

LETTER TO THE EDITOR

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Weaning modes in the anaesthesia machine ventilators: a novel way of managing ventilation in tracheo-oesophageal fistula patients undergoing corrective surgery under general anaesthesia

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To the Editor,

A 25-year-old female presented to the author's institution with complaints of dyspnea and cough after each meal. The patient gave history of corrosive poisoning 6 months earlier, for which she was tracheostomised and had long-term ventilation. She was now suspected to have iatrogenic tracheo-oesophageal fistula (TOF), and CT scan confirmed the presence of TOF at D2 level. Fiberoptic bronchoscopy showed granulation tissue at the level of the fistula causing stenosis of tracheal lumen. Preoperative feeding jejunostomy was done for improvement of the nutritional status. She was scheduled for repair of TOF.

Intraoperatively, arterial blood pressure, arterial blood gas, and entropy along with standard ASA monitoring were done. After premedication with 0.2-mg glycopyrrolate, anaesthesia was induced with fentanyl (2 mcg/kg), midazolam 1 mg and titrated doses of propofol to achieve entropy value of 50–60. Intraoperative fiberoptic examination confirmed preoperative findings. The trachea was intubated with a cuffed 6.5-mm endotracheal tube (ETT), and its tip was placed above the narrowing. Gentle squeezes of the bag to confirm ventilation led to large leaks of air through TOF (as evident by gurgling sounds and leak through jejunostomy tube, which was intentionally kept open to vent excessive pressure). After suctioning out residual gastric content, Nasogastric tube was kept open to atmosphere. Anaesthesia was maintained with O₂ in 50% air, propofol infusion at the rate of

100 mcg/kg/min and sevoflurane to maintain entropy (SE) of 50–60. Patient was put on CPAP+PSV mode on Avance CS₂ anaesthesia machine, and spontaneous ventilation was maintained (PSV 8 cm H₂O, back up rate of 8, PEEP 5 cm H₂O). In the event of apnea, inspired sevoflurane concentration and propofol infusion rate were decreased to facilitate reduction of anaesthetic depth and resumption of spontaneous respirations.

The TOF was accessed through a lower neck incision. After exposure and division of the tracheo-oesophageal fistula, the endotracheal tube was passed beyond the stenotic granulation tissue under vision (Fig. 1). The granulation tissue was excised from the tracheal wall, and haemostasis was achieved. The tracheal and oesophageal wall were subsequently repaired. Finally, the lateral head of the sternocleidomastoid was dissected, detached from the clavicular end and wrapped around the repaired fistula site of oesophagus to prevent recurrence of the fistula. The neck incision was closed in layers. The patient was successfully extubated on table and had an uneventful postoperative hospital stay. Postoperatively, there was no evidence of oesophageal or tracheal stenosis (by endoscopy and fiberoptic bronchoscopy respectively). The patient was doing well at 6 months follow-up.

Discussion

Acquired TOF is a rare but serious condition. Most common causes include malignancy, trauma, and sequelae of prolonged endotracheal intubation or tracheostomy and after oesophagectomy (Reed and Mathisen 2003). Management of ventilation in patients with TOF often poses a challenge. Various techniques for managing oxygenation like the

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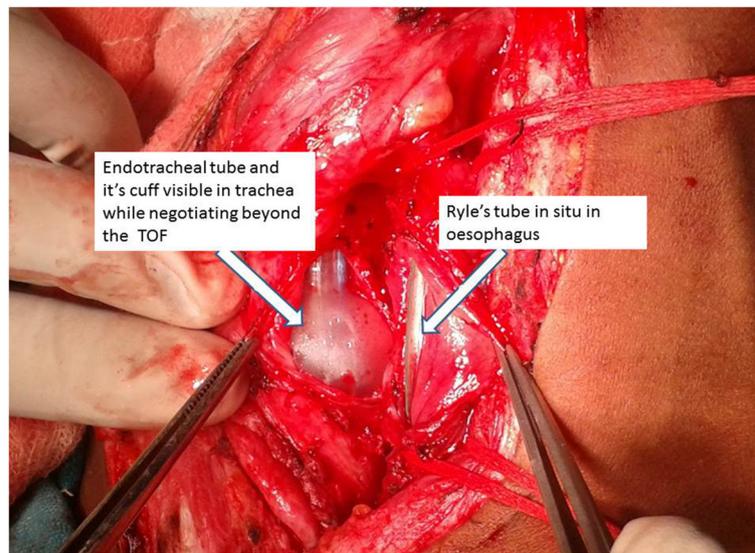


Fig. 1 Figure showing the exposed tracheal and oesophageal lumens after excision of the TOF. The tracheal lumen shows the endotracheal tube and its cuff as it is being passed beyond the TOF. The oesophageal lumen shows Ryle's tube in situ

passage of single/double lumen tube beyond TOF under fiberoptic guidance (Giquel et al. 2012), selective bilateral bronchial intubation (Ford and Shields 2012), jet ventilation (Ehlers et al. 2015) and even ECMO have been described (Collins et al. 2014).

In our patient, blind passage of endotracheal tube beyond the fistula was not considered because of the presence of narrowing due to granulation tissue. Forceful passage of ETT beyond the narrowing might have led to bleeding. Instead, we chose to introduce the tube under vision after the tracheal end of the TOF was excised, bringing the tracheal lumen into view.

Controlled ventilation in our patient with the ETT tip above the fistula would have led to leak through the fistula leading to gastric distension and possible aspiration. Spontaneous ventilation being negative pressure ventilation does not cause air leak through fistula. Thus, we sorted to spontaneous ventilation. In the absence of a muscle relaxant, deeper anaesthesia levels are required to prevent movement in response to surgical stimulus. Under this condition, spontaneous ventilation in the bag mode may lead to apnea/hypopnea and may easily be missed till hypoxia ensues. CPAP+PSV (continuous positive airway pressure + pressure support ventilation) and PSV-pro are the two spontaneous ventilation modes in Avance CS² machine. They ensure delivery of adequate tidal volume due to pressure support even when the patient hypoventilates. Further, automatic switch to back up ventilation (when apnea is detected for prescribed time as set in the machine) prevents unattended hypoxia. Application of CPAP also prevents atelectasis which leads to better oxygenation and minimises post-operative complications. In our case,

the patient could maintain spontaneous ventilation except for one occasion when back up ventilation was initiated. There are reports in the literature of TOFs being repaired while the patient breathes spontaneously, although assisted ventilation was often necessary (Reed and Mathisen 2003; Bartels et al. 1998; Couraud et al. 1996).

Although weaning modes have been incorporated into the anaesthesia machine ventilators for a while, their use during routine anaesthetic practice is rare, as most cases are managed under controlled ventilation. The aim of the present report is to highlight the advantages of weaning modes to maintain spontaneous ventilation in patients with tracheo-oesophageal fistula, where the tracheal tube cannot be passed beyond the level of fistula.

Abbreviations

ASA: American Society of Anesthesiologist; CPAP: Continuous positive airway pressure; CT scan : Computed tomographic scan; ECMO: Extracorporeal membrane oxygenation; ETT: Endotracheal tube; PSV: Pressure support ventilation; TOF: Tracheo-oesophageal fistula

Availability of data and materials

Yes, all available data related to case have been included in the article; however, no data analysis was done as it is not a study but a case report.

Authors' contributions

Dr. PK conceptualised the article, did the reference search and written the manuscript. Dr. RM, Prof RG and Dr. ARM helped in the reference search and helped in writing the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Yes, written informed consent was obtained from patient.

Competing interests

The authors declare that they have no competing interests.

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