

The Cardiac Mass; Is it A Thrombus, Tumor or Vegetation? Take it in the Context of the Disease

Adam M Au*

*Specialty in Internal Medicine, Plantation General Hospital, 401 Nw 42nd Ave, Plantation, FL 33317, Florida, United States

*Corresponding author: Adam M Au, Specialty in Internal Medicine, Plantation General Hospital, 401 Nw 42nd Ave, Plantation, FL 33317, Florida, United States, Tel: 954-587-5010; Email: dradamau@gmail.com

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Abstract

Background: Masses are common findings in echocardiography and cardiac imaging; largely confusing without surgical and pathological interventions for diagnosis.

Method: Through case presentations and peer-reviewed publications, this paper elucidates a scientific methodology on how a clinician can arrive at a timely diagnosis by focusing on the respective properties of the mass on imaging.

Results: Twenty-three cardiac masses and two imaging cases are delineated respectively to tumor, vegetation or emboli, as well as other findings. One of the masses is substantiated by histopathological analysis after additional assessment with transesophageal echocardiogram.

Conclusion: With eminent symptoms and potentially perilous delay of treatment, a careful examination of cardiac masses provides numerous unique clues in helping the clinician expedite treatment.

Keywords: Valvular vegetation; Infective endocarditis; Cardiac mass; Thrombus; Valvular disease

The Cardiac Mass; Is it a Thrombus, Tumor or Vegetation ?

In every-day echocardiography, extra intracardiac structures namely in order of least to most common: tumor, vegetation, and thrombus are encountered and often easily confused without a pathological diagnosis. Sometimes sample anatomical specimens surgically excised are inevitably covered in blood products, and without histopathologic processes are difficult to diagnose (Figure 1A).

Hence to administer a timely treatment for in situ masses, it is necessary to wield a high pretest probability from the perspective of different acoustic windows obtained from transesophageal (TEE), transthoracic (TTE), multiplane imaging modalities as well as from the patient's clinical history. Using this approach, the table below unveils the most probable of the three of the named masses by fixating on their properties such as texture, and size variability [1].

Clinical Presentation

A 36 years of old female on multi-drug regimen for end-stage renal disease, insulin dependent diabetes mellitus, systemic arterial

hypertension and a history of lung transplant presents with new-onset worsening palpitations [2], and feeling of episodic impending doom (Figure 1B). Initial work up with cardiac troponins are negative, electrocardiogram showed non-specific T wave abnormalities in the lateral precordial leads, while cardiac enzymes were elevated at 0.05 (Table 1). Physical examination shows a patient who is anxious, afebrile with faint 1/6 holosystolic murmur without radiation to axilla and a delayed plop [3]. Bedside echocardiogram in the emergency department was followed with a 2D echocardiogram (Figure 1C).

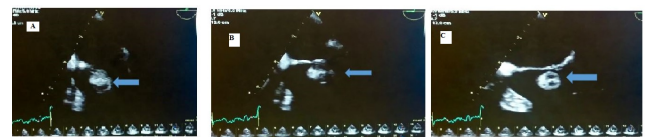


Figure 1: The case report pointing to different views of the same mass; in spite a close look reveals a continuum of preserved features such as circular roundness. Blue arrows (in Figures 1A, 1B, and 1C).

Cardiac Masses	Comments on Features	Diagnosis
Left ventricular apical mass	Apex of the LV a tapering regional cavity is predisposed to stasis. In association with anterior infarcts, there is a	Thrombus

