Constrictive Pericarditis
Curable Paradoxical Diastolic Heart Failure
ASE EBRC 2018

May 8th, 2018

Constrictive Pericarditis
Contents

• Clinical features and Diagnostic criteria
  • Symptoms and signs
  • Imaging
  • Hemodynamics
  • Echo Diagnosis
  • Constriction Mimickers
• Effusive-constrictive Pericarditis
• Management
• Summary
Constrictive Pericarditis
Symptoms/Signs & Exam Findings

- Right Heart Failure
- Ascites
- Edema
- Abdominal pain
- JVP elevation with Kussmaul
- Rapid “y” descent of JVP
- Pericardial Knock (S3)
- Pleural effusion

Constrictive Pericarditis
Traditional Imaging and Hemodynamic Features

- Pericardial calcification (CXR and CT)
- Increased pericardial thickness (Echo, CT, and MRI)
- Hemodynamics by Cath
  - Increased RA pressure with rapid “y” descent
  - Equalization of LV/RV end-diastolic pressures
  - Dip and Plateau (M or W pattern)
  - Pulmonary artery systolic pressure < 50 mmHg
  - High ratio between RV end-diastolic and systolic pressure
Constrictive Pericarditis

**Calcific Constrictive Pericarditis: Is It Still with Us?**

Lieng H. Ling, MBBS, MRCP; Jae K. Oh, MD; Jerome F. Breen, MD; Hartzell V. Schaff, MD; Gordon K. Danielson, MD; Douglas W. Mahoney, MSc; James B. Seward, MD; and A. Jamil Tajik, MD

Ling et al AIM 2000

**Constrictive Pericarditis in 26 Patients With Histologically Normal Pericardial Thickness**

Deepak R. Talreja, MD; William D. Edwards, MD; Gordon K. Danielson, MD; Hartzell V. Schaff, MD; A. Jamil Tajik, MD; Henry D. Tazelaar, MD

Talreja, Oh et al. Circulation 2003
Constriction vs Restrictive Myocardial Disease
Traditional Hemodynamic Data Comparison

- Equalization LV/RV End-diastolic pressure
- Pulmonary artery systolic pressure (PASP) \( \leq 50 \text{ mmHg} \)
- RVEDP / PASP \( \geq 1/3 \)

Vaitkus and Kussmaul AHJ 1991
Talreja, Nishimura et al. JACC 2008

Differentiation of Constrictive Pericarditis and Restrictive Cardiomyopathy by Doppler Echocardiography

Liv K. Hatle, MD, Christopher P. Appleton, MD, and Richard L. Popp, MD

Constrictive Pericarditis (N=7)
Restrictive Cardiomyopathy (N=11)

"Dissociation between Intracardiac and Intrathoracic Pressure"

Hatle et al. Circulation 1989
Constrictive Pericarditis
Mitral Inflow vs Cath

Dissociation between intrathoracic and intracardiac pressures
Differential ventricular filling with respiration

Hemodynamics in Constriction
Intracardiac pressure $\Delta <$ intrathoracic pressure $\Delta$
Interventricular dependence
Constriction
Ventricular Septal Motion Abnormality
“Consider constriction if there is septal motion abnormality in patients with HF and preserved EF (HFpEF)”

Doppler was diagnostic for CP in 22 of 25 (88%) patients who were proven to have constriction at the time of operation

Echo Dx of Constriction
1. Abnormal Septal Motion
2. Restrictive Mitral Inflow with Respiratory Variation > 25%
3. Hepatic Vein Diastolic Flow Reversals with Expiration

Oh et al JACC 1994
Diastolic Function Assessment by Echo

e’ velocity reflects LV relaxation


Differentiation of Constrictive Pericarditis From Restrictive Cardiomyopathy: Assessment of Left Ventricular Diastolic Velocities in Longitudinal Axis by Doppler Tissue Imaging

MARIO J. GARCIA, MD, LEONARDO RODRIGUEZ, MD,* MIGUEL ARES, MD,* BRIAN P. GRIFFIN, MD,* JAMES D. THOMAS, MD, FACC,* ALLAN L. KLEIN, MD, FACC

JW Ha et al AJC 2004
Using mitral ‘annulus reverse’ to diagnose constrictive pericarditis

Christina S. Reuss¹, Susan M. Wilansky¹, Steven J. Lester¹, Joan L. Lusk¹, Diane E. Grill², Jae K. Oh³, and A. Jamil Tajik³*

