

Traumatic hyoid bone fracture – a case report and review of the literature

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Objective: *To present a case of traumatic hyoid bone fracture and a review of the literature*

Rationale: *Traumatic hyoid bone fractures are rare, however with the increasing popularity of martial arts the incidence of traumatic hyoid bone fracture may increase in prevalence.*

Clinical Features: *A thirteen year old taekwondo athlete collapsed after receiving a kick to the anterior neck. Following first aid emergency care the athlete reported pain with speaking and swallowing and was suffering from dyspnea. Ecchymosis and tenderness were noted over the hyoid bone.*

Intervention and Outcome: *Lateral radiographs revealed fracture of the hyoid. Patient was sent home with analgesics and instructed to rest. The athlete was cleared for sport at 4 weeks post injury.*

Conclusion: *Ensuring airway integrity and screening for signs of laryngeal laceration are essential in*

Objectif : *Présenter un cas de fracture traumatique de l'os hyoïde ainsi qu'une recension des écrits.*

Motif : *Les fractures traumatiques de l'os hyoïde sont rares, mais avec la popularité croissante des arts martiaux, leur prévalence risque d'augmenter.*

Caractéristiques cliniques : *Un adepte du taekwondo de treize ans s'est écroulé après avoir reçu un coup de pied à la face antérieure du cou. Après avoir reçu des premiers soins d'urgence, l'athlète s'est plaint d'une douleur ressentie lorsqu'il parlait et avalait, et il souffrait de dyspnée. On a noté une ecchymose et une sensibilité au niveau de l'os hyoïde.*

Intervention et résultat : *Les radiographies latérales ont révélé une fracture l'hyoïde. Le patient est retourné chez lui avec des analgésiques et la directive de se reposer. L'athlète pouvait reprendre l'activité sportive quatre semaines après la blessure.*

Conclusion : *Dans les cas où une fracture de l'os hyoïde est suspectée, il est essentiel de veiller à l'intégrité des voies respiratoires et de faire un dépistage des signes de laceration laryngée. Une*

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the management of suspected hyoid bone fractures. Observation for 48-72 hours is highly recommended. (JCCA 2012; 56(4):269-274)

KEY WORDS: hyoid, fracture, traumatic, martial arts

Introduction

The world of mixed martial arts (MMA) is continually increasing in popularity; with the Ultimate Fighting Championship (UFC) being the world's largest promoter of MMA. In the past 10 years the number of UFC events per year has increased from 6 in 2000 to 24 in 2010,¹ and has currently set North American live-gate records at UFC 129 with an attendance of 55,724 totaling 11.5 million Canadian dollars.² A viewership of 1.5 million was recorded for the live aired fights on cable television before the main event.³ All of the 24 fighters involved in the event received medical suspensions, 7 of which were related to knockouts or serious trauma to the head region.⁴

Due to the increasing popularity of MMA, it is essential to understand the injury profiles for which these athletes are at risk. In 2007 a five year retrospective cohort study reported 19.0% of injuries sustained by MMA athletes were to the head and neck regions.⁵ In a report of 116 MMA fights over seven years, it was reported that 29.1% of injuries were to the head and neck regions.⁶ Kochhar et al. reported on several maneuvers commonly used within MMA, and showed that they share similar kinematic features as those who sustain a rear impact motor vehicle accident.⁷ They concluded that due to the similar kinematic profiles MMA athletes may be at risk for cervical spine injuries commonly seen in rear impact motor vehicle accidents.⁷

Analysis of individual martial arts used in MMA can provide further insight into risks of injury. Taekwondo is a martial art form involving strikes and kicks to an opponent, with more points in a match being awarded for a kick impacting the head.⁸ Head and neck injury rates within taekwondo have been found to be similar to those

période d'observation de 48 à 72 heures est fortement recommandée. (JCCA 2012; 56(4):269-274)

MOTS CLÉS : hyoïde, fracture, traumatique, arts martiaux

found in MMA.^{9,10} A 1997 analysis of a national level taekwondo even showed that 9.2% of injuries sustained were to the head and neck regions.⁹ In a 2009 retrospective longitudinal study of taekwondo injuries, it was found that over a 9 year period 23.3% of injuries were to the head and neck.¹⁰ This information may suggest that there has been an increase in the prevalence of head and neck injuries within the martial art of taekwondo.

