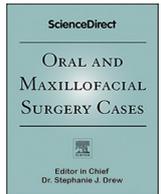




ELSEVIER

Contents lists available at ScienceDirect

## Oral and Maxillofacial Surgery Cases

journal homepage: [www.oralandmaxillofacialsurgerycases.com](http://www.oralandmaxillofacialsurgerycases.com)

# Concurrent hyoid bone fracture associated with multiple facial fractures secondary to assault: Case report and review of literature

Yoh Sawatari<sup>a</sup>, Yousef Alshamrani<sup>b,\*</sup>

<sup>a</sup> University of Miami, Miller School of Medicine, Oral and Maxillofacial Surgery, Miami, Florida, USA

<sup>b</sup> Jackson Memorial Hospital, Oral and Maxillofacial Surgery, Miami, Florida, USA

## ARTICLE INFO

### Keywords:

Facial fractures  
Isolated hyoid bone fracture  
Hyoid bone  
Hyoid bone fracture management  
Laryngeal trauma  
Hyoid bone fracture complications

## ABSTRACT

**Introduction:** Hyoid bone fractures are rarely reported as an isolated entity due to the infrequent occurrence accounting for only 0.002% of all head and neck fractures and 1.15 as the highest incidence. Strangulation remains the most common cause of isolated hyoid bone fractures with an incidence of 27–50%. However, blunt trauma, motor vehicle crash, sport related injuries, falls, assaults, and gunshot wounds are additional documented causes of hyoid bone fractures.

**Case report:** A 23-year-old male who was assaulted to the face. He complained of pain to the face and neck, sore throat, dysphagia and changes in speech. The face and neck CT scans revealed multiple facial fractures along with a hyoid bone fracture. Patient was admitted to for observation and close monitoring for airway protection until the mandible and hyoid bone fractures were treated. ORIF of the mandibular fractures took place; we elected to treat the hyoid bone fracture conservatively as it was asymptomatic. The patient's hospital course was unremarkable.

**Result:** 56 articles were reviewed from 1949 to 2017, which revealed that isolated hyoid bone fractures and hyoid bone fractures associated with other facial fractures are very rare. Hyoid bone fractures due to direct trauma, road traffic accidents, falls, assault and gunshot wounds are more common in males than females. However, in strangulation and suicidal hanging, the incidence is higher in females than males. Multiple methods can be used to evaluate the hyoid bone fractures. The majority of hyoid bone fractures are treated conservatively

## 1. Introduction

Fractures of the hyoid bone are rarely reported as an isolated entity due to the infrequent occurrence accounting for only 0.002% of all head and neck fractures [2,6,16,18] and 1.15 as the highest incidence [30]. Strangulation remains the most common cause of isolated hyoid bone fractures with an incidence of 27–50% [9,19,22,37]. However, blunt trauma, motor vehicle crash, motorcycle crash, sport related injuries (skiing and hockey), vomiting, falls, assaults, and gunshot wounds are additional documented causes of hyoid bone fractures [5,9,11,17,19,35]. Hyoid bone fractures have been associated with other injuries including thyroid, cricoid cartilage fractures, and cervico-spinal fractures. Hyoid bone fractures occur more frequently in men than women due to the incidence of blunt trauma, gunshot wounds, sport related injuries, falls, and assault as in this case [9,31]. However, the incidence of hyoid bone fracture is higher in females when related to attempts at suicide by hanging [21,22,37].

\* Corresponding author.

E-mail addresses: [ysawatari@med.miami.edu](mailto:ysawatari@med.miami.edu) (Y. Sawatari), [yousef.alshamrani@jhsmiami.org](mailto:yousef.alshamrani@jhsmiami.org) (Y. Alshamrani).

<https://doi.org/10.1016/j.omsc.2019.100119>

Received 4 July 2019; Accepted 3 August 2019

Available online 8 August 2019

2214-5419/© 2019 Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 2. Case report

