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Unexpected Difficult Intubation Due to Subglottic Stenosis - Two Case Reports

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Abstract **Case Report**

Aims and Background: Unexpected difficult intubation caused by subglottic stenosis is a rare but potentially life-threatening event during general anesthesia, as it may rapidly lead to hypoxia and perioperative morbidity. Subglottic stenosis can remain clinically silent and may not be detected during routine preoperative airway assessment. ***Case Description:*** We report two cases of unanticipated difficult airway management due to previously undiagnosed, asymptomatic subglottic stenosis caused by granulation tissue. The first case involved a 72-year-old man scheduled for right total hip arthroplasty who experienced unexpected resistance during tracheal intubation with a 7.0-mm internal diameter (ID) tube despite an adequate glottic view. Fiberoptic evaluation revealed subglottic granulation tissue, and successful intubation was achieved via a 6.0-mm ID tube. The second case involved a 74-year-old woman undergoing left mastoidectomy and tympanoplasty, in whom multiple intubation attempts using 6.0–7.0-mm ID tubes and laryngeal mask airway ventilation failed due to subglottic narrowing. Definitive airway management was accomplished with a 5.5-mm ID tube using a stylet. In both cases, subglottic stenosis was not suspected on the basis of the preoperative clinical evaluation. ***Conclusion:*** Asymptomatic subglottic stenosis caused by granulation tissue may present as unexpected difficult intubations. Anesthesiologists should maintain a high index of suspicion in patients with a history of tracheostomy or repeated endotracheal intubations, even in the absence of respiratory symptoms. The immediate availability of advanced airway equipment, including video laryngoscopes and fiberoptic bronchoscopes, is essential to ensure patient safety.

Keywords: Airway Management; Anesthesia, General; Granulation Tissue; Intubation, intratracheal; Laryngostenosis; Case report.

INTRODUCTION

Expected or unexpected difficult intubation is a common problem that anesthesiologists can face every day in the operating or emergency room. Unexpectedly difficult intubation can be very challenging to an anesthesiologist, and if it is not managed properly, these situations may expose the encountered patient to significant risks such as hypoventilation, hypoxia, or major organ failure [1]. The prevalence of difficult intubation varies widely from 0.1% to 10.1%, depending on the definition used [2,3]. If a situation of unexpected difficult intubation occurs during the process of attempting endotracheal intubation for the induction of anesthesia, the next step is to ask for help from those around you and reattempt endotracheal intubation. Anesthesiologists should decide whether to use another device as a substitute after the patient recovers from anesthesia and assess the patient's airway status. In this process, various preparations and monitoring methods, such as a video laryngoscope, supraglottic airway, fiberoptic endoscope, tracheostomy, or reevaluation of the patient after recovery, are necessary [4-6]. We experienced unexpectedly difficult intubation due to subglottic stenosis caused by granulation tissue on the posterior surface of the trachea during anesthesia induction in a patient who had no specific symptoms or signs of respiratory or airway system problems in the preoperative examination. We attempted fiberoptic-guided endotracheal intubation and successfully managed anesthesia. We report these two cases along with a literature review. This case study was authorized by our institutional review board (IRB no. 2025-03-003).

Case 1

A 72-year-old man (62.1 kg, 161.8 cm; body mass index [BMI], 23.6 kg/m²) was scheduled for right total hip arthroplasty due to avascular necrosis of the femoral head. He had a past medical history of cervical spine 4–5 and lumbar spine disc herniation in 2015. The cervical spine disorder was treated with conservative and physical therapy and lumbar spine 4-5 fusion at another hospital. On January 7, 2018, the patient underwent video-assisted transthoracic decortication at our hospital for right lung empyema. According to the medical records at the time, a 37 Fr. double lumen tube was used during anesthesia, and one instance of lung ventilation during surgery was not smooth; thus, CO2 was retained, and EtCO2 was recorded as 72. After surgery, consciousness and stable breathing recovered, extubation was performed, and the patient was transferred to the intensive care unit (ICU). However, 30 minutes after arriving at the ICU, he complained of dyspnea with decreased oxygen saturation under 90, endotracheal intubation was performed, and mechanical ventilation was maintained. His condition gradually worsened, progressing to acute respiratory distress syndrome and septic shock. After one month in the ICU, a tracheostomy 7.5 I.D. was performed, and long-term mechanical ventilation was used for respiratory care. In March 2018, the patient's condition gradually worsened, and extracorporeal membrane oxygenation care was provided for approximately 2 weeks. The patient gradually recovered, and home care was performed using a T-tube (7.5 I.D.) cuffed tube while maintaining a home vent beginning on May 3, 2018. However, the T-tube was uncomfortable with self-breathing support, so the T-tube was gradually replaced to 5.0 on May 28, 2018. After that, the tracheostomy tube was removed on June 3, and the patient was discharged with stable breathing. On July 2, 2018, the patient complained of discomfort due to delayed closure of the tracheostomy site, so general anesthesia was performed along with endotracheal intubation with an armoured tube I.D.7.0, without any difficulty, and a flap operation was performed to close the tracheostomy site. He was discharged after 3 days without any adverse events. It was reported that the patient was able to return to daily life without any discomfort thereafter.