Many structures exist within the head and neck region which may be susceptible to injury during a MMA fight. The hyoid bone is a U-shaped bone situated in the anterior portion of the neck.^{11,12} Hyoid bone fractures, or Garrotter's Throat, are very rare.^{13,14} The incidence of fracture of the hyoid bone is reported as being 0.002% of all fractures; however this statistic appears to be determined anecdotally from references as far back as 1949.¹⁴⁻¹⁷ These incidence statistics may not be representative of today's society, especially considering the increasing popularity of MMA and the associated rates of head and neck trauma previously reported.

A case of traumatic fracture of the hyoid bone in a taekwondo athlete is presented. To the author's knowledge this is the first case of hyoid bone fracture associated with taekwondo.

Case presentation

A thirteen year old male provincial level black belt taekwondo athlete was kicked in the anterior aspect of the throat during a match. The athlete fell prone onto the mat and was immediately assessed by the medical staff for breathing and any cervical spine trauma. Immediately after the kick the athlete reported severe neck pain, particularly in the anterior region. The neck was stabilized and

a full examination including sensory and motor examination was conducted and reported as unremarkable. There was no loss of consciousness and Glasgow Coma Scale was rated as 15/15. The patient's pupils were equal and reactive to light and upon palpation there was no mid-line bony tenderness in the cervical spine. Since signs of severe spinal trauma were ruled out, the athlete was carefully log-rolled to the supine position with cervical spine stabilization. The athlete was experiencing dyspnea, wheezing, and coughing, and at this point the ambulance was called for fear of tracheal obstruction.

The athlete was otherwise healthy with no previous cervical spine or anterior throat trauma. Systems review was performed and was unremarkable with no other significant complaints. No numbness or tingling into the upper or lower extremities was reported. The medical staff proceeded to remove the chest and head protection for further inspection of the chest and anterior neck. At this point edema was noted on the anterior aspect of the neck at the level of the larynx. The primary pain was directly located to the hyoid bone in the anterior aspect of the neck. Vital signs including blood pressure, heart rate, and respiratory rate were within normal limits. A complete neurological examination of the upper and lower limbs was completed off the mat at the medic station including reflexes, sensation, and motor function. Deep tendon reflexes at C5, C6, C7, L4, S1 were graded as 2+ bilaterally, sensation was unremarkable in all dermatomes, and the motor examination was graded as 5/5 bilaterally in C5, C6, C7, C8, T1, L4, L5, S1. Capillary refill was <2 seconds in the fingernails and toenails.

Observation of the cervical spine was unremarkable. Due to the absence of neurological compromise and osseous tenderness in the cervical spine, the lead medical coordinator deemed it appropriate to proceed with further physical assessment of the athlete. Active range of motion in the cervical spine revealed full and pain-free flexion, bilateral lateral rotation, and bilateral lateral flexion. Pain was experienced in the anterior aspect of the neck localized to the hyoid bone with full terminal extension. Passive range of motion of the cervical spine revealed identical findings as the active range of motion testing. Resisted cervical range of motion was pain-free in all ranges. Observation and palpation of the mandible was unremarkable. Observation at the level of the cricoid cartilage and larynx revealed slight edema. There was

