AMSER Case of the Month February 2025

89 y/o male with progressive shortness of breath and lower leg swelling

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Patient Presentation

HPI: 89 y/o male presenting with progressive dyspnea associated with lower bilateral lower extremity edema

PMHx: No history of DM, HTN, HLD, PE, DVT, or cardiac disease

PSHx: No drug or alcohol use

FHx: No known family history of heart disease

Physical Exam: Massive bilateral leg edema with no jugular venous distention or fluid in lungs

Pertinent Labs

Patient was started on furosemide which is resulted in elimination of his dyspnea but **no improvement of his lower leg edema.**

CBC: Hb: 10.6, Hct: 31.3, PLT: 100,000

CMP: BUN: 22, Cr: 1.14, Ca^{2+}: 8.5, AST: 157, ALT: 48, Alk Phos: 223

ProBNP: 733

PE: Albumin: 2.1, Total protein, S: 5.2

Free Kappa: 55.7

Free Lambda: 44.1

What Imaging Should We Order?

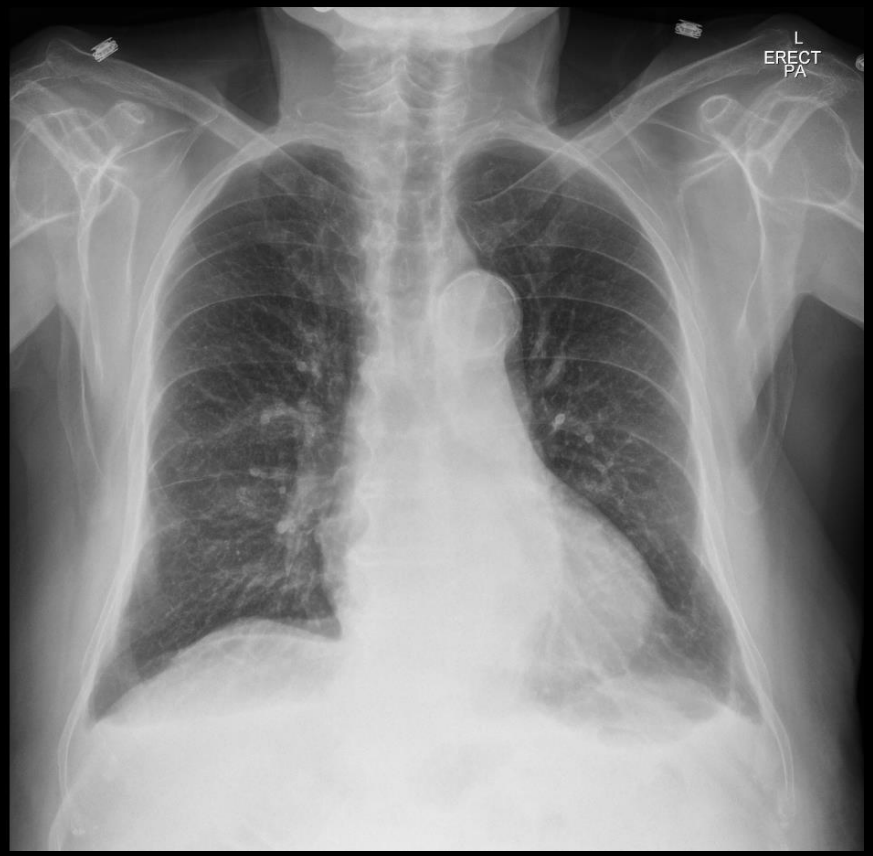
ACR Appropriateness Criteria

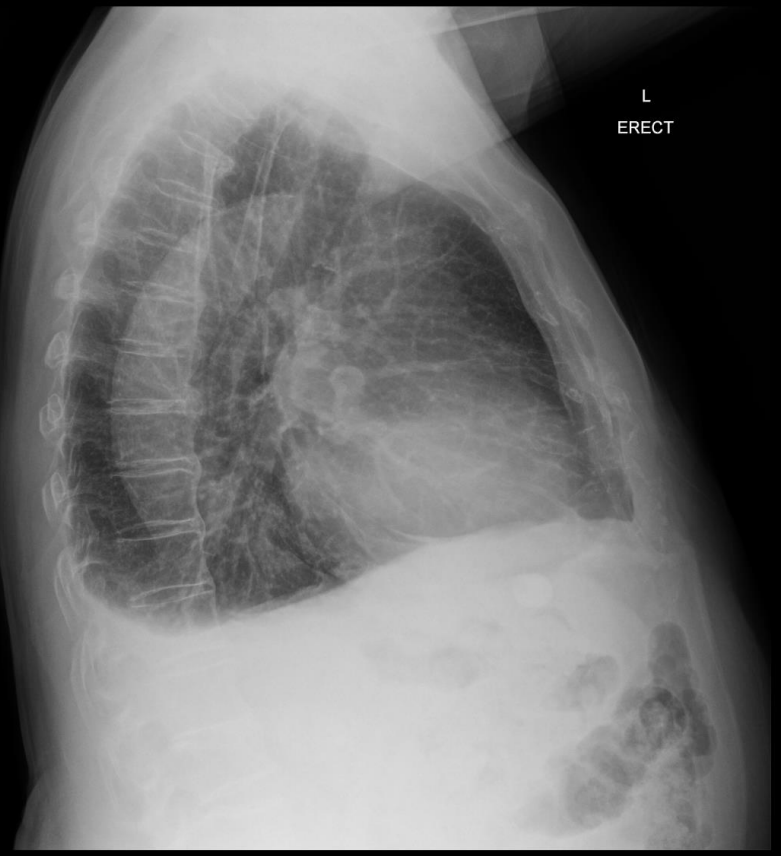
Variant 1: **Chronic dyspnea. Unclear etiology. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
Radiography chest	Usually Appropriate	☢
CT chest without IV contrast	May Be Appropriate (Disagreement)	☢☢☢
CT chest with IV contrast	May Be Appropriate	☢☢☢
CT chest without and with IV contrast	Usually Not Appropriate	☢☢☢
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢☢
MRI chest without and with IV contrast	Usually Not Appropriate	O
MRI chest without IV contrast	Usually Not Appropriate	O
US chest	Usually Not Appropriate	O

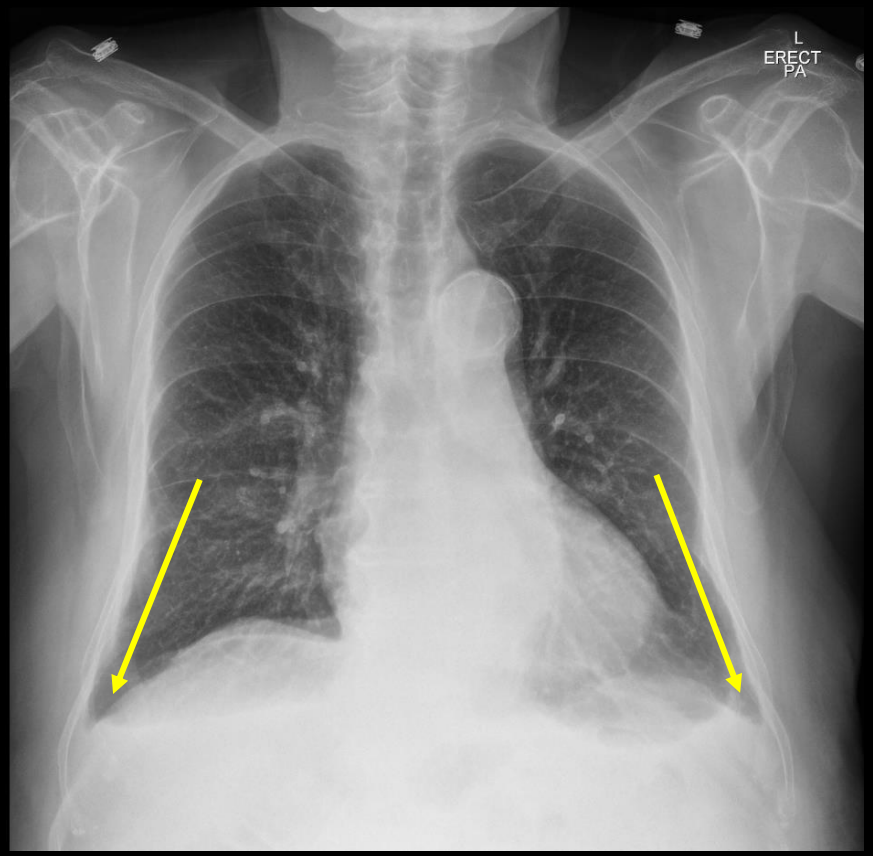
This imaging modality was ordered by the physician

