

Threatening Airway Obstruction by Mediastinal Masses: The Experience of a Medical Intensive Care Unit

Anne Ann Ling Hsu, *MMed, FRCP*, Ghee Chee Phua, *MBBS, MRCP*

Department of Respiratory and Critical Care Medicine, Singapore General Hospital, Singapore

ABSTRACT

Objective: Life-threatening airway obstruction is a dreaded complication of mediastinal masses. The acute management is difficult and catastrophic outcomes have been reported. We describe our experience in a Medical Intensive Care Unit (ICU) and discuss the management options.

Design: Retrospective observational study.

Setting: 1,600-bed tertiary-care hospital.

Patients and Participants: 13 patients were treated between January 1996 and February 2010.

Interventions: All patients were mechanically ventilated. Three received emergent chemotherapy, 10 underwent airway stenting and 2 underwent surgery.

Measurements and Results: The median age was 51 years (range 13 to 64). In 5 patients (36%), the diagnosis was only made after ICU admission. Two had benign pathologies (retrosternal goitre and bronchogenic cyst) and 3 had lymphoma. The remaining 8 had metastatic mediastinal lymphadenopathy. All were successfully weaned off the ventilator (range 0 to 5 days). All patients with benign pathologies and lymphoma were still alive with a mean follow-up of 2.8 years (range 1 to 7 years). All patients with metastatic disease died, with a mean survival of 3.8 months (range 1 to 9 months).

Conclusion: In the management of life-threatening airway obstruction by mediastinal masses, we reported the heterogeneous nature of this group of conditions. Therefore in the intensive care setting, a definitive diagnosis needs to be established urgently, as treatment and prognosis are highly dependent on the underlying etiology. We propose categorising patients into subgroups and combining various therapeutic modalities.

Keywords: intensive care unit, mechanical ventilation, mediastinal neoplasm, rigid bronchoscopy, stent

INTRODUCTION

Life-threatening airway obstruction is a dreaded complication of mediastinal masses of both benign and malignant pathologies. As airway compression may progress insidiously, patients may be undiagnosed until they present dramatically in severe respiratory distress. The management of this condition is fraught with difficulty and catastrophic outcomes have been reported¹⁻³. Whilst advances have been made in the surgical and bronchoscopic management of airway obstruction⁴⁻⁷, there is limited data that focuses on the subgroup of critically-ill patients requiring mechanical ventilation and intensive care.

We describe our experience with 13 patients and discuss the management options.

MATERIALS AND METHODS

We conducted a retrospective review of all patients with airway obstruction by benign or malignant mediastinal masses who were admitted to the Medical Intensive Care Unit (ICU) between January 1996 and February 2010.

Hospital records were reviewed and data was collected on patient demographics, clinical features, aetiology, diagnostic investigations, requirements for mechanical ventilation

and intervention. Outcome indices included weaning from mechanical ventilation, survival and complications.

RESULTS

There were 13 patients (8 females) with a median age of 51 years (range 13 to 64 years). The clinical characteristics, intervention and outcome are presented in Table 1. In 5 patients (patients 1 to 5), the diagnosis was made only after admission to ICU. Two had benign pathologies, retrosternal goitre and bronchogenic cyst, which were diagnosed on computed tomography (CT) scan and subsequently confirmed on surgical resection. Three had lymphoma and of these, 2 had emergent (within 1 day of admission to the MICU) transthoracic needle biopsy and the third patient (patient 3) had surgical biopsy performed under intravenous sedation leading to acute airway collapse. The remaining 8 had metastatic mediastinal lymphadenopathy evident on emergent CT thorax scan performed during the admission to the MICU. The histological diagnosis of the primary malignancy was obtained prior to the hospitalisation of life threatening airway obstruction.

Intervention

All patients required emergent mechanical ventilatory support, with 11 patients receiving invasive ventilation and 2 patients (patients 2 and 5) receiving non-invasive positive pressure support. Patient 3 needed 4 days of extracorporeal membrane oxygenation (ECMO) as positive pressure ventilation via the endotracheal tube and airway intervention with the rigid bronchoscope and stenting failed. Three patients received emergent chemotherapy, 10 underwent airway stenting and 2 underwent surgery.

Outcome

All were successfully weaned off mechanical ventilation (range 0 to 5 days). There were no complications related to the intervention. All patients were transferred out of ICU and discharged from hospital alive without the need for supplemental oxygen. On follow-up, all patients with benign pathologies and lymphoma were still alive with a mean follow-up of 2.8 years (range 1 to 7 years). All patients with metastatic disease died, with a mean survival of 3.8 months (range 1 to 9 months).

