

Cardiac transplantation in children

Filip Kucera
Matthew Fenton

Abstract

Heart transplantation improves the prognosis and quality of life in children with end-stage cardiac disease. With advances in surgical technique, post-operative care and immunosuppression the survival has considerably increased and can reach in most cases 15–20 years. The commonest indication for heart transplantation in childhood is cardiomyopathy, followed by complex congenital heart disorders. Prognosis following heart transplantation is largely determined by complications resulting from rejection or complications from medications. Primary graft failure, acute rejection, coronary allograft vasculopathy, infections and development of malignancy are the main causes of death. Despite decreasing incidence of graft rejection following improved immunosuppressive protocols, coronary allograft vasculopathy remains the main long term cause of death after transplant and has limited treatment options.

Although most organs arise following neurological determination of death, donation after circulatory determination of death is now possible but is not routinely utilised for heart transplantation. The demand for hearts outstrips the number of available organs and nearly a third of those listed will die waiting. Alternative strategies are required to support children in heart failure in addition to improvement in public awareness so that donor availability can increase. This article briefly reviews the current criteria for transplantation, the important aspects of surgical and medical care of the paediatric heart transplant recipient and the prognosis.

Keywords heart failure; heart transplantation; organ donation; transplantation waiting list

Introduction

Heart transplantation is an accepted therapy for children with end-stage heart failure. The introduction of cyclosporine in the 1980s significantly improved quality of life and survival. In the last decade approximately 4000–4500 heart transplants were performed every year in the world (195 in the UK in 2015). This includes 450–500 paediatric cases (30–40 in the UK per year) and their proportion remains relatively stable. Children less than 2 years of age and teenagers are the most frequently transplanted age groups.

Amongst children, the two most common indications for transplantation are dilated cardiomyopathy and congenital heart

Filip Kucera MD is a Locum Consultant in Paediatric Cardiology at Great Ormond Street Hospital in London, UK. Conflict of interest: none.

Matthew Fenton MD MBBS is a Consultant in Paediatric Cardiology and Heart Transplantation at Great Ormond Street Hospital in London, UK. Conflict of interest: none.

disease. There are a growing number of patients with heart failure after surgical palliation for congenital heart disease, especially following palliation with a single ventricle strategy.

Increasing waiting lists resulting from a significant shortage of donor organs is a major limitation. Waiting list mortality is around 30% within the UK. Donor availability has been maximised through accepting more marginal donors, bridging to transplant with mechanical devices, performing a transplant across blood groups for young children (ABO incompatible) and using heart donors after circulatory death. An important recent landmark is the revision of guidelines allowing neurological determination of death in neonates. If universally adopted within neonatal units it is possible that organ availability for babies will increase significantly and provide an opportunity for donor families to decide whether they would like to donate.

Indications and contraindications to cardiac transplantation

Which children might benefit from a heart transplant?

Some children with heart failure have an unacceptable quality of life and are severely limited in their ability to perform daily activities despite maximal medical treatment. A few patients even require an intravenous infusion of inotropic drugs or mechanical circulatory support in order to maintain adequate tissue perfusion. Children with congenital heart disease unsuitable for surgery or untreatable arrhythmias may also be considered suitable for transplantation (see [Table 1](#)). If no organ becomes available, the progressive nature of the disease ultimately leads to death.

What are the contraindications?

An irreversible elevation of pulmonary vascular resistance is an accepted contraindication to transplantation though an accepted value for PVRI remains debatable. Patients with an active infection or malignancy, significant genetic or metabolic disorder with multiorgan involvement, severe irreversible pulmonary, renal, hepatic failure, uncertain neurological prognosis and important behavioural issues that increase the risk of non-compliance with life saving treatment after transplant are also relative contraindications to cardiac transplantation (see [Table 1](#)).

Transplant listing

Transplant assessment

Patients with end-stage cardiac disease are referred to transplant centres for assessment by members of the transplant team, including a transplant cardiologist. The assessment consists of a number of tests and clinical review designed to assess their baseline status and inform families regarding the relative merits and disadvantages of heart transplantation. This results in a multidisciplinary decision regarding suitability and timing for being placed on the waiting list.

Both parents and their child are also involved in decision making. A patient is accepted onto the waiting list only if the heart transplant seems to be the best option. Alternative treatment such as intensification of medical or other surgical intervention may be recommended in some cases instead. Pre-transplant tests are summarised in [Table 2](#). Patients have blood tests, swabs, ECG, 24-hour ECG tape, ECHO, exercise test, abdominal ultrasound and chest X-ray.

