

Difficult extubation: A rare cause

Sir,

Anaesthesiologist experiences several unusual situations in clinical practice. We share one such instance in which problem was encountered in extubating a patient post-operatively due to a manufacturing defect in endotracheal tube (ETT).

A 7-month-old baby was posted for emergency laparotomy for intestinal obstruction. Pre-anaesthetic evaluation was normal. After applying routine monitoring such as electrocardiogram, pulse oximeter and non-invasive blood pressure, patient was pre-medicated with intravenous (IV) injection glycopyrrolate, fentanyl and ondansetron. Patient was induced with IV ketamine and rapid sequence intubation attempted with no. 3.5 uncuffed ETT (polyvinyl chloride). Since, it was difficult to negotiate beyond glottis; patient was intubated with smaller ETT (no. 3.0) orally in the next attempt. ETT was fixed after confirming bilateral equal air entry, normal end-tidal carbon dioxide (EtCO₂), and 100% oxygen saturation (SpO₂).

Injection atracurium and isoflurane were used for maintenance. Patient was manually ventilated with Mapelson F circuit during the entire course of surgery keeping EtCO₂ near normal. Bag pressure required for ventilating also remained uniform intra-operatively. Patient was reversed with injection neostigmine and glycopyrrolate after the appearance of spontaneous respiratory efforts and motor activity of limbs. Oral suctioning was done, and as a part of our routine procedure, we checked the ability of the patient to maintain acceptable saturation on room air prior to extubation. To our surprise, SpO₂ dipped to 88-90% with laboured respiration. Mapelson circuit was immediately reconnected and 100% O₂ delivered with manual assistance. Chest auscultation revealed no added

sounds. ETT suction with infant feeding tube no. 8, inserted to the depth of 20 cm, was done to rule out probable obstruction of ETT by secretions. Attempt of room air trial was unsuccessful. ETT kinking in the oral cavity was ruled out by examination. Arterial blood gas and serum electrolyte reports showed no abnormality. Chest X-ray, done to rule out pneumothorax, pleural effusion and pulmonary oedema was normal. Meanwhile, oxygenation and manual ventilatory assistance continued to maintain normal SpO₂ and EtCO₂. While it was being discussed on further course of management, patient got extubated accidentally. Immediately patient was oxygenated with face mask and breathing circuit with 100% oxygen. To our surprise, respiratory efforts appeared to be normal and regular. Room air trial was attempted and found to be successful. We examined the ETT for possible obstruction. What we found was unusual – a crescentic projection in ETT lumen was revealed on ETT dissection, which was a result of manufacturing defect [Figure 1].

An ETT obstruction commonly occur from causes such as mucus plugs^[1] or blood clots.^[2] Infrequently manufacturing defects such as plastic meniscus in ETT lumen,^[3] defective connector,^[4] asymmetric cuff,^[5] or kinking,^[6] have also resulted in ETT Obstruction. Our case represents a manufacturing defect, which has not been reported so far.

In this case, we missed manufacturing defect on pre-operative examination because of three reasons. First, ETT selected had to be changed to smaller one in a hurry and thus escaped careful examination. Second, the small calibre of the tube limited ability

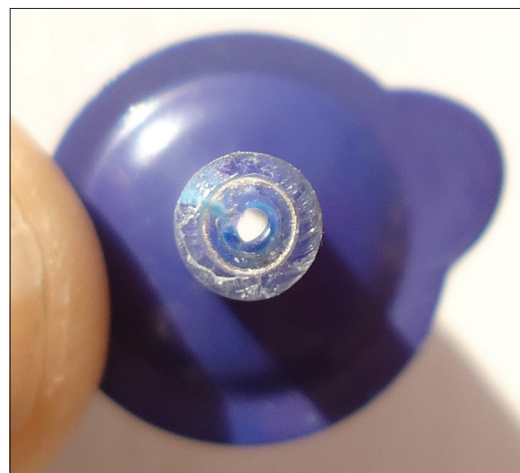


Figure 1: A crescentic projection in endotracheal tube lumen seen on cut section

of manual inspection. Finally, because of transparent nature of the manufacturing defect, it was not readily identifiable.

The principal cause for desaturation in the case was obstruction of endotracheal tube with a consequent increase in airway resistance. The total work of breathing in patient on spontaneous ventilation consists of the patient's own physiologic work of breathing and additional work in overcoming the resistance offered by the breathing circuit and ETT. This additional work of breathing is mainly determined by the inner diameter of the breathing circuit, and the ETT (the narrowest of all the tubings) creates the most significant resistance to air flow. ETT resistance to airflow depends, besides on tube length and curvature, primarily on its diameter. Poiseuille's equation for resistance during laminar flow ($R \propto (\eta \cdot L) / r^4$) states that resistance is inversely proportional to radius to the 4th power. Therefore, small changes in radius have a 16-fold effect on resistance. Thus, the manufacturing defect, though small, by narrowing ETT lumen has added to work of breathing.

The above case emphasises on careful exclusion of manufacturing defect in ETT and not just a casual look at the patency of ETT lumen even in emergency situations. Furthermore, though accidental extubation was a fortunate event in the current case, it may not be a welcome event during routine practice, and all measures must be excised to prevent it.

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REFERENCES

- Gupta A, Kishor, Thakur VK, Kumar A. Sudden endotracheal tube block in a patient of achalasia cardia. *J Anaesthesiol Clin Pharmacol* 2012;28:381-3.
- Park C, Kim H, Yum K. Acute obstruction of an endotracheal tube: A case report. *Anesth Prog* 2004;51:62-4.
- Sofi K, El-Gammal K. Endotracheal tube defects: Hidden causes of airway obstruction. *Saudi J Anaesth* 2010;4:108-10.
- Chen HS, Jawan B, Tseng CC, Cheng KW, Wang CH. Difficult ventilation with a double-lumen endotracheal tube: An unusual manufacturing defect. *Anesth Analg* 2005;101:1094-7.
- Rho EH, Long TR, Wass CT. Inadequate tidal volume: Asymmetric endotracheal tube cuff inflation resulting in a massive persistent airway leak. *Anesth Analg* 2003;97:1853.
- Chua WL, Ng AS. A defective endotracheal tube. *Singapore Med J* 2002;43:476-8.

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