We present a 23-year-old male who was assaulted and presented emergently to the trauma center via ambulance. Per EMS report, the patient was struck in the face and neck multiple times. Upon arrival, he was neurologically and hemodynamically stable, and was alert and awake with a GCS of 15. He complained of pain to the face and neck (primarily the lower jaw), sore throat, dysphagia and changes in speech. His physical examination revealed mild to moderate swelling and ecchymosis to the right cheek and anterior neck areas. The patient stated that there was a change in his occlusion along with trismus of approximately 1cm. He had significant deviation of the mandible to the right side upon opening. Brain, facial, and neck computed tomography (CT) scans were obtained. The neck CT scan revealed right mandibular ramus, right mandibular angle, left mandibular symphysis, right pterygoid plate fractures along with a hyoid bone fracture without any effects on the airway (Figs. 1–3); the brain and spinal CT were negative. Laryngoscopy did not reveal any pharyngeal lacerations or injuries. Patient was admitted to the OMFS service for observation and close monitoring for airway protection until the mandible and hyoid bone fractures were treated. He received 10 mg of dexamethasone IV x three doses. On the third post injury day, he was taken to the operating room by OMFS for open reduction and internal fixation of the mandibular fractures; OMFS team elected to treat the hyoid bone fracture conservatively as it was asymptomatic by the end the third day and the neck swelling had significantly decreased (Figs. 4–10). The patient's hospital course was unremarkable, the pain and swelling to left cheek and the anterior neck area improved within 2 days and he never presented with any airway distress. The patient was discharged on the fifth post injury day and was limited to a liquid diet. The patient returned for a postoperative visit one week later and his examination revealed a stable/repeatable occlusion, decreased swelling, diminished anterior neck ecchymosis, and no complaints of dysphagia. The patient was followed up an additional 3 weeks later, which revealed no neck ecchymosis and the neck edema had completely resolved. In the 3 months follow up, patient presented with a complete recovery of the mandibular and hyoid bone fractures. The patient was provided another 6 months follow up appointment, however, he did not show.

## 3. Discussion

### 3.1. Mechanism of injuries

56 articles were reviewed from 1949 to 2017, which revealed that isolated hyoid bone fractures and hyoid bone fractures associated with other facial fractures are very rare [9,15,31]. Hyoid bone fractures due to direct trauma [6,13,23,36], road traffic accidents, falls, and gunshot wounds are more common in males than females accounting for 91% of all presentations [1,6,9,31]. However, in strangulation and suicidal hanging, the incidence is higher in females than males [22,37]. Hyoid bone fractures are very rare in the pediatric population [36] Hyoid bone fractures may be associated with other concomitant injuries or masked by other injuries including mandible fractures [9,31,34]. Ramchand T reported hyoid bone fractures associated with mandibular fractures in 8 of 41 patients (17.4%), cervical spine injuries in 6 patients (13.0%), and Lefort III fracture in 2 patients (4.3%). Hyoid bone fractures have also been associated with facial lacerations [10], external carotid pseudoaneurysm [5], and laryngeal injuries [3]. Hyoid bone fractures can be accompanied by laryngeal cartilages fractures which may lead to voice changes, stridor, compromise of the airway, and pharyngeal lacerations [24]. In motorcycles accidents, helmets may cause compression or fracture of the hyoid bone [32].



Fig. 1. CT scan/axial cut showing the hyoid bone and mandible fractures.



Fig. 2. CT scan/axial cut showing the hyoid bone and mandible fractures.



Fig. 3. CT scan/axial cut showing the hyoid bone and mandible fractures. CT scan/axial cut showing the hyoid bone and mandible fractures.

Transesophageal echocardiogram (TOE) or endotracheal intubation has also been documented to cause laryngeal or hyoid bone injuries [26].

Comprehensive physical exam, plain film imaging, CT scans, laryngoscopy, and Valsalva maneuver are all methods utilized to evaluate for any hyoid bone and/or laryngeal injuries [9,28,29]. Dysphagia is another indication of possible hyoid bone fracture [1,2,4,5,11,12,16–18]. The majority of hyoid bone fractures are treated conservatively [8]. However, other authors reported cases which did not show any improvement with conservative observation, and subsequently required surgical intervention by open reduction and internal fixation, partial removal of hyoid bone, tracheostomy, or laryngeal laceration repair [13,23,28,34]. Although the conservative treatment is always the first treatment option, patients must be admitted and observed for at least 24 hours to rule out any airway complications. In addition, a 2 week follow up evaluation is highly recommended after discharge of this group of patients [9,11,27].

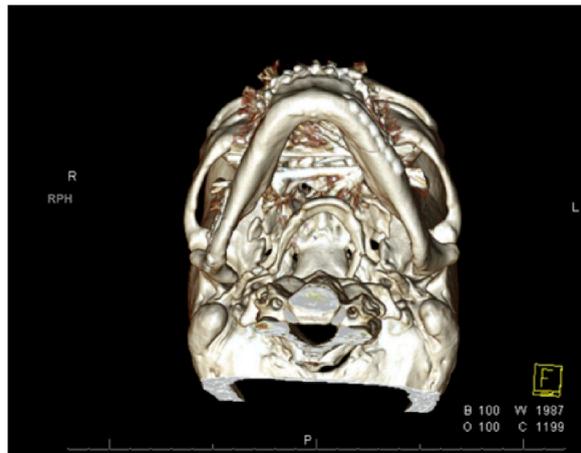


Fig. 4. 3D submentovertex view/ORIF of the mandible fracture and close reduction of the hyoid bone fracture.