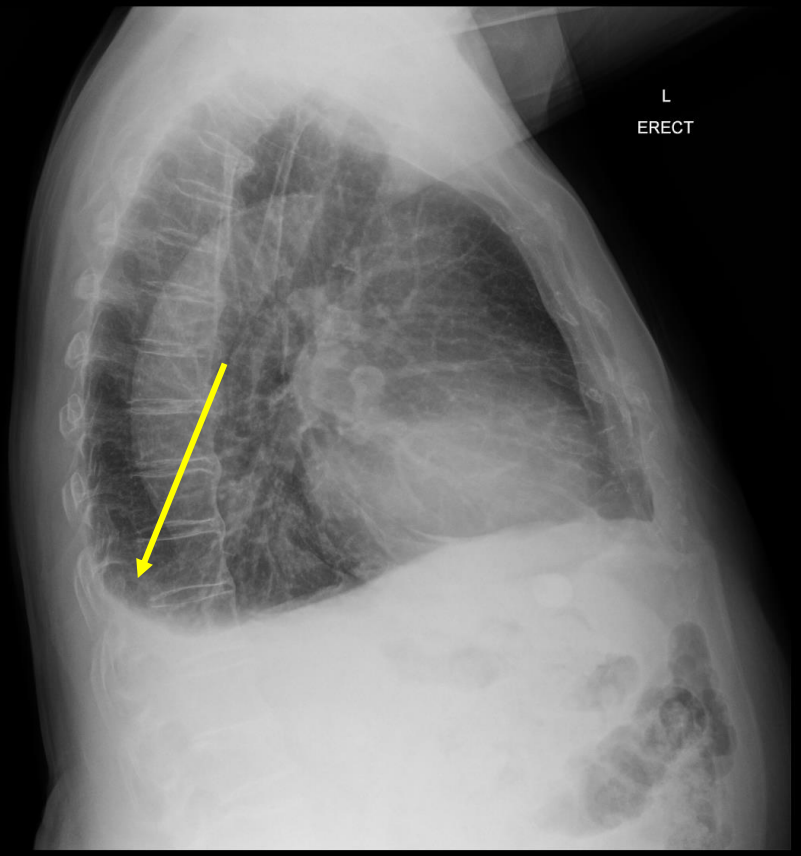
Findings (unlabeled)





Findings: (labeled)



