Gerald Sotsky, MD: Disclosures

- No financial disclosures
• Rising incidence
• 40,000-50,000 new cases per year (USA)
• Surgery performed in 50-60% cases
• High 1 year mortality unchanged
ENDOCARDITIS 2019

- Multidisciplinary Endocarditis Team
- Antibiotic Prophylaxis
  - BAV, MVP, HCM
- Health Care Associated Endocarditis
  - Invasive Procedures, TAVR, CIED, Opioid epidemic
- Early Surgery/ Neurologic Complications
Clinical Practice Guideline: Focused Update

2017 AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease

A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines

Developed in Collaboration With the American Association for Thoracic Surgery, American Society of Echocardiography, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Anesthesiologists, and Society of Thoracic Surgeons
# 2017 Update of 2014 AHA/ACC Guidelines

## Multispecial Endocarditis Team

<table>
<thead>
<tr>
<th>COR</th>
<th>LOE</th>
<th>Recommendations</th>
<th>Comment/Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>B</td>
<td>Decisions about timing of surgical intervention should be made by a multispecialty Heart Valve Team of cardiology, cardiothoracic surgery, and infectious disease specialists (255).</td>
<td>2014 recommendation remains current.</td>
</tr>
<tr>
<td>I</td>
<td>B</td>
<td>Early surgery (during initial hospitalization before completion of a full therapeutic course of antibiotics) is indicated in patients with IE who present with valve dysfunction resulting in symptoms of HF (256-261).</td>
<td>2014 recommendation remains current.</td>
</tr>
<tr>
<td>I</td>
<td>B</td>
<td>Early surgery (during initial hospitalization before completion of a full therapeutic course of antibiotics) is indicated in patients with left-sided IE caused by S. aureus, fungal, or other highly resistant organisms (261-268).</td>
<td>2014 recommendation remains current.</td>
</tr>
<tr>
<td>I</td>
<td>B</td>
<td>Early surgery (during initial hospitalization before completion of a full therapeutic course of antibiotics) is indicated in patients with IE complicated by heart block, annular or aortic abscess, or destructive penetrating lesions (261,269-273).</td>
<td>2014 recommendation remains current.</td>
</tr>
<tr>
<td>I</td>
<td>B</td>
<td>Early surgery (during initial hospitalization before completion of a full therapeutic course of antibiotics) for IE is indicated in patients with evidence of persistent</td>
<td>2014 recommendation remains current.</td>
</tr>
</tbody>
</table>
Inception of the ‘endocarditis team’ is associated with improved survival in patients with infective endocarditis who are managed medically: findings from a before-and-after study

Amit Kaura,1,2 Jonathan Byrne,1 Amanda Fife,3 Ranjit Deshpande,1 Max Baghai,1 Margaret Gunning,1 Donald Whitaker,1 Mark Monaghan,1 Philip A MacCarthy,1 Olaf Wendler,1 Rafal Dworakowski1
MULTIDISCIPLINARY ENDOCARDITIS TEAM

• 196 consecutive patients (UK) with IE 2009-15
• Period 1: prior to Endocarditis Team (ET)
  Period 2: after Endocarditis Team (ET)
• ET: CTS, 2 Cardiologists, Microbiologist, Cardiac Imager, Nurse Coordinator

Regular multidisciplinary meetings to confirm diagnosis, inform type and duration of antibiotic therapy, recommend early surgery when indicated
MULTIDISCIPLINARY ENDOCARDITIS TEAM

MEDICALLY TREATED MOST SURVIVAL BENEFIT AT 2 MONTHS

SURGICALLY TREATED

Figure 2: Kaplan-Meier survival curves comparing survival between both time periods according to management strategy. Survival in patients with infective endocarditis managed (A) medically and (B) surgically in the periods with (solid line) and without (dotted line) involvement of the endocarditis team (ET). Ticks denote censored events. Differences between the curves evaluated with the log-rank statistic.
MULTIDISCIPLINARY ENDOCARDITIS TEAM

RESULTS (Post ET vs Pre ET)

- Reduced time to IE specific antibiotic therapy
- Reduced time to surgery
- 1 year survival benefit

Medically treated patients: 43% vs 67%
Surgically treated patients: 81 vs 86%
Better survival in medically treated group may be related to improved patient selection for surgery especially in patients with persistent sepsis
MULTIDISCIPLINARY ENDOCARDITIS TEAM

- International Collaboration on Endocarditis-Prospective Cohort Study (ICE-PCS): 24% with left sided IE and surgical indication did not have surgery (poor prognosis, hemodynamically unstable, stroke, sepsis, surgeon declined)

A standardised multidisciplinary team approach may lead to earlier diagnosis of IE, more appropriate individualised management strategies, expedited surgery, where indicated, and improved survival in those patients chosen for medical management.
ENDOCARDITIS 2019

- Multidisciplinary Endocarditis Team
- Antibiotic Prophylaxis
  - BAV, MVP, HCM
- Health Care Associated Endocarditis
  - Invasive Procedures, TAVR, CIED, Opioid epidemic
- Early Surgery/ Neurologic Complications
American Heart Association

Prevention of Rheumatic Fever and Bacterial Endocarditis Through Control of Streptococcal Infections*

By Committee on Prevention of Rheumatic Fever and Bacterial Endocarditis, Charles H. Rammelkamp, Chairman

This article is the second revision of the American Heart Association statement on the prevention of rheumatic fever issued January 1953. This statement was prepared by the Committee on Prevention of Rheumatic Fever and Bacterial Endocarditis appointed by the Council on Rheumatic Fever and Congenital Heart Disease of the American Heart Association. The committee is cognizant of the fact that no recommendations of any group can be final at this time. The present approach may not be the eventual solution of the problem of preventing rheumatic fever. Revisions and changes will be made as new knowledge may indicate.

RHEUMATIC fever is a recurrent disease which in most instances can be prevented. Since both the initial and recurrent attacks of the disease are precipitated by infections with group A streptococci, prevention of rheumatic fever and rheumatic heart disease depends upon the control of streptococcal infections. This may be accomplished by (1) early and making a positive diagnosis and assure adequate treatment.

