

Airway Obstruction by a Metastatic Mediastinal Tumor During Anesthesia

Sheng-Huan Chen, MD; Jee-Ching Hsu, MD, PhD; Ping-Wing Lui, MD, PhD; Chih-Hung Chen¹, MD; Ching-Yue Yang, MD

A case of low back pain syndrome was diagnosed due to spinal metastasis with unknown primary origin. During anesthesia for surgical stabilization, unexpected airway obstruction occurred after endotracheal intubation. Fiber-optic bronchoscopic examination showed narrowing of the trachea and main bronchi caused by extrinsic compression. After administration of neostigmine to reverse neuromuscular blockade, the patient resumed spontaneous breath. Airway obstruction was relieved thereafter. The extrinsic lesion was diagnosed as mediastinal lung cancer. The mechanism and management of this airway compromise caused by mediastinal tumor is discussed. (*Chang Gung Med J* 2005;28:258-63)

Key words: mediastinal tumor, airway obstruction, lung cancer, tracheal stenosis.

According to their anatomical location, an anterior mediastinal tumor could compress the heart, large vessels (principally superior vena cava), trachea, or main bronchi.^(1,2) Several researchers have described cases with anterior mediastinal masses, either symptomatic or asymptomatic, who developed life-threatening airway obstruction after endotracheal intubation for general anesthesia.⁽³⁻⁵⁾ Most of the cases were neoplasms of lymphocytic origin. We present a patient with undetected lung cancer who developed a severe airway obstruction during induction of general anesthesia for surgery on a vertebral pathologic fracture. Airway patency was reestablished immediately after administration of neostigmine to reverse muscle blockade and resume spontaneous breathing. This case reminds us of the life-threatening situation for a mass lesion located at anterior mediastinum.

CASE REPORT

A 42-year-old woman suffering from low back

pain with radiculopathy for a few months was diagnosed with a pathological fracture of the 4th vertebral body of the lumbar spine. She was quite well before the operation without any other systemic diseases. Metastatic lesion was considered but the primary site could not be found. Examination results of the breast and reproductive tract were all normal. Multiple myeloma has been suggested but the laboratory data did not confirm this diagnosis. In order to release her symptoms, surgical decompression and instrumental fixation were arranged.

During the pre-anesthesia visit, the patient appeared well without any respiratory problems. Vital signs were stable on arrival in the operating room including a blood pressure of 143/87 mmHg, pulse rate of 98 beats/min, and a regulatory respiratory pattern. The routine pre-operative laboratory examination results were all within normal ranges. Chest X-ray demonstrated a patch infiltration on the right upper lung field without specific diagnosis (Fig. 1). After pre-oxygenation with 100% O₂ for approximately 5 minutes, anesthesia was induced

From the Department of Anesthesiology; ¹Department of Thoracic Medicine I, Chang Gung Memorial Hospital, Taipei.

Received: Mar. 22, 2004; Accepted: Jun. 23, 2004

Address for reprints: Dr. Ching-Yue Yang, Department of Anesthesiology, Chang Gung Memorial Hospital, 5, Fushing Street, Gueishan Shiang, Taoyuan, Taiwan 333, R.O.C. Tel.: 886-3-3281200 ext. 3621; Fax: 886-3-3281200 ext. 2793; E-mail: yangcy@adm.cgmh.org.tw



Fig. 1 Chest X-ray shows patchy infiltration of the right upper lung zone.

with 200 μ g fentanyl and 300 mg thiopental. Muscle relaxation was achieved using 40mg atracurium. Endotracheal intubation with a 7.0-mm (internal diameter) cuffed tube was then performed under direct laryngoscopy without any difficulty. After intubation, anesthesia was maintained with 3% sevoflurane and 100% oxygen. However, high resistance was encountered when applying positive controlled ventilation. Auscultation disclosed no breathing sounds on the right lung and faint breathing sounds with wheezing on the left lung. Initially, bronchospasm was suggested. Therefore, 200 mg glucocorticoid and 250 mg aminophylline were given intravenously. Because of the persistence of high airway pressure, we considered examining the airway by fiber-optic bronchoscope through the endotracheal tube. Narrowing of the lower portion of the trachea, near-total occlusion of the right main bronchus and partial occlusion of the left main bronchus, which were probably due to extrinsic compression, was demonstrated (Fig. 2). Ventilation in the face of such severe airway obstruction appeared inadequate because of the significant retention of carbon dioxide (end tidal CO_2 : 60 mmHg) and decreased oxygen saturation (SaO_2 : 92%), despite the 100% concentration