There was no problem communicating with the patient during the preoperative visit, and there was no specific discomfort in the respiratory or cardiovascular system. On the day of surgery, the patient was admitted to the operating room, and after the patient's status was checked, monitoring equipment, such as blood pressure, electrocardiogram, and oxygen saturation, was installed. Anesthesia was induced by administering 40 mg of lidocaine and 1.5 mg/kg propofol. After confirming loss of consciousness and no eyelash reflex, a face mask was placed, and 50 mg rocuronium (0.8 mg/kg) was administered while assisted ventilation was maintained. After 3 minutes, endotracheal intubation (I.D. 7.0) was attempted via direct laryngoscopy, but intubation did not proceed smoothly because of insertion difficulty after the vocal cord was passed. There was resistance that impeded the advancement of the ETT I.D. 7.0. In the second attempt, we observed the area behind the vocal cord with a video laryngoscope. The video-laryngoscope screen confirmed that the lumen was narrowed by subglottic granulation tissue and very narrow free space (Figure 1). It was slightly difficult to maintain mask ventilation. However, after confirming that the patient's vital signs and oxygen saturation were within normal limits, a third endotracheal intubation (I.D. 6.0) was performed via a fiberoptic endoscope, and airway management was successfully achieved. Dexamethasone (5 mg IV) was administered to relieve and prevent laryngeal edema due to airway stimulation.

Figure 1: Subglottic stenosis View of video-laryngoscope. The point at which endotracheal intubation is difficult. The circle indicates the point of subglottic stenosis and blocks the insertion of the endotracheal tube

After the surgery finished, the patient was administered 100 mg of sugammadex, and extubation was performed after confirming recovery of breathing and consciousness. Thereafter, he was moved to the recovery room without any unusual events. Stable self-breathing and oxygen saturation were maintained in the recovery room without any unusual events, self-breathing was maintained, and the patient was moved to the ward 30 minutes later. We checked the old and preoperative chest PA X-ray once more and detected suspicious differences in the shadow of the tracheal lumen in the neck region. The radiologists' findings included mild cardiomegaly, right pleural thickening, and multiple old rib fractures (Figure 2). He never complained of any symptoms or signs due to subglottic stenosis and would undergo further examination and treatment if symptoms developed in the future and was discharged 10 days after surgery.