Medial e’ = 12 cm/s  Lateral e’ = 8 cm/s

Echo Diagnostic Criteria

Echocardiographic Diagnosis of Constrictive Pericarditis: Mayo Clinic Criteria
Terrence D. Welch, Lieng H. Ling, Raul E. Espinosa, Nandan S. Anavekar, Heather J. Wiste, Brian D. Lahr, Hartzell V. Schaff and Jae K. Oh

Echo Diagnostic Criteria

Septal motion abnormality
Hepatic Vein Diastolic reversal with expiration
MV Flow Velocity Restrictive (E/A >1)
Medial e’ ≥ 8 cm/s

Sensitivity 87 %
Specificity 91 %

Welch et al Circ Imaging 2014
Illustrative Cases
Diagnosis and Management

71 year old man with dyspnea 2 years after CABG

• Physical Examination
  • JVP elevation
  • Prominent S3
  • Peripheral edema

• Cath: Equalized end-diastolic pressures
• CT was obtained: Calcified Pericardium
71 year old man with calcified pericardium

Medial e' = 5 cm/s
Mitral inflow E= 80  A= 20 cm/s

Amyloidosis

Constrictive Pericarditis in the Modern Era
Novel Criteria for Diagnosis in the Cardiac Cath Laboratory
(Talreja, Nishimura, Oh, Holmes. Jan. 2008 JACC)

Discordant change
Constriction

Concordant change
Restrictive CM
52 year old man with NYHA 3-4 waiting for heart transplantation
(had Echo, Cath, and MRI)
You just took over his care in HF service. What would you do?

1= Pericardiectomy  2= Transplantation  3= Myocardial Bx  4=Repeat Cath
5= A long talk with previous staff and surgeon
Case # 1

27 yo man with fatigue and dyspnea

- Sep. 2015…Flu-like symptoms, treated with inhaler
- Oct. 2015…Pre-syncopy and palpitation
  - Pericardial rub
  - Pericardial effusion on Echo
  - Treated with Ibuprofen 2400 mg/d
  - Colchicine 0.6 mg BID
- Not feeling better and CRP 60
- Underwent pericardial window
27 year old man underwent a window

Referred to Mayo

• Pericardial fluid …studies were negative
• Not feeling better
• RUQ abdominal pain and fatigue
• U/S…Enlarged gallbladder and liver
• Consideration of cholecystectomy

Interventricular Dependence and IVC Plethora
Constrictive Pericarditis
27 yo man after pericardial window

Hepatic Vein Expiratory Diastolic Flow Reversal

Mitral Inflow

Mitral e’ = 15 cm/sec

Subacute Effusive-Constrictive Pericarditis

By E. W. Hancock, M.D.

Circulation, Volume XLIII, February 1971

Pre procedure

Post procedure

Miranda et al. Heat 2015
• 205 consecutive patients with pericardiocentesis
• ECP was diagnosed in 33 (16%)
  • More frequent hemo-pericardium (33% vs 13%)
  • Higher % of neutrophils
  • Baseline medial mitral annulus e’ higher
  • Expiratory diastolic flow reversal in HV more frequent
• 2 required pericardiectomy in 3.8 year follow-up
### Transient Constriction

<table>
<thead>
<tr>
<th></th>
<th>Reversible (N=14)</th>
<th>Persistent (N=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>54 ± 17</td>
<td>59 ± 16</td>
</tr>
<tr>
<td>LVEF (%)</td>
<td>57 ± 3</td>
<td>60 ± 3</td>
</tr>
<tr>
<td>E’ (cm/sec)</td>
<td>12 ± 1</td>
<td>11 ± 1</td>
</tr>
<tr>
<td>Steroid Rx</td>
<td>71 %</td>
<td>53 %</td>
</tr>
<tr>
<td>Pericardium</td>
<td>3.8 ± 0.6 mm</td>
<td>4.0 ± 0.6 mm</td>
</tr>
<tr>
<td>DE Pericardium</td>
<td>4.4 ± 0.4 mm</td>
<td>2.1 ± 0.4 mm</td>
</tr>
<tr>
<td>Grade 3-4/4 DE</td>
<td>93 %</td>
<td>33 %</td>
</tr>
<tr>
<td>Sed rate</td>
<td>45 to 4</td>
<td>25 to 20</td>
</tr>
<tr>
<td>CRP</td>
<td>75 to 2</td>
<td>14 to 15</td>
</tr>
</tbody>
</table>

