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CASE REPORT

Intraoperative Detection of Ascending Aortic Dissection by Transesophageal Echocardiography in a Patient with Bicuspid Aortic Valve and Ascending Aortic Aneurysm

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ABSTRACT

Bicuspid aortic valve is a common congenital heart defect frequently associated with complications of aortic valve and dilatation of ascending aorta. High index of suspicion is required for diagnosis of aortic dissection in patient with bicuspid aortic valve and ascending aortic dilatation. We present a case of bicuspid aortic valve with ascending aortic aneurysm in which aortic dissection was detected by intraoperative transesophageal echocardiography (TEE). A careful review of patient's preoperative computed tomography (CT) scan showed dissection flap in the ascending aorta, which was overlooked in CT reporting. We present how intraoperative TEE helped in surgical planning for the patient.

Keywords: Aortic aneurysm, Aortic dissection, Bicuspid aortic valve, Computed tomography, Transesophageal echocardiography.

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INTRODUCTION

Bicuspid aortic valve (BAV) is the most common congenital heart disease and the commonest cause of aortic stenosis in young patients.[1] Bicuspid aortic valve predisposes to aneurysm formation in ascending aorta and aortic arch and is also associated with coarctation of aorta.[2] The diagnosis of bicuspid aortic valve should prompt the echocardiographer to search for other common associated findings.

The architectural makeup of the aortic wall is abnormal and predisposes to aneurysm formation as well as aortic dissection.[3] Computed tomography (CT) or CT angio is the investigation of choice in cases of aortic dissection, although transesophageal echocardiography (TEE) has been found to be equally good for assessing ascending aortic dissection.[4] Transesophageal echocardiography can also provide valuable information on associated lesions, like aortic regurgitation, involvement of coronary arteries, biventricular and other valvular function, pericardial collection as well as extension of dissection flap in descending aorta. We present a case of bicuspid aortic valve with ascending aortic aneurysm in which ascending aortic dissection was detected by intraoperative TEE. Intraoperative TEE also helped in further intraoperative management on surgical decision making and assessing adequacy of repair in the post bypass period.

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CASE REPORT

A 29-year-old male, weighing 54 kg presented with gradually progressive shortness of breath for the past 5 years. Physical examination revealed grade III ejection systolic murmur audible in the aortic area. A preoperative transthoracic echocardiogram (TTE) showed bicuspid aortic valve, severe aortic stenosis, concentric left ventricular hypertrophy, normal left ventricular systolic function and aneurysmal dilatation of aortic root and ascending aorta. A preoperative CT scan showed aneurysmal dilatation of aortic root (65.4 mm) and ascending aorta (61.7 mm). The corresponding measurements for aortic arch and descending aorta were normal (36 and 24 mm respectively). He was planned for Bentall's procedure with a composite valved graft.

Invasive lines were placed under local anesthesia. After induction of anesthesia and endotracheal intubation, a TEE probe (6VT-D, GE vivid E9; GE Vingmed Ultrasound AS, Horten, Norway) was inserted which confirmed the diagnosis of bicuspid aortic valve, severe aortic stenosis, dilated aortic root (aortic annulus 27 mm, sinus 65 mm), ascending aorta (57 mm) and mild aortic regurgitation. There was an unanticipated finding of a dissection flap in the aortic root and ascending aorta arising 1 cm above the aortic valve extending until the visualized aorta (proximal ascending aorta); however, it was not involving the distal aortic arch, descending aorta or coronary arteries (Figs 1, 2, Videos 1, 2). Although the

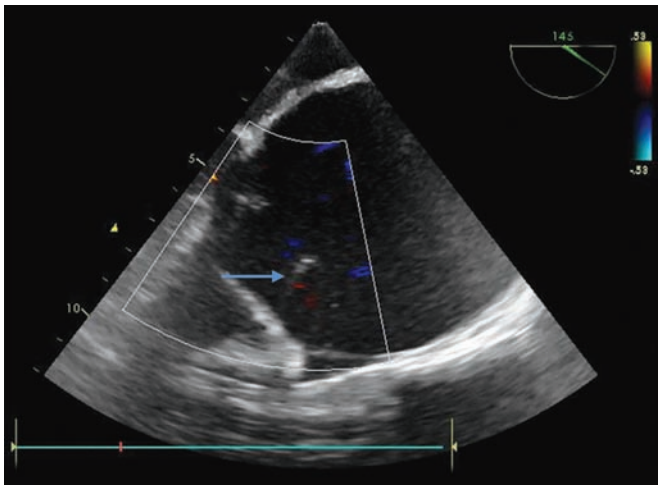

Fig. 1: Midesophageal aortic valve long axis view showing dilated aortic root and dissection flap (arrow)

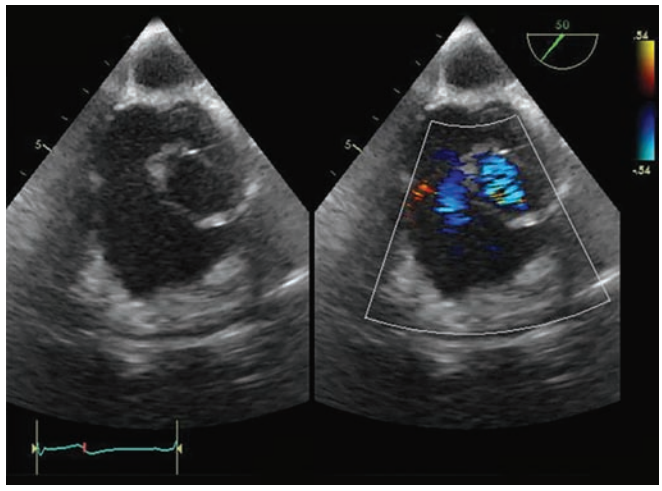

Fig. 2: Midesophageal aortic valve short axis view showing a bicuspid aortic valve