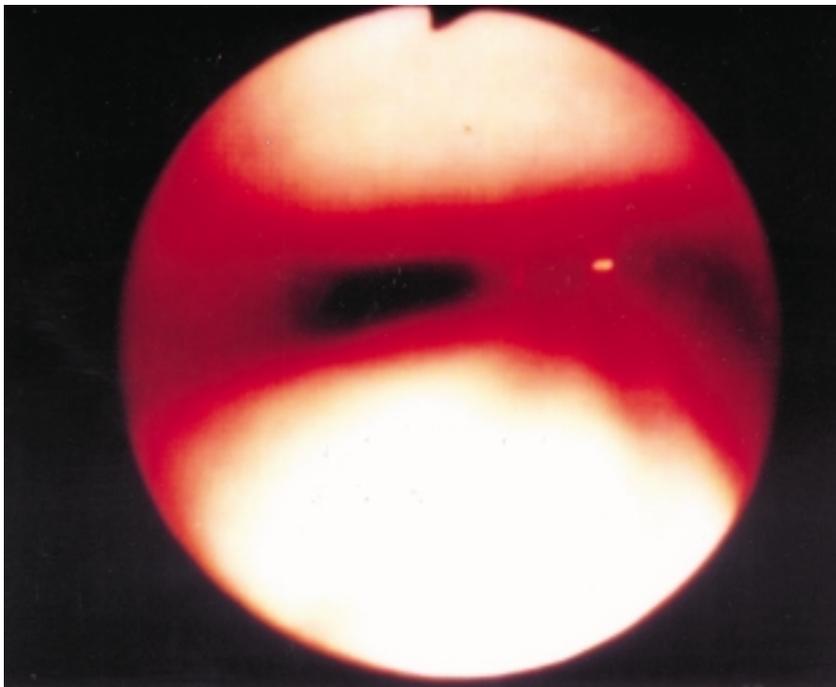


Fig. 2 Fiber-optic bronchoscopy showing near-total occlusion of the right main stem bronchus and partial occlusion of the left main stem bronchus. There is no intrinsic tumor found in the right main bronchus.

of inspiratory oxygen that was given. It was determined that the patient could not tolerate the situation and the anesthesia was interrupted immediately. Then, the neuromuscular blockade was reversed with 1.5 mg neostigmine and 0.8 mg atropine, and the administration of inhalational anesthetic was ceased. Subsequently, the airway pressure began to drop down, and retention of carbon dioxide and low oxygen saturation also improved. The operation was cancelled for further evaluation of the lesion of the airway. After resuming spontaneous breathing, the patient fully awoke and was extubated smoothly without any complication. The post-anesthesia course was uneventful. Subsequent computerized tomographic scan (CT) showed the existence of lung cancer in the right upper lobe with invasion to the mediastinum (Fig. 3). The tissue biopsy proved squamous cell carcinoma.

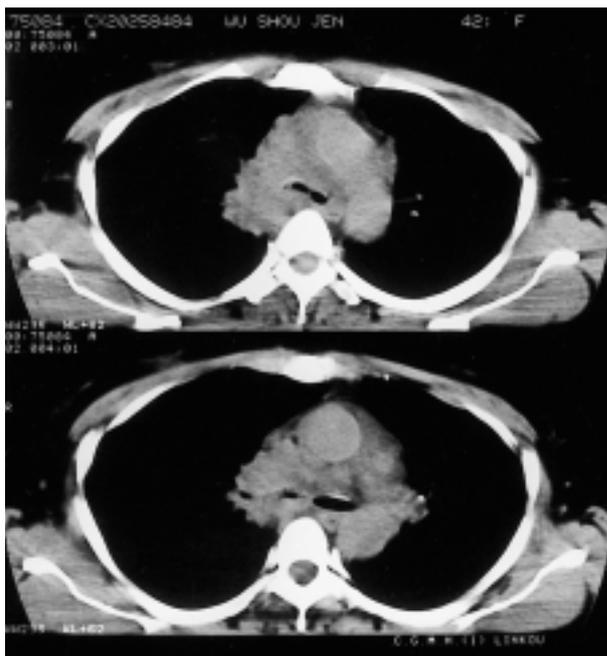


Fig. 3 Computerized tomographic scan of the thorax showing tumor invading the mediastinum compressing the trachea and main bronchi.

