Cardiac Masses Evaluation

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Conflicts of interest:

No financial conflicts of interest

I will discuss off label/ investigational use of echo contrast and Gadolinium contrast MRI
Objectives:

Recognize normal variants and artifacts which may appear as “cardiac masses”

Understand the role of echocardiography for diagnosis of cardiac masses

Recognize the use of other imaging techniques in addition to echocardiography in evaluating cardiac masses
Cardiac masses

- Normal variants
- Thrombus
- Vegetation (infected thrombus)
- Tumors (primary or secondary)
Normal findings and pitfalls

- Chiari network
- Coumadin ridge (Q-tip) a tissue ridge between the LA appendage and left upper pulmonary vein
- Crista terminalis – a tissue ridge in the RA between the IVC and SVC
- Lipomatous interatrial septal hypertrophy
Lipomatous interatrial septal hypertrophy
Chiari network:
Highly mobile netlike structure
Arises near the IVC and does not attach to the interatrial septum
No particular function known
Eustachian valve:
Arises from the IVC and runs towards the fossa ovalis
Directs blood to the fossa in the fetus
Left atrial mass?

Partial volume artifact
Thrombus: the most common cardiac mass
Layered (mural) LV apical thrombus
Mobile (pendulum like) LV apical thrombus
Another mobile (pendulum like) LV apical thrombus
Small calcified LV apical thrombus
Snake like cast of venous thrombus in the RA
TEE in same patient with large LAA thrombus
Tricuspid valve endocarditis (*Strep agalactiae*) with embolization to the pulmonic artery
Cardiac tumors

- Secondary tumors are 20-40x more frequent than primary

- Primary cardiac tumors prevalence = 0.001 - 0.03%

- 75% of primary tumors are histologically benign

- >50% of primary benign tumors are myxomas
Primary benign tumors

- Myxomas
- Fibromas
- Rhabdomyomas
- Fibroelastomas
- Teratomas
- Hemangiomas
- Lipomas
Primary malignant tumors

Sarcomas - 95%
- angiosarcomas
- leiomyosarcomas
- rhabdomyosarcomas
- liposarcomas

Lymphomas
Clinical manifestations of cardiac tumors

- **Systemic**: fever, chills, malaise, weight loss

- **Embolic**: thrombi or tumor fragments

- **Local Cardiac**: mechanical (tumor plop, valvular stenosis) or electrophysiological

- **Metastatic manifestations**: lung, brain
Diagnosis

1 pound of high index of suspicion and 1 ounce of pure luck
Diagnosis

Patients will likely see more than one physician before a correct diagnosis is made...

Systemic/embolic manifestations will be attributed to more common diseases

Rarely does a patient present with a “tumor plop” or sudden, intermittent and positional symptoms

Imaging studies:

- Echocardiography (TTE and TEE)
- Cardiac MRI with Gadolinium contrast – tissue characterization
- Cardiac CT with and without contrast
- Cardiac PET-CT
48 yo F is admitted to the hospital for syncope.

She reports a 3 month history of fatigue, myalgia, dyspnea, cough and dizziness.

Holosystolic murmur radiating to axilla and soft diastolic murmur

Chest X-ray and EKG are normal
Myxomas

- >50% of primary benign tumors
- Female: male = 3:1
- 80% in the left atrium (fossa ovalis)
- Often have a polypoid shape and stalk
- May present as nonspecific chest pain, fever, embolic phenomenon

- 5% AD familial: Carney syndrome: myxoma, pituitary adenomas, thyroid tumors.
Myxomas – imaging aspects

- **Echo** – usually mobile mass in the left atrium attached to the fossa ovalis, may prolapse through the mitral valve (*tumor plop*)
- **CT** – may show calcification
- **MRI** – increased signal on T2w, low signal on cine MRI and heterogenous Gd enhancement.
LA myxoma: multimodality imaging

- Contrast CT
- Biplane 2D TEE
- 3D TEE
Large right atrial myxoma
Cardiac fibromas

