Recommendations for the practice of echocardiography in infective endocarditis

Gilbert Habib (France)*, Luigi Badano (Italy), Christophe Tribouilloy (France), Isidre Vilacosta (Spain), and Jose Luis Zamorano (Spain)

Scientific Committee: Maurizio Galderisi (Italy), Jens-Uwe Voigt (Belgium), Rosa Sicari (Italy)
Document Reviewers: Bernard Cosyns (Belgium), Kevin Fox (UK), Svend Aakhus (Norway)
On behalf of the European Association of Echocardiography

Service de Cardiologie, CHU La Timone, Bd Jean Moulin, 13005 Marseille, France

Received 20 December 2009; accepted after revision 30 December 2009
IE: new guidelines EAE 2010

1. diagnosis
2. management of complications
3. prognostic assessment / follow-up
4. intraoperative echocardiography
5. specific situations

www.escardio.org/EAE
IE: new guidelines EAE 2010

1. **diagnosis**

2. management of complications

3. prognostic assessment / follow-up

4. intraoperative echocardiography

5. specific situations
# Anatomic and echo definitions

<table>
<thead>
<tr>
<th></th>
<th>Surgery/necropsy</th>
<th>Echocardiography</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vegetation</strong></td>
<td>Infected mass attached to an endocardial structure, or on implanted intracardiac material</td>
<td>Oscillating or non oscillating intracardiac mass on valve or other endocardial structures, or on implanted intracardiac material</td>
</tr>
<tr>
<td><strong>Abscess</strong></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><strong>Pseudoaneurysm</strong></td>
<td>Perivalvular cavity communicating with the cardiovascular lumen</td>
<td>Pulsatile perivalvular echo-free space, with colour-Doppler flow detected</td>
</tr>
<tr>
<td><strong>Perforation</strong></td>
<td>Interruption of endocardial tissue continuity</td>
<td>Interruption of endocardial tissue continuity traversed by colour-Doppler flow</td>
</tr>
<tr>
<td><strong>Fistula</strong></td>
<td>Communication between 2 neighbouring cavities through a perforation</td>
<td>Colour-Doppler communication between 2 neighbouring cavities through a perforation</td>
</tr>
<tr>
<td><strong>Valve aneurysm</strong></td>
<td>Saccular outpouching of valvular tissue</td>
<td>Saccular bulging of valvular tissue</td>
</tr>
<tr>
<td><strong>Dehiscence of a prosthetic valve</strong></td>
<td>Dehiscence of the prosthesis</td>
<td>Paravalvular regurgitation identified by TTE/TEE, with or without rocking motion of the prosthesis</td>
</tr>
</tbody>
</table>

[www.escardio.org/EAE](http://www.escardio.org/EAE)
Clinical Suspicion of IE

TTE

Prosthetic Valve Intracardiac device

Poor quality TTE

Positive

Negative

Clinical suspicion of IE

High

Low

Stop

If initial TEE is negative but suspicion for IE remains, repeat TEE within 7-10 days

*TEE is not mandatory in isolated right-sided native valve IE with good quality TTE examination and unequivocal echocardiographic findings.
Recommendation 1: diagnosis

1) **TTE is recommended as the first imaging modality in suspected IE**

2) **TEE is recommended in patients with high clinical suspicion of IE and a normal TTE**

3) **TEE should be considered in the majority of patients with suspected IE, even in case with positive TTE**

4) **Repeat TTE/TEE within 7-10 days is recommended in case of initially negative examination when clinical suspicion of IE remains high**

5) **TEE is not indicated in patients with good-quality negative TTE and low clinical suspicion of IE**
IE: new guidelines EAE 2010

1. diagnosis

2. management of complications

3. prognostic assessment / follow-up

4. intraoperative echocardiography

5. specific situations

www.escardio.org/EAE
## Recommendations: Indications for surgery

### A - HEART FAILURE
- **Aortic or mitral IE with severe acute regurgitation or valve obstruction causing refractory pulmonary oedema or cardiogenic shock**
  - **Timing:** Emergency
  - **Class:** I
  - **Level:** B
- **Aortic or mitral IE with fistula into a cardiac chamber or pericardium causing refractory pulmonary oedema or shock**
  - **Timing:** Emergency
  - **Class:** I
  - **Level:** B
- **Aortic or mitral IE with severe acute regurgitation or valve obstruction and persisting heart failure or echocardiographic signs of poor haemodynamic tolerance (early mitral closure or pulmonary hypertension)**
  - **Timing:** Urgent
  - **Class:** I
  - **Level:** B
- **Aortic or mitral IE with severe regurgitation and no HF**
  - **Timing:** Elective
  - **Class:** IIa
  - **Level:** B

