

**heart transplant**

criteria for recipient

**Clinical**  
 Heart Failure Survival Score (HFSS),<sup>3</sup> high risk  
 NYHA class III/IV heart failure refractory to maximal medical treatment  
 Severely limiting angina not suitable for revascularization: surgical or medical  
 Recurrent symptomatic ventricular arrhythmias refractory to medical, surgical or electrophysiological treatments

**Physiological**  
 Peak oxygen consumption less than 10 ml/kg per min after reaching anaerobic threshold

**Exclusion criteria**  
 Age greater than 65 years  
 Transpulmonary gradient (mean PAP – mean PAoP) > 15 mmHg (2.0 kPa) or PVR > 5.0 Wood Units despite standardized reversibility testing with nitrates or inhaled nitric oxide  
 Insulin-dependent diabetes mellitus with end organ dysfunction  
 Severe psychiatric disturbance or intellectual retardation  
 Current alcohol or drug abuse  
 Morbid obesity  
 Concurrent malignancy  
 Severe hepatic or renal disease, unrelated to cardiac disease (unless being considered for combined organ transplant)  
 Immunodeficiency disease  
 Active systemic infection

NYHA, New York Heart Association; PAP pulmonary artery pressure; PAoP, pulmonary artery occlusion pressure (or 'wedge' pressure); PVR, pulmonary vascular resistance.

pharmacology of the transplant heart

Drug	Effect on recipient	Mechanism
Digoxin	Normal increase in contractility; minimal effect on atrioventricular node	Direct myocardial effect, denervation
Adenosine	Four-fold increase in sinus and atrioventricular node blocking effect	Denervation super-sensitivity
Atropine	None	Denervation
Epinephrine	Increased contractility and chronotropy	Denervation super-sensitivity
Norepinephrine	Increased contractility and chronotropy	Denervation super-sensitivity
Isoprenaline	Normal chronotropic effect	Denervation
Glyceryl trinitrate	No reflex tachycardia	Baroreflex disruption
Quinidine	No vagolytic effect	Denervation
Verapamil	Atrioventricular block	Direct effect
Nifedipine	No reflex tachycardia	Denervation
$\beta$ -blockers	Increased antagonistic effect	Denervation
Pancuronium, neostigmine, succinylcholine	No bradycardia	Denervation

post operative care

Treatment	Directed at	Based on
Inotropic support (e.g. milrinone or epinephrine)	Poor contractility of LV, RV or both LV and RV	Elevated filling pressures, low cardiac output, echocardiography (TTE or TOE)
Pressor support (e.g. norepinephrine)	Low systemic arterial blood pressure despite adequate filling pressures and supported contractility	Arterial pressure monitoring, cardiac output and TTE or TOE
Heart rate support with chronotropic drugs (e.g. isoprenaline or milrinone) or pacing	Low intrinsic grafted heart rate	Heart rate less than 90 in the first 48 h usually symptomatic and indication for support
Mechanical support (e.g. IABP)	Poor LV function not responsive to other measures	Elevated LAP, low cardiac output, poor response to drugs, TTE or TOE
Temporary ventricular assistance – RVAD, LVAD or BiVAD	Very poor RV, LV or biventricular function	As above, no response to less invasive measures and where recovery or retransplantation may be an option
Inhaled nitric oxide	RV failure combined with reversible elevation of PVR	Filling pressures, PAP, TTE or TOE
Resternotomy	Catastrophic states where excessive bleeding or tamponade is suspected	Combination of observations but particularly TOE

LV, left ventricle; RV, right ventricle; TTE, trans thoracic echocardiography; TOE, trans oesophageal echocardiography; IABP, intra-aortic balloon pump counterpulsation; LAP, left atrial pressure (direct or indirect); RVAD, LVAD, BiVAD, right, left or biventricular assist device support; PAP, pulmonary arterial pressure; PVR, pulmonary vascular resistance.

non-transplant or bridge to transplant options for severe heart failure

Treatment modality	Notes
Angiotensin-converting enzyme (ACE) inhibitors	Reduce cardiac work and improve output – beware exacerbation of renal failure
$\beta$ -blockers <sup>5,6</sup>	Improve $\beta$ -receptor numbers and function
Inotropic support	Rescue therapy – rescue and re-stabilization sometimes possible – requires central vascular access
Intra-aortic balloon pump counterpulsation	Rescue therapy combined with inotropes – may re-stabilize and thus temporary but invasive
Anti-arrhythmic treatments – implantable defibrillators and advanced pacing devices	Where recurrent or severe arrhythmias threaten life or cause general destabilizations
Surgical interventions	Routine such as coronary artery bypass or complex – such as anterior ventricular remodelling, mitral reconstruction where severe mitral regurgitation complicates cardiomyopathy
Ventricular assist devices (VAD) <sup>7</sup>	Short term and medium term mechanical support for the failed heart – extremely invasive – usually holding stage or bridge to transplant
Totally implanted artificial heart <sup>8</sup>	Longer term version of VAD – ultimately may be instead of transplant