Name	Manufacturer	Type of vaccine	Efficacy rate
BNT162b2	Pfizer-BioNTech	mRNA	95%
mRNA-1273	Moderna	mRNA	94.5%
Ad26.COV2.S	Janssen (Johnson & Johnson)	Viral vector	66%
AZD1222	Oxford-AstraZeneca	Viral vector	81.3% Trusted Source
Covishield*	Serum Institute of India	Viral vector	81.3%
Ad5-nCov	CanSino	Viral vector	65.28%
Sputnik V	Gamaleya	Viral vector	91.6% Trusted Source
Covaxin	Bharat Biotech	Inactivated	80.6%
BBIBP-CorV	Sinopharm (Beijing)	Inactivated	79.34% Trusted Source
Inactivated (Vero Cell)	Sinopharm (Wuhan)	Inactivate	

Amiloidosi Incidenza

Un paziente su sei con Stenosi aortica trattata con TAVI può avere amiloidosi

Probabilmente l'uno 2% dei pazienti al di sopra dei 75 anni possono avere amiloidosi

Amiloidosi si trova in circa il 10% dei pazienti operati di tunnel carpale

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Diagnosis made by multimodalities

- Clinical suspicion (please follow the guideline)
  - LVH
  - HFpEF
- Nuclear PYP
- ECHO
- MRI
- Blood/Urine
- BX

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Pyrophosphate (PYP) Bone Avid Tracer

- Used in 80s for MI imaging
- Calcium dependent P component binds amyloid fibrils together
- PYP binds via calcium mechanism to calcium dependent P component

Need to exclude AL – bone marrow disease

- Can have pos pyp > 20% of time

1. Serum free light chains (Kappa/Lambda)
2. Serum immunofixation
3. Urine immunofixation

- **Not Serum protein electrophoresis (SPEP)**

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AL

- Referral to Hematology/Oncology
- Diagnosis Bone marrow biopsy
- Treatment Chemotherapy

Cardiac Amyloidosis
Screening

- Serum and urine immunofixation
  - Not serum protein electrophoresis
- Serum-free light chains

95-100% of *AL* amyloid

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3 parts to Interpretation

1. Visual interpretation (Semi-quantitative-grades)
2. SPECT or SPECT/CT
3. H/CL (heart/contralateral lung) Quantitative

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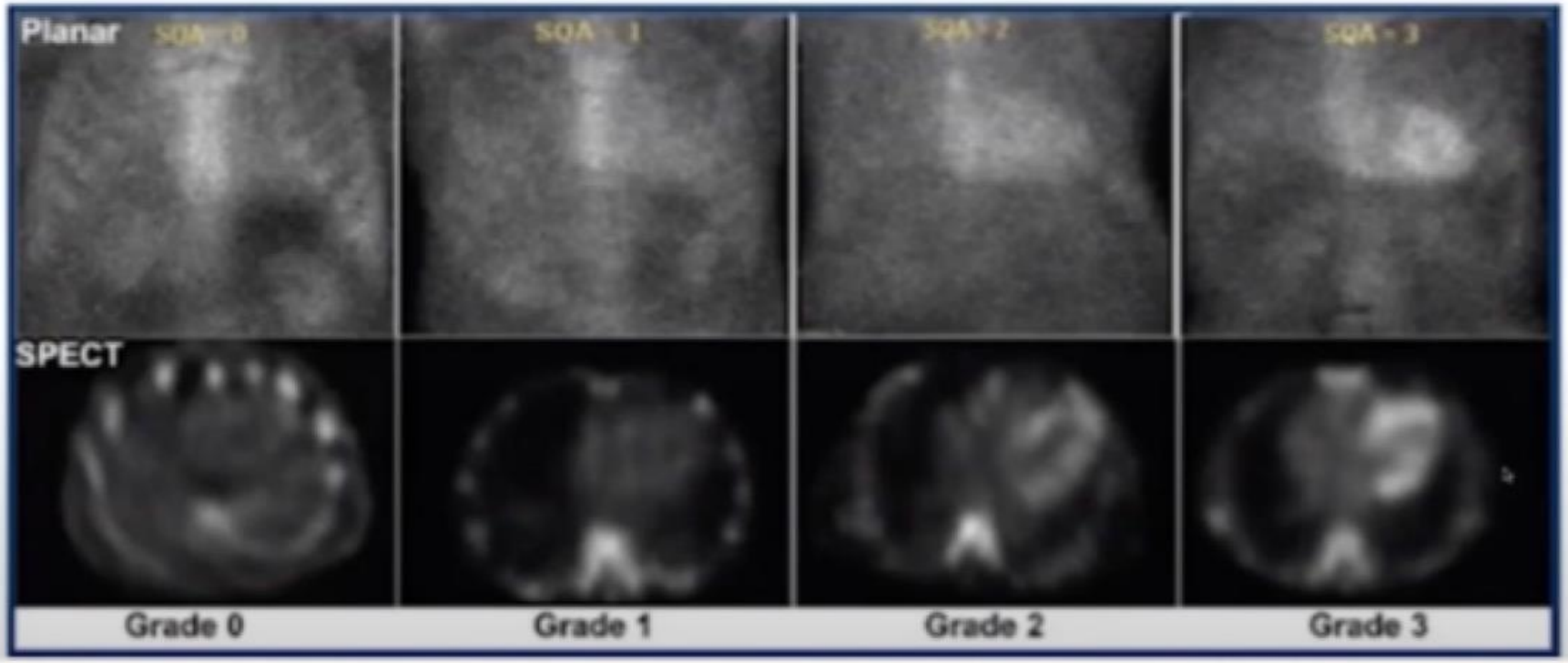
STEP 1:
Semi-quantitative (grades)