	10-40% incidence of thrombus reported.	
Ventricular regional wall mass	Ventricular infarcts, aneurysms, dyskinesis, akinesis form endothelial injuries which by Virchow's triad become thrombogenic.	Thrombus
Non-prosthetic aortic valve mass	In pseudo aortic stenosis (reduced EF) and true aortic stenosis, stasis in the left ventricle become precipitating factors for thrombogenicity	Thrombus
Non - prosthetic valve mass on upstream side	Vegetations are typically located on the upstream side of the valve, are usually irregular grotesque shaped and exhibit disordered motion not in pattern with the valve leaflets' excursion.	Vegetation
Mass with severe valvular regurgitation	Unlike thrombi, most vegetations rarely cause stenosis.	Vegetation
Mass in cardiomyopathy	There is a 1.6-3.5% incidence of thromboembolic events in patients with CHF stage II-IV for which several studies indicate no benefit from anticoagulation.	Thrombus
Rheumatic valvular mass	M protein from Group A Streptococcus elicits an immune cascade leading to disruption of valvular endothelium and the valve basement membrane damage with erythrocyte rouleaux formation.	Thrombus
Mechanical prosthetic mitral valve mass	There is a high occurrence of thrombus formation on mechanical valves, while thrombus on bioprosthetic valves are rare.	Thrombus
Mechanical prosthetic aortic valve mass	Thrombus are more likely on mechanical mitral valves, pannus formation occurs frequently on prosthetic aortic valves. Pannus are chronic fibrous tissue growth mostly flat and non-mobile and non-sessile.	Pannus
Mass on early bioprosthetic valve	Non-endothelialized sewing rings and suture materials on the ring is adhesive to blood products.	Vegetation
Mass on AICD or Pacemaker lead	Thoracotomy and device insertion predisposes to vegetation most of which attach to the electric lead.	Thrombus
RA or LA appendage mass	Morphologies of both appendages, have been associated with erythrocyte sludge formation and eventual thrombogenesis.	Thrombus
Anti-phospholipid syndrome mass	Libman Sacks verrucous non-bacterial thrombotic endocarditis are common in this hypercoagulable anticardiolipin syndrome	
Pedunculated left atrial mass.	Myxoma, the most common cardiac mass located in the LA. Thrombus can mimic myxoma even in anticoagulated patients.	Myxoma
Line related mass	While you will suspect that line-related masses are infectious in etiology, on the contrary lines cause more thrombus. Certain factors such as: oscillating motion of the line, chemotherapeutic agents, and choice of specific line material can correlate with thrombogenesis.	Thrombus
Echogenic mass in intravenous drug-user	One typical example of right-sided masses. Bacteremia and endothelial mass or mass on valves are pointers to endocarditis Using the modified Duke's criteria in prosthetic valve is helpful	Vegetation

	in arriving at the diagnosis.	
Simultaneous biventricular apical obliterating masses	Cardiac involvement in hypereosinophilia affects both the left and right sides with fibrotic fibrin formation, with wall damage and ensuing thrombosis.	Thrombus
Mass on papillary muscle	Second most common cardiac benign tumors. Attachment usually contiguous with valve leaflet. Mostly found on the aortic valve possibly obstructing the outflow tract.	Papillary Fibroelastoma
Mass in a dilated LA.	Structural dilatation in the LA associated with poor forward flow is associated with thrombus formation.	Thrombus
Mass in SLE	Libman-Sacks Vegetation are sterile growth on valvular structures in autoimmune lupus erythematosus. They, like other vegetations can be associated with severe regurgitation.	Vegetation
Recent MI or CABG with mass	In certain cases of hibernating myocardium post bypass graft, and ventricular infarcts there is a risk for blood stasis.	Vegetation
Adjacent regional wall mass post valvular surgery	Suturing and prosthetics valves cause artifacts. Shadowing artifacts can be mistaken for masses hence need for multiplane views and parameters for better identification.	Artifact
Pulmonary vein mass	TTE is poor modality for detecting pulmonary emboli. Most masses seen in the proximity of the pulmonary valve should be seen in the context of the RVSP, and clinical symptoms such as hemoptysis for possible neoplastic migration or embolism	Pulmonary valve remnant
Severe TV regurgitation	Patient with flushing, wheezing and diarrhea should raise suspicion for malignancy. The 5HIAA disease affects the TV first, except in septal defects without a closure – left heart valves involved.	Carcinoid

Table 1: This table is only a guide in addressing cardiac masses.