The accurate recognition of individual streptococcal infections, their adequate treatment and the control of epidemics in the community presently offer the best means of preventing initial attacks of rheumatic fever.
<table>
<thead>
<tr>
<th>Year (Reference)</th>
<th>Primary Regimens for Dental Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955 (6)</td>
<td>Aqueous penicillin 600 000 U and procaine penicillin 600 000 U in oil containing 2% aluminum monostearate administered IM 30 minutes before the operative procedure</td>
</tr>
<tr>
<td>1957 (7)</td>
<td>For 2 days before surgery, penicillin 200 000 to 250 000 U by mouth 4 times per day. On day of surgery, penicillin 200 000 to 250 000 U by mouth 4 times per day and aqueous penicillin 600 000 U with procaine penicillin 600 000 U IM 30 to 60 minutes before surgery. For 2 days after, 200 000 to 250 000 U by mouth 4 times per day.</td>
</tr>
<tr>
<td>1960 (8)</td>
<td>Step I: prophylaxis 2 days before surgery with procaine penicillin 600 000 U IM on each day Step II: day of surgery: procaine penicillin 600 000 U IM supplemented by crystalline penicillin 600 000 U IM 1 hour before surgical procedure Step III: for 2 days after surgery: procaine penicillin 600 000 U IM each day</td>
</tr>
<tr>
<td>1965 (9)</td>
<td>Day of procedure: procaine penicillin 600 000 U, supplemented by crystalline penicillin 600 000 U IM 1 to 2 hours before the procedure For 2 days after procedure: procaine penicillin 600 000 U IM each day</td>
</tr>
<tr>
<td>1972 (10)</td>
<td>Procaine penicillin G 600 000 U mixed with crystalline penicillin G 200 000 U IM 1 hour before procedure and once daily for the 2 days after the procedure</td>
</tr>
<tr>
<td>1977 (11)</td>
<td>Aqueous crystalline penicillin G (1 000 000 U IM) mixed with procaine penicillin G (600 000 U IM) 30 minutes to 1 hour before procedure and then penicillin V 500 mg orally every 6 hours for 8 doses.</td>
</tr>
<tr>
<td>1984 (12)</td>
<td>Penicillin V 2 g orally 1 hour before, then 1 g 6 hours after initial dose</td>
</tr>
<tr>
<td>1990 (13)</td>
<td>Amoxicillin 3 g orally 1 hour before procedure, then 1.5 g 6 hours after initial dose</td>
</tr>
<tr>
<td>1997 (1)</td>
<td>Amoxicillin 2 g orally 1 hour before procedure</td>
</tr>
</tbody>
</table>
AHA Guideline

Prevention of Infective Endocarditis
Guidelines From the American Heart Association
A Guideline From the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group

Walter Wilson, MD, Chair; Kathryn A. Taubert, PhD, FAHA; Michael Gewitz, MD, FAHA; Peter B. Lockhart, DDS; Larry M. Baddour, MD; Matthew Levison, MD; Ann Bolger, MD, FAHA; Christopher H. Cabell, MD, MHS; Masato Takahashi, MD, FAHA; Robert S. Baltimore, MD; Jane W. Newburger, MD, MPH, FAHA; Brian L. Strom, MD; Lloyd Y. Tani, MD; Michael Gerber, MD; Robert O. Bonow, MD, FAHA; Thomas Pallasch, DDS, MS; Stanford T. Shulman, MD, FAHA; Anne H. Rowley, MD; Jane C. Burns, MD; Patricia Ferrieri, MD; Timothy Gardner, MD, FAHA; David Goff, MD, PhD, FAHA; David T. Durack, MD, PhD

The Council on Scientific Affairs of the American Dental Association has approved the guideline as it relates to dentistry. In addition, this guideline has been endorsed by the American Academy of Pediatrics, Infectious Diseases Society of America, the International Society of Chemotherapy for Infection and Cancer,* and the Pediatric Infectious Diseases Society.
2007 Revised AHA Recommendations

- No clinical trial proving efficacy
- Concern about adverse reactions to antibiotics
- Concern about antibiotic resistance
- 2007 AHA: High risk patients (Complex congenital heart disease, Prosthetic valves, Prior IE) / invasive dental procedures
- 2009 ESC: Similar recommendations
- 2008 UK NICE: Complete cessation of AB Prophlax
Antibiotic Prophylaxis and Incidence of Endocarditis Before and After the 2007 AHA Recommendations

Martin H. Thornhill, MBBS, BDS, PhD, a, b Teresa B. Gibson, PhD, c Eli Cutler, PhD, c Mark J. Dayer, MBBS, PhD, d Vivian H. Chu, MD, a Peter B. Lockhart, DDS, b Patrick T. O’Gara, MD, f Larry M. Baddour, MD f
HIGH RISK GROUP
INITIAL SMALL DEC Rx
SIGNIF INC IE INCID

INTERMED RISK GROUP
INITIAL LARGE DEC Rx
SMALL INC IE INCID

LOW/UNKNOWN RISK GROUP
INITIAL MODERATE DEC Rx
IE INCID UNCHANGED
POST 2007 AHA RECOMMENDATIONS

Significant decrease in antibiotic prescription

- Largest decrease in moderate risk - not to zero
- Decrease in low/unknown risk – not to zero
- Decrease in high risk - ?? confusion about rec’s

Increase in IE incidence

- Greatest in high risk group
- Small increase in moderate risk group despite large dec in rx

?? Possibility that some considered moderate risk may benefit from prophylaxis
Infective Endocarditis in Patients With Bicuspid Aortic Valve or Mitral Valve Prolapse

Isabel Zegri-Reiriz, MD, PhD, Aristides de Alarcón, MD, PhD, Patricia Muñoz, MD, PhD, Manuel Martínez Sellés, MD, PhD, Víctor González-Ramallo, MD, PhD, Jose M. Miro, MD, PhD, Carles Falces, MD, PhD, Claudia Gonzalez Rico, MD, Xabier Kortajarena Urkola, MD, José Antonio Lepe, MD, Regino Rodriguez Alvarez, MD, Jose Maria Reguera Iglesias, MD, Enrique Navas, MD, Fernando Dominguez, MD, PhD, Pablo Garcia-Pavia, MD, PhD, for the Spanish Collaboration on Endocarditis—Grupo de Apoyo al Manejo de la Endocarditis infecciosa en España (GAMES)

ABSTRACT

BACKGROUND There is little information concerning infective endocarditis (IE) in patients with bicuspid aortic valve (BAV) or mitral valve prolapse (MVP). Currently, IE antibiotic prophylaxis (IEAP) is not recommended for these conditions.

OBJECTIVES This study sought to describe the clinical and microbiological features of IE in patients with BAV and MVP and compare them with those of IE patients with and without IEAP indication, to determine the potential benefit of IEAP in these conditions.

