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Tubeless Airway Strategy Using THRIVE And TCI For Subglottic Stenosis: Case Report

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ABSTRACT

Granulomatosis with polyangiitis (GPA) is a systemic vasculitis that can cause subglottic stenosis (SGS), posing significant challenges in airway management. We present a case of a 19-year-old male with GPA and Grade 2 SGS who underwent successful balloon dilatation under general anaesthesia using Transnasal Humidified Rapid Insufflation Ventilatory Exchange (THRIVE) and Target-Controlled Infusion (TCI) of Propofol. THRIVE enabled uninterrupted apnoeic oxygenation and improved surgical access, while TCI ensured stable anaesthetic depth. The procedure was completed uneventfully in 25 minutes with no desaturation. This case highlights THRIVE-TCI as an effective alternative in managing complex shared-airway surgeries.

INTRODUCTION

Granulomatosis with polyangiitis (GPA) is a systemic autoimmune vasculitis involving necrotizing granulomas, primarily affecting the upper and lower respiratory tract.(1,2) Subglottic stenosis (SGS), a known complication of GPA often requires surgical intervention.(3) Traditionally managed with tracheal intubation or jet ventilation, both methods pose risks such as barotrauma and hypoxia. Recently, THRIVE has emerged as a safer alternative, providing continuous, humidified high-flow oxygen for apnoeic oxygenation, improving surgical access and reducing complications. This case highlights successful use of THRIVE with Target control infusion (TCI).(4,5)

CASE REPORT

A 19-year-old, 51kg male with Granulomatosis with Polyangiitis presented with progressive shortness of breath and hoarseness. Nebulised Levo-salbutamol, Ipratropium, and Budesonide were administered, and grade 2 subglottic stenosis was confirmed by CT neck and video laryngoscopy. He had multiple similar ENT episodes; all promptly managed with surgical and medical interventions (see Table 1).

PERIOD	MEDICAL EVENTS
July 2022	• Underwent Tonsillectomy/ Adenoidectomy / Septoplasty with bilateral myringotomy and grommet insertion
August 2022	• Extrusion of grommet for which reinsertion and revision myringotomy was done
December 2022	• Ear discharge with pain and granulomatous changes noted, reinsertion of grommet
August 2023	• Complains of respiratory distress and diagnosed as subglottic stenosis on Flexible NPL scope • Work-up for autoimmune disorder showed positive C-ANCA with immunofluorescence and ELISA • Balloon dilation was done for airway stenosis

	• Biopsy from anterior third of glottis was taken and examined to be vasculitis on HPE
December 2023	• Complains of stridor for which laryngoscope examination showed adducted vocal cord • Balloon dilatation was done
April 2024	• Complains of stridor and hearing impairment, airway endoscopy showed minimal scarring of subglottic region • Bilateral grommet insertion done
September 2023	• Admitted for dyspnoea and palpitation, treated for posterior scarring in the subglottic with balloon dilation
May 2025	• Admitted for shortness of breath and hoarseness, diagnosed as subglottic stenosis with adducted vocal cord

Table 1:- Medical history of the patient

DIAGNOSTIC ASSESSMENT

CT Neck	A focal segmental smooth circumferential narrowing noted involving the subglottic portion of trachea for a length of 2.5cm with maximum narrowing of 65% at the level of C6 vertebral body (Myer-Cotton grade 2)
CT Thorax	Lungs with areas of air trapping noted involving the lateral and medial segment of right middle, anterior, medial segment of right lower lobe and anteromedial segment of left lower lobes.
Direct Laryngoscope	Bilateral vocal cord in adducted position

Patient was advised to continue nebulisation and medication for GPA; written informed consent was taken. Since the patient's pre-operative parameters were stable with room air saturation around 98%, we planned to use Trans-nasal Humidified Rapid Insufflation Ventilatory Exchange (THRIVE) for airway management and Total Intravenous Anaesthesia (TIVA) for sedation. After shifting the patient to the operating theatre, we established standard monitoring (5-lead ECG, non-invasive blood pressure, and oxygen saturation) and secured an 18G IV line in the left upper limb. We also prepared the difficult airway cart and tracheostomy kit in case of an emergency.

Initially patient was pre-oxygenated for 3 minutes with THRIVE at 35l/min in sitting position and pre-medicated with injection FENTANYL at 2mcg/kg. After patient losing consciousness with Target Control Infusion (TCI) of PROPOFOL started with a target concentration of 5mcg/ml over 3 minutes THRIVE flow was changed to 60l/min, Injection SUCCINYLCHOLINE was injected at 2mg/kg intravenously and handed over to Otorhinolaryngologist for the placement of rigid bronchoscope and proceed for balloon dilation. With rigorous monitoring TCI PROPOFOL concentration was maintained ranging from 5-7mcg/ml in order to achieve depth of sedation. Just before handing over the patient to surgeon, we had check whether patient could be mask ventilated in case of emergency alternative.