DISCUSSION

There is a paucity of literature on patients presenting with life-threatening airway obstruction due to mediastinal masses requiring intensive care. In this case series, we report the heterogeneous nature of this group of conditions. As the underlying aetiologies and clinical characteristics were different; we had to rely on a variety of approaches to relieve airway obstruction.

Our study was limited by the small study population. Despite this, we recognised 3 distinct subgroups: (1) surgically-treated conditions; (2) chemosensitive tumours; and (3) non-chemosensitive tumours.

1. Surgically-treatable conditions

In this group of patients, e.g. mediastinal cyst and retrosternal goitre, definitive surgical correction should be performed urgently to relieve airway obstruction.

2. Chemosensitive tumours

In these patients, the mediastinal tumours respond rapidly to chemotherapy. Management should be supportive whilst awaiting tumour shrinkage and relief of obstruction. We successfully used continuous positive airway pressure (CPAP) via facemask in Patient 5 to pneumatically splint the compressed airway⁸ and avoid intubation. If this fails, temporary airway stenting is valuable as a bridging strategy until chemotherapy alleviates obstruction⁹. The use of ECMO¹⁰ as a last resort has been described in case reports, and was similarly used successfully in a patient in our series.

We believe that aggressive management, including the use of ECMO, is worthwhile, as the prognosis of this group of patients is good with appropriate anti-tumor therapy¹¹.

3. Non-chemoresponsive tumors

This group is made up of mediastinal pathologies that are neither suitable for surgery nor rapidly respond to chemotherapy, e.g. metastatic lymphadenopathies from various primary malignancies. The management of this group of patients is controversial and there has been much debate on the utility of aggressive intervention in advanced malignancies^{12,13}. We believe that patients with good functional status should be considered for palliative

Table 1. Clinical characteristics, interventions and outcomes.

Patient	Age, Yr/Sex	Aetiology	Location of obstruction	Intervention	Ventilator days after intervention	Status follow-up
1	13/F	Bronchogenic Cyst	Distal trachea, LMB	Surgical resection	1	Alive at 7yrs
2	62/F	Retrosternal goitre	Mid trachea	Surgical resection	1	Alive at 2yrs
3	21/F	Lymphoma	Distal trachea, carina, LMB, RMB	ECMO & emergent chemotherapy	5	Alive at 1yr
4	20/M	Lymphoma	Distal trachea, RMB	Airway stenting+ & emergent chemotherapy	0	Alive at 3yrs
5	22/M	Lymphoma	Distal trachea, carina	Emergent chemotherapy	2	Alive at 1yr
6	50/M	Metastatic lymphadenopathy (NSCLC)	Distal trachea, carina, LMB, RMB	Airway stenting	1	Died 9 months later
7	51/F	Metastatic lymphadenopathy (NSCLC)	Distal trachea, carina, LMB, RMB	Airway stenting	2	Died 2 months later
8	58/F	Metastatic lymphadenopathy (neuroendocrine tumor)	Distal trachea, carina, LMB, RMB	Airway stenting	1	Died 3 months later
9	64/F	Metastatic lymphadenopathy (NSCLC)	Distal trachea	Airway stenting	1	Died 2 months later
10	58/F	Metastatic thyroid carcinoma	Mid trachea	Airway stenting	1	Died 1 month later
11	51/M	Advanced Oesophageal carcinoma	Mid trachea	Airway stenting	0	Died 2 months later
12	61/M	Metastatic lymphadenopathy (NSCLC)	Distal trachea, carina	Airway stenting	3	Died 2 months later
13	64/F	Metastatic lymphadenopathy (Anal carcinoma)	Distal trachea, carina, LMB, RMB	Airway stenting	2	Died 8 months later

*The aetiologies of patients 1 to 5 were not known at time of presentation.

+Stent removed 6 months later.

Abbreviations: M: Male; F: Female; NSCLC: Non-small cell lung carcinoma; LMB: Left main bronchus; RMB: Right main bronchus; ECMO: Extracorporeal membrane oxygenation.

