Cardiac Mass and Mass-like Structures

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Introduction

✓ Although cardiac tumors are rare, they represent an important group of cardiovascular abnormalities because an early and accurate diagnosis may permit a curative procedure or in some circumstances, may even avoid unnecessary surgery.

✓ In addition, echocardiographic evaluation of intracardiac masses is critically dependent on the ability to distinguish normal from abnormal findings.
Cardiac Mass

✓ Cardiac tumors
  - Epidemiology
  - Primary benign tumors
    • Myxoma
    • Papillary fibroelastoma
    • Lipoma
    • Rhabdomyoma
    • Fibroma
  - Primary malignant tumors
  - Metastatic tumors

✓ Non-tumors
  - Intracardiac thrombi
  - Vegetations

✓ Normal variants and benign conditions

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Epidemiology

- Primary cardiac tumors: 0.001~0.03% in autopsy series
- Secondary involvement of the heart by extracardiac tumors is 20-40 times more common than by primary cardiac tumors

<table>
<thead>
<tr>
<th>Type</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Benign (70%)</strong></td>
<td></td>
</tr>
<tr>
<td>Myxoma</td>
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</tr>
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</tr>
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<td>Teratoma</td>
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<td>Angiosarcoma</td>
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Primary Benign Tumors

Myxoma

✓ ≈30% of all primary cardiac tumors
✓ ≈70% of primary benign cardiac tumors in adults
✓ Mean age at Dx: 50 years
✓ F>M (60-70%)
✓ 80% in LA, 15% in RA
  - Can occur in ventricles
✓ Average size: 5-6 cm
✓ 90% solitary, 7% Carney complex
✓ Friable/villous surface (1/3) → emboli
✓ Histology
  - Mesenchymal cells in mucopolysaccharide stroma

Primary Benign Tumors

Myxoma

✓ Clinical manifestations
  - Factors: size, anatomic location

✓ Classic triad of symptoms
  - Intracardiac obstruction
    - Dyspnea, orthopnea, pulmonary edema
    - Presyncope/syncope
  - Systemic embolization
    - CVA, retinal artery emboli, emboli to extremities
  - Constitutional symptoms: fever, fatigue, weight loss, ...
Primary Benign Tumors

Myxoma

✓ Echo Findings
  - Prolapsing mass across MV/TV
  - Mobile, distensible tumor connected to the limbus of fossa ovalis by a narrow stalk (pedicle)

High embolic risk
  friable
  villous
  polypoid
  prolapsing

Low embolic risk
  round
  smooth

RA

LA
Primary Benign Tumors

Myxoma

Mean PG = 14 mmHg

✓ Treatment
  - Resection
    - Including surrounding septum at attachment
  - Surgical mortality <5%
  - Risk for atrial arrhythmias
  - Recurrence in 2-5%
  - Recurrence in Carney complex 12-22%

  - After surgical excision, surveillance echocardiograms should be obtained annually for several years
Primary Benign Tumors
Papillary Fibroelastoma
✓ ≈10% of all primary cardiac tumors
✓ Mean age: 60 years
✓ Mean size: 9 mm (2-70 mm)
✓ The most often valve tumors
- 80~90% on valvular endocardium
  - AV 36% > MV 29% > TV 11% > PV 7%
- Downstream side
✓ Clinical manifestations
- 1/3: asymptomatic
- Embolization: tumor or thrombus
  - CVA/pulmonary/peripheral embolization
- MI, angina, sudden cardiac death, syncope

Primary Benign Tumors
Papillary Fibroelastoma
✓ Echo Findings
- 5~20 mm in diameter
- Homogeneous echogenicity
- Usually attached to the downstream side of the valve by a small pedicle
- Often confused with vegetations
Primary Benign Tumors

