Endocarditis and Its Complications: The Role of Echocardiography

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Disclosures

✓ No relevant financial disclosures
Endocarditis

- > 50,000 cases/yr in US (47,000 Medicare hospitalizations/year)
- Left sided - Majority of cases
- Highest mortality and complication rate

☑ Review
  - Guidelines for prophylaxis
  - Diagnosis and indications for TEE
  - Identification of complications
  - Prognostic (echocardiographic) features
  - Indications for surgery

ICE-PCS

☑ 4100+ hospitalized cases of IE with CHF
☑ 30% 1 month mortality
☑ 33% of patients with advanced CHF (Class III or IV)
☑ In-hospital mortality of IE (without CHF) 13%

Keifer T et al. JAMA 2011
Prevention

✓ Antibiotic prophylaxis recommended:
  – Prosthetic heart valves or prosthetic material valve repair
  – History of endocarditis
  – Heart transplant with abnormal valve function
  – Certain congenital heart defects
    • Cyanotic heart disease, not fully repaired
    • Within 6 months of repair of defect
    •Repairs with residual defects and/or leaks

American Heart Association 2007

Infective Endocarditis Prophylaxis

NOT recommended for:
  – Transesophageal echocardiography
  – EGD
  – Colonoscopy
  – Cystoscopy without ongoing infection

Regardless of valvular/endocarditis risk
2017 AHA/ACC Focused Update

- Antibiotic prophylaxis before dental procedures now is also recommended for:
  - Patients with transcatheter prosthetic valves, and for
  - Patients with prosthetic material used in valve repair
    - Annuloplasty rings and/or artificial chords
  - Class IIa, Level of Evidence [LOE] C-LD

Nishimura RA et al. 2017 AHA/ACC Focused Update of 2014 Guidelines
Diagnosis

- At least 2 sets of blood cultures
- Modified Duke Criteria for suspected IE
- Transthoracic recommended in those with suspected IE
  - Assess for vegetations
  - Assess hemodynamic severity of valve lesions
  - Assess cardiac function
  - Re-evaluation for clinical change/symptoms

Nishimura et al. Valvular Heart Disease Guidelines, JACC 2014

Modified Duke Criteria

- Definite infective endocarditis
  - Clinical Criteria
    - 2 Major criteria, or
    - 1 Major criterion and 3 minor criteria, or
    - 5 Minor criteria
  - Major criteria
    - Blood culture positive
    - Typical microorganism for IE (multiple variations)
    - Endocarditis by imaging study

Circulation 2005;111:e394-434
Echocardiography Criteria

✔ Evidence of endocarditis
  – Oscillating intracardiac mass on valve or supporting structures, in the path of regurgitant jets, or on implanted material in the absence of an alternative anatomic explanation, or
  – Abscess, or
  – New partial dehiscence of prosthetic valve, or
  – New valvular regurgitation

Circulation 2005;111:e394-434
Rule Out Endocarditis!

- Negative or non-diagnostic TTE
  - TEE if clinical suspicion high
  - If TEE negative and clinical suspicion persists
    - REPEAT studies at 5-12 days
    - Vegetations or abscess may now be present
    - If still negative, look for another source
      • Pacemaker, vascular grafts, catheters, PDA
      • CIED (Cardiac Implantable Electronic Device) Infections

Rule out Endocarditis!

47 yo Female, IV drug abuse, +Blood cultures (MRSA), persistent fevers.
## Echocardiography

### Transthoracic
- Resolution ~ 3-4 mm
- Sensitivity: 62-82%
- Specificity: 91-100%
- Readily available, usual initial test of choice

### Transesophageal
- Resolution ~ 1-2 mm
- Sensitivity: 87-100%
- Specificity: 91-100%
- Greater (3-4x) sensitivity for prosthetic valves


## Case

58 yo Female, chronic IV drug abuse presents with fever and malaise. +Blood cultures (MSSA). Acute HF
Post-Op

- Surgery:
  - Totally endoscopic robotic repair
  - P3 Resection
  - Pericardial patch repair
  - Mitral annuloplasty ring
  - No significant MR
Old Habits Die Hard

3 Years Later

Leaflet Aspect

✓ Infective endocarditis
  – More commonly seen on the **upstream aspect**
    • Ventricular surface of AV with AI
    • Atrial surface of MV with MR
  – Usually at a site of endothelial damage

✓ **Downstream Aspect**
  – Usually a degenerative finding
  – Papillary fibroelastoma
  – Chordal structure (MV)
  – Less likely associated with significant regurgitation
47yo Male presenting with acute DVT and PE
Upstream or Downstream?

