Dynamic anterior mediastinal mass compression of the superior vena cava during airway stent deployment

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INTRODUCTION

Mediastinal tumors account for 3% of all the tumors that arise in the thoracic cavity. Nearly, one-third of these patients are asymptomatic and for those who develop symptoms, the severity is based on the location of the mass, postural symptoms, and degree of tracheal and cardiovascular compression.[1-4] We present the case of a 48-year-old patient with the dynamic collapse of the superior vena cava (SVC) during instrumentation of the airway, noticed via endobronchial ultrasound (EBUS). Airway stenting for the management of tracheobronchial narrowing may be associated with compression of the surrounding vascular structures during deployment of the device, either by the instrumentation utilized or by indirect local mass effect.[5,6]

CASE HISTORY

A 48-year-old female with a history of chronic obstructive pulmonary disease and extensive history of smoking presented with dyspnea on exertion and cough associated with wheezing and right-sided chest pain. She denied postural symptoms (worsening dyspnea on supine) as well as reproducible hypotension while supine on physical examination. Vital signs were otherwise stable, except oxygen saturation of 89% on room air.

Further radiographic imaging revealed severe hyperinflation of the lungs with bullous emphysema, therefore, computed tomography (CT) with intravascular contrast was performed that revealed a 5.2 × 4.2 × 5 cm central necrotic mass in the right mid-lower paratracheal region.
was admitted to the medical intensive care unit for further recovery. The patient was evaluated by interventional pulmonology (IP) team, who recommended bronchoscopy and possible tumor debulking and tracheal stent placement.

The patient was admitted to the operating room the next day. A pre-procedure arterial line was placed for close hemodynamic monitoring. General anesthesia was initiated uneventfully, with intravenous propofol and remifentanil, as well as rocuronium to ensure adequate muscle paralysis. Vital signs remained within normal limits, with an initial blood pressure of 122/82 mmHg. The IP team then inserted a rigid bronchoscope for airway visualization. Ventilation was performed through the side port of the rigid bronchoscope.

On initial examination, narrowing of the distal trachea was noticed, as well as 100% extrinsic compression of the right mainstem bronchus and distortion of the carina [Figure 2]. Upon advancing the rigid bronchoscope in the mid-distal trachea, it was immediately noticed a sudden drop in the blood pressure (80/50 mmHg), prompting insertion of additional vascular access (lower extremity) for fluid and vasopressors administration. Moreover, it was also noticed that upon withdrawing the rigid bronchoscope the hemodynamics slowly improved. The decision was made to remove the rigid bronchoscope and an endotracheal tube size 9.0–French was introduced via direct laryngoscopy, through which an endobronchial ultrasound bronchoscope-EBUS – (Olympus America, Center Valley, PN) was inserted for evaluation of the paratracheal space.

The EBUS scope identified the right paratracheal mass and its vicinity to the SVC [Figure 3a and b]. After approximately 2 L of crystalloids were administered, the hemodynamics of the patient stabilized, thus the IP team proceeded to perform gradual balloon dilation tests in the right mainstem, to evaluate for further hemodynamic changes. The patient tolerated these dilations adequately without blood pressure changes noticed.

The IP team removed the endotracheal tube and reinserted the rigid bronchoscope through which a 15 × 12 × 12 mm Dumon Y-stent (Novatech SA, France) was deployed. The patient remained hemodynamically stable throughout the insertion of the tracheobronchial stent. Images after this event revealed a 100% patent distal trachea and a 75% patent right mainstem. The rigid bronchoscope was removed and exchanged for a laryngeal mask airway for emergence. The patient had uneventful extubation and was admitted to the medical intensive care unit for further recovery.

Figure 1: Coronal CT view depicting the location of the mass (yellow circle). Red arrows point at superior vena cava demonstrating the decreased caliber

Figure 2: Rigid bronchoscope view before hemodynamic changes. The green arrow represents left main bronchus; red arrow represents carina and yellow arrow depicts 100% collapsed right main bronchus

Figure 3: Endobronchial Ultrasound (EBUS) of the patient. A: The right para-tracheal mass (yellow circle) is seen close to the superior vena cava (SVC, green circle). B: The mass occludes the SVC when the airway is intermittently manipulated by the proceduralist. Blue arrow represents the visceral pleura
DISCUSSION

As part of the spectrum of complications resulting from anterior mediastinal masses, dynamic (acute) compression of the great vessels poses significant challenges for the anesthesiologist and the procedural team. The anesthesia literature citing perioperative hemodynamic complications secondary to mediastinal mass is vast and the incidence is reported to be around 7–20% intraoperatively, although EBUS-guided management of a dynamic SVC compression is scarce.

Preoperative CT scan evaluation in addition to a thorough physical exam aids the clinician in predicting the likelihood of an intraoperative adverse hemodynamic episode, although these events are often difficult to foretell. Transesophageal echocardiography (TEE) has been employed in the past to assess the relationship of mediastinal masses with the heart and the great vessels, although this tool is not routinely employed as part of the anesthesia management of patients undergoing airway stent insertion.

In the present case, while both the anesthesia and the procedural team were aware of the location and extension of the mass, the patient remained hemodynamically stable after patient positioning, induction of anesthesia, and muscle relaxation, when most of the catastrophic cardiopulmonary events onset. Sudden hemodynamic changes during the advancement of the rigid bronchoscope into the distal trachea raised the suspicion that potentially the thickness of the scope, which raised the suspicion that potentially the thickness of the scope might have directly compressed one of the great vessels or pushed the mediastinal mass in question away and then indirectly pushed the mass away.

Based on these premises, both the anesthesia and procedural teams concluded that the best conduct to follow would be to aggressively replete the patient intravascular status with crystalloids (administered through a lower extremity venous access to avoid the obstruction at the SVC) and vasoressors as needed, considering the vicinity of the mass with the SVC as per the preoperative CT scan. Subsequently, the IP team conducted an interrogation of the paratracheal space through EBUS, which ended up providing the utmost important information that helped to guide fluid resuscitation maneuvers and final airway manipulation.

There is no formal consensus in the literature regarding the ideal anesthetic management for patients with mediastinal masses. Most authors suggest that each case should be individualized based on patients’ risk factors, characteristics of the mass, and whether the procedure is diagnostic and/or therapeutic. Our case exemplifies the importance of employing an alternative technology such as EBUS for the diagnosis on the intraoperative hemodynamic crisis that involves a mediastinal mass, and constant communication between the anesthesia and the procedural team during crisis management to assure positive clinical outcomes.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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