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Heart Failure Syndromes related to Unusual Cardiomyopathies

Juan M. Aranda Jr., M.D.
Professor of Medicine
Medical Director of Heart Failure/ Transplant Program
University of Florida College of Medicine

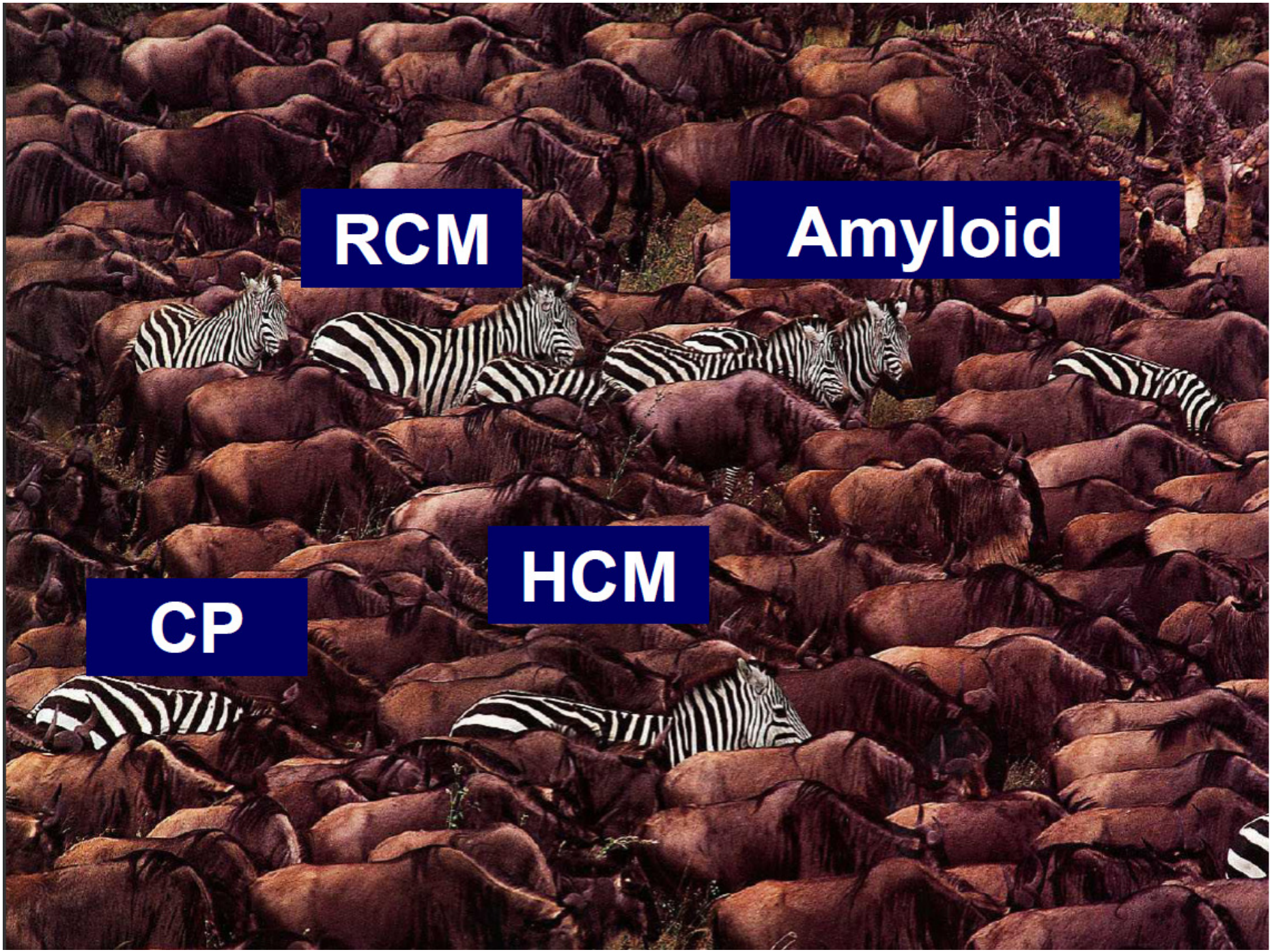
UF UNIVERSITY of FLORIDA

Disclosures: None

2013 ACCF/AHA Guideline for the Management of Heart Failure

HFrEF	HFpEF	HFpEF, borderline	HFpEF, improved
≤ 40 %	≥ 50%	41-49	> 40

Yancy C. J Am Coll Cardiol. 2013;62:e147-239


RCM
Amyloid
HCM
CP

Survival by Underlying Cause of Cardiomyopathy

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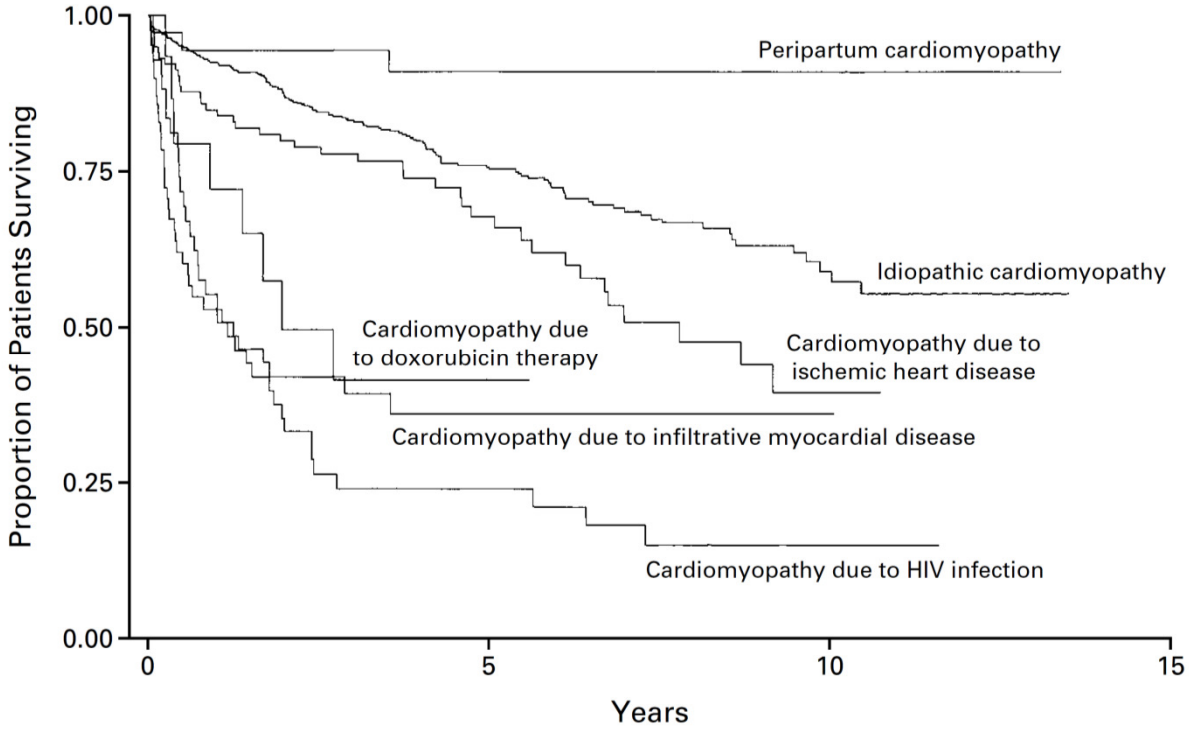


