

Review Article

Mediastinal Masses and Emergency Management Challenges -The Great Mimic!

Uma Hariharan*

Anaesthesia and Intensive care, Dr.Ram Manohar Lohia Hospital and PGIMER, New Delhi, India

***Corresponding Author:** Uma Hariharan, Anesthesia and Intensive care, Dr. Ram Manohar Lohia Hospital and PGIMER, New Delhi, India, Tel: +91 9811271093; Email: uma1708@gmail.com

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Abstract

Mediastinum is one of most the enigmatic areas of the human body and its pathology can be equally riveting. The mediastinum is broadly divided into four regions: Anterior mediastinum; Superior mediastinum; Middle or visceral mediastinum and Posterior or paravertebral mediastinum. All these compartments contain vascular, lymphatic, neural, capsular and solid organ structures, which may be affected by various disease processes and tumours. Mediastinal masses can be silent for a long time and present suddenly as a life-threatening situation, which can be confusing to the untrained mind. These include symptoms of sudden airway obstruction, bronchospasm, venous engorgement and sometimes, even sudden death. While a lot has been published regarding their anaesthetic and surgical management, there is paucity of literature on emergency or intensive care management. This narrative review proposes to highlight the varied acute presentations of mediastinal tumours and their critical care management.

Keywords: Airway obstruction; Bronchospasm; Emergency; Mediastinum; Mass

Introduction

The mediastinum [1] is bounded anteriorly by the sternum, posteriorly by the spine and by the lungs on either side. It contains the vital organs of the body like heart, aorta, esophagus, thymus and trachea. Mediastinal masses can originate from any of the organs or soft-tissues or lymph nodes or neurovascular structures. They can cause symptoms due to mass effect, pressure effect or malignant invasion on vital structures. Anaesthesiologists and intensivists can be involved in the care of these patients either in the operation theatre for resection of mediastinal mass or in the critical care set-up for emergency management. More than one third of mediastinal tumours are symptomatic and can grow to dangerous proportions. Surgical indications (open or minimally-invasive [2]) of mediastinal masses include mass effects or pressure effects on vital structures, malignant invasion or paraneoplastic features. The main contraindications to their surgical resection include development of Mediastinal Syndrome (SMS or MMS) characterised by pressure effects on airway, heart and great vessels. Such patients with severe airway or cardiovascular compression are candidates for lymph node node biopsy or diagnostic thoraco-centesis under local anaesthesia [3]. The anterior mediastinum contains mainly

the thymus gland. Anterior mediastinal masses usually consist of thymomas, lymphomas and germ cell tumours. Middle mediastinal masses can be due to lymph node enlargement {benign or malignant}, infectious processes (abscess, tuberculosis) or inflammatory conditions (sarcoidosis, erdheim-chester disease [4] etc.). Posterior mediastinal masses can be benign tumours or cysts originating from nerves (neurogenic tumours) or from the oesophagus (Foregut Duplication Cysts). Diagnosis can generally be made by contrast enhanced computed tomography [5]. In some cases, a diagnostic thoracoscopy or a CT-guided biopsy or VATS (Video-Assisted Thoracoscopic Surgery) biopsy may be required for a final diagnosis.

The common types of antero-superior mediastinal masses can be enumerated by remembering the mnemonic: 5T's=Thymomas; Thyroid (Ectopic) masses; Thoracic aorta (dilatation or aneurysm of the ascending thoracic aorta); Terrible lymphoma and Teratomas (germ cell tumours). The differential diagnosis of posterior [7] mediastinal masses includes neoplastic or non-neoplastic masses. Neoplastic ones can be neurogenic (most common) or non-neurogenic tumours. Non-neoplastic masses can be infectious (abscess), inflammatory (mediastinitis, pseudocyst), vascular (descending thoracic aneurysm or varices), hernias, traumatic (paraspinal hematoma), lymphadenopathy, duplication cyst and thoracic meningocoele. The types of middle [8] mediastinal

masses can be remembered by the pneumonic: HABIT 5L=Hernia or hematoma; Aneurysm; Bronchogenic carcinoma or duplication cyst; Inflammation; Tumour; 5L-lung, lymphoma, leukemia, leiomyoma and lymph nodes.

