



# Combined use of Ventrain and S-Guide for Airway Management of Severe Subglottic Stenosis

Maël Zuercher<sup>1</sup> , Mélanie Pythoud-brügger<sup>1</sup> , Kishore Sandu<sup>2</sup> , Patrick Schoettker<sup>1</sup> 

<sup>1</sup>Department of Anaesthesiology, CHUV - University Hospital of Lausanne, Lausanne, Switzerland

<sup>2</sup>Airway Unit of the Department of Otorhinolaryngology and Head and Neck Surgery, CHUV – University Hospital of Lausanne, Lausanne, Switzerland

**ORCID IDs of the authors:** M.Z. 0000-0002-9644-2940 ; M.P.B. 0000-0003-1177-4629 ; K.S. 0000-0003-1977-4551 ; P.S. 0000-0001-5370-048X.

**Cite this article as:** Zuercher M, Pythoud-brügger M, Sandu K, Schoettker P. Combined use of Ventrain and S-Guide for Airway Management of Severe Subglottic Stenosis. *Turk J Anaesthesiol Reanim* 2019; 47(3): 238-41.

## Abstract

The airway management of a patient with severe tracheal stenosis depends on its severity, length, location, and type of surgery. Its management is complex and requires the collaboration of an experienced team of anaesthetist and ear, nose, and throat surgeon. We report an innovative combination of Ventrain™ and S-Guide™ for airway management of a planned endoscopic dilation of a severe subglottic stenosis in an adult patient. This new alternative may offer advantages over existing airway management techniques in similar cases.

**Keywords:** Airway management, anaesthesia, intubation, otorhinolaryngologic diseases, tracheal stenosis, ventilation

## Introduction

We present a case of a 56-year-old woman with severe tracheal stenosis undergoing endoscopic balloon dilation, with a difficulty of management of airways for the anaesthetist while allowing the ear, nose, and throat (ENT) surgeon to operate.

## Case Presentation

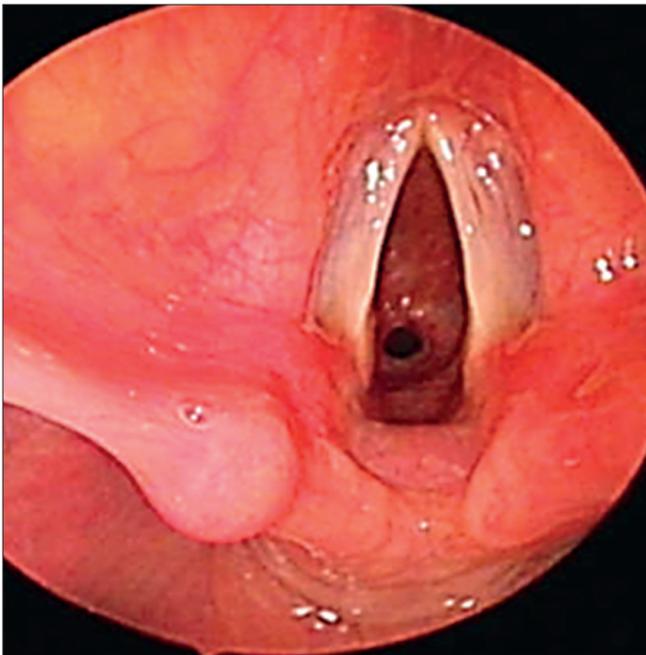
We report a case of a 56-year-old woman presenting with progressive dyspnea and shortness of breath during exercise for the last 6 months.

On physical examination, mild inspiratory and expiratory stridor was observed, worsening during exercise or stress. No history of intubation or trauma to the trachea was reported. The result for Wegener granulomatosis with c- and p-anti-neutrophil cytoplasmic antibodies was found to be negative as an acquired cause. A thoracic computed tomography (CT) scan revealed a subglottic tracheal stenosis estimated to be 3.5 mm in diameter and 11 mm in length and located 95 mm from the carina. An endoscopic examination was performed under general anaesthesia with spontaneous breathing technique (sevoflurane administered through a face mask). Transnasal fibroscopy (Olympus<sup>R</sup>, 4.2 mm) and direct laryngo-tracheoscopy (Storz<sup>R</sup> 0°, 4.0 mm) estimated the stenosis to be 7 mm in diameter corresponding to the Cotton-Myer grade III stenosis with an 80% reduction in the airway lumen (Figures 1-3). The stenosis involved the mid-part of the cricoid cartilage and the 1st tracheal ring with the craniocaudal distance measuring at 8 mm. An endoscopic treatment of the stenosis was planned 2 days later.