Felker GM. New Engl J Med 2000; 342:1077-1084.

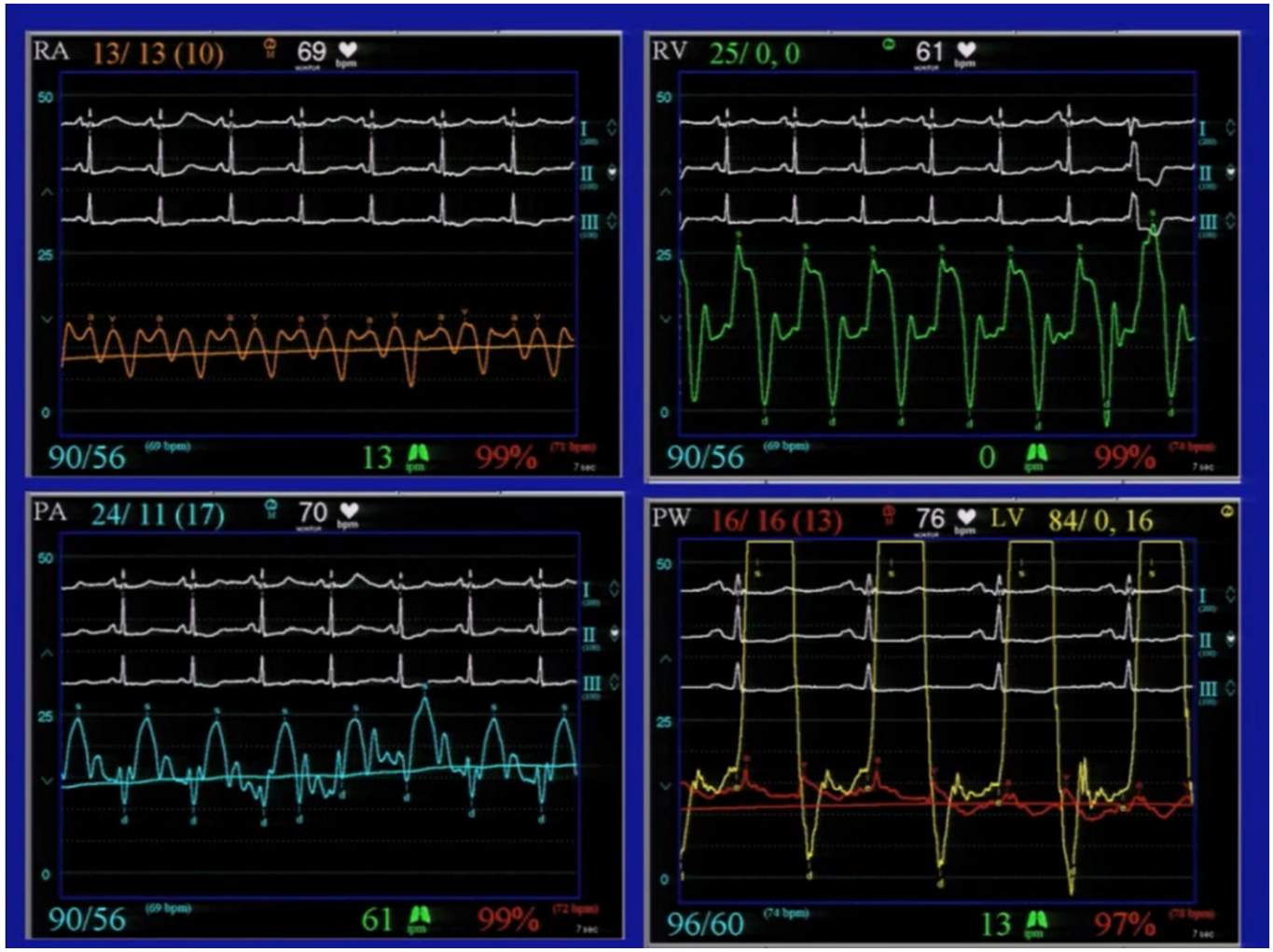
The following hemodynamics are most suggestive of:

