**Name of Journal:** *World Journal of Clinical Cases*

**Manuscript NO:** 82542

**Manuscript Type:** CASE REPORT

**Paradoxical vocal fold motion masquerading as post-anesthetic respiratory distress: A case report**

Baek J *et al*. Paradoxical vocal fold motion after anesthesia

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**Author contributions:** Baek J and Choi EK contributed to the investigation, original draft writing, and manuscript reviewing and editing; Jee DL contributed to supervision and manuscript reviewing and editing; Choi YS and Kim SW contributed to manuscript reviewing and editing; all authors have read and approved the final manuscript.

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**Received:** December 22, 2022

**Revised:** January 18, 2023

**Accepted:** March 15, 2023

**Published online:** April 6, 2023

**Abstract**

BACKGROUND

Functional vocal cord disorders can be a differential diagnosis for postoperative upper airway obstruction requiring urgent intervention. However, this may be unfamiliar to anesthesiologists who would favor inappropriate airway intervention and increased morbidity.

CASE SUMMARY

A 61-year-old woman underwent cervical laminectomy, followed by laparoscopic cholecystectomy 10 mo later. Despite adequate reversal of neuromuscular blockade, the patient experienced repetitive respiratory difficulty with inspiratory stridor after extubation. After the second operation, the patient was diagnosed with paradoxical vocal fold motion (PVFM) by an otolaryngologist based on the clinical features and fiberoptic bronchoscopy results, and the patient was successfully treated.

CONCLUSION

PVFM should be considered a differential diagnosis if a patient presents with stridor after general anesthesia.

**Key Words:** Anesthesiology; Vocal fold; Paradoxical motion; Postoperative respiratory distress; Case report

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**Citation**: Baek J, Jee DL, Choi YS, Kim SW, Choi EK. Paradoxical vocal fold motion masquerading as post-anesthetic respiratory distress: A case report. *World J Clin Cases* 2023; 11(10): 2349-2354

**URL:** https://www.wjgnet.com/2307-8960/full/v11/i10/2349.htm

**DOI:** https://dx.doi.org/10.12998/wjcc.v11.i10.2349

**Core Tip:** Postoperative upper airway obstruction after general anesthesia requires urgent airway intervention. Postoperative stridor is a common cause of laryngeal spasm, but functional vocal cord disorders may also be a cause. However, anesthesiologists may be unfamiliar with functional vocal cord disorders, and this may lead to inappropriate interventions. We present the case of a patient with post-extubation repetitive stridor who was postoperatively diagnosed with paradoxical vocal fold motion (PVFM) by an otolaryngologist and discuss the diagnosis and treatment of PVFM. Our case presentation showed that PVFM should be considered in the differential diagnosis of postoperative stridor.

**INTRODUCTION**

Postoperative upper airway obstruction after general anesthesia is a significant problem that can cause severe complications that require urgent airway intervention. In addition to common causes, such as laryngeal spasm induced by residual muscle relaxants, a functional vocal cord disorder can also be a differential diagnosis of postoperative stridor[1,2]. However, as this cause may be unfamiliar to those in anesthesiology, it could lead to inappropriate airway interventions and increased morbidity.

Here, we present the case of a patient with repetitive stridor after extubation who was postoperatively diagnosed with paradoxical vocal fold motion (PVFM) by an otolaryngologist.

**CASE PRESENTATION**

***Chief complaints***

A 61-year-old woman (weight, 70 kg; height, 155 cm; body mass index, 29.14) developed respiratory difficulties with inspiratory stridor after extubation for each of her surgeries.