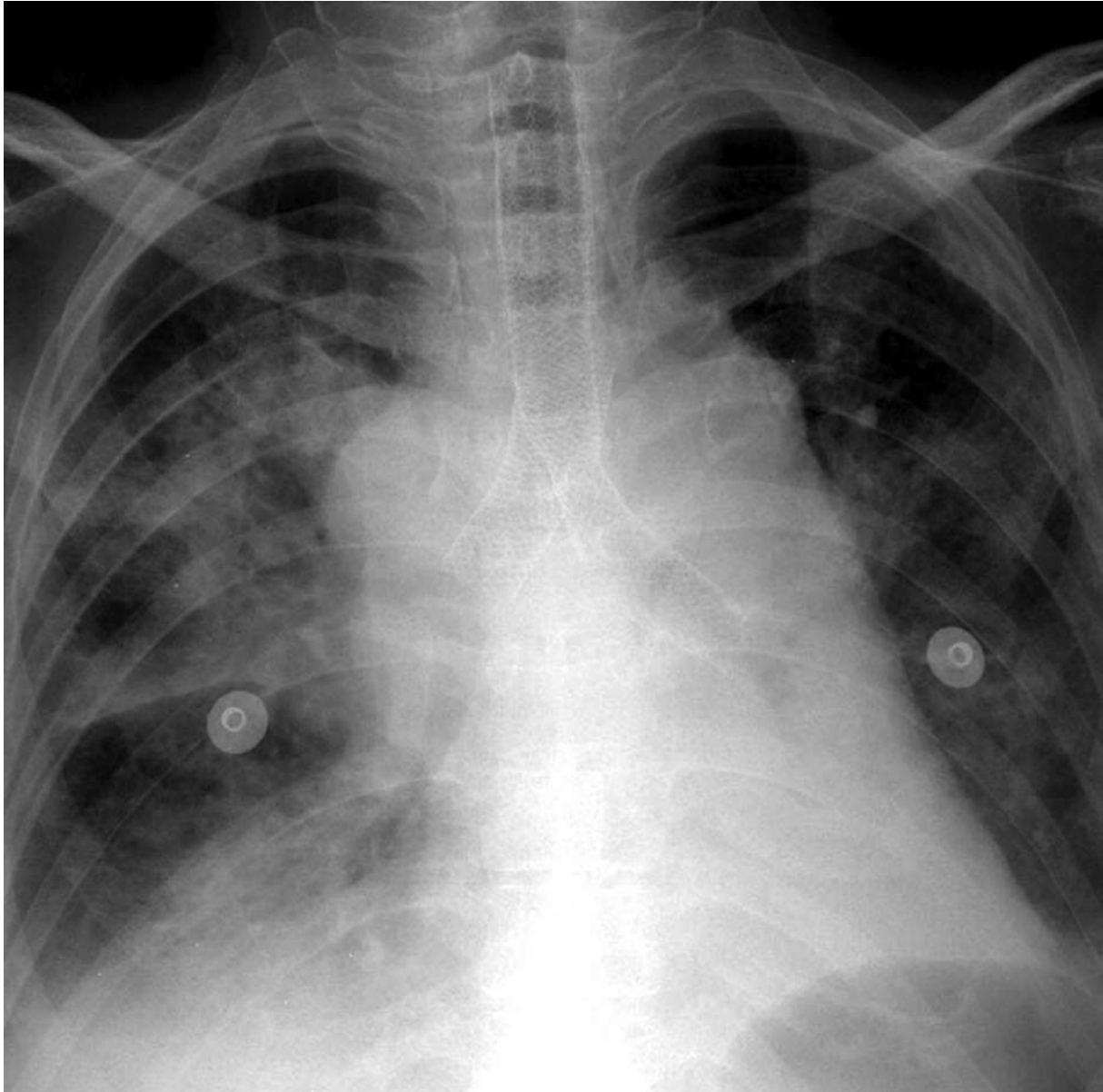


Fig. 1. Airway stenting in Patient 7. Restoration of airway patency using 2 uncovered metallic Wallstents overlapping at the carina and trachea.

endobronchial stenting (Fig. 1) to prevent death by suffocation and to facilitate extubation^{14,15}. On the other hand, in patients with extensive neoplastic disease and poor performance status, conservative comfort measure may be preferred.

Other than specific therapy, general measures we adopted to avoid worsening airway obstruction included positioning the patient in the lateral (Fig. 2) or upright position, and avoidance of muscle relaxants. In the diagnostic

work-up, general anaesthesia should be avoided whenever possible and alternative methods of obtaining tissue diagnosis used, e.g. CT-guided biopsy under local anaesthesia only^{16,17}. In the mechanical ventilation of these patients, we used extrinsic positive end-expiratory pressure (PEEP) as a “pneumatic” splint to maintain intraluminal patency. Despite these measures, due to the severity of airway compression, ventilation of these patients was difficult and advanced airway management techniques, e.g. airway stenting and ECMO, were required.