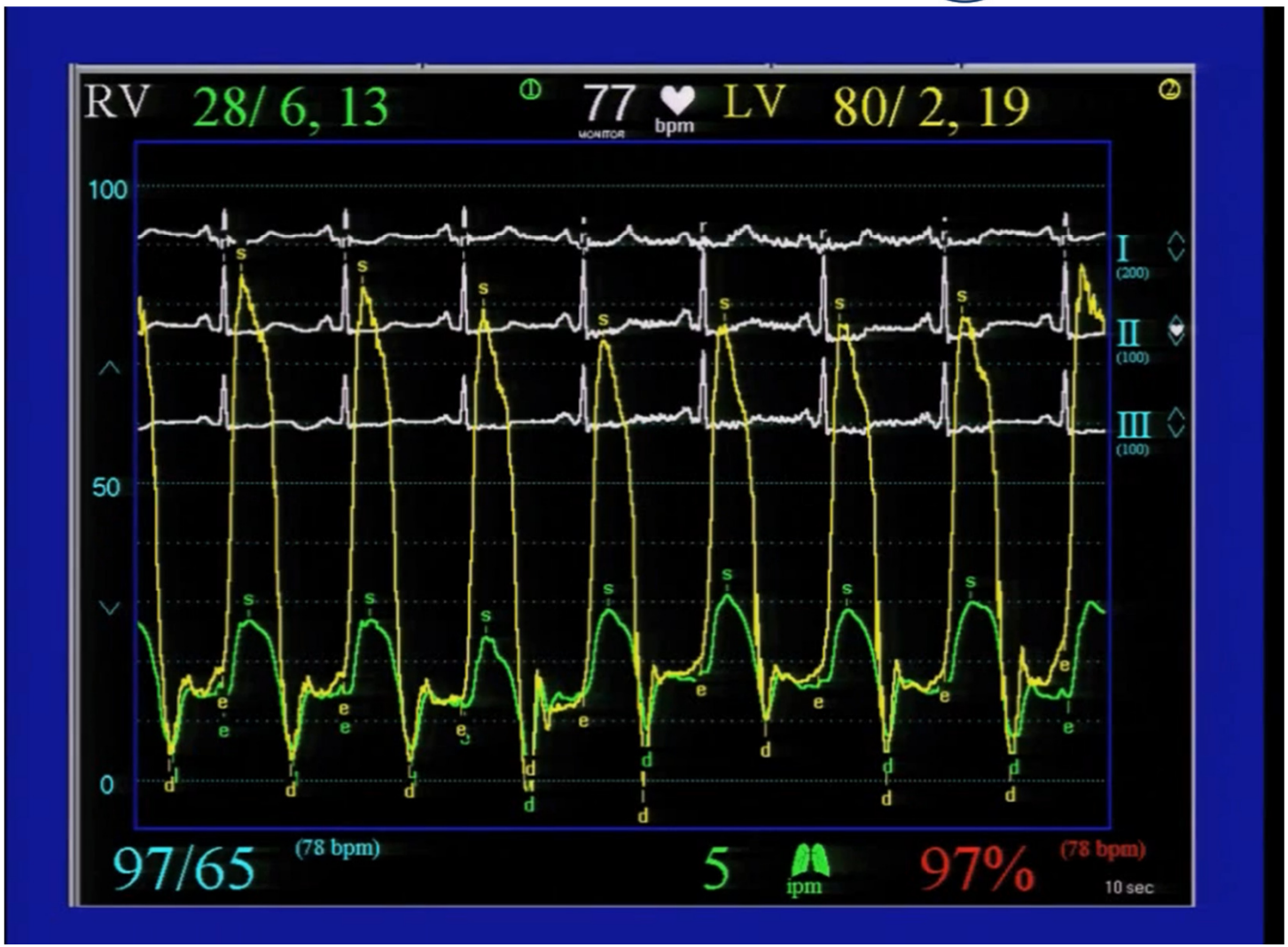
a. Constrictive pericarditis

b. Restrictive cardiomyopathy (Amyloid)

c. Dilated cardiomyopathy

d. Hypertophic cardiomyopathy


RA 13/ 13 (10) 69
90/56 13 99%
RV 25/ 0, 0 61
90/56 0 99%
PA 24/ 11 (17) 70
90/56 61 99%
PW 16/ 16 (13) 76 LV 84/ 0, 16
96/60 13 97%


RV 28/ 6, 13
77 bpm
MONITOR
LV 80/ 2, 19
100
50
0
I (200)
II (100)
III (100)
97/65
(78 bpm)
5
ipm
97%
(78 bpm)
10 sec

Constrictive Pericarditis

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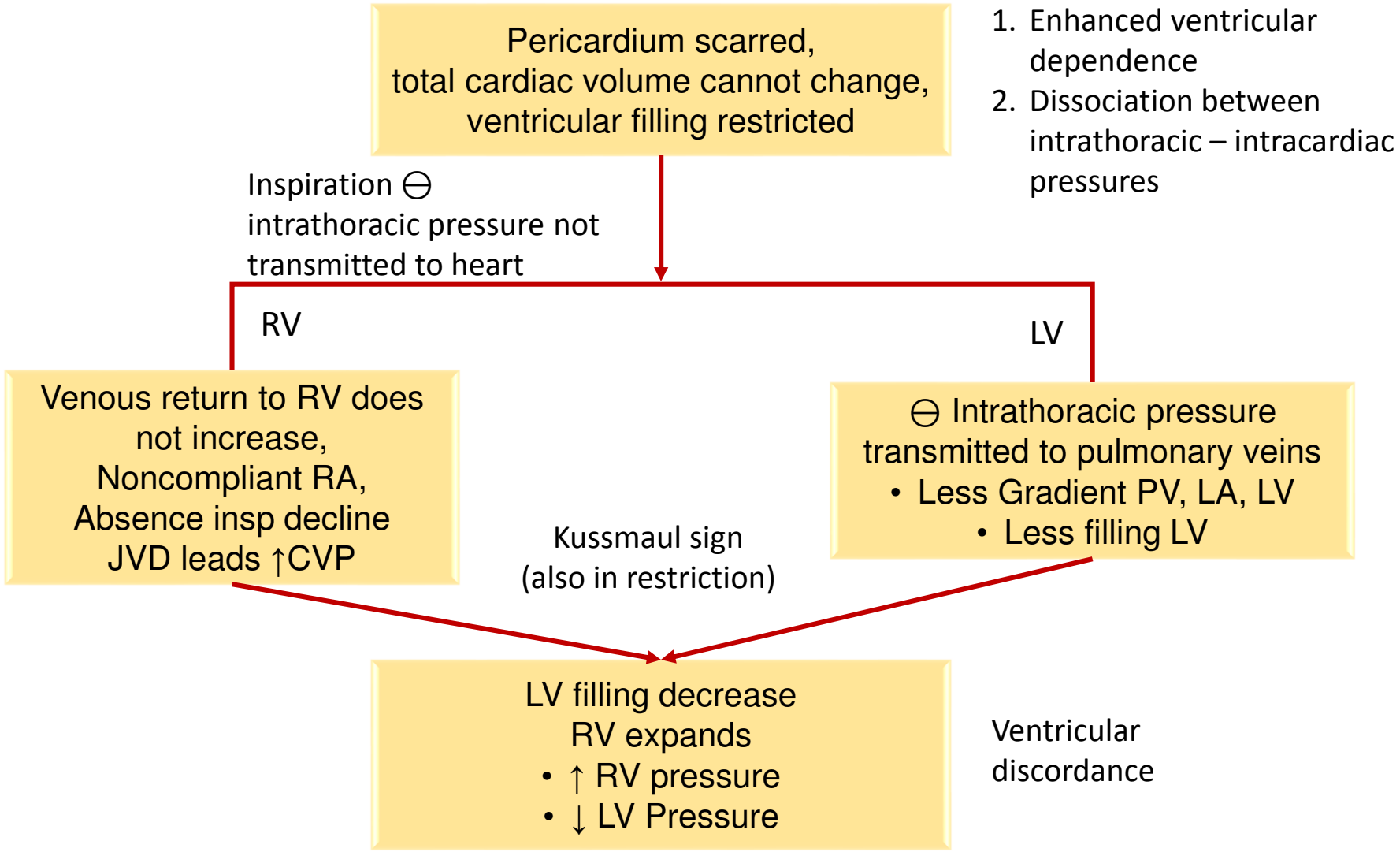
- CP defined as impedance to diastolic filling caused by a fibrotic pericardium
- Common etiologies: viral pericarditis, cardiac surgery, mediastinal radiation
- Clinical characteristics: heart failure, chest pain, abdominal symptoms (hepatomegaly, acites, edema), atrial arrhythmias
- Mean duration of symptoms 11.7 months
- Common misdiagnosis of chronic liver disease

