Successful Double-lumen Tube Intubation in the Lateral Position for a Patient with a Giant Superior Mediastinal Tumor

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Objective: Anesthetic management of patients with giant mediastinal tumors is challenging from the perspective of both cardiovascular and respiratory management, and airway assessment is important for both concerns. We report the successful induction of general anesthesia and double-lumen tube intubation in the right lateral position for a patient with a giant mediastinal tumor with tracheal compression, using pre-operative chest radiograph imaging to minimize tracheal compression during induction.
Methods: A 41-year-old man required thoracoscopic giant superior mediastinal tumor resection. His trachea was compressed and displaced because of the tumor. Because preoperative chest radiography revealed that the tracheal diameter increased in the right lateral position, we chose this position for induction.
Results: Prompt and smooth intubation with a 35-Fr double-lumen tube (DLT) was achieved, and no adverse events associated with intubation were encountered.
Conclusion: Safe and smooth induction with a DLT was performed owing to the perioperative chest radiograph imaging examination, which revealed the most advantageous position regarding minimal tracheal compression.

Key words: mediastinal tumor, lateral position, double-lumen tube, video laryngoscope, tracheal intubation

INTRODUCTION

Mediastinal mass syndrome remains an anesthetic challenge that cannot be underestimated, and airway assessment is important in the anesthetic management of mediastinal tumor surgery [1–3]. We report a case of anesthetic management with induction of general anesthesia and double-lumen tube (DLT) intubation in the lateral position for a patient in whom tracheal compression and displacement due to a giant superior mediastinal tumor improved in the lateral position.

MATERIALS AND METHODS

A 41-year-old man with a height of 188 cm, weight of 94 kg, and body mass index of 27 kg/m^2 was scheduled for tumor resection via video-assisted thoracoscopic surgery for a superior mediastinal tumor found by examination of shoulder pain. The patient had a history of bronchial asthma and had been taking inhaled and oral medications since the age of 16 years. At the age of 16, thyroid cyst puncture was performed under general anesthesia. The patient experienced no dyspnea while sleeping; however, he developed a cough 2 months prior to surgery. Chest radiograph and thoracic computed tomography (CT) revealed a superior mediastinal tumor (94.2 × 87.7 × 92.1 mm), with marked tracheal displacement by the mass at the left posterior segment of the fourth to fifth intercostal region. The smallest tracheal cross-sectional area of the compressed portion of the trachea on chest CT was 180 mm^2, and the area constituted 58% of the tracheal cross-sectional area at the left posterior segment of the sixth intercostal region. In addition, the minimum tracheal diameter on chest radiographs was 8.9 mm in the standing position and 10.6 mm in the right lateral position. The tracheal deviation from the midline was 18.6 mm in the standing position, and deviation improved in the right lateral position. Tracheal pressure was relieved and improvement of the tracheal displacement was observed in the right lateral position (Fig. 1). No other abnormal findings were observed.

ANESTHETIC PLAN

Because tracheal diameter increased in the right lateral position, this was the chosen position for induction of general anesthesia. Moreover, to confirm that the tracheal diameter was maintained, we decided to repeat and evaluate chest radiographs at each change in position.

ANESTHETIC MANAGEMENT

On arrival in the operating room, the patient's blood pressure was 140/85 mmHg, heart rate: 86 beats/min, and oxygen saturation (SpO_2): 94–5%. An epidural catheter was placed at the Th 5/6 intervertebral level in the right lateral position under oxygenation. We re-confirmed improved tracheal compression and deviation in the right lateral position on chest