Fig. 5. 3D submentovertex view/ORIF of the mandible fracture and close reduction of the hyoid bone fracture.



Fig. 6. 3D sagittal view/ORIF of the mandible fracture and close reduction of the hyoid bone fracture.

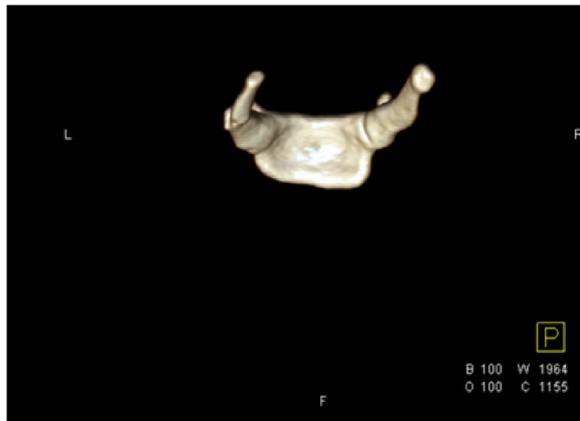


Fig. 7. 3D view of the hyoid bone fracture.



Fig. 8. 3D view of the hyoid bone fracture.



Fig. 9. 3D view of the ORIF of the mandible fractures and the close reduction of the hyoid bone fracture.

### 3.2. Anatomy

The hyoid bone is a semi-circular irregular horseshoe-shaped structure surrounded and protected by bony structures including the mandible anteriorly and laterally, and by the cervical spine posteriorly. In addition, the hyoid bone is suspended by muscles and ligaments to these surrounding structures which generally protect it from any direct force or trauma. Due to this protection, the hyoid bone fracture is an exceedingly rare fracture compared with the other head and neck fractures. The hyoid bone consists of 2 greater and



Fig. 10. 3D view of the ORIF of the mandible fractures and the close reduction of the hyoid bone fracture.

2 lesser cornu which are suspended by ligaments (Stylohyoid and Hyoepiglottic ligaments). With the lack of any direct bony contact, the hyoid bone remains mobile in multiple directions.

### 3.3. Prevalence

Hyoid bone fractures accounted for only 0.002% of all head and neck fractures [2,6,14,16,18]. The majority of the isolated bone fractures had been reported due to strangulation and suicidal hanging [2,7,9,20,21,22,25,37].

### 3.4. Clinical and radiographic findings and diagnosis

According to the reported cases that were reviewed, patients who sustained hyoid bone fractures generally are asymptomatic at the initial examination [13,34]. However, for patients who present with symptomatic fractures, clinical findings include ecchymosis, pain, swelling, stridor, and tenderness to the anterior aspect of the neck, submental region, and occasionally to the oral cavity [13,28,34]. Pain, dysphagia, odynophagia, dysphonia and limited range of neck motion are indicative of hyoid bone, laryngeal cartilage, and/or spinal injuries [28,33]. During the clinical examination, Palpation to the hyoid bone may reveal mobility or crepitus may be the preliminary indicator of fractures of the hyoid bone [17]. Dysphagia, odynophagia, or pain with coughing or blowing the nose must be taking in consideration during exam to rule out any fracture of the hyoid bone [11,16,17]. In addition, others recommended laryngoscopic examination to rule out any pharyngeal lacerations [3,13,21].

In addition to the clinical examination, radiographic imaging must be obtained to rule out any head and neck fractures including fractures of the hyoid bone. CT scan and lateral-view cervical x-ray are the primary imaging studies to evaluate the presentation of hyoid bone fractures.

