Case report

Pre-hospital care of laryngeal trauma and a hyoid bone fracture in a 14-year-old county-level rugby player

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1. Introduction

1.1. Anatomy

The hyoid bone is a mobile bone that functions as a “anchoring structure for the tongue” to which various muscles attach (Table 1). It is afforded protection by the mandible and cervical spine. Due to this protection and the ability of the attaching muscles and tendons to deflect forces, fractures are rare, with only 0.002–1% of all fractures involving the hyoid. Most commonly such fractures are found in victims of strangulation or hanging, but their occurrence in sport is not unknown and is usually the result of high-impact blunt trauma. Due to the proximity of the hyoid to the larynx, it is situated immediately superior to the larynx, and hyoid fractures due to trauma almost always also involve significant damage to the larynx. The prognosis of hyoid fractures tends to be poor, with mortality rates of between 2% and 15% and high pre-hospital mortality rates. This is due to the high forces required to overcome the protection afforded to the hyoid bone damaging the airway, such as those found in American football, rugby, baseball and hockey.

1.2. Symptoms of laryngeal trauma and hyoid bone fracture

Patients suffering a fracture of the hyoid or blunt laryngeal trauma often suffer dysphagia and odynophagia as the muscles attached to the hyoid “elevate and elongate and, conversely, depress and shorten the floor of the mouth during swallowing”. Other symptoms can include pain and ecchymosis over the anterior aspect of the neck in addition to oedema, dyspnoea, haemoptysis, changes to voice and subcutaneous emphysema. Stridor can also occur as the airway becomes compromised by a compressive haematoma or swelling in the soft tissues surrounding it. Patients can however exhibit no signs initially, making diagnosis difficult as medical staff focus on other complications to the trauma, such as fractures or bleeding from other sites. It is often in these patients with ‘hidden’ airway injuries that the worst prognoses occur, as severe airway injuries are hidden until a late stage and the patient deteriorates rapidly, especially following blunt trauma.

Penetrating laryngeal trauma is extremely rare in sport and is usually the result of a stabbing injury or gunshot. Management of penetrating laryngeal trauma is usually superior to that of blunt trauma as the injury is more obvious and airway management is commenced more rapidly.

2. Case report

A 14-year-old county-level rugby player sustained a blow to the anterolateral aspect of his neck whilst attempting to tackle an opposing player running at speed during a match. The player immediately complained of anterior neck pain but was able to stand before medical assistance arrived and continued to play the remaining few minutes until the half-time interval. During the interval, the player noted odynophagia and dysphagia whilst drinking water and the covering medical staff were asked to review the player.

2.1. Initial assessment

On initial assessment of the airway there was no stridor and the patient was able to speak in full sentences, albeit with a hoarse, quiet voice and occasional harsh cough. It was also noted that there was marked anterior neck swelling but no bruising. The patient was moving his neck freely with no misalignment, with a pain free full range of motion and did not exhibit bony tenderness. Despite this, the cervical spine was immobilised as an injury could not be completely ruled out. There was no increased effort of breathing and on auscultation there was air entry throughout with oxygen saturations of 94% on air and no deviation of the trachea. No record of respiratory rate was kept. The patient’s heart rate was 86 beats/min and they were warm, well perfused with a normal colour in the extremities and a capillary refill of less than 2 s. There were no signs of significant external or internal haemorrhage. Glasgow Coma Scale rating was noted to be 15.
Table 1
Attachments of the hyoid bone.

<table>
<thead>
<tr>
<th>Superior</th>
<th>Inferior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle pharyngeal constrictor muscle</td>
<td>Thyrohyoid muscle</td>
</tr>
<tr>
<td>Hyoglossus muscle</td>
<td>Omohyoid muscle</td>
</tr>
<tr>
<td>Digastric muscle</td>
<td>Sternohyoid muscle</td>
</tr>
<tr>
<td>Geniohyoid muscle</td>
<td></td>
</tr>
<tr>
<td>Mylohyoid muscle</td>
<td></td>
</tr>
</tbody>
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2.2. Secondary survey

After undertaking an initial assessment, it was noted that there was significant, progressive swelling to the anterior aspect of the neck, although no bruising or broken skin was noted. Upon palpation, crepitus was evident within the swelling but there was no bony tenderness to the face or chest.