METHODS This analysis involved 3,208 consecutive IE patients prospectively included in the GAMES (Grupo de Apoyo al Manejo de la Endocarditis infecciosa en España) registry at 31 Spanish hospitals. Patients were classified as high-risk IE with IEAP indication (high-risk group; n = 1,226), low- and moderate-risk IE without IEAP indication (low/moderate-risk group; n = 1,839), and IE with BAV (n = 54) or MVP (n = 89).
INFECTIVE ENDOCARDITIS
BAV/MVP

GAMES (Grupo de Apoyo al Manejo de la Endocarditis Infecciosa en Espana) registry

- 31 Spanish hospitals
- 3,208 consecutive pts with IE; Jan 2008-Sept 2016
- 54 IE pts with BAV  89 IE pts with MVP
- 1226 pts (38%) high risk with IEAP indication
- 1839 pts (62%) low/moderate risk- no IEAP
INFECTIVE ENDOCARDITIS
BAV/MVP

Bicuspid Aortic Valve

- 65% with moderate-severe aortic valve dysfunction
- Most common organism Strep viridans (35%)
- Most common portal of entry - oral cavity
- Intracardiac complications and CHF common
- Cardiac surgery indicated in 76% of cases
- Mortality (in-hospital) 5.6%
INFECTIVE ENDOCARDITIS
BAV/MVP

Mitral Valve Prolapse

- 56% moderate-severe MR
- Most common organism Strep viridans
- Most common portal of entry oral cavity
- Intracardiac complications and CHF common
- Cardiac surgery indicated in 63%
- In hospital mortality 10%
**CENTRAL ILLUSTRATION:** Infective Endocarditis in Bicuspid Aortic Valve and Mitral Valve Prolapse


Isabel Zegri-Reiriz et al. JACC 2018;71:2731-2740
Infective endocarditis in hypertrophic cardiomyopathy
A multicenter, prospective, cohort study

Fernando Domínguez, MD,a Antonio Ramos, MD, PhD b Emilio Bouza, MD, PhD, c, d Patricia Muñoz, MD, PhD, c, d
Maricela C. Valerio, MD, c, d M. Carmen Fariñas, MD, PhD, e José Ramón de Berrazuela, MD, f Jesús Zarauza, MD, PhD, g Juan Manuel Pericás Pulido, MD, PhD, h Juan Carlos Paré, MD, PhD, i Arístides de Alarcón, MD, PhD, j
Dolores Sousa, MD, PhD, k Isabel Rodríguez Bailón, MD, l Miguel Montejo-Baranda, MD, PhD, m
Mariam Noureddine, MD, n Elisa García Vázquez, MD, o and Pablo Garcia-Pavia, MD, PhD a, p, *

Monitoring Editor: Susanna Esposito.

> Author information > Article notes > Copyright and License information Disclaimer
IE in HCM patients (group 1) compared with IE patients with indication for IE antibiotic prophylaxis (group 2).

<table>
<thead>
<tr>
<th>Suspected predisposing factor, %</th>
<th>HCM (n = 26)</th>
<th>IE with prophylaxis indicated (n = 696)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental</td>
<td>16 (61.5%)</td>
<td>278 (40.1%)</td>
<td>0.023</td>
</tr>
<tr>
<td>Genitourinary</td>
<td>5 (22.7%)</td>
<td>41 (6.0%)</td>
<td>0.002</td>
</tr>
<tr>
<td>Cutaneous</td>
<td>0 (0.0%)</td>
<td>25 (3.5%)</td>
<td>0.359</td>
</tr>
<tr>
<td>Vascular</td>
<td>2 (9.1%)</td>
<td>30 (4.4%)</td>
<td>0.300</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>3 (11.5%)</td>
<td>112 (16.1%)</td>
<td>0.675</td>
</tr>
<tr>
<td>Respiratory</td>
<td>0 (0.0%)</td>
<td>42 (6.1%)</td>
<td>0.257</td>
</tr>
<tr>
<td>Others</td>
<td>3 (11.5%)</td>
<td>31 (4.5%)</td>
<td>0.271</td>
</tr>
<tr>
<td>Etiology, %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staphylococcus coagulase negative</td>
<td>5 (19.2%)</td>
<td>175 (25.1%)</td>
<td>0.491</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>7 (28.9%)</td>
<td>103 (14.8%)</td>
<td>0.091</td>
</tr>
<tr>
<td>Enterococcus spp.</td>
<td>1 (3.8%)</td>
<td>100 (14.4%)</td>
<td>0.129</td>
</tr>
<tr>
<td>Streptococcus spp.</td>
<td>10 (38.5%)</td>
<td>152 (21.8%)</td>
<td>0.046</td>
</tr>
<tr>
<td>Others</td>
<td>0 (0.0%)</td>
<td>103 (14.8%)</td>
<td>0.122</td>
</tr>
<tr>
<td>Negative blood cultures</td>
<td>2 (7.7%)</td>
<td>63 (9.1%)</td>
<td>0.812</td>
</tr>
</tbody>
</table>
INFECTIVE ENDOCARDITIS

HYPERTROPHIC CARDIOMYOPATHY

- HCM: 18-28 times risk of IE compared to general population.
- HCM with obstruction: 48-80 times risk of IE compared to general population

GAMES REGISTRY IE in HCM patients: conclusions

- Mitral valve most commonly affected
- Strep most common causative organism (almost 40%)
- Oral cavity most common site of entry
INFECTIVE ENDOCARDITIS
BAV/MVP/HCM

- Aggressive clinical course with intracardiac complications similar to high-risk cardiac conditions and more than low/intermediate risk groups
- High rate of Strep viridans group
- High rate of dental origin
- ??? IEAP
ENDOCARDITIS 2019

- Multidisciplinary Endocarditis Team
- Antibiotic Prophylaxis
  - BAV, MVP, HCM
- Health Care Associated Endocarditis
  - Invasive Procedures, TAVR, CIED, Opioid epidemic
- Early Surgery/ Neurologic Complications
LAW OF UNINTENDED CONSEQUENCES
HEALTH CARE ASSOCIATED INFECTIVE ENDOCARDITIS

- >25% cases health care acquired
- Changing demographic
  Older, sicker patients (Cancer, ESRD, COPD, IVDU, Immunosuppression)
- Catheters (CVP, Hemodialysis)
- Medical devices including CIED’s
- Staph most frequent causative organism
Invasive Procedures Associated With the Development of Infective Endocarditis

Imre Janszky, MD, PhD, a,b Katalin Gémes, PhD, c Staffan Ahnve, MD, PhD, c Hilmir Asgeirsson, MD, PhD, a,b,c Jette Möller, PhD c

ABSTRACT

BACKGROUND Various invasive medical procedures might induce bacteremia and, hence, act as triggers for infective endocarditis. However, empirical data in humans on the potential dangers of invasive medical procedures in this regard are very sparse. Due to lack of sufficient data, it is currently debated whether the risk for endocarditis with medical procedures is substantial or rather negligible.

OBJECTIVES The purpose of this nationwide case-crossover study was to quantify the excess risk for infective endocarditis in association with invasive medical and surgical procedures.

