

Tracheal rupture after tracheal intubation

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SUMMARY

We report a case of tracheal rupture in an 84-yr-old patient after tracheal intubation. The aetiology and treatment are discussed and the recent literature is reviewed. (Br. J. Anaesth. 1994; 72: 705-706)

KEY WORDS

Intubation, tracheal: complications. Complications: intubation tracheal.

Tracheal injury is a well known but rare complication of tracheal intubation. We report successful repair in an octogenarian, 6 days after injury.

CASE REPORT

An 84-yr-old woman (non-smoker), was referred to our cardiothoracic unit with increasing surgical emphysema. Six days before transfer, she underwent cataract extraction under general anaesthesia. The anaesthetic team reported straightforward intubation with an 8-mm RAE tube; a stylet was not used. The tracheal tube had a high volume low pressure cuff which was inflated with minimal pressure to prevent air leak. Anaesthesia was maintained with nitrous oxide and isoflurane in oxygen for approximately 45 min. While the lungs were ventilated, airway pressures were normal throughout and oxygen saturation remained at approximately 96%.

The postoperative course was unremarkable, apart from a sore throat on awakening. She was discharged home the next day only to be re-admitted later that evening with surgical emphysema. Chest x-ray showed mediastinal emphysema but no pneumothorax. There was no respiratory embarrassment. She was given 60% oxygen and ampicillin-flucloxacillin (Magnapen). Surgical consultation led to a barium meal which showed a normal oesophagus. However, the emphysema progressed. Fibre-optic bronchoscopy showed a tear in the distal trachea. She was referred to us for further management.

On admission to our unit, she had impressive surgical emphysema involving the upper half of her body and she was unable to open her eyes. She was breathing comfortably and chest x-ray was normal, apart from mediastinal and extensive subcutaneous emphysema.

The patient was taken to the operating theatre and anaesthesia was induced with propofol, fentanyl and 100% oxygen. She was allowed to breathe spon-

taneously and the vocal cords were sprayed with 10% lignocaine. Anaesthesia was maintained with an infusion of propofol and fentanyl. A rigid bronchoscope was passed after administration of suxamethonium 50 mg i.v., as the jaw was inadequately relaxed. Oxygen saturation remained at 99% throughout. The mass apnoeic oxygenation technique was used. Bronchoscopy revealed a 5-cm tear on the right edge of the membranous part of the trachea, extending to the carina. When the bronchoscope was withdrawn, an 8-mm high volume low pressure cuff was passed, making sure that the distal end of the tracheal tube was well above the tear. This was checked with a fibreoptic intubating flexible laryngoscope.

Anaesthesia was continued with an infusion of propofol and fentanyl. The patient breathed 100% oxygen spontaneously to avoid excessive pressure in the trachea. She was placed in the left lateral position. End-tidal carbon dioxide, ECG, oxygen saturation and arterial pressure were monitored continuously. A right posterolateral thoracotomy was performed, which revealed a superior mediastinal air sac. When this was opened, a massive air leak resulted, necessitating left endobronchial intubation. This was accomplished without difficulty using a medium-sized left Robertshaw's tube and the right lung was isolated.

Atracurium 30 mg was given at this time and the lungs were ventilated using a Siemens Servo 900 D ventilator. The 5-cm tracheal tear was found to have well defined edges and there was no evidence of mediastinitis. Multiple interrupted sutures (3/0 Vicryl) were placed. The endobronchial tube was withdrawn to enable tension-free approximation of the edges and was replaced by a soft cuff single lumen tube with the patient still on her left side. At the end of the procedure, a cryo-probe was applied to five intercostal nerves and the chest closed. Residual neuromuscular block was antagonized and the trachea was extubated.

The patient's postoperative course was uneventful but she was given 50% oxygen therapy until surgical emphysema disappeared. She was discharged home after 10 days and was well when reviewed at the outpatients clinic 8 weeks later. She had no stridor and chest x-ray was normal.

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DISCUSSION

Although conservative treatment has been reported to be successful [1, 2], because of the technical ease of the procedure and the immediate cure it provides with early mobilization, a surgical approach was selected for this patient after the pathology was ascertained at bronchoscopy. Repair would have been more strongly indicated had the patient been bronchitic with a chronic cough or if the sputum had been infected. Conservative management might have been favoured had the tear involved the left side of the trachea, as exposure would have been poor. Tracheotomy was not performed as the tissues were healthy and excessive postoperative coughing was not anticipated.

The presentation (pneumomediastinum and surgical emphysema without pneumothorax) was typical of tracheal rupture [3]. In this patient, surgical emphysema was extensive enough to exclude oesophageal rupture. The other differential diagnosis, alveolar rupture, could present in the same manner, but in this patient was excluded by the findings at bronchoscopy. Rigid bronchoscopy offers the best means of identifying and defining the extent of such tears because air insufflation, distending the trachea, displays the laceration.

We know of 16 tracheal ruptures reported with intubation [1, 2, 4–8]. When reviewed, only one was related definitely to cuff over-distension, in which pressurized oxygen was inadvertently connected to the cuff [8]. In one patient, in which the tube was a red rubber Magill with a cuff known to eccentrically inflate posteriorly, there was, in addition, nearby dissection of the oesophagus and either or both of these causes may have been responsible for the tear [2]. In the other 14 patients, the mechanism was speculative. In the five cases reported by Rollins and Tocino, where an increase in horizontal diameter of the cuff was documented by chest radiograph and a diagnosis of tracheal rupture proved afterwards at bronchoscopy, the cuff pressures did not exceed 23 cm H₂O before or after the distended cuff was observed [6]. If the tear had resulted from other causes, a previously normally inflated cuff would expand to occupy the new diameter. Hence documentation of increased cuff volume on x-ray alone, does not necessarily indicate over-distension of the cuff as the cause of the tear.

In our patient, tracheal intubation was atraumatic and a stylet was not used. The finding of a clean, sharp-edged tear at exploration excluded the blunt end of the tracheal tube as a cause and there was no obvious pathological abnormality of the trachea as a predisposing factor. The cuff may have been over-inflated [2, 8] or there may have been a sudden increase in intrabronchial pressure. Rupture from an

over-distended cuff seems unlikely in this patient because of the position of the tear. Had the tear occurred during tracheal intubation, positive pressure ventilation would have caused surgical emphysema to appear before 36 h. Therefore, we believe that the injury was caused by a sudden increase in intrabronchial pressure, possibly at the time of extubation, when many patients cough.

That part of the trachea distal to the cuff has the widest diameter of the tracheobronchial tree, which makes it the most sensitive section to increased intraluminal pressure in the patient whose trachea is intubated. Under normal circumstances, the volume of gas in the trachea cushions the effect of increased airway pressures after a sudden cough. This is reduced with intubation to 3.8–5.2 cm between the cuff and the carina, an area which appears to be inherently predisposed to injuries; of the tracheal injuries reported after blunt chest trauma, 80% occur in this region [9]. The reported cases in the literature are predominantly in females and the injuries have affected mostly the anatomically less supported right side. This seems to support tracheal weakness as an additional predisposing factor.

The delay in presentation could be explained by the fact that the peritracheal fascia may have prevented a significant air leak in spite of the tracheal tear, at least for some time and, as she did not suffer from chronic obstructive airways disease and did not have a cough, her airways pressure would have remained low, reducing the tendency for surgical emphysema to develop.

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