Frequency of Various Causes of Chest Pain and Perioperative Mortality after Percardiectomy

	Cleveland Clinic series [15] (163 patients between 1977 and 2000)	Mayo Clinic series [13] (135 patients between 1985 and 1995)	Stanford series [14] (95 patients between 1970 and 1985)
Idiopathic	46 (idiopathic/viral, 75)	33 (45)	42 (40)
Post-surgical	37 (60)	18 (24)	11 (10)
Post-radiation	9 (15)	13 (17)	31 (29)
Miscellaneous			
Pericarditis	1 (purulent, 1)	16 (22)	
Post-infection		3 (4)	6 (6)
Tuberculosis	4 (6)		
Arthritic disease	1 (rheumatoid, 2)	7 (10)	
Connective tissue disease-related			4 (4)
Systemic lupus erythematosus	1 (2)		
Wegener's granulomatosis	1 (1)		
Sarcoidosis			1 (1)
Prior chest trauma	1 (1)		
Uremic disease			2 (2)
Neoplastic disease			3 (3)
Non-specified causes		10 (13)	
Perioperative overall mortality after pericardiectomy	6	6	12

Schwefer M, et al. Eur J Cardiothorac Surg 2009; 36:502-510.

Pathophysiology of Constriction



1. Enhanced ventricular dependence
2. Dissociation between intrathoracic – intracardiac pressures

Pressures in the left (LV) and right ventricle (RV) of a patient with constrictive pericarditis.