***History of present illness***

**First surgery:** The patient underwent a cervical laminectomy to resect an extradural tumor at the C2 to C3 vertebral level. No premedication was administered, and standard anesthetic monitoring, including electrocardiogram, non-invasive blood pressure, and pulse oximetry, was conducted after arriving at the operating room. Anesthesia was induced with propofol and rocuronium, and a 7.5 mm armored endotracheal tube was used, without difficulty, during intubation. The Cormack-Lehane grade observed on laryngoscopy during intubation was grade 1. Anesthesia was maintained with desflurane and 50% oxygen for 3 h and 30 min. There were no notable intraoperative events. Pyridostigmine and glycopyrrolate were injected to reverse the neuromuscular blockade, and the patient was extubated without difficulty. Spontaneous breathing was maintained immediately after extubation, and no abnormal respiratory signs were observed. However, 5 min after arriving at the post-anesthesia care unit (PACU), breathing difficulties and tachypnea were observed. The patient developed respiratory difficulty with inspiratory stridor.

**Second surgery:** Ten months after the first surgery, the patient was scheduled to undergo laparoscopic cholecystectomy for gallstones and polyps. Preoperative evaluations conducted by an otolaryngologist revealed normal structure and movement of the vocal cords. Intravenous propofol and rocuronium were administered to induce anesthesia. Before intubation with the endotracheal tube, intravenous lidocaine was administered to attenuate airway reflexes and hemodynamic fluctuations. As a vocal cord disorder developed after the previous operation, a 6.5 mm cuffed endotracheal tube was used with special caution, and dexamethasone 5 mg was administered 30 min before extubation. Anesthesia was maintained with desflurane, 50% oxygen, and an infusion of 0.5-1.5 μg/kg/min of remifentanil for 50 min. There were no special intraoperative events. After clinical confirmation of adequate neuromuscular blockade reversal using train-of-four (TOF), the endotracheal tube was removed. Shortly after extubation, the patient developed respiratory difficulty, and stridor was heard again. An O2 mask was applied with 100% oxygen, and breathing was assisted with a bag-valve mask. Despite these efforts, the respiratory distress and inspiratory stridor did not improve.

***History of past illness***

There were no abnormal findings in the preoperative evaluation, including physical examination, laboratory tests, electrocardiogram, and chest X-ray. The patient had an average-sized neck, and the preoperative Mallampati score was grade 1.

***Personal and family history***

Three years before the present admission, the patient was diagnosed with thyroid cancer and had undergone total thyroidectomy. No perioperative complications related to anesthesia were observed at that time. The patient’s medical history was unremarkable. The patient did not smoke or drink alcohol and had no history of allergies.

***Physical examination***

**First surgery:** Immediately after extubation, the patient’s oxygen saturation (SpO2) in the operating room was 99%. After arriving at the PACU, 100% oxygen was administered at 2 L/min *via* a nasal cannula; SpO2 was 99%. Complete clinical reversal was confirmed by observing a TOF (peripheral nerve stimulator) after the development of inspiratory stridor.

**Second surgery:** Adequate reversal of neuromuscular blockade was clinically confirmed by TOF immediately before extubation. Oxygen saturation was maintained above 98% by providing 100% oxygen immediately after the stridor started.

***Laboratory examinations***

The preoperative laboratory test results were within normal limits. However, mild hyperventilation (pH, 7.48; PaCO2, 31.6 mmHg; PaO2, 106 mmHg) was observed in arterial blood gas analysis when reintubation was performed due to postoperative stridor.

***Imaging examinations***

After the second surgery, an otolaryngologist performed a nasal fiberoptic bronchoscopy to resolve these repetitive episodes. No laryngeal trauma, edema, or vocal cord paralysis was observed. However, the vocal cords moved paradoxically during inspiration (Figure 1).

**FINAL DIAGNOSIS**

The patient was finally diagnosed with PVFM by the otolaryngologist.

**TREATMENT**

***First surgery***

Although complete clinical reversal was confirmed, reversal agents for neuromuscular blockade were additionally administered for suspected laryngeal spasm. Intravenous lidocaine, dexamethasone, and intraoral salbutamol spray were administered to relieve respiratory distress, and the patient’s head was elevated. Her vital signs, including SpO2, remained stable, but the inspiratory stridor lasted for approximately 10 min. No other lung parenchymal sounds were noted on auscultation except for stridor. The decision to perform re-intubation was made, and intravenous propofol was given. After intubation, the patient’s breathing patterns improved, and arterial blood sampling showed mild hyperventilation (pH, 7.48; PaCO2,31.6 mmHg; PaO2, 106 mmHg). The SpO2 remained at > 98% without oxygen support. After discussion with the neurosurgery department, the patient was transferred to the intensive care unit for close observation. The otolaryngologist suspected that her symptoms were due to underlying asymptomatic vocal cord paralysis after total thyroidectomy, which was not recognized before the operation, or vocal cord irritation caused by intubation. A few hours later, the patient was extubated under close observation. She developed mild hoarseness; however, her breath sounds were normal, and her SpO2 was 99% with no stridor. The patient was discharged without further evaluation based on her wishes.

