Infective Endocarditis: Medical vs. Surgical Treatment
The Surgeon’s perspective

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Medical Management or Surgery?

Infective Endocarditis is a FATAL DISEASE
Notoriously Difficult to Treat

WHY?
IE is a FATAL DISEASE
CASE: 49 year old male

- Severe burn to > 20% of his body
- Respiratory failure - 3 weeks on vent
- Bacteremia: Serratia and MRSA
- Cardiogenic Shock, Hypoxemia, Pulmonary Edema, Systemic Pulmonary Artery Pressure
- 2nd degree heart block

Medical Management or Surgery?
Native valve endocarditis
CASE: Chest X-ray 49 yo male, Serratia & MRSA

Medical Management or Surgery?
Endocarditis Survival
Natural and Modified History

% 

0 2 4 6 8 10 12
Months

Staph Aureus Acute IE
Strep Viridans Sub Acute IE

+ Surgical
Medical

GP, SH, NS, EHB 2017
Probability of success with medical therapy in endocarditis

- PVE
- NVE

Presymptomatic stage

Time from onset of infection

Shrestha 2017
Medical Management or Surgery?

This is the Wrong Question when it is a matter of Operate or let die and

Everyone gets Medical Treatment!
Cleveland Clinic Surgery for Active IE 2002-2015
Infectious Endocarditis (IE) Disease Stages

- Bacteremia & Endocardial damage (Valve Disease)
- Adherence
- Vegetations / Biofilm
- Embolism
- Release of Enzymes
- Tissue Disintegration
  - Cusps and Leaflets
  - Invasion & Destruction
Difficult to treat: Organisms Hide and Thrive in Vegetations / Biofilm

- Biofilm matrix protects organism
- Planktonic cells / Persister cells
- Quorum sensing / Resistance genes

Wozniak DJ, Parsek MR. F1000Prime Rep 2014
Native Valve Endocarditis
Prosthetic Valve Endocarditis
A-V block caused by RA Invasion and His bundle and A-V Node destruction!

LVOT
LVOT
LCA
RCA
CS
AVN
AVN
Medical treatment YES!
What can the Surgeon add?

- Remove infected necrotic tissue and foreign material
- Restore cardiac integrity
- Restore valve function

and thereby makes the patient and infection curable and...

- Removes a source of embolism
Current Indications for Surgery

- Heart failure / valve regurgitation
- Unresponsive sepsis
- Advanced invasive pathology
- Infected prosthetic valve
- Large mobile vegetations, >10-15mm
- Recurrent Sepsis/IE and Prosthetic Valve
Current Hesitations / Delays

• Neurological complication, Cerebral bleeding
• Patient is TOO old, TOO sick …
• Active local & systemic infection
• TOO difficult surgery, TOO high risk
  – Highest Mortality Valve Surgery
• Questionable benefit, Lack of RCTs:
  – Referral, Selection and Survival bias
2012 - Finally ONE randomized trial!


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# N = 76

<table>
<thead>
<tr>
<th>Valve involved</th>
<th>Conventional Treatment (N = 39) no. (%)</th>
<th>Early Surgery (N = 37) no. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitral</td>
<td>23 (59)</td>
<td>22 (59)</td>
</tr>
<tr>
<td>Aortic</td>
<td>11 (28)</td>
<td>11 (30)</td>
</tr>
<tr>
<td>Aortic and mitral</td>
<td>5 (13)</td>
<td>4 (11)</td>
</tr>
<tr>
<td>Vegetation diameter</td>
<td>14.1±3.5</td>
<td>13.5±3.2</td>
</tr>
</tbody>
</table>

**Valvular disease:**

- Sev. stenosis: 3 (8) vs. 1 (3)
- Sev. regurgitation: 36 (92) vs. 36 (97)

*Kang et al, N ENGL MED 2012*
Probability of Death, Embolism, or recurrent IE – Very Different!

Kang et al, N ENGL MED 366;26 June 2012

Conventional treatment

Early surgery

$P = 0.009$ by log-rank test

$P = 0.009$ by log-rank test

Kang et al, N ENGL MED 366;26 June 2012
Outcomes after Conventional Treatment, N = 39

- Died 1
- Urgent surgery 27
- Discharged 11
  - Sudden death 1
  - Surgery 3
    - Recurrent IE 1
  - Symptomatic 4
  - Remained asymptomatic 3

Kang et al, N ENGL MED 2012
Implications of Kang’s RCT:

• Validated current Class I Indications
• Large Vegetations and Severe Valve Dysfunction: **Operate, don’t wait!**
• Well designed RCTs are possible

• …and DO impress and move the medical community!
...and there seems to be minimal penalty to be paid for operating for IE in the active phase!

