or practices. The athlete denied having any preceding neck trauma or possessing symptoms of odynophagia or difficulty breathing prior to this initial injury.

For comfort, a soft cervical collar was placed in the emergency department. Computed tomography (CT) of the head and magnetic resonance imaging of the brain were performed out of concern for concussive symptoms (ie, confusion and slowed speech), and results revealed no abnormalities. Of note, following return from imaging, the player had complete resolution of right upper extremity weakness, graded as 5 out of 5 strength. Cervical CT of the neck demonstrated medial displacement of the posterior portion of the right aspect of the hyoid bone, impressing on the right epiglottis and causing an asymmetric appearance of the pharyngeal mucosa (Figure 1, A-C). No acute fracture was noted, but acute angulation to the right side of the hyoid was noted, with well-corticated edges and minimal callus formation, suggestive of a prior-healed fracture approximately 4 to 6 weeks old, based on consultation with 3 musculoskeletal radiologists (Figure 1, D-F). No free air within the neck was appreciated. No malalignment of the cervical spine or stenosis of the spinal canal or foramina was present, and no additional injuries to the laryngeal skeleton were noted. CT arteriogram of the neck revealed no vascular abnormalities.

Owing to continued point tenderness and odynophagia, the player underwent flexible nasopharyngoscopy that demonstrated slight effacement of the right hypopharynx mucosa, more easily seen during phonation. No mucosal injury, masses, or lesions to the pharyngeal walls were present. True vocal movement was intact bilaterally and the airway widely patent with no evidence of obstruction. The player was admitted for 24 hours of observation to detect for possible worsening edema or decline in swallowing function. He remained stable and was discharged the following day with instructions to remain on a soft diet for

Figure 1. (A–C) Noncontrast computed tomography scans (axial views) of cervical region showing medial displacement of the right aspect of the hyoid (red arrows) causing mild compression of the epiglottis and pharyngeal mucosal space (blue arrows). (D–F) Noncontrast computed tomography scans (sagittal views) showing angulation and displacement of the hyoid with well-corticated edges (red arrow), indicative of prior fracture.
48 hours and progress as tolerated while remaining in the collar. At his 2-week follow-up with the otolaryngologist, he was still in the collar because of the mild neck pain that he experienced when turning his head; however, his odynophagia had resolved, and he was tolerating a regular diet. His otolaryngologist did recommend retirement from football for fear of additional, more severe injury to the hyoid and neck from direct-impact trauma leading to potential complications involving the airway or external carotid artery. Three weeks following injury, he reported being asymptomatic with no neck pain throughout range of motion, and the collar was discontinued. Despite the absence of neck pain, he remained sidelined and restricted from all contact through the conclusion of the football season secondary to persistent concussive symptoms. His pediatric neurologist cleared him 37 days following injury for full-contact participation in time for the start of basketball. During the basketball season, he remained asymptomatic, playing in every game and having no recurrent symptoms or additional injuries to the neck.

**DISCUSSION**

Although reported injuries to the hyoid in adults are rare, such injuries are even less common in the pediatric population, as documented in this case report. In pediatric patients, the hyoid is not completely ossified (Figure 2A), as the greater and lesser cornua undergo fusion at approximately 38 years of age in men and women (Figure 2B). This allows for additional protection from injury secondary to increased mobility in all directions, as the hyoid is less rigid and more flexible in younger patients because of its elastic, cartilaginous composition. As such, the reported mean age of fracture is typically around 35 years and commonly occurs in cases of manual strangulation, hanging, or motor vehicle accidents. 

Sport-related injury mechanisms typically involve direct trauma to the neck. To date, only 2 reported cases of hyoid injury resulting from participation in American football, both involving acute fractures, are present in the literature. Cutuk et al reported both cases of hyoid fracture in collegiate football players, one in which a player’s mask was forced into the anterior neck following a direct blow while standing on the sideline with the helmet unsecured. The other case, similar to this report, involved a player in full pads and a secured helmet sustaining a direct hit from a teammate’s helmet to the anterolateral neck during a full-contact practice drill. Both athletes were treated conservatively following confirmation of the absence of additional injury, airway compromise, or pharyngeal lesions on CT imaging and laryngoscopy. Both athletes returned to full participation by postinjury day 14.

Chowdhury et al described a case of direct trauma in which a 16-year-old hockey player sustained a hyoid fracture after being hit in the anterior neck by a hockey puck. No additional bony or tissue injury was identified, and the athlete was treated overnight with dexamethasone to reduce swelling and pain. He was noted to be asymptomatic at 2-week follow-up and advised to abstain from strenuous exercise for 6 weeks. Meanwhile, direct trauma was documented during basketball or karate in which an individual sustained a direct blow to the anterior aspect of the neck from an opponent’s hand or foot while the neck was in hyperextension. While hyperextended, a large part of the neck is exposed and more susceptible to injury, as the muscles attaching the hyoid are placed under tension, decreasing the mobility of the hyoid and its protective ability to dissipate forces.

Only 1 other reported case of hyoid dislocation currently exists in the literature, and it involves a 45-year-old man who presented with 1 year of odynophagia and dysphonia after an argument triggered the acute onset of right-sided neck pain. Laryngoscopy revealed a mass in the right hypopharynx, and treatment with partial resection of the lateral hyoid was performed. The authors reported full resolution of symptoms, and repeat laryngoscopy demonstrated disappearance of mucosal indentation.

