Pericardial Disease: Case Examples

Echo Fiesta 2017
Objectives

• Have a systematic approach to evaluation of constriction
CASE 1
71 year old man with and HF
Referred for pericardiectomy

- Echocardiography
  - LVEF = 65%
  - LV wall thick = 13 mm
  - Mitral E = 80 cm/sec
  - A = 20 cm/sec
  - Medial e’ = 2 cm/sec
  - Lateral e’ = 5 cm/sec
- CT: Calcified pericardium
71 year old man with calcified pericardium

Diagnosis?
1. Constrictive pericarditis
2. Restrictive CM
3. Not sure
71 year old man with calcified pericardium
Cardiac Amyloidosis

MRI: Patchy myocardial delayed enhancement and increased wall thickness

Medial e’ ≤ 5 cm/s indicates myocardial disease
Constrictive pericarditis—a curable diastolic heart failure

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Abstract | Constrictive pericarditis can result from a stiff pericardium that prevents satisfactory diastolic filling. The distinction between constrictive pericarditis and other causes of heart failure, such as restrictive cardiomyopathy, is important because pericardiectomy can cure constrictive pericarditis. Diagnosis of constrictive pericarditis is based on characteristic haemodynamic and anatomical features determined using echocardiography, cardiac catheterization, cardiac MRI, and CT. The Mayo Clinic echocardiography and cardiac catheterization haemodynamic diagnostic criteria for constrictive pericarditis are based on the unique features of ventricular interdependence and dissociation of intrathoracic and intracardiac pressures seen when the pericardium is constricted. A complete pericardiectomy can restore satisfactory diastolic filling by removing the constrictive pericardium in patients with constrictive pericarditis. However, if inflammation of the pericardium is the predominant constrictive mechanism, anti-inflammatory therapy might alleviate this transient condition without a need for surgery. Early diagnosis of constrictive pericarditis is, therefore, of paramount clinical importance. An improved understanding of how constrictive pericarditis develops after an initiating event is critical to prevent this diastolic heart failure. In this Review, we discuss the aetiology, pathophysiology, and diagnosis of constrictive pericarditis, with a specific emphasis on how to differentiate this disease from conditions with similar clinical presentations.
Constriction or Restriction

Mitral inflow E/A > 0.8
Dilated inferior vena cava

Yes

Ventricular septal with respect

No

Mitral medial e’

>8 cm/s
Constrictive Pericarditis

<6 cm/s
Restrictive Cardiomyopathy

<6 cm/s
Mixed Constriction Restriction

6 - 8 cm/s

E/A = 4

Further imaging or cardiac catheterization if constrictive pericarditis still suspected

Medial e’ = 2 cm/sec, Lateral e’ = 5 cm/sec

Mitral lateral e’ < medial e’
(Annulus Reversus)

Hepatic vein expiratory end-diastolic reversal velocity / forward flow velocity ≥ 0.8

Most likely constriction

Definite constriction

Also possible in obstructive airways disease especially young patients (↑ inspiratory SVC flow seen)
Case #2
67 year old Man Hx Hodgkin's Lymphoma Heart Failure, Ascites, Edema and AS Valve Clinic for TAVR
What observation do you make?

1. Large v wave
2. Rapid x descent
3. Rapid y descent
4. Rapid x and y descent
Jugular Venous Pressure

Normal

Constriction

Tricuspid Valve
67 year old Man Hx Hodgkin's lymphoma, HF and AS
Valve Clinic for TAVR

Stroke volume = \((1.9)^2 \times 0.785 \times 21 = 60\) cc

AVA = \(60 / 76 = 0.8\) cm\(^2\)
67 year old Man Hx Hodgkin's lymphoma, HF and AS
Valve Clinic for TAVR
Mitral Annulus Tissue Doppler

- Medial:
  - E = 100 cm/s
  - A = 50 cm/s
  - E/A = 2
  - DT = 169 ms
  - e’ Medial = 8 cm/s

- Lateral:
  - Medial e’ = 6 cm/s
67 year old Man Hx Hodgkin's lymphoma, HF and AS
Valve Clinic for TAVR
Hepatic Vein Doppler

IVC = 2.5 - 3 cm
What is the major underlying problem?