- Do this first
- Look for diffuse uptake VS focal uptake
- Diffuse - think Amyloid
- Focal - think MI or other causes

How to interpret the test?

Figure 2. Grading ^{99m}Tc-PYP Uptake on Planar and SPECT Images



Visual interpretation
Grading scheme "Perugini"
Semi-quantitative

Again confusing
3 terms for the same thing

- Your estimate of tracer in heart compared to ribs
- Grade 0 No Heart uptake, Neg for ATTR
- Grade 1 Heart uptake less then rib, Equivocal
- Grade 2 Heart uptake equal to rib, strongly suggestive
- Grade 3 Heart uptake greater than rib, Pos for ATTR
- ALWAYS EXLUDE AL

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PYP

- The higher the myocardial uptake the worse the prognosis

Whole Body Planar Images

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STEP 2: Need SPECT

- Blood pool
- Diffuse or Focal uptake

Figure 1

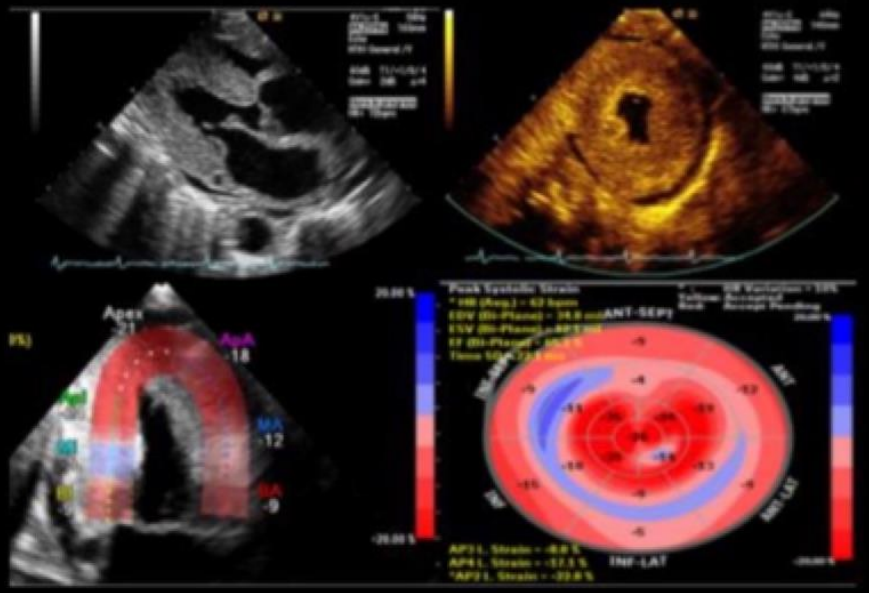


Figure 2

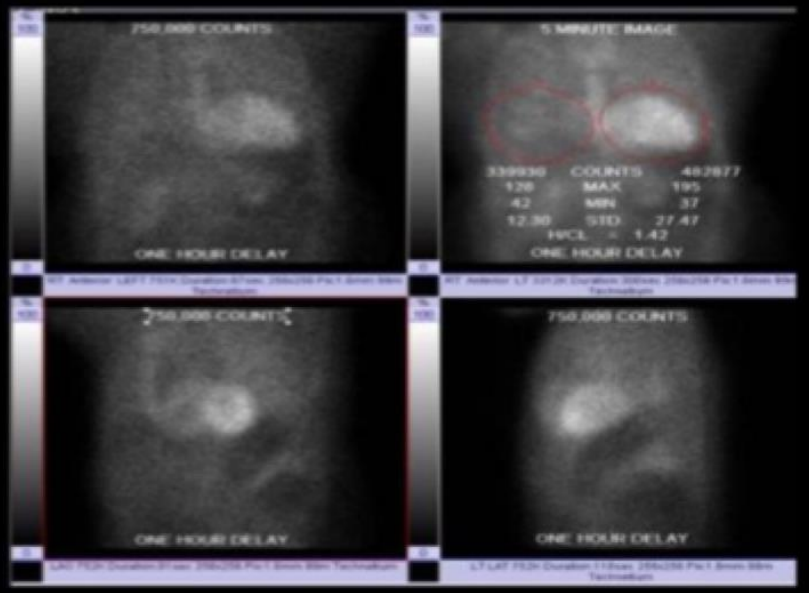
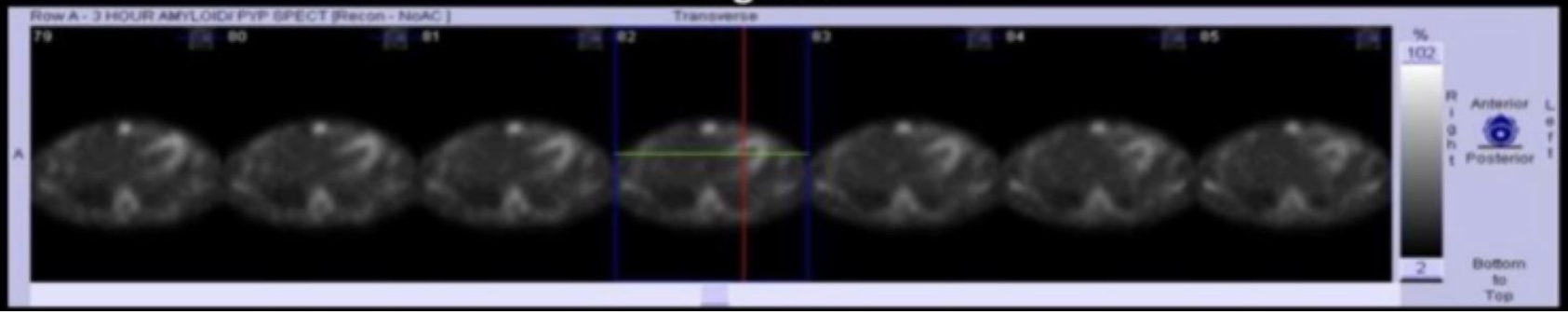


Figure 3



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STEP 3 Heart: Contralateral Lung (H/CL)

- H/CL
- We all want a simple number to say positive or negative
- As research/experience develops interpretation matures

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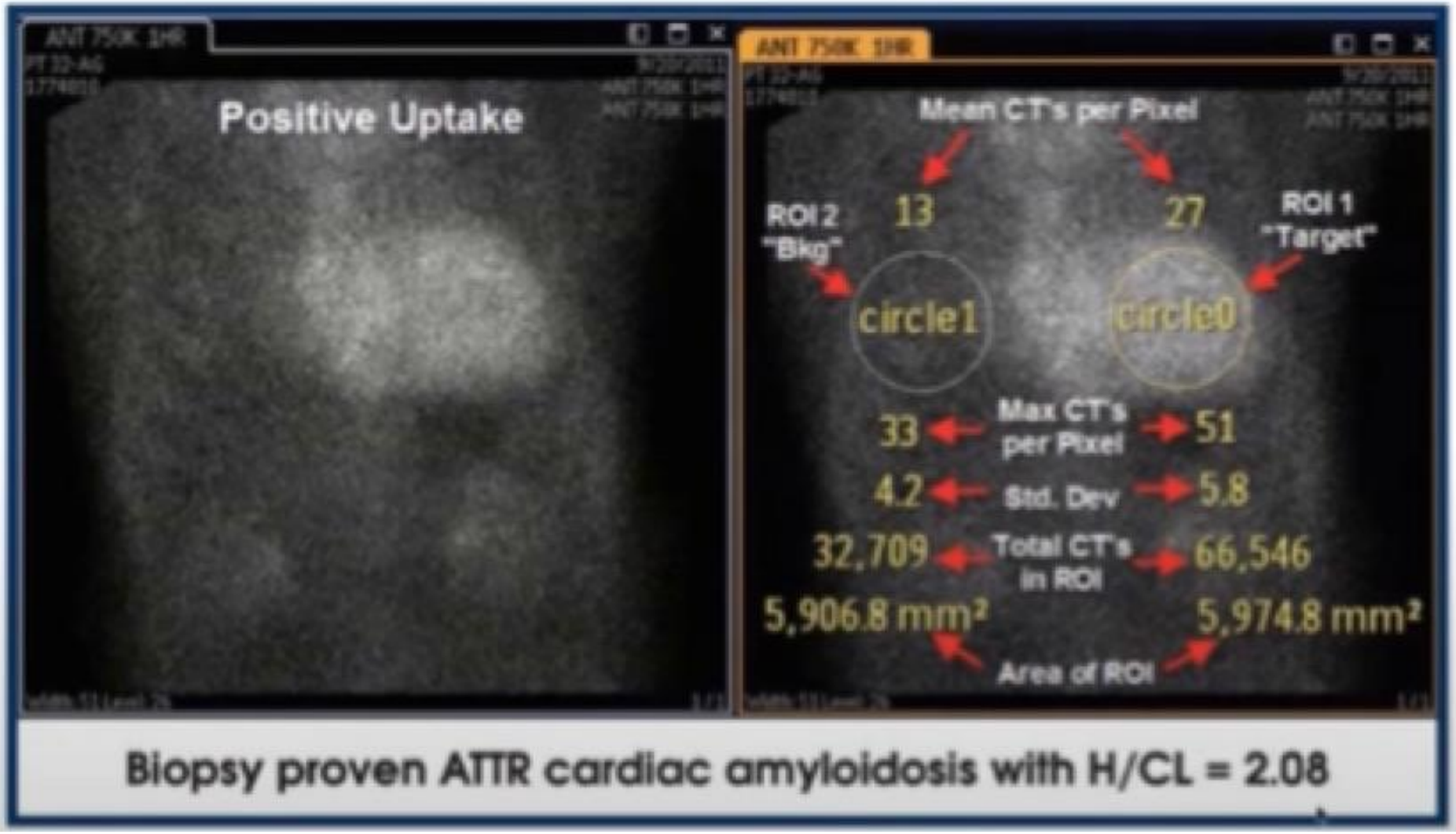
Quantitative Heart:Contralateral lung (H/CL)

