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LETTER TO EDITOR

Apnoeic 'active' oxygenation techniques during tracheal surgery

Dear Editor,

Apnoeic oxygenation helps in prolonging the duration of apnoea during airway instrumentation or repair. During the apnoeic phase following denitrogenation, oxygen is extracted from the alveolus by the capillary network, resulting in a drop in alveolar pressure. The pressure gradient causes the movement of oxygen from the larger airways to the alveoli and subsequently to the alveolar capillary. This process, also referred to as a ventilatory mass flow,'[1] 'diffusion respiration,'[2] and 'apnoeic diffusion of oxygen,' forms the backbone of apnoeic oxygenation with a constant supply of oxygen into the airway. We use various improvised methods of apnoeic oxygenation by inculcating the principles of jet ventilation, continuous flow apnoeic ventilation[3], and hypoventilatory mass flow[4] during our tracheal resection and reconstruction procedures. Conduits of active oxygenation can be an airway exchange catheter [Figure 1], a fibreoptic bronchoscope [Figure 2], or in low-resource centres, a simple suction catheter—the hub being cut and the cut catheter end connected to a 2 ml syringe through an endotracheal tube size 3.5 connector [Figure 3]. The oxygenation is carried out via a Mapleson F circuit with intermittent positive pressure being generated by occluding the bag pressure relief outlet. In cases where high flow needed to be delivered through the suction port of the fibreoptic scope, we use the oxygen flush of the anaesthesia machine. When pressed intermittently, it acts as a jet ventilator and delivers oxygen at a rate nearing 50 L/min.[5] The risk of barotrauma or volutrauma is less because during tracheal surgery when this kind of oxygenation is required, the airway is usually open to the atmosphere at some level.

These techniques create a mass flow of oxygen into the airway more than those achieved by simple passive oxygenation. This augments pressure gradient-dependent diffusion of oxygen into the bloodstream and carbon dioxide (CO_2) from the bloodstream to the alveoli as the continuous high flow of oxygen dilutes the alveolar CO_2. Moreover, some amount of positive airway pressure is generated by the jet of oxygen and helps in keeping the alveoli open. In our patients, we generally maintain apnoea for 10–20 minutes at a stretch without significant desaturation (pulse oximetry recording <92%) while the surgeons discontinue the cross-field ventilation during tracheal end-to-end anastomosis. The depth of anaesthesia is maintained with propofol infusion guided by bispectral index monitoring. Upon resumption of ventilation post-anastomosis, the observed end-tidal CO_2 is generally in the range of 60–75 mmHg, which would have been otherwise >90 mmHg.[6] Figures 1, 2, and 3 depict the various techniques of active oxygenation during periods of apnoea.

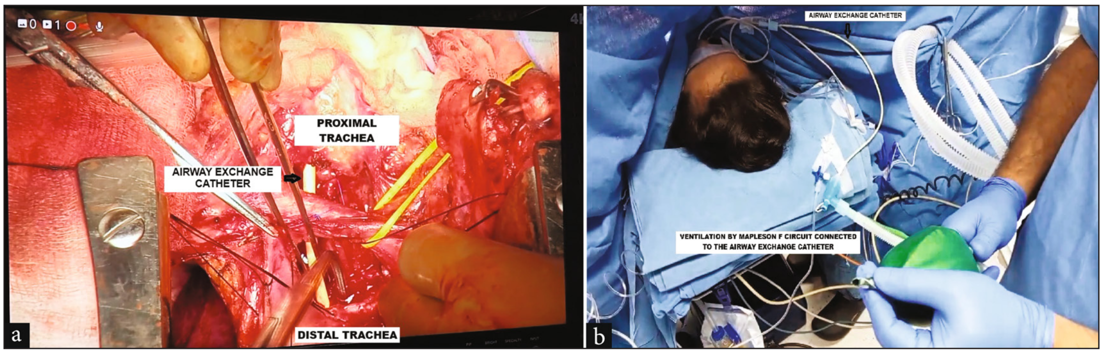

Figure 1: (a and b) Use of an airway exchange catheter (yellow tube) for apnoeic oxygenation by the Mapleson F circuit

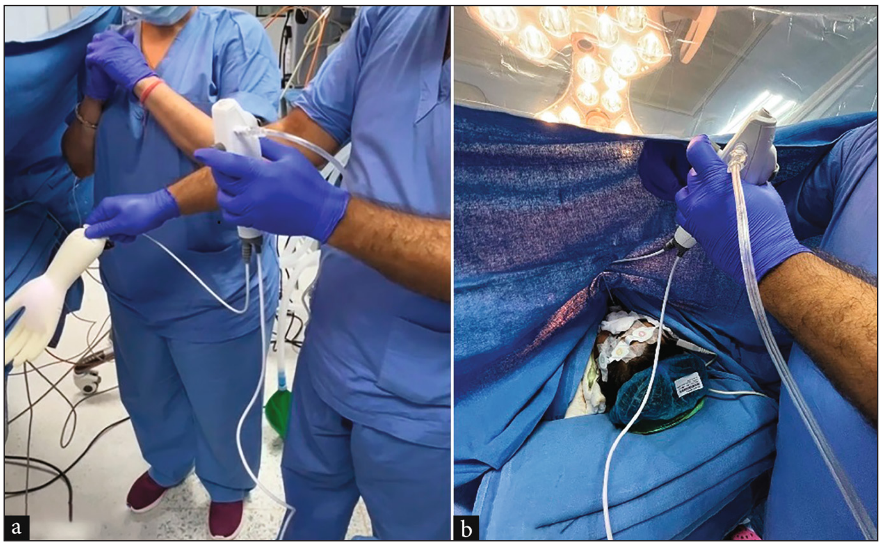

Figure 2: (a and b) Use of fibreoptic bronchoscope to insufflate the distal airway

Figure 3: Use of suction catheter for oxygen insufflation in low-resource scenario

Declaration of Patient Consent: Patient's consent not required as patients identity is not disclosed or compromised.

Financial support and sponsorship: Nil.

Conflicts of interest: There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation: The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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Received: 28 July 2024
Accepted: 07 February 2025
Published: 15 February 2025

DOI:
10.25259/PEAK_4_2024

Quick Response Code:

REFERENCES

1. Rudlof B, Faldum A, Brandt L. Aventilatory mass flow during apnea: Investigations on quantification. Anaesthesist 2010;59:401–9.
2. Draper WB, Whitehead RW, Spencer JN. Studies on diffusion respiration: Alveolar gases and venous blood pH of dogs during diffusion respiration. Anesthesiology 1947;8:524–33.
3. Smith RB, Babinski M, Bunegin L, Gilbert J, Swartzman S, Dirting J. Continuous flow apneic ventilation. Acta Anaesthesiologica Scandinavica 1984;28:631–9.
4. Lyons C, Callaghan M. Uses and mechanisms of apnoeic oxygenation: A narrative review. Anaesthesia 2019;74:497–507.
5. Mun SH, No MY. Internal leakage of oxygen flush valve. Korean J Anesthesiol 2013;64:550–1.
6. Riva T, Greif R, Kaiser H, Riedel T, Huber M, Theiler L, et al. Carbon dioxide changes during high-flow nasal oxygenation in apneic patients: A single-center randomized controlled noninferiority trial. Anesthesiology 2022;136:82–92.

How to cite this article: Das J, Khanna S, Kumar S, Singh M, Mehta Y. Apnoeic 'active' oxygenation techniques during tracheal surgery. Pract Evid Anaesth Knowl. 2025;1:50–51. doi: 10.25259/PEAK_4_2024