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Case Report *Cardiopulmonary Imaging*

Delineating thrombus versus myxoma: Perioperative 3D transesophageal echocardiography to the rescue!

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ABSTRACT

Cardiac masses are a significant cause of patient morbidity and mortality by virtue of their symptoms and surgical removal. Preoperative diagnosis of a cardiac mass is usually based on clinical correlation and transthoracic echocardiography findings. Myxomas are the most common benign cardiac tumors, commonly occurring in the left atrium attached to the interatrial septum near the fossa ovalis. Although, at times atypical location and unusual morphology may pose a diagnostic dilemma with 2D echocardiography. 3D echocardiography with its multifaceted advantages, including multiplanar cropping abilities and superior imaging quality can help distinguish between a clot and a myxoma.

Keywords: Myxoma, Thrombus, 3D echocardiography

INTRODUCTION

Cardiac masses are uncommon, with an echocardiographic prevalence of 0.15%.[1] Historically, cardiac myxomas have been considered the most common benign cardiac tumor, usually occurring as a sporadic, solitary lesion on the left atrial side of the fossa ovalis (80%). Myxomas have also been reported to arise from the right atrium (RA) in 20% of cases. More rarely, the aorta, pulmonary artery, ventricles, and even the vena cava can be the site of origin.[2] Although benign, myxomas can cause varied symptoms due to hemodynamic impairment (valve obstruction, compression of vessels, and cardiac chambers), arrhythmias, and embolism requiring therapy, either medical or surgical.[3] The imaging appearance of thrombi and sessile myxomas may mimic each other.[4] Conversely, an atrial thrombus in some cases may have a stalk, misleading clinicians into diagnosing it as a myxoma. Differentiating between them can at times become a diagnostic challenge for the intraoperative echocardiographer, which is of paramount importance in tailoring treatment strategies.[5]

CASE DETAILS

A 19-year-old male presented with gradually worsening dyspnea on exertion over 2 years with associated complaints of abdominal distension and pedal edema for 12 months. The patient also had a history of atrial fibrillation. Transthoracic echocardiography revealed a dilated RA with spontaneous echo contrast (SEC), dilated and severely dysfunctional right ventricle (RV), and a sessile solitary mass attached to the RA-free wall. Valvular pulmonary stenosis was also noted. Taking into consideration the clinical and echo findings, the mass was diagnosed as a

thrombus. Low-molecular-weight heparin therapy was started, and the patient was planned for clot removal and pulmonary valvotomy. Intraoperative 2D transesophageal echocardiography (TEE) revealed a 3.5 cm × 3.8 cm echodense, homogeneous, ovoid-shaped, sessile, and immobile mass situated below the superior vena cava (SVC) on the RA free wall, suggestive of a thrombus [Figure 1]. 3D echocardiography (3DE) confirmed it to be a solitary, sessile mass; however, the 3D volume data set analysis showed that the mass had a heterogeneous, granular surface texture [Figure 2], few irregular calcifications in crop plane view, and random small areas of echolucency, suggestive of a tumor rather than a thrombus [Figure 3 and Video 1].[6] Surgically excised mass pointed toward it being a myxoma [Figure 4].

DISCUSSION

Primary cardiac tumors, cardiac metastases, vegetations, thrombi, fluid-filled lesions, and artifacts form the differential diagnosis for cardiac masses [Table 1].[6,7] Among them atrial myxomas show the most variability in shape and consistency. Right heart thrombi are often serpiginous, highly mobile, and associated with deep vein thrombosis and pulmonary embolism. Treatment with anticoagulants can help dissolve the thrombus, as was tried in our case.

Echocardiography is the first line of diagnostic tool for the evaluation of intra-cardiac tumors.[8] TEE with better resolution becomes the imaging modality of choice for posteriorly located lesions, in perioperative assessment and guidance for surgical removal. The RA mass in our patient was not suspicious of myxoma, given the absence of stalk, location in RA, attachment site on the RA free wall, immobility along with dilated RA, RV, history of atrial fibrillation, and SEC or "smoke-like" echo, indicating a predisposing stasis, which almost always accompanies a thrombus on 2D echo. Table 2 gives the differentiating features between tumor (myxoma) and thrombi. Although