### 3.5. Management and prognosis

The management of hyoid bone fracture primarily depends on the severity of the case on presentation or during the hospital course. Most hyoid bone fracture cases that had been reported in literature underwent nonsurgical management, as the majority were asymptomatic. These asymptomatic patients generally recover within 2 weeks [10,17,21,27]. However, in some infrequent cases, surgical intervention (ORIF) was performed [8,9,21,28]. If the injury is minimal with mild pain, it can be treated conservatively with oral analgesics for pain management and liquid or semi-soft diet. For external lacerations, debridement of the wound with primary closure is performed. Pharyngeal laceration should be deeply closed after removing any loose hyoid bone fragments. If there is suspicion of respiratory distress, airway should be secured with endotracheal tube intubation or tracheostomy to avoid any cardiorespiratory collapse [9,28,33]. In addition, Kaufman HJ, Ciraulo DL, and Burns RP recommended securing the airway due to hematoma formation and soft tissue swelling that may jeopardize the airway after hyoid bone fracture. All the hyoid bone fractures should be admitted and observed for at least 24–72 hours according to the severity of the case [28]. Most of the patient's symptoms will improve in 1–3 weeks after the trauma, however, rest, liquid diet, and analgesic medications were recommended [19]. The course of bony healing may take up to 6–8 weeks [8,11,28]. Dickenson, A. J performed a closed reduction for his patient who had hyoid bone fractures. However, open reduction of such fracture is not required for all the patient unless it is combined with deep neck lacerations, pharyngeal lacerations, fractures compromising airway, or associated with other head and neck fractures [28]. However, the hyoid

bone removal itself is not recommended [8,13,28,34]. According to the study that was done by Ramchand T., 26 patients did not reveal any improvement with conservative treatment. 21 of them underwent surgical treatment of the hyoid bone fracture and 9 of the 21 patients had tracheostomy performed due to a compromised airway. another 6 patients had pharyngeal laceration repair. Oropharyngeal or nasopharyngeal feeding tube is recommended for the endotracheal or tracheostomy patients. Generally, hyoid bone fracture prognosis is good regardless of the severity of the injury [9,27].

The patient in this case report had an unremarkable hospital course with a 4-week period that covered both the hyoid fracture and the mandible fractures.

#### 4. Conclusion

Hyoid bone fractures are an exceedingly rare injury, especially as an isolated fracture. In addition, hyoid bone fractures are also very rare when occurring simultaneously with head and neck fractures. Surgical intervention is not recommended for most hyoid bone fractures unless the patient presents with airway compromise, symptoms, or becomes symptomatic during their hospital observation. Although surgical intervention would be an option in some cases, including open debridement and open reduction and internal fixation, complete removal of the hyoid bone is never recommended. Observation is traditionally the primary management modality with a hospital admission of 24–72 hours, followed by a two-week post injury evaluation after discharge. Endotracheal intubation or tracheostomy are recommended for any suspicion of compromised airways or the development of such during the observation period.