METHODS The authors identified all adult patients treated for endocarditis in hospitals in Sweden between January 1,
INVASIVE PROCEDURES ASSOCIATED WITH DEVELOPMENT OF INFECTIVE ENDOCARDITIS

- ALL PTS WITH ENDOCARDITIS IN HOSPITALS IN SWEDEN 1998-2011
- COMPARED OCCURRENCE OF INVASIVE MEDICAL PROCEDURES 12 WEEK PERIOD BEFORE ENDOCARDITIS WITH CORRESPONDING 12 WEEK PERIOD 1 YEAR PRIOR
- 7013 TOTAL CASES OF ENDOCARDITIS
- MULTIPLE PROCEDURES ASSOCIATED WITH INCREASED RISK OF ENDOCARDITIS INCLUDING CABG, TRANSFUSION, DIALYSIS, BONE MARROW PUNCTURE, BRONCHOSCOPY
- CONCLUSION: SIGNIFICANTLY ELEVATED RELATIVE RISK FOR ENDOCARDITIS IN THE 12 WEEKS AFTER COMMON INVASIVE MEDICAL PROCEDURES
30% OF IE PATIENTS WITH RECENT EXPOSURE TO HEALTHCARE THERAPEUTIC PROCEDURES: CTS, SKIN AND WOUND PROCEDURES, HD, TRANSFUSIONS, DIAGNOSTIC PROCEDURES: BM PUNCTURE, CARDIAC CATH, BRONCOSCOPY


Imre Janszky et al. JACC 2018;71:2744-2752
INVASIVE PROCEDURES ASSOCIATED WITH DEVELOPMENT OF INFECTIVE ENDOCARDITIS

- Reconsideration of antibiotic prophylaxis prior to high risk procedures
- Improvement of aseptic techniques before and during procedures
- Increased awareness of increased risk in the after procedures may lead to earlier diagnosis and higher likelihood of successful treatment
INFECTIVE ENDOCARDITIS
TAVR

- 250 Cases of IE after TAVR (Infective Endocarditis after TAVR International Registry)
- Incidence 1.1% per patient-year
- Median 5.3 months post procedure
- High mortality
INFECTIVE ENDOCARDITIS
TAVR

Diagnosis of Infective Endocarditis After TAVR
Value of a Multimodality Imaging Approach

Erwan Salaun, MD, Laura Sportouch, MD, Pierre-Antoine Barral, MD, Sandrine Hubert, MD, Cécile Lavoute, PhD, Anne-Claire Casalta, MD, Julie Pradier, MD, Daniel Ouk, MD, Jean-Paul Casalta, MD, Marc Lambert, MD, Frédérique Gouriet, MD, PhD, Jean-Yves Gaubert, MD, Aurélie Dehaene, MD, Alexis Jacquier, MD, PhD, Laetitia Tessonnier, MD, Julie Haentjens, PhD, Alexis Theron, MD, Alberto Riberi, MD, Serge Cammilleri, MD, PhD, Dominique Grisoli, MD, Nicolas Jaussaud, MD, Frédéric Collart, MD, Jean-Louis Bonnet, MD, Laurence Camoin, PhD, Sebastien Renard, MD, Thomas Cuisset, MD, PhD, Jean-François Avierinos, MD, PhD, Hubert Lepidi, MD, Olivier Mundler, MD, PhD, Didier Raoult, MD, PhD.
INFECTIVE ENDOCARDITIS

TAVR

- 16 pts post TAVR suspicious for IE: 10 confirmed; 1 possible; 5 rejected

- Multi-imaging approach to diagnosis:

  - Echo: major Duke criteria (vegetations, paravalvular lesions) in 5 pts; new regurgitation in 1 pt

  - Echo: Leaflet thickening (70%) and increased mean gradient (80%) in cases of definite IE
INFECTIVE ENDOCARDITIS

TAVR

- CT: Major criteria (abscess, pseudoaneurysm, fistula) 2 pts; vegetation (3 pts) and leaflet thickening (5 pts)

- PET/CT Scan: positive uptake on transcatheter valve in all but 1 with definite IE
INFECTIVE ENDOCARDITIS
TAVR

- Multi-imaging approach: sensitivity 100% for definite diagnosis of IE
- Modified Duke criteria 50% sensitivity
- Leaflet thickening and high transvalvular gradient common
CARDIAC IMPLANTABLE ELECTRONIC DEVICES (CIED) INFECTION

- Pocket, bloodstream, cardiac structures (endocarditis)
- 0.5% of de novo devices
  2.0% of CIED replacements
- Onset bimodal
  Early related to implantation procedure
  Late (seeding of infection to the leads via the blood): usually ill patients
CIED INFECTIONS

- Incidence of infection increased out of proportion to the increase in implantation rates
- Staph 60-80% cases
- Patient related risk factors: DM, ESRD, CHF, COPD, malignancy, prior device infection
- Class I indication for lead removal
- 30 day mortality 5-6%; 1 year mortality 8-17%
CIED INFECTIONS

FIGURE 3 Cardiac CT and {\textsuperscript{18}FDG-PET/CT Imaging in the Diagnosis of CDI

Pacemaker lead IE in a young man with congenital atrioventricular block. On TEE, vegetations were seen on the pacemaker leads (A and B, white arrow). On CT imaging, vegetations were seen on the pacemaker lead (C, white arrow) with an accompanying pulmonary embolism (D, red arrow). Confirmation of active pacemaker.
(continued)

<table>
<thead>
<tr>
<th>Evidence</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Complete removal of pacemaker or defibrillator systems, including all leads and the generator, is indicated as part of the early management plan in patients with IE with documented infection of the device or leads (277-280). 2014 recommendation remains current.</td>
</tr>
<tr>
<td>IIa</td>
<td>Complete removal of pacemaker or defibrillator systems, including all leads and the generator, is reasonable in patients with valvular IE caused by S. aureus or fungi, even without evidence of device or lead infection (277-280). 2014 recommendation remains current.</td>
</tr>
<tr>
<td>IIa</td>
<td>Complete removal of pacemaker or defibrillator systems, including all leads and the generator, is reasonable in patients undergoing valve surgery for valvular IE. 2014 recommendation remains current.</td>
</tr>
<tr>
<td>IIa</td>
<td>Early surgery (during initial hospitalization before completion of a full therapeutic course of antibiotics) is reasonable in patients with IE who present with recurrent emboli and persistent vegetations despite appropriate antibiotic therapy (281-283). 2014 recommendation remains current.</td>
</tr>
<tr>
<td>IIb</td>
<td>Early surgery (during initial hospitalization before completion of a full therapeutic course of antibiotics) may be considered in patients with native valve endocarditis who exhibit mobile vegetations greater than 10 mm in length (with or without clinical evidence of embolic phenomenon) (281-283). 2014 recommendation remains current.</td>
</tr>
<tr>
<td>IIb</td>
<td>Operation without delay may be considered in patients with IE and an indication for surgery who have suffered a stroke but have no evidence of intracranial hemorrhage or extensive neurological damage (284,285).</td>
</tr>
</tbody>
</table>