- ROI on heart and contralateral lung
- Look at ratio
- > 1.5 Strongly suggestive, at 1 hr
- > 1.3 at 3 hr Strongly suggestive (tracer dissipates over time)
- 1-1.5 Equivocal

Figure 1. Quantitation of Cardiac ^{99m}Tc-PYP Uptake Using Heart-to-Contralateral Lung (H/CL) Ratio



Biopsy proven ATTR cardiac amyloidosis with H/CL = 2.08

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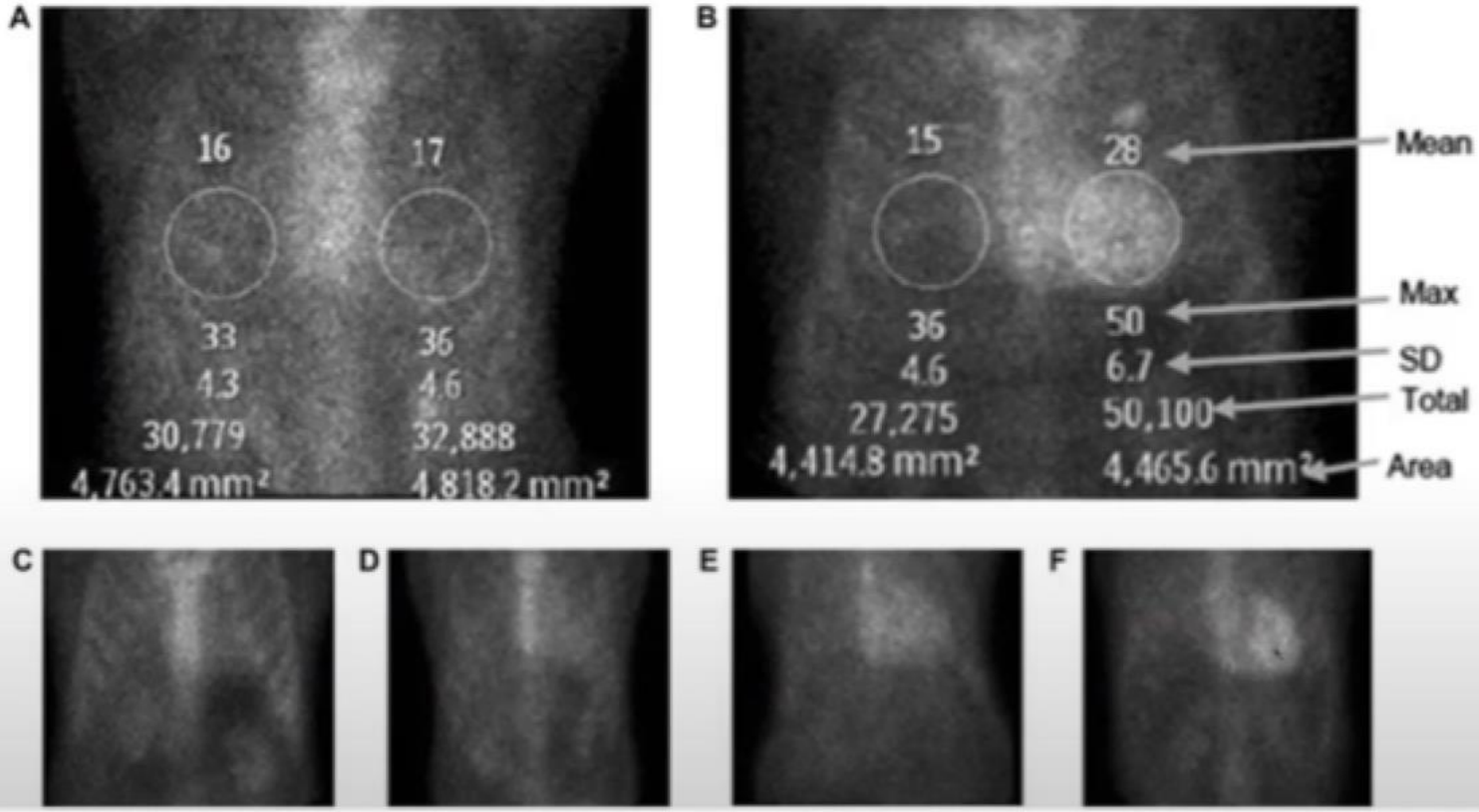
Example of how to do H/CL



