Fracture of the cricoid cartilage after Sellick’s manoeuvre

K. J. Heath, M. Palmer and S. J. Fletcher

Summary

We report a case of fracture of the cricoid cartilage associated with cricoid pressure during rapid sequence tracheal intubation in a patient with status asthmaticus. This patient had a history of laryngeal trauma 48 yr previously. Fracture of the cricoid cartilage has not been reported previously after cricoid pressure. (Br. J. Anaesth. 1996; 76: 877–878)

Key words

Larynx, cricoid pressure. Complications, fractured cricoid cartilage.

Case report

A 67-yr-old man was admitted to hospital suffering from acute exacerbation of bronchial asthma. He had a long-standing history of asthma and chronic obstructive airways disease and had been treated with bronchodilators and inhaled steroids for many years. He had been in hospital for 48 h when his condition worsened and he became progressively hypoxic and hypercapnic, despite nebulized salbutamol therapy; he developed a “silent” chest with arterial blood–gas tensions of $P_{aCO_2}$ 15 kPa and $P_{aO_2}$ 8.5 kPa on an inspired oxygen fraction of 0.6. The decision was made to perform tracheal intubation and intermittent positive pressure ventilation. He was transferred to the intensive therapy unit and tracheal intubation was carried out by an anaesthetic senior registrar using ketamine 1 mg kg$^{-1}$ and suxamethonium 1 mg kg$^{-1}$, with an experienced operating department assistant (ODA) performing cricoid pressure. Intubation was easy, with a grade 1 [1] view of the larynx, and a size 9 cuffed oral tracheal tube was passed. The patient underwent intermittent positive pressure ventilation requiring inflation pressures of up to 35 cm H$_2$O, and was treated with bronchodilators and hydrocortisone. A chest radiograph performed shortly after tracheal intubation revealed slightly hyperinflated lungs and the tracheal tube in a satisfactory position; there were no other abnormalities on the chest radiograph.

The patient made a rapid recovery and 24 h later was assessed as being ready for extubation. Almost immediately after extubation the patient developed marked inspiratory stridor, severe hypoxia and suffered a brief cardiopulmonary arrest. His trachea was re-intubated rapidly by an anaesthetic senior house officer and cricoid pressure was applied by an experienced intensive care nurse. On this occasion the larynx was difficult to see initially; however, a good view of the vocal cords was obtained by repositioning the patient’s head. The laryngeal structures were noted to be swollen but not markedly, a size 9 cuffed oral tracheal tube was reinserted and the lungs ventilated again, requiring inflation pressures of 30–36 cm H$_2$O. Another chest radiograph was obtained shortly after re-intubation; this showed a possible mediastinal mass that could have accounted for the marked stridor after extubation. The tracheal tube was noted to be in a satisfactory position, level with the fifth thoracic vertebra, and there were no signs of barotrauma or surgical emphysema to account for the patient’s difficulty in breathing.

The patient was investigated further for a mediastinal mass because he was noted to have generalized swelling of his neck and dilatation of the veins of his chest and upper extremities, consistent with a possible diagnosis of superior vena cava obstruction. It was suggested that a mediastinal mass could have accounted for the marked inspiratory stridor immediately after extubation and the clinical signs. A limited CT scan of the patient’s upper mediastinum, however, showed no abnormalities and when the chest radiograph was reviewed by a consultant radiologist it was reported to show some increased shadowing at the left lung base, but no other abnormal findings. Fibreoptic bronchoscopy was also performed which showed a normal tracheobronchial tree, the larynx was not examined fibreoptically as the tracheal tube was positioned below the larynx and it was not felt necessary to withdraw the tube to examine the larynx.

It was difficult to wean the patient from the ventilator and he underwent a formal tracheotomy performed by an ENT senior registrar on day 8 after admission to the intensive care unit. At operation the surgeon reported that the cricoid cartilage was partially calcified and that there was an undisplaced fracture to the left of the midline of the cricoid arch. The surgeon suggested that the fracture may have been caused by cricoid pressure.