NEW: The risk of postoperative neurological deterioration is low after a cerebral event that has not resulted in extensive neurological damage or intracranial hemorrhage. If surgery is required after a neurological event, recent data favor early surgery for better overall outcomes.
Opioid epidemic causes surge in infective endocarditis

December 3, 2018

Stemming from the opioid crisis, the rate of hospitalizations for drug use–associated infective endocarditis increased markedly in North Carolina over the past decade, according to findings published in Annals of Internal Medicine.
DRUG USE ASSOCIATED INFECTIVE ENDOCARDITIS (DUA-IE)

- North Carolina 2007-2017
- 22,825 IE hospitalizations
- 11% DUA-IE
- 12 fold annual increase DUA-IE hospitalizations
- 13 fold annual increase in DUA-IE hospitalizations with valve surgery
- Increases not seen in non DUA-IE
- 2017: 42% of IE valve surgeries were for DUA-IE
Case #1

- EO
- 34 year old woman
- Bechet’s syndrome with severe cutaneous ulcers
- Multiple admissions for sepsis
- Treated with immunosuppressive medications
- History of CVA
- PFO Septal occluder 2017
- Admitted with fever
### CASE #1

<table>
<thead>
<tr>
<th>Collected</th>
<th>Source</th>
<th>Procedure/Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/04/18 12:58</td>
<td>Bld, Venous</td>
<td>AFB Blood Culture - Final Acid fast bacilli</td>
</tr>
<tr>
<td>08/29/18 17:58</td>
<td>Bld, Venous</td>
<td>AFB Blood Culture - Final Acid fast bacilli</td>
</tr>
<tr>
<td>08/29/18 17:58</td>
<td>Bld, Venous</td>
<td>AFB Blood Culture - Final Acid fast bacilli</td>
</tr>
<tr>
<td>08/29/18 16:58</td>
<td>Bld, Venous</td>
<td>Blood Culture - Final Mycobacterium abscessus Group</td>
</tr>
<tr>
<td>08/29/18 16:58</td>
<td>Bld, Venous</td>
<td>Blood Culture - Final Mycobacterium abscessus Group</td>
</tr>
<tr>
<td>08/14/18 02:36</td>
<td>Urine, Catch</td>
<td>Urine Culture - Final Non-significant flora 10,000 - 50,000 cfu/ml Bacteria isolated suggestive of normal urogenital flora and are insufficient in number to suggest urinary tract infection.</td>
</tr>
<tr>
<td>08/14/18 02:36</td>
<td>Bld, Venous</td>
<td>Blood Culture - Final Mycobacterium abscessus Group</td>
</tr>
<tr>
<td>08/14/18 02:09</td>
<td>Bld, Venous</td>
<td>Blood Culture - Final Mycobacterium abscessus Group</td>
</tr>
<tr>
<td>06/05/18 23:30</td>
<td>Urine, Catch</td>
<td>Urine Culture - Final Non-significant flora &lt;10,000 cfu/ml</td>
</tr>
<tr>
<td>06/01/18 19:56</td>
<td>Urine, Catch</td>
<td>Urine Culture - Final Non-significant flora 10,000 - 50,000 cfu/ml Multiple organisms present, probable contamination</td>
</tr>
<tr>
<td>04/06/18 18:35</td>
<td>Blood, Peripheral</td>
<td>Blood Culture - Final No growth after five days.</td>
</tr>
</tbody>
</table>
Subacute Endocarditis of an Atrial Septal Closure Device in a Patient With a Patent Foramen Ovale

Seth B. Krantz, MD, Jennifer S. Lawton, MD
Division of Cardiothoracic Surgery, Department of Surgery, Washington University School of Medicine, St. Louis, Missouri

DOI: https://doi.org/10.1016/j.athoracsur.2013.12.079
ENDOCARDITIS
ATRIAL SEPTAL CLOSURE DEVISE

- Infectious complications rare
- Endocarditis usually with ASD closure; 2 reported cases after PFO closure
- Higher likelihood of infection before device is endothelialized. This case occurred after.
- Therefore: lifelong risk of infection. Maintain high index of suspicion as with other prosthetic devices
Case #1

- Treated with antibiotics
- Blood Cultures persistently positive
- Surgery recommended; patient refused
- Discharged at her request to Hospice due to quality of life issues
- Patient expired in less than 1 month
Mycobacterial endocarditis: a comprehensive review

Yuan Shi-Min, MMed, PhD

doi: 10.5935/1678-9741.20140113

PMCID: PMC4389517
PMID: 25859873

Language: English | Portuguese
<table>
<thead>
<tr>
<th>Table 1</th>
<th>Predisposing risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite AVR</td>
<td>1 (3.7)</td>
</tr>
<tr>
<td>MVR + AVR</td>
<td>1 (3.7)</td>
</tr>
<tr>
<td>Redo-MVR + AVR</td>
<td>3 (11.1)</td>
</tr>
<tr>
<td>Redo-AVR</td>
<td>2 (7.4)</td>
</tr>
<tr>
<td>Mitral valve ring plasty with aortic valve repair</td>
<td>1 (3.7)</td>
</tr>
<tr>
<td>Ventricular septal defect patch repair</td>
<td>3 (11.1)</td>
</tr>
<tr>
<td>Atrial septal defect patch closure</td>
<td>1 (3.7)</td>
</tr>
<tr>
<td>Foreign material implant</td>
<td>11 (22)</td>
</tr>
<tr>
<td>Pacemaker</td>
<td>4 (36.4)</td>
</tr>
<tr>
<td>Percutaneous coronary intervention</td>
<td>3 (27.3)</td>
</tr>
<tr>
<td>Automatic implantable cardioverter defibrillator implant</td>
<td>1 (9.1)</td>
</tr>
<tr>
<td>Dialysis, catheter infection, immunosuppressive therapy</td>
<td>1 (9.1)</td>
</tr>
<tr>
<td>Hemodialysis</td>
<td>1 (9.1)</td>
</tr>
<tr>
<td>Stenting of the abdominal aorta + renal angioplasty</td>
<td>1 (9.1)</td>
</tr>
<tr>
<td><strong>IDU</strong></td>
<td><strong>5 (10)</strong></td>
</tr>
<tr>
<td>IDU alone</td>
<td>2 (40)</td>
</tr>
<tr>
<td>IDU + human immunodeficiency virus infection</td>
<td>2 (40)</td>
</tr>
<tr>
<td>IDU + tricuspid endocarditis (Methicillin-resistant Staphylococcus aureus)</td>
<td>1 (20)</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>7 (14)</td>
</tr>
</tbody>
</table>
AVG LATENCY
2 YEARS
<table>
<thead>
<tr>
<th>Initial blood culture</th>
<th>n (%)</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>18 (40)</td>
<td>[11,14,25,27,28,30]</td>
</tr>
<tr>
<td>Acid-fast bacteria</td>
<td>9 (20)</td>
<td>[7,10,13,22,23,25,35,36]</td>
</tr>
<tr>
<td>Gram-positive bacilli/rod</td>
<td>5 (11.1)</td>
<td>[15,20,26,31,33]</td>
</tr>
<tr>
<td>Atypical mycobacterial infection</td>
<td>1 (2.2)</td>
<td>[37]</td>
</tr>
<tr>
<td>Non-tuberculous mycobacteria</td>
<td>1 (2.2)</td>
<td>[38]</td>
</tr>
<tr>
<td>Rapidly growing mycobacteria</td>
<td>1 (2.2)</td>
<td>[34]</td>
</tr>
<tr>
<td>Mycobacterium species</td>
<td>1 (2.2)</td>
<td>[21]</td>
</tr>
<tr>
<td>Fortuitum</td>
<td>4 (8.9)</td>
<td>[9,12,17,24]</td>
</tr>
<tr>
<td>Abscessus</td>
<td>1 (2.2)</td>
<td>[18]</td>
</tr>
<tr>
<td>Neoaurum</td>
<td>1 (2.2)</td>
<td>[34]</td>
</tr>
<tr>
<td>Chimaera</td>
<td>1 (2.2)</td>
<td>[14]</td>
</tr>
<tr>
<td>Peregrinum</td>
<td>1 (2.2)</td>
<td>[16]</td>
</tr>
<tr>
<td>Tuberculous</td>
<td>1 (2.2)</td>
<td>[19]</td>
</tr>
</tbody>
</table>
MYCOBACTERIAL ENDOCARDITIS