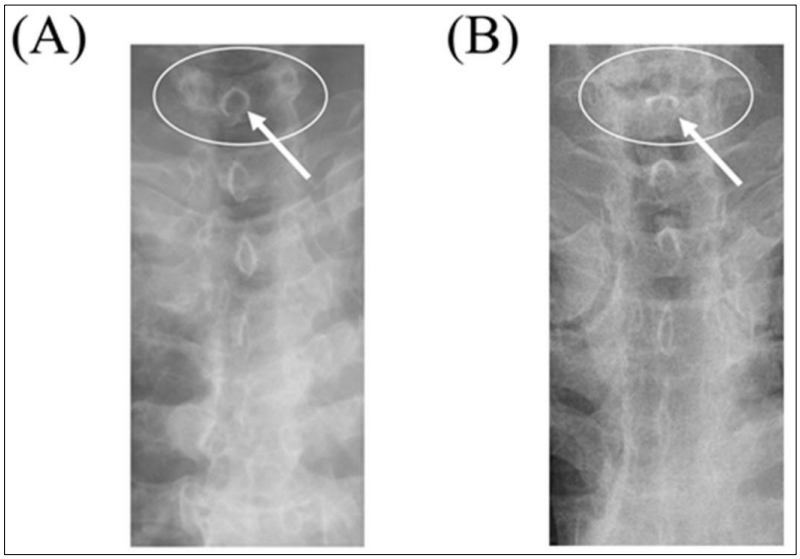

Figure 2: Chest X-ray view of the tracheal region. (A) A chest PA radiograph obtained 8 years earlier and (B) a preoperative chest PA radiograph. Comparison of the two images reveals subtle differences in the shadow of the tracheal lumen in the neck region (arrows), at the level of the sixth cervical vertebra (C6). Additional radiologic findings include mild cardiomegaly, right pleural thickening, and multiple old rib fractures

Case 2

A 74-year-old woman (56.1 kg, 148.3 cm; BMI, 25.5 kg/m²) was scheduled for left mastoidectomy and tympanoplasty for chronic otitis media. Her medical history included hypertension and dyslipidemia with medication for more than 5 years, and a lumbar microdiscectomy was performed 20 years ago. In May 2024, a cholecystectomy was performed. She underwent botulinum toxin injection in January 2025, followed by peroral endoscopic myotomy for achalasia under general anesthesia with endotracheal intubation in June 2025. According to the last general anesthesia record, intubation was performed when the ETT changed from 6.5 to 6.0 for no reason other than little resistance, and it was not evaluated as difficult intubation.

During the preoperative routine physical and laboratory examinations, spirometry revealed an obstructive pattern, with a forced expiratory volume in 1 second (FEV1) of 72% of the predicted value and an FEV1/FVC ratio of 68%. Chest computed tomography performed in May 2024 revealed significant tracheal narrowing, with minimal diameters of 4.32 mm, 4.73 mm, and 5.88 mm at the different subglottic levels. General anesthesia was induced with 100 mg propofol, 40 mg lidocaine, 25 mcg fentanyl, and 50 mg rocuronium. After the eyelash reflex had disappeared and assisted ventilation was maintained for 3 minutes, initial intubation via a video laryngoscope with an ETT (I.D.7.0) failed. Subsequent attempts with 6.5 and 6.0 I.D. ETTs were also unsuccessful. Ventilation with a laryngeal mask airway (LMA) was then attempted: sizes 3 and 4 were ineffective due to significant leakage at 15 mmHg in size 3 and high peak airway pressure at 30 mmHg in size 4. Ultimately, successful intubation was achieved with a 5.5-I.D. ETT. Following intubation, dexamethasone (5 mg) was administered. Fiberoptic bronchoscopy was also attempted to check the trachea; however, visualization of the stenotic tracheal segment was less than 1.0 cm distal from the vocal cords and was limited by intense light reflection within the narrowed lumen (Figure 3). The surgery proceeded uneventfully, and the patient finished. All anesthetic drugs were stopped, and the neuromuscular blockade (TOF ratio > 0.4) was reversed with sugammadex 100 mg (0.16 mg/kg). After 5 minutes, she was extubated and transferred to the recovery room without any respiratory problems, such as stridor, dyspnea or respiratory difficulty. Although further diagnostic evaluation was recommended postoperatively, she declined because she had no specific symptoms or signs of subglottic stenosis for usual life and was discharged 5 days later.