General anaesthesia was induced with propofol, fentanyl, and rocuronium, and the patient was intubated with a C-MAC® D-Blade video laryngoscope (Karl Storz, Tuttlingen, Germany), allowing placement of a 5.0 Fr

S-Guide™ intubating stylet (VBM Medizintechnik GmbH, Sulz a.N, Germany) through the tracheal stenosis. Proper positioning was confirmed by the surgical team using a 0° telescope (Storz® 0°, 4.0 mm). S-Guide™ was connected to Ventrain™ (Ventinova Medical B.V., Eindhoven, Netherlands) (Figure 4) for ventilation (FiO<sub>2</sub>=100% and I:E=1:2, frequency 10–12/min), and the surgical procedure was

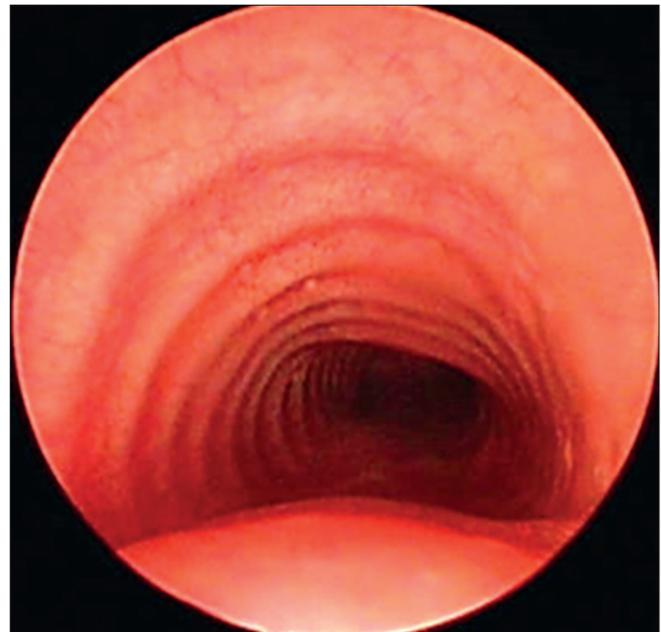
started. The stenosis was first infiltrated submucosally with depot corticosteroid triamcinolone acetate (40 mg mL<sup>-1</sup>), and a “Mercedes-Benz”-like star-shaped incision was performed at 12, 4, and 8 o’clock positions. The stenosis was then dilated with a pulmonary balloon catheter (CRE™ Pulmonary; Boston Scientific, Marlborough, MA, USA) up to 13.5 mm using a 4.5 ATM inflation pressure. Topical epinephrine was applied followed by intubation with a 5.0 mm Microcuff® tube (Kimberly-Clark, Roswell, GA, USA). Extubation and recovery of the patient were uneventful, and symptoms were relieved without the need of tracheostomy. Currently, the patient has no respiratory complaints (Figure 5). Informed consent was obtained from the patient for reporting the case.



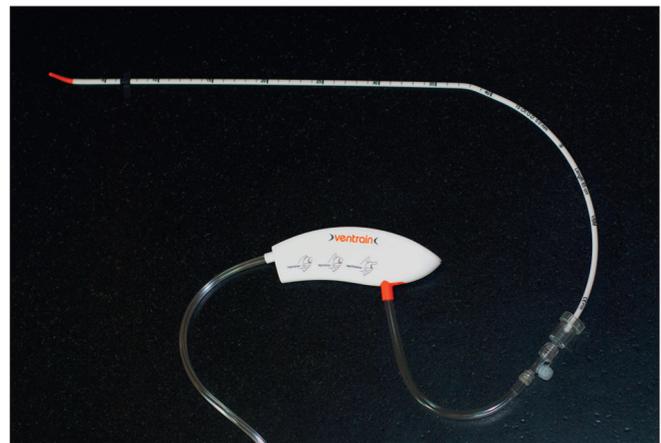
**Figure 1. Endoscopic view of the glottic and subglottic regions with severe tracheal stenosis**



**Figure 2. View of the grade III tracheal stenosis**



**Figure 3. View of the distal trachea**



**Figure 4. S-Guide™ malleable intubating guide connected to the Ventrain™ via the Luer Lock O2 Connector**



**Figure 5. View of the trachea after balloon dilatation**

## Discussion

Airway management while allowing surgical access for idiopathic subglottic stenosis (ISGS) is a challenge for the anaesthetist and the ENT surgeon and mandates a team approach. In our case, severe subglottic stenosis prevented conventional tracheal intubation. Owing to the extent of the stenosis, an endotracheal tube with a size of 3.5 mm with an external diameter of 4.9 mm would be necessary, but a length of 21 cm was insufficiently long.

Discrepancies as to the extent of the subglottic tracheal stenosis as assessed by CT or endoscopic examination raised questions about the specific management. There was an exaggeration of stenosis dimensions while comparing endoscopy and CT scan, and this is secondary to stagnated secretions in the vicinity of the stenosis. A dedicated airway endoscopy (dynamic and rigid) is critical to diagnose and stage an airway stenosis and is the investigation of choice. The first endoscopic examination was performed with a 4.2 mm fiber bronchoscope, allowing passage and exploration of the stenosis. This fiberoptic assessment allowed safe usage of the 5.0 mm external diameter of the S-Guide.