H/CL-3hr 1.3, grade 2

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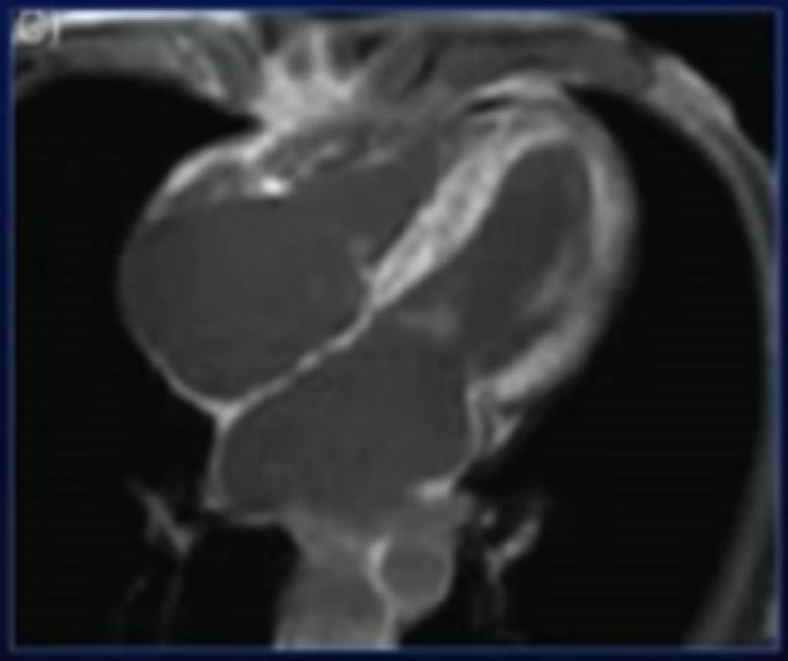
Can you differentiate ATTR and Al by PYP?

- 50% of AL have cardiac involvement
- >20% AL have PYP uptake
- Usually grade 1-2 (but not always)
- We CAN NOT mess this up
- DX (treatment/prognosis/ramifications VERY different)
- NEEDED IN ALL PTS
  - Serum Free Light chains
  - Immunofixation serum and urine

Cardiac MR in Amyloid
Pattern of Delayed Enhancement

- Diffuse late gadolinium enhancement
- Difficult to "null" the myocardium



Described by Maceira et al: JACC, 2005

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What makes a Positive test

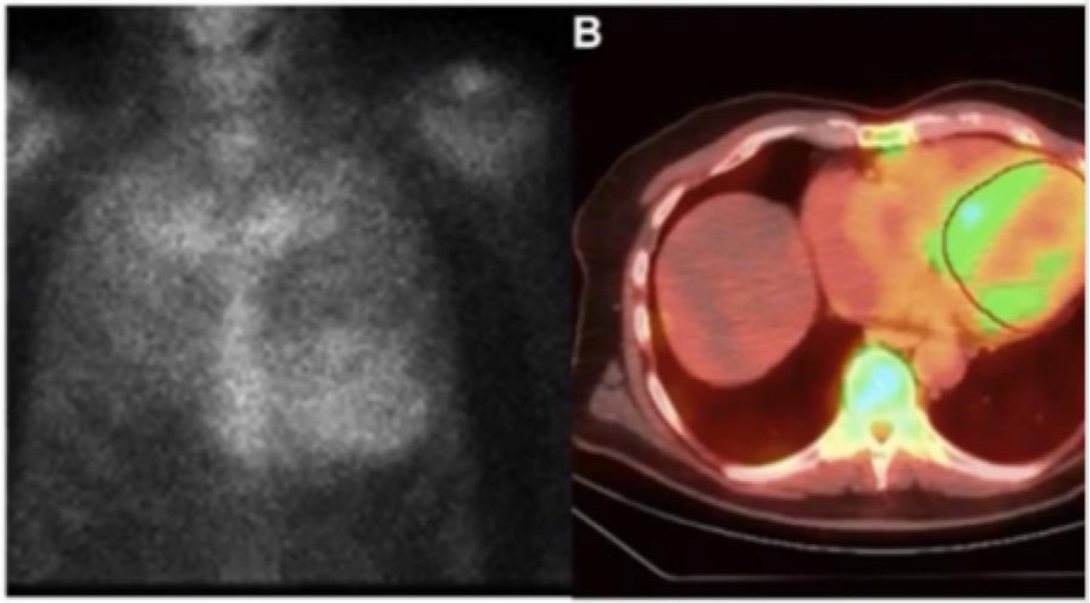
- Positive for ATTR: Positive PYP
  - Grade 2-3
- SPECT evaluation
- Negative: sFLC and urine/serum IFE
- Collaborating factors: clinical, Echo, MR
- H/Cl used for conformation