- Rare
- Predisposing risk factors: cardiac surgery, medical procedures (central venous access, hemodialysis catheter, mammoplasty, arthroplasty)
- Average latency 2 years (range 0-8 years)
- Predisposing risk factors: immunocompromised including HIV, hematologic malignancies, immunosuppressive drugs
- Resistant to antimicrobial rx: high mortality
CASE #2

- 63 year old male
- Bentall with a bioprosthetic AVR with ascending aorta/hemiarch replacement with CABGx1 2014
- 3/18 Adm with CVA (Right midbrain)
- CT angiogram in ER: aortic repair stable; mass in the subvalvular area of the aortic prosthesis
- TEE performed confirming lesion
- Blood Cultures negative x 2
CASE #2

• 3/18 Surgical removal of 1x1.4 mass on leaflet
  Culture of surgical specimen negative

• 4/18 Acute CVA (multiple infarcts); thrombectomy of basilar artery. Treated with AC

• 10/18 presents with weakness, fatigue and wt loss
  MRI multiple emboli

• TEE performed
**CASE #2**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fungal Culture, Blood</strong></td>
<td><strong>Mycobacterium chimaera</strong></td>
</tr>
<tr>
<td><strong>Organism 1</strong></td>
<td>11/19/18-1500</td>
</tr>
</tbody>
</table>

APB smear results called to [REDACTED] on 10/28/18 AT 1515

**Mycobacterium chimaera:**
This species is a member of the M. Avium complex.

There are no established interpretive guidelines for agents reported without interpretations.

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>MIC (mcg/mL)</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moxifloxacin</td>
<td>8</td>
<td>N</td>
</tr>
<tr>
<td>Clarithromycin</td>
<td>8</td>
<td>S</td>
</tr>
<tr>
<td>Amikacin</td>
<td>16</td>
<td>N</td>
</tr>
<tr>
<td>Streptomycin</td>
<td>32</td>
<td>R</td>
</tr>
<tr>
<td>Linezolid</td>
<td>32</td>
<td>N</td>
</tr>
<tr>
<td>Ethambutol</td>
<td>16</td>
<td>N</td>
</tr>
<tr>
<td>Rifampin</td>
<td>8</td>
<td>R</td>
</tr>
<tr>
<td>Rifabutin</td>
<td>1</td>
<td>N</td>
</tr>
</tbody>
</table>

S = Susceptible  I = Indeterminate  R = Resistant
N = Not Susceptible  D = Susceptible Dose Dependent

Identification and susceptibility performed by Mayo Medical Laboratories.
Global outbreak of severe *Mycobacterium chimaera* disease after cardiac surgery: a molecular epidemiological study

Jakko van Ingen, PhD  •  Thomas A Kohl, PhD  •  Katharina Kranzer, PhD  •  Barbara Hasse, MD  •  Peter M Keller, MD  •  Anna Katarzyna Szafranska, PhD  • et al.  Show all authors  •  Show footnotes

Published: July 12, 2017  •  DOI: https://doi.org/10.1016/S1473-3099(17)30324-9  •  Check for updates

Summary

Background

Since 2013, over 100 cases of *Mycobacterium chimaera* prosthetic valve endocarditis and disseminated disease were notified in Europe and the USA, linked to contaminated heater-cooler units (HCUs) used during cardiac surgery. We did a molecular epidemiological investigation to establish the source of these patients' disease.
MYCOBACTERIUM CHIMAERA AFTER CARDIAC SURGERY

- Since 2013 > 100 cases of M chimaera prosthetic valve endocarditis in Europe and US linked to contaminated heater-cooler units used during cardiac surgery

- Phylogenetic analysis on whole genome isolates: cardiac surgery isolates formed a distinct subgroup

- HCU contamination with M chimaera at LivaNova factory in Germany is likely source for cardiac surgery related M chimaera infections in Europe, Australia and the US
“And what physicians say about consumptive illnesses is applicable here: that at the beginning, such an illness is easy to cure but difficult to diagnose; but as time passes, not having been recognized or treated at the outset, it becomes easy to diagnose but difficult to cure.”
ENDOCARDITIS
2019