DISCUSSION

The patient presented with back pain syndrome which was suggested to be a metastatic spinal lesion. Although she did not have respiratory symptoms

before anesthesia, unexpected high airway resistance was found when positive pressure ventilation was applied after uneventful endotracheal intubation. Fiber-optic bronchoscopic examination revealed tracheal and bronchial narrowing with extrinsic mass compression. Finally, lung cancer was diagnosed.

This case was unusual since airway compression occurred after a successful endotracheal intubation. In fact, the patient was asymptomatic before her operation. However, significant obstruction after induction of anesthesia occurred. During spontaneous respiration while awake, the pleural pressure is markedly negative compared with the airway pressure. This transpleural pressure gradient tends to increase the airway diameter and minimize the effects of intrathoracic airway obstruction. After the patient was anesthetized for intubation, the distending pressure gradient was lost and the effect of the extrinsic airway compression became greater. On the other hand, relaxation of the bronchial smooth muscle using general anesthetics or muscle relaxants might induce greater compressibility of the extrinsic mass of the large airways. That is the reason the patient was difficult to ventilate after anesthesia. Positive pressure ventilation may also further worsen airway obstruction. Therefore, in patients with mediastinal masses, spontaneous breathing is better than positive pressure mechanical ventilation for maintaining airway patency. Sibert et al. presented a patient with anterior mediastinal mass and critical airway compromise who was allowed to maintain spontaneous ventilation throughout general anesthesia for a thoracotomy.⁽⁶⁾ Our patient also showed similar circumstance. Therefore, when confronting airway obstruction caused by a mediastinal mass, it is better to discontinue positive pressure mechanical ventilation and resume spontaneous breathing as soon as possible.

In the bronchial tree of a healthy person, the trachea and first few generations of bronchi are the major sites of the airway resistance. As the airway muscles contract, they narrow the bronchioles but stiffen the large bronchi, thereby increasing the expiratory flow rate. When these muscles are relaxed, the maximum expiratory flow rate decreases because of the increased compressibility of the large airways. This may lead to airway obstruction in the situation of airway narrowing by external mass compression.⁽⁷⁾ Gordon et al. also stated that the trachea restricted by

a tumor may collapse and yield complete airway occlusion if the action of the voluntary respiratory muscles are paralyzed during induction of anesthesia.⁽⁸⁾ Therefore, in the principle for treatment of this airway situation, muscle relaxants will exacerbate the airway occlusion and should be reversed as soon as possible. Our patient showed that airway pressure decreased and obstruction relieved subsequently after discontinuing inhalational anesthetics and reversing neuromuscular blockade. Auscultation then revealed symmetric breathing sounds without abnormalities. These changes appeared dramatically almost within 10 minutes, indicating the methods are effective in the treatment of airway compression by mediastinal tumor.

The most common anterior mediastinal tumor is lymphoma.⁽¹⁾ Metastatic lung cancer invading the mediastinum and inducing airway occlusion is less seen. High airway pressure after successful endotracheal intubation could result from bronchospasm, incidental intrabronchial intubation, foreign bodies, lung diseases with poor compliance, tension pneumothorax, or anterior mediastinal masses. Some of these entities are medical emergencies. Quick differential diagnosis using bronchoscopic examination is indicated. When high airway pressure occurred in our patient, it was fortunate that we quickly found extrinsic tracheobronchial compression using bronchoscopic examination early before any severe instability of vital signs ensued. Under certain circumstances, it is possible to bypass an upper airway obstruction by stenting a longer endotracheal tube to pass the obstructed region.^(3,9) We did not have to do so. Since the compression was at the bronchial level, general endotracheal tube was difficult to pass through. In addition, we did not have any information about the length and extend of airway narrowing. If this procedure had failed, edema or hemorrhage of the airway mucosa would have further exacerbated the airway occlusion.