proximal entry point could be visualized, the distal end point and involvement of great vessels could not be commented upon as they lie in the blind spot of the TEE.[5] Flow in one lumen could be seen synchronous with aortic valve opening in systole confirming it to be true lumen. The suspicion of an artefact was ruled out as the flap could be seen in multiple imaging planes and had independent mobility on M-Mode echo. There was no aortic regurgitation. Intraoperative TEE findings were conveyed to the surgical team. A careful re-examination of the CT films showed dissection flap in the aortic root and ascending aorta terminating before the origin of arch vessels (Fig. 3). The need to reconfirm the distal extent of the dissection using epiaortic scanning was discussed, but as the patient was hemodynamically unstable, it was decided to go on pump using femoral cannulation and inspect the aorta under deep hypothermic circulatory arrest (DHCA). Cardiopulmonary bypass (CPB) was established accordingly using the right femoral artery and right atrial cannulation. The surgical team confirmed the presence of dissection flap in aortic root and ascending aorta ending approximately 1 cm before origin of innominate artery. Patient underwent Bentall's procedure using 23 mm composite valved conduit. Total CPB time was 253 minutes and aortic cross clamp time was 141 minutes, which included 34 minutes of DHCA. Patient was weaned off CPB with minimum inotropic support and had an uneventful recovery.

DISCUSSION

Estimated prevalence of BAV is between 0.5 and 2% with a 3:1 male predominance.[6] Recent studies suggest autosomal dominant inheritance with incomplete penetration.[7] The extracellular matrix in the aortic valve is abnormal which predisposes to aneurysmal dilatation and dissection of the thoracic aorta.[3] Bicuspid aortic valve and associated thoracic aortopathy are thought to be manifestations of a single gene defect.[7] All patients with a BAV should have both the aortic root and thoracic aorta evaluated for evidence of aortic dilatation and dissection. Imaging modality to evaluate aorta should be based on patient variables, availability and institutional expertize. In cases of high clinical suspicion for acute aortic dissection and a negative aortic imaging, a second imaging study should be considered.[8] Transesophageal echocardiography, CT scan or Magnetic resonance imaging can be used for evaluation of aortic dissection.[9,10]

Advantages of CT scan include easy availability, imaging of the entire aorta, including lumen, wall, periaortic regions and ability to identify anatomic variants and branch vessel involvement. It is possible to generate motion-free images of the aortic root and coronary arteries using electrocardiogram-gated techniques, similar to coronary CT angiographic imaging. Newer-generation multidetector helical CT scanners have sensitivity of up to 100% and specificity of 98 to 99%.[11,12] Magnetic resonance

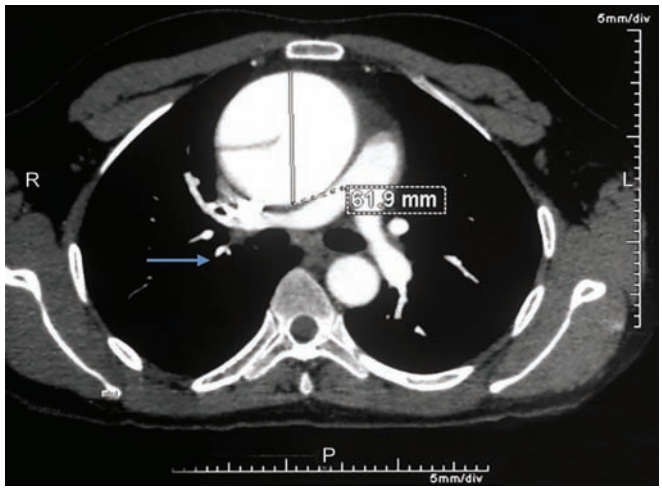

Fig. 3: Computed tomography scan at level of ascending aorta showing aneurysmal dilation of ascending aorta and a dissection flap (arrow) in ascending aorta

imaging is very accurate in the diagnosis of thoracic aortic disease with sensitivity and specificity that is equivalent to or better than those of CT and TEE.[13] Disadvantages of MRI include prolonged duration of image acquisition more so in acute dissection with hemodynamic instability, difficult access to the patient, inability to use gadolinium contrast in patients with renal insufficiency and lack of widespread availability. It is contraindicated in patients with claustrophobia, metallic implants or pacemakers. Shiga et al[9] in their meta analysis found CT, MRI and TEE equally reliable for diagnosing or ruling out thoracic aortic dissection. If only a single imaging modality is used, up to 5% of thoracic aortic dissections can be missed.

Intraoperative TEE may be considered as imaging modality of choice in emergency situation in a patient with high suspicion for aortic dissection. However, TEE examination of distal ascending aorta and proximal aortic arch is poor due to blind spot caused by air-filled trachea.

In our case, a dissection flap was found in the ascending aorta. No dissection flap could be visualized in aortic arch and descending aorta. At this point, a careful review of CT scan showed a dissection flap in ascending aorta that was missed in CT reporting. Transesophageal echocardiography facilitated the change in surgical plan by altering the aortic cannulation site and need for DHCA for examination of the arch vessels.

CONCLUSION

Bicuspid aortic valve is associated with aortopathy. High index of suspicion is required for diagnosis of aortic dissection in patient with bicuspid aortic valve with ascending aortic dilatation. Multimodal evaluation of aorta is advisable with a high suspicion of aortic dissection in patients with BAV and ascending aortic dilatation. Transesophageal echocardiography is a minimally invasive investigation of thoracic aorta performed at bedside or in operating room.

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