- Multidisciplinary Endocarditis Team
- Antibiotic Prophylaxis
  BAV, MVP, HCM
- Health Care Associated Endocarditis
  Invasive Procedures, TAVR, CIED, Opioid epidemic
- Early Surgery/ Neurologic Complications
<table>
<thead>
<tr>
<th>Conditions</th>
<th>AHA Guidelines 2015 (89)</th>
<th>Class, Level of Evidence</th>
<th>ESC Guidelines 2015 (68)</th>
<th>Class, Level of Evidence</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart failure</td>
<td>Early surgery* is indicated in patients with IE who present with valve dysfunction resulting in symptoms or signs of HF</td>
<td>I, B</td>
<td>Aortic or mitral NVE, or PVE with severe acute regurgitation, obstruction, or fistula causing refractory pulmonary edema or cardiogenic shock</td>
<td>I, B</td>
<td>Emergency</td>
</tr>
<tr>
<td></td>
<td>Early surgery* is indicated in patients with PVE with symptoms or signs of HF resulting from valve dehiscence, intracardiac fistula, or severe prosthetic valve dysfunction</td>
<td>I, B</td>
<td>Aortic or mitral NVE, or PVE with severe regurgitation or obstruction causing symptoms of HF, or echocardiographic signs of poor hemodynamic tolerance</td>
<td>I, B</td>
<td>Urgent</td>
</tr>
<tr>
<td>Uncontrolled infection</td>
<td>Early surgery* is indicated in patients when IE is complicated by heart block, annular or aortic abscess, or destructive penetrating lesions</td>
<td>I, B</td>
<td>Locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation)</td>
<td>I, B</td>
<td>Urgent</td>
</tr>
<tr>
<td>Prevention of embolism</td>
<td>Early surgery is reasonable for patients with relapsing PVE</td>
<td>IIa, C</td>
<td>Infection caused by fungi or multiresistant organisms</td>
<td>I, C</td>
<td>Urgent/elective</td>
</tr>
<tr>
<td></td>
<td>Early surgery* should be considered, particularly in patients with IE caused by fungi or highly resistant organisms (e.g., VRE, multidrug-resistant gram-negative bacilli)</td>
<td>I, B</td>
<td>Persisting positive blood cultures despite appropriate antibiotic therapy and adequate control of septic metastatic foci</td>
<td>IIa, B</td>
<td>Urgent</td>
</tr>
<tr>
<td></td>
<td>Early surgery* is indicated for evidence of persistent infection (manifested by persistent bacteremia or fever lasting &gt;5-7 d, and provided that other sites of infection and fever have been excluded) after the start of appropriate antimicrobial therapy</td>
<td>I, B</td>
<td>PVE caused by staphylococci or non-HACEK gram-negative bacteria</td>
<td>IIa, C</td>
<td>Urgent/elective</td>
</tr>
<tr>
<td></td>
<td>Early surgery is reasonable in patients who present with recurrent emboli and persistent or enlarging vegetations despite appropriate antibiotic therapy</td>
<td>IIa, B</td>
<td>Aortic or mitral NVE, or PVE with persistent vegetations &gt;10 mm after ≥1 embolic episode despite appropriate antibiotic therapy</td>
<td>I, B</td>
<td>Urgent</td>
</tr>
<tr>
<td>Prevention of embolism</td>
<td>Early surgery is reasonable in patients with severe valve regurgitation and mobile vegetations &gt;10 mm</td>
<td>IIa, B</td>
<td>Aortic or mitral NVE with vegetations &gt;10 mm, associated with severe valve stenosis or regurgitation, and low operative risk</td>
<td>I, B</td>
<td>Urgent</td>
</tr>
<tr>
<td>Prevention of embolism</td>
<td>Early surgery may be considered in patients with mobile vegetations &gt;10 mm, particularly when involving the anterior leaflet of the mitral valve and associated with other relative indications for surgery</td>
<td>IIb, C</td>
<td>Aortic or mitral NVE, or PVE with isolated very large vegetations (&gt;30 mm)</td>
<td>IIb, C</td>
<td>Urgent</td>
</tr>
<tr>
<td>Prevention of embolism</td>
<td>Early surgery* may be considered in patients with mobile vegetations &gt;10 mm, particularly when involving the anterior leaflet of the mitral valve and associated with other relative indications for surgery</td>
<td>IIb, C</td>
<td>Aortic or mitral NVE, or PVE with isolated large vegetations (&gt;15 mm) and no other indication for surgery</td>
<td>IIb, C</td>
<td>Urgent</td>
</tr>
</tbody>
</table>

*Defined as “during initial hospitalization and before completion of a full course of antibiotics.” †Defined as emergency surgery = performed within 24 h; urgent surgery = within a few days; elective surgery = after at least 1 to 2 weeks of antibiotic therapy.

HACEK = Haemophilus species, Aggregatibacter species, Cardiobacterium hominis, Eikenella corrodens, and Kingella species; HF = heart failure; NVE = native valve infective endocarditis; PVE = prosthetic valve infective endocarditis; VRE = vancomycin-resistant Enterococcus. Other abbreviations as in Tables 1 and 2.
Early Surgery versus Conventional Treatment for Infective Endocarditis

Duk-Hyun Kang, M.D., Ph.D., Yong-Jin Kim, M.D., Ph.D., Sung-Han Kim, M.D., Ph.D., Byung Joo Sun, M.D., Dae-Hee Kim, M.D., Ph.D., Sung-Cheol Yun, Ph.D., Jong-Min Song, M.D., Ph.D., Suk Jung Choo, M.D., Ph.D., Cheol-Hyun Chung, M.D., Ph.D., Jae-Kwan Song, M.D., Ph.D., Jae-Won Lee, M.D., Ph.D., and Dae-Won Sohn, M.D., Ph.D.

ABSTRACT
EARLY SURGERY VS CONVENTIONAL TREATMENT FOR IE (EASE)

- Patients with severe mitral or aortic valve disease and vegetation with a diameter greater than 10 mm
- Primary Endpoint: composite of in-hospital death or clinical embolic events occurring within 6 weeks of randomization
- 76 patients: 37 early surgery; 39 conventional treatment
Figure 2. Kaplan-Meier Curves for the Cumulative Probabilities of Death and of the Composite End Point at 6 Months, According to Treatment Group.

There was no significant between-group difference in all-cause mortality at 6 months (Panel A). The rate of the composite end point of death from any cause, embolic events, recurrence of infective endocarditis, or repeat hospitalization due to the development of congestive heart failure was 3% in the early-surgery group versus 28% in the conventional-treatment group (hazard ratio, 0.08; 95% CI, 0.01 to 0.65; P = 0.02) (Panel B).

PRIMARY ENDPOINT
1/37 EARLY SURGERY
9/39 CONVENTIONAL
Early surgery within 48 hours after diagnosis reduced composite endpoint of death from any cause or embolic events by reducing risk of systemic embolization.
Influence of the timing of cardiac surgery on the outcome of patients with infective endocarditis and stroke.


Abstract

BACKGROUND: The timing of cardiac surgery after stroke in infective endocarditis (IE) remains controversial. We examined the relationship between the timing of surgery after stroke and the incidence of in-hospital and 1-year mortalities.

METHODS: Data were obtained from the International Collaboration on Endocarditis–Prospective Cohort Study of 4794 patients with definite IE who were admitted to 64 centers from June 2000 through December 2006. Multivariate logistic regression and Cox regression analyses were performed to estimate the impact of early surgery on hospital and 1-year mortality after adjustments for other significant covariates.