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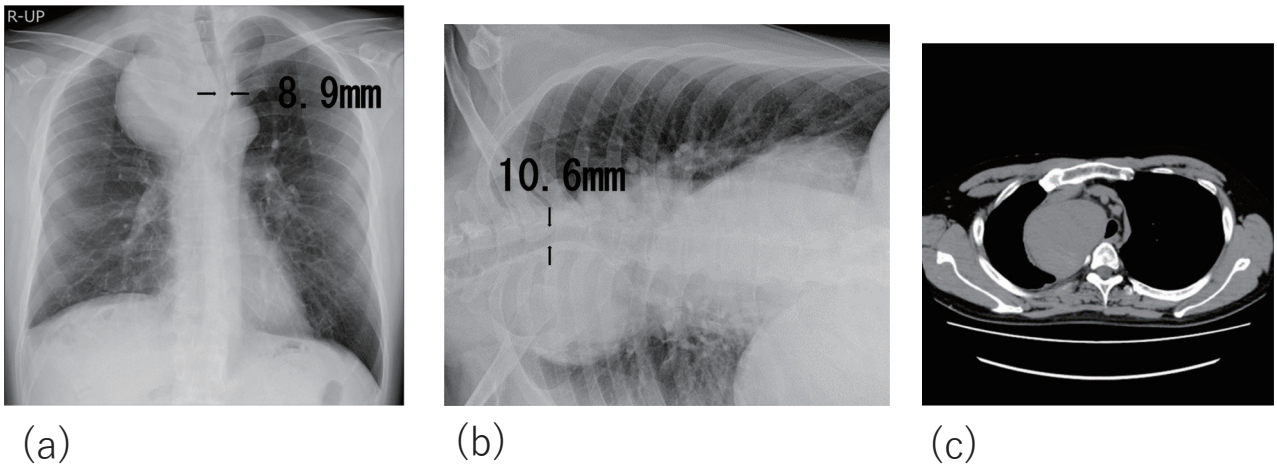

Fig. 1 (a) Pre-operative radiograph, standing position. (b) Pre-operative radiograph, right lateral position. (c) Pre-operative radiograph, supine position.

radiographs and that there was no change in tracheal diameter before inducing anesthesia. Induction of general anesthesia was performed in the right lateral position.

Under intravenous arterial pressure measurement, fentanyl 100 μg and propofol 180 mg were administered. Following confirmation of the feasibility of mask ventilation, 90 mg of rocuronium was administered. We then inserted a McGRATH™ MAC laryngoscope (Medtronic, Minneapolis, MN, USA), and we promptly and smoothly intubated the patient with a 35-Fr DLT (Shiley™ endobronchial tube with left-sided polyurethane cuff; Medtronic). Subsequently, the head of the DLT was placed in the left bronchus under the guidance of a bronchofiberscope. No resistance was observed when advancing the DLT.

After tracheal intubation, the position of the DLT and the degree of tracheal displacement were confirmed by chest radiographs in the right lateral position, in the supine position, and then in the left lateral position (Fig. 2). Superior mediastinal tumor resection via video-assisted thoracoscopic surgery was then performed.

RESULTS

Under anesthetic maintenance with sevoflurane, remifentanil, and ropivacaine (epidural injection), surgery was completed without complications (surgical duration, 3 h and 34 min; anesthesia duration, 5 h and 37 min). The tumor was cystic and confirmed histopathologically to be of thyroid origin.

Postoperatively, relief of the tracheal compression was confirmed on chest radiographs (Fig. 3), and the patient was extubated in the operating room. After extubation, no symptoms of airway stenosis appeared, and the patient was transferred to the intensive care unit after confirming that his respiratory condition was stable.

The patient's respiratory status was monitored continuously in the intensive care unit, and he was transferred to the general ward the following day. Chest radiographic findings when the patient left the intensive care unit are shown in Fig. 4.

DISCUSSION

Mediastinal mass syndrome remains an anesthetic challenge that cannot be underestimated. Anesthetic management of patients with giant mediastinal tumors is challenging from the perspective of both cardiovascular and respiratory management. Many cases of hemodynamic and airway collapse induced by general anesthesia have been reported in patients with a giant mediastinal mass [4-5]; therefore, airway assessment is important in the anesthetic management of these patients. Large mediastinal tumors, because of the mass effects, may be associated with dramatic cardiopulmonary complications, such as progressive airway obstruction, loss of lung volume, pulmonary artery or cardiac compression, and superior vena cava obstruction. Each of these complications can cause death during anesthesia if not expertly handled [1-3].

If postural symptoms, such as dyspnea and stridor, are identified, efforts should be made to define the position in which symptoms are minimized [1-3]. One report described performing tracheal intubation in the position where compression by the tumor was released [6]. In our case, we confirmed that tracheal compression and displacement improved in the right lateral position preoperatively, and anesthetic induction was performed in this position. Regarding conscious intubation [1-3], considering the risk of poor ventilation, airway patency in the right lateral position was checked again immediately before inducing anesthesia in the operating room, and we confirmed that tracheal patency was unchanged compared with the preoperative radiograph.

