

Successful management of a case of delayed post-operative recovery under general anesthesia due to endotracheal tube defect and malfunction in a case of massive abdominal teratoma in 2-month-old infant

Suvidha Sood¹, Anoj², Megha Soni³

From ¹Professor; ²Medical Officer; ³Senior Resident, Department of Anaesthesia, ESI PGI MSR and Hospital, Basaidarapur, New Delhi, India

ABSTRACT

Endotracheal tube (ETT) connector is an important part of the airway equipment, especially in intubated neonates and pediatric patients, which if narrow and improper sized, due to manufacturing defect, can compromise airway safety by causing high airway resistance, inadequate gaseous exchange, and ventilation through the ETT causing respiratory acidosis and hypercapnia resulting in a delayed recovery of infants. Hence, equipment check before anesthesia is mandatory especially in extremes age groups such as neonate and pediatric population. We, hereby, report the case of a blocked ETT defect in a 2-month-old child posted for massive abdominal teratoma.

Key words: Connector, Endotracheal tube, Manufacturing defect, Ventilation

Manufacturing defects of endotracheal tubes (ETTs) are well-known during anesthetic procedure [1,2]. Pre-anesthetic checkup of anesthesia equipment's, drugs, and machine helps to avert such mishappenings in the operation theatre. A blocked ETT can result in increase airway resistance, inadequate gas exchange, and ventilation. There are no substitutes for monitoring under anesthesia. Careful vigilance and continuous monitoring are the key to successful patient outcome and are recommended in all anesthetized patients but more in the extreme age groups like small children. Hajimohammadi *et al.* [1] and Shamse *et al.* [3] reported such ETT defects in the literature.

A blockage of the ETT due to manufacturing defect is a rare phenomenon and often missed. Hence, we want to highlight the importance of equipment check before surgery. We, hereby, report the case of a blocked ETT defect in a 2-month-old child posted for massive abdominal teratoma.

CASE REPORT


A 2-month-old female child was posted for resection of a massive retroperitoneal teratoma. On examination, the child had a weight of 4.5 kg with a respiratory rate of 48/min and oxygen saturation of 99%. She was induced with a mixture of 3–4% sevoflurane in 100% O₂ and intravenous (IV) fentanyl 8 µg. After establishing

neuromuscular paralysis, the child was intubated with a 3.5 mm ID Magill's ETT [1] and ventilated on Jackson Rees (JR) modification of Ayre's T tube circuit. On chest auscultation, immediate post-intubation air entry was absent on the left side.

The ETT was withdrawn up to 9 cm mark under laryngoscopy, allowed safe limit in small infants. Air entry on the left side improved, but was still less as compared to the right side. Resistance was felt in the reservoir bag of the JR circuit which felt unusually tight. Manipulation of airways such as neck extension and ETT rotation was tried, but these maneuvers did not improve the child's ventilation. No wheeze was audible on chest auscultation.

Anesthesia was maintained with IV atracurium infusion at 6 µgms/kg/min and 100% O₂ or a mixture of 60:40 O₂:N₂O intermittent with 3% sevoflurane. As soon as, N₂O was switched on intermittent intraoperatively, the child's SpO₂ dropped repeatedly from 100% to 92% or below, again picking up to 100% after switching off N₂O each time. Intraoperatively, the infant's heart rate varied between 146/min and 174 /min, systolic blood pressure between 93 mmHg and 102 mmHg, diastolic blood pressure between 47 and 53 mmHg, and oxygen saturation remained between 98% and 100%. A huge tumor mass of size 12 × 12 × 8 cm was surgically excised after opening the infant's abdomen. On gross examination, a unilocular cyst with opaque gray-white layer of epidermis with epithelial lining was seen (Fig. 1).

Peak airway pressure (Paw) reached up to 44 cm H₂O and did not reduce in spite of our best efforts. EtCO₂ ranged at alarmingly

Access this article online	
Received - 13 December 2020 Initial Review - 22 December 2020 Accepted - 22 January 2021	Quick Response code 
DOI: 10.32677/IJCR.2021.v07.i01.010	

Correspondence to: Suvidha Sood, Department of Anaesthesia, ESI PGI MSR and Hospital, House Number 8, Second Floor, Pocket -1, Sector -21, Rohini, Basaidarapur, New Delhi - 110 086, India. E-mail: suvidhasood1962@gmail.com

