Infective Endocarditis, Improving Diagnosis

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• IE is a disease of multisystem involvement, master of disguise
• Despite high achievements in medicine and antibiotics, disease is getting more and aggressive and complicated
• At the same time its incidence is increasing
**Diagnosing IE**

*Definite:*
Pathological
Clinical; 2 major, 1 major & 3 minor, 5 minor

*Possible:*
1 major criterion and 1 minor criterion; or
3 minor criteria

*Rejected:*
Firm alternative diagnosis explaining evidence of IE; or
Resolution of IE syndrome with antibiotic therapy for 4 days; or
No pathological evidence of IE at surgery or autopsy, with antibiotic therapy for 4 days; or
Does not meet criteria for possible IE as above
Major criteria

1. **Blood cultures positive for IE**
   a. **Typical microorganisms consistent with IE from 2 separate blood cultures:**
      - *Streptococcus viridans*, *Streptococcus galalcticus* (Streptococcus bovis), *HAECB* group, *Staphylococcus aureus*; or
      - Community-acquired enterococci, in the absence of a primary focus; or
   b. **Microorganisms consistent with IE from persistently positive blood cultures:**
      - ≥2 positive blood cultures of blood samples drawn >12 h apart; or
      - All of 3 or a majority of ≥4 separate cultures of blood (with first and last samples drawn ≥1 h apart); or
   c. **Single positive blood culture for Coxiella burnetii or phase I IgG antibody titre >1.800**

2. **Imaging positive for IE**
   a. **Echocardiogram positive for IE:**
      - Vegetation:
        - Abscess, pseudoaneurysm, intracardiac fistula;
        - Valvular perforation or aneurysm;
        - New partial dehiscence of prosthetic valve.
   b. **Abnormal activity around the site of prosthetic valve implantation detected by 18F-FDG PET/CT** (only if the prosthesis was implanted for >3 months) or radiolabelled leukocytes SPECT/CT.
   c. **Definite para- or valvular lesions by cardiac CT.**

Minor criteria

1. **Predisposition** such as predisposing heart condition, or injection drug use.
2. **Fever** defined as temperature >38°C.
3. **Vascular phenomena** (including those detected by imaging only):
   - Major arterial emboli, septic pulmonary infarcts, infectious (mycotic) aneurysm, intracranial haemorrhage, conjunctival haemorrhages, and Janeway’s lesions.
4. **Immunological phenomena**: glomerulonephritis, Osler’s nodes, Roth’s spots, and rheumatoid factor.
5. **Microbiological evidence**: positive blood culture but does not meet a major criterion as noted above or serological evidence of active infection with organism consistent with IE.
So diagnosis is based on:
- Clinical Features
- Imaging Techniques
- Laboratory work-up

1. Cardiac Imaging
2. Non Cardiac Imaging
I. Cardiac Imaging

2D TTE & TEE
3D Echocardiography

• 3D TEE have demonstrated advantages over 2-dimensional TEE to better detect and delineate vegetations and to identify IE Complications

• Allows the analysis of 3D volumes of cardiac structures in any possible plane

• Better analysis of vegetation morphology and size may lead to better prediction of the embolic risk
• Particularly useful in the assessment of perivalvular extension of the infection, prosthetic valve dehiscence and valve perforation

• *Conventional 2D TTE and TEE will remain the corner stone to diagnose IE and its complications*
MSCT Cardiography

- Detection of perivalvular extension especially in PVE & with extensive calcifications
- Superior in information regarding the extent and consequences of perivalvular extension, including the anatomy of pseudoaneurysms, abscesses and fistulae
- Use of CT in IE is the non-invasive assessment of the coronaries prior to surgery, esp. in AV IE, where coronary angiography is associated with risk of systemic embolization & aortic wall perforation

- NVE & PVE results of MSCT are comparable to intra-operative findings, and with no significant difference to TTE & TEE
- Cerebral & Abdominal CT could be performed in the same setting
**F-fluorodesoxyglucose (F-FDG) PET-CT**

- Few reports are existing, mainly in PVE, where abnormal FDG uptake around cardiac prosthesis may help in early diagnosis
- Helpful to differentiate active IE from old healed infection
- Less valuable in NVE, however might be helpful in detecting perivalvular extension
- Extracardiac spread of infection

**II. Non Cardiac Imaging**
Abdominal U/S and CT

- Systemic embolization occurs in 22% to 50% of cases of IE
- Splenic infarction is a common complication of left-sided IE (40% of cases)
- About 5% of patients with splenic infarction will develop splenic abscess
- Acute renal failure is a common complication of IE, occurs in about 30% of patients:
  - *Immune complex* and vasculitic glomerulonephritis
  - *Renal infarctions*
Solid Organ Embolization
Mesenteric Vascular Occlusion

CNS Imaging
• CNS gets a major share (65%) of the embolic events

• Neurologic complications, dramatically change the prognosis & affect ttt plan

• Such complications are clinically apparent in 20% -40% of cases

• True incidence of acute brain embolization is not actually known

• In one study, findings of cerebral MRI upgraded the diagnosis of IE in 25% of patients presenting initially with non-definite IE
Effect of Early Cerebral Magnetic Resonance Imaging on Clinical Decisions in Infective Endocarditis
A Prospective Study

Xavier Duval, MD, PhD; Bernard Jung, MD; Isabelle Klein, MD, PhD; Eric Broustel, MD; Gabrielle Thubel, MD, PhD; Florence Arnaud, MD; Laurent Lepeau, MD; Jean-Pierre Leblay, MD, PhD; Michel Wolff, MD; and Catherine Laport, MD, PhD, for the IMAGE (Intracranial Magnetic Resonance Imaging at the Acute Phase of Infective Endocarditis) Study Group

Background: Neurologic complications of endocarditis can influence diagnosis, therapeutic plans, and prognosis.

