

# Indications and optimal timing for surgery in infective endocarditis

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More and more patients are operated on during the active phase of infective endocarditis (IE).<sup>1</sup> Between 1991 and 1999, in France, the rate of cardiac surgery has increased from 31% to 50%.<sup>1</sup> This may, at least in part, explain the concomitant decrease of in hospital mortality, from 22% to 17%.<sup>1</sup> Nonetheless, the indications for cardiac surgery and its optimal timing remain difficult decisions.

The principal indications for cardiac surgery are heart failure, no control of infection, embolisms, large size of vegetations, severe valvar and perivalvar lesions, and infection caused by some microorganisms.

## INDICATIONS FOR CARDIAC SURGERY

### Heart failure

If heart failure is present, the mortality rate of native valve infective endocarditis is 55–85% in the case of medical treatment only and 10–35% in operated patients.<sup>2</sup>

The first indication for cardiac surgery in infective endocarditis is heart failure: it represents more than half of the indications. Heart failure caused by aortic regurgitation is particularly poorly tolerated (heart failure is better tolerated in the case of mitral regurgitation because the left atrium and the pulmonary vascular bed adapt better than the left ventricle to the regurgitant volume), and it progresses faster, thus needing rapid surgery.

Not only does heart failure increase the mortality rate if there is no surgery, but it also increases the perioperative mortality rate: from 5–10% in patients without heart failure to 15–35% in patients with heart failure. Moreover, delaying surgery increases the risk of perivalvar infection.

### No control of infection

The first step is to make sure that there is no extracardiac infectious location. If there is no such extracardiac location, cardiac surgery should be performed if the course of fever and inflammatory syndrome is unfavourable after one week of appropriate antibiotic treatment.

### Vegetations and embolic risk

The literature on this topic contrasts greatly. The embolism rate varies from 10–50% in different series.<sup>3</sup> Three quarters of embolisms occur before the beginning of antibiotic treatment.<sup>4</sup> The embolic risk decreases greatly and regularly over time, from 15% after one week of treatment to 1% after four weeks of treatment.<sup>5</sup> In mitral infective endocarditis, embolisms look to be more frequent if vegetations are located on the anterior leaflet than on the posterior leaflet.<sup>6</sup> Embolisms are more frequent when vegetation size is more than 20 mm in some studies, but not in other studies.<sup>2</sup> In a recent study, embolisms were more frequent when the size of the vegetations was more than 10 mm or when vegetations were very mobile.<sup>3</sup>

Embolisms should always be looked for not only by clinical means but also by systematic scanners (for example, cerebral, thoraco-abdominal), searching for clinically silent embolisms, especially in spleen and kidneys.

Rapid surgery must be performed when there has been an embolic episode and when large and mobile vegetations remain. When there are large and/or mobile vegetations but no embolic event, the medical community is divided. The decision is easier in the case of mitral infective endocarditis when valve repair looks possible, or when there are other arguments for surgery (heart failure, no control of infection, severe valvar and perivalvar lesions, etc).

### Perivalvar infection

Infective endocarditis on the aortic valve and prosthetic infective endocarditis are those most commonly associated with perivalvar infection, such as abscesses and intracardiac fistula: 10–40% of aortic valve infective endocarditis and 45–100% of prosthetic infective endocarditis.<sup>7</sup> Occurrence and persistence of conduction disturbances are not very sensitive indicators of perivalvar infection, but they look very specific (85%–90%).<sup>8</sup>

Rapid surgery is recommended in most cases since the perioperative risk increases with the delay to surgery.<sup>8,9</sup> However, in large aortic abscesses, a large resection exposes the patient to the risk of postoperative complete atrio-ventricular block.

### Valvar obstruction

Valvar obstruction is an obvious indication for urgent surgery.

### Unstable prosthesis

Dehiscence of an infected prosthesis means that there is perivalvar infection, and haemodynamic deterioration usually occurs quickly. Thus rapid surgery is recommended.<sup>2</sup>

### Prosthetic infective endocarditis

In early prosthetic infective endocarditis (< 12 months after valve replacement), most often the microorganism is a *Staphylococcus* and lesions are severe (abscess, prosthesis dehiscence).<sup>10</sup> Redo surgery is associated with a lower mortality rate than medical treatment alone, and it is most often necessary, although it may be technically difficult.<sup>11</sup>

The mortality rate of prosthetic infective endocarditis caused by *Staphylococcus aureus* is about 75% in the case of medical treatment and 25% in the case of medical + surgical treatment.<sup>12</sup> In a multivariate analysis in a study including 33 patients, the risk of death was 14 times higher if there was an intracardiac complication, and it was 20 times lower in operated patients than in non-operated patients.<sup>12</sup> Surgery is thus recommended in prosthetic infective endocarditis caused by *S aureus* when there is an intracardiac complication.

