Case Report

Traumatic Transection of Descending Thoracic Aorta: A Rare Cause of Pulmonary Vein Obstruction

Abstract

Pulmonary vein obstruction is rare condition characterized by challenging diagnosis and unfavorable prognosis at advanced stage. Computerized tomography, magnetic resonance imaging, and transesophageal echocardiography (TEE) are often essential to reach a final diagnosis. External compression of pulmonary vein resulting from the mass effect of pseudoaneurysm and perianeurysmal hematoma due to aortic transection is extremely rare. We describe a case of traumatic transection of descending thoracic aorta where TEE was instrumental in the diagnosis of left upper pulmonary vein obstruction and help in the modification of the surgical plan.

Keywords: *Aortic transection, pulmonary vein, transesophageal echocardiography*

Alok Kumar, Bhupesh Kumar, Rupesh Kumar[1]

Departments of Anaesthesia and Intensive Care and [1]Cardiothoracic and Vascular Surgery, Post Graduate Institute of Medical Education and Research, Chandigarh, India

Introduction

Pulmonary venous obstruction (PVO) due to external compression is an extremely rare condition in patients presenting for cardiac surgery.[1] This may lead to pulmonary venous congestion resulting in right-sided failure. The severity of symptoms resulting from PVO depends on the degree of stenosis and the number of stenosed pulmonary veins.[2] We describe a case of traumatic descending thoracic aortic transection that resulted in left upper PVO due to compression from dissected aneurysm. The patient underwent successful emergency single-stage repair of the thoracic aortic aneurysm with relief in the PVO.

Case Report

A 25-year-old male without any comorbid illness presented with the complaint of nonradiating constant chest pain following a road traffic accident. There was no history of breathlessness, abdominal pain, or features of head injury. His general physical examination revealed mild tachycardia (heart rate 110/min) with normal blood pressure (130/86 mmHg), respiratory rate (20/min), systemic oxygen saturation (98% on room air), and fracture of the left femur. Auscultation of chest revealed diminished breath sound on bilateral costophrenic angles; normal heart sound and no murmur. Routine laboratory tests and electrocardiogram were essentially normal except for the presence of sinus tachycardia. Chest X-ray revealed mediastinal widening with trachea deviated to right and congestion of left lung parenchyma [Figure 1]. Computerized tomography scan showed irregular outpouching in the descending thoracic aorta (DTA) only distal to left subclavian artery, adjacent mediastinal hematoma and bilateral pleural effusion with the collapse of the underlying lung [Figure 2]. He was planned for repair of the transected aorta using cardiopulmonary bypass (CPB).

In the OR after instituting standard American Society of Anesthesiologist monitoring and bispectral index, cannulation of the right radial artery, dorsalis pedis artery, and left internal jugular vein was accomplished under local anesthesia. Anesthesia was induced and maintained using the balanced narcotic technique. Transesophageal echocardiography (TEE) performed using a 5-MHz phased array transducer (6VT-D probe), and GE vivid E9 echocardiography system (GE Medical Systems, Horten, Norway) showed tear in the aortic wall only distal to the origin of the left subclavian artery. Lacerated wall of DTA was observed moving with cardiac pulsation. The DTA lumen was connected through a large entry point to a pseudoaneurysmal cavity (2.9 cm × 3.8 cm) with surrounding hematoma [Figure 3].

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

Video Available on: ww.annals.in

Access this article online

Website: www.annals.in

DOI: 10.4103/aca.ACA_195_17

Quick Response Code:

How to cite this article: Kumar A, Kumar B, Kumar R. Traumatic transection of descending thoracic aorta: A rare cause of pulmonary vein obstruction. Ann Card Anaesth 2018;21:293-6.

Examination of pulmonary veins showed narrowing of the left upper pulmonary vein (LUPV) with an adjacent hematoma. Color flow Doppler showed continuous turbulence flow pattern [Figure 4 and Video 1]. Pulsed wave Doppler with sample volume at narrowed segment showed peak pulmonary vein velocity 1.2 m/s with was biphasic flow pattern. The peak and mean gradient in the LUPV were 8 and 4 mmHg, respectively. Examination of the left lower pulmonary vein (LLPV) and right pulmonary veins showed normal flow pattern with peak velocity <0.80 m/s [Figure 5]. Imaging the heart showed normal cardiac function and no pericardial collection. A diagnosis of a contained aortic transection with large pseudoaneurysm and compression of LUPV was confirmed to the surgeon.