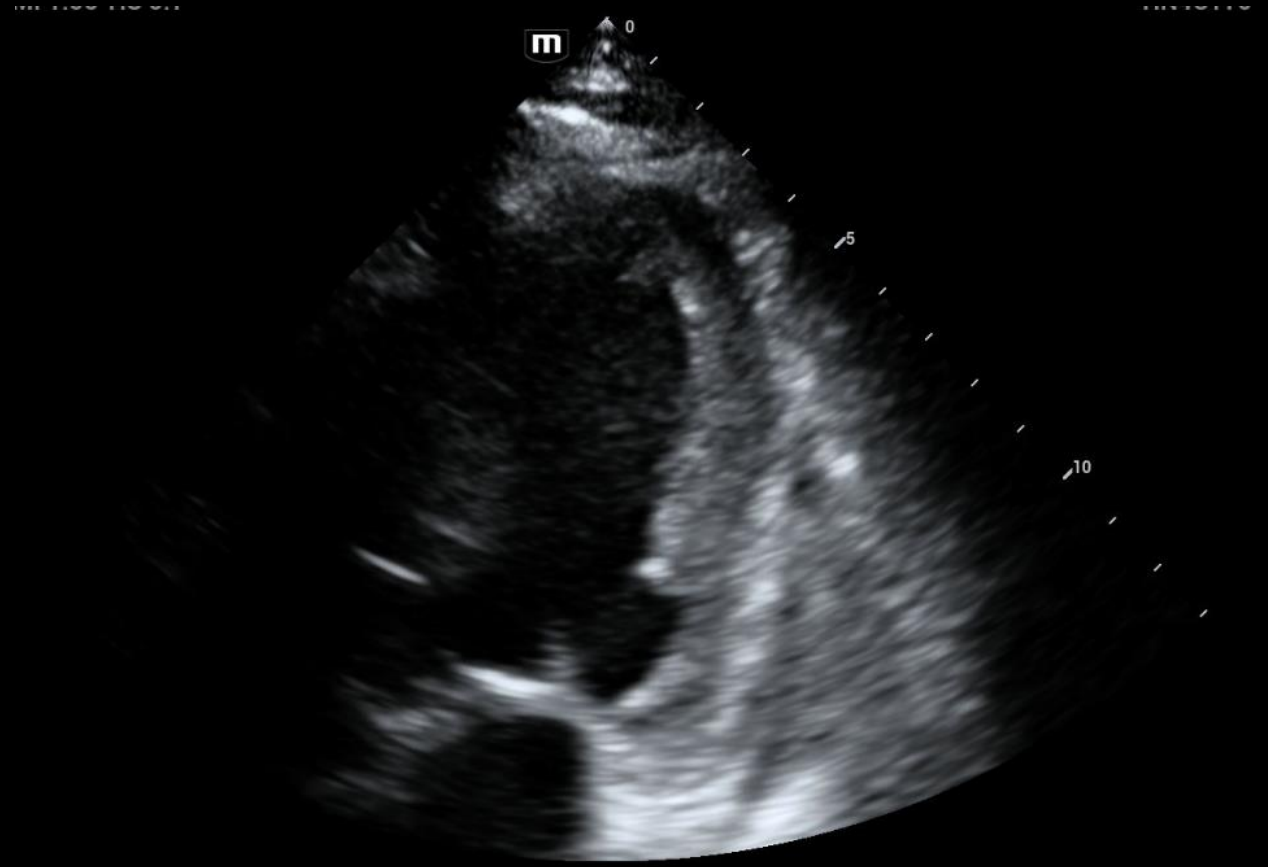


Unremarkable besides the presence of small bilateral pleural effusions

Additional Imaging

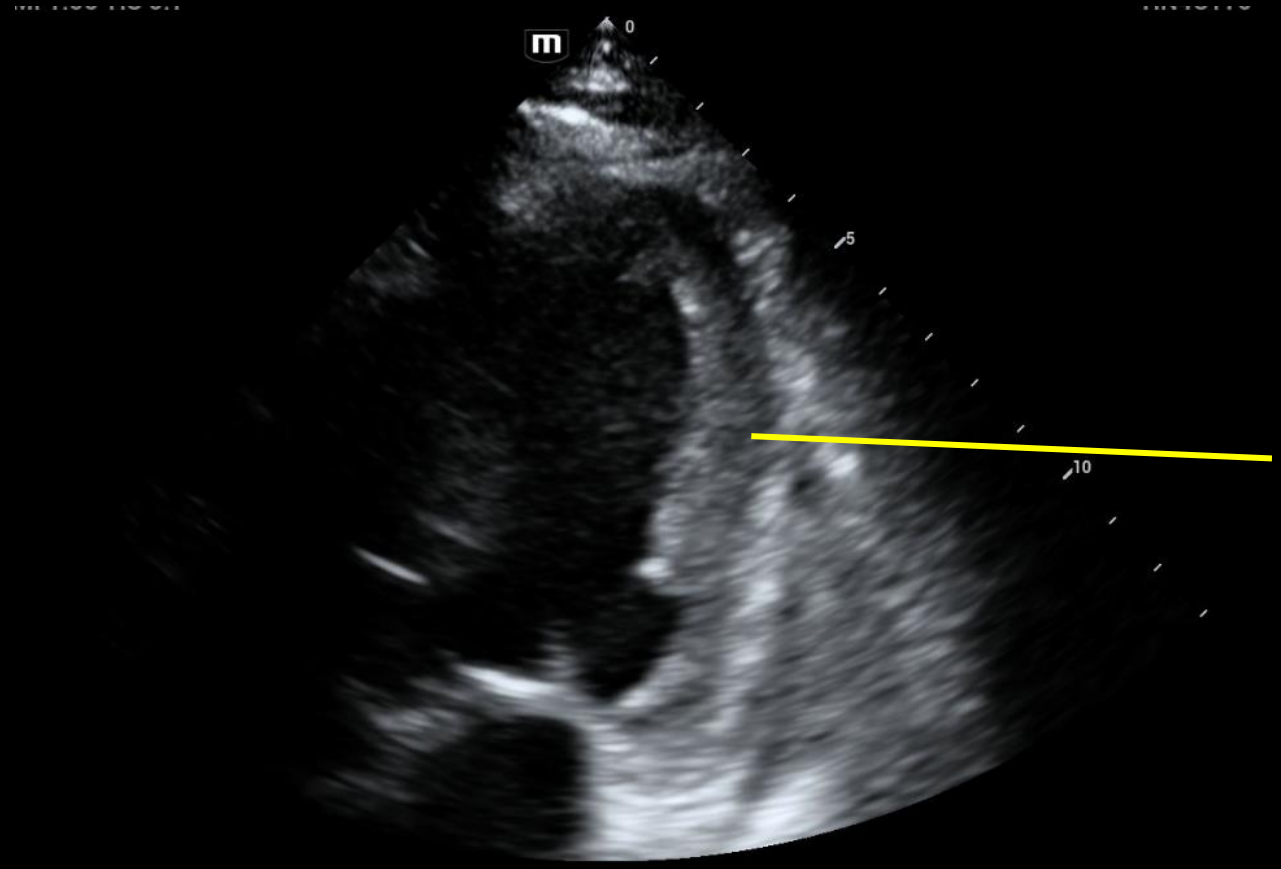
An echocardiogram revealed **thickened heart muscle with a speckled pattern.** Echo, chest x-ray, and physical exam findings, declining liver function and anemia on labs, and no decrease in lower limb swelling with diuretics resulted in a high clinical concern for **amyloid,** and a **HDP thoracic SPECT scan** was ordered by the cardiologist.

