Native Valve Endocarditis and its Complications

SCVP and Binford-Dammin Society of Infectious Disease Pathologists
Shared Companion Meeting
USCAP 2017 Annual Meeting

Mathieu C. Castonguay, MD, FRCP(C)
March 5, 2017

Outline

• Basics of infective endocarditis
• Epidemiology
• Clinical features
• Pathologic features
• Complications
• Differential diagnoses

Basics

• Definition
  • bacterial or fungal infection of the endocardium
  • usually valvular
    • native (NVE) or prosthetic (PVE) valves

Disclosures

Relevant financial relationships
• None

Off-label usage
• None

Outline

• Basics of infective endocarditis
• Epidemiology
• Clinical features
• Pathologic features
• Complications
• Differential diagnoses

Basics

• Historical overview (“We cannot escape history”)
  • first description (1646, Lazare Rivière)
  • A. Lincoln, 1862

“... round carbuncles ... resembled a cluster of hazelnuts and filled the opening of the aorta ...”
Basics

• Historical overview
  • “valvular vegetation” (1806, Jean-Nicolas Corvisart)

“... perfect resemblance to venereal nodules and cauliflowers ... that their nature may be syphilitic”

Basics

• Historical overview
  • “valvular vegetation” (1806, Jean-Nicolas Corvisart)

Basics

• Historical overview
  • “endocarditis” (1835, Jean-Baptiste Bouillaud)

Coined the word “endocardium”

Basics

• Historical overview
  • emboli (1852, William Senhouse Kirkes)

Endocarditis as a disease with multi-systemic manifestations

Basics

• Historical overview
  • emboli (1852, William Senhouse Kirkes)

Basics

• Historical overview
  • parasitic disease (1869, Emanuel Winge)

“filaments ... entangled with micro-organisms ... short round beads or tiny sticks ...”
Basics

- Historical overview
  - acute and chronic forms (1885, William Osler)

- Pathogenesis
  - bacteremia
    - mucosal or cutaneous entry points

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Epidemiology

- General (developed world)
  - annual incidence 3-10/100,000
  - M : F > 2 : 1
  - 15-20% in-hospital mortality
  - ~ 40% one-year mortality
  - > 25% healthcare-acquired
  - > $120,000/patient (US)

Epidemiology

- Predisposing conditions
  - structural abnormalities
  - rheumatic disease
  - congenital heart disease
  - unrepaired cyanotic
  - congenitally BAV
  - myxomatous mitral valve disease
  - degenerative fibrocalcific aortic valve disease

Epidemiology

- Predisposing conditions
  - structural abnormalities
  - intracardiac devices
  - coexisting conditions
    - diabetes mellitus
    - HIV infection
    - hemodialysis
    - IVDU

Epidemiology

- Predisposing conditions
  - structural abnormalities
  - intracardiac devices
  - coexisting conditions
  - recent invasive procedure
  - previous endocarditis

Epidemiology

- Predisposing conditions
  - 50% none identified
Epidemiology

- Sites of involvement (clinical)

<table>
<thead>
<tr>
<th>Sites of involvement (clinical)</th>
<th>Epidemiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites of involvement (surgical pathology)</td>
<td>Epidemiology</td>
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</table>

<table>
<thead>
<tr>
<th>Table 8: Vegetation Findings in 2781 Patients With Definite Endocarditis</th>
<th>Table 2: Patient age, sex, and valve function versus valve site for 310 infected native valves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetation present</td>
<td>Native valve site</td>
</tr>
<tr>
<td>AV</td>
<td>Mitral</td>
</tr>
<tr>
<td>248 (8.9%)</td>
<td>1638 (57.1%)</td>
</tr>
<tr>
<td>MV</td>
<td>1122 (41.3%)</td>
</tr>
<tr>
<td>TV</td>
<td>359 (12%)</td>
</tr>
<tr>
<td>PV</td>
<td>1122 (41.3%)</td>
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</tbody>
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Modified from Arch Intern Med 2009; 169: 463-473

- Sites of involvement (surgical pathology)

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<tr>
<td>Staphylococcus</td>
<td>Epidemiology</td>
</tr>
<tr>
<td>S. aureus</td>
<td>Epidemiology</td>
</tr>
<tr>
<td>30% of cases (stable)</td>
<td>Epidemiology</td>
</tr>
<tr>
<td>aggressive disease</td>
<td>Epidemiology</td>
</tr>
<tr>
<td>healthcare-related infections</td>
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<td>IVDU</td>
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Modified from Cardiovasc Pathol 2013; 22: 19-27