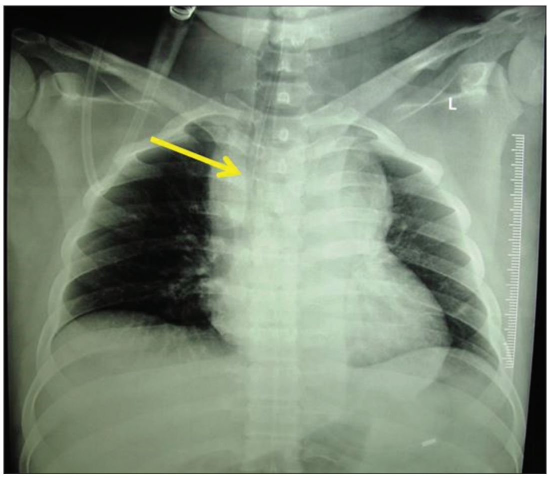

Figure 1: Chest X-ray anteroposterior view showing mediastinal widening with trachea deviated to right (arrow mark) and congestion of left lung

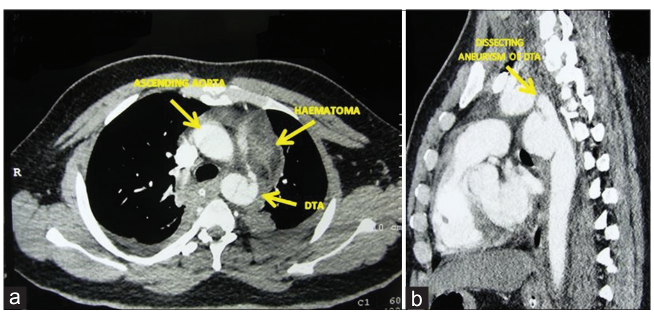

Figure 2: Computed tomography scan (a) transverse section and (b) coronal section showing dissecting aneurysm of the descending thoracic aorta and the adjacent hematoma

The surgical approach included left thoracotomy and the use of left heart bypass. Under moderate hypothermic CPB, a 22 mm integrated woven intravascular interposition tube graft was used for the replacement of a transected DTA segment. Complete evacuation of hematoma and excision of the aneurysmal cavity was done to ensure relief of PVO. The total duration of CPB and aortic cross-clamp were 220 and 160 min, respectively. Weaning from CPB was achieved with the minimal use of inotropes. TEE after termination of CPB showed no residual obstruction in the LUPV flow as evidenced by the absence of turbulence on color flow Doppler and decrease in the gradient (peak 4 mmHg and mean 2 mmHg) [Figure 6]. He was weaned off form ventilator after 6 h and subsequently transferred uneventfully to the orthopedic department for the management of fracture femur.

Discussion

Traumatic aortic transection most commonly occurs at aortic isthmus (80%–90%) followed by ascending aorta (5%–10%) and DTA near diaphragm hiatus (1%–3%).[3] Echocardiography and computed tomography are commonly employed modalities for confirmation of its diagnosis. TEE is considered to be one of the most sensitive and specific diagnostic tests for detecting aortic transection.[4] It should be considered among one of the first-line imaging modality for suspected injury of the thoracic aorta because of its portability, safety, diagnostic accuracy, and potential impact on patient management.[5,6]

Aortic aneurysm or dissection may cause compression to the pulmonary artery and other adjacent vascular structures such as an innominate vein.[7] Displacement of the pulmonary veins and compression of the left and right pulmonary veins by the large dissecting hematoma may be explained by the proximity of the descending aorta to the pulmonary veins.[8]

On echocardiography, pulmonary vein obstruction may produce an increase in flow velocity associated with

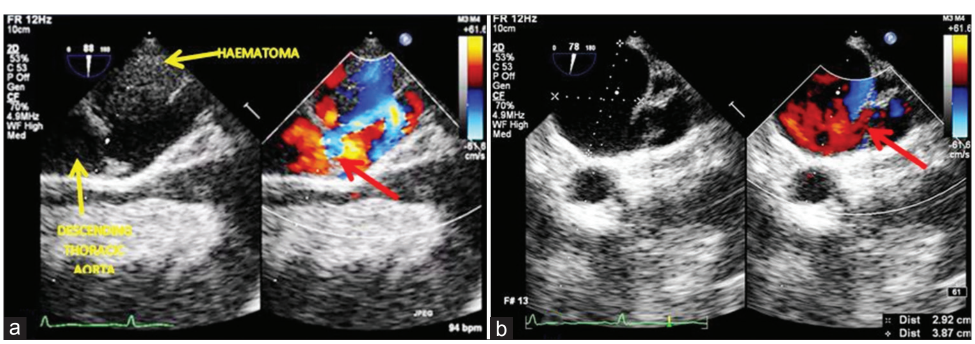

Figure 3: Transesophageal echocardiography-mid esophageal aortic (descending thoracic aorta) (a) short axis view and (b) long axis view showing turbulent flow entering the pseudoaneurysm (red arrow) and adjacent hematoma

