Palliative Medicine Doctors’ Meeting

Major Airway Obstruction

Dr. Ma Chi Ming,
Department of Pulmonary and Palliative Care, Haven of Hope Hospital.
Correspondence: mcm985@ha.org.hk

ABSTRACT

Major airway obstruction (MAO) is often diagnosed too late for definitive intervention. High index of suspicion and early diagnosis are crucial for successful management. Common clinical presentations of MAO include dyspnoea, cough, mucus secretions and stridor. Spirometry, imaging and bronchoscopy are the main investigations for MAO. Management strategies include interim measures, treatment targeted on the aetiology, and symptom palliation. A brief review of these interventions will be presented.

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Introduction

Major airway obstruction (MAO) poses a management challenge in palliative medicine. Often it is either too late or too difficult to reverse this life-threatening situation. Early diagnosis and management is the key for successful MAO management.

Case History

Madam C, a 58 year-old-lady, suffered from breast cancer with metastases to lung, peri-bronchial and hilar lymph nodes. She developed dyspnoea and stridor while she was hospitalized in Haven of Hope Hospital for symptom control. ENT surgeon was consulted. Flexible laryngoscopy showed left vocal cord palsy while right vocal cord was mobile. There was no obstruction seen below the glottis. Intrathoracic tracheal obstruction was suspected. She was given intravenous dexamethasone and low dose alprazolam. Her dyspnoea initially improved and she managed to spend some good time with her grandchildren in the ward garden. However, her condition suddenly deteriorated soon after, and she was too ill for transferral to the oncology clinic. Palliative sedation was started and she died peacefully after one day.

Physiology

Upper airway refers to the air passage from the nose or mouth to the carina and obstruction means anything that leads to increase in airway resistance. Airway resistance is proportional to the length of the airway, inversely proportional to the fourth power of airway radius, and is affected by gas density. As central airway contributes to eighty percent of the total airway resistance, even a small obstruction in the upper airway can pose a significant increase in airway resistance.

Pathophysiology and clinical features

Stridor, dyspnoea, cough and mucus secretion are the most common clinical features of MAO. Stridor is caused by turbulent air flow when gas molecules pass through the site of obstruction. Inspiratory stridor is more likely with extrathoracic obstruction. During inspiration, the surrounding atmospheric pressure of the extrathoracic airway is higher than the tracheal pressure, causing compression of the extrathoracic airway and inducing inspiratory stridor. Expiratory stridor is more likely to occur in intrathoracic obstruction. During expiration, the surrounding pleural pressure of intrathoracic airway is higher than the tracheal pressure, causing compression of the intrathoracic airway and inducing expiratory stridor. Cough and mucus secretion are related to the direct mechanical effect of the obstruction. Dyspnoea is related to the work of breathing, neuro-mechanical dissociation, and chemoreception of blood oxygen and carbon dioxide levels; all these are in turn related to the obstruction.

Pathology of MAO

MAO can be caused by endoluminal tumors, extrinsic compression by tumors or mediastinal masses, and bilateral vocal cord palsy. Common cancers causing MAO include head and neck cancer, lung cancer, and mediastinal lymph node or endobronchial metastasis due to primary malignancy in the breast, gastrointestinal tract, kidneys, ovaries, uterus, testis, thyroid gland, nasopharynx and adrenal gland. Less likely, it can be due to primary tracheal tumour.

Investigations

Spirometry, imaging and bronchoscopy are the mainstay of investigations for MAO. As spirometry can only detect airway resistance
when its diameter is less than 8 mm, it is not a sensitive method until late in the course of MAO. The sensitivity of detecting upper MAO by Chest X-ray is only 66%. Helical computer tomography can detect intramucosal, submucosal and extraluminal lesions with a sensitivity up to 97%. With 3-Dimension reconstruction, it allows better visualization of the extent of the disease and airway obstruction. MRI is inferior to CT scan for airway visualization but superior in visualizing vascular structures surrounding the airway.

**Management**

Factors affecting the clinical management of MAO include urgency of presentation, aetiology, localization, extent of obstruction and prognosis. Interim measures while waiting for definitive treatment and interventions with palliative intent include proper head positioning, oxygen supplement, helium-oxygen (Heliox) inhalation, systemic corticosteroids, securing the airway, cardiopulmonary bypass and palliative sedation.

Heliox, a gas with nitrogen replaced with helium, is a lower density gas that reduces airway resistance. In one case-control study, it reduces around 30% of breathing work.1 Systemic steroid mainly acts on the edema of inflamed tissue.2 Its effect is directly proportional to the local concentration of steroids in the inflamed tissue.

Measures targeted at the cause of obstruction include dilatation, resection techniques, stenting, brachytherapy, external irradiation and photodynamic therapy, depending on their availability.

Resection techniques include tissue removal with rigid bronchoscopy, laser - Neodymium yttrium aluminium garnet (Nd:YAG) and cryotherapy. A systematic review of more than 2500 patients undergoing Nd:YAG showed a 80% dyspnoea relief rate, and success rates of 70-95%, 40-60%, 57% for central lesions, lobar lesions and complete obstruction respectively. Mortality rate was around 0.4-3%.3 Cryotherapy induces tumor necrosis by freezing the tissue and inducing tissue death, followed by bronchosscopic examination to remove the resultant necrotic tissue. Repeated bronchoscopic treatment may be needed. In a systematic review of 411 patients, 65-68% showed symptom relief. Success rates of 60% and 35% for central and peripheral lesions were reported respectively.3

Metallic or silicone stents can be used for stenting. In one case study, 80% of patients showed immediate symptom relief with no immediate peri-operative death.4 However, 5-10% had stent migration, 4-8% had stent obstruction for those using silicone stents and 40% required repeated stenting.5

Brachytherapy delivers a relatively high dose of a radiation source via bronchoscopy. Follow-up bronchoscopy is needed for removal of necrotic tissue. It allows treatment for both endoluminal and extrinsic tumour. In a case study6, 60-90% showed symptom palliation, but 1-3% developed bronchovascular fistula and stenosis, 10% developed radiation bronchitis and 5-20% had massive hemoptysis. A Cochrane review7 showed no single regimen that could give greater palliation. In addition, high dose regimens led to more acute toxicity especially radiation oesophagitis. There was a modest increase in survival of 5% at 1 year and 3% at 2 years in patients with higher performance status and receiving higher dose radiotherapy. The risk of radiation myelitis is a concern.

Photodynamic therapy induces tumor necrosis by administration of a photosensitizing agent followed by activation of the agent with light of specific wavelength. Follow-up bronchoscopy is needed. Sunlight exposure should be avoided for 4 to 6 weeks.

**Conclusion**

Early diagnosis is required for successful management of MAO. Some measures can be used as interim measures before more definitive treatment, but none is consistently better than others. Treatment decision is mainly determined by the balance of risks and benefits, patient’s goals and wishes, aetiology, disease trajectory and prognosis, and available resources.

**References**