***Second surgery***

After fiberoptic bronchoscopy, 2 mg of midazolam was administered with reassurance for suspected PVFM. The stridor intensity was reduced, and the patient was moved to the PACU. The patient did not develop respiratory distress, and her oxygen saturation was maintained at 98%-100% on 2 L/min of oxygen *via* a nasal cannula.

**OUTCOME AND FOLLOW-UP**

The patient was discharged three days after the second surgery without complications. One month later, the patient revisited the otorhinolaryngology department because of laryngeal symptoms, including chronic cough, the sensation of a lump in her throat, and repeated throat clearing. Furthermore, the patient experienced three episodes of dyspnea with stridor lasting for several minutes, similar to the events that occurred after the two surgeries while sleeping or eating. The otolaryngologist suspected PVFM clinically and prescribed a proton pump inhibitor and laryngeal control therapy. After two months of treatment, all symptoms improved, and the patient was finally diagnosed with PVFM by the otolaryngologist.

**DISCUSSION**

After the first surgery, the patient did not receive a timely and proper diagnosis and treatment. Because the patient had no previous respiratory or psychiatric history, and there was no increased awareness of the functional causes of upper airway obstruction, PVFM was not recognized as a cause of sustained stridor and dyspnea. Consequently, the patient was reintubated in the PACU without additional fiberoptic bronchoscopic examinations to diagnose this disorder.

Postoperative upper airway obstruction presenting with inspiratory stridor is a common phenomenon in anesthesiology. Depressed laryngeal muscle activity due to residual effects of anesthetics and muscle relaxants, laryngeal edema caused by the prolonged placement of the endotracheal tube, and laryngeal stimulation by secretions such as blood and mucus can precipitate laryngospasm in partially awake or, rarely, fully awake patients[3]. In addition to the aforementioned causes, vocal cord paralysis and laryngomalacia can be considered identifiable organic etiologies of postoperative upper airway obstruction[3]. Although some cases of post-extubation stridor do not require urgent intervention, others can result in disastrous clinical symptoms requiring resuscitation, which increases patient morbidity and mortality. Therefore, accurate diagnosis and adequate treatment are necessary.

Stridor management should be directed toward the underlying cause. Stridor is usually inspiratory and is a sign of upper airway obstruction. However, not all stridor has organic cause. Typically, PVFM is a functional stridor. This condition shows paradoxical adduction of vocal cords during inspiration and occasionally during early expiration[4]. Other names for PVFM include functional inspiratory stridor, factitious asthma, and emotional laryngismus[5]. Owing to clinical presentations that mimic serious upper airway obstruction, PVFM is often misdiagnosed as several pathological states, including croup, subglottic stenosis, traumatic airway edema, laryngomalacia, and asthma[3], leading to inappropriate treatment, extensive investigation, and considerable delay in making a proper diagnosis. According to one case series, 28% of 95 patients with PVFM were intubated, and some underwent tracheostomy[6]. In this case, the patient presented with sustained respiratory difficulties with inspiratory stridor, although oxygen saturation remained within the normal range. After excluding the residual effects of muscle relaxants and anesthetics, the patient was initially treated conservatively without improvement. After the first surgery, we had not yet considered PVFM as a differential diagnosis related to postoperative airway obstruction, and the patient was eventually reintubated to resolve severe respiratory distress. If there was an awareness of functional vocal cord disorders, fiberoptic bronchoscopy could have been performed to determine the cause of inspiratory stridor, and other treatment options such as sedation and reassurance would have been performed instead of reintubation.

