

Management of massive air leak following intubation injury in a very low birth weight infant

R. Méndez^{1*}, A. Pensado², M. Tellado¹, I. Somoza¹, J. Liras³, E. Pais² and D. Vela¹

¹Departments of Pediatric Surgery, ²Pediatric Anaesthesia and ³Neonatal Intensive Care, Children's Hospital 'Teresa Herrera', Complejo Hospitalario 'Juan Canalejo' 15006, As Xubias 84, A Coruña, Spain

*Corresponding author

Perforation of an infant's trachea after orotracheal intubation for general anaesthesia is a rarely described serious complication. This article reports an unusual case of laceration of the trachea in an 8-week-old infant with a history of prolonged neonatal intubation needed to treat hyaline membrane disease. After diagnosis the tracheal injury was managed conservatively. Factors involved in the occurrence of the injury and its management are discussed.

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Tracheal laceration after orotracheal intubation in children is a rare but potentially devastating complication. Clinical signs and symptoms result from a major air leak into the mediastinum, bilateral pneumothorax, subcutaneous emphysema and occasionally pneumoperitoneum.^{1 2} Elective management usually consists of early surgical repair of the tracheal lesion. Few reports describe non-operative treatment of intubation-related tracheal injuries.^{3–6}

Case report

An 8-week-old, 2850 g, female infant with retrolental fibroplasia presented for cryotherapy of an avascular retina. The patient was a product of a twin pregnancy with an extremely low birth weight (1030 g). Severe respiratory distress (hyaline membrane disease) required tracheal

intubation and mechanical ventilation (for one month). At the time of the procedure, the respiratory status of the patient was stable, and supplementary oxygen was not needed. The baby was brought to the operating theatre and routine monitors (pulse oximetry, arterial pressure cuff, ECG and axillary temperature probe) were placed. The infant was pretreated with i.v. atropine followed by inhalation induction with oxygen, nitrous oxide and isoflurane. Pancuronium was used for neuromuscular blockade. Direct laryngoscopy revealed altered anatomy of the upper airway (laryngeal asymmetry and displacement, with fibrosis and scar tissue adjacent to the vocal cords). At the fourth attempt an uncuffed rubber tracheal tube (internal diameter 3 mm) was passed into the trachea, which offered more resistance than usual. After manual ventilation and confirmation of the correct position of the tube, mechanical ventilation was begun using a peak

inspiratory pressure of 24 cm H₂O. Within minutes of the intubation procedure, cervical subcutaneous emphysema, cyanosis and pneumoperitoneum were noted. Based on the clinical signs, tracheal rupture was suspected and the trachea was extubated immediately. The trachea was reintubated with a siliconized polyvinylchloride uncuffed tube (internal diameter 2.5 mm). The tube was passed into the right main bronchus and gradually withdrawn in order to leave it in the carina, just below the suspected lesion. Mechanical ventilation was reinstated and the patient's lungs were ventilated with an oxygen/air mix ($F_{I_{O_2}}$ = 70). Radiological examination revealed bilateral pneumothoraces, pneumoperitoneum and pneumomediastinum. The pneumothoraces were drained, and the infant's condition improved. The postoperative course in the neonatal intensive care unit was uneventful but the child required mechanical ventilation of her lungs for 5 days, until the subcutaneous emphysema, pneumothoraces and pneumomediastinum had resolved. The ventilator was set to deliver synchronized intermittent mandatory ventilation with an initial peak inspiratory pressure of 25 cm H₂O and positive end-expiratory pressure of 2–3 cm H₂O. The baby was sedated with midazolam and fentanyl until extubation. Ampicillin and tobramycin were used as antibiotic therapy. She made a full recovery and left the hospital 3 weeks after extubation, with no supplementary oxygen. Five years after this episode, the child is disease free and has no respiratory symptoms.

Discussion

Tracheal injuries in neonates and infants are a well-known but rare iatrogenic complication following tracheal intubation. Only 10 paediatric cases have been documented,^{7–15} while several more adult cases have been published.^{1–6,20} The lesions described in these reports were discovered either intraoperatively or within 24 h postoperatively. Most lesions were repaired surgically after diagnosis. Few reports describe successful non-operative treatment of these injuries.^{5,21,22}

There are several anatomical reasons why tracheal injuries can occur more frequently in children than in adults.^{3,23} Of greater concern are the consequences of prolonged tracheal intubation in neonates and premature infants who survive severe respiratory diseases. These chronic internal tracheal injuries lead to glottic and subglottic stenosis.^{9,24} Successive tracheal intubations in these patients can result in several complications but the most serious is tracheal perforation: 70% of the paediatric cases reported died. The most probable explanation for the tracheal rupture described here is that superficial injury of the mucosa was caused by the tube when it was passed through scar tissue.

In many of the cases reported, the tracheal rupture was diagnosed at autopsy. The clinical observation of sudden appearance of subcutaneous emphysema, pneumomediasti-

num and bilateral pneumothoraces following orotracheal intubation suggested disruption of the trachea in our case. It is important to note that a vigorous attempt at intubation, with excessive hyperextension of the head and neck, was made in our case because of the altered anatomy of the larynx. These factors and the summative effects of the previous chronic intubation are likely to be directly involved in the iatrogenic tracheal laceration.

Of the previous cases reported, surgical treatment was the elective therapy except in one case treated with a cuffed tube passed beyond the tracheal tear.⁶ In our case a cuffed tube was not necessary and the adverse findings progressively resolved after reintubation with an uncuffed tube passed beyond the tear. The other measures important in the conservative management of such cases include drainage of air, use of low ventilatory pressures, and sedation. High frequency ventilation may be beneficial when low pressures cannot be otherwise achieved.

In summary, it is important to emphasize that when performing tracheal intubation in a premature infant, care must be taken to avoid forceful attempts to introduce the tube through the trachea. Other preventive measures include the use of a satin-slip intubating stylet and avoiding hyperextension of the head and neck.¹⁵

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