Medical treatment only may be sufficient in cases of late infective endocarditis caused by some microorganisms (oral streptococci, organisms from the HACEK group—*Haemophilus* species, *Actinobacillus actinomycetemcomitans*,

**Table 1** Indications for surgery in patients with infective endocarditis<sup>2</sup>

Indication	Evidence
Emergency indication for cardiac surgery (same day)	
Acute AR with early closure of mitral valve	A
Rupture of a sinus Valsalva aneurysm into a right heart chamber	A
Rupture into the pericardium	A
Urgent indication for cardiac surgery (within 1–2 days)	
Valvar obstruction	A
Unstable prosthesis	A
Acute AR or MR with heart failure, NYHA III–IV	A
Septal perforation	A
Evidence of annular or aortic abscess, sinus or aortic true or false aneurysm, fistula formation, or new onset conduction disturbances	A
Major embolism+mobile vegetation >10 mm+appropriate antibiotic treatment <7–10 days	B
Mobile vegetation >15 mm+appropriate antibiotic therapy <7–10 days	C
No effective antimicrobial treatment available	A
Elective indication for cardiac surgery (earlier is usually better)	
Staphylococcal prosthetic valve infective endocarditis	B
Early prosthetic valve infective endocarditis (<2 months after surgery)	B
Evidence of progressive paravalvar prosthetic leak	A
Evidence of valve dysfunction and persistent infection after 7–10 days of appropriate antibiotic treatment, as indicated by presence of fever or bacteraemia, provided there are no non-cardiac causes for infection	A
Fungal infective endocarditis caused by a mould	A
Fungal infective endocarditis caused by a yeast	B
Infection with difficult-to-treat organisms	B
Vegetation growing larger during antibiotic treatment >7 days	C

A: Strong evidence or general agreement that cardiac surgery is useful and effective; B: Inconclusive or conflicting evidence or a divergence of opinion about the usefulness/efficacy of cardiac surgery, but weight of evidence/opinion of the majority is in favour; C: Inconclusive or conflicting evidence or a divergence of opinion; lack of clear consensus on the basis of evidence/opinion of the majority.

AR, aortic regurgitation; MR, mitral regurgitation; NYHA, New York Heart Association functional class.

*Cardiobacterium hominis*, *Eikenella corrodens*, and *Kingella kingae*), if there are no signs of perivalvar infection.<sup>13</sup>

### Fungal infective endocarditis

Infective endocarditis caused by *Candida* or *Aspergillus* are often complicated with very large vegetations, infectious metastases, perivalvar infection, and embolisms.<sup>14</sup> Amphotericin B poorly penetrates into vegetations. Rapid surgery is thus most often needed.

### Difficult-to-treat microorganisms

Surgery is almost always needed in infective endocarditis caused by certain Gram negative bacilli (for example, *Pseudomonas aeruginosa*, *Achromobacter xylosoxitans*), by *Brucella*, or by highly resistant enterococci.

### Neurological complications

The rate of neurological complications varies from 15% to 45% in different series.<sup>3–4</sup> They mostly are ischaemic cerebral vascular accidents, but also cerebral haemorrhages, ruptured mycotic aneurysms, meningitis, and encephalopathy.

A cerebral scan must always be performed in infective endocarditis, to look for silent cerebral vascular accidents. In the case of cerebral haemorrhage, an arteriography or an angio-magnetic resonance image must be performed, to look for a mycotic aneurysm.

There is a risk of cerebral haemorrhage associated with cardiac surgery because of anticoagulation during and after the procedure. The risk of cerebral haemorrhage is not increased in the case of a stroke without haemorrhage, but it is greatly increased if the stroke is haemorrhagic. In this case, cardiac surgery should be delayed 2–3 weeks.<sup>15</sup>

If there is a ruptured mycotic aneurysm, it must be resected, clipped or embolised before cardiac surgery.<sup>15</sup>

### TIMING OF CARDIAC SURGERY

Classically, early surgery was considered to be a greater risk than delayed surgery because of tissue inflammation and the

surgery was technically more difficult. In fact, the duration of antibiotic treatment before surgery does not appear to influence the perioperative mortality, nor the rate of recurrent infective endocarditis.<sup>2 10 16</sup>

Surgery should be rapid in the case of haemodynamic deterioration, where there is no control of infection, or there are large and mobile vegetations. Decision as to the timing of surgery is particularly difficult when there is a neurological complication.

### CONCLUSION

Table 1 presents a summary of the indications for surgery and its timing, as proposed recently by Olaison and Pettersson.<sup>2</sup>

Indications for surgery and its timing are difficult decisions to reach. The patient must be followed up closely (clinical examinations once or twice a day, regular scans, and transthoracic and transoesophageal echocardiography). There must be close collaboration between the physician, the cardiac surgeon, and the microbiologist.

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## IMAGES IN CARDIOLOGY

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### Mitral and tricuspid valve thrombus in antiphospholipid syndrome

A 58 year old woman with a one year history of antiphospholipid syndrome and ineffective anticoagulant treatment (international normalised ratio 1.2) was admitted with pain in the left hypochondrium. Abdominal ultrasound revealed a 5 cm wide splenic infarction. Transoesophageal echocardiography showed mobile masses resembling bunches of grapes on both the mitral and the tricuspid valves (panels A and B, and video 1—to view video footage go to <http://www.heartjnl.com/supplemental>). On control transoesophageal echocardiography after six weeks of effective anticoagulation, these masses almost entirely disappeared from both valves (panel C and video 2). The patient showed no signs or symptoms of embolism during the same period.



Video footage appears on the *Heart* website—<http://www.heartjnl.com/supplemental>

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