Case Report

Vascular airway compression management in a case of aortic arch and descending thoracic aortic aneurysm

Alok Kumar, Vikas Dutta, Sunder Negi, G. D. Puri

Department of Anaesthesia and Intensive Care, Postgraduate Institute of Medical Education and Research, Chandigarh, India

ABSTRACT

Airway compression due to distal aortic arch and descending aortic aneurysm repair has been documented. This case of tracheal and left main stem bronchus compression due to aortic aneurysm occurred in a 42-year-old man. The airway compression poses a challenge for the anesthesiologist in airway management during aortic aneurysm repair surgery. The fiber-optic bronchoscope is very helpful in decision-making both preoperatively and postoperatively in such cases. We report a case of airway compression in a 42-year-old patient who underwent elective distal aortic arch and descending aortic aneurysm repair.

Received: 08-03-16
Accepted: 19-05-16

Key words: Airway compression; Aortic aneurysm; Fiber-optic bronchoscopy; Tracheomalacia

INTRODUCTION

Vascular tracheobronchial compression syndrome could be acquired or congenital, commonly seen with double aortic arch, aberrant subclavian artery, and pulmonary artery sling.[1] Kommerell's diverticulum is a rare cause of tracheobronchial compression.[2] Aneurysms of aortic arch and descending thoracic aorta can also cause airway compression.[3] Chronic compression of trachea can lead to tracheomalacia.[4] Various methods are used to rule out airway compression or tracheomalacia in the postoperative period.[1] We describe a case where intraoperative fiber-optic bronchoscopy (FOB) was used to rule out the airway compression.

CASE REPORT

A 42-year-old male was admitted in our cardiac center with a history of dry cough, hoarseness of voice, and chest pain for the past 4 months. Chest X-ray showed a widened mediastinum and dilated descending thoracic aorta with elevated left hemidiaphragm [Figure 1]. Computed tomography (CT) angiography revealed a large fusiform aneurysm of the arch of aorta and proximal descending thoracic aorta, distal to the left common carotid artery with involvement of origin of the left subclavian artery. The descending thoracic aorta showed aneurysmal dilatation till D8 level. The saccular part of the aneurysm measured 8.5 cm × 7.0 cm with total craniocaudal span of the aneurysmally dilated segment measuring 16 cm. Compression and narrowing of the trachea was seen with displacement of the trachea and esophagus toward the right. The left major bronchus was mildly displaced anteriorly. Atelectatic changes were seen in the left lower lobe [Figure 2].

Access this article online
Website: www.annals.in
DOI: 10.4103/0971-9784.185568
Quick Response Code:

Address for correspondence: Dr. Alok Kumar, Department of Anaesthesia and Intensive Care, Postgraduate Institute of Medical Education and Research, Chandigarh - 160 012, India.
E-mail: docsomi@yahoo.com

Cite this article as: Kumar A, Dutta V, Negi S, Puri GD. Vascular airway compression management in a case of aortic arch and descending thoracic aortic aneurysm. Ann Card Anaesth 2016;19:568-71.

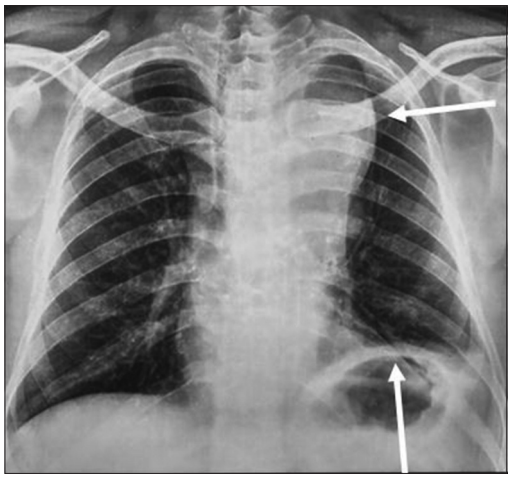

Figure 1: Posteroanterior view of chest X-ray depicting aortic arch aneurysm and elevated left diaphragm

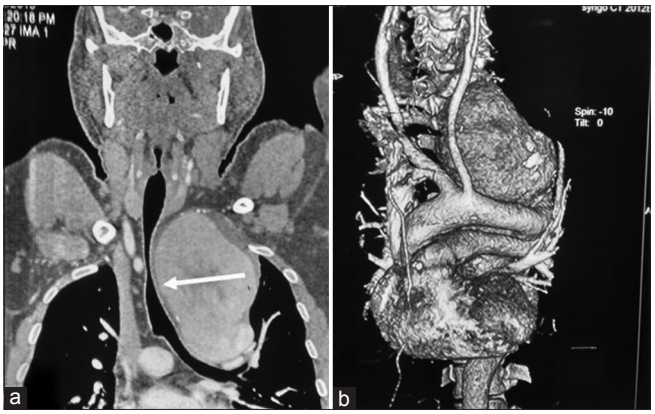

Figure 2: (a) Contrast-enhanced computed tomography chest showing aortic arch aneurysm compressing the tracheal lumen and left main stem bronchus. (b) Three-dimensional reconstructed view of the aneurysm