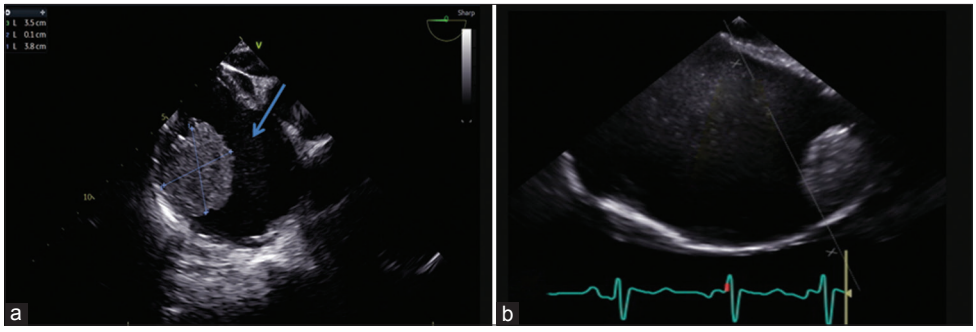


Figure 1: 19-year-old male presented with dyspnea on exertion over 2 years with abdominal distension and pedal edema for 12 months. (a) 2D transesophageal echocardiography (TEE) image in midesophageal 4 chamber right focused view (0°) shows a homogenous mass located on the supero-lateral wall of the right atrium (RA) measuring 3.5 cm × 3.8 cm with spontaneous echo contrast (blue arrow). (b) 2D TEE image in midesophageal bicaval view, showing the mass on the superolateral wall of a dilated right atrium (RA).

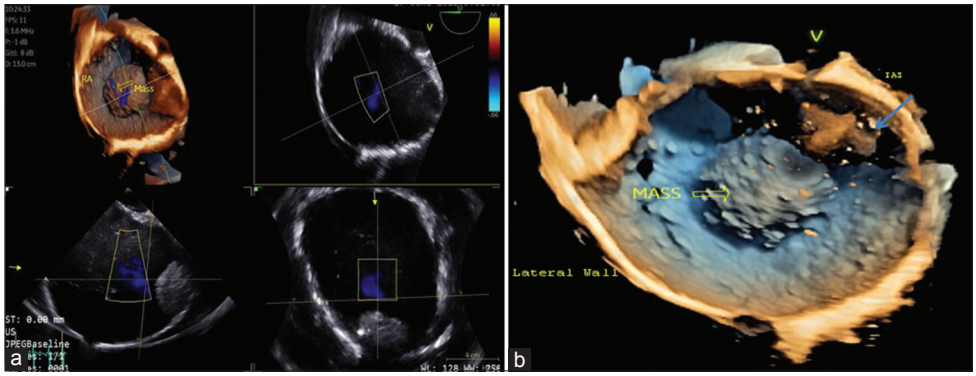


Figure 2: A 19-year-old male presented with dyspnea on exertion over 2 years with abdominal distension and pedal edema for 12 months. (a) 3D transesophageal echocardiography (TEE) showing multi-planar reconstruction of the mass in the right atrium (RA). (b) 3D TEE view from the right ventricular aspect. The mass (hollow yellow arrow) on the superolateral surface of the RA has a granular surface with the presence of red colored, cross-shaped (blue arrow) artifacts due to spontaneous echo contrast.

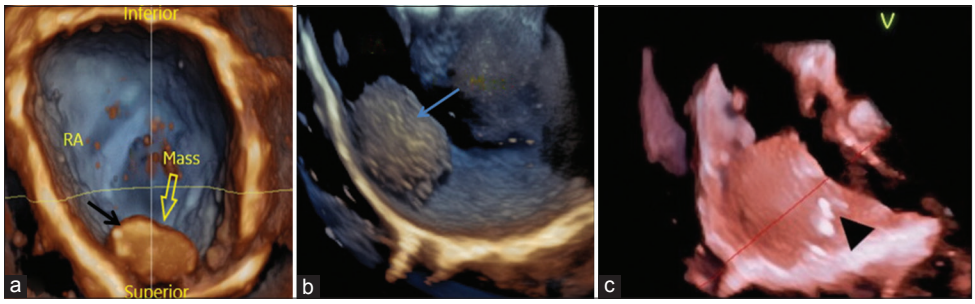
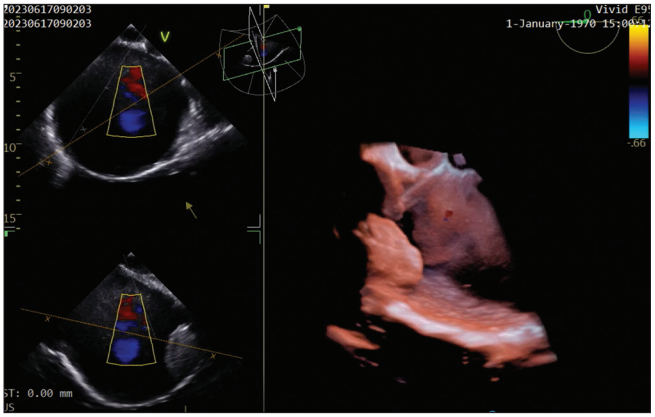