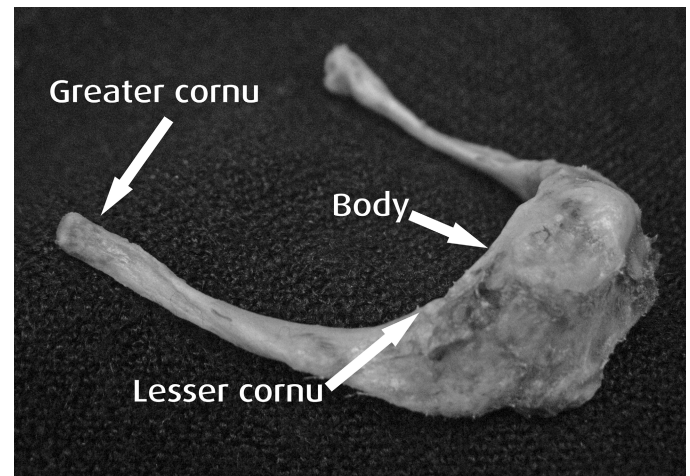


Figure 1: *Cadaveric dissection of the hyoid bone.*

no obvious deviation of the trachea, larynx, or cricoid cartilage. Palpation of the cricoid cartilage, larynx, and hyoid bone reproduced chief complaint. The cricoid cartilage moved superiorly when the patient was asked to swallow however recreated pain in the anterior neck. A stethoscope examination was performed directly over the cricoid cartilage and trachea revealing stridor and wheezing. Hoarseness was noted while assessing voice quality.

Ice was placed over the athlete's anterior neck while he awaited the arrival of the ambulance. Suspecting a hyoid fracture, a cervical spine radiographic series and CT scan were completed by the attending physician at the hospital. The patient was diagnosed by a medical radiologist with an acute hyoid bone fracture at the lesser cornu (Figure 1) and was sent home from the hospital and prescribed rest and anti-inflammatory medication. Four weeks following his diagnosis, the patient had a follow up examination by the attending physician. The patient was symptom free and was cleared to return to full activity.

Discussion

Anatomy

The hyoid bone is located in the anterior neck at the level of the C3 vertebra between the thyroid cartilage and the mandible.¹¹ It is suspended by the stylohyoid ligaments as well as muscles attaching to the mandible, styloid processes, thyroid cartilage, manubrium and scapulae.^{11,12} The hyoid is composed of five sections; the body, 2

greater and 2 lesser cornua.^{11,12} The lesser cornua is attached to the body via fibrous tissue and in some cases by a synovial joint. The lesser cornua itself can remain a cartilaginous structure well into adulthood.¹¹ Functionally the hyoid provides a movable base for the tongue, attachment points for the middle pharynx and maintains patency of the pharynx, required during swallowing and respiration.¹¹ In males the greater and lesser cornua fuse to the body of the hyoid bone unilaterally at 38.25 and bilaterally at 53.16 years of age respectively while females achieve boney fusion unilaterally and bilaterally at 38.00 and 48.50 years of age respectively.¹⁸

Mechanism of Injury

Fracture of the hyoid is typically associated with strangulation.^{12,15,17,19-25} Traumatic cases do exist in the literature and include mechanisms such as blunt trauma,^{16,17,26-29} hyperextension,^{17,30-32} gunshot,³³ motor vehicle accidents,^{27,30-32,34,35} induced vomiting,³⁶ cervical trauma,³⁷ and one case involving a headlock.¹⁵ Based on this information, striking and choking techniques commonly employed in martial arts provide potential mechanisms for hyoid bone fractures. It is thought that the rarity of this condition is due to the protection it receives from the mandible as well as from its mobility.^{12,17} In situations where hyperextension is induced the hyoid bone is exposed and may be at greater risk for blunt trauma.¹⁷ This position also places many of the muscles attaching to the hyoid bone under tension, decreasing the mobility of the hyoid and potentially reducing its mobility and thus its ability to absorb forces.

The age at which the hyoid bone fuses has been suggested as another protective factor.^{17,18} Prior to fusion, the elastic cartilaginous structure of the hyoid may offer protective mobility when exposed to trauma.¹⁷ The average age of presentation for a hyoid bone fracture has been reported to range from 15 to 55 with an average age of 35. A much higher prevalence in men than women has been identified.¹⁷ This would suggest that despite the suggested mechanisms afforded by a lack of fusion these fractures still occur. Perhaps it is the activities being undertaken by individuals in this age range that is of importance rather than the age of fusion.

In the present case, blunt direct trauma in the form of a kick was delivered to the hyoid bone resulting in hyperextension of the head. The age of the patient would sug-

gest a possible protective effect due to the absorption of force afforded by the elastic cartilaginous hyoid. The case highlights that the activity involved may represent a more important role in predicting the presence of a hyoid bone fracture than the patient age and degree of fusion of the hyoid bone.

