

# Diagnosing thoracic venous aneurysm: A contemporary imaging perspective

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## Abstract

Thoracic venous aneurysms are a rare clinical entity and contrast-enhanced computed tomography has been the cornerstone of their diagnosis. We are reporting a rare case of isolated left brachiocephalic vein aneurysm, which was surgically managed, highlighting the role of dynamic contrast-enhanced magnetic resonance imaging as a definitive diagnostic modality in this patient.

**Key words:** Aneurysm; brachiocephalic vein; MRI

## Introduction

Reports of aneurysmal dilatation of thoracic veins have been far and few in the existing literature, most commonly involving the superior vena cava. Isolated involvement of brachiocephalic vein is extremely rare with only 16 cases reported. Till date, very few thoracic venous aneurysms have undergone surgical repair.<sup>[1-4]</sup> The diagnostic modality of these venous aneurysms has been contrast-enhanced computerized tomography (CECT) and there is no report till date highlighting the role of electrocardiogram (ECG)-gated magnetic resonance imaging (MRI) in these patients. We report a surgically managed case of aneurysmal dilatation of a major thoracic vein, highlighting the contemporary role of dynamic contrast-enhanced MRI (CE-MRI) as the definitive diagnostic modality.

## Case Description

A 20-year-old young male, presented with a 15-day history of nonproductive cough, not associated with fever

or weight loss. While laboratory parameters including routine hemogram were normal, he was detected to have a large anterior mediastinal mass on his chest radiographs [Figure 1].

Considering the differential possibilities of anterior mediastinal mass in a young patient such as teratoma/lymphoma, the patient underwent CECT of the thorax at a peripheral hospital for further characterization of the mass. The study revealed a normal lung parenchyma with no mediastinal lymphadenopathy. The mediastinal mass was diagnosed as an aneurysm of the ascending aorta with partial luminal thrombus [Figure 2], and patient was transferred to our hospital, a tertiary care centre, for further management by a cardiothoracic surgeon. On review of the CECT at our centre, abnormal dilatation of left brachiocephalic vein (LBCV) was suspected, with posteriorly displaced superior vena cava (SVC). Because the CECT study was non-ECG gated, the distal end of this vascular abnormality and its junction with SVC/right atrium could not be well defined. For clear definition of the mass and its mediastinal

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relations, an ECG-gated cardiac MRI was performed on a 1.5-T machine (Magnetom Avanto, Siemens Erlangen, Germany). Breathhold “black blood” images were acquired using T2 half-Fourier acquisition single-shot turbo spin-echo (HASTE) for mediastinum in axial and coronal planes followed by “bright blood” imaging using true fast imaging with steady-state free precession (TRUFISP) cine sequence in four-chamber and short-axis planes. This was followed by contrast-enhanced MR angiography (with contrast injection from a left-sided venous access) using T1 fast low angle shot (FLASH) 3D sequences (TR = 3.2, TE = 1.1, FOV = 500, base resolution = 384, phase resolution = 90). Sequential angiographic images revealed a large partially thrombosed aneurysm of the LBCV reaching upto the SVC junction but not involving the SVC [Figure 3] and reaching anteriorly till the sternum. SVC was displaced towards the right posterolateral aspect, and the right atrium and ventricle were displaced posteriorly, with well-maintained interface with the cardiac chambers [Figure 4]. No intracardiac extension of thrombus was seen.

As per the accepted line of management, a conservative approach was planned which included low molecular

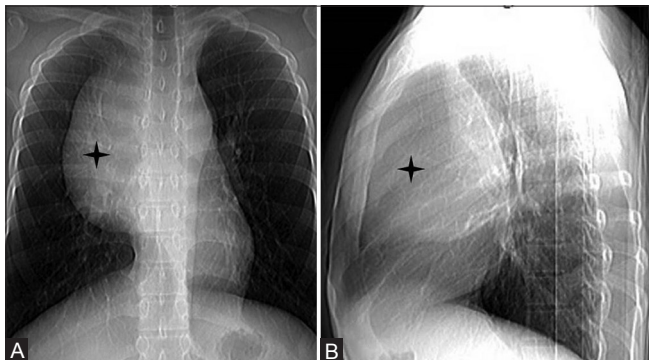
weight heparin and close follow up.<sup>[5]</sup> However, on the third day of admission, patient had an episode of unexplained sudden onset syncope, cyanosis and respiratory distress. The patient was taken up for emergency surgery, considering a possibility of complicated aneurysm.

