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Blunt external trauma to the trachea: report of two cases

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Abstract. *Blunt external trauma to the trachea: report of two cases.* We present two cases of blunt external trauma to the trachea. The first was a 19-year-old man who had suffered rupture of the first tracheal ring as a consequence of attempting suicide by hanging from a cable. The second was an 11-year-old boy who fell from a bicycle and struck his neck against the handlebars. Fracture of the second tracheal ring was found at surgery. Both cases were treated by primary repair. A surgical exploration is essential in the case of subcutaneous emphysema, even if no respiratory distress is present and a radiological evaluation is negative. Follow up, according to the extent and type of injury, is recommended to prevent post traumatic stenosis of the trachea.

Introduction

The overall incidence of aerodigestive trauma is 4.9%. Laryngotracheal trauma forms approximately one third of aerodigestive trauma.[1] Blunt aerodigestive trauma has an incidence[1] of 1.2%. Location of the trauma, delayed diagnosis, associated trauma, and limited surgical experience due to the rarity of these injuries are the major factors of high mortality.[2] Two case reports of blunt external trauma to the trachea are presented in this article. A diagnostic and therapeutic approach is discussed.

Figure 1
CT of the trachea at the level of the first tracheal ring in *Case 1*. No fracture is seen, but massive emphysema is present.

Case reports

Case 1

A 19-year-old man was admitted to the intensive care unit (ICU) of our hospital in May 2003 following a suicide attempt by hanging from a cable. After resuscitation his spontaneous breathing was normal, but massive subcutaneous emphysema of the neck was present, spreading to the anterior wall of the chest and up toward the cheeks and eyelids. After orotracheal intubation the emphysema ceased spreading. The patient had a clearly visible strangulation groove around his neck. A computed tomogram (CT) of the larynx and trachea revealed massive emphysema but no fracture (Figure 1).

A surgical exploration was performed: rupture of the first tracheal ring was found (Figure 2). The rupture involved two-thirds of the tracheal circumference and was sutured initially. The patient's head was fixed to the neck in a flexed position. An endotracheal tube was left in the trachea for