Papillary Fibroelastoma
Primary Benign Tumors

Lipoma

✓ Slow-growing
✓ Mature adipose tissue
✓ Location
  - LV > RA > IAS
  - Sub-endocardial (50%), myocardial (25%), sub-epicardial (25%)
  - Valvular attachment rare
✓ Clinical manifestations
  - Most asymptomatic
    - Invasive into tissue → arrhythmias, conduction block
    - ↑Size → obstruction
✓ Treatment
  - Resection recommended (continued growth)

Echo findings
- Sessile or polypoid
- Low mobility
- Homogeneous & increased echogenicity
Primary Benign Tumors
Lipomatous Hypertrophy of the IAS

- Older, obese women
- Rarely associated with clinical manifestations
- Echo findings: spares fossa ovalis → "dumbbell-shaped"

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Primary Malignant Tumors

✓ Overall 15~30% of primary cardiac tumors
✓ Sarcomas: most common (95%)
  - Angiosarcoma
  - Sarcomas with myo- or fibroblastic differentiation
  - Rhabdomyosarcoma
✓ Suggestive echo findings
  - Right-sided
  - Originated from myocardium → growth into ventricular/atrial/pericardial cavities
  - Broad-based attachment
  - Ill-defined margins
  - Tissue inhomogeneity / heterogeneous contrast enhancement
  - Size >5 cm
  - Pericardial effusion

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✓ Most common primary malignant tumor
✓ M>F, peak incidence in 40s
✓ RA involved in 75% → RV, pericardium
✓ Clinical symptoms
  - Right heart failure
  - Tamponade
✓ Metastases in 66-89% → lungs/brain/bone/liver
✓ Treatment
  - Resection + chemotherapy
    • ↑ Survival with complete resection
  - Transplantation

• Echo: mural type
• Echo findings: intramural type

✓ ~5% of primary malignant cardiac tumors
✓ Increasing in immunocompromised patients
✓ Mean age: 38 years
✓ Echo findings: RA, pericardial effusion
✓ Treatment
  - Chemotherapy
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Metastatic Tumors

- 1.5~20.6% (~6%) of oncology patients at autopsy
  - Most clinically silent
- Most common: lung cancer, melanoma
- Tumors can spread to heart by
  - Propagation through venous system
  - Direct extension
  - Hematogenous spread
- Manifest as
  - Mass
  - Pericardial disease (effusion common)
  - Myocardial involvement
- Multiple masses suggestive
### Metastatic Tumors to the Heart: Sources and Cardiac Manifestations

<table>
<thead>
<tr>
<th>Origin of source</th>
<th>Cardiac effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung</td>
<td>Direct extension, often via pulmonary veins, effusion</td>
</tr>
<tr>
<td>Breast</td>
<td>Hematogenous or lymphatic spread; effusion</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>Lymphatic spread, varied manifestations</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>Variable manifestations</td>
</tr>
<tr>
<td>Melanoma</td>
<td>Intracardiac or myocardial involvement</td>
</tr>
<tr>
<td>Renal cell carcinoma</td>
<td>IVC to RA to RV; confused with thrombus</td>
</tr>
<tr>
<td>Carcinoid</td>
<td>Tricuspid and pulmonic valve thickening</td>
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### Metastatic Tumors

**Venous Spread From Lung Cancer via Pulmonary Vein**
Metastatic Tumors

Pericardial & Myocardial Involvement from HCC

2010.6

2010.9

2010.11

Metastatic Tumors

Direct Pericardial Invasion From Breast Cancer
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Intracardiac Thrombi

✓ Risk factors
  - Dilated cavity
  - Decreased contractility
  - Low flow & blood stasis

✓ LV
  - Recent MI
  - LV aneurysm
  - Significant LV dysfunction: DCM

✓ LA
  - ↑Risk: MS, atrial fibrillation, LV failure
  - ↓Risk: significant MR, ↑flow velocity within the LA during systole
Intracardiac Thrombi