In our case, thoracoscopic surgery was planned, and for one-lung ventilation, we selected a DLT for the left bronchus as the first choice, and a spiral tube (long type) (Fuji Systems, Tokyo, Japan) was prepared for left bronchial intubation as the second choice. We did not choose a bronchial blocker because it was expected to be difficult to intubate the right bronchus because of tracheal compression by the tumor.

During tracheal intubation in the lateral position, we used a video laryngoscope, which showed the effectiveness of the tracheal intubation in various positions, such as sitting and prone positions [6-8].

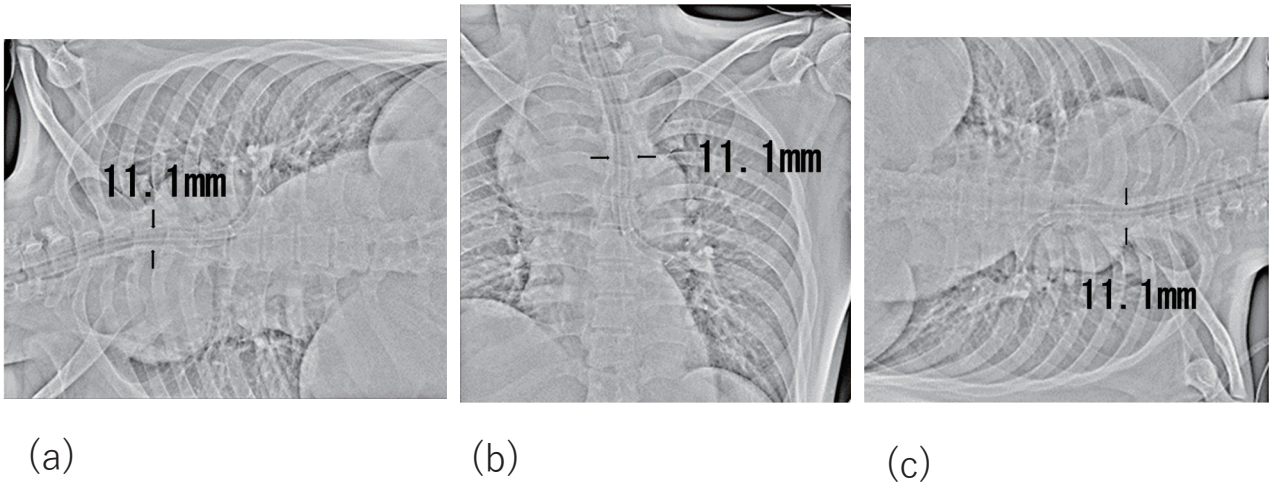

Fig. 2 (a) Radiograph after intubation, right lateral position. (b) Radiograph after intubation, supine position. (c) Radiograph after intubation, left lateral position.

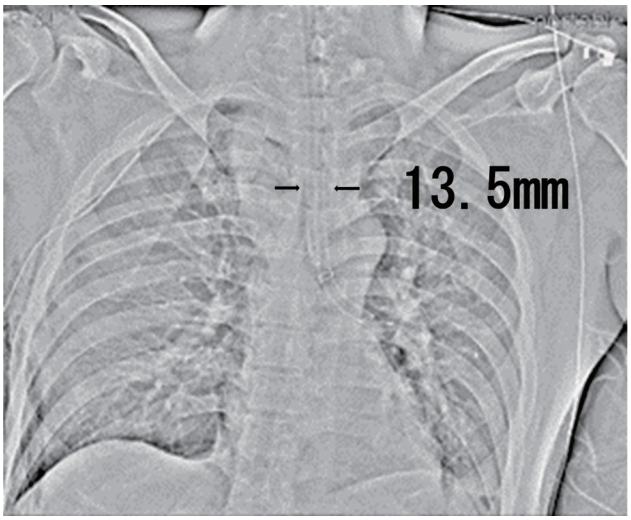

Fig. 3 Radiograph after operation, supine position.