TEE
Case

49 yo Male with a progressive mandibular infection and +Blood cultures (Strep pneumo)

Natural History

3 Days Later
Surgery

1 Week Later

Underwent a Ross procedure (pulmonary autograft) with aortic root reconstruction

Complications of IE

- Leaflet perforation
- **Aortic root abscess**
- Annular perforation
- **Fistula formation**
- Embolism
- **Purulent pericarditis**
- Hardware infection
- Erosion
Glossary

<table>
<thead>
<tr>
<th></th>
<th>Surgery/necropy</th>
<th>Echocardiography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fistula</td>
<td>Communication between two neighbouring cavities through a perforation.</td>
<td>Colour-Doppler communication between two neighbouring cavities through a perforation.</td>
</tr>
<tr>
<td>Valve aneurysm</td>
<td>Saccular outpouching of valvular tissue.</td>
<td>Saccular bulging of valvular tissue.</td>
</tr>
<tr>
<td>Dehiscence of a prosthetic valve</td>
<td>Dehiscence of the prosthesis.</td>
<td>Paravalvular regurgitation identified by TTE/TOE, with or without rocking motion of the prosthesis.</td>
</tr>
</tbody>
</table>

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<tr>
<th></th>
<th>Surgery/necropy</th>
<th>Echocardiography</th>
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</thead>
<tbody>
<tr>
<td>Abscess</td>
<td>Perivalvular cavity with necrosis and purulent material not communicating with the cardiovascular lumen.</td>
<td>Thickened, non-homogeneous perivalvular area with echodense or echolucent appearance.</td>
</tr>
<tr>
<td>Pseudoaneurysm</td>
<td>Perivalvular cavity communicating with the cardiovascular lumen.</td>
<td>Pulsatile perivalvular echo-free space, with colour-Doppler flow detected.</td>
</tr>
</tbody>
</table>

Indications for Early Surgery

- Valve dysfunction/ADHF
- Resistant organisms: Staph Aureus, Fungus
- Heart block or abscess formation
- Large mobile vegetation
- Persistent positive blood cultures
- Prosthetic valve endocarditis
- Fungal endocarditis
- Recurrent embolization
Case

18 yo Female present with an acute L MCA stroke and lower extremity thromboembolism. Negative blood cultures. New dx SLE

Treated with SC Lovenox. Returned for followup TEE. Moderate aortic insufficiency (improved).
Dx: Libman-Sacks Endocarditis
Differential Diagnosis

- Vegetation
  - Infective vs. non-infective/marantic
- Lambl’s excrescence
- Papillary fibroelastoma (PFE)
- Thrombus
- Ruptured chord
- Valvular strands
- Myxomatous

Case

74 yo Male with prior TAVR Sapien THV aortic valve presents with a cold left arm

Urgent embolectomy. + Blood cultures (Strep)
Unable to perform TEE due to scleroderma esophagitis. Cardiac CT and Intracardiac echocardiogram performed to better characterize valve.

Intracardiac Echocardiography

Treated with IV antibiotics and oral anticoagulation
6 Month Follow Up

Endocarditis vs. Thrombosis

Subclinical leaflet thrombosis in surgical and transcatheter bioprosthetic aortic valves: an observational study

Taren Chakraverty, Lars Søndergaard, John Friedman, Ole De Becker, Daniel Berman, Klaus F Kofod, Hassan Ashkouri, Tatsuhiko Shiota, Vigal Abramowitz, Tove H Jørgensen, Tanya Rami, Shajied Issac, Gregory Fontana, Martina de Kuijt, Andreas Fuchs, Patrick Lyden, Alfredo Trento, Deepak L Bhatt, Martin B Leon, Raj R Mokkapati, on behalf of the RESOLVE and SAVORY Investigators

DAPT

Oral Anticoagulation

Chakraverty et al. Lancet 2017
Size, Mobility and Embolic Events

DiSalvo et al. JACC 2001

Location, Location, Location

Villacosta et al. JACC 2002
Case

✓ 68 yo male
  – Bioprosthetic MVR for IE (4 months ago)
  – Severe LV dysfunction, LVEF 10-15%
  – CKD on HD, T2DM, Prior CVA

Fever, chills, SOB, rigors; Staph epi multiple culture bottles
Weaned from CPB on 3 inotropes, IABP then suffered seizure and large MCA territory CVA, pupils fixed and dilated. Expired.
Prosthetic Valve Endocarditis

Piper et al. BMJ 2001

Table 1  Microbiology of early and late PVE. Authors’ own findings compared to a recent European literature review³

<table>
<thead>
<tr>
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<th>Early PVE (%)</th>
<th>Late PVE (%)</th>
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<tbody>
<tr>
<td></td>
<td>Own experience (n=34)</td>
<td>Europe (n=68)</td>
</tr>
<tr>
<td>Staphylococcus epidermidis</td>
<td>29</td>
<td>43</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>18</td>
<td>13</td>
</tr>
<tr>
<td>Streptococci</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Enterococci</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>HACEK</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>Fungi</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Mixed infections</td>
<td>6</td>
<td>–</td>
</tr>
<tr>
<td>Others</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Culture negative</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

*Viridans group n=13 (10%), β haemolytic streptococci n=3 (2%), and Streptococcus bovis n=4 (3%).
HACEK, Haemophilus, Actinobacillus, Cardiobacterium, Eikinella, Kingella.

Prosthetic Valve Endocarditis

- Perivalvular regurgitation
- Dehiscence/rocking motion
- Bulging of the annulus
- Necessitates TEE
ASCeXAM Focus

- Review
  - Guidelines for prophylaxis
  - Diagnosis and indications for TEE
  - Identification of complications
  - Prognostic (echocardiographic) features
  - Indications for surgery

ASCeXAM Focus

- Appropriate indications for TEE in IE
- Echocardiographic features of vegetations as described in modified Duke criteria
- Complications of IE and terminology
- Follow-up study if high suspicion and initial study negative
Thank You!