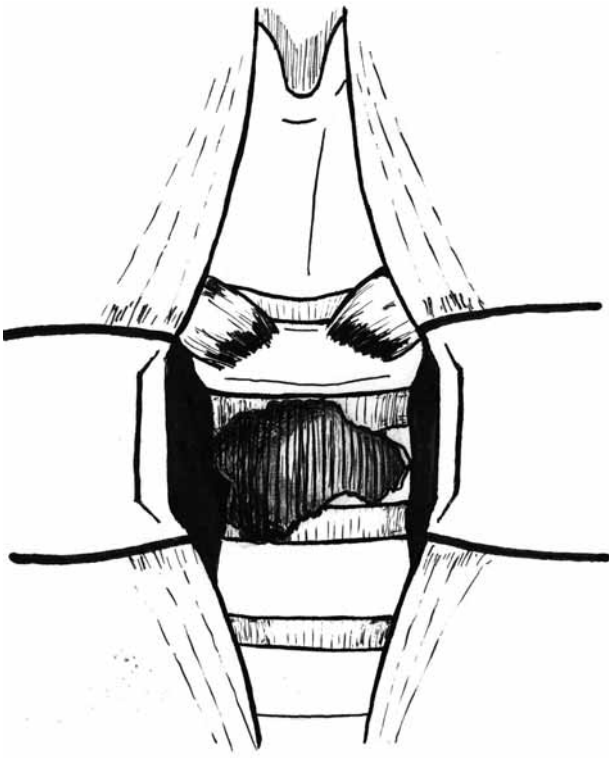

Figure 2
Drawing of ruptured first tracheal ring in *Case 1*

Figure 3
A skin wound on the anterior neck in *Case 2*

5 days. He regained full consciousness within two days but was kept under sedation three further days of intubation. Cefuroxime 1,5 g, metronidazole 1 g, and gentamicin 480 mg were administered intravenously daily for nine days. On the fifth post-operative day, the patient was able to take oral medications and began a prednisone taper starting with 40 mg orally daily, and decreasing by 10 mg every five days. Laryngotracheoscopy was performed on the fourth and eighth days after the operation. Preoperatively neither flexible nor rigid laryngotracheoscopy was performed, because of the presence of massive, progressive emphysema, and a gradual deterioration in inspiratory breathing. More specifically, granulation tissue on the anterior tracheal wall obstructed air flow and formed a scar. Once his respiratory status improved, the patient was transferred from the ICU to our ward, and underwent psychiatric examination and rehabilitation of the neck. He was discharged on the 21st post-operative day. He was prescribed corticosteroids in a gradually decreasing dose for a few weeks after his discharge. Laryngotracheoscopy two months after discharge showed that the stenotic granulation tissue had disappeared.

Case 2

An 11-year-old boy was admitted to the paediatric ICU in June 2003 following a fall from a bicycle when he struck his neck against the handlebars. On admission he was found to be suffering from dyspnoea and was cyanotic. His neck was swollen, but his breathing improved. He had horseshoe-shaped skin wound on the anterior neck, (Figure 3) with swelling and emphysema of the neck. A submucosal haematoma was present in the subglottic space. Urgent surgical treatment was indicated. No endoscopy was performed preoperatively in order to avoid compression of the airways due to progressive emphysema, and to treat the open wound as quickly as possible. Fracture of the second tracheal ring in the midline was revealed (Figure 4) and the defect was sutured initially. Amoxicillin/clavulanate 1.8 g intravenously, gentamicin 480 mg intravenously, and metronidazole 500 mg orally were administered daily for six days. No corticosteroids were administered because the injury was small. The patient was discharged on the sixth post-operative day. An endoscopic evaluation two weeks later showed normal healing without stenosis. No further follow up was required.

Discussion

For clinical purposes, the neck is divided into three regions.[2] The

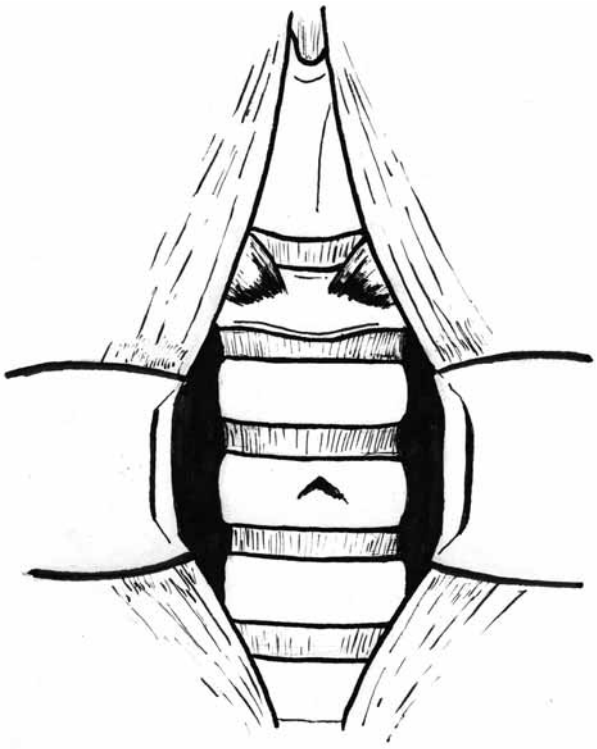

Figure 4
Drawing of the fractured second tracheal ring in *Case 2*

trachea is situated at the base of the neck (region 1) together with the great vessels, aortic arch, oesophagus, lung apices, cervical spine, spinal cord and cervical nerve roots. The region is bounded inferiorly by the thoracic inlet and the cricoid cartilage superiorly. It is only partly protected by flexion of the neck. Due to the high concentration of critical structures within this region, the prognosis following traumatic injury is poor. Region 2 encompasses the midportion of the neck from the cricoid cartilage to the angle of the mandible. Region 3 is bounded by the angle of the mandible and the base of the skull.