Peroperatively, a large, partly thrombosed saccular brachiocephalic venous aneurysm was identified. After ligating the origin of the left innominate vein, cardiopulmonary bypass was instituted and aneurysm sac opened and the thrombus was completely removed. The sac was resected after ligating the opening of the sac into SVC from within the sac [Figure 5].

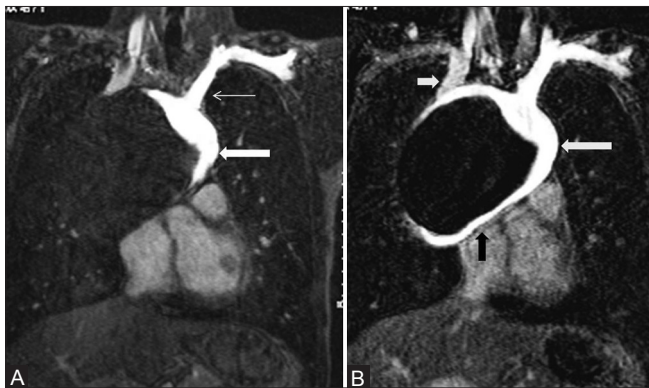
Post-operative CT angiography was done which revealed a small residual postoperative fluid filled cavity with normal orientation of SVC [Figure 6]. Postoperative period was uneventful and the patient was discharged 3 weeks after surgery. The patient recovered completely and remains asymptomatic till last follow-up at 6 months review.

### Discussion

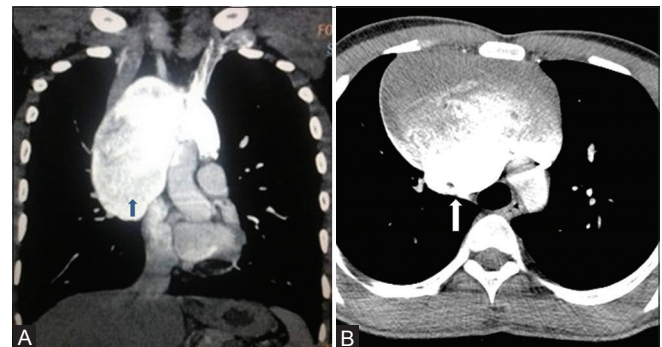
Vascular aneurysms of mediastinum are a known entity, with venous aneurysms being extremely rare compared to arterial aneurysms.<sup>[6]</sup> Only few cases of venous aneurysms have been reported in literature, with majority cases



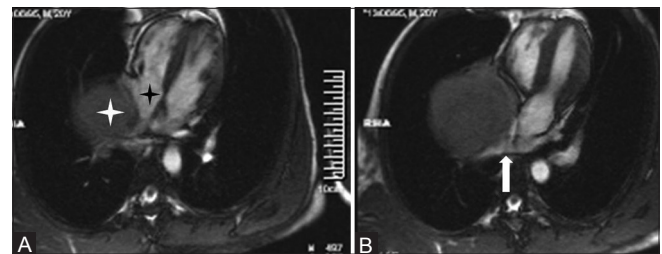
**Figure 1 (A and B):** Chest radiographs PA (A) and Lat view (B) showing a large anterior mediastinal mass (black star)



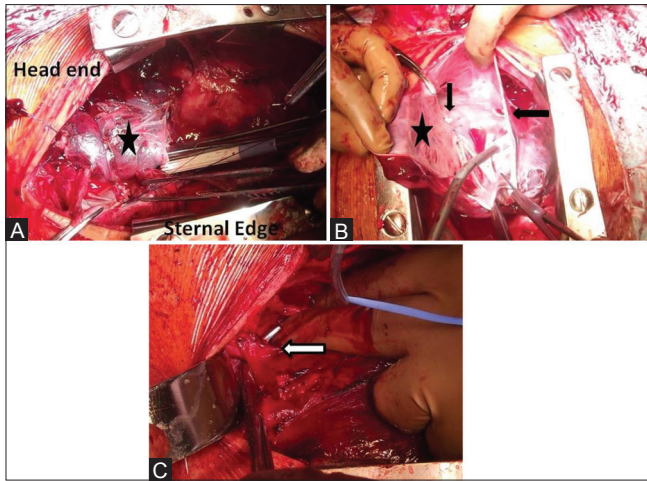
**Figure 3 (A and B):** (A) Dynamic contrast enhanced MR angiography showing of large thrombosed aneurysm (white block arrow) arising from left brachiocephalic vein (thin white arrow). (B) Sequential filling of aneurysm sac (long white arrow) with clear delineation of relation with Superior vena cava (short white arrow) and right atrium (vertical black arrow)