1. Constriction due to radiation HD
2. RCM due to radiation HD
3. Mixed RCM and CP due to radiation HD
4. Valvular HD causing diastolic dysfunction

Constrictive Pericarditis Due to Radiation Heart Disease
Constriction or Restriction

Mitra inflow E/A > 0.8 + Dilated inferior vena cava

Yes

Constriction / Restriction unlikely

No True Septal Motion Abnormality

Ventricular septal motion abnormality with restriction

Medial e' = 8

Mitral medial e'

>8 cm/s

Constrictive Pericarditis

Lateral e' < Medial e'

Mitral lateral e' < medial e'

(Annulus Reversus)

Hepatic vein expiratory end-diastolic reversal velocity / forward flow velocity ≥ 0.8

Definite constriction

Restrictive Cardiomyopathy

Mixed Constriction Restriction

<6 cm/s

Most likely constriction

A = 50 cm/s
E/A=2

E = 100 cm/s

Further imaging pericarditis still suspected
IVC Flow

IVC = 2.5 – 3 cm

IVC Reversal Flow/Forward Flow = 0.9
Recording (subcostal window) Hepatic Vein
Pulsed-wave Doppler

Hepatic Vein Doppler Patterns

Constriction

Myocardial Disease

Severe TR
Case #3
65 yo man with Pleural Effusion

- CABG 9 months ago
- Increasing dyspnea 6 weeks after the surgery
- Underwent 7 thoracenteses, chest tube and pleurodesis
- Referred to our pulmonary section
- ↑JVP, rapid X & Y descents
65 yo man with Pleural Effusion
65 yo man with Pleural Effusion

What to do next?

1. Hemodynamic Cardiac Catheterization
2. Surgical consultation
3. TEE
4. More images
Other Constriction Mimics with Respiratory Variations and Septal Shift

- Pleural Effusion
- COPD
- Obesity
- Pulmonary Embolism
Differential of Respiratory Variation
SVC Can Help

Our Patient’s SVC Profile

Constriction

Pleural Effusion
History and exam

2DE Doppler

Classic presentation
- Septal shift & shudder
- Restrictive filling
- Mitral flows variation
- HV Dilated & Expiratory reversal
- Annulus TDI
History and exam

2DE Doppler

Surgery
History and exam

2DE Doppler

Equivocal findings

Only 75% of the time

Surgery
85% thick Pericardium

23% Ca++

Restriction? Or Constriction?
CMR in Constriction

Dynamic MRI sequences
- Septal bounce

Dynamic MRI sequences
- Septal Shift

Anavekar N. The International Journal of Cardiovascular Imaging 2013
Restriction vs. Constriction
Cardiac Catheterization: LV and RV

Restriction

Constriction

Concordance
Ventricular Independence

Discordance
Ventricular Interdependence

Nishimura RA. Heart 86: 619, 2001
Complete Pericardiectomy

Courtesy of Jae Oh
Case 5
57 year old Female, retired CFO

• New York Heart Association functional class III
• Hx of Hodgkin's lymphoma age 25
• 3 episodes of pleurisy or pericarditis ‘07, ‘11, July 2015 all treated with NSAID
• Fall ‘15 Presents with to GI with elevated LFTs and peripheral edema, increase abdominal girth, lethargy and chest pain, dyspnea, chest pain & pleural effusion and 500 cc removed
57 year old Female, retired CFO with Chest Pain, Heart Failure and Increased LFTs

- Exam BP 100/79 mmHg Pulse 113
- Vessels: see movie
- Heart: mid diastolic sound, no murmurs, apex nondisplaced or sustained
- Lungs: dullness at both bases
- Abdomen: slight hepatomegaly
- Peripheral examination: revealed 1+ sacral edema, 2+ pedal edema to the mid tibia bilaterally and at the ankles
What additional sign do you see here?
Neck vein exam shows?