Sensitivity: 75~95%
Specificity: 86~88%

LV

DCM

Acute MI

DCM

Acute myocarditis

Standard A4C view

Off-axis views

5 MHz transducer
8 MHz transducer
Use of contrast agent
Intracardiac Thrombi

**DDx LV Thrombi**

- Thrombus
- Myxoma
- Eosinophilic endomyocarditis
- Isolated LV noncompaction

**Intracardiac Thrombi**

**LA**

- TTE: sensitivity <50%
- TEE: sensitivity & specificity 95~100%

- No thrombus

#1347604 72/M, #KSE
#1570966 51/M, #1432733 33/F
Intracardiac Thrombi

LA

#1330198 73F

Intracardiac Thrombi

RA

#1577655 65/F, #1536312 62/M, #528042 68/F
Vegetations

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Artifacts: Near-field Clutter

Normal Variants and Benign Conditions

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<tr>
<th>RA</th>
<th>Chiari network</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eustachian valve</td>
</tr>
<tr>
<td></td>
<td>Crista terminalis</td>
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<tr>
<td></td>
<td>Catheter</td>
</tr>
<tr>
<td></td>
<td>Pacemaker leads</td>
</tr>
<tr>
<td></td>
<td>Lipomatous hypertrophy of interatrial septum</td>
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<tr>
<td></td>
<td>Pectinate muscles</td>
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<tr>
<td></td>
<td>Fatty material (surrounding tricuspid annulus)</td>
</tr>
<tr>
<td>LA</td>
<td>Suture line following transplant</td>
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<tr>
<td></td>
<td>Fossa ovalis</td>
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<tr>
<td></td>
<td>Calcified mitral annulus</td>
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<td></td>
<td>Coronary sinus</td>
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<tr>
<td></td>
<td>Ridge between LUPV and LAA</td>
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<td>Lipomatous hypertrophy of interatrial septum</td>
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<td></td>
<td>Pectinate muscles</td>
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<tr>
<td></td>
<td>Transverse sinus</td>
</tr>
<tr>
<td>RV</td>
<td>Moderator band</td>
</tr>
<tr>
<td></td>
<td>Muscle bundles/trabeculations</td>
</tr>
<tr>
<td></td>
<td>Catheters and pacemaker leads</td>
</tr>
<tr>
<td>LV</td>
<td>False chords (tendons)</td>
</tr>
<tr>
<td></td>
<td>Papillary muscles</td>
</tr>
<tr>
<td></td>
<td>LV trabeculations</td>
</tr>
<tr>
<td>Aorta</td>
<td>Brachiocephalic vein</td>
</tr>
<tr>
<td></td>
<td>Innominate vein</td>
</tr>
<tr>
<td></td>
<td>Pleural effusion</td>
</tr>
<tr>
<td>Valves</td>
<td>Lambl’s excrescence</td>
</tr>
<tr>
<td></td>
<td>Flail or prolapsing leaflet</td>
</tr>
<tr>
<td></td>
<td>Severed MV apparatus after MVR</td>
</tr>
<tr>
<td></td>
<td>Fatty TV annulus</td>
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<tr>
<td></td>
<td>Mitral annular calcification</td>
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Feigenbaum’s echocardiography
RA: Chiari Network

RA: Eustachian Valve
RA/RV: Pacemaker Lead / Catheter

RV: Moderator Band
LV: False Tendon

LA: Coumadin Ridge (Q Tip)
AV: Lambl’s Excrescence

MV: Mitral Annular Calcification
Take Home Message

✓ Primary cardiac tumors: rare and usually benign
  - Myxoma
  - Clinical presentation varies by location and size of mass
✓ Secondary cardiac metastatic tumors: more common
✓ Echo (TTE and TEE) remains the initial imaging test
✓ Conditions mimic cardiac tumors
  - Intracardiac thrombi / vegetations
  - Iatrogenic sources: pacemaker leads or catheters
  - Normal variant and benign conditions
  • Recognition of normal variants depends on image quality, technique, and experience

Thank You
For Your Attention!