With the overall procedure getting over in 25 minutes, TCI pump with PROPOFOL infusion was put off, adequate oropharyngeal suctioning was done and THRIVE flow was gradually reduced to 35l/min with patient in 45degree head end elevated position. When the patient achieved complete consciousness with regular breathing pattern, THRIVE was disconnected and patient was put on Hudson's face mask at 6l/min and shifted to post-operative care unit for observation.

DISCUSSION

Subglottic stenosis (SGS) occurs in 16-23% of GPA cases and is often hard to diagnose, but was easier in our patient due to prior history.(3) Anaesthetic management, especially ventilation poses a major challenge in these cases. With limited options available such as controlled ventilation with endotracheal intubation, high frequency jet ventilation, the best suitable for our patient was THRIVE for ventilation and

TCI with Propofol for sedation. (5,6)THRIVE provides a better view of an uninterrupted surgical field, continuous high flow with 100% oxygenation causes de-nitrogenation and washout of anatomical dead space while ensuring a median apnoeic time between 19 and 27 min, ensuring adequate oxygenation and ventilation. More than oxygenation during apnoea, THRIVE follows a phenomenon of Aventilatory Mass Flow (AVMF) for providing apnoeic oxygenation, where negative pressure gradient that favours the bulk flow of gas from the anatomical dead space into the alveoli due to increased alveolar oxygen absorption exceeding the carbon-dioxide production because of relative difference in blood solubility.(5,6) To et al. successfully used HFNO in 17 subglottic stenosis patients undergoing balloon dilatation, achieving a median apnoea time of 18 minutes while maintaining adequate oxygenation.(7)

Our management differed by using TCI Propofol for anaesthesia depth, administering Succinylcholine during rigid bronchoscope placement, and maintaining ventilation with THRIVE, providing the surgeon a clearer view without compromising ventilation. Over all procedure was done under 25 minutes with no desaturation noted at any point. Using a BSI monitor to maintain anaesthesia depth and prioritizing EtCO2 over TcCO2 or oxygen reserve index could enhance management. Effective multidisciplinary communication, clear strategies, rescue plans, and equipment availability are crucial for successful shared-space surgeries.

CONCLUSION

This case highlights the safe use of THRIVE and TCI Propofol in managing SGS in GPA, enabling optimal surgical access and oxygenation. A tailored, multidisciplinary approach ensured effective airway management and a smooth perioperative course.

REFERENCE

1. An J, Song JW. Life-Threatening Subglottic Stenosis of Granulomatosis with Polyangiitis: A Case Report. Medicina. 2021 Apr 27;57(5):423.
2. Shah M, Kapoor H. Anaesthetic Management of Subglottic Stenosis in Granulomatosis with Polyangiitis. Airway. 2021 Jan;4(1):54–6.
3. Jordan NP, Verma H, Siddiqui A, Morrison GA, D'Cruz DP. Morbidity and mortality associated with subglottic laryngotracheal stenosis in granulomatosis with polyangiitis (Wegener's granulomatosis): a single-centre experience in the United Kingdom. J Laryngol Otol. 2014Sep;128(9):831–7.
4. Roma C, Sá A, Lemos L, Frada R, Mexedo C. Successful Application of Transnasal Humidified Rapid-Insufflation Ventilatory Exchange in a Case of Subglottic Stenosis. Cureus [Internet]. 2024 Apr 11 [cited 2025 Jun 15]; Available from: https://www.cureus.com/articles/239661-successful-application-of-transnasal-humidified- rapid-insufflation-ventilatory-exchange-in-a-case-of-subglottic-stenosis
5. Min SH, Seo JH. Tube or tubeless: an anesthetic strategy for upper airway surgery. Anesth Pain Med. 2023 Apr 30;18(2):123–31.
6. Bharathi MB, Kumar MRA, Prakash BG, Shetty S, Sivapuram K, Madhan S. New Visionary in Upper Airway Surgeries–THRIVE, a Tubeless Ventilation. Indian J Otolaryngol Head Neck Surg. 2021 Jun;73(2):246–51.
7. To K, Harding F, Scott M, Milligan P, Nixon IJ, Adamson R, et al. The use of Transnasal Humidified Rapid-Insufflation Ventilatory Exchange in 17 cases of subglottic stenosis. Clinical Otolaryngology. 2017 Dec;42(6):1407–10.