Objective: To describe how early cerebral magnetic resonance imaging (MRI) affects the diagnosis and management of endocarditis in hospitalized adults.


Setting: Tertiary care university hospital in France.

Patients: 136 patients with endocarditis.

Intervention: Cerebral MRI with angiography performed up to 7 days after admission and before any surgical intervention.

Measurements: Two experts jointly established the endocarditis diagnosis using Duke criteria (clinical and therapeutic criteria plus before and after MRI and then compared them.

Results: Neurological signs were initially classified as definite in 77 patients, probable in 33, and possible in 26. A total of 51 patients (19%) had acute neurological symptoms. Central lesions were detected by MRI in 56 patients (42%), including ischemic lesions in 11, hemorrhages in 7, and silent lesions in 30. Only on the basis of MRI results and including microembolism, diagnostic modification of 17 of 85 (20%) cases of neurologic symptoms were revealed by other imaging in 24 patients or failure of 12 patients. Endocarditis therapeutic plans were modified for 24 (18%) of the 136 patients, including surgical plan modifications for 18 (14%). Overall, early MRI led to modifications of diagnosis or therapeutic plan in 36 patients (26% of 20% to 36%).

Conclusions: Early MRI in patients with endocarditis and no neurological symptoms may affect both diagnostic classifications and clinical management plans.

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Subclinical Brain Embolization in Left-Sided Infective Endocarditis
Results From the Evaluation by MRI of the Brains of Patients With Left-Sided Intracardiac Solid Masses (EMBOLISM) Pilot Study

Howard A. Cooper, MD; Elissa C. Thompson, MD; Robert Laurence, MD; Anthony Falsi, MD; Alexander Mark, MD; Mark Lin, MD; Steven A. Goldstein, MD

Background—Acute brain embolization (ABE) in left-sided infective endocarditis has significant implications for clinical decision making. The true incidence of ABE, including subclinical brain embolization, is unknown.

Methods and Results—We prospectively studied 56 patients with definite left-sided infective endocarditis. Patients were examined by a study neurologist and selected for clinical or neuroradiologic examination of the brain. Patients without clinical evidence of acute stroke but with magnetic resonance imaging evidence of ABE were considered to have subclinical brain embolization. Clinical stroke was present in 14 of 56 patients (25%). Among 40 patients undergoing magnetic resonance imaging, the incidence rate of subclinical brain embolization and any ABE was 48% and 80%, respectively. ABE was present in 15 of 15 patients (100%) with angiographic evidence of infection.

At 6 months, mortality was similar among patients with clinical stroke and subclinical brain embolization (62% versus 55%, P=0.68) and was higher among patients with any ABE than among those without ABE (54% versus 12%, P=0.046). Vascular surgery was performed in 25 patients (48%), including 16 with ABE, at a median of 4 days. No patient suffered a postoperative neurological complication. Surgery was independently associated with a lower risk of mortality at 6 months (odds ratio, 0.11; 95% confidence interval, 0.03 to 0.40; P=0.001).

Conclusions—Magnetic resonance imaging detected subclinical brain embolization in a substantial number of patients with left-sided infective endocarditis, suggesting that the incidence of ABE may be significantly higher than reported based on clinical and computed tomography findings. Brain magnetic resonance imaging may play a role in the complex decision about surgical intervention in infective endocarditis. (Circulation. 2009;119:585-593.)

Key Words: infective endocarditis • magnetic resonance imaging • stroke • surgery
• July 2007 to Dec. 2012 carried out by IE working group Kasr El-Ainy
  
  • 81 consecutive patients had lt side IE
  
  • Patients underwent CTA within 1 wk
  
  • 34 patients had symptomatic CNS embolization
  
  • ICMA occurred in 26(32%) patients; 15(18.5%) were silent
  
  • CTA findings changed treatment plan in 21 patients (25.6%); 11 were neurologically free
Brain CT & CT angiography
Laboratory Techniques
• Positive blood cultures remain the cornerstone of diagnosis
• 3 sets are taken at 30-min intervals, each containing 10 mL of blood
• Incubated in both aerobic and anaerobic atmospheres
• Sampling should be obtained from a peripheral vein rather than from a central venous catheter
• Using a meticulous sterile technique
• Withdraw Bl cultures prior to any antibiotic use

Investigation for blood culture negative infective endocarditis

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Diagnostic procedures</th>
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<tbody>
<tr>
<td><em>Brucella</em> spp.</td>
<td>Blood cultures, serology, culture, immunohistology, and PCR of surgical material.</td>
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<tr>
<td><em>Coxiella burnetii</em></td>
<td>Serology (IgG phase 1 &gt; 1:800), tissue culture, immunohistology, and PCR of surgical material.</td>
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<td><em>Bartonella</em> spp.</td>
<td>Blood cultures, serology, culture, immunohistology, and PCR of surgical material.</td>
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<td><em>Tropheryma whipplei</em></td>
<td>Histology and PCR of surgical material.</td>
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<td><em>Mycoplasma</em> spp.</td>
<td>Serology, culture, immunohistology, and PCR of surgical material.</td>
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<tr>
<td><em>Legionella</em> spp.</td>
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Thank you