**Figure 2 (A and B):** Pre operative CT angiography (non ECG gated). (A) Coronal section showing aneurysmal sac (vertical black arrow) in relation to ascending aorta. (B) Axial section showing large partially thrombosed aneurysm displacing the superior vena cava (vertical white arrow)



**Figure 4 (A and B):** Trufi cine four chamber image in end diastolic phase (A) and end systolic phase (B) showing distinct intervening plane of aneurysm (white star) with right atrium (black star) and aneurysm with Superior vena cava (vertical white arrow)



**Figure 5 (A-C):** Per op images of the aneurysmal sac. (A) Aneurysm sac from left brachiocephalic vein as seen after sternotomy (black star). (B) Smooth walled aneurysm cavity (black star), edge of the aneurysm cavity which has been emptied of the clots (horizontal black arrow), Communication of the aneurysm with superior vena cava sutured with 4/0 prolene (vertical black arrow). (C) Left brachiocephalic vein being ligated (horizontal white arrow)

involving SVC, whereas isolated brachiocephalic vein aneurysm are very rarely encountered.<sup>[1-4]</sup> Most of these patients were asymptomatic and were followed up conservatively. The main complications which can occur in these venous aneurysms range from pressure effect on surrounding structures, thromboembolism and rarely rupture of the aneurysm.<sup>[3,4]</sup> Our patient presented with respiratory symptoms and was incidentally found to have a large mediastinal mass on routine chest radiograph, whose stable clinical course was abruptly complicated by sudden onset cyanosis and respiratory difficulty. The cause of his sudden respiratory distress could be secondary to the pressure effect of large thrombosed aneurysm on adjacent mediastinal structures. No rupture of the sac was confirmed per-operatively nor there was any clinical confirmation of pulmonary embolism.

Etiology of the venous aneurysm has been largely unknown, with proposed mechanisms attributed to changes in vessel wall secondary to trauma, inflammation, and degeneration.<sup>[7]</sup> In our case, the histopathology of the resected dilated sac was normal, with no evidence of degeneration or inflammatory changes seen in vessel wall. Most of the mediastinal venous aneurysms are managed conservatively.<sup>[8]</sup> Surgery as a management option is reserved to tackle any complication, purely depending on the clinical condition of the patient.<sup>[8,9]</sup> Our patient had incidental detection of a LBCV aneurysm, which became complicated during his course of stay in the hospital, for which he underwent an emergency surgery with a favorable outcome and uneventful postoperative recovery. The diagnosis of these aneurysms have been made on CECT which can have pitfalls, as has been reported by Mark *et al.*, where a thrombosed left brachiocephalic vein aneurysm was misdiagnosed as solid and cystic anterior



**Figure 6:** Post operative CECT scan. Coronal section showing normally oriented Superior Vena cava (horizontal black arrow) and post operative fluid filled cavity (white star)

mediastinal tumor and was even biopsied. This happened due to single phase scan following a right hand injection which led to contrast bypassing the thrombosed aneurysm resulting in misdiagnosis.<sup>[3]</sup> French *et al.* reported a similar case of misdiagnosed thrombosed IVC aneurysm.<sup>[10]</sup> CECT has such inherent imaging pitfalls besides practical limitations of dependence on luminal contrast density and radiation hazard. The dynamic CEMRI can overcome these limitations, as a single contrast bolus can be traced in sequential scans without any radiation exposure or additional contrast burden. The higher sensitivity of MRI to detect gadolinium-induced T1 shortening of blood would ensure adequate delineation of venous origin and residual non thrombosed aneurysm lumen even on delayed phases, which would unequivocally establish the diagnosis as in our patient. Another imaging modality that might be contributory in some patients is transthoracic color doppler with a small footprint probe using intercostal or suprasternal window. Although the specific role in left brachiocephalic aneurysm has not been reported, color doppler would be limited in analyzing only lesions touching the chest wall and might not be able to establish the origin of mass from left brachiocephalic vein. Transesophageal echocardiography also has similar limitations, apart from being semi-invasive and specifically equipment and expertise dependant.

## Conclusion

Thoracic venous aneurysms are an extremely rare entity. Most are asymptomatic and majority are discovered

incidentally. MRI with dynamic CEMRI scans is a definitive tool for the diagnosis of this condition. Most cases are managed conservatively with surgical intervention reserved for patients in whom there is deterioration in clinical status or any superimposed complication associated with aneurysm.

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#### Conflicts of interest

There are no conflicts of interest.

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