Findings (unlabeled)



Echocardiogram

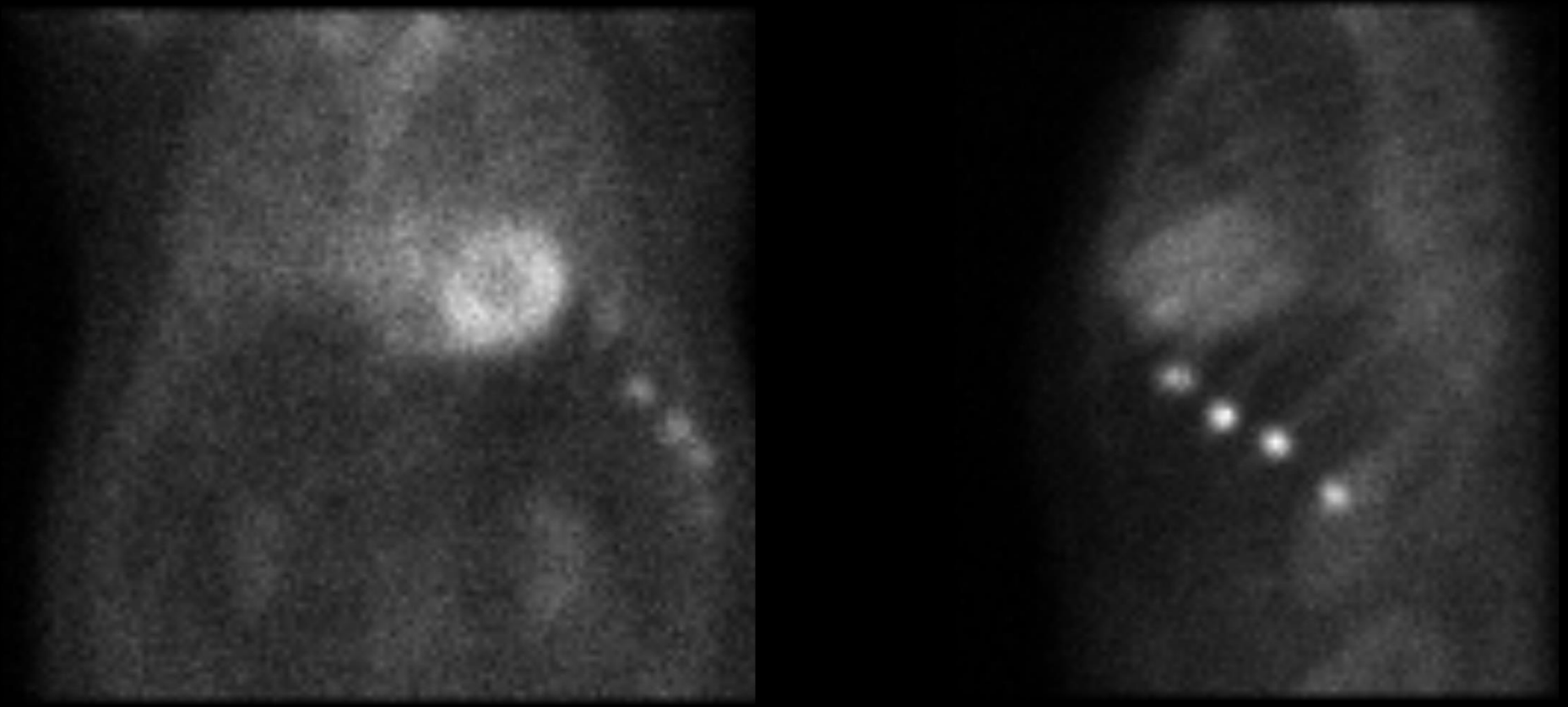
Findings (unlabeled)