This patient initially presented with back pain syndrome without complaining respiratory problems. This may be demonstrated by the lack of any extreme respiratory exertion when developing back pain. Indeed, the patch infiltration of the chest x-ray should be further studied in this case. However, it is still easily missed in the diagnosis of mediastinal lesion. Chest (CT) should be arranged because it shows a more accurate view than chest x-ray in dis-

closing lung lesions. It is also valuable in disclosing the length and extent of airway involvement.⁽¹⁾ This case again demonstrates the importance of complete examination of medical history, symptoms, signs, and radiography when confronting a patient with cancer metastasis without known primary origin. If the airway compression had been recognized pre-operatively, a series of examinations would have been arranged to clarify their effects on the cardiopulmonary systems. Patients with mediastinal masses are at grave risk to receive general anesthesia. Alternative treatments other than surgery for the pathological fracture should be advocated. The performance of the procedure under local anesthesia technique should be a priority.^(3,10) If general anesthesia is necessary, it is possible to arrange chemotherapy, radiotherapy or palliative stent to release airway compression first.^(3,11)

In summary, we present this case to demonstrate that airway compromise can occur in patients with anterior mediastinal masses after induction of general anesthesia even without any respiratory symptoms pre-operatively. The importance of complete pre-anesthesia evaluation was emphasized. It should be noticed that mediastinal masses should be included in the list of differential diagnosis when high airway pressure occurs after successful endotracheal intubation. When confronted with airway obstruction caused by mediastinal masses during anesthesia, immediately disrupting the surgery, ceasing the inhalational anesthesia, reversing the action of muscle relaxant and resuming spontaneous ventilation may be helpful in the treatment of the airway obstruction. Early recognition and prompt management is essential in successfully handling this potentially life-threatening situation.

REFERENCES

1. Pullerits J, Holzman R. Anesthesia for patients with mediastinal masses. *Can J Anesth* 1989;36:681-8.
2. Northrip DR, Bohman BK, Tsueda K. Total airway occlusion and superior vena cava syndrome in a child with an anterior mediastinal tumor. *Anesth Analg* 1986;65:1079-82.
3. Neuman GG, Weingarten AE, Abramowitz RM, Kushins LG, Abramson AL, Ladner W. The anesthetic management of the patient with an anterior mediastinal mass. *Anesthesiology* 1984;60:144-7.
4. Keon TP. Death on induction of anesthesia for cervical

- node biopsy. *Anesthesiology* 1981;55:471-2.
5. Viswanathan S, Campbell CE, Cork RC. Asymptomatic undetected mediastinal mass: a death during ambulatory anesthesia. *J Clin Anesth* 1995;7:151-5.
 6. Sibert KS, Biondi JW, Hirsch NP. Spontaneous respiration during thoracotomy in a patient with a mediastinal mass. *Anesth Analg* 1987;66:904-7.
 7. Bittar D. Respiratory obstruction associated with induction of general anesthesia in a patient with mediastinal Hodgkin's disease. *Anesth Analg* 1975;54:399-403.
 8. Gordon RA. Anesthetic management of patients with airway problems. *Int Anesth Clin* 1972;10:37-59.
 9. McMahon CC, Rainey L, Fulton B, Conacher ID. Case report: Central airway compression-Anesthetic and intensive care consequences. *Anesthesia* 1997;52:158-62.
 10. Goh MH, Liu XY, Goh YS. Anterior mediastinal masses: an anesthetic challenge. *Anesthesia* 1999;54:670-82.
 11. Greengrass R. Anesthesia and mediastinal masses. *Can J Anaesth* 1990;37:596-7.

由於轉移的縱隔腔腫瘤造成麻醉過程中呼吸道阻塞

陳聖桓 徐至清 呂炳榮 陳志弘¹ 楊靖宇

一個病患由於下背痛被發現有脊椎的病理性骨折，懷疑是起因於轉移性腫瘤，不過原發之處沒有查出，為了治療其下背疼痛，病人被安排作脊椎固定術，在病患接受全身麻醉後發現呼吸道的阻力突然明顯增加，同時換氣也發生困難，經由光纖支氣管鏡的檢查發現氣管和支氣管都因為外在壓迫而導致管徑狹窄，在給予 neostigmine 拮抗神經肌肉阻斷使病患回復自主呼吸之後，呼吸道阻力很快的下降而換氣恢復正常，進一步的檢查發現病患有肺癌縱隔腔轉移並且壓迫呼吸道，經由這個病例我們討論麻醉過程中縱隔腔腫瘤壓迫呼吸道的機轉以及處理的方法。(長庚醫誌 2005;28:258-63)

關鍵字：縱隔腔腫瘤，呼吸道阻塞，肺癌，氣管狹窄。

長庚紀念醫院 台北院區 麻醉部，¹胸腔一科

受文日期：民國93年3月22日；接受刊載：民國93年6月23日。

索取抽印本處：楊靖宇醫師，長庚紀念醫院 麻醉部。Tel: (03)3281200轉3621; Fax(03)3281200轉3623; E-mail: yangcy@adm.cgmh.org.tw