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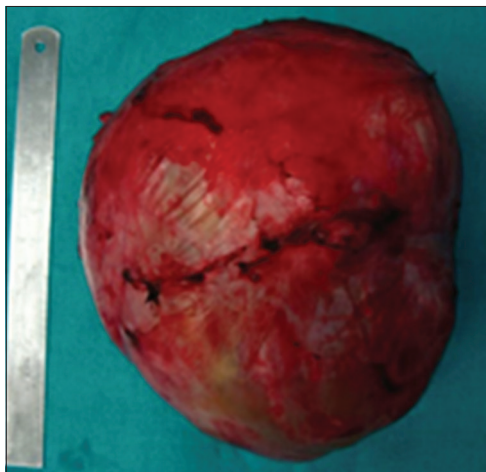


Figure 1: A huge tumor mass of size 12 cm × 12 cm × 8 cm was surgically excised after opening the infant's abdomen

high levels between 84 mmHg and 98 mmHg shortly after the start of surgery. Throughout 1 h of surgical procedure, serial arterial blood gas (ABG) analysis showed a picture of respiratory acidosis. Intraoperative serial blood pH readings were 7.04, 7.05, and 7.06, respectively, paO_2 ranged between 105 mmHg, 108 mmHg and 112 mmHg, pCO_2 86 mmHg, 94 mmHg, and 105 mmHg in three consequent readings, respectively. This happened despite our best efforts to control the infant's hypercapnia and wash out excess CO_2 . No signs of bronchospasm on chest auscultation and pneumothorax on percussion were found.

After the surgery, the child showed no signs of recovery from anesthesia. She had no limb movements, eye-opening, or spontaneous ventilation indicating delayed signs of recovery for 32 min and inhalational agent sevoflurane was switched off immediately after the surgery. She tolerated ETT with no efforts of spontaneous ventilation. During an attempt at endotracheal suctioning, difficulty was encountered in negotiating a 5 Fr G suction catheter through a 15 mm universal ETT connector. A 3.5 mm ID of the ETT normally allows an 8 Fr G suction catheter through it [3].

Immediately after the surgery, we disconnected the tube connector from ETT and found that its inner taper fitting into ETT has a severely narrow orifice. We immediately changed the ETT with a new 3.5 mm ID Murphy ETT, fixed at a 9 cm mark at the right angle of the mouth. Immediately, the child's ventilation and chest air entry improved significantly bilaterally equal with adequate chest expansion. Paw reduced to 25 cm H_2O and EtCO_2 decreased to 40 mmHg within 2 min. ABG showed resolution of respiratory acidosis and PaCO_2 came down to 42 mmHg, further reduced to 32 mmHg within 5 min after changing the ETT. The child opened her eyes started bucking, moving her limbs vigorously, reversed from the neuromuscular blockade, and extubated successfully after 3 min. On comparison of same sized pediatric ETT from various manufacturers, we found that the inner taper of the first ETT was significantly narrow in comparison with other manufacturers, causing inadequate intraoperative ventilation, hypercapnia, respiratory acidosis, and delayed recovery (Fig. 2).

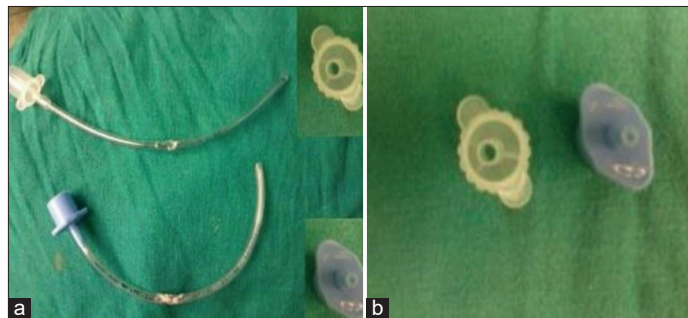


Figure 2: (a) Endotracheal tube malformation; (b) Difference in the size of endotracheal tube connector

DISCUSSION

Manufacturing defects of ETT are quite known during anesthetic procedure [1]. Equipment check is a must to rule out any defect before anesthetic induction [1] but in spite of an anesthesiologist's best efforts to ensure the patient safety, step checking, and visual inspection during an anesthetic procedure more cautiously in an infant, accidents do happen due to the equipment failure and manufacturer error [2]. For a safe airway and ventilation, anesthesia machine and equipment used to provide airway should be checked thoroughly. Improper checking causes a high incidence of life-threatening complications during anesthetic procedures [3-5].