The initial assessment was repeated and there were no changes noted except for a decrease in the oxygen saturations to 90% on air, although this was not associated with increased work of breathing. Due to the presence of emphysema and the mechanism of injury it was suspected that the cause of the decreased saturations was a pneumothorax.

2.3. Pre-hospital management

In view of the worsening oxygen saturations, 100% oxygen at 15 l/min was commenced and bilateral intravenous access was obtained. A decision was made not to intubate the patient as the level of the fracture or tear was not known. This combined with the effect of ventilation on the likely pneumothoraces would require increasing levels of ventilation pressures to maintain oxygenation, resulting in a vicious cycle as the increased levels required subsequently worsened the surgical emphysema and pneumothoraces. In an attempt to decrease the swelling and stop any bleeding, IV hydrocortisone (200 mg) and nebulised adrenaline (1 mg) via a portable nebuliser were given.

Plain lateral radiograph and computed tomography images later identified a fracture of the hyoid bone, which had not been identified or suspected by the medical staff providing the initial management. The child made a full recovery and has recently been accepted into the academy of a local Premiership team.

3. Discussion

3.1. Initial assessment

This case report highlights many issues involved in caring for patients who have suffered from laryngeal trauma. The “C-spine, ABCDE” approach taken by the medical staff provides a good assessment of the patient that deals with complications according their severity.5,8 The medical staff continuously reviewed their assessment to ensure that changes in the condition of the patient were highlighted and acted upon. This is essential in the management of laryngeal trauma and hyoid fractures as severe airway injuries can initially be hard to detect and medical management may focus on other consequences of the trauma, causing failure to notice the worsening airway until a late stage. Early diagnosis of these airway injuries leads to better outcomes in voice and airway patency.5,8

Various case reports have highlighted the need for all anterior neck trauma to be treated with great caution, even if no dysphagia, voice changes, neck pain or other symptoms are present.8,7,12,27,29,30 This is due to the risk of airway compromise and the rapid, catastrophic consequences that can occur. Any patient suffering laryngeal trauma who exhibits signs of respiratory distress or stridor necessitates a definitive airway.8,9 These definitive airways include laryngeal mask airways, nasopharyngeal airways, cricothyroidotomy, tracheal intubation and tracheostomy. Despite the unanimous consensus that “suitable” airway management is essential, there is disagreement over the optimal form of management, especially in cases such as ours where no respiratory distress or stridor is evident.3,8,14,18,20,22

A laryngeal mask airway was not used for several reasons. In addition to being contraindicated when the anatomy is distorted10 (due to decreased efficacy and the potential to worsen the injury), it was unknown at what level the fracture/tear had occurred. This could have resulted in an airway intervention that did not reach below the level of injury, rendering it useless and potentially worsening symptoms. Nasopharyngeal intubation10 and cricothyroidotomy9 are not advised in cases of suspected upper airway injuries as they can exacerbate the injury and so were not considered.

The decision faced in this scenario of whether to perform tracheal intubation is a difficult one and as the patient was immediately intubated on arrival at the accepting hospital the question is raised as to whether this should have occurred sooner. There was concern that if the patient was ventilated, the increased pressure in the lungs could cause the surgical emphysema to worsen. Although there were signs of airway compromise, there was no guarantee that intubation would improve the condition of the patient as the emphysema and pneumothoraces may worsen with ventilation, requiring increased ventilator pressures which would lead to further worsening of the aforementioned problems. Additionally, tracheal intubation is difficult to perform whilst preserving the cervical spine by individuals who are not highly skilled at it9,10 and so is not recommended unless adequate kit and highly trained individuals are available.9 Intubation can also have long-term implications for the patients including changes in voice (which is not always resolved with voice therapy) and stenosis of the airway, which often requires the patient to undergo a tracheostomy for pulmonary toilet.9

Tracheostomy is often regarded as the optimal airway management intervention in cases of laryngeal trauma but requires a highly skilled, senior ENT or emergency medicine professional to perform the procedure. It is therefore is rarely used pitchside.

Therefore despite the consensus that “suitable” airway management must be carried out, there are advantages and disadvantages to every intervention and the “optimal” airway management may vary within the timeframe of the incident as the condition of the patient changes or other complications become apparent.