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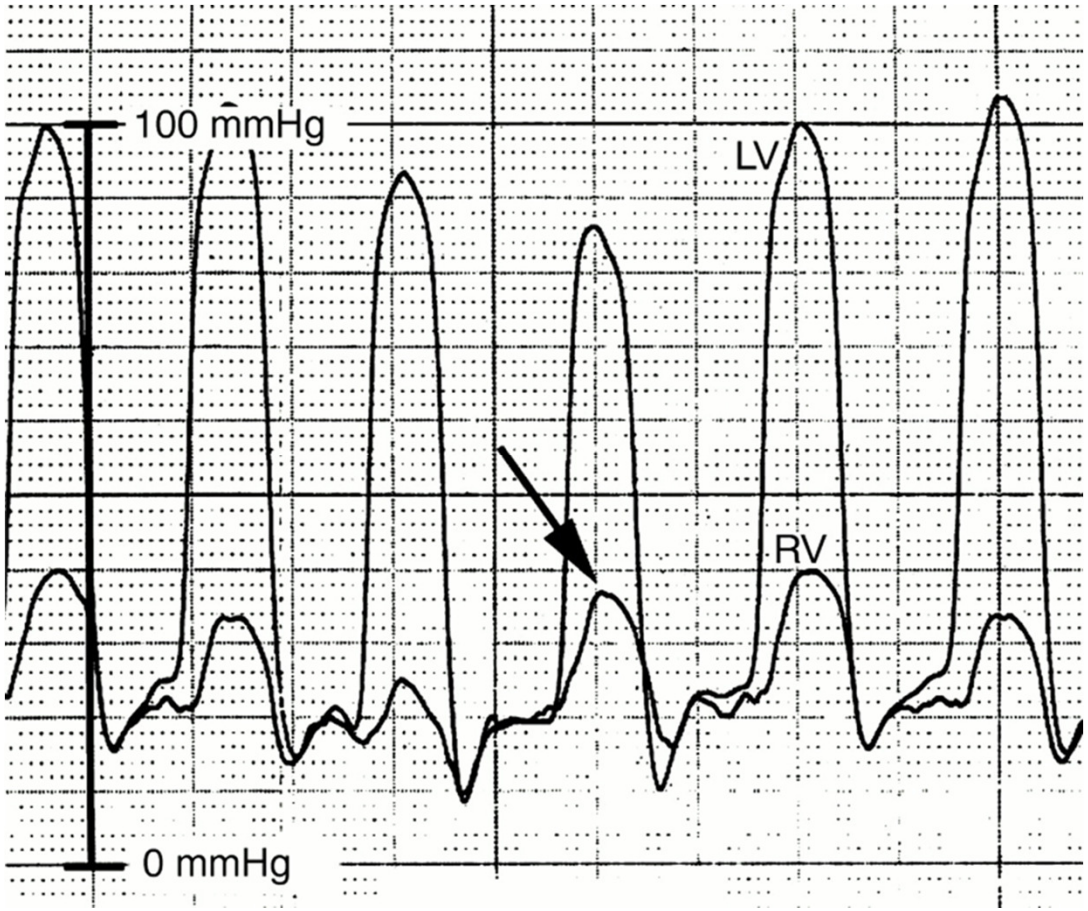
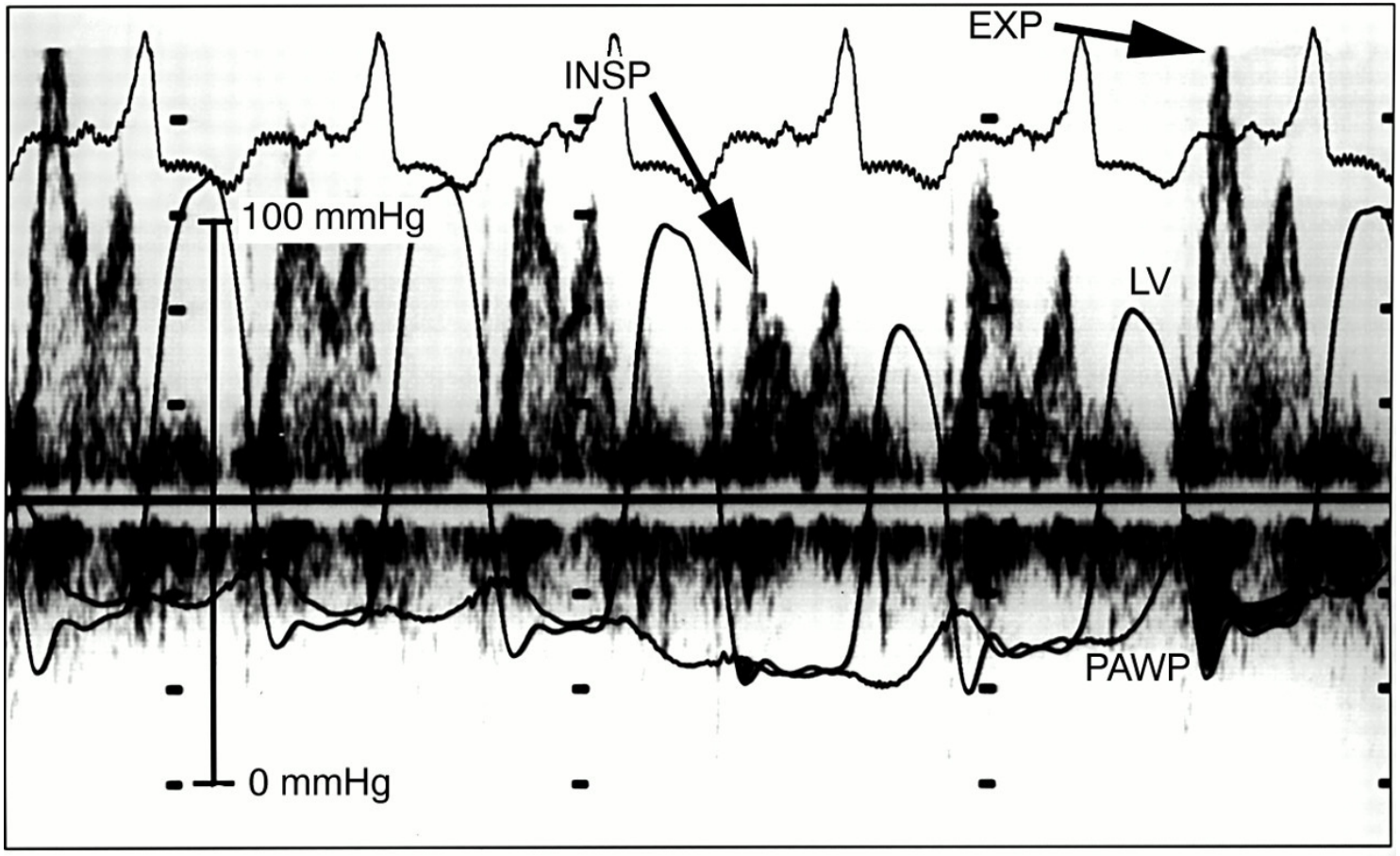