The use of a jet ventilation would be an alternative, but owing to the risk of complete airway obstruction in view of the extent of the stenosis, passive outlet of the insufflated air was not guaranteed. The risk of associated barotrauma was assessed to be too severe (1).

Successive apnoea technique has been described as an alternative allowing for adequate visualization with vocal cords

immobility while carrying the risk of laryngeal spasms, hypercapnia, and inhalation due to gastric insufflation (1, 2). Moreover, this may mandate repeated short surgical procedures, depending on how long the patient can tolerate a period of apnoea (3). Many episodes of reoxygenation were estimated to greatly prolong the operation.

In this context, ventilation by Ventrain™ was decided to be the best alternative. Ventrain™ is a single-use, manually operated device that allows oxygenation and gas exchange with expiratory ventilation assistance through a small lumen catheter as previously described (4). It was first registered as an emergency ventilation device even in paediatric cases where stenosis with very small diameters is encountered. Many case reports have shown the efficiency of Ventrain™ in adult and paediatric difficult airway situations (5, 6). Paxian et al. (7) demonstrated the efficacy of Ventrain™ associated with a small lumen catheter to provide adequate ventilation on an animal study with varying degrees of tracheal stenosis. One previous study reports about the usage of Ventrain™ in an elective situation. Fearnley et al. used Ventrain™ in a case of supraglottic stenosis and demonstrated the effectiveness of ventilation with Ventrain™ when a first operation attempt was aborted due to the inability of ventilation with jet ventilation (8). Furthermore, they inserted a Cricath™ cannula (Dolphys Medical BV, Eindhoven, Netherlands) through the cricothyroid membrane. In our case, the stenosis was subglottic and restricted the cricothyroid approach. The design of Ventrain™ allows the connection to an adaptor mounted on a malleable intubating guide through the stenosis.

The treatment of ISGS is predominantly endoscopic. In our case, the ENT surgeon used a pulmonary dilation balloon to dilate the stenosis. The surgeon was able to treat the stenosis with the use of a small lumen catheter as the S-Guide™ through the stenosis, leaving the S-Guide™ in the trachea along the dilation catheter. It allowed continuous ventilation of the patient even in the balloon inflation phase of the operation.

## Conclusion

The combination of Ventrain™ with S-Guide™ malleable intubating guide is secure and allows adequate ventilation in severe subglottic tracheal stenosis without episodes of desaturation.

**Informed Consent:** Written informed consent was obtained from patient who participated in this case.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept – P.S.; Supervision – P.S.; Literature Search – M.Z., M.P.B.; Writing Manuscript – M.Z., M.P.B.; Critical Review – K.S., P.S.

**Conflict of Interest:** The authors have no conflicts of interest to declare.

**Financial Disclosure:** The authors declared that this study has received no financial support.

## References

1. Jaquet Y, Monnier P, Melle GV, Ravussin P, Spahn DR, Chollet-Rivier M. Complications of Different Ventilation Strategies in Endoscopic Laryngeal Surgery: A 10-year Review. *Anesthesiology* 2006; 104: 52-9. [\[CrossRef\]](#)
2. Weisberger EC, Emhardt JD. Apneic anesthesia with intermittent ventilation for microsurgery of the upper airway. *Laryngoscope* 1996; 106: 1099-102. [\[CrossRef\]](#)
3. Werkhaven JA. Microlaryngoscopy-airway management with anaesthetic techniques for CO<sub>2</sub> laser. *Paediatr Anaesth* 2004; 14: 90-4. [\[CrossRef\]](#)
4. Hamaekers AEW, Borg PAJ, Enk D. Ventrain: an ejector ventilator for emergency use. *Br J Anaesth* 2012; 108: 1017-21. [\[CrossRef\]](#)
5. Willemsen MGA, Noppens R, Mulder ALM, Enk D. Ventilation with the Ventrain through a small lumen catheter in the failed paediatric airway: two case reports. *Br J Anaesth* 2014; 112: 946-7. [\[CrossRef\]](#)
6. Escribá Alepuz FJ, Alonso García J, Cuchillo Sastriques JV, Alcalá E, Argente Navarro P. Emergency ventilation of infant subglottic stenosis through small-gauge lumen using the ventrain: a case report. *A A Pract* 2018; 10: 136-8. [\[CrossRef\]](#)
7. Paxian M, Preussler NP, Reinz T, Schlueter A, Gottschall R. Transtracheal ventilation with a novel ejector-based device (Ventrain) in open, partly obstructed, or totally closed upper airways in pigs†. *Br J Anaesth* 2015; 115: 308-16. [\[CrossRef\]](#)
8. Fearnley RA, Badiger S, Oakley RJ, Ahmad I. Elective use of the Ventrain for upper airway obstruction during high-frequency jet ventilation. *J Clin Anesth* 2016; 33: 233-5. [\[CrossRef\]](#)