- Microbiology

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<tr>
<td>coagulase-negative staphylococci</td>
<td>Epidemiology</td>
</tr>
<tr>
<td>10% (increasing)</td>
<td>Epidemiology</td>
</tr>
<tr>
<td>antibiotic resistance</td>
<td>Epidemiology</td>
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<tr>
<td>aggressive disease</td>
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<td>Streptococcus</td>
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</tr>
<tr>
<td>oral (viridans) streptococci</td>
<td>Epidemiology</td>
</tr>
<tr>
<td>20% (decreasing)</td>
<td>Epidemiology</td>
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<td>invasive dental procedures</td>
<td>Epidemiology</td>
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- Microbiology

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<tr>
<td>oral (viridans) streptococci</td>
<td>Epidemiology</td>
</tr>
<tr>
<td>other streptococci</td>
<td>Epidemiology</td>
</tr>
<tr>
<td>10%</td>
<td>Epidemiology</td>
</tr>
<tr>
<td>group D (S. gallolyticus) colorectal ca</td>
<td>Epidemiology</td>
</tr>
</tbody>
</table>
Epidemiology

- Microbiology
  - Staphylococcus
  - Streptococcus
  - Enterococcus
- 10%
- GU/GI

Epidemiology

- Microbiology
  - Staphylococcus
  - Streptococcus
  - Enterococcus
  - HACEK organisms
  - zoonoses
  - fungal
  - others
- 5-10%

Epidemiology

- Microbiology
  - polymicrobial
  - 1-2%

Epidemiology

- Microbiology
  - polymicrobial
  - culture negative
  - 10-20%
  - recent antibiotic use
  - fastidious organism
  - may decrease with better identification methods

Epidemiology

- Changes

Epidemiological Trends of Infective Endocarditis: A Population-Based Study in Olmsted County, Minnesota

DANIEL D. QURESHI, MD, LISA M. HUEGENER, MD, MS; NATHAN S. ANDERSON, MB, BCH; JASON C. SCHULZ, MD; JENNIFER M. THOMAS, MD; BRIAN D. LARIMORE, MD; ADAM BUCHHOLZ, MD; STEVEN PAYNE, MD; WALTER R. WILSON, MD, and LARRY M. RICHOUR, MD

Epidemiology

• Changes

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Age (yrs)</td>
<td>37.9 ± 17.6</td>
<td>40.2 ± 16.7</td>
<td>40.1 ± 16.6</td>
<td>39.8 ± 16.7</td>
<td>39.3 ± 16.2</td>
<td>0.001</td>
</tr>
<tr>
<td>Sex</td>
<td>Male: 13,296 (58.1%)</td>
<td>13,221 (57.8%)</td>
<td>13,205 (57.8%)</td>
<td>13,247 (57.8%)</td>
<td>13,154 (57.5%)</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>White: 18,555 (80.7%)</td>
<td>18,401 (80.3%)</td>
<td>18,388 (80.3%)</td>
<td>18,429 (80.3%)</td>
<td>18,335 (80.2%)</td>
<td></td>
</tr>
</tbody>
</table>

Increasing incidence and mortality of infective endocarditis: a population-based study through a record-linkage system

Ugo Fredrii1, Elena Schnau2, Dao Bui6F6, Giampiero Petizzi4, Paola Sciacca1


Epidemiology

• Changes

Outline

• Basics of infective endocarditis
  • Epidemiology
  • Clinical features
  • Pathologic features
  • Complications
  • Differential diagnoses

Clinical Features

• Presentation
  • protean
  • constitutional features of infection
    • fever, sweats
    • fatigue
    • anorexia
    • weight loss
    • joint pain

BMC Infect Dis 2011; 11: 48

Clinical Features

• Presentation
  • protean
  • constitutional features of infection
    • fever, sweats
    • fatigue
    • anorexia
    • weight loss
    • joint pain

BMC Infect Dis 2011; 11: 48
Clinical Features

- Presentation
  - protean
  - constitutional features of infection
  - cardiac findings
  - new/changed murmur
  - heart failure
  - new conduction abnormality

Clinical Features

- Diagnostic criteria
  - modified Duke
  - definite IE (clinical criteria)
    - 3 major
    - 1 major + 3 minor
    - 5 minor
  - definite IE (pathologic criteria)
    - micro-organism by culture or histology
    - pathologic lesion confirmed by histology

Clinical Features

- Presentation
  - protean
  - constitutional features of infection
  - cardiac findings
  - vascular phenomena
  - emboli

Clinical Features

- Diagnostic criteria
  - modified Duke
  - definite IE (clinical criteria)
    - 3 major
    - 1 major + 3 minor
    - 5 minor
  - definite IE (pathologic criteria)
    - micro-organism by culture or histology
    - pathologic lesion confirmed by histology