The surgical plan in this case was to exclude the thoracic aneurysm and reduce the volume of the aneurysm to reduce compression on the airways. This aneurysm could have been treated by placing a stent graft, but this would not have reduced pressure on the airways for several weeks to months. Thus, the open surgical repair was planned under cardiopulmonary bypass (CPB) through peripheral cannulation.[5] Transesophageal echocardiography was performed perioperatively in this case.

In preanesthetic assessment, all laboratory investigations were normal, with arterial pressure (blood pressure [BP]) of 110/70 mmHg and heart rate of 72 beats/min. Preinduction monitoring included electrocardiogram, pulse oximetry, bispectral index, and invasive BP in the right radial and left femoral artery. Femoral vein and femoral artery were prepared for emergency femoro-femoral bypass. After induction of anesthesia and endotracheal intubation, FOB was performed to see the extent of tracheal compression. It showed a narrowed and pulsatile trachea at the level of carina. The left main stem bronchus was also narrowed. The right main stem bronchus was normal in caliber [Figure 3].

After heparinization, CPB was commenced using the right femoral and right axillary arterial cannulation. Interposition dacron graft of 16 mm was used for anastomosis of thoracic aorta. The left subclavian artery was sacrificed. Before chest closure, a repeat FOB was carried out to see the residual tracheal compression and rule out the presence of tracheomalacia. Bronchoscopy showed a normal caliber trachea at the level of carina [Figure 4]. The left main stem bronchus was also normal in caliber. No residual narrowing or tracheomalacia was seen. The patient developed quadriplegia in the postoperative period, which was successfully managed with cerebrospinal fluid drainage. The patient was extubated on postoperative day 6. Postextubation, the patient was stable with no difficulty in breathing and no stridor. On the 10th postoperative day, the patient was discharged from the hospital.

DISCUSSION

Tracheobronchial compression is a well-known complication of aneurysms of the ascending aorta and/or the aortic arch.[4] In general, compression occurs because of the close anatomic relationship of the aortic arch to the trachea and the left main stem bronchus. Patients with thoracic aortic aneurysm (TAA) may be asymptomatic or may be found incidentally during workup for other processes. Symptoms vary according to the size, location, and changes in the aneurysm. Tracheobronchial compression commonly presents with chest, back, and abdominal pain in patients who are symptomatic. Hoarseness may signify vagus or left recurrent laryngeal nerve compression. Wheezing, dyspnea, or cough suggest tracheal compression. Hemoptysis may be a sign of aneurysmal erosion into the trachea. The findings of the physical examination are usually normal. CT scanning, magnetic resonance imaging, angiography, and transesophageal echocardiography are most often used to assess thoracic aneurysm. The preferred method of assessment depends on the stability of the patient, the availability of radiographic modalities, and the preference of the surgeon. However, CT scanning is most commonly used in both emergent and outpatient settings to diagnose and follow thoracic aneurysm. Chest radiography should be obtained in the initial workup of patients with chest

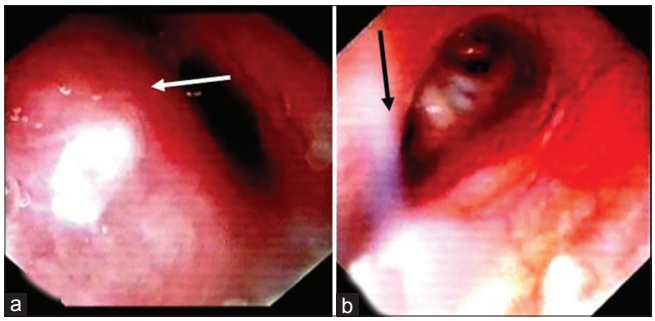

Figure 3: Preoperative fiber-optic bronchoscopic image showing external compression of the trachea (white arrow) (a) and left main stem bronchus (black arrow) (b) by aortic arch aneurysm

