TABLE 155-6 TIMING OF CARDIAC SURGICAL INTERVENTION IN PATIENTS WITH ENDOCARDITIS

	Indication for Surgical Intervention	
Timing	**Strong Supporting Evidence**	**Conflicting Evidence, but Majority of Opinions Favor Surgery**
Emergent (same day)	Acute aortic regurgitation plus preclosure of mitral valve	
	Sinus of Valsalva abscess ruptured into right heart	
	Rupture into pericardial sac	
Urgent (within 1–2 days)	Valve obstruction by vegetation	Major embolus plus persisting large vegetation (>10 mm in diameter)
	Unstable (dehisced) prosthesis	
	Acute aortic or mitral regurgitation with heart failure (New York Heart Association class III or IV)	
	Septal perforation	
	Perivalvular extension of infection with or without new electrocardiographic conduction system changes	
	Lack of effective antibiotic therapy	
Elective (earlier usually preferred)	Vegetation diameter >10 mm plus severe aortic or mitral valve dysfunction[a]	Staphylococcal prosthetic valve endocarditis
	Progressive paravalvular prosthetic regurgitation	Early prosthetic valve endocarditis (≤2 months after valve surgery)
	Valve dysfunction plus persisting infection after ≥7–10 days of antimicrobial therapy	Fungal endocarditis (*Candida* spp.)
	Fungal (mold) endocarditis	Antibiotic-resistant organisms

[a]Supported by a single-institution randomized trial showing benefit from early surgery. Implementation requires clinical judgment.

Source: Adapted from L Olaison, G Pettersson: Infect Dis Clin North Am 16:453, 2002.

surgery (indications assessed in studies as *propensity*), with adjustments for predictors of death (comorbidities) and timing of the surgical intervention. Although study results vary, surgery for currently advised indications appears to convey a significant survival benefit (27–55%) that becomes apparent only with follow-up for ≥6 months. During the initial weeks after surgery, mortality risk may appear increased (disease + surgery–related mortality).

Indications • ***CONGESTIVE HEART FAILURE*** Moderate to severe refractory CHF caused by new or worsening valve dysfunction is the major indication for cardiac surgery. At 6 months of follow-up, patients with left-sided endocarditis and moderate to severe heart failure due to valve dysfunction who are treated medically have a 50% mortality rate, while among matched patients who undergo surgery the mortality rate is 15%. The survival benefit with surgery, which is most predictable among patients with the most weighty indications (propensity), is seen in both NVE and PVE. Surgery can relieve functional stenosis due to large vegetations or restore competence to damaged regurgitant valves by repair or replacement.

PERIVALVULAR INFECTION This complication, which is most common with aortic valve infection, occurs in 10–15% of native valve and 45–60% of prosthetic valve infections. It is suggested by persistent unexplained fever during appropriate therapy, new electrocardiographic conduction disturbances, or pericarditis. TEE with color Doppler is the test of choice to detect perivalvular abscesses (sensitivity, ≥85%). For optimal outcome, surgery is required, especially when fever persists, fistulae develop, prostheses are dehisced and unstable, or infection relapses after appropriate treatment. Cardiac rhythm must be monitored since high-grade heart block may require insertion of a pacemaker.

UNCONTROLLED INFECTION Continued positive blood cultures or otherwise-unexplained persistent fevers (in patients with either blood culture–positive or –negative endocarditis) despite optimal antibiotic therapy may reflect uncontrolled infection and may warrant surgery. Surgical treatment is also advised for endocarditis caused by organisms against which effective antimicrobial therapy is lacking (e.g., yeasts, fungi, *P. aeruginosa*, other highly resistant gram-negative bacilli, *Brucella* species).

S. AUREUS ENDOCARDITIS The mortality rate for *S. aureus* PVE exceeds 50% with medical treatment but is reduced to 25% with surgical treatment. In patients with intracardiac complications associated with *S. aureus* PVE, surgical treatment reduces the mortality rate twentyfold. Surgical treatment should be considered for patients with *S. aureus* native aortic or mitral valve infection who have TTE-demonstrable vegetations and remain septic during the initial week of therapy. Isolated tricuspid valve endocarditis, even with persistent fever, rarely requires surgery.

PREVENTION OF SYSTEMIC EMBOLI Death and persisting morbidity may result from cerebral or coronary artery emboli. Predicting a high risk of systemic embolization by echocardiographic determination of vegetation size and anatomy does not by itself identify those patients in whom surgery to prevent emboli will result in increased chances of survival. Net benefits from surgery to prevent emboli are most likely when other surgical benefits can be achieved simultaneously—e.g., repair of a moderately dysfunctional valve or debridement of a paravalvular abscess. Only 3.5% of patients undergo surgery solely to prevent systemic emboli. Valve repair, with the consequent avoidance of prosthesis insertion, improves the benefit-to-risk ratio of surgery performed to address vegetations.

CIED ENDOCARDITIS Removal of all hardware is recommended for patients with established CIED infection (pocket or intracardiac lead) or erosion of the device through the skin. Percutaneous lead extraction is preferred. With lead vegetations of >3 cm and the resulting risk of a pulmonary embolus or with retained hardware after attempted percutaneous extraction, surgical removal should be considered. Removal of the infected CIED during the initial hospitalization is associated with increased 30-day and 1-year survival rates over those attained with antibiotic therapy and device retention. If necessary, the CIED can be reimplanted percutaneously or surgically (epicardial leads) at a new site after at least 10–14 days of effective antimicrobial therapy. CIEDs should be removed and replaced subsequently when patients undergo valve surgery for endocarditis.

Timing of Cardiac Surgery With the more life-threatening indications for surgery (valve dysfunction and severe CHF, paravalvular abscess, major prosthesis dehiscence), early surgery—i.e., during the initial week of therapy—is associated with a greater chance of survival than later surgery. With less compelling indications, surgery may reasonably be delayed to allow further treatment as well as improvement in overall health (Table 155-6). After 14 days of recommended antibiotic therapy, excised valves are culture-negative in 99% and 50% of patients with streptococcal and *S. aureus* endocarditis,