- Located in the **ventricular septum** or LV free wall
- Collection of fibroblasts and collagen.
- **Dystrophic calcification** may be present
- May obliterate the LV cavity, produce arrhythmias or conduction abnormalities
Cardiac fibroma in the lateral LV wall
Cardiac fibromas – imaging aspects

- Echocardiography may show “asymmetric hypertrophy” of the septum
- Isointense to myocardium on cine MRI
- Hyperenhancement with Gd contrast
- CT may demonstrate dystrophic calcification
Rhabdomyomas

- Most frequent in children (80% <1 yo)
- May present as multiple masses
- Usually in the interventricular septum or right ventricle
- May be associated with tuberous sclerosis
- May regress spontaneously
Rhabdomyoma
61 yo F with prior history of mitral valve replacement (bileaflet mechanical valve) on chronic oral anticoagulation with Coumadin and good control of the INR presents with a TIA.

No history of fever, blood cultures are negative.

A transthoracic echocardiogram is performed but is technically limited and nondiagnostic.

A TEE is ordered to detect “source of emboli”
Fibroelastoma of the aortic valve and MVR
Papillary fibroelastoma

- Slow growing tumor of fibroblastic origin
- Most are firmly attached to valvular endocardium
- Aortic valve is affected in >40% of cases
- May be associated with embolic episodes
- Should be surgically excised if attached on aortic valve, >1cm, mobile or prior embolism
Fibroelastoma of the aortic valve
Tricuspid valve fibroelastoma on TEE
Echocardiography/TEE is initial imaging method

Echogenic, mobile, round or irregularly shaped lesion on the downstream side of valves (unlike vegetations which tend to be on the upstream side)

Gated cardiac CT can depict the lesion

MRI with Gd-contrast may differentiate between thrombus and tumor in selected cases
Cardiac lipoma

- **Encapsulated** lipomatous tumors

- **Most are asymptomatic** but may produce mass effect when large and intracavitary or conduction abnormalities if intramural

- Echocardiography is primary imaging modality but MRI or CT are used for tissue characterization
Lipoma of the crista terminalis
RA - IVC junction lipoma
Cardiac Lymphomas

- Primary cardiac lymphomas may occur in both immunocompetent and immunocompromised patients
- Associated with HIV or post transplant (PTLD)
- May present with constitutional symptoms, heart failure, arrhythmias or pericardial effusion
- PTLD is usually treated with trial of reduced immunosuppression
- Echocardiography followed by Cardiac MRI for tissue characterization
Mass in the right atrioventricular groove
Left atrial sarcoma
Secondary cardiac tumors

Metastatic (secondary) cardiac tumors are 20-40x more frequent than primary.

Most common are lung and breast cancer.

Melanoma, lymphoma and gastrointestinal neoplasm do also metastasize to the heart.

Renal, liver, adrenal cancers can grow into the IVC.
Cardiac mass in patient who was diagnosed with colon adenocarcinoma

Echocardiogram with echo contrast shows intense uptake of microbubbles in the well vascularized metastasis
Time intensity curves and parametric maps can be generated by drawing regions of interest in a cardiac mass and comparing the evolution of the mean echo intensity with a similar region situated in the adjacent normally perfused myocardium.

This can evaluate the presence or absence of vascularization in cardiac masses.
LV mass attached to distal lateral wall in patient with known lung cancer
RV thrombus and RA metastasis in patient with pancreatic cancer

Ultrasound Contrast Quantification for the Diagnosis of Intracardiac Masses. Strachinaru et al JACC CVI 06 2016
Pericardial metastases
Pericardial metastases
Conclusion

Secondary tumors are 20-40x more frequent than primary.
75% of primary tumors are benign.
Myxomas are the most frequent benign tumors.
Angiosarcomas are the most frequent malignant primary tumors.

Clinical manifestations are often vague or nonspecific.
Systemic: fever, chills, malaise, weight loss.
Embolic: thrombi or tumor fragments.
Local Cardiac: mechanical or electrophysiological.
Thank you