The presentation of mediastinal masses varies from asymptomatic lesions detected incidentally to life-threatening clinical scenarios. Malignant masses present more frequently with symptoms of invasion or obstruction. Anterior mediastinal masses are likely to be more malignant than those in other compartments. Symptoms can be due to compression of vital structures or direct invasion of adjoining structures or from paraneoplastic phenomenon. The main symptoms [9] include dysphagia or odynophagia (posterior mediastinal mass), hoarseness of voice, facial edema (superior vena caval syndrome due to middle mediastinal mass), dyspnoea (especially on lying supine from anterior mediastinal mass), PUO (Pyrexia of Unknown Origin), chest pain, weight loss (lymphomas), cough or systemic symptoms due to release of hormones and cytokines. A few patients present with paraneoplastic syndromes. In children [10], these masses are prone to cause tracheobronchial compression, stridor and symptoms of recurrent pneumonia or bronchitis.

Anterior mediastinal masses are more likely to result in features of airway obstruction and bronchospasm. Their presentation can masquerade [11] an acute attack of bronchial asthma or an exacerbation of Chronic Obstructive Pulmonary Disease (COPD). The patient usually presents with dyspnea, wheezing, tachypnea and cough. The main differentiating feature is the improvement in symptoms and oxygen saturation following bronchodilator therapy, corticosteroids, controlled oxygen therapy and nebulisations in patients with reactive airway disease, as opposed to patients with mediastinal masses. Anterior mediastinal masses are the most sinister amongst the mediastinal masses with the potential to cause sudden death. Extreme care should be exercised while anesthetising these patients. It can present as a diagnostic dilemma to the untrained mind. This narrative review article aims to analyse the literature for mediastinal masses presenting with airway obstruction and to understand the challenges of their critical care management.

Review of Literature and Discussion

There is paucity of literature on intensive care management of acute presentation of mediastinal masses. On the other hand, there have been several case reports [12,13] and reviews [14] on anaesthetic management of mediastinal masses for thoracic and non-thoracic surgery. Induction of general anaesthesia may prove fatal in these patients, due to major airway and/or cardiovascular compression. Anaesthesia should never be induced in patients with suspected mediastinal masses without preparations for airway management, bronchoscopy and Cardio Pulmonary Bypass (CPB). A detailed discussion on the anaesthetic management is beyond the scope of this article, as we are dealing with critical care manage-

ment of emergency presentation of mediastinal masses. The major precautions [15] which need to be taken include maintaining spontaneous respiration, awake fibre-optic intubation, passage of definitive airway distal to the site of airway compression, positioning adjustments, avoidance of muscle relaxants till the confirmation of correct tube placement and immediate availability of rigid bronchoscopy and cardio-pulmonary bypass. The main aim is to prevent further airway compression by maintaining spontaneous patient respirations till the passage of definitive airway beyond the point of obstruction. The availability of a standby cardiopulmonary bypass can be made possible in an operation theatre environment. But this is not feasible either in the emergency or the intensive care unit or in the areas outside the operating room.

A patient of undetected mediastinal mass can present to the emergency with complaints of acute breathlessness, dyspnea on mild exertion or sometimes at rest, change in voice, noisy breathing, intractable cough and chest discomfort. On auscultation, there can be diffuse bronchial breath sounds. These features point us towards a diagnosis of exacerbation of bronchial asthma or chronic obstructive pulmonary disease. These symptoms do not generally respond to symptomatic treatment in the form of humidified oxygen, bronchodilators, steroid nebulisations and empiric antibiotics. They mislead us by showing some initial improvement in symptoms. This can complicate the situation, as there is progressive increase in trachea-bronchial obstruction from the mediastinal mass, especially in the supine position. Airway obstruction can be insidious or intra-thoracic in case of bronchial compression. Unless the clinician is aware of the existence of a mediastinal mass, such intrinsic airway compression can prove deleterious. There have been very few reported cases of mediastinal masses presenting with acute airway obstruction in the intensive care unit or emergency setup. Airway compression can be precipitated with any of our interventions, in the form of endotracheal intubation, positioning or any other airway manipulation. If the mediastinal mass is encircling the airway distal to the tip of the endotracheal tube, then the compression is not relieved. Positive pressure ventilation in the face of unrelieved mechanical airway obstruction can be life threatening. Tracheal intubation may be required in emergency situations with oxygen desaturation or severe respiratory distress due to large or malignant mediastinal masses, wherein accidental connection to the mechanical ventilator or manual positive pressure ventilation can lead to further increase in airway and intra-thoracic pressures. This can mimic a tension-pneumothorax-like situation and cause subcutaneous emphysema and hemodynamic compromise. In the event of an unrecognized mediastinal mass causing compression on any of the bronchi or the trachea, the pressure symptoms will not be relieved by drugs or even endotracheal intubation. An intra-thoracic or extra-thoracic airway obstruction by a large mass can be rapidly fatal, especially under anaesthesia [16]. An extrapolation of this situation can arise in the emergency room or the critical care unit, where the patient can present in varying degrees of respi-