The ultimate diagnosis, however, depends on their bacteriologic and microscopic properties [4]. In all cases of suspected thrombus or pannus, vegetation should be excluded in the diagnosis. In addition, markers such as d-dimer, fibrin, prothrombin fragments, and serum levels of von Willebrand factor can be pointers to thrombus formation, while auto-immune markers are elevated in SLE [5]. Sometimes relentless search can end up to PCR in the diagnosis of marantic nodules such as in Hodgkin's (Figure 2).

Lymphoma

A careful examination of the images in the case demonstrates a well-defined rounded mass freely oscillating ipsilateral to the flow direction [6]. The 2D video images also show the mass coursing the motion of the valve. TEE and the pathologic diagnosis confirmed a thrombus (Figure 5).

Clinical Presentation of a Prosthetic Valve Lesion

42 years old male referred for evaluation for valvular heart disease with history of valve replacement. Overall, the left ventricular systolic function is preserved with ejection fraction of 65-70%, with moderate to severe concentric left ventricular hypertrophy and a restrictive filling pattern [7]. The aortic valve showed obstructed mechanical prosthetic valve with a large mass noted causing severe aortic stenosis with peak/

mean pressure gradient 120 mmHg/70 mmHg. The estimated aortic valve area by the continuity equation 0.9 cm² (Figure 3). The tricuspid valve had mild regurgitation with the right ventricular systolic pressure estimated at 65 mmHg [8].

While prosthetic valves have some inherent degree of obstruction, a close look at this view reveals a lesion on the valve [9]. TEE confirmed the diagnosis. While transthoracic echocardiogram without contrast has 85% sensitivity in detecting intracavitary masses, the transesophageal procedure improves the diagnostic accuracy to about 95%, especially if the location is in the atrial appendage [10]. Patient was administered thrombolysis. Post treatment echocardiogram showed aortic valve stenosis with a better peak/mean pressure gradient of 77/40 mmHg with thrombus no longer seen and the right ventricular systolic pressure estimated at 35-40 mmHg (Figure 4). And normal proximal aortic diameter [11,12].

The mass in the second case was also a thrombus befitting its location on a mechanical aortic valve [13]. The clinician administered thrombolysis without surgical intervention or microscopic diagnosis based on most the criteria cited in the table above [14].

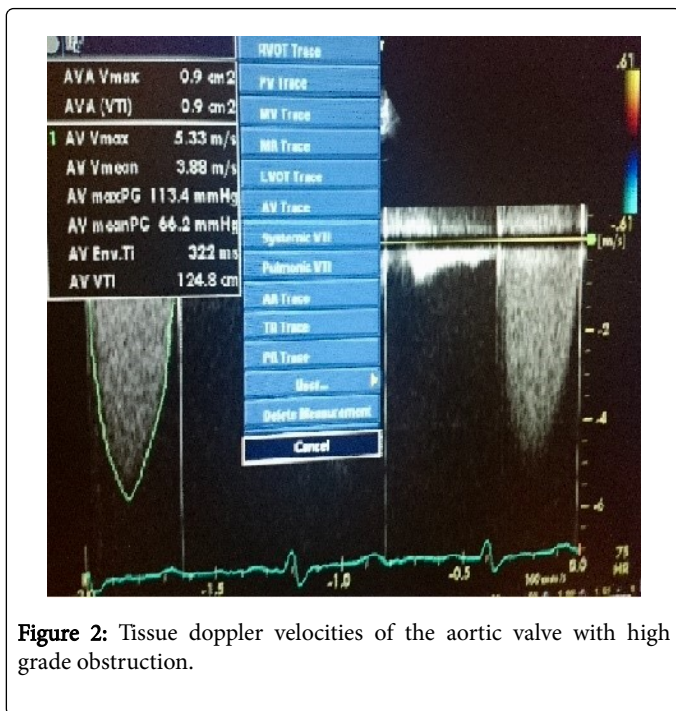


Figure 2: Tissue doppler velocities of the aortic valve with high grade obstruction.