### Transient Constrictive Pericarditis

*One week of Steroid Rx*
Heart failure with ascites and leg edema
Referred for TV repair

Diastolic Flow Reversals in the HV

Hepatic Vein Doppler is a Key

Constriction

Myocardial Disease

Severe TR
67 year old man with severe AS came for AVR

**Low Flow Low Gradient AS**

- LVOT TVI = 21 cm
- LVOT D = 1.9 cm
- MG 26 mmHg

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

AVA = \(60 / 76 = 0.79\) cm²

---

67 year old man with heart failure and LFLG AS

**Mitral Annulus Tissue Doppler**

- E = 100 cm/s
- Medial e’ = 9 cm/s
- Lateral e’ = 6 cm/s
67 year old man with AS and Constriction

Hepatic Vein Doppler c/w constriction

Radiation Heart Disease

Valvular Heart Disease

Low-Flow, Low-Gradient Severe Aortic Stenosis in the Setting of Constrictive Pericarditis
Clinical Characteristics, Echocardiographic Features, and Outcomes

Michael Y.C. Tsang, MD; Jin-Oh Choi, MD, PhD; Barry A. Borlaug, MD; Kevin L. Greason, MD; Stephen S. Chu, MSc; Rick A. Nishimura, MD; Jae K. Oh, MD

Constriction with Atrial Fibrillation

Medial e' = 11 cm/s

Lateral e' = 7 cm/s
Constriction with A. Fibrillation After Cardioversion

A 27 yo woman with dyspnea
Marked Septal Motion Abnormality
A 27 yo woman with dyspnea

Constrictive Pericarditis?

1. E’ is increased
2. Septal motion abnormality
3. Mitral inflow variation

A 27 yo woman with dyspnea

Pulsus Paradoxus with Asthma

Mitral Inflow

E’ = 10 cm/sec

IVC

HV
Constrictive vs COPD/Asthma
SVC Flow Velocities

COPD

Constriction


Pericardiectomy at Mayo Clinic
The first cardiac surgery in 1936
Pericardiectomy at Mayo Clinic
The first cardiac surgery in 1936

Reprinted from The Southern Surgeon,

Pericardiectomy

Courtesy of W. Edwards, MD

Courtesy of H. Schaff, MD
Pericardiectomy for Constrictive Pericarditis at Mayo Clinic (n=1,066)

- It affords the explanation of a group of symptoms and signs
- It obviates confusion with other conditions
- Expert thoracic surgery may now lead to cure what was once a hopeless disease

The establishment of the diagnosis of CP has a three-fold importance:

1. It affords the explanation of a group of symptoms and signs
2. It obviates confusion with other conditions
3. Expert thoracic surgery may now lead to cure what was once a hopeless disease

P.D. White  The Lancet 1935

©2018 MFMER  |  3712003-47
Constriction vs Restriction
Take Home Points

• Dx of Constriction should be based on hemodynamics
  • Restrictive mitral inflow with or without respiratory variation
  • Preserved or increased medial mitral e’
  • Respiratory variation of septal motion
  • Hepatic vein expiratory diastolic flow reversal
• Under-diagnosed and mis-diagnosed

Pericardial Diseases Team
Department of CV Diseases

Cardiology
• Nandan Anavekar, MD
• Raul Espinosa, MD
• Sharonne Hayes, MD
• Garvan Kane, MD
• Allen Luis, MD
• Rowlen Melduni, MD
• William Miranda, MD
• Jae Oh, MD

Cardiac Surgery
• Kevin Greason, MD
• Hartzell Schaff, MD
• Josheph Dearani, MD
• John Stulak, MD
• Rocky Daily, MD

Cardiac Pathology
• Joseph Maleszewski, MD

Rheumatology
• Eric Matteson, MD
• Kevin Moder, MD

Imaging
• Eric Williamson, MD
• Phillip Young, MD

CV Echo Lab
• James Glockner, MD

Fellows (Old and Current)
• JW Ha, MD
• Michel Senni, MD
• Gabriella Veress, MD
• Lieng Ling, MD
• Smonporn Boonyaratavej, MD
• Terrence Welch, MD
• F. Syed, MD
• Dali Feng, MD
• D. Talreja, MD
• WM Soo, MD
• J. Dal-Bianco, MD
• F. Syed, MD
• J. Dal-Bianco, MD
• J. Dal-Bianco, MD
Questions & Discussion