Need it all

- If positive do genetics

Grade 3 PYP
H/CL 1.8
Diagnosis of ATTR wt

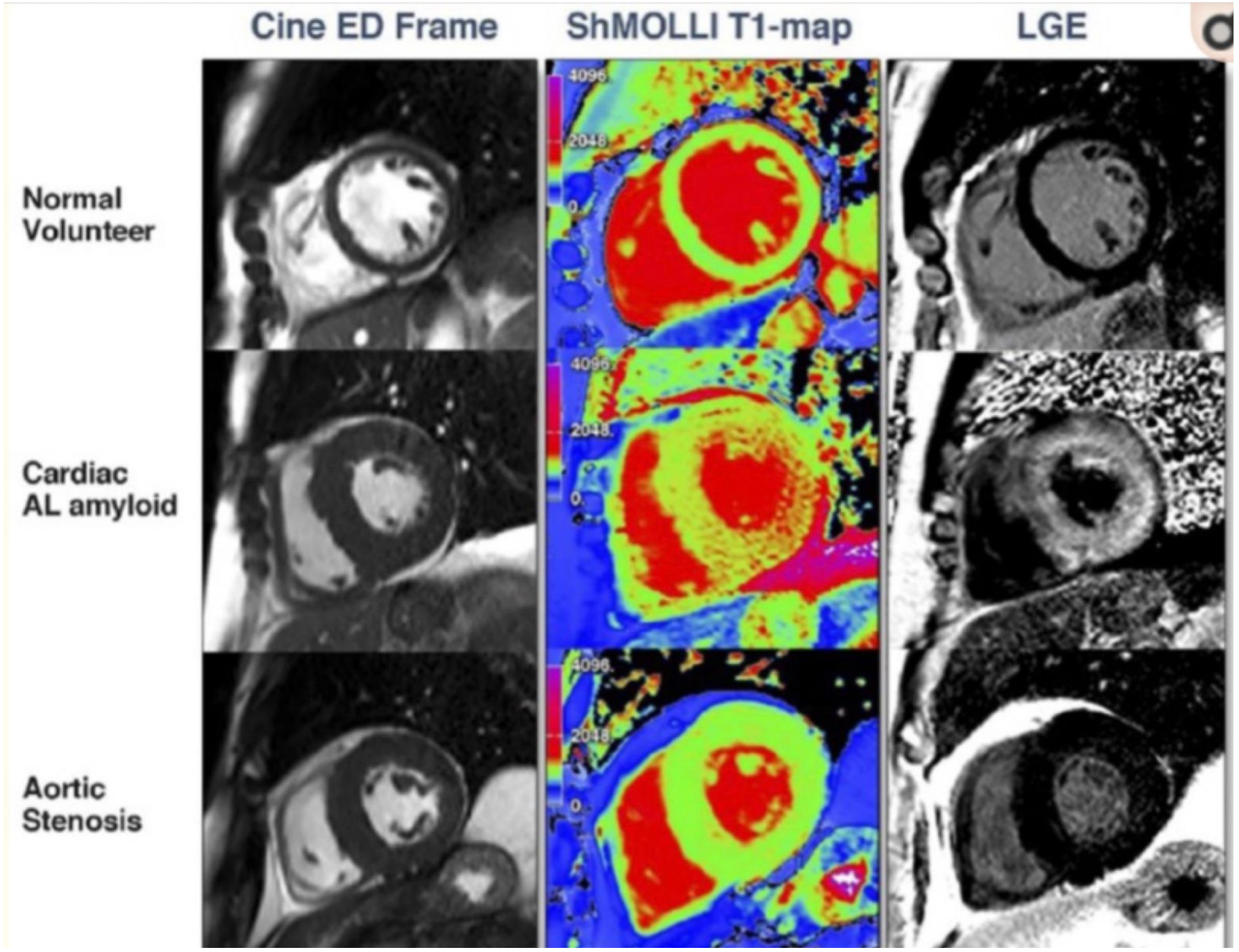
Teaching point- Kappa/Lambda is abnormal



C

Free Light Chain Assay Results (normal range)
Kappa = 2.63 mg/dl (0.33-1.94)
Lambda = 1.25 mg/dl (0.57-2.63)
Ratio = 2.1 (0.26-1.65)

Hanna, M et al. 2020;75(22)2851-62
JACC Volume 75, Issue 22, 9 June 2020, Pages 2851-2862


Cine ED Frame
ShMOLLI T1-map
LGE
Normal Volunteer
Cardiac AL amyloid
Aortic Stenosis
4096
2048
0
4096
2048
0
4096
2048
0