Figure 3: A 19-year-old male presented with dyspnea on exertion over 2 years with abdominal distension and pedal edema for 12 months. 3D transesophageal echocardiography images using tissue rendering mode: (a) mass viewed from the left atrium with the interatrial septum removed and the image flipped with the inferior portion on top shows areas of echolucency (black arrow) within the mass (hollow yellow arrow). (b) Mass viewed from the lateral wall of the right atrium, showing a rough echotexture (blue arrow). (c) shows a crop plane cutting through the middle of the mass, the random small areas of echolucency and few irregular calcifications (black arrow head) are suggestive of a tumor rather than a thrombus. Right atrium (RA).

Figure 4: A 19-year-old male presented with dyspnea on exertion over 2 years with abdominal distension and pedal edema for 12 months. Mass after surgical excision is shown above.



Video 1: Video showing loops from 3D transesophageal echocardiography view through various crop planes of the mass.

Table 1: Echocardiographic features of cardiac tumors and mass.

Tumor/mass	Characteristics
Myxoma	Usually smooth surface, mobile, pedunculated, heterogeneous, and minimal enhancement with contrast echo
Papillary fibroelastoma	Mobile pedunculated, homogenous, multiple fibrillar projections, small<1 cm, attached to valvular structures/cords
Lipoma	Smooth surface, increased echogenicity, minimal enhancement with echo contrast
Rhabdomyoma	Small, well-defined, solitary/multiple homogenous nodules or pedunculated mass, age <1 year
Sarcoma	Heterogeneous echogenicity, and hypoechogenic area may be suggestive of tumor necrosis
Cardiac hemangioma	Vascular channels with large echolucent areas, and high echogenicity with echo contrast
Vegetations	Irregular, lobulated, echo dense, chaotically mobile, can be multiple, attached to the upstream surface of valvular leaflets or mural endocardium

cardiac magnetic resonance imaging (MRI) could have been performed for better tissue characterization of the RA mass,[9] in addition to it being expensive, it is not a part of routine investigation at our institute.

3DE can delineate structural details difficult to image with 2D [Table 3].[10,11] 3DE refined the diagnosis as a myxoma in a case of cardiac mass by visualization of the peduncle.[12] A 13-patient study concluded, that 3D TEE is a valuable tool in morphologic imaging, bridges the gap between 2D and anatomy, useful in making decisions and surgical interventions.[13] 3DE was superior even to MRI in confirming a myxoma by identifying the stalk and attachment

Table 2: Differentiation between thrombus versus myxoma.

Characteristics	Thrombus	Tumor (Myxoma)
Area of origin	LAA or LA (Rarely other chambers)	LA, fossa ovalis Less often in RA or other chambers
Mode of attachment	Broader attachment rarely has a stalk	Usually pedunculated, rarely sessile
Predisposing conditions	Enlarged atria, atrial fibrillation, Low cardiac output syndrome, and LV aneurysm	Carney's complex (familial myxoma syndrome)
Appearance	Well defined borders	Capsulated myxoma – regular borders, smooth surface Gelatinous myxomas – more irregular, soft, and multilobate surface
Response to intervention	Decreased size with thrombolytic therapy and anticoagulation	No response to thrombolysis/ anticoagulation
Echogenicity	Homogenous, central hypodense zone post thrombolysis	Heterogeneous
Multiplicity	Single or multiple	Usually, solitary
Contrast Echocardiography	No Enhancement	Myxomas – Partial enhancement Malignant tumors – complete enhancement

LAA: Left atrial appendage, LA: Left atrium, RA: Right atrium, LV: Left ventricle

Table 3: Advantages of 3D echocardiography over 2D.

Characteristics	3D	2D
Localization	+++	+
Attachment	++	+
Atypical anatomical features	+++	+
En-face view	+++	_
Dropout artifacts for thin structures	_	++
Spatial relationship	+++	++
Mobility	+++	+
Multiplane cropping	+++	_

- No, + fair, ++ good, +++ very good

at the base of the interatrial septum close to the origin of the right inferior pulmonary vein.[14] 3D with its ability to acquire a pyramidal volume of 2D image,[15] which can be rotated and multi-planar cropping[16] capabilities to focus on the region of interest assists in identifying atypical masses allowing better tumor characterization, spatial relations, attachment, differential diagnosis, surgical planning, rationalized use of hospital resources, and eventual patient outcome.