PVFM can occur at any age but is more common in adult females[7]. A history of recent respiratory tract infection and stress-related psychiatric disorder is often present in PVFM. Moreover, upper airway obstruction features such as dysphonia, accessory muscle use, and stridor can be present, often resulting in a misdiagnosis of asthma[8]. The most important consideration for anesthesiologists is that PVFM can occur after general anesthesia. PVFM is a rare condition in anesthesiology and has only partly been reported in the respiratory and otorhinolaryngology fields. Therefore, clinicians should suspect PVFM in patients presenting with postoperative stridor. In other words, the differential diagnosis of postoperative stridor should include PVFM, laryngeal spasm, laryngeal edema, and vocal cord paralysis. Some case reports have discussed functional stridor after anesthesia[9,10]. A confirmative diagnosis of PVFM can be obtained by fiberoptic laryngoscopy, which reveals abnormal adduction of the vocal cords on inspiration and normal vocal cord motion during expiration[11]. However, organic disorders related to upper airway obstruction should be excluded first. Once diagnosed, short-term sedation and reassurance may help control symptoms in the acute phase, and definitive treatment includes psychotherapy, speech therapy, and patient education.

**CONCLUSION**

PVFM should be considered a differential diagnosis if a patient presents with an episode of upper airway obstruction after general endotracheal anesthesia without organic airway disorders. An increased awareness of functional vocal cord disorders will help make timely diagnoses and avoid potentially harmful treatments.

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**Footnotes**

**Informed consent statement:** Informed written consent was obtained from the patient for publication of this report.

**Conflict-of-interest statement:** The authors declare that they have no conflict of interest to disclose.

**CARE Checklist (2016) statement:** The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

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**Provenance and peer review:** Unsolicited article; Externally peer reviewed.

**Peer-review model:** Single blind

**Peer-review started:** December 22, 2022

**First decision:** January 9, 2023

**Article in press:** March 15, 2023

**Specialty type:** Anesthesiology

**Country/Territory of origin:** South Korea

**Peer-review report’s scientific quality classification**

Grade A (Excellent): 0

Grade B (Very good): B

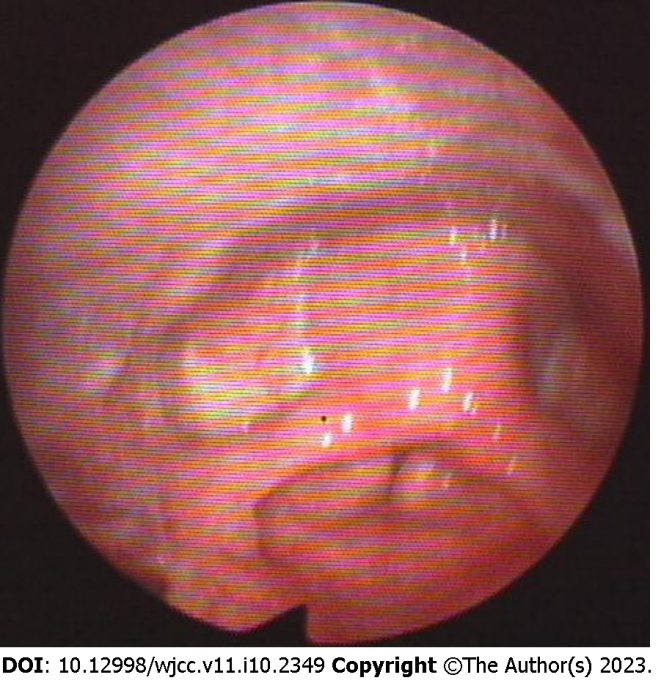
Grade C (Good): C

Grade D (Fair): 0

Grade E (Poor): 0

**P-Reviewer:** Roy S, United States; Zhang YN, China **S-Editor:** Yan JP **L-Editor:** A **P-Editor:** Yan JP

**Figure Legends**



**Figure 1** **Nasal fiberoptic bronchoscopy image of paradoxical vocal cord motion during inspiration.**



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