Injury Extra

Case report

Injury risk related to the helmet strap: Mandible and hyoid bone fractures with a hyoepiglottic ligament lesion

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1. Introduction

Hyoid bone fractures are rare (0.002% of all fractures)1 and most result from strangulation or hanging.2 Other causes are direct trauma, mostly traffic accidents,9,13,14 sports injuries,3,4,6 gunshot,2 and induced vomiting.8 The diagnosis is often difficult, especially when associated with other soft tissue injuries or fractures, which may seem more worthy of treatment.

Only one hyoid bone fracture caused by a helmet strap in a traffic accident has been reported.10 The case we present is unusual.

2. Case report

A 65-year-old male motorcycle accident victim was brought to the emergency department of our hospital. On arrival, he was awake and oriented. He had significant bleeding from the mouth and was in respiratory distress; he also had neck swelling and subcutaneous crepitus without significant pain (spontaneous or provoked by pressure). Physical examination of the neck was difficult because of the presence of an orthopedic collar; he reported painful swallowing. The skin on the chin was lacerated. No nosebleed or other skin injury was present. He had dysphonia, with a guttural, helium-like voice.

The patient wore superior and inferior removable dental prostheses: the inferior one had been broken and lost during the crash, while the superior one had been damaged, but not dislodged. After removing it, no mucosal wounds were seen in the oral cavity and no blood was seen draining from the pharynx posteriorly.

Because bleeding from the nose and mouth were excluded, an ENT surgeon and anesthesiologist were consulted with regard to the respiratory distress, and the patient was intubated. Subsequently, fibre optic endoscopy was used to evaluate the upper aero-digestive tract (UADT): a large laceration was found in the glossoepiglottic region, with a hyoepiglottic ligament lesion and subsequent posterior epiglottis collapse on the glottic plane (Fig. 1). As the patient was stable and could be monitored, computed tomography (CT) was performed and showed fractures of the mandibular symphysis and left condyle, thyroid cartilage, and hyoid bone bilaterally, with disarticulation of the hyoid corpus from the greater horns (Fig. 2). Significant subcutaneous emphysema of the neck was also seen. A maxillofacial surgeon was asked to evaluate the mandibular fractures. The physical examination also revealed left wrist trauma; standard X-rays showed dislocation of the lunate bone and a temporary brace was applied to immobilise the wrist.

The patient was transferred to the intensive care unit (ICU). Three days later, CT was repeated to re-evaluate the cervical soft tissue emphysema, which appeared to have decreased slightly, with expected partial healing of the UADT fistula.

Subsequently, the patient was brought to the operating room to undergo laryngoscopy, a tracheostomy to protect the lower airways, a CO2 laser epiglottectomy, because it was impossible to suture the epiglottis wound firmly, due to extensive necrosis and the frailty of the surrounding tissues, and titanium plate osteosynthesis of the mandibular left condyle and symphysis fractures. The hyoid and thyroid cartilage fractures were managed conservatively.

Postoperatively, the patient spent five days in the ICU. Then, the tracheostomy tube was removed and the patient started swallowing rehabilitation, with the help of a speech-language-swallowing pathologist.

Subsequently, the left wrist fracture was treated by an orthopedic surgeon.

At follow-up, there was a complete functional restoration and rehabilitation of the head and neck structures and functions, especially swallowing. The patient brought the helmet he was wearing when the accident happened to our unit (Fig. 3). The helmet strap fastened over the hyoid bone and the helmet probably slipped off during the crash, so that the strap fractured the hyoid and thyroid cartilage and caused the hyoepiglottic ligament injury indirectly.
Fig. 1. (a) Normal larynx and periepiglottic spaces; (b) the direct injury on the hyoid bone (1) determines an indirect lesion of the hyoepiglottic ligament with posterior collapse of the epiglottis on the glottic plane (2); (c) endoscopic view of the epiglottis kept in its physiologic position by the surgical instrument; (d) endoscopic view of the hyoepiglottic ligament lesion and mucosal wound of the glossoepiglottic region, with posterior collapse of the epiglottis.

Fig. 2. Bilateral hyoid bone fracture with disarticulation of the greater horns from the body; thyroid cartilage injury; mandibular symphiseal fracture and left condyle fracture.
3. Discussion

Hyoid bone fractures (isolated or associated with other facial injuries) are rarely reported as remarkable events and account for only 0.002% of all fractures. In fact, the hyoid bone is well-protected in the neck, mainly by the mandible. Furthermore, the hyoid bone is protected by its mobility in all directions. However, when the neck is hyperextended, the protection is reduced, which increases the risk of a lesion with direct trauma. Because of the change in trauma model in recent times, strangulation may not be the most common cause of hyoid fracture. Motorcycle riders wearing a helmet may actually have a high risk of this kind of fractures.

Motorcycle helmets are a universally accepted means of head/face protection for motorcycle riders. Their use is compulsory in most countries. There are many types of helmet intended for motorcycling, from full-face to open-face and half helmets. All of these types are approved for motorcycling in Europe, if they satisfy European Regulation ECE 22-05. They are all secured by a chin strap, and their protective benefits are greatly reduced if the chin strap is not fastened securely. In fact, when the chin strap is loose, especially with open-face and half helmets, there is a high risk of the helmet slipping backwards, which can cause it to be suspended from the hyoid bone region. If it slips violently, as happens in traffic accidents, this could result in severe injuries to the neck structures.

Furthermore, open-face helmets do not protect the chin, which is frequently the first facial structure to be hit in a motorcycle accident. This often leads to direct mandibular symphyseal fractures with indirect condylar fractures (unilateral or bilateral).

4. Conclusions

Our patient had severe injuries to the hyoid bone, thyroid cartilage, and hyoepiglottic ligament, with laceration of the hyoepiglottic membrane. These caused marked symptoms and severe complications (e.g., cervical soft tissue emphysema). These findings constitute an unusual injury in a motorcycle accident and demonstrate the importance of fastening the helmet strap correctly. Moreover, we believe that open-face helmets do not provide satisfactory protection from facial injuries, such as the severe mandible fractures and skin laceration in our patient, and could even cause trauma to the neck similar to that in hanging.

For diagnosis of this kind of fractures is difficult, greater attention should be paid to people with head injuries and wearing a helmet.

References