1. Rapid x & y decent
2. Rapid x & y descent and v wave
3. Rapid x & y descent and Kushmal’s sign
4. Normal JVP
57 year old Female, retired CFO with Chest Pain, Heart Failure and Increased LFTs

Labs

- Sed Rate 30 l/hr
- hsCRP 53 mg/l
57 year old Female, retired CFO with Chest Pain, Heart Failure and Increased LFTs
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57 year old Female, retired CFO with Chest Pain, Heart Failure and Increased LFTs
What would you do next?

1. Start NSAID
2. Cardiac MR
3. Hemodynamic catheterization
4. Cardiac surgical consult for pericardiectomy
CMR On Presentation

- Edema
- Sensitive Images
- Delayed Enhancement
- Pericardial Thickness
- Free Breathing
How would you treat this patient?

1. NSAID and Colchicine
2. Steroids and Colchicine
3. Pericardectomy
4. Interferon
Sinak Rules

1. Radiation heart disease has a bad outcome
2. If you think you can improve that go back to rule #1

Treatment

1. Prednisone taper
2. Colchicine
3. Prilosec and Bactrim (until prednisone < 20 mg)
Edema Sensitive Images  Delayed Enhancement  Pericardial Thickness  Free Breathing

1-22-2016

2-21-2017
Take – Home Point

- A subset of patients with constrictive pericarditis may be treated medically
- Indicted by increased inflammatory markers
- Inflammation in the pericardium by MRI
- Recent onset
Structural Heart Disease

Echocardiographic Diagnosis of Constrictive Pericarditis
Mayo Clinic Criteria

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Background—Constrictive pericarditis is a potentially reversible cause of heart failure that may be difficult to differentiate from restrictive myocardial disease and severe tricuspid regurgitation. Echocardiography provides an important opportunity to evaluate for constrictive pericarditis, and definite diagnostic criteria are needed.

Methods and Results—Patients with surgically confirmed constrictive pericarditis (n=130) at Mayo Clinic (2008–2010) were compared with patients (n=36) diagnosed with restrictive myocardial disease or severe tricuspid regurgitation after constrictive pericarditis was considered but ruled out. Comprehensive echocardiograms were reviewed in blinded fashion. Five principal echocardiographic variables were selected based on prior studies and potential for clinical use: (1) respiration-related ventricular septal shift, (2) variation in mitral inflow E velocity, (3) medial mitral annular e’ velocity, (4) ratio of medial mitral annular e’ to lateral e’, and (5) hepatic vein expiratory diastolic reversal ratio. All 5 principal variables differed significantly between the groups. In patients with atrial fibrillation or flutter (n=29), all but mitral inflow velocity remained significantly different. Three variables were independently associated with constrictive pericarditis: (1) ventricular septal shift, (2) medial mitral e’, and (3) hepatic vein expiratory diastolic reversal ratio. The presence of ventricular septal shift in combination with either medial e’ ≥ 9 cm/s or hepatic vein expiratory diastolic reversal ratio ≥ 0.79 corresponded to a desirable combination of sensitivity (87%) and specificity (91%). The specificity increased to 97% when all 3 factors were present, but the sensitivity decreased to 64%.

Conclusions—Echocardiography allows differentiation of constrictive pericarditis from restrictive myocardial disease and severe tricuspid regurgitation. Respiration-related ventricular septal shift, preserved or increased medial mitral annular e’ velocity, and prominent hepatic vein expiratory diastolic flow reversals are independently associated with the diagnosis of constrictive pericarditis. (Circ Cardiovasc Imaging. 2014;7:526-534.)
Final Points: Constrictive Pericarditis

Echo Diagnosis

- Septal motion
- Restrictive MV Flow Velocity
- Hepatic Vein Diastolic reversal with expiration
- Medial e’ 12 cm/s
- Lateral e’ 6 cm/s
Take-home Points
Constrictive Pericarditis

- Consider constriction in all patients with heart failure and normal ejection fraction.

- Mayo Clinic Echo Criteria
  - Septal motion abnormality
  - Medial e’ 8 cm/s or greater (Medial > lateral e’)
  - Hepatic vein diastolic flow reversal

- COPD, BMI & Pleural Effusions
  - SVC

- Discordant data cath for LV/RV systolic pressure discordance
Thank You!

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