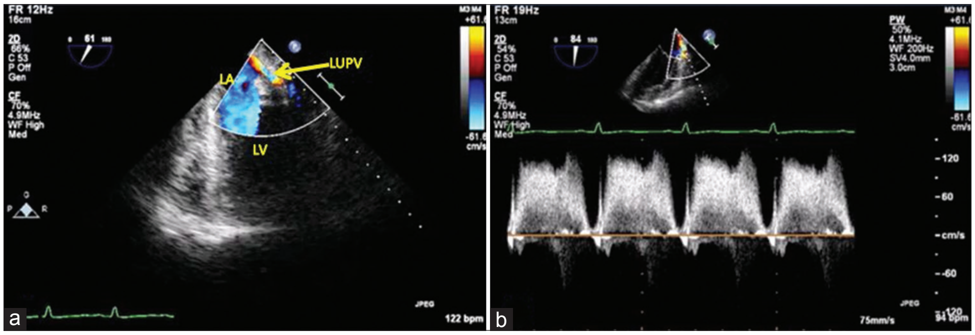

Figure 4: Transesophageal echocardiography-(a) mid esophageal left upper pulmonary vein view and (b) pulsed wave Doppler of left upper pulmonary vein showing dynamic obstruction with peak velocity of 1.2 m/s. LA: Left atrium, LV: Left ventricle

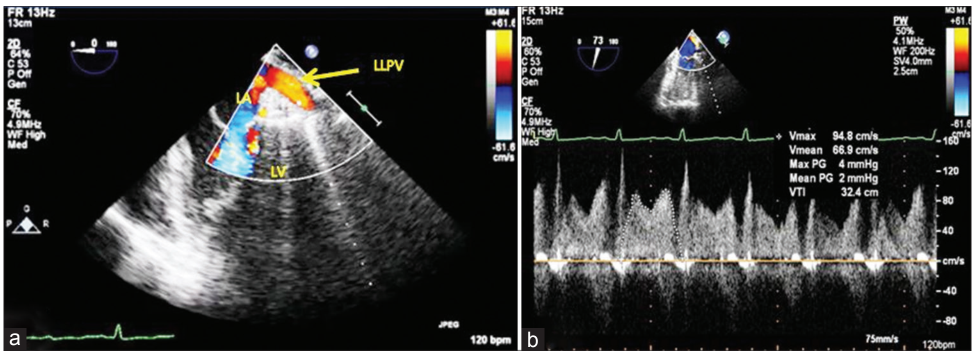

Figure 5: Transesophageal echocardiography. (a) Mid esophageal left lower pulmonary vein view and (b) pulsed wave Doppler of left lower pulmonary vein showing peak velocity of 0.8 m/s. LA: Left atrium, LV: Left ventricle

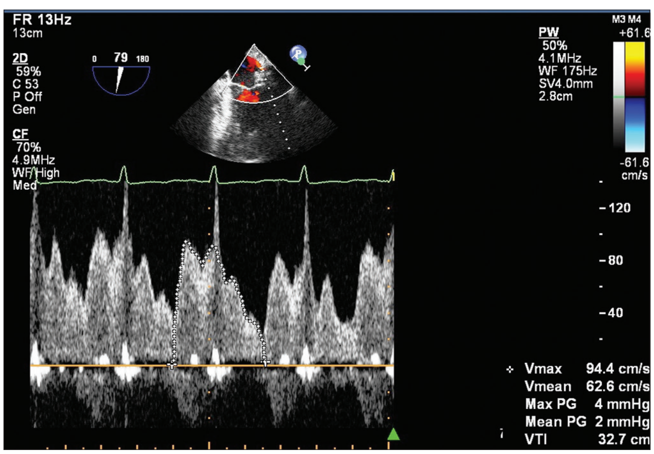

Figure 6: Postoperative transesophageal echocardiography-mid esophageal left upper pulmonary vein pulsed wave Doppler showing peak velocity of 0.95 m/s

turbulence and spectral broadening, as well as distortion and overlap of the various components of the flow signal. The magnitude of increase in flow velocity depends on the volume of flow and the severity of obstruction. Pulse wave Doppler usually shows an increase in both systolic and diastolic flow velocity in case of PVO. In the index case there was an increase in systolic peak velocity while the diastolic flow velocity remains normal suggesting it to be a dynamic obstruction due to the pulsating aneurysm. The quantitative TEE criterion for detection and classification of the degree of PVO is still in nascent phase. The peak Doppler velocity across stenosed pulmonary vein has shown to vary from 1.1 m/s to 2.2 m/s while in normal pulmonary veins remains below 0.8 m/s.[9-12]