#### References

- [1] Anthony R, Martin-Hirsch D, England J. Dysphagia secondary to iatrogenic hyoid bone fracture. *Br J Neurosurg* 2000;14(4):337–8.
- [2] Bagnoli ML, Leban SG, Williams FA. Isolated fracture of the hyoid bone: report of a case. *J Oral Maxillofac Surg* 1988;46(4):326–8.
- [3] Bell RB, Verschueren DS, Dierks EJ. Management of laryngeal trauma. *Oral Maxillofac Surg Clin N Am* 2008;20(3):415–30.
- [4] Browne WG. Fractures of the hyoid bone complicating facial fracture: a case report. *Br J Oral Surg* 1973;11(2):106–9.
- [5] Campbell AS, Butler AP, Grandas OH. A case of external carotid artery pseudoaneurysm from hyoid bone fracture. *Am Surg* 2003;69(6):534–5.
- [6] Carroll B, Boulanger B, Gens D. Hyoid bone fracture secondary to gunshot. *Am J Emerg Med* 1992;10(2):177–9.
- [7] Charoonnate N, Narongchai P, Vongvaivet S. Fractures of the hyoid bone and thyroid cartilage in suicidal hanging. *J Med Assoc Thail* 2010;93(10):1211–6.
- [8] Chowdhury R, Crocco AG, El-Hakim H. An isolated hyoid fracture secondary to sport injury. A case report and review of literature. *Int J Pediatr Otorhinolaryngol* 2005;69(3):411–4.
- [9] Dalati T. Isolated hyoid bone fracture. Review of an unusual entity. *Int J Oral Maxillofac Surg* 2005;34(4):449–52.
- [10] David S, Corrigan AM. Fracture of the hyoid bone presenting as a dislocated mandible. *Dentomaxillofac Radiol* 1989;18(2):89–90.
- [11] Dickenson AJ. Fracture of the hyoid bone following minimal trauma. *Injury* 1991;22(5):420–1.
- [12] Doring A, Kahle M. [Isolated hyoid bone fracture]. *Der Unfallchirurg* 2000;103(11):996–8.
- [13] Eliachar I, Goldsher M, Golz A, Joachims HZ. Hyoid bone fracture with pharyngeal lacerations. *J Laryngol Otol* 1980;94(3):331–5.
- [14] Erdogan B, Erdogan MO, Colak S, Kibici O, Bozan K, Alper B. An isolated hyoid bone fracture caused by blunt trauma to the neck. *J Pak Med Assoc* 2015;65(11):1233–4.
- [15] Gregersen M, Vesterby A. Iatrogenic fractures of the hyoid bone and the thyroid cartilage. A case report. *Forensic Sci Int* 1981;17(1):41–3.
- [16] Guernsey LH. Fractures of the hyoid bone. *J Oral Surg (Chic)* 1954;12(3):241–6.
- [17] Gupta R, Clarke DE, Wyer P. Stress fracture of the hyoid bone caused by induced vomiting. *Ann Emerg Med* 1995;26(4):518–21.
- [18] Kaufman HJ, Ciraulo DL, Burns RP. Traumatic fracture of the hyoid bone: three case presentations of cardiorespiratory compromise secondary to missed diagnosis. *Am Surg* 1999;65(9):877–80.
- [19] Keerthi R, Quadri A. Hyoid bone fracture: associated with head and neck trauma-A rare case report. *J Maxillofac Oral Surg* 2016;15(Suppl 2):249–52.
- [20] Kuo LC, Lin HL, Chen CW, Lee WC. Traumatic hyoid bone fracture in patient wearing a helmet: a case report. *Am J Emerg Med* 2008;26(2). 251.e251-252.
- [21] Levine E, Taub PJ. Hyoid bone fractures. *Mt Sinai J Med* 2006;73(7):1015–8.
- [22] Ma J, Jing H, Zeng Y, Tao L, Yang Y, Ma K, Chen L. Retrospective analysis of 319 hanging and strangulation cases between 2001 and 2014 in Shanghai. *J Forensic Leg Med* 2016;42:19–24.
- [23] Maran AG, Stell PM. Acute laryngeal trauma. *Lancet* 1970;2(7683):1107–10.
- [24] Mendis D, Anderson JA. Blunt laryngeal trauma secondary to sporting injuries. *J Laryngol Otol* 2017;131(8):728–35.
- [25] Olmstead EG. Fractures of the hyoid bone; presentation of two cases, with a review of the literature. *Arch Otolaryngol* 1949;49(3):266–74.
- [26] Ong HI, Lilic N, Agar NJ. Hyoid bone fracture: an unrecognized complication of intubation or transoesophageal echocardiogram? *N Z Med J* 2015;128(1412):60–3.
- [27] Padgham ND. Hyperextension fracture of the hyoid bone. *J Laryngol Otol* 1988;102(11):1062–3.
- [28] Ramchand T, Choudhry OJ, Shukla PA, Tomovic S, Kuperan AB, Eloy JA. Management of hyoid bone fractures: a systematic review. *Otolaryngol Head Neck Surg* 2012;147(2):204–8.
- [29] Spielmann PM, Hathorn IF, Clarke JK, Denholm S. Hyoid bone fracture identified only with nasal Valsalva manoeuvre. *J Laryngol Otol* 2010;124(4):431–2.
- [30] Stiebler A, Maxeiner H. [Non-strangulation-induced injuries of the larynx and hyoid bone]. *Beitr Gerichtl Med* 1990;48:309–15.
- [31] Tohill RM, Gupta DK. Severe laryngeal injuries masked by fractured mandible. *Dent Update* 2008;35(8):535–9.
- [32] van Dongen MJ, Falger-Veeken SN. The risk of a bicycle helmet: hyoid bone fracture. *Ann Emerg Med* 2016;67(1):145–6.
- [33] Wang W, Kong L, Dong R, Zhao H. Fracture of the hyoid bone associated with atlantoaxial subluxation: a case report and review of the literature. *Am J Forensic Med Pathol* 2007;28(4):345–7.
- [34] Whyte AM. Fracture of the hyoid bone associated with a mandibular fracture. *J Oral Maxillofac Surg* 1985;43(10):805–7.
- [35] Zachariades N. Fracture of the hyoid bone: an unusual case. *Oral Surg Oral Med Oral Pathol* 1985;59(6):663.
- [36] Zachariades N, Mezitis M. Fracture of the hyoid bone-report of a case. *Br J Oral Maxillofac Surg* 1987;25(5):402–5.
- [37] Zatopkova L, Janik M, Urbanova P, Mottlova J, Hejna P. Laryngo-hyoid fractures in suicidal hanging: a prospective autopsy study with an updated review and critical appraisal. *Forensic Sci Int* 2018;290:70–84.