discomfort. Findings suggestive of aneurysm include mediastinal widening, blurring of the aortic knob, and tracheal displacement. An elevated hemidiaphragm may suggest phrenic nerve compression from mass effect, as seen in our case, but this finding is exceedingly rare compared with the other findings listed. Intravenous contrast-enhanced CT scanning is the investigation of choice for the diagnosis. Its sensitivity is 96–100% and specificity is 99% for detecting aneurysms. CT scanning is useful in evaluating aneurysm size, proximal and distal extension, presence or absence of dissection, and in seeking other pathologies within the chest. Contrast angiography is useful in assessing the complex aortic pathology and identifying the anatomy of branch vessels. Its sensitivity is 85% and specificity is 95% in detecting aneurysms.[5] Angiography has been considered the gold standard for specifically delineating topographic vascular anatomy, relative dimensions, and flow distributions, which can explain the mechanism of airway compression in many such cases.[5,6] Magnetic resonance angiography is useful in assessing the aortic anatomy, the size of the aneurysm, the dissection, and the branch vessels. Its sensitivity is 100% and specificity is 100% in detecting aneurysms. Magnetic resonance angiography does not require the administration of iodinated radiologic contrast material.

Patients who present with a descending TAA and require lung isolation can be managed with either a left-sided double-lumen endotracheal tube (DLT) or a right-sided DLT if there is a compression of the entrance of the left main stem bronchus.[7] With a large aneurysm of the descending thoracic aorta, the anatomy can be distorted if the aneurysm compresses the trachea or the entrance of the left main stem bronchus.[8,9] This may make the placement of a left-sided DLT dangerous in patients in whom the aneurysm involves the left main stem bronchus because the potential exists for rupture

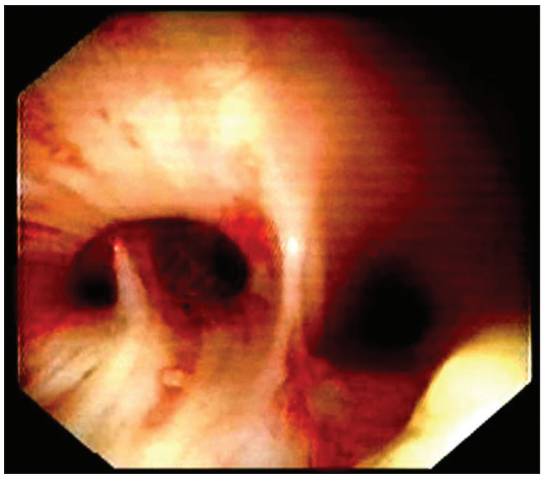

Figure 4: Postoperative fiber-optic bronchoscopic image showing trachea, carina, and both main bronchus with no narrowing of tracheal lumen or left main bronchus

of the aneurysm. Contraindications for the use of double-lumen tubes include anatomic barriers that make positioning improbable or dangerous (i.e., carinal or bronchial lesions, strictures, and vascular compression by aortic aneurysm).[10] Therefore, a decision of using single-lumen tube was taken. The crucial importance of intraoperative bronchoscopic monitoring of airway decompression and its effectiveness has been emphasized in several reports.[11-13] Flexible bronchoscope facilitated inspection of all the accessible airway portions, assessment of endoluminal tissue properties of the airway wall, and effective direct clearing of retained secretions after decompression.

Tracheomalacia can be sometimes associated with congenital (or acquired) aortic arch abnormalities. The acquired form of tracheomalacia may be secondary to chronic external compression by mediastinal mass, but rarely, chronic aortic arch aneurysm causing tracheomalacia has been reported in literature.[4] As such in this case, the history was of 4 months only and any aneurysm causing tracheomalacia is rare.

Tracheomalacia can occur in cases of aortic arch aneurysm with a posterior expansion, a long-standing compression of the tracheobronchial tree, and can be managed with the endoscopic implantation of a silicon T or T-Y tube. FOB is used to diagnose the airway compression and it is also being used to deploy expandable metallic airway stents.[14,15]

Our patient did not have airway compression postsurgery and therefore, he was planned for early weaning and extubation. This case report highlights the utility of

confirming the extent, location, and severity of tracheal and bronchial compression with an FOB before and after the aortic arch aneurysm surgery, which helps in deciding the course of action for airway management.

SUMMARY

Patients with a large TAA may develop an airway compression. During the preoperative evaluation, review of the chest X-ray and CT scan is important to determine if the trachea or the left main stem bronchus has any compression due to a large aneurysm. In addition, review of the chest CT scan will determine the precise location of the compression. FOB is the best method to diagnose an airway compression in patients with a descending TAA to rule out any postoperative tracheomalacia and deciding the course of action postoperatively.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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