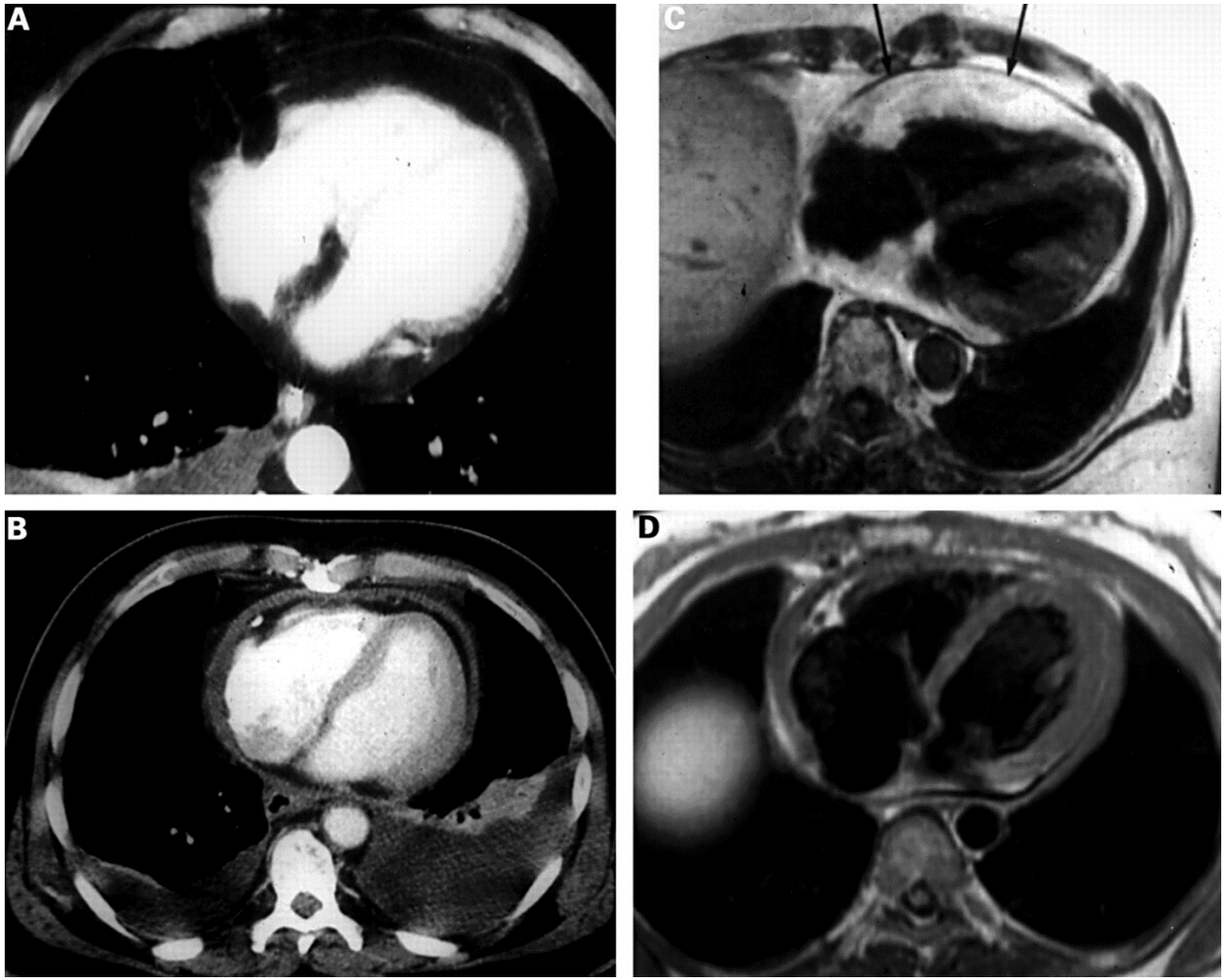
R A Nishimura Heart 2001;86:619-623

Transmitral flow velocity in a patient with constrictive pericarditis



R A Nishimura Heart 2001;86:619-623

Normal and abnormal pericardium seen on computed tomography (CT) and magnetic resonance imaging (MRI) studies



R A Nishimura Heart 2001;86:619-623

Cardiac Amyloidosis

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- Cardiac amyloid is a manifestation of one of several systemic diseases know as the amyloidosis.
- Common feature is extracellular deposition of a proteinaceous material that, when stained with Congo red, demonstrates apple-green birefringence under polarized light.
- May involve atria, ventricles, valve conduction system resulting in biventricular wall thickening and nondilated ventricle.

Characteristics of the Systemic Amyloidoses

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Type	Fibril Composition	Precursor Protein	Clinical Features	Laboratory Studies for Diagnosis
AL (primary)	Monoclonal immunoglobulin light chains	λ or κ light chains (ratio of λ to κ, 3:1)	Cardiomyopathy, hepatomegaly, proteinuria, macroglossia, orthostasis, autonomic and peripheral neuropathy, ecchymoses	Immunofixation electrophoresis of urine and serum, bone marrow biopsy with immunohistochemical staining for λ and κ light chains
ATTR (familial)	Transthyretin	Abnormal transthyretin (>50 identified)	Midlife onset of peripheral and autonomic neuropathy, cardiomyopathy, vitreous opacities	Serum isoelectric focusing for abnormal transthyretin or DNA-based test for mutant transthyretin gene
AA (secondary)	Amyloid A protein	Amyloid A protein	Underlying inflammatory disorder, hepatosplenomegaly, proteinuria, renal insufficiency, orthostasis	Elevated concentrations of serum amyloid A protein, immunohistochemical staining of tissue specimen for AA protein
Other familial types				Genetic studies at special centers
AApoA-I	Apolipoprotein A-I	Apo A-I	Polyneuropathy, nephropathy	
AGel	Gelsolin	Gelsolin	Lattice dystrophy of cornea, corneal neuropathy	
AFib	Fibrinogen A α	Fibrinogen A α	Nephropathy, hypertension	
ALys	Lysozyme	Lysozyme	Nephropathy, hepatomegaly	

*In addition, systemic amyloidosis is associated with hemodialysis and localized forms of amyloidosis are associated with Alzheimer's disease, type II diabetes, medullary carcinoma of the thyroid, and atrial amyloid deposition.

Falk RH, et al. New Engl J Med 1997;337:898-909.

Clinical Features

- Dyspnea
- Angina (small vessels)
- Profound peripheral edema
- Troponin elevation
- Bruising, periorbital purpura
- Macroglossia
- Carpal tunnel
- Low radial pulse
- ↑ JVD steep X and Y descent
- Kussmaul sign rarely present
- No fourth heart sound

Tissue Diagnosis

- Requires tissue biopsy that demonstrates apple-green birefringence when stained Congo red.
- NOT necessary to biopsy heart if the echo appearances are typical for cardiac amyloidosis, provided histological diagnosis made from another tissue
- Once tissue obtained, need to do immunofixation to determine type of amyloid
- Serum and urine immunofixation should be done rather than urine electrophoresis (small amount of paraprotein).
- Serum free-light chain assay
  - Kappa/lambda ratio <0.26 suggest population plasma cells producing clonal lambda chain
  - Ratio > 1.65 suggest clonal kappa channel.