The patient made a slow recovery from his asthma attack and was eventually discharged to the ward breathing spontaneously through his tracheostomy. When the patient had recovered sufficiently to provide a full history, he denied any recent trauma;...
however, on further questioning he admitted that he had been in hospital when aged 19 yr after an accident where he had managed to partially hang himself. He had also sustained direct blunt trauma to his larynx 20 yr previously during a caravanning accident but had not been hospitalized on that occasion.

We suggest that the fracture of this patient's cricoid cartilage may have been caused by Sellick's manoeuvre in the presence of a weakened cricoid cartilage associated with the hanging accident when the patient was 19 yr of age and possibly with later more minor laryngeal trauma. This patient's long-term steroid therapy may also have caused some weakening of the cricoid cartilage. Inspiratory stridor after extubation could have been caused by either oedema associated with fracture of the cricoid cartilage or collapse of the fractured cricoid cartilage inwards on inspiration. The other possible causes for stridor after extubation were excluded, such as a mediastinal mass or surgical emphysema associated either with the fractured cricoid cartilage or baro-trauma from high airway pressures.

Discussion

Cricoid pressure was first described by Sellick in 1961 [2]. It is often difficult to judge exactly how much pressure to exert during Sellick's manoeuvre. Sellick referred to "firm" pressure in his original article [2] and "the pressure which would cause pain if applied to the bridge of the nose" has also been suggested [3]. A force of 44 N [4] applied to the cricoid ring pressing back against the bodies of the cervical vertebrae has been shown to be effective in protecting the majority of adult patients from regurgitation of gastric contents.

There are several potential complications associated with cricoid pressure, such as rupture of the oesophagus should vomiting occur during the manoeuvre or aggravation of cervical spine injury. Incorrectly applied cricoid pressure can distort the view of the larynx making tracheal intubation difficult. Complete airway obstruction has been caused by Sellick's manoeuvre [5] in a patient undergoing rapid sequence induction of anaesthesia with an undiagnosed lingual thyroid that resulted in supraglottic obstruction when cricoid pressure was applied. There has also been a case of airway obstruction after cricoid pressure in a patient with undiagnosed traumatic injury [6]. In this case the laryngeal injury was acute and the resulting airway obstruction required urgent surgery.

Our case is unique in that the patient underwent tracheal intubation for medical reasons and there was no acute trauma to the larynx. Intubation was carried out by a senior anaesthetist with an experienced assistant in order to minimize any complications, with what was essentially an emergency procedure in a patient in extremis; it would have been unlikely in these circumstances that cricoid pressure would have been applied incorrectly. It has been demonstrated, however, that there is a wide variation in force applied to the cricoid ring during cricoid pressure, even by experienced staff. Pressures applied have ranged from 10.8 to 120.6 N [7]. Laryngotracheal injury is rare, requiring considerable force. It would be highly unlikely, even if cricoid pressure was applied too forcibly, that a fracture could occur in a normal cricoid cartilage. Eighty percent of laryngeal injuries and 90% of fractures, dislocations and separation of the laryngotracheal skeleton are caused by significant, high velocity blunt trauma sustained during road traffic accidents [8]. These high velocity injuries are often associated with multisystem trauma and cervical spine injury. Fracture of the thyroid cartilage is the most frequently encountered injury to the larynx, while fracture of the cricoid alone is unusual; in most cases fractures of the cricoid cartilage also involve the trachea or the thyroid cartilage. Underlying weakness of the cricoid ring was therefore highly likely in our patient.

Hanging is the other main recognized cause of laryngeal trauma [9], and we suggest that our patient had a weakened cricoid cartilage or even an ununited fracture as a result of his hanging injury at 19 yr of age. In a series of 80 consecutive cases of death caused by hanging, 45% were associated with laryngeal trauma. In this series, however [9], the cricoid cartilage was never fractured and there were no fractures of the larynx in subjects less than 25 yr of age. The second injury to this patient's neck occurred 20 yr ago, but did not result in hospital admission; as significant force is required to fracture the cricoid cartilage it is unlikely that the cricoid ring was fractured at that time. We postulate, therefore, that the old injuries to this patient's larynx together with long-term steroid therapy caused weakening that resulted in fracture of the cricoid cartilage when routine cricoid pressure was applied during rapid sequence tracheal intubation for status asthmaticus.

References