Fig. 2. Computed tomographic scan of Patient 5. The scan was performed with the patient lying in the left lateral position, as he was unable to tolerate supine position due to dyspnea. He was supported with non-invasive positive pressure support during the scan and subsequently during transthoracic needle biopsy of the mass.

Thus, management of these patients requires a multidisciplinary team including the intensivist, interventional pulmonologist, thoracic surgeon, anaesthetist and cardiopulmonary by-pass personnel.

CONCLUSION

Life-threatening airway obstruction may be caused by a heterogeneous group of mediastinal pathologies. In the intensive care setting, a diagnosis needs to be established urgently as immediate and definitive treatment is dependent on the underlying aetiology.

A flexible multidisciplinary approach combining various therapeutic modalities are required to optimize outcome as illustrated in our study that all our patients were successfully weaned off ventilatory support and discharged from hospital alive without the need of supplemental oxygen.

REFERENCES

1. Goh MH, Liu XY, Goh YS. Anterior mediastinal masses: an anaesthetic challenge. *Anaesthesia*, 1999;54(7):670–4.
2. Levin H, Bursztein S, Heifetz M. Cardiac arrest in a child with an anterior mediastinal mass. *Anesth Analg*. 1985;64(11):1129–30.

3. Neuman GG, Weingarten AE, Abramowitz RM, Kushins LG, Abramson AL, Ladner W. The anaesthetic management of the patient with an anterior mediastinal mass. *Anaesthesiology*. 1984;60(2):144–7.
4. Cavaliere S, Venuta F, Foccoli P, Toninelli C, La Face B. Endoscopic treatment of malignant airway obstructions in 2,008 patients. *Chest*. 1996;110(6):1536–42.
5. Ernst A, Feller-Kopman D, Becker HD, Mehta AC. Central airway obstruction. *Am J Respir Crit Care Med*. 2004;169(12):1278–97.
6. Seijo LM, Sterman DH. Interventional pulmonology. *N Engl J Med*. 2001;344(10):740–9.
7. Wood DE. Management of malignant tracheobronchial obstruction. *Surg Clin North Am*. 2002;82(3):621–42.
8. King JW, Walsh TE. Variable intrathoracic upper airway obstruction due to non small cell lung cancer. Palliation using physiologic and mechanical stenting. *Chest*. 1986;89(6):896–8.
9. Schmidt B, Massenkeil G, John M, Arnold R, Witt C. Temporary tracheobronchial stenting in malignant lymphoma. *Ann Thorac Surg*. 1999;67(5):1448–50.
10. Stewart AS, Smythe WR, Aukburg S, Kaiser LR, Fox KR, Bavaria JE. Severe acute extrinsic airway compression by mediastinal tumour successfully managed with extracorporeal membrane oxygenation. *ASAIO J*. 1998;44(3):219–21.
11. Jeffery GM, Mead GM, Whitehouse JM. Life-threatening airway obstruction at the presentation of Hodgkin's disease. *Cancer*. 1991;67(2):506–10.
12. Monnier P, Mudry A, Stanzel F, Haeussinger K, Heitz M, Probst R, et al. The use of the covered Wallstent for the palliative treatment of inoperable tracheobronchial cancers. A prospective, multicenter study. *Chest*. 1996;110(5):1161–8.
13. Vonk-Noordegraaf A, Postmus PE, Sutedja TG. Tracheobronchial stenting in the terminal care of cancer patients with central airways obstruction. *Chest*. 2001;120(6):1811–4.
14. Colt HG, Harrell JH. Therapeutic rigid bronchoscopy allows level of care changes in patients with acute respiratory failure from central airways obstruction. *Chest*. 1997;112(1):202–6.
15. Shaffer JP, Allen JN. The use of expandable metal stents to facilitate extubation in patients with large airway obstruction. *Chest*. 1998;114(5):1378–82.
16. Singer P, Karsli C. Management of the patient with a large anterior mediastinal mass: recurring myths. *Curr Opin Anaesthesiol*. 2007 Feb;20(1):1–3.
17. Gothard JW. Anesthetic considerations for patients with anterior mediastinal masses. *Anesthesiol Clin*. 2008 Jun;26(2):305–14.