RESULTS: Of the 857 patients with IE complicated by ischemic stroke syndromes, 198 who underwent valve replacement surgery poststroke were available for analysis. Overall, 58 (29.3%) patients underwent early surgical treatment vs 140 (70.7%) patients who underwent late surgical treatment. After adjustment for other risk factors, early surgery was not significantly associated with increased in-hospital mortality rates (odds ratio, 2.308; 95% confidence interval [CI], .942-5.652). Overall, probability of death after 1-year follow-up did not differ between 2 treatment groups (27.1% in early surgery and 19.2% in late surgery group, P = .328; adjusted hazard ratio, 1.138; 95% CI, .802-1.650).

CONCLUSIONS: There is no apparent survival benefit in delaying surgery when indicated in IE patients after ischemic stroke. Further observational analyses that include detailed pre- and postoperative clinical neurologic findings and advanced imaging data (eg, ischemic stroke size), may allow for more refined recommendations on the optimal timing of valvular surgery in patients with IE and recent stroke syndromes.
TIMING OF SURGERY
IE WITH NEUROLOGIC COMPLICATIONS

International Collaborative on Endocarditis-Prospective Cohort Study

- 857 pts with IE complicated by ischemic stroke
- 198 valve replacement surgery
  - 58 (29%) Early surgery (1-7 days)
  - 140 (71%) late surgery
RESULTS

• No difference in in-hospital mortality
• No difference in one year mortality

CONCLUSION

• No benefit in delaying indicated surgery after ischemic stroke
Neurologic Complications of Infective Endocarditis: Risk Factors, Outcome, and Impact of Cardiac Surgery: A Multicenter Observational Study

May 10, 2013

Citation: Circulation 2013;May 6:[Epub ahead of print].
Summary By: David S. Bach, MD, FACC
Spain Cohort 8 Centers

- 1345 patients with left sided endocarditis
  - 340 (25%) neuro complications
  - 192 (14%) ischemic stroke
  - 86 (6%) meningitis/encephalopathy
  - 60 (5%) hemorrhagic stroke
Risk factors

- Size of vegetation (> 3cm), Mitral valve, Staph aureus
- Anticoagulation (hemorrhage)

Results

Mortality 45%: pts with neuro complications

24%: pts without neuro complications

Only moderate to severe stroke and hemorrhage associated with poorer prognosis
Neurologic complications associated with poorer prognosis

Appropriate early antibiotic therapy reduced risk of neurologic complications

Anti-coagulation associated with higher risk of hemorrhage

? Consider transiently stopping AC therapy
<table>
<thead>
<tr>
<th>Level</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I</strong></td>
<td>Complete removal of pacemaker or defibrillator systems, including all leads and the generator, is indicated as part of the early management plan in patients with IE with documented infection of the device or leads (277-280). 2014 recommendation remains current.</td>
</tr>
<tr>
<td><strong>Ia</strong></td>
<td>Complete removal of pacemaker or defibrillator systems, including all leads and the generator, is reasonable in patients with valvular IE caused by S. aureus or fungi, even without evidence of device or lead infection (277-280). 2014 recommendation remains current.</td>
</tr>
<tr>
<td><strong>Ia</strong></td>
<td>Complete removal of pacemaker or defibrillator systems, including all leads and the generator, is reasonable in patients undergoing valve surgery for valvular IE. 2014 recommendation remains current.</td>
</tr>
<tr>
<td><strong>Ib</strong></td>
<td>Early surgery (during initial hospitalization before completion of a full therapeutic course of antibiotics) is reasonable in patients with IE who present with recurrent emboli and persistent vegetations despite appropriate antibiotic therapy (281-283). 2014 recommendation remains current.</td>
</tr>
<tr>
<td><strong>Ib</strong></td>
<td>Early surgery (during initial hospitalization before completion of a full therapeutic course of antibiotics) may be considered in patients with native valve endocarditis who exhibit mobile vegetations greater than 10 mm in length (with or without clinical evidence of embolic phenomenon) (281-283). 2014 recommendation remains current.</td>
</tr>
<tr>
<td><strong>IIb</strong></td>
<td>Operation without delay may be considered in patients with IE and an indication for surgery who have suffered a stroke but have no evidence of intracranial hemorrhage or extensive neurological damage (284,285). 2014 recommendation remains current.</td>
</tr>
</tbody>
</table>

**NEW:** The risk of postoperative neurological deterioration is low after a cerebral event that has not resulted in extensive neurological damage or intracranial hemorrhage. If surgery is required after a neurological event, recent data favor early surgery for better overall outcomes.
Stroke is an independent risk factor for postoperative death in IE patients. Recommendations about the timing of operative intervention after a stroke in the setting of IE are hindered by the lack of RCTs and reliance on single-center experiences. In early observational data, there was a significantly decreased risk of in-hospital death when surgery was performed >4 weeks after stroke (284). These data were not risk adjusted. In an observational study that did adjust for factors such as age, paravalvular abscess, and HF, the risk of in-hospital death was not significantly higher in the group who underwent surgery within 1 week of a stroke than in patients who underwent surgery ≥8 days after a stroke (285).

NEW: In patients with extensive neurological damage or intracranial hemorrhage, cardiac surgery carries a high risk of death if performed within 4 weeks of a hemorrhagic stroke.

Patients with hemorrhagic stroke and IE have a prohibitively high surgical risk for at least 4 weeks after the hemorrhagic event. One multicenter observational study (286) showed wide variation in patient deaths when those who underwent surgery within 4 weeks of a hemorrhagic stroke were compared with those whose surgery was delayed until after 4 weeks (75% versus 40%, respectively). The percentage of new bleeds postoperatively was 50% in patients whose surgery was performed in the first 2 weeks, 33% in patients whose surgery was performed in the third week, and 20% in patients whose surgery was performed at least 21 days after the neurological event (286).
# CONCLUSIONS

**CENTRAL ILLUSTRATION** Infective Endocarditis: Preventive Strategies, Diagnosis, and Management

<table>
<thead>
<tr>
<th>Preventive strategies</th>
<th>Improving diagnosis</th>
<th>Optimal management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce hospital acquired bacteremia</td>
<td>High index of clinical suspicion in at-risk groups</td>
<td>Evaluation by an endocarditis team</td>
</tr>
<tr>
<td>Good oral hygiene for at-risk groups</td>
<td>Patient education</td>
<td>Early risk stratification</td>
</tr>
<tr>
<td>Antibiotic prophylaxis for high risk groups</td>
<td>Early echocardiography</td>
<td>Early transfer to center of expertise</td>
</tr>
<tr>
<td>In future, antibacterial coatings/materials</td>
<td>Adjunctive imaging if echocardiography non-diagnostic</td>
<td>Tailored antibiotic therapy</td>
</tr>
<tr>
<td></td>
<td>Rapid microbiology results with antibacterial sensitivity</td>
<td>Early surgery for selected patients</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monitoring for complications</td>
</tr>
</tbody>
</table>

THANK YOU!!!