

## Acknowledgement

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## Ventrain<sup>®</sup> for ventilation of the lungs

Editor—Ventrain (Dolphys Medical, Eindhoven, The Netherlands) has been registered as an emergency ventilation device.<sup>1</sup> We report its use in an elective ENT patient (Fig. 1).

A 60-yr-old man with an exophytic glottic tumour and significant inspiratory stridor presented for diagnostic laryngo-tracheo-bronchoscopy and possibly tracheostomy. Several options were considered for management of the airway.

First, high-frequency jet ventilation (HFJV) is the routine ventilation technique in our hospital for diagnostic laryngoscopies. Usually, a small-bore jet ventilation catheter is

introduced via the nose into the trachea with the help of a Magill forceps, guided by routine direct laryngoscopy. The second option was routine (flexible) laryngoscopy and (awake) tracheal intubation with a wide-bore ( $\geq 4$  mm ID) tube over a flexible bronchoscope, gum elastic bougie, or Aintree intubation catheter. However, both the options carry the risks of bleeding and swelling of the tumour, making an emergency tracheostomy more likely in a situation with pre-existing serious stridor. The third option would be an elective awake wide-bore tracheostomy, having a higher success rate than an emergency procedure, but this may be unnecessary and is not preferable from the oncological point of view. Fourthly, introducing a small-bore cannula through the cricothyroid membrane into the trachea to apply HFJV is also a common procedure in our hospital. It creates a temporary, minimally invasive access to the airway below the level of the obstruction. However, any HFJ ventilator is a unidirectional device only providing inspiration, so expiration by the natural upper airway is mandatory. A large tumour might hinder expiration, leading to air trapping, with the risks of barotrauma and the inability to ventilate efficiently. In contrast, the Ventrain is capable of controlling both inspiration and expiration through a small-bore catheter and might thus reduce the risk of air trapping. We agreed on using this last option as it is minimally invasive and safe compared with the other techniques and leaves all therapeutic options intact.

It was explained to the patient that a cannula would be introduced in the neck in order to ventilate the lungs throughout the procedure. The patient consented and was quiet and cooperative all the time.

After local infiltration and injection of 3 ml 4% lidocaine into the trachea, a 2 mm ID, 75 mm long emergency trans-tracheal airway catheter (ETAC; Cook Medical, Bloomington, IN, USA) was introduced via the cricothyroid membrane and its intratracheal position was confirmed by aspiration of air and by capnography. The Ventrain was then connected to the ETAC and to a 2 litre oxygen cylinder with a built-in pressure compensated flow regulator set to 15 litre  $\text{min}^{-1}$ . General anaesthesia was provided by our standard procedure: initially, propofol and remifentanyl boluses and subsequently continuous pump-driven infusion combined with boluses of cisatracurium, gauged by train-of-four monitoring. Ventilation with the Ventrain (2 s each for inspiration and expiration, thus a frequency of 15  $\text{min}^{-1}$ ) produced moderate but clearly visible thoracic excursions with the chest always returning to its original shape. Temporarily closing nose and mouth led to greater excursions, but not to air trapping. Laryngoscopy by the ENT surgeon revealed left-sided vocal paralysis besides the large glottic tumour, explaining the inspiratory stridor at least in part. Laryngoscopy and biopsies lasted 15 min.  $\text{SpO}_2$  was 100% throughout. After the surgical procedure, the syringe drivers were stopped, the neuromuscular blocking agent was reversed, and ventilation was reduced by lowering the driving oxygen flow to 5 litre  $\text{min}^{-1}$  to raise the  $P_{\text{CO}_2}$ . Capnography was connected to the Ventrain and spontaneous ventilation started at an end-tidal  $P_{\text{CO}_2}$  of 6.3 kPa. The patient woke up quietly. The



**Fig 1** Ventrain being used for an elective laryngoscopy.

Ventrain was disconnected and the ETAC was left in position and was only removed 6 h later on the post-anaesthesia care unit, when it was clear there was no increase in inspiratory stridor by swelling or bleeding. The whole procedure was uneventful. The diagnostic information gathered led to the decision to start radiotherapy.

In conclusion, we report the successful and uneventful elective use of the Ventrain with 20 min of adequate ventilation and oxygenation in a patient with a partial obstruction of the laryngeal inlet.

### Declaration of interest

D.E. is the inventor of the Ventrain and receives royalty payments from Dolphys Medical.

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