Generally, diagnosis of hyoid fracture or dislocation is difficult, owing to variable presentation and the low degree of suspicion secondary to the rarity of the injury. When not present in the setting of more serious trauma, isolated...
injuries typically present with anterior neck swelling, ecchymosis, and decreased range of cervical motion secondary to pain.\textsuperscript{9,28} Alternatively, in the setting of minimal or no soft tissue injury, physical examination results may be normal.\textsuperscript{27} When present, throat pain is typically exacerbated with swallowing, nose blowing, or coughing.\textsuperscript{6} Patients may also complain of dysphagia and odynophagia.\textsuperscript{9} Physical examination typically reveals point tenderness over the midline or on 1 side of the neck and potentially crepitus.\textsuperscript{9} While not employed in this case report, initial diagnostic workup generally involves obtaining cervical radiographs.

The majority of hyoid fractures are appreciated on lateral radiographs by the presence of cortical discontinuity.\textsuperscript{8,15} To eliminate superimposition of the 2 horns of the hyoid and to improve visualization, Papavasiliou and Speas\textsuperscript{20} advocated for inclusion of oblique views of the cervical spine during the initial evaluation. Superior visualization and diagnosis are afforded by CT imaging, in which fracture location and severity or dislocation are better appreciated and detection of associated injuries to the cervical spine or mandible is enabled.\textsuperscript{4,12} In a systematic review examining 46 cases of hyoid fractures, Ramchand et al\textsuperscript{23} reported that diagnosis of hyoid fracture was confirmed via cervical radiographs in 63\% (n = 29) of cases and CT imaging in 30\% (n = 14), while the remaining 3 cases were diagnosed through open exploration of the neck in the operating room. Moreover, in studies published since 1998, 73\% of patients (n = 14) were diagnosed using CT.

Most authors advocate that in the setting of hematoma, dyspnea, dysphonia, or respiratory distress, laryngoscopy should be performed to assess for the presence of pharyngeal lacerations, vocal cord mobility, and the patency of the airway.\textsuperscript{4,14,16,23} However, others argue for laryngoscopy to be performed in all cases of potential hyoid injury once cervical spinal injuries are excluded.\textsuperscript{9,17} In the setting of fractures, sharp ends of the bone may penetrate the prevertebral musculature and the pharyngeal mucosa, resulting in hemorrhage into the airway as well as subcutaneous emphysema secondary to air escaping into the soft tissues.\textsuperscript{8,14,19,28} Such complications could lead to life-threatening consequences necessitating immediate diagnosis and treatment.

No consensus exists for the treatment of hyoid fractures or dislocations, thereby necessitating that treatment be tailored per individual presentation and symptom severity.\textsuperscript{4,6,21,23} Asymptomatic patients or those with mild symptoms and no airway compromise or progressively worsening dysphonia or dysphagia are generally treated conservatively. Analgesics, soft collar immobilization for comfort, and a brief period of a soft/liquid diet with close observation allow for symptomatic resolution.\textsuperscript{4,5} A period of in-hospital observation between 48 and 72 hours following injury is also recommended to watch for the potential development of late complications, such as dysphagia, dysphonia, or dyspnea secondary to airway obstruction.\textsuperscript{24,25} One patient in the literature developed acute airway obstruction as far out as 51 hours following injury.\textsuperscript{25} In the setting of pharyngeal lacerations following hyoid fracture, surgeons may elect to smooth the sharped ends of bone,\textsuperscript{7} perform wire reduction and internal fixation,\textsuperscript{15} or undergo partial or total hyoid bone removal.\textsuperscript{7} In patients with acute respiratory distress, endotracheal intubation or surgical tracheotomy may be required to ensure an adequate airway.\textsuperscript{13,26}

Overall, the prognosis for patients suffering hyoid fracture or dislocation is good in the absence of acute airway compromise, pharyngeal laceration, or late complications secondary to swelling or infection.\textsuperscript{6,21,23} In uncomplicated cases, symptoms generally resolve between 2 and 8 weeks, with athletes successfully returning to sports following resolution of neck pain.\textsuperscript{4,5,6,21} For patients with fractures that progress to nonunion based on repeat cervical radiographs, no significant lasting effects on swallow function or neck pain have been documented, with most patients reporting satisfactory results.\textsuperscript{8,15,19}

This case report represents the first account in the literature involving an acute dislocation of the posterior portion of the hyoid following a healed subacute fracture in a high school American football player. One limitation to this case report is the fact the athlete did not have radiographic, CT, or magnetic resonance imaging during the initial injury, for which he pursued no medical treatment. While a fracture likely occurred during the initial injury, as verified by the well-corticated edges at the angulated portions of the hyoid, the potential for an associated dislocation of the hyoid following initial injury is unknown. While this is possible given the athlete’s report of 4 weeks of minor neck pain and odynophagia, we believe that the second trauma did result in either an acutely isolated or acute-on-chronic exacerbation of a prior hyoid dislocation, based on the increased severity of neck and throat symptoms. However, the extent of this dislocation versus the initial injury cannot be determined.

Despite properly fitted helmets and chinstraps, injury to the hyoid may be encountered when contact from the helmet of another player is directed to the upper chest and neck. Because of the potential life-threatening consequences associated with fracture or dislocation, a high index of suspicion must be maintained for hyoid injury in athletes presenting with generalized neck pain, point tenderness, or odynophagia following neck trauma in any sport.

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