2D Echo Image from a Patient with AL Cardiac Amyloidosis

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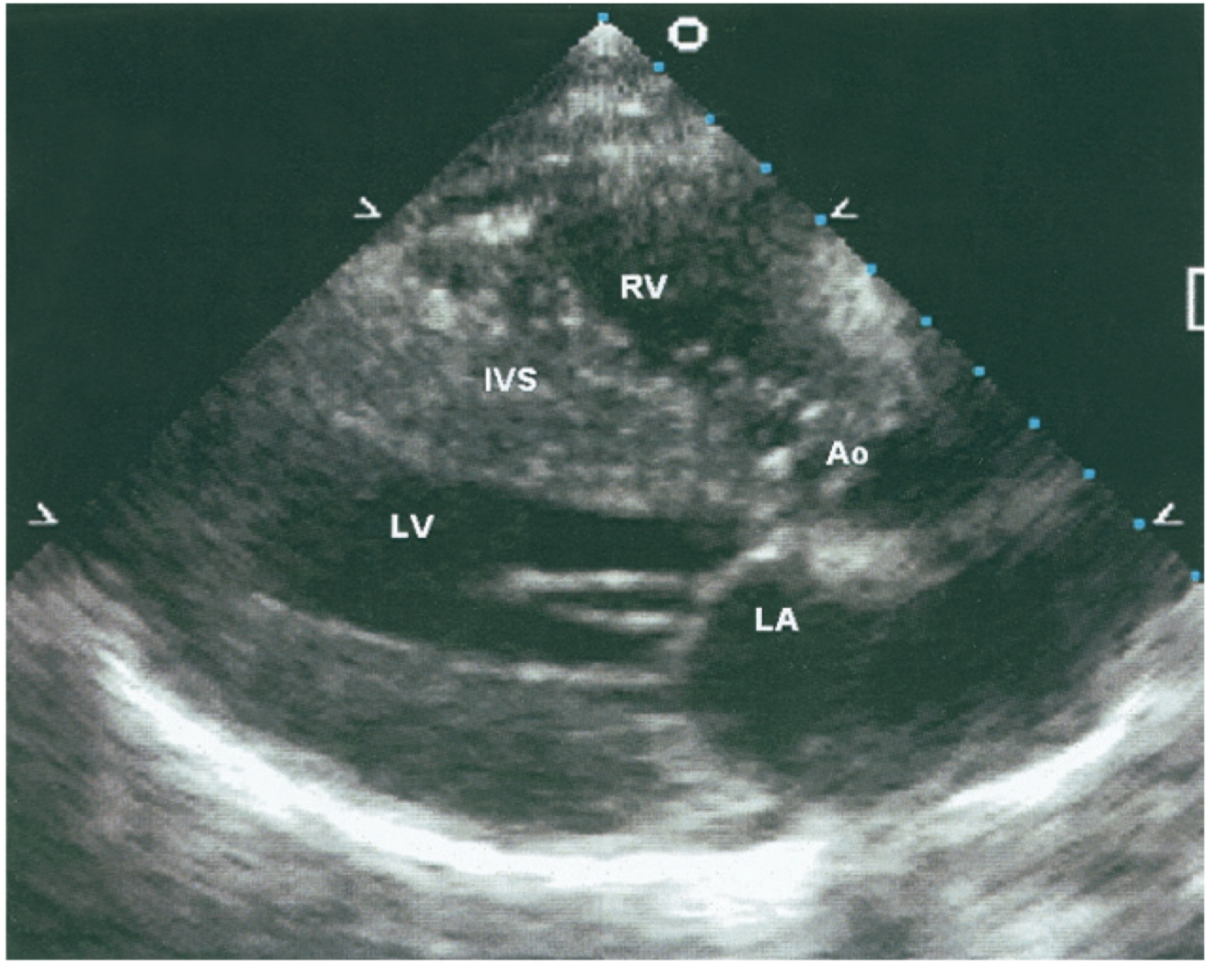

Selvanayagam JB, et al. J Am Coll Cardiol 2007; 50:2101-2110.

Diagnosis and Management of the Cardiac Amyloidoses

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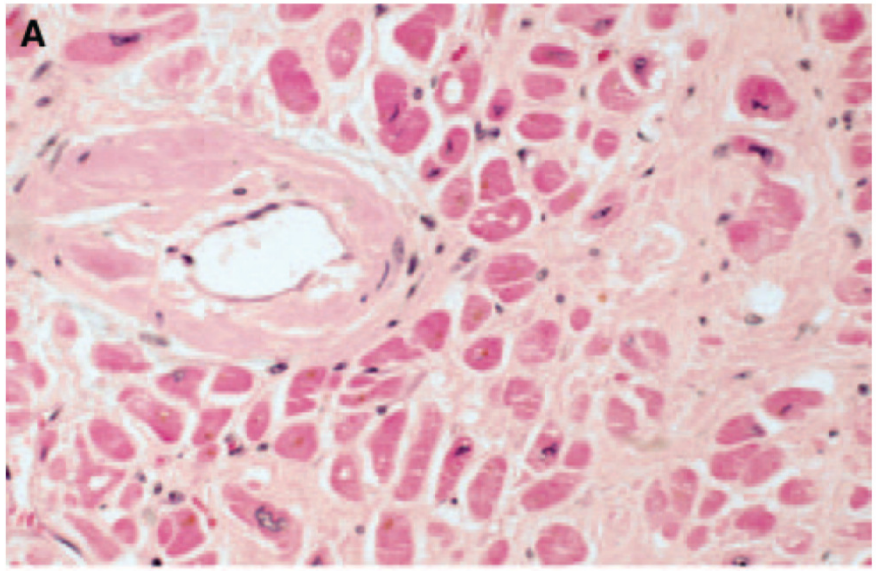
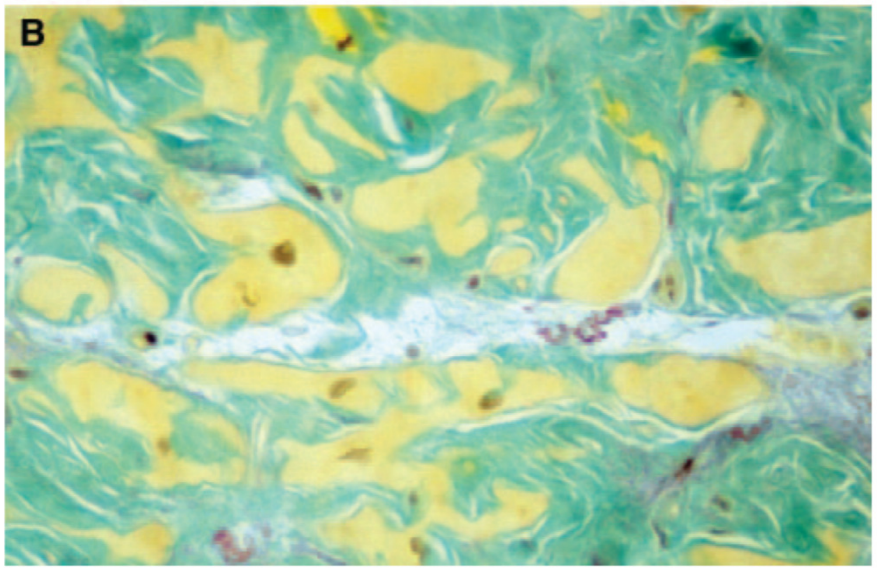


A, Endomyocardial biopsy specimen, stained with hematoxylin and eosin, from a patient with cardiac amyloidosis. The amyloid stains light pinkish red and is seen as an amorphous material that separates the darker staining myocytes.