PVO may manifest with features of pulmonary venous congestion and right-sided failure depending on the number of pulmonary veins involved and the severity of obstruction. Although acute pulmonary hypertension caused by aortic dissecting hematoma is rare, the potential risk should be borne in mind when treating patients with this condition. In our patient, the absence of respiratory distress, normal hemodynamics and normal cardiac function on transthoracic echocardiography indicated the absence of pulmonary hypertension or, right heart failure. Although chest X-suggested increases vascularity of the left lung; TEE examination was instrumental in detecting LUPV obstruction due to compression effect produced by hematoma around a pseudoaneurysm. Following this finding surgeon ensured that complete evacuation of clots and excision of pseudoaneurysm to relieve compression on the pulmonary vein.

Conclusion

Traumatic aortic transection may rarely cause PVO. TEE may be instrumental in the detection of cause of obstruction, assessing the magnitude of hemodynamic effects and monitoring of the adequacy of relief following surgical correction.

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.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Obeid AI, Carlson RJ. Evaluation of pulmonary vein stenosis by transesophageal echocardiography. J Am Soc Echocardiogr 1995;8:888-96.
2. Saad EB, Rossillo A, Saad CP, Martin DO, Bhargava M, Erciyes D, *et al.* Pulmonary vein stenosis after radiofrequency ablation of atrial fibrillation: Functional characterization, evolution, and influence of the ablation strategy. Circulation 2003;108:3102-7.
3. Kouchoukos NT, Blackstone EH, Hanley FL, Kirklin JK. Acute Traumatic Aortic Disruption. In: Kirklin JW, Barratt-Boyes B, editors: Cardiac Surgery. 4th ed. Vol 1. Philadelphia: Elsiever Saunders; 2013. p. 918.
4. Galvin IF, Black IW, Lee CL, Horton DA. Transesophageal echocardiography in acute aortic transection. Ann Thorac Surg 1991;51:310-1.
5. Meredith EL, Masani ND. Echocardiography in the emergency assessment of acute aortic syndromes. Eur J Echocardiogr 2009;10:i31-9.
6. Vignon P, Guéret P, Vedrinne JM, Lagrange P, Cornu E, Abrieu O, *et al.* Role of transesophageal echocardiography in the diagnosis and management of traumatic aortic disruption. Circulation 1995;92:2959-68.
7. Chao CL, Hung CL. Acute type B aortic dissection present as innominate vein compression syndrome: A rare presentation. Int J Gerontol 2016;10:49-51.
8. Saiki Y, Kawamoto S, Akasaka J, Motoyoshi N, Sai S, Tabayashi K, *et al.* Pulmonary venous obstruction in a patient with Marfan syndrome: Rare presentation of an expanding dissecting descending thoracic aortic aneurysm with annuloaortic ectasia. J Thorac Cardiovasc Surg 2009;137:1282-4.
9. Sigurdsson G, Troughton RW, Xu XF, Salazar HP, Wazni OM, Grimm RA, *et al.* Detection of pulmonary vein stenosis by transesophageal echocardiography: Comparison with multidetector computed tomography. Am Heart J 2007;153:800-6.
10. Gaither NS, Hull RW, Wortham DC, Yost WJ, Jelinek J. Pulmonary venous obstruction: Utility of transesophageal echocardiography. Am Heart J 1991;121:203-5.
11. Smallhorn JF, Pauperio H, Benson L, Freedom RM, Rowe RD. Pulsed Doppler assessment of pulmonary vein obstruction. Am Heart J 1985;110:483-6.
12. Schneider C, Ernst S, Bahlmann E, Malisius R, Krumsdorf U, Boczor S, *et al.* Transesophageal echocardiography: A screening method for pulmonary vein stenosis after catheter ablation of atrial fibrillation. Eur J Echocardiogr 2006;7:447-56.