ratory distress. It must be remembered that the airway obstruction is external and mechanical. This requires either surgical resection or Institution of Cardiopulmonary Bypass [17] to tide over the crisis. It is not possible to have immediate access to cardiopulmonary bypass machine in the intensive care or emergency area. Hence, an Extra-Corporeal Membrane Oxygenator (ECMO) [18], can also be used as a temporizing measure, till the patient is stabilized and prepared for surgery. ECMO is a recent and promising addition to the armamentarium of emergency life support systems available in select centres for such life-threatening scenarios. It is a form of bridging therapy providing artificial circulatory and respiratory support in patients with respiratory or cardiac failure. ECMO can be either Arterio-Venous (AV) or Veno-Venous (VV). It is generally indicated in mediastinal mass patients undergoing complex trachea-bronchial reconstructions, Carinal resection and complex paediatric thoracic surgery. A detailed discussion of the modalities and use of ECMO or CPB is beyond the scope of this review.

Critical Care Management

Emergency and intensive care management of a patient with pre-existing mediastinal mass unknown to the clinician can be quite challenging. Maintaining a high degree of suspicion in patients presenting with acute airway obstruction and respiratory distress can be rewarding. Contrast-enhanced computed tomographic scans can diagnose the site and extent of mediastinal masses. Our most important aim should be to prevent further harm to the patient by realizing that the airway obstruction is intrathoracic and external to the airway tube. Presentation can mimic an acute exacerbation of bronchial asthma or COPD. Standard medical management [19] in the form of beta-2 agonists, steroids, nebulizations, theophylline derivatives, propped-up position and oxygen supplementation may not produce the desired response. Oxygen desaturation may be a late feature and cyanosis may be a preterminal event. These patients can deteriorate early and suddenly. Any airway manipulation can trigger bronchospasm and further increase airway obstruction. Endotracheal intubation if attempted, must be done gently and the tube should pass beyond the site of airway compression for effective ventilation. Forceful positive pressure ventilation should be avoided at all costs [20]. If airway pressures are very high after a smooth and successful intubation, then the possibility of unrelieved airway obstruction due a compressing mass must be kept in mind, especially in a patient with no known history of bronchial asthma, COPD or allergic bronchitis. A thoracic surgeon may be contacted early and investigations to rule out a mediastinal mass may be undertaken if the patient is hemodynamically stable. Swift action must be taken before the onset of hemodynamic instability due to increase in intra-thoracic pressure. Some mediastinal masses may also be visible on the chest x-ray, which can be taken at the bedside of the patient. If a mediastinal mass is suspected, then the femoral vessels can be prophylactically cannulated, if the need for life-support arises. Institution of cardiopulmonary bypass is not be

feasible in an ICU. Hence, facilities for ECMO, if available, must be made possible. Definitive management in the form of thoracotomy or sternotomy to excise the mediastinal mass may be considered in consultation with the CTVS (Cardio-Thoracic Vascular) surgeon. Adequate blood and blood products must be arranged, with judicious fluid management. Airway must be secured under spontaneous respiration and positive pressure ventilation must be avoided. In hemodynamically stable patients in whom the diagnosis of a mediastinal mass is made on radiological investigations, a minimally invasive approach in the form of mediastinoscopy or VATS (Video-Assisted Thoracoscopic Surgery) [21] can be undertaken. A Double Lumen Tube (DLT) insertion to facilitate surgical exposure may be necessary in such situations. A DLT may also be passed beyond the site of distal airway obstruction to facilitate ventilation of the affected lung. A Bronchial Blocker (BB) may also be used to facilitate one lung ventilation, if insertion of a DLT is not possible. Both the DLT and BB [22] must be made available in the emergency setup to handle such difficult cases.

Conclusion

Mediastinal masses can act as a great mimic. They can masquerade as an attack of bronchial asthma or COPD exacerbation. Hemodynamic collapse following airway intervention or positive pressure ventilation can mimic a tension pneumothorax-like situation. An unsuspecting clinician can further complicate the situation and lead to increased patient morbidity and mortality. In hemodynamically stable patients, radiological investigations can be conducted to clinch the diagnosis of a mediastinal mass. In a patient with known mediastinal mass with impending airway obstruction, prophylactic femoral vessel cannulation and an early thoracic surgeon consult is recommended. As facilities for cardiopulmonary bypass may not be possible outside the operating theatre environment, facilities for institution of ECMO may be considered in an ICU setup to tide-over the crisis, till definitive management can be arranged..

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