Patient Presentation

The primary presenting symptom of hyoid bone fracture patients is sharp anterior neck pain aggravated by talking, nose blowing, coughing and swallowing.^{12,15,17,38,39} Dysphagia associated pain is worse when swallowing solids compared to fluids.^{12,17} Changes in voice quality such as lowered pitch and hoarseness have also been reported along with dyspnea, stridor and crepitus in the neck.^{12,15,17,39-41} It has been reported that cases resulting from muscular force such as hyperextension injuries may report a snapping or give way sensation.¹² In situations where sharp ends of the hyoid cause laryngeal lacerations and prevertebral muscle damage symptoms of hemoptysis, subcutaneous emphysema and ecchymosis are commonly noted.¹⁵ There may be pain with palpation of the anterior neck and hyoid with pain during cervical spine ranges of motion.¹⁵ Concomitant injuries may include mandibular fractures, facial fractures, thyroid cartilage fractures, cervical spine injuries, facial lacerations and external carotid artery pseudoaneurysm.^{15,42}

The patient in the present case experienced anterior neck pain aggravated by swallowing, palpation and neck extension. Dyspnea, stridor and hoarseness in the voice were all noted. There was no evidence of hemoptysis, subcutaneous emphysema or ecchymosis. The presenting symptoms are suggestive of a hyoid bone fracture with no evidence of laryngeal laceration.

Diagnosis

Diagnosis is typically made using clinical findings along with a radiograph, CT scan, direct laryngoscopy, nosendoscopy or surgical inspection.^{15,17,38,40} As in the presented case, radiographs are typically taken in a lateral orientation and must reveal a radiolucent line, interruption of the cortex or displaced fragments to diagnose a hyoid bone fracture.^{15,17} Fractures are typically seen in the body or the greater cornua of the hyoid.¹⁷ Direct laryngoscopy is recommended where dyspnea, hemoptysis or laryngeal lacerations are present to assess for pharyngeal

integrity and to assess for any bony protrusion.^{15,17} In some situations it may be beneficial to employ a Valsalva maneuver during laryngoscopy as it may further highlight any deformity.⁴⁰

Treatment

All patients suffering a hyoid bone fracture must be observed for a 48-72 hour period as previously asymptomatic patients may develop rapid hemoptysis, edema, ecchymosis and spasm resulting in life threatening asphyxia, requiring a tracheostomy and retro-pharyngeal drainage.^{15,17,38}

Treatment is typically dependant on whether or not there is perforation of the larynx or pharynx.¹² In cases where no perforation exists conservative treatment is employed.¹² Typically no reduction of the fracture is needed.^{12,15} Diet may be restricted to liquids until dysphagia subsides, or in more extreme cases a feeding tube may be inserted.^{12,15,38} Ice and analgesics may be employed to control ecchymosis and pain.^{15,17} Where there is larynx or pharynx perforation, removal of the fractured hyoid and any fragments as well as suturing and fixation may be warranted.^{15,17,40} With soft tissue compromise the risk of infection does exist, as such body temperature should be monitored.¹⁵ As with conservative therapy, a liquid diet, resting of the voice and possible nasogastric feeding tube may be implemented.¹⁵ Treatment for the presented case was in agreement with previously outlined treatments for hyoid bone fractures not involving laryngeal laceration.^{12,15,17,40} Due to the presenting symptoms of the patient the ambulance was called for fear of increasing dyspnea and possible asphyxia.

Prognosis

Even in cases of non union, the prognosis for hyoid bone fractures is good.^{17,31} Prognosis in cases involving laryngeal laceration may be less favorable due to underlying complications such as increased edema, hemoptysis, dyspnea and risk of infection.¹² While osseous healing in any fracture typically occurs in 6 weeks, symptom resolution for a hyoid fracture has been reported at 2 – 8 weeks.^{16,29,31,39,41} The patient in the present case had full resolution of symptoms by 4 weeks.

Summary

Traumatic fractures of the hyoid bone are a rare entity,

with potentially life threatening complications. Airway preservation is of the highest importance in these patients with a 48 – 72 hour observational period recommended. Although laryngeal lacerations are best viewed using direct laryngoscopy, certain presenting symptoms can heighten a clinician's suspicion. With simple food and activity modifications a good prognosis is expected. The ever increasing popularity of MMA demands that practitioners be away of potential injuries that may begin to increase in prevalence.

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