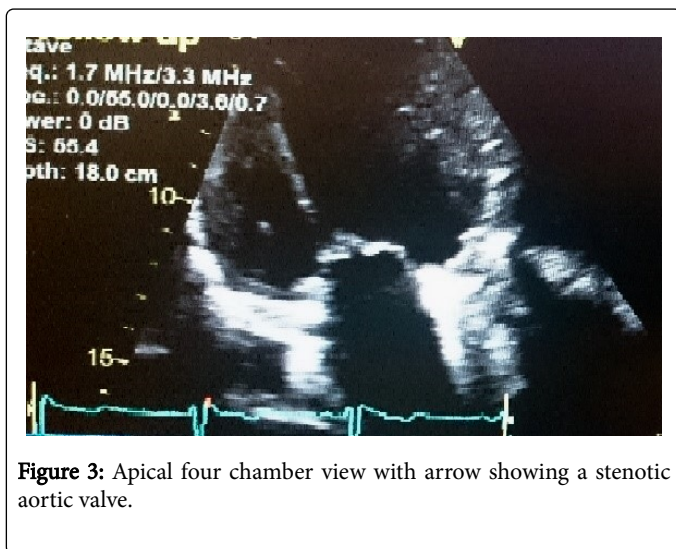


Figure 3: Apical four chamber view with arrow showing a stenotic aortic valve.

Conclusion

Cardiac masses either symptomatic or incidental are common findings in echocardiography and are problematic in precise diagnosis without intricate probing. While well-timed treatment is necessary, it is also absolutely essential to avoid administration of wrong treatment which could potentially be lethal to the patient. For a judicious diagnosis and treatment, characteristics such as regional location, mass morphology, clinical syndrome, and wave with the valve excursion are a few of the numerous clues to guide the clinician in the right direction.

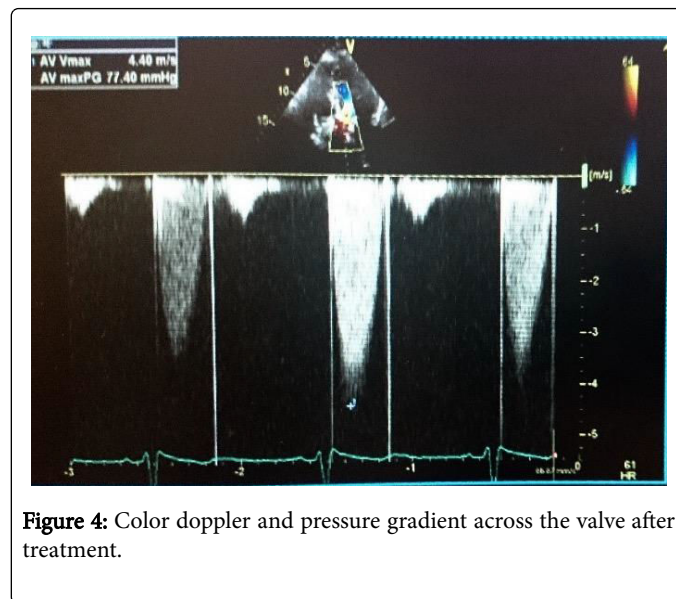


Figure 4: Color doppler and pressure gradient across the valve after treatment.

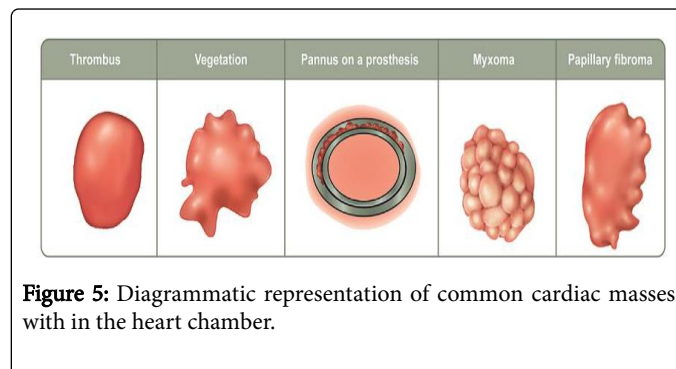


Figure 5: Diagrammatic representation of common cardiac masses with in the heart chamber.

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