(...unless the Organism is Insensitive to given Anti Microbial Treatment!)
Residual Surgical Issues

• Neurological complications

• Other embolic complications
  – Spleen, spine, other
  – Mycotic aneurysms

• High early mortality
  – Highest risk valve surgery!
IE & STROKE: Early vs. Delayed Surgery?
No Dogmas – risk vs. benefits!

Considerations for Early vs Delayed Surgery

Early Surgery
- High Embolic Risk
  - Vegetation > 10mm
  - Mobile Vegetation
  - Mitral Valve Vegetation (Anterior Leaflet)
- Virulent Species
  - *S. Aureus and Fungal*
- Cerebral Abscess
- Prosthetic Valve Endocarditis
- Heart Failure

Delayed Surgery
- Decreased Level of Consciousness/Coma
- Ongoing Sepsis
- Low Life Expectancy/ Multi-Organ Failure
- Ruptured Infectious Aneurysm
CCF Active Left-sided IE 2002-12

n = 773

- 18% Aortic & Mitral
- 31% Mitral
- 51% Aortic
Isolated Aortic Valve IE (AV)

n = 395

58% PVE

41% NVE

1% Previous Repair
Isolated Mitral Valve IE (MV)

n = 237

9% Previous Repair

28% PVE

63% NVE
Survival: Native vs. Prosthetic Valve IE

% survival over years for Native Valve Event (NVE) and Prosthetic Valve Event (PVE) with a p-value of 0.6.
Survival: Non-Invasive vs. Invasive IE

Non-Invasive

Invasive

$\rho = 0.01$
Non-Invasive vs. Invasive IE by Valve

Non-Invasive

Invasive

Aortic $P = .75$
Mitral $P = .001$
AV+MV $P = .02$
MV: Non-Invasive vs. Invasive IE

Non-Invasive

Invasive

\( p=0.001 \)
MV Patients’ Propensity Scores (55)

55 matched pairs:
Blue = AV
Green = MV
Non-Invasive vs. Invasive: AV vs. MV (Matched vs. Unmatched)
2. MV Pathology:
MV Invasion is to AV grove!
Invasive Disease by Involved Valve

Invasion only on left side!

- Aortic: 68% Invasive, 32% Non-Invasive
- Mitral: 35% Invasive, 65% Non-Invasive
- AV+MV: 69% Invasive, 31% Non-Invasive
- Right Sided: 0.7% Invasive, 99.3% Non-Invasive
Right-Sided IE

- More often I.V. Drug Use
- Septic Pulmonary Embolism
- Non-Invasive / Still *Staph. Aureus*
- Indications for surgery
  - Large Vegetations / Embolism Prevention
  - Severe TR with CHF and elevated PVR / low CO
IE SURGERY IS NOT EASY:
4 months post 2nd Homograft reoperation for endocarditis – dehisced homograft!
Reoperation or Hospice??
Pitfalls
Pitfalls

- Too Late - Preoperative Stroke
- Too Early - Hemorrhagic stroke
- Organism insensitive to given antimicrobial
- Incomplete debridement
- Missed invasive lesions = Incomplete debridement
- Misinterpretation of Anatomy and Pathology
The Surgeons cannot avoid Referral and Survival Bias!

- Referral bias = Appropriate patient selection!
- Survival bias = Surgeons can only consider surgery on live patients!
Endocarditis Survival
Natural and Modified History

% vs Months

- Staph Aureus Acute IE
- Strep Viridans Sub Acute IE
- + Surgical
- Medical

GP, SH, NS, EHB 2017
Probability of success with medical therapy in endocarditis

Probability of success

Time from onset of infection

Presymptomatic stage

PVE

NVE

Shrestha 2017
Once there is an indication for surgery – OPERATE!

- Leaky valves won’t become competent!
- Disintegrated tissue will not regrow!
- Infective endocarditis is not a reason to postpone an operation otherwise indicated but the opposite!
Should all PVE be Treated Surgically?

Yes, unless

- very recent onset
- uncertain diagnosis and good valves
- ...and minimal echo findings, bacteremia cleared, no further embolic events, and patient is well!
- prohibitively high surgical risk
  - Low expectation of success and close follow up
Success with endocarditis surgery requires experience, lots of experience!
Thank You!