Systemic Malignancies Involving the Heart

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Disclosures

None
• Background
  - Incidence
  - Pathophysiology

• Clinical examples

71 yoM with history of CABG and thymic neuroendocrine tumor. Coronary CTA performed to assess for relationship of mass to bypass grafts. Multiple cardiac metastatic lesions were also present.
Incidence

• Metastatic disease to the heart is more common than primary cardiac tumors (20-40X)

• At autopsy
  - In the general population
    • Primary cardiac tumors 0.01-0.1%
    • Metastatic tumors 0.7-3.5%
  - In cancer patients
    • Metastasis in up to 9% (without known distant disease)
    • 14% (known metastatic disease)

45 yoF with spindle cell carcinoma and a large pericardial mass and pericardial effusion with signs of early tamponade.
Common Cardiac Mets

Bronchogenic Carcinoma
Most common cardiac metastasis (36-39%)

Lymphoma
10-21% of cardiac mets

Breast Cancer
10-12% of cardiac mets

Sarcoma
15% of sarcomas with mets to heart

Melanoma
46-71% of patients with cardiac mets

Common Tumors that Metastasize to the Heart
Pathophysiology

• Sites of involvement pericardial > epicardial and myocardial > endocardial and intracavitary

77 yoF with history of myxoid liposarcoma of the right buttock metastatic to the pericardium.
Pericardial Involvement

• Most commonly from lung > breast > hematologic malignancies
  - On autopsy 1/3 of lung cancer patient with pericardial involvement
  - Pericardiocentesis with high yield for detecting metastatic disease (80-90%)

• Pericardium adjacent to the RV free wall and R atrioventricular groove most common sites

72 yoM with metastatic liposarcoma. Metastatic deposit involving the pericardium causing mass effect on the RA as well as invading this chamber.
Pathophysiology

- Metastasis reach the heart via four pathways
  - Direct extension
  - Hematogenous
  - Lymphatic
  - Intra-cavitary growth

62 yoM with history of esophageal cancer s/p esophagectomy. Imaging findings demonstrate recurrent disease in the right lung (yellow arrow), diaphragmatic hiatus (red arrow) as well as the LV free wall (blue arrow).
Pathophysiology

- Direct extension
  - Leads to pericardial involvement
  - Most commonly seen in bronchogenic carcinoma
  - Up to 50% of pleural mesothelioma patient have cardiac involvement on autopsy

Progression of pleural mesothelioma to the pericardium.
Pathophysiology

- **Hematogenous**
  - Myocardial or endocardial implants
  - Most commonly melanoma, lymphoma or sarcoma
  - Usually also have evidence of hematogenous spread to other organs

72 yoF with endometrial cancer with metastatic disease to the lungs and RV myocardium.
Pathophysiology

• Lymphatic spread
  - Retrograde flow via lymphatics
  - Leads to epicardial or pericardial implants
  - Most commonly seen in lung and breast cancer

62 yoM with neuroendocrine tumor with an epicardial metastatic lesion posterior to the ascending aorta.
Pathophysiology

- Transvenous
  - Routes include
    - SVC or IVC to RA
    - Pulmonary veins to LA
  - Most commonly seen in hepatic and renal carcinoma
    - IVC extension in 4-10% RCC of cases

69 yoM with RCC s/p ablation. Tumor thrombus extends along the IVC (arrow) and into the RA (not shown).
Case examples

70 yoF with history of MI s/p PCI X2 and NSCLC (stage IV)
- Presented to clinic for evaluation for immunotherapy with crizotinib
  • ALK rearrangement therapy
- Typical work up is CMP and ECG
  • Risk of increasing LFTs and bradycardia with therapy

Patient otherwise feeling well
• Bradycardia (HR 43) with 2\textsuperscript{nd} degree heart block with 2:1 conduction

• Sent to ER for evaluation
Patient was evaluated by cardiology
- Held nodal blocking medications
- Placed on telemetry with transcutaneous pacer and atropine at bedside
- Underwent eval for MI, echo

TTE with possible RA mass
- CT heart performed
Cardiac mass/met involving the interatrial and interventricular septum explaining conduction abnormalities.

Additional new sites of metastatic disease (arrow).
Planned immunotherapy with crizotinib

- Highly effective given her ALK mutation however risk of worsening bradycardia
- Patient provided with treatment options
  - Surgical pacer placement via thoracotomy
    » Not able to be performed transvenously given location of mass
  - Admit with transcutaneous pacing and give chemotherapy

Patient elected hospice.
Case examples

22 yoM with history of high grade myoepithelial carcinoma of the left arm s/p resection.

Developed left sided chest pain prompting an ER evaluation. A CT of the chest was performed.
CT with large LLL mass extending into the LIPV with small L pleural effusion.

Patient underwent bronchoscopy and thoracentesis.

- LLL mass consistent with metastatic disease
- Negative mediastinal and hilar LN
- Negative pleural fluid
Cardiac MR:
Heterogeneous enhancing LLL mass (T1 FS initial post contrast images above)

Expansion of the LIPV containing non-enhancing and enhancing components

Non-enhancing filling defect in the LA extending from the LIPV mass
Underwent operation with both thoracic and cardiac surgery.

Per the operative report:

“...we visualized the left atrium. There was a large protruding mass that was seen emanating from the left inferior pulmonary vein ...The frozen section of this mass did come back as positive for tumor.”

Post operatively has done well and currently receiving carbo/taxol.
50 yoF with metastatic melanoma (osseous, hepatic) presenting with confusion.

Underwent an MR with multifocal infarcts concerning for an embolic source.
- TTE negative however patient could not tolerate TEE 2/2 L humeral pathologic fracture - requested cardiac MR.
T2 bright hyperintense focus of the subepicardium with findings of enhancement.

Numerous other lesions within the myocardium (not shown).

Patient elected to enter hospice given cardiac mets.
Case Example

52 yoF who was admitted at an OSH for vaginal bleeding. On US a mass was seen in the IVC and presumed to be due to thrombus.

The patient was ultimately placed on anticoagulation and underwent repeat US imaging demonstrating the IVC mass which continued into the right atrium unchanged despite treatment.
Patient was referred to cardiac surgery for further evaluation and underwent cardiac MR.

Coronal SSFP  Axial STIR  Axial T1
Cardiac MR demonstrated a mass extending from the infra-renal IVC into the right atrium. Enhancement was seen on late gadolinium enhanced imaging suggesting mass was not thrombus.

Dedicated abdominal imaging was recommended to fully evaluate the entire extent of the mass.
CT of the A/P with IVC mass (yellow arrow) extending into the left renal vein (not shown).

A similar filling defect was seen in the left gonadal vein (red arrow) and left iliac vein (not shown).

MR was also performed demonstrating enhancement of each of these intravascular masses.
Diagnosed with intravascular leiomyomatosis.

Patient considering surgical options at this time.
Summary

- Cardiac metastatic primary cardiac tumors.

- The most common cardiac met is from lung cancer.

- Mets most commonly affect the pericardium.

- 4 pathways: lymphatics, direct extension, hematogenous or intracavitary.

79 yoM with history of SCC. Metastatic lesion to the right ventricle seen on PET, CT and MR (TI and LGE).
Thank You

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References