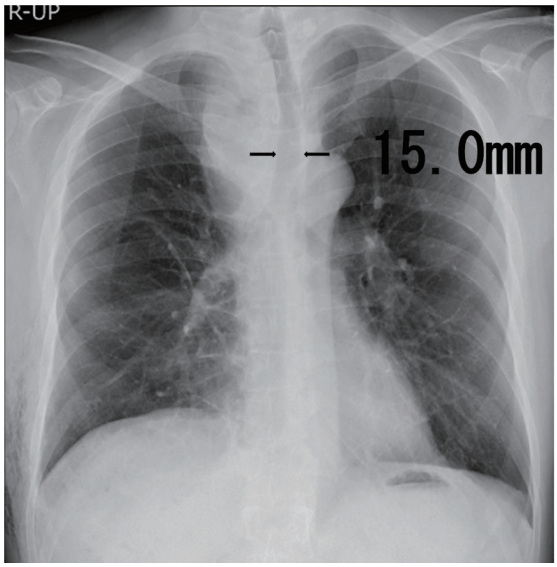

Fig. 4 Radiograph 1 day after the operation, standing position.

In some cases, intubation with video laryngoscopy did not affect the success rate or time required when comparing the right and left lateral positions [9]. Some reports recommended periodic intubation training in the lateral position as preparation for difficult intubation cases [10, 11]. In our hospital, the McGRATH™ MAC (Medtronic) and the Airway Scope AWS-200™ and Inlock (M-ITL-LL) (both by Nihon Kohden Corporation, Tokyo, Japan) were available for use; we chose the McGRATH™ MAC, which is used frequently and routinely in our institution.

Tracheal intubation in the right lateral position in our case was easy, and the depth was adjusted from the left bronchial lumen by confirming that the narrowing of the tracheal lumen was not severe, by bronchoscopy. Additionally, tracheal tube deformation associated with tracheal pressure caused by the tumor was evaluated by obtaining chest radiographs in each position. The tracheal diameter after relieving tumor-related compression was 11.1 mm after tracheal intubation, and this degree of relief was maintained in each position (Fig. 2).

Tracheal and bronchial injuries caused by tracheal tubes have been reported [12]; however, in the current case, we considered it possible to maintain the tracheal diameter using a tracheal tube because the cystic tumor was flexible and benign, with no invasion of the tumor into the trachea.

Regarding the preparation for extracorporeal circulation, Erdos *et al*. recommended femoral arteriovenous cannulation prior to inducing anesthesia in adults with mediastinal tumors when the tracheal and bronchial diameters are less than 50% of the normal diameters on imaging [3]. Our patient's tracheal diameter was 58% of that at the site of maximal compression; therefore, we decided to perform emergency cannulation when ventilatory failure and poor oxygenation at anesthetic induction were noticeable, and standby percutaneous cardiopulmonary support (PCPS) was prepared.

Generally, tracheal and bronchial compression by tumors in the thoracic cavity or mediastinum is relieved with tumor removal, allowing immediate postoperative extubation; however, the patient's airway condition after surgery must be monitored continuously [1–3]. In our case, after completing the operation, alleviation of tracheal compression and deviation was

confirmed by chest X-ray before extubation, and the extubation was performed by confirming that there was no obvious edema in the tracheal mucosa by bronchoscopy. Postoperatively, our patient was managed in the intensive care unit for careful observation for airway edema and tracheomalacia symptoms due to the long-term compression.

CONCLUSION

We performed anesthetic management for a patient undergoing excision of a giant superior mediastinal tumor compressing the airway. On preoperative imaging, we confirmed improved tracheal compression and deviation in the right lateral position, and we planned anesthesia induction and tracheal intubation in this position. After tracheal intubation, repositioning was performed in a stepwise manner, and the condition of the trachea was checked by chest X-ray in each position. One-lung ventilation during anesthesia and thoracoscopic surgery with proper use of a DLT was performed safely without encountering ventilatory failure or hypoxemia.

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We obtained consent from the patient for publication of this case report. This investigation conformed to the principles outlined in the Declaration of Helsinki (Cardiovascular Research 1997; 35: 2–4). The authors have no conflicts of interest to declare.

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