### B - UNCONTROLLED INFECTION
- **Locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation)**
  - **Timing:** Urgent
  - **Class:** I
  - **Level:** B
- **Persisting fever and positive blood cultures > 7-10 days**
  - **Timing:** Urgent
  - **Class:** I
  - **Level:** B
- **Infection caused by fungi or multiresistant organisms**
  - **Timing:** Urgent/elective
  - **Class:** I
  - **Level:** B

### C - PREVENTION OF EMBOLISM
- **Aortic or mitral IE with large vegetations (> 10 mm) following one or more embolic episodes despite appropriate antibiotic therapy**
  - **Timing:** Urgent
  - **Class:** I
  - **Level:** B
- **Aortic or mitral IE with large vegetations (> 10 mm) and other predictors of complicated course (heart failure, persistent infection, abscess)**
  - **Timing:** Urgent
  - **Class:** I
  - **Level:** C
- **Isolated very large vegetations (> 15 mm)**
  - **Timing:** Urgent
  - **Class:** IIb
  - **Level:** C
Recommendation 2: management of complications

1) Heart failure, perivalvular infection, and high embolic risk are the 3 main indications for early surgery

2) Echocardiography plays a major role in decision-making when one of these situations occurs

3) Echocardiography helps clinicians not only for taking the decision to operate or not, but also for choosing the optimal timing of surgery

4) The presence of heart failure, abscess, or high embolic risk usually indicates urgent surgery
IE: new guidelines EAE 2010

1. diagnosis
2. management of complications
3. **prognostic assessment / follow-up**
4. intraoperative echocardiography
5. specific situations

[www.escardio.org/EAE](http://www.escardio.org/EAE)
Echocardiographic findings

- Periannular complications
- Severe left-sided valve regurgitation
- Low left ventricular ejection fraction
- Pulmonary hypertension
- Large vegetations
- Severe prosthetic dysfunction
- Premature mitral valve closure and other signs of elevated diastolic pressures
Recommendation 3: follow-up

1) **Repeat TTE and TEE are recommended as soon as a new complication of IE is suspected**

2) **Repeat TTE and TEE should be considered during the follow-up of uncomplicated IE, in order to detect silent complication and monitor vegetation size.**

3) **TTE is recommended before discharge for subsequent comparison**

4) **Clinical and echocardiographic periodic follow-up is mandatory during the first year after the end of antibiotic treatment.**
IE: new guidelines EAE 2010

1. diagnosis

2. management of complications

3. prognostic assessment / follow-up

4. intraoperative echocardiography

5. specific situations
Recommendation 4: Intra-operative echocardiography

1) Intraoperative TEE provides useful data for the planning of surgery, is essential for the immediate control of the surgical procedure, has the potential to improve surgical results, and is a reference for future studies.

2) The impact of intraoperative TEE leads to recommend its routine and systematic use, especially in cases of conservative valve surgery and other complex procedures.

3) Intraoperative TEE is recommended in all patients with IE undergoing cardiac surgery.
IE: new guidelines EAE 2010

1. diagnosis
2. management of complications
3. prognostic assessment / follow-up
4. intraoperative echocardiography
5. specific situations
IE: specific situations

1. Prosthetic valve IE (PVE)
2. Cardiac device-related IE (CDRIE)
3. Right-sided IE
Recommendaion 5: PVE

1) Both TTE and TEE are recommended in suspected or definite PVE

2) Perivalvular complications are frequent in PVE and are better assessed by TEE

3) The sensitivity of echocardiography is lower in PVE than in NVE

4) Peroperative and postoperative echocardiographic assessments of patients with PVE are recommended

5) Repeat echocardiography after discharge is recommended in PVE treated by medical therapy alone because of the risk of late prosthetic dysfunction
1) Although TTE is superior to TTE, both are mandatory in suspected or definite CDRIE

2) The sensitivity of echocardiography is lower in CDRIE than in NVE

3) Echocardiography is also useful for the measurement of vegetation size and should be repeated for follow-up after device explantation.
Recommendation 7: right-sided IE

1) TEE is not mandatory in isolated right-sided native valve IE with good quality TTE examination and unequivocal echocardiographic findings.

2) The size of the tricuspid vegetation and the severity of the tricuspid regurgitation must be evaluated by echocardiography, because these measurements have the potential to influence the therapeutic strategy.
Conclusion: echocardiography in IE

1. key role of echocardiography, but diagnosis is still sometimes difficult

2. major role for prognostic assessment
   - hemodynamic risk
   - infectious risk
   - embolic risk

3. intraoperative echo in the majority of patients