Blunt external trauma to the trachea typically results from motor vehicle accidents (dashboard or steering column injury), sport related injuries, blows from fists or feet, strangulation, or excessive manipulation (e.g. repositioning of the spine).

Strangulation may result from hanging, ligature suffocation, manual choking and postural asphyxiation. However, the major cause of death in hanging is cervical spinal disruption, not simple asphyxiation. The trachea may be damaged by a sudden increase in intratracheal pressure against a closed glottis or a rapid acceleration-deceleration action.

Tracheal injuries include minor endotracheal, submucosal haematoma, and longitudinal, or transversal lacerations of the membranous portion of the trachea. Serious trauma to the trachea usually results in partial rupture, particularly at the laryngotracheal junction, or total rupture of the trachea, more frequently in its thoracic part.[3]

The presence of symptoms is not always diagnostic of tracheal injuries: only 15% of symptomatic patients have significant injuries requiring treatment.[1] Presenting symptoms of blunt tracheal trauma include dysphonia (frequently associated with a recurrent nerve injury), emphysema, haemoptysis, dyspnoea, tachypnoea and stridor. Pulmonary oedema and aspiration pneumonia are recognised, delayed complications.[4] When dyspnoea and bleeding occur, urgent surgical exploration is necessary.[5,6] In our opinion, massive progressive emphysema is another indication for surgery. Cervical vertebral fractures and dislocations, perforation of the pharynx and oesophagus and vascular injuries must be excluded as well.[7]

In stable patients, after the airways have been evaluated, a radiological evaluation and endoscopy may be performed. CT is generally preferred, but is not always reliable. As noted in the first case report, the extent and type of injury dictate how useful the imaging study is. Fiber optic endoscopy is recommended for suspected laryngotracheal injuries.[1,8] In both of our cases, no preoperative endoscopic evaluation was performed because progressive emphysema and compression of the airways prompted immediate surgical exploration. Our preferred follow up after surgery was rigid laryngotracheobronchoscopy.

Treatment of the blunt external tracheal trauma involves medical and surgical approaches. For minor injuries such as haematoma or small longitudinal ruptures of the posterior tracheal wall without associated injuries to the oesophagus; medical therapies including antibiotics and corticosteroids may be adequate.[9,10] Treatment of

an attempted hanging injury should include cerebral oxygenation, lowering intracranial pressure, and treating respiratory distress.[4]

Surgical management includes initial suture in cases of partial rupture. A total rupture or laryngotracheal separation is treated by end-to-end anastomosis or endotracheal stenting. A silicone T-tube or Lorenz tracheal stent could be inserted.[11,12] However, this unusual injury usually results in immediate death, except in a few reported cases.[13,14] Tracheotomy is recommended in the case of laryngotracheal injury or injury of the upper trachea. We consider tracheotomy necessary if primary suture is not possible. Surgical treatment may not be delayed if the injury is life threatening. Postoperative follow up is required to assess for tracheal stenosis, and guides the decision to perform laser or reconstruction surgery. Documenting permanent voice changes is also important.[15]

Even with adequate treatment, the prognosis of tracheal injury is poor. Combined tracheoesophageal injuries are associated with a high incidence of local complications, up to 74% in some series.[1] The prognosis is even worse if the injury is in region 1, if associated injuries are not found immediately, and, in the case of strangulation, if asystole occurs and the Glasgow coma score is less than 3.

Conclusions

Correct and early diagnosis of the tracheal trauma and associated injuries are necessary for successful management. In a stable patient with subcutaneous emphysema, surgical exploration is preferred, even if the CT is negative. Follow up is recommended to prevent stenosis of the trachea.

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