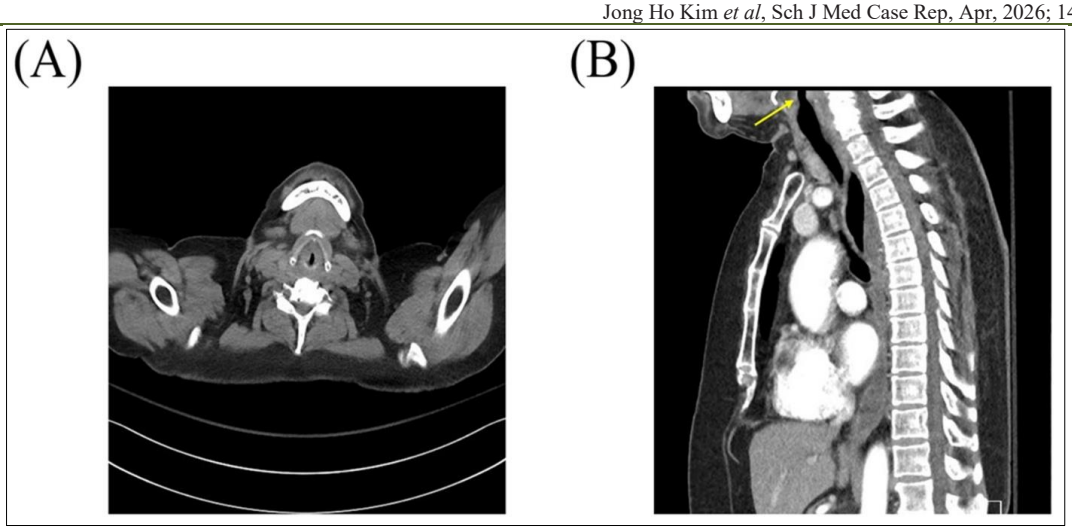

Figure 3: (A) Axial computed tomography (CT) image of the neck showing focal narrowing of the subglottic airway. (B) Sagittal CT image demonstrating significant subglottic stenosis approximately 1.0 cm below the vocal cords (yellow arrow), with the minimal tracheal diameter measuring 4.32 mm

DISCUSSION

Subglottic stenosis refers to a condition in which the airway is narrowed inferior to the glottis. It can occur at the level of the supraglottis, glottis, subglottis, or trachea. Each of these conditions may present and result in potentially life-threatening restrictions on ventilation. The incidence is approximately 1 in 200,000 adults annually. The most common cause is iatrogenic trauma, and other causes include autoimmune disease and idiopathic disease, with laryngeal trauma and infection [7]. These two cases were suspected of being caused by trauma, such as post-tracheostomy and multiple endotracheal intubations.

However, in these two cases, there were no respiratory difficulty symptoms or signs, such as dyspnea, stridor, or voice changes, other than a history of multiple and prolonged endotracheal intubations or tracheostomies that could be suspected before surgery, so the possibility of difficult intubation could not be suspected. In these two cases of unanticipated difficult intubation, since unexpected difficulties are encountered at each stage, the risk of apnea or hypoventilation and hypoxia may increase, so patients may ask for help from those around them to prepare for this and treat it effectively. In the second case, difficult intubation could have been predicted through the medical records. However, the anesthesiologist did not consider anesthesia records, such as when the endotracheal tube size was relatively small. The trachea of these patients was smaller in diameter than that of ordinary patients.

During the procedure of endotracheal intubation, if a second or third attempt is made, the airway status should be assessed after the first or second attempt, and device selection and replacement should be decided during the second or third attempt to achieve successful endotracheal intubation or postpone the operation after recovery from anesthesia and evaluation [8]. To do so, sufficient personnel and equipment preparation are needed, and the equipment should be familiar with the characteristics and usage techniques of each piece of equipment [4-8]. In these two cases, we confirmed subglottic stenosis via video laryngoscopy. The technique was changed to a fiberoptic endoscope with a decreased tube size from 6.5 to 6.0 in the first case and from 7.0 to 5.5 in the second case. Considering that there were no symptoms or signs and that the endotracheal tube was inserted without difficulty via a fiberoptic endoscope or video-laryngoscope view, the degree of subglottic stenosis was thought to be classified as stage I or II [9]. In these two cases, endotracheal intubation was performed safely, smoothly and gently without heavy power. This can cause airway trauma and increase the risk of airway problems.

Mild subglottic stenosis is often asymptomatic; however, when present, the main reported symptoms are dyspnea (especially after exertion), hoarseness and occasional stridor. Subglottic stenosis is frequently misdiagnosed as asthma, and patients are often referred to ear, nose and throat (ENT) surgeons only once asthma medications have failed to alleviate their symptoms [10-12]. In this case, we suspect that the patient did not complain about any symptoms or signs, such as voice changes, stridor or respiratory problems. Therefore, it was very difficult to detect subglottic stenosis before anesthesia-by-anesthesia providers.

A focused literature review revealed previously unrecognized subglottic stenosis in adults discovered following the induction of anesthesia. None of the studies described failed tracheal intubation leading to an emergency front-of-neck airway. The reports describe a range of origins of subglottic stenosis, including postintubation injury, Wegener's granulomatosis, cricoid chondrosarcoma, laryngeal web, subglottic ring and subglottic stenosis related to preeclampsia during pregnancy [6,12]. In the first case, there was a risk of

subglottic stenosis due to a history of long-term endotracheal intubation and tracheostomy, but it was not predicted at all because there were no suspicious symptoms or signs. In addition, there was no specific difficult endotracheal intubation for a previous operation for a flap.