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Reporting: Conclusions

- Overall Interpretation
  - Not suggestive of ATTR (grade 0)
  - Strongly suggestive of ATTR (grade 2-3)
  - Equivocal for ATTR (grade 1, can use H/CL
- Interpret in context of:
- Same as stress test LOOK AT ALL the data
  - sFLC, IF urine and serum (can not exclude AL)
  - Echo, MR

Cardiac Amyloid

- Supportive care
- Diuretics
- Pleurx catheter
- Patient and family education
- AF – challenging – accept higher heart rate due to restrictive hemodynamics
- Digoxin may be preferable to beta/calcium channel blocker – low dose, level 0.5-0.8 ng/ml

Cardiac Amyloidosis

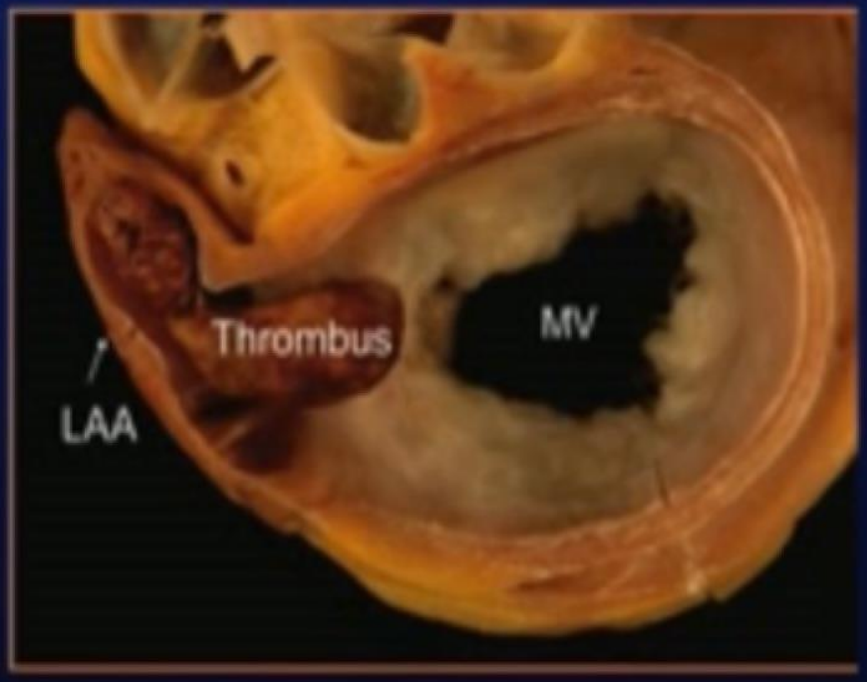
Treatment

Cardiac Arrest in AL

- Despite advances in treatment of AL, mortality in the first year remains at 50%
- Sudden cardiac death
- PEA commonly reported
- Role of ICD questionable

PEA in patient with cardiac AL and ICD

108 Autopsy Hearts with Amyloid



- AL
  - 17% Atrial Fibrillation
  - 51% Intracardiac thrombus
- Non-AL
  - 40% AF
  - 17% had thrombus

Elective Cardioversion: Always with TEE and anticoagulation

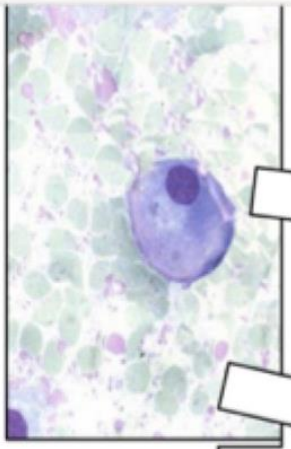
Cardiac Amyloid
Summary

- Diverse presentation and imaging findings
- Normal voltage or LVH does not exclude dx
- Amyloid type determines treatment and prognosis
- Extreme caution with beta-blocker, ACE/ARB
- Do not cardiovert without TEE
- Trials on the horizon for TTR, including senile

The Many Faces of Cardiac Amyloid
Unmasking the Great Masquerader

Delayed Diagnosis
A major factor in poor prognosis

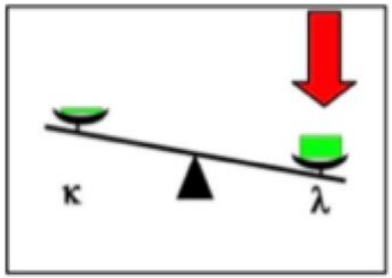
We Need to make the Diagnosis ***Earlier***