Left ventricular cavity size normal. Moderately increased left wall thickness

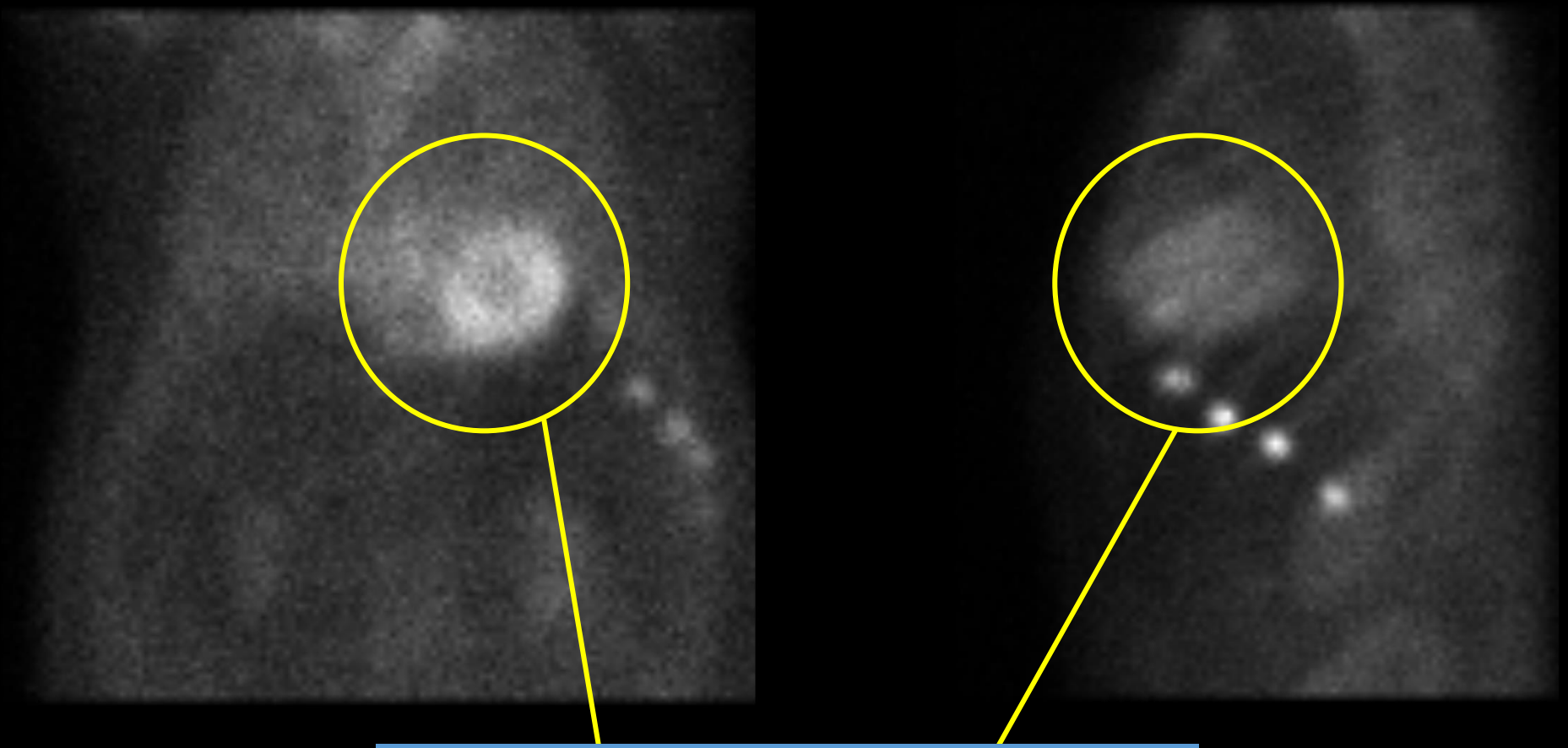
Echocardiogram

Findings (unlabeled)