B, Staining of the tissue from the same patient using sulfated Alcian blue. The amyloid stains turquoise green and the myocytes stain yellow, characteristic of amyloid.

Falk RH. Circulation 2005;112:2047-2060.

Evaluation of a Patient with Suspected Cardiac Amyloidosis

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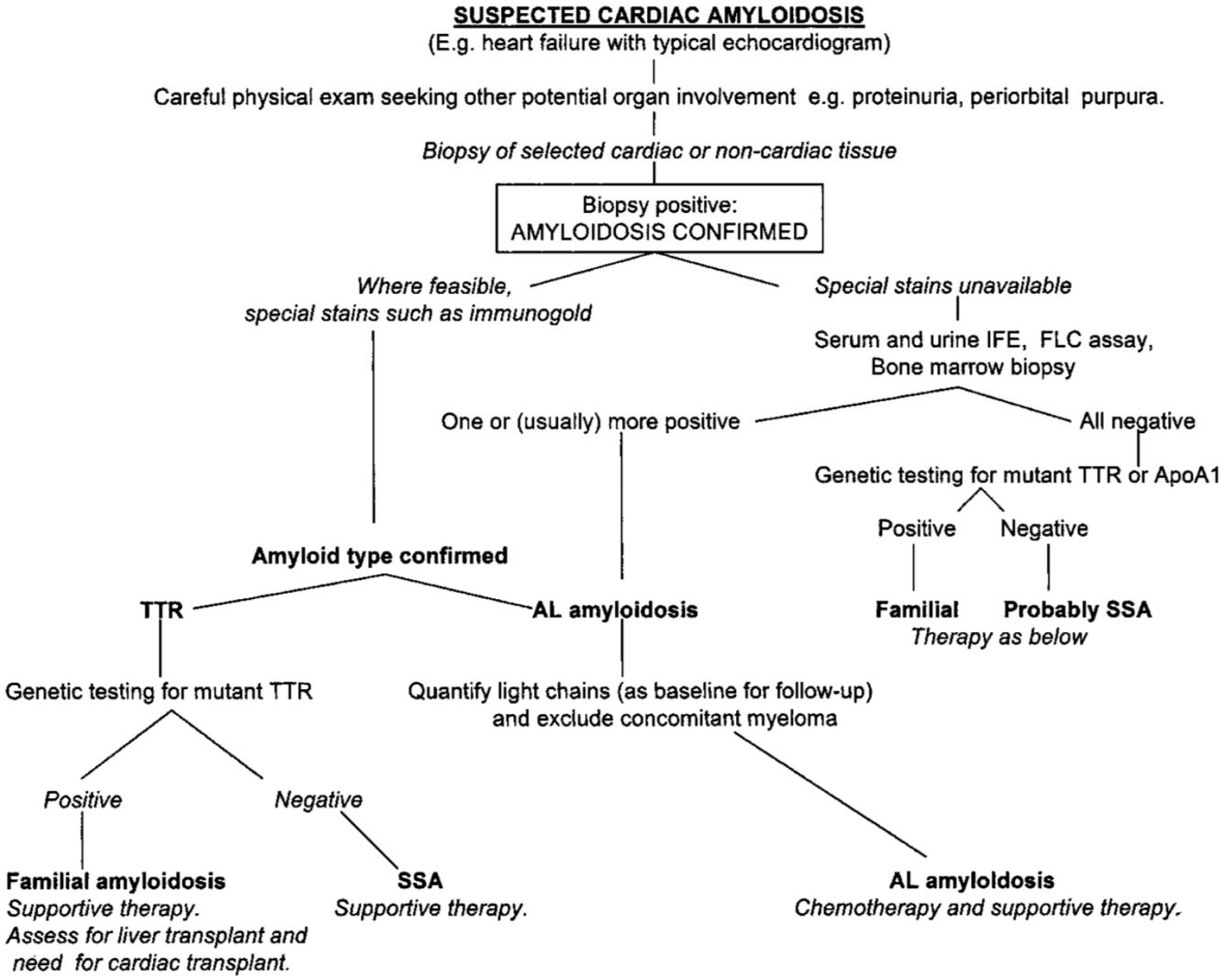

Falk RH. Circulation 2005; 112:2047-2060.

The Differential Diagnosis of Restrictive Cardiomyopathy and Constrictive Pericarditis

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Type of Evaluation	Restrictive Cardiomyopathy	Constrictive Pericarditis
Physical examination	Kussmaul's sign may be present Apical impulse may be prominent S3 may be present, rarely S4 Regurgitant murmurs common	Kussmaul's sign usually present Apical impulse usually not palpable Pericardial knock may be present Regurgitant murmurs uncommon
Electrocardiography	Low voltage (especially in amyloidosis), pseudoinfarction, left-axis deviation, atrial fibrillation, conduction disturbances common	Low voltage (<50 percent)
Echocardiography	Increased wall thickness (especially thickened interatrial septum in amyloidosis) Thickened cardiac valves (amyloidosis) Granular sparkling texture (amyloid)	Normal wall thickness Pericardial thickening may be seen Prominent early diastolic filling with abrupt displacement of interventricular septum
Doppler studies	Decreased RV and LV velocities with inspiration Inspiratory augmentation of hepatic-vein diastolic flow reversal Mitral and tricuspid regurgitation common	Increased RV systolic velocity and decreased LV systolic velocity with inspiration Expiratory augmentation of hepatic-vein diastolic flow reversal
Cardiac catheterization	LVEDP often >5 mm Hg greater than RVEDP, but may be identical	RVEDP and LVEDP usually equal RV systolic pressure <50 mm Hg RVEDP >one third of RV systolic pressure
Endomyocardial biopsy	May reveal specific cause of restrictive cardiomyopathy	May be normal or show nonspecific myocyte hypertrophy or myocardial fibrosis
CT/MRI	Pericardium usually normal	Pericardium may be thickened

Kushwaha SS, et al. New Engl J Med 1997;336:267-276.

Conclusions

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- Do not assume that everything with heart failure with preserved EF is related to simple diastolic dysfunction.
- Good history, physical exam, echocardiography are essential to make appropriate diagnosis.
- Know your hemodynamics.
- Know your “cucarachas.” It can make a difference.