<table>
<thead>
<tr>
<th>Major criteria</th>
<th>Minor criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood cultures</td>
<td>Predisposing condition</td>
</tr>
<tr>
<td>Endocardial involvement</td>
<td>Fever</td>
</tr>
<tr>
<td>Echocardiographic</td>
<td>Vascular phenomenon</td>
</tr>
<tr>
<td>New regurgitation</td>
<td>Immunologic phenomenon</td>
</tr>
<tr>
<td></td>
<td>Microbiological evidence</td>
</tr>
</tbody>
</table>
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Pathologic Features

- Local
  - vegetations

Pathologic Features

- Local
  - vegetations
  - a growth or excrescence of any sort
  - specifically, a clot, composed largely of fused blood platelets, fibrin, and sometimes microorganisms, adherent to a diseased heart orifice or valve, and often initiated by infection of the structures involved

Stedman's Medical Dictionary, 27th Edition

Pathologic Features

- Local
  - vegetations

Source: dreamicus.com/vegetation.html
Pathologic Features
• Local
  • vegetations

H&E, 1X

Pathologic Features
• Local
  • vegetations

Elastic, 1X

Pathologic Features
• Local
  • vegetations

H&E, 10X

Pathologic Features
• Local
  • vegetations

Elastic, 2X

Pathologic Features
• Local
  • vegetations

H&E, 20X

Pathologic Features
• Local
  • vegetations

H&E, 40X

Pathologic Features
• Local
  • vegetations -- healing

H&E, 2X

Pathologic Features
• Local
  • vegetations

H&E, 100X

Pathologic Features
• Local
  • vegetations

S. mitis

Pathologic Features
• Local
  • vegetations

Prev MV annuloplasty (H40)

Pathologic Features
• Local
  • vegetations

MV prolapse

Pathologic Features
• Local
  • vegetations

LV, RV
Pathologic Features

• Local
  • vegetations -- healing

Pathologic Features

• Local
  • vegetations

Pathologic Features

• Local
  • vegetations

Pathologic Features

• Local
  • vegetation

Pathologic Features

• Local
  • vegetation

Pathologic Features

• Local
  • vegetation
Pathologic Features

• Local
  • vegetation
    • frequently submitted to microbiology first
    • cultures, molecular studies
    • may not get infected material in surg path lab
  • integration of all available data is key

Pathologic Features

• Local
  • perforation

Pathologic Features

• Local
  • perforation -- healed

Table 7
Clinical and pathologic features in 300 infected native valves

<table>
<thead>
<tr>
<th>Feature</th>
<th>Native valve site</th>
<th>Aortic</th>
<th>Mitral</th>
<th>Tri</th>
<th>Pulm</th>
<th>Cox AV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perforation</td>
<td></td>
<td>1/18</td>
<td>5/57</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>1/18</td>
</tr>
</tbody>
</table>

Modified from Cardiovasc Pathol 2013; 22: 19-27

Pathologic Features

• Local
  • valve aneurysm
Pathologic Features

• Local
  • effect on valve function
    • regurgitation
    • stenosis
    • combined

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• Differential diagnoses

Complications

• Cardiac
  • abscess (may progress to fistula)
Complications

- Cardiac
  - rupture (cord or papillary muscle)

Complications

- Cardiac
  - cusp prolapse

Complications

- Cardiac
  - septic myocarditis/vasculitis

Complications

- Cardiac
  - myocardial infarction (embolic)

Complications

- Cardiac
  - pericarditis

Complications

- Systemic
  - emboli
Outline

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Differential diagnoses

• Non-bacterial thrombotic endocarditis (NBTE)
  • sterile valve thrombi
  • risk factors
    • structurally abnormal valves
    • hypercoagulable states
    • endothelial damage

Differential diagnoses

• Non-bacterial thrombotic endocarditis (NBTE)

Differential diagnoses

• Non-bacterial thrombotic endocarditis (NBTE)

Differential diagnoses

• Fenestrations
  • age-related degenerative change (semilunar valves)
  • no functional significance
**Differential diagnoses**

- Fenestrations

![Image 1: Fenestrations](image1)

- Valvular dysplasia
  - congenitally abnormal valves

![Image 2: Valvular dysplasia](image2)

- Valvular dysplasia

![Image 3: Valvular dysplasia](image3)

- Valvular dysplasia

![Image 4: Valvular dysplasia](image4)

- Traumatic perforation
  - iatrogenic
  - other

![Image 5: Traumatic perforation](image5)
Differential diagnoses

- Traumatic perforation

---

Differential diagnoses

- Traumatic perforation

---

Differential diagnoses

- Traumatic perforation

---

Differential diagnoses

- Traumatic perforation

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