Intraoperative caution should have been exercised had the mass been a thrombus – during central venous catheterization, bicaval venous cannulation site since the mass was near the SVC-RA junction, to avoid inadvertent dislodgement and iatrogenic pulmonary embolism, which could have increased the cardiopulmonary bypass (CPB) duration and difficult weaning from CPB in a pre-operative dysfunctional RV.

CONCLUSION

An intracardiac mass should be evaluated taking into consideration the clinical setting, age of the patient, tumor location, and echocardiography findings. 3D TEE gives us greater imaging quality and additional information, improving the sensitivity and specificity of diagnosis compared to 2D imaging.

Ethical approval

Institutional Review Board approval is not required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

REFERENCES

1. Motwani M, Kidambi A, Herzog BA, Uddin A, Greenwood JP, Plein S. MR imaging of cardiac tumors and masses: A review of

methods and clinical applications. Radiology 2013;268:26-43.
2. Al Sergani R, Alamro B, Al Admawi M, Elmahi I, Iannuzzo G, Cittadini A, *et al*. Three dimensional echocardiographic imaging of multiple recurrent myxomas. Monaldi Arch Chest Dis 2020;90:17-20.
3. Pino PG, Moreo A, Lestuzzi C. Differential diagnosis of cardiac tumors: General consideration and echocardiographic approach. J Clin Ultrasound 2022;50:1177-93.
4. Mahmoud O, Haynos W, Rollor J. Left atrial thrombi masquerading as myxomas: Mini case series and literature review. CASE (Phila) 2020;4:252-9.
5. Kuon E, Kreplin M, Weiss W, Dahm JB. The challenge presented by right atrial myxoma. Herz 2004;29:702-9.
6. Peretz-Larochelle M, Blissett S, Lipes J, Kovacina B, Afilalo J, Rudski L. Clot or not? CASE (Phila) 2018;2:47-50.
7. Kirkpatrick JN, Wong T, Bednarz JE, Spencer KT, Sugeng L, Ward RP, *et al*. Differential diagnosis of cardiac masses using contrast echocardiographic perfusion imaging. J Am Coll Cardiol 2004;43:1412-9.
8. Zaragoza-Macias E, Chen MA, Gill EA. Real time three-dimensional echocardiography evaluation of intracardiac masses. Echocardiography 2012;29:207-19. Erratum in: Echocardiography 2012;29:1. Zaragosa-Macias, Elisa [corrected to Zaragoza-Macias, Elisa].
9. Alyami A, Ajeebi A, Almutairi T, Suliman I. Large right atrial mass, is it tumor or thrombus? A case report. Int J Med Dev Countries 2020;4:2357-61.
10. Gadhinglajkar S, Sreedhar R. Intraoperative evaluation of left atrial myxoma using real-time 3D transesophageal echocardiography. Ann Card Anaesth 2010;13:180-1.
11. Mantegazza V, Gripari P, Tamborini G, Muratori M, Fusini L, Ghulam Ali S, *et al*. 3D echocardiography in mitral valve prolapse. Front Cardiovasc Med 2023;9:1050476.
12. Jang KH, Shin DH, Lee C, Jang JK, Cheong S, Yoo SY. Left atrial mass with stalk: Thrombus or myxoma? J Cardiovasc Ultrasound 2010;18:154-6.
13. Alamro B, Pergola V, Eltayeb A, Alshammari A, Kholaif N, Alhamshari A, *et al*. Role of three-dimensional transesophageal echocardiography in cardiac myxomas: an imaging challenge. Monaldi Arch Chest Dis 2023. Doi: 10.4081/monaldi.2023.2768.
14. Galzerano D, Pragliola C, Al Admawi M, Mallardo M, Di Michele S, Gaudio C. The role of 3D echocardiographic imaging in the differential diagnosis of an atypical left atrial myxoma. Monaldi Arch Chest Dis 2018;88:906.
15. Mankad R, Herrmann J. Cardiac tumors: Echo assessment. Echo Res Pract 2016;3:R65-77.
16. L'Acqua C, Piazzoni N, Muratori M, Mazzanti V. Intraoperative 3D TrueVue transesophageal echo imaging in cardiac mass: Bridge between cardiac anesthesiologist and surgeon. Ann Card Anaesth 2022;25:241-3.

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