Severe subglottic stenosis after resection of anterior mediastinal tumor using a double-lumen tube: a case report

Hiroaki Oiwa1,2^, Kosuke Sugawara3, Sho Morita3, Asuka Uebayashi1,2, Hiroaki Sakai4, Kazuhito Funai2, Toshinari Ema1,2

1Department of Thoracic Surgery, Fujieda Municipal General Hospital, Fujieda, Japan; 2First Department of Surgery, Hamamatsu University School of Medicine, Hamamatsu, Japan; 3Department of Otorhinolaryngology, Fujieda Municipal General Hospital, Fujieda, Japan; 4Department of Anesthesiology, Fujieda Municipal General Hospital, Fujieda, Japan

Contributions: (I) Conception and design: H Oiwa, K Sugawara, T Ema; (II) Administrative support: All authors; (III) Provision of study materials or patients: None; (IV) Collection and assembly of data: H Oiwa, K Sugawara, T Ema; (V) Data analysis and interpretation: All authors; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Hiroaki Oiwa, MD. Department of Thoracic Surgery, Fujieda Municipal General Hospital, 4-1-11, Surugadai, Fujieda 426-8677, Japan; First Department of Surgery, Hamamatsu University School of Medicine, Hamamatsu, Japan. Email: o.hiroaki0114@gmail.com.

Background: Double-lumen tubes (DLTs) are commonly used for differential pulmonary ventilation during thoracic surgery. Few reports exist on subglottic stenosis among patients who underwent surgery involving DLTs; we lack immediate postoperative period documentation leading up to the onset and subsequent recovery of subglottic stenosis. Herein, we present a case of a 75-year-old woman successfully treated for subglottic stenosis after DLT.

Case Description: A 75-year-old woman presented to our hospital with an abnormal chest shadow, which was identified during a medical examination. Chest computed tomography revealed an anterior mediastinal mass with a poor contrast effect measuring 6.0 cm × 3.1 cm × 1.9 cm, which grew from 2.2 to 6.0 cm over 21 months. Low and high signals were detected on T1- and T2-weighted thoracic magnetic resonance imaging, respectively. Concordantly, a thymic cyst was suspected. The patient underwent robotic-assisted thoracoscopic resection via the right lateral approach. A 35-Fr left-sided DLT was used for intubation and differential lung ventilation. Hoarseness and stridor were observed on postoperative day (POD) 1. Laryngoscopy showed submucosal hemorrhage around the vocal cords and mild subglottic stenosis; however, there was no arytenoid dislocation or findings necessitating emergency treatment. On POD 4, her stridor became more severe and laryngoscopy was re-performed and revealed subglottic stenosis progression prompting emergency tracheotomy. The stenosis further progressed, and almost complete airway obstruction was observed on POD 7. By POD 9, partially improving the subglottic stenosis, thereafter the subglottic stenosis was almost completely alleviated by POD 12. The tracheal cannula was removed on POD 22. Trachea-cutaneous fistula closure was performed on POD 35, and she was discharged on POD 42, remaining well. The pathological examination of the anterior mediastinal tumor confirmed the diagnosis of thymic cyst.

Conclusions: Airway obstruction owing to subglottic stenosis may occur several days post-surgery with a DLT. Prompt tracheostomy is recommended to prevent complete airway obstruction in patients with progressive subglottic stenosis.

Keywords: Subglottic stenosis; double-lumen tube (DLT); thoracic surgery; case report

Received: 13 July 2023; Accepted: 02 November 2023; Published online: 13 December 2023.
doi: 10.21037/acr-23-92

View this article at: https://dx.doi.org/10.21037/acr-23-92

^ ORCID: 0009-0008-9873-4665.
Introduction

Double-lumen tubes (DLTs) are commonly used for differential pulmonary ventilation during thoracic surgery. Few reports exist on subglottic stenosis among patients who underwent surgery involving DLTs (1-3). Progressive subglottic stenosis is a fatal complication leading to asphyxia. However, we lack immediate postoperative period documentation leading up to the onset and subsequent recovery of subglottic stenosis.

Herein, we present a case of a 75-year-old woman successfully treated for subglottic stenosis after DLT. We present this article in accordance with the CARE reporting checklist (available at https://acr.amegroups.com/article/view/10.21037/acr-23-92/rc).

Case presentation

A 75-year-old woman presented to our hospital with an abnormal chest shadow, which was identified during a medical examination (Figure 1A). She had a history of dyslipidemia and nontuberculous mycobacteriosis. Chest computed tomography (CT) revealed an inflammatory nodule in the lingula and an anterior mediastinal mass with a poor contrast effect measuring 6.0 cm × 3.1 cm × 1.9 cm (Figure 1B), which grew from 2.2 to 6.0 cm over 21 months. Low and high signals were detected on T1- and T2-weighted thoracic magnetic resonance imaging (Figure S1A, S1B) and gradual improvement was observed. However, the patient's narrow glottis, however, DLT barely passed through the glottis in one attempt. The surgical operating time was 1 h 28 min; the anesthesia time was 2 h 46 min. The patient was extubated in the operating room after the end of surgical procedure. No intraoperative complications were observed. Hoarseness and stridor were observed on postoperative day (POD) 1, which was initially attributed to the intubation. Patient’s percutaneous oxygen saturation (SpO₂) was 97% and respiratory status was stable, with a nasal cannula set at 1 L/min oxygen flow rate. Laryngoscopy showed submucosal hemorrhage around the vocal cords and mild subglottic stenosis just below the glottis; however, there was no arytenoid dislocation or findings necessitating emergency treatment (Figure 2A).