The other risk factors for laryngotracheal stenosis in adult patients are obesity (> 35.9 BMI) and female sex. The following criteria were used: tube size > 6, cuff pressure 30 cmH2O, more than 10 days of endotracheal intubation, use of the percutaneous technique, and failure to create the Bjork flap. Patient factors such as patient age, sex, race, alcoholism, and tobacco use were classified as factors with little influence [13-15].

Another problem in the second case was that laryngeal mask airways 3 and 4 in size were sequentially applied because intubation was difficult on the first attempt. However, effective ventilation could not be maintained due to air leaks resulting in airway pressures less than 15 mmHg in size 3 and high peak airway pressures greater than 30 mmHg in size 4. Although the size was selected on the basis of patient weight according to the manufacturer's recommendations, the cause of supragiglottic airway device insertion failure could be obstruction due to LMA cuff ballooning and subglottic granulation tissue. Thus, laryngeal mask airway failure may have been due to the patient's acquired abnormality and subglottic stenosis [16].

In these two cases, the main problems were as follows: the preoperative chest-ray and computed tomography findings were cardiovascular and pulmonary problems, so epiglottic stenosis was not confirmed by an attending subspecial physician, radiologists or anesthesiologist. In addition, difficult intubations can be detected during preoperative visits and evaluations, but descriptions of the preoperative physical examination and medical records of the patient's condition during the previous operation are insufficient. Then, anesthesiologists should be familiar with airway management on the basis of the location and severity of subglottic stenosis. With unanticipated subglottic stenosis, the anesthesia team must make rapid decisions. Close multidisciplinary team management is needed for patients who have complex comorbidities. The second problem, the cause of subglottic stenosis, led to the use of smaller size of endotracheal tube from 7.0 to 6.0 and from 6.5 to 6.0, is suspect to be prolonged tracheostomy and multiple endotracheal intubations. A high-volume, low-pressure cuff was used, but subglottic stenosis due to granulation tissue, a decrease in tracheal diameter of more than 1mm. Therefore, these two patients who undergo repeated endotracheal intubations within a short period of time or prolonged tracheostomy should be cautious about cuff volume and pressure application. Furthermore, if such patients are encountered for anesthesia, preparation for difficult intubation us also necessary

CONCLUSION

We report two cases with a long history or multiple experiences of endotracheal intubation and tracheostomy who experienced unexpected difficult intubation due to subglottic stenosis and were safely managed under general anesthesia by performing endotracheal intubation via a fiberoptic endoscope and video laryngoscope. The authors recommend that cuff pressure should be adjusted and managed in patients with the possibility of prolonged endotracheal intubation and tracheostomy and that anesthesia providers should be prepared and described by considering the possibility of unexpected difficult intubation even in the absence of symptoms and signs of suggestive subglottic stenosis posttracheostomy or multiple endotracheal intubations.

Institutional Review Board Statement

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of Chuncheon Sacred Heart Hospital, Hallym University College of Medicine (IRB No. 2025-03-003).

Patient Consent for Publication

Written informed consent was obtained from all patients for publication of this case report and the accompanying images.

Clinical Trial Registry Number: Not applicable.

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Conflict of Interest

The authors declare that they have no conflicts of interest related to this study.

Acknowledgments: None

Strengths and Limitations

This case report highlights two rare cases of unexpected difficult intubation caused by asymptomatic subglottic stenosis, emphasizing the importance of thorough airway assessment and preparedness even in the absence of clinical symptoms. However, this study is limited by its small sample size and the inherent inability of case reports to establish causality or generalize findings to a broader population.

Author Contributions

J.H.K case acquisition and writing–original draft, S.K case acquisition and visualization/figures, B.K.S patient management, S.M.H patient management, J.J.L data curation, Y.S.K literature review, H.S.Y writing–review & editing and supervision. All authors reviewed and approved the final manuscript.

Data Availability Declaration

The datasets generated during the current study are not publicly available due to ethical and confidentiality restrictions but are available from the corresponding author upon reasonable request.

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