HDP thoracic SPECT scan

Findings: (labeled)



Myocardial uptake of radioactive tracer indicates the presence of amyloid

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Final Dx:

Cardiac Amyloidosis

Case Discussion – HDP Thoracic SPECT Scan

HDP Thoracic SPECT scans use radioactive Tc to detect the presence of transthyretin amyloid

- Radioactive Tc is injected into the patient and if amyloid is present in heart tissue, the radio-isotope will be absorbed
- A 3-point grade scale of the uptake relative to the ribs is used to interpret the images, with grade 2 and 3 suggesting the presence of cardiac amyloidosis

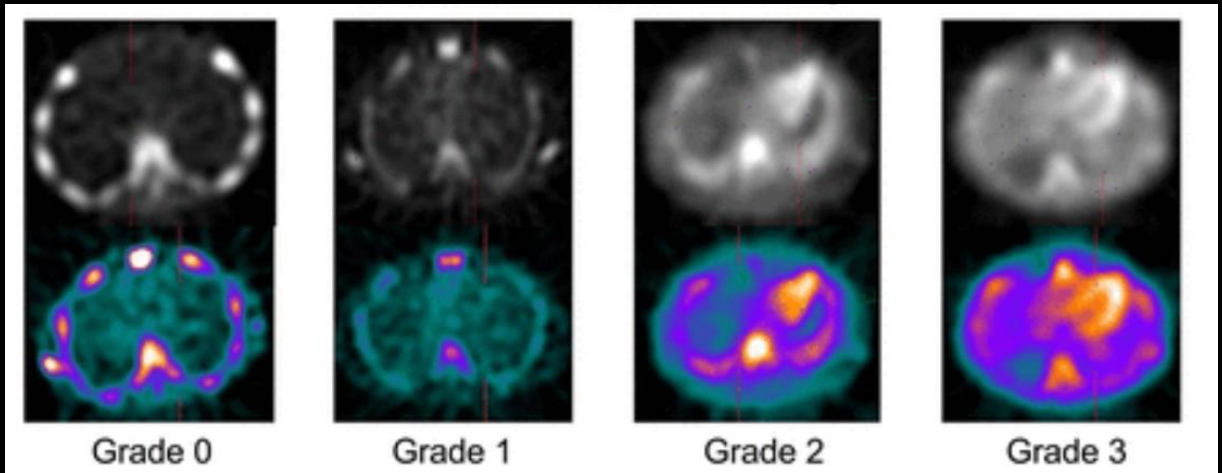

Figure from Shockling EJ et al.

Grade 0: no cardiac uptake
Grade 1: cardiac uptake less than bone
Grade 2: equal cardiac and bone uptake
Grade 3: cardiac uptake greater than bone

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Case Discussion – Cardiac Amyloidosis

Pathophysiology

- Amyloid is a misfolded protein fragment that can deposit in various tissues and organs, such as the heart.
- Cardiac amyloidosis can occur secondary to systemic amyloid disease or the accumulation of transthyretin.
- Deposition of amyloid leads to stiffening of the ventricles, resulting in heart failure with preserved ejection fraction (HFpEF).
- Two major cardiac amyloid subtypes include light-chain amyloidosis (AL) and transthyretin amyloidosis (ATTR)

Clinical Features

- Patients may present with symptoms of HFpEF such as **dyspnea,** chest pain, syncope, orthopnea, paroxysmal nocturnal dyspnea, or **lower limb edema.**
- Periorbital purpura and macroglossia are two pathognomonic physica findings that may be present in patients with cardiac amyloidosis.

Case Discussion – Cardiac Amyloidosis

Diagnosis

- The gold standard is tissue biopsy, in which green birefringence is seen when Congo red-stained amyloid is visualized under polarized light
- Noninvasive imaging findings include:
  - Speckling of the myocardium on echocardiogram
  - Diffuse late gadolinium enhancement in the sub-endocardial region on cardiac magnetic resonance imaging
  - Increased radio-isotope uptake on nuclear scintography

Management

- Treatment focuses on relief of HFpEF symptoms with the use of diuretics and mineralocorticoid receptor antagonists
- AL amyloidosis has poorer prognostic outcomes compared to ATTR amyloidosis due to its aggressive progression and systemic involvement
  - AL amyloidosis may require the use of systemic therapies, such as chemotherapy, in addition to cardiac management

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