3.2. Medical supplies

The medical staff attending this injury was in possession of medical kit which met the Rugby Football Leagues (RFLs) “minimum standards of equipment” and the RFLs approved “emergency drug box”. This meant that corticosteroids could be given promptly, which has been shown to greatly improve patient outcomes (voice, airway patency) in the management of laryngeal trauma.1,9,19 Standardisation of kit amongst medical teams ensures that staff have an easy access to essential drugs and that these drugs have not expired.11,23

3.3. The multi-disciplinary approach

Due to the complexity of the injury and the low incidence in the UK, no member of the pitchside medical team was fully confident in managing the patient alone and so a multi-disciplinary approach was essential. Good communication was essential to the successful management of this patient as each
member of the team utilised their strengths and acknowledged their weaknesses to discuss management and ensure that a suitable plan was constructed and implemented. Senior opinion from the receiving hospital was sought where individuals felt more expertise was needed and a detailed handover to the paramedics was provided. This was essential to ensure that the receiving hospital staff were fully aware of the management which had been undertaken on the pitch. This avoided unnecessary, and potentially dangerous, duplications of medication. It also ensured that the receiving staff were able to assess if there had been any changes in the patient’s situation since the initial management by pitchside staff.

3.4. Training of medical staff

The medical staff involved in this case all possessed up-to-date pitchside trauma qualifications including “Immediate Medical Management On the Field of Play” (IMMOPF). Although no studies have investigated whether athlete outcome measures are improved by undertaking such courses, evaluation forms indicate that participants feel “more confident with planning for and managing pre-hospital sports critical care situations”.1,7 Participants of these courses are more able to make evidenced based management decisions and utilise skills such as intubation, although these abilities decline with time.1,2,4 It is therefore essential that “refresher” sessions are undertaken to ensure that individuals are able to manage patient effectively at the pitchside, especially for rare injuries where practitioners will not have first-hand experience of but can apply principles learned from the courses.

Guidelines developed from aviation safety investigations and implemented in high-stress situations such as operating theatres have shown that where staff are aware of one-another’s names, roles and responsibilities from the start, errors are greatly reduced.6,21,24 This was not possible at this incident as the team was assembled at short notice utilising expert members of the crowd as it was an amateur, youth rugby match. Medical staff should be aware of their roles in an emergency prior to the event starting and ensure that everyone is aware of local facilities (neurology, departments, etc.) as well as where equipment is stored on-site. These measures would lead to an improvement in the co-ordination of emergency pitchside management and a reduction in the number and severity of errors that occur.6,21,24

4. Conclusions

Although fractures of the hyoid bone are extremely rare, any injury to the larynx must be viewed as a serious injury and treated with a high index of suspicion. Patients with seemingly minor laryngeal injuries can deteriorate rapidly and consequently there is a high pre-hospital mortality associated with hyoid fractures. Despite the severity of this injury, evidence is relatively limited on initial management, mainly due to the high rates of mortality and the ease in missing hyoid bone fractures, particularly when the cervical-spine is immobilised.

“Suitable” airway management is essential but as there are no definitive guidelines for which method to use in laryngeal trauma but the ultimate aim of management should be focused on restoring the continuity of the airway where compromise has occurred. It is therefore essential that medical staff has up-to-date training in pitchside trauma. This allows them to exercise informed judgement when choosing an airway intervention using skills and evidence-based knowledge gained from the courses, whilst operating within their competency level. These qualifications should be kept up-to-date to ensure that practitioners do not become “deskilled”. When managing injuries such as hyoid fractures that are relatively scarce, staff must utilise the individual skills of their team and communicate with external resources (local hospitals, etc.). Good communication with receiving hospitals is also vital to ensure that they recognise the potential severity of the injuries and are aware of clinical findings/management that has occurred prior to their arrival at hospital. The availability of adequate medical kit to manage the patient at events where high force laryngeal trauma can occur is also essential and the RFL has guidelines and requirements covering medical kit. In addition, principles applied in operating theatres to reduce error should be implemented at all sporting events to ensure optimal co-ordination of management in emergency, high-stress situations. These include ensuring that all medical staff are aware of their various roles and responsibilities.

Consent

Consent was obtained from the patient to have their management written up and presented.

References