ETT connector is an important part of the airway equipment, especially in intubated neonates and pediatric patients, which if narrow and improper sized, due to manufacturing defect, can compromise airway safety by causing high airway resistance, inadequate gaseous exchange, and ventilation through the ETT causing respiratory acidosis and hypercapnia resulting in a delayed recovery of infants. Device failure and cuff valve failure causing ventilation failure is reported in the literature by various authors [1-3]. Ozer *et al.* stated that the ETT cuff, lumen, and connector should be checked in the pre-operative preparation period if unchecked, results in serious airway obstructions and air leakage during anesthesia [4,6-8]. Airway obstruction should be suspected if airway and breathing bag pressures increase with ventilation difficulty before enough tidal volume is generated. After satisfactory system check, ETT defects such as herniation, air leakage [5,6], kinking of the cuff, intraluminal plastic film, or obstruction by meniscus and obliteration of ETT connector are known manufacturing defects and can produce difficulty in ventilation [1,2,6,8-10]. It becomes mandatory on part of the anesthesiologist to immediately change faulty equipment if any manufacturing defect of the ETT is suspected [2,3].

Tight bag situation arises when a mechanical obstruction in ETT requires excessive pressure that needs to be applied to reservoir bag of the intubated patient, posing ventilation difficulties [3,6]. Usual paw 15–20 cm of H_2O delivers 8 mL/kg volume becomes tight bag if crosses 25 cm [6,8]. In our case, it was a manufacturing defect in a new ETT. ETT connector inner taper was very narrow as compared to the standard tubes of other manufacturer's. Such manufacturing errors are usually missed

and not visible from the outside [2,5]. Shamse *et al.* [3] reported difficulty in inserting the stylet inside the tube which happened due to narrowing of the tube connector making ventilation difficult and occlusion of tube lumen, similar to our case.

CONCLUSION

Difficult ventilation after successful endotracheal intubation can be due to equipment failure such as faulty ETT connector manufacture defect. Therefore, it is necessary to check anesthesia equipment before use. Furthermore, it is imperative to standardize the diameter of the inner taper of 15 mm universal connector, especially in pediatric ETT which is very important for effective ventilation in neonates and pediatric patients so as to avoid any intraoperative catastrophe due to inadequate ventilation, hypercapnia, and respiratory acidosis during a surgical procedure.

REFERENCES

1. Hajimohammadi F, Taheri A, Eghtesadi-Araghi P. Obstruction of endotracheal tube; a manufacturing error. *Middle East J Anaesthesiol* 2009;20:303-5.
2. Sofi K, El-Gammal K. Endotracheal tube defects: Hidden causes of airway obstruction. *Saudi J Anaesth* 2010;4:108-10.
3. Shamse C, Kannaujia A, Gautam S. Ventilation failure due to endotracheal tube T-connector defect. *Indian J Anaesth* 2010;54:357-8.
4. Ozer AB, Erhan OL. Two different endotracheal tube manufacturing defects. *Int J Case Rep Images* 2013;4:150-3.
5. Badmali AK, Ishwar B. Defective endotracheal tube: Undetected by routine inspection. *Saudi J Anaesth* 2014;8:303-4.
6. Inoue S, Nishimine N, Kitaguchi K, Furuya H, Taniguchi S. Double lumen tube location predicts tube malposition and hypoxaemia during one lung ventilation. *Br J Anaesth* 2004;92:195-201.
7. Kapoor D, Singh A. An unusual site of an occult air leak in an armoured endotracheal tube in the midst of surgery. *Indian J Anaesth* 2012;56:99-100.
8. Bharti N, Bala I, Sharma K. Endotracheal tube connector defect as a cause of high airway pressure. *Paediatr Anaesth* 2012;22:502-3.
9. Lower BM, Karim Z, Henderson RS. Large air leak from an endotracheal tube due to a manufacturing defect. *Anesth Analg* 1997;85:944-5.
10. Chua WL, Ng AS. A defective endotracheal tube. *Singapore Med J* 2002;43:476-8.

Funding: None; Conflicts of Interest: None Stated.

How to cite this article: Sood S, Anoj, Soni M. Successful management of a case of delayed post-operative recovery under general anesthesia due to endotracheal tube defect and malfunction in a case of massive abdominal teratoma in 2-month-old infant. *Indian J Case Reports*. 2021;7(1):31-33.