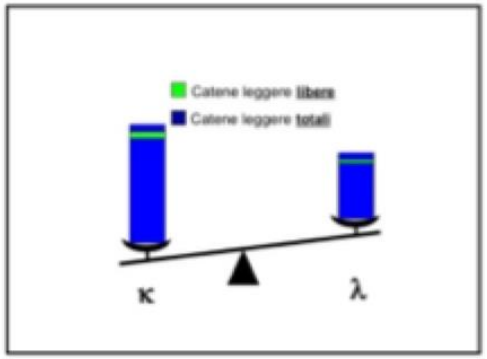
Catene leggere
"***legate***" sulla Ig

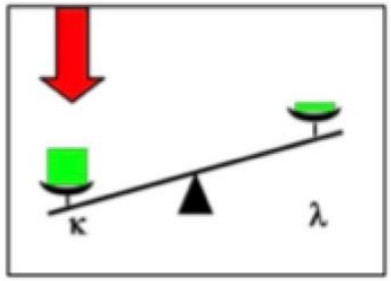
Catene leggere
"***libere***" nel siero

Catene λ libere
(dimeriche)



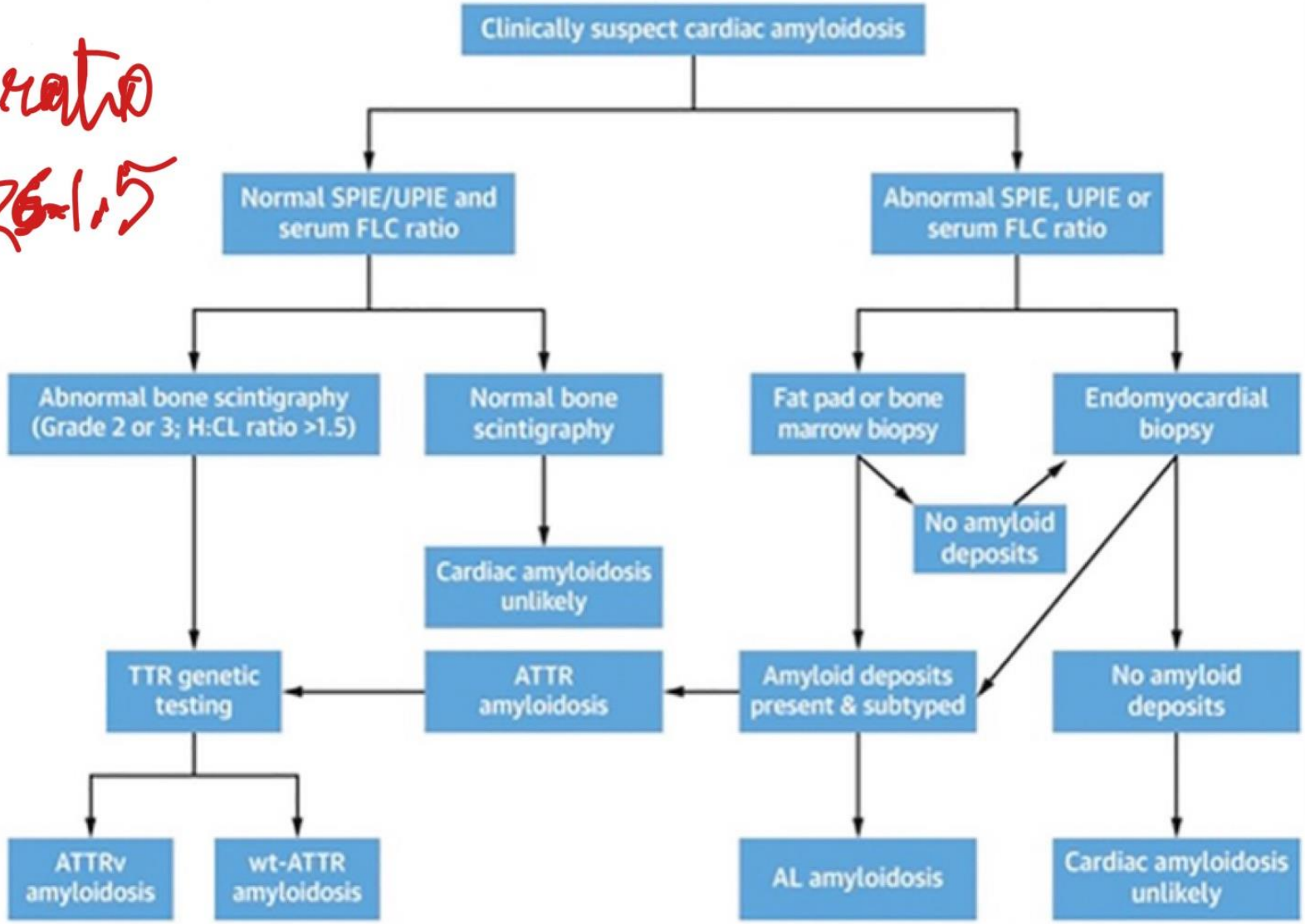
Eccesso di catene leggere libere λ
FLC ratio < **0,26**





Eccesso di catene leggere libere κ
FLC ratio > **1,65**

CENTRAL ILLUSTRATION: Algorithm for Evaluation for Suspected Cardiac Amyloidosis



Witteles, R.M. et al. J Am Coll Cardiol CardioOnc. 2019;1(1):117-30.