On POD 4, her SpO₂ was 97% on room air and the hoarseness had improved. However, her stridor became more severe and laryngoscopy was re-performed and revealed subglottic stenosis progression prompting emergency tracheotomy (Figure 2B). The tracheotomy tube was used Mera Sofit D-7CFs (Senko Medical Instrument Mfg. Co., Ltd., Tokyo, Japan). Intravenous hydrocortisone sodium succinate (250 mg/day) and inhaled epinephrine (0.1 mg/day) were administered. On POD 5, subglottic stenosis progressed further (Figure 3A). By POD 7, observation of the glottis through the tracheotomy orifice revealed almost complete airway obstruction (Figure 3B). By POD 9, partially improving the subglottic stenosis (Figure 3C), thereafter the subglottic stenosis was almost completely alleviated by POD 12 (Figure 3D) (Figure S1A, S1B) and gradual improvement continued (Figure S1C). Hydrocortisone was discontinued on POD 14, and the tracheal cannula was removed on POD 22 (Figure S1D, S1E). Trachea-curitaneous fistula closure was performed on POD 35, and she was discharged on POD 42, remaining well (Figure S1F-S1H). The pathological examination of the anterior mediastinal tumor confirmed the diagnosis of thymic cyst. All procedures performed in this study were in accordance with the ethical standards...
of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

**Discussion**

Reports on subglottic stenosis after thoracic surgery using
DLTs are limited (1-3); however, similarities were observed between previous cases and the present one. These included significant resistance while passing through the glottis during intubation, worsening stridor noted on the first POD, emergency airway treatment required on POD 4 and improvement of the subglottic stenosis by PODs 10–14. This sequence of events was possibly caused by the large tube size damaging the tracheal mucosa, as in previous reports (1-3). DLTs have a larger outer diameter than the standard tracheal tubes; making appropriate size selection challenging. Despite previous attempts to identify the appropriate DLT size through various factors, such as patient height, weight, tracheal and left main bronchial diameters, and transverse diameters of the cricoid cartilages, established methods are lacking (4,5). In this case, we suspected that the DLT may have damaged the tracheal mucosa as a possible cause of subglottic stenosis. There were no systemic diseases that promote an inflammatory response, and the anesthesia time was not particularly long, lasting less than 3 hours. The instantaneous and powerful damage to the tracheal mucosa by the DLT rather than the intubation time may be the cause of severe subglottic stenosis. As a preventive measure of the stenosis, downsizing the DLT and using a bronchial blocker may have been considered. However, Takahashi et al. reported that subglottic stenosis occurred when the tube size was changed from 35 to 32 Fr, owing to resistance during intubation (3). It may be difficult to prevent subglottic stenosis completely by downsizing the DLT.

Since it is difficult to predict the onset of subglottic stenosis before surgery and more effective preventive measures have not been established, early intervention such as tracheostomy is crucial. Systemic administration of steroids and epinephrine inhalation have been used to treat subglottic stenosis. However, formal evidence is lacking and airway clearance via tracheotomy is likely necessary.

**Figure 3** Laryngoscopic findings after tracheostomy. (A) On POD 5, laryngoscopy of the glottis through the tracheostomy orifice suggested progressive subglottic stenosis. (B) On POD 7, laryngoscopy of the glottis through the tracheostomy orifice revealed almost complete airway obstruction. (C) On POD 9, laryngoscopy of the glottis through the tracheostomy orifice indicated partial improvement in the subglottic stenosis. (D) On POD 12, laryngoscopy of the glottis through the tracheostomy orifice revealed almost complete resolution of the subglottic stenosis. POD, postoperative day.
Conclusions

This case highlights the potential of subglottic stenosis following thoracic surgery using a DLT. Patients should be monitored for hoarseness and stridor, as airway obstruction secondary to subglottic stenosis may occur several days after surgery with a DLT. Tracheostomy is recommended for worsening subglottic stenosis and early intervention is crucial.

Acknowledgments

We would like to thank Editage (www.editage.com) for English language editing.

Funding: None.

Footnote

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at https://acr.amegroups.com/article/view/10.21037/acr-23-92/rc

Peer Review File: Available at https://acr.amegroups.com/article/view/10.21037/acr-23-92/prf

Conflicts of Interest: The authors have completed the ICMJE uniform disclosure form (available at https://acr.amegroups.com/article/view/10.21037/acr-23-92/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

Open Access Statement: This is an Open Access article distributed in accordance with the Creative Commons Attribution-NonCommercial-NoDerivs 4.0 International License (CC BY-NC-ND 4.0), which permits the non-commercial replication and distribution of the article with the strict proviso that no changes or edits are made and the original work is properly cited (including links to both the formal publication through the relevant DOI and the license). See: https://creativecommons.org/licenses/by-nc-nd/4.0/.

References


doi: 10.21037/acr-23-92

Figure S1 Progressive changes in the laryngoscopic findings. (A) On POD 11, laryngoscopy of the glottis through the tracheostomy orifice indicated an improvement in the subglottic stenosis. (B) On POD 12, laryngoscopy revealed almost complete resolution of the subglottic stenosis. (C) On POD 15, laryngoscopy of the glottis through the tracheostomy orifice revealed no recurrence of the subglottic restenosis. (D) On POD 22, laryngoscopy confirmed the absence of recurrence of the subglottic restenosis. (E) On POD 22, laryngoscopy of the glottis through the tracheostomy orifice revealed no recurrence of the subglottic restenosis. (F-H) On POD 36, 49 and 58, respectively, laryngoscopy revealed a vocal cord granuloma. POD, postoperative day.