Indications for paediatric heart transplantation

Indications for cardiac transplantation:

- refractory cardiogenic shock, heart failure requiring continuous intravenous inotropic or mechanical circulatory support
- peak oxygen consumption (VO_2) of 14 ml/kg/minutes. (without a β -blocker) or VO_2 of 12 ml/kg/minutes. (with a β -blocker) or $\text{VO}_2 \leq 50\%$ of predicted
- progressive deterioration of cardiac function or functional capacity despite maximal medical treatment
- unacceptable quality of life, inability to perform daily activities
- congenital heart disease unsuitable for surgical palliation or repair
- malignant life-threatening arrhythmias resistant to medical treatment, catheter ablation, surgery or implantable cardioverter-defibrillator
- progressive pulmonary hypertension that could potentially become a contraindication to heart transplantation in the future

Relative contraindications to cardiac transplantation:

- non-reversible elevation of pulmonary vascular resistance to more than 6 Wood units/ m^2 (normal upper limit less than 1.5 Wood units/ m^2) or a transpulmonary gradient more than 15 mmHg (normal upper limit less than 12 mmHg) both presenting a major risk for post-operative donor heart right ventricular failure
- active or recently diagnosed malignancy
- major brain pathology with bad or uncertain neurological prognosis
- severe progressive metabolic disorder with multiorgan involvement
- significant dysmorphism or genetic syndrome
- severe irreversible end-organ failure (pulmonary and/or renal and/or hepatic)
- small size, prematurity
- major risk of drug non-compliance, lack of family support
- mental illness, drug, tobacco, alcohol abuse
- severe active infection or sepsis
- relative contraindication: HIV, chronic hepatitis B and C infection

Table 1

A cardiac catheter measuring the pulmonary vascular resistance (PVR) is usually performed only in children with restrictive cardiomyopathy or those with palliated congenital heart disease as they are most likely to have an elevated PVR sometimes even precluding the transplant. The PVR in patients with end-stage dilated cardiomyopathy is generally in the transplantable range. Therefore a high risk general anaesthetic for a cardiac catheter needs careful consideration of the risks.

Transplant listing criteria

Priority is given to patients on the urgent list in whom survival without transplantation is likely to be very short. To qualify they need to be bridged to transplantation with a mechanical circulatory support such as ECMO, Berlin Heart ventricular assist device or high dose inotropes.

A non-urgently listed stable patient on a Heartware ventricular assist device may become urgently listed due to device related

Investigations required in preparation for heart transplantation

Pre-transplant investigations:

A. Blood tests:

- **Routine blood tests:** full blood count, coagulation profile, extended biochemistry
- **Serologies:** HSV IgG, VZV IgG, EBV VCA IgG, CMV IgG, rubella IgG, measles IgG, toxoplasma IgG, HBs antigen, hepatitis C antibodies, HIV
- **Immunology tests:**
 - HLA typing
 - Panel Reactive Antibody (PRA) testing (quantifying the amount of pre-existing antibodies targeting HLA antigens present in a general population).
 - Isohaemagglutinin titres (anti-A or B blood group antibodies) in ABO incompatible transplant candidates

B. Other tests:

- Chest X-ray
- ECHO
- ECG
- 24-hour ECG tape
- Abdominal ultrasound
- Exercise test, 6-minute walk test
- Cardiac catheter (not routinely)
- Bacterial swabs, sputum and urine sample

Table 2

complications significantly increasing the risk of device failure such as infection. Waiting lists are updated on a daily basis. All children being on the waiting list are re-evaluated regularly in the transplant centre and may be temporarily (suspended) or permanently taken off the list if there is worsening of their condition making the chance for a successful transplant too low.

The waiting times depend on several factors that determine the suitability of a donor organ for the child such as weight, blood group, antibody testing and tissue typing results. Sadly, as many as a third of children are never transplanted and die whilst waiting for a new heart. Waiting times for young children are often many months and rarely as long as a year whilst being bridged to a transplant with mechanical support. Waiting times are increasing as a result of our ability to keep children alive longer without significant complications in the majority. However admission to hospital in younger patients supported by the Berlin heart Excor device is mandatory.

Transplant donation

Increasing organ shortage represents the biggest problem in transplant medicine. Despite the fact that about 90% of the UK population is in favour of transplantation, the UK has one of the highest refusal rates in Europe with 43% of relatives not consenting on behalf of their relative. In 2013, one year after listing, there were no patients actively waiting on the routine list; 75% had been moved to the urgent list, 8% had been removed and 17% had died waiting. The median UK waiting time during in 2013 was 81 days on the urgent and 357 days on the routine waiting list.

Download English Version:

<https://daneshyari.com/en/article/5720017>

Download Persian Version:

<https://daneshyari.com/article/5720017>

[Daneshyari.com](https://daneshyari.com)