

**NHS BLOOD AND TRANSPLANT  
LIVER ADVISORY GROUP**

**Protocols and Guidelines for Children Undergoing  
Deceased Donor Liver Transplantation in the UK**

**PROTOCOLS AND GUIDELINES**

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**April 2010**

# PROTOCOLS AND GUIDELINES

## 1. Introduction

1.1 Paediatric liver transplantation has been a major success and is now an established therapeutic entity. The use of innovative surgical techniques has allowed the application of liver transplantation to even very young infants with excellent results. Selection criterion for adults is properly based on outcome measures. The major driving force for this has been the mismatch between the number of donor organs and potential recipients. While the same general principles apply to children there are notable differences. The success of liver splitting allows many children to benefit from liver transplantation with little net effect on the overall donor organ pool. Also in some circumstances a smaller probability of long-term success may be a very worthwhile outcome for some children and their families. The particularly high mortality in children awaiting combined liver and intestinal transplantation has been recognised by allocating this group a higher priority in the allocation sequence.

## 2. The need for liver transplantation

### 2.1 Referral to a transplant centre

Most children with liver disease who are candidates for transplant have already been referred to one of the three paediatric liver transplant centres; King's College Hospital, London, The Children's Hospital Birmingham and Leeds General Infirmary. Well-established referral pathways exist for this. Patients assessed for liver transplantation will fall into the following broad groups:

Primary recipient disease:

- (i) Chronic liver disease
  - Biliary atresia
  - Alpha-1-antitrypsin deficiency
  - Autoimmune hepatitis
  - Sclerosing cholangitis
  - Caroli syndrome
  - Wilson's Disease
  - Cystic Fibrosis
  - Progressive familial intrahepatic cholestasis (all types)
  - Alagille syndrome
  - Glycogen storage diseases type 3 and 4
  - Tyrosinaemia type 1
  - Graft versus host disease
  - Budd-Chiari syndrome
  - Any aetiology leading to hepatopulmonary syndrome
  
- (ii) Acute liver failure

Multisystem disorder in which severe acute impairment of liver function with or without encephalopathy occurs in association with hepatocellular necrosis in a child with no recognised underlying chronic liver disease.

(iii) Liver tumours

Unresectable hepatoblastoma (without active extrahepatic disease)  
Unresectable benign liver tumours with disabling symptoms

(iv) Metabolic liver disease with life-threatening extra-hepatic complications

Crigler Najjar Syndrome  
Urea Cycle defects  
Hypercholesterolaemia  
Organic acidaemias  
Primary hyperoxaluria  
Glycogen storage disease type 1  
Inherited disorders of complement causing atypical haemolytic uraemic syndrome

## 2.2 Indications for liver transplantation

These are usually accepted as:

1. Acute liver failure in children less than 2 years old.
  - a. INR > 4 or Grade 3/4 encephalopathy
2. Acute liver failure due to Seronegative hepatitis, hepatitis A or hepatitis B or an idiosyncratic drug reaction
  - a. Any grade of encephalopathy, and any three from the following: unfavourable aetiology (idiosyncratic drug reaction, seronegative hepatitis), age <10 years, jaundice to encephalopathy time >7 days, serum bilirubin >300µmol/l, prothrombin time >50 seconds or INR >3.5.
3. Acute liver failure due to Wilson's disease, Budd Chiari syndrome, Paracetamol poisoning or early graft dysfunction
  - a. As per the indications for adults
4. Chronic liver disease
  - (i) Life expectancy: Anticipated length of life < 18 months (because of liver disease)
  - (ii) Unacceptable quality of life (because of liver disease)
  - (iii) Growth failure or impairment due to liver disease
  - (iv) Reversible neuro-developmental impairment due to liver disease.
  - (v) Likelihood of irreversible end organ damage (Which may be renal, respiratory or cardiovascular depending on underlying disorder)

For the more frequent indications listed above it is usually clear whether these criteria are met, and if so, they should be offered transplantation if:

There is an expectation that they have a >50% probability of survival at 5 years after transplantation with a quality of life acceptable to them and their families.

### **Rarer indications**

The complicating factor is that in paediatric practice many of the conditions affecting children are individually rare and decisions have to be based on general principles rather than condition specific data. Also, a <50% probability of good quality long term survival is a very worthwhile outcome for many families and clinicians.

Particular rare indications for liver transplantation that Paediatric centres would feel are reasonable, but for which there is limited outcome data, would include the following conditions:

- (a) Liver transplantation for organic acidaemia
- (b) Unresectable hepatic malignancies without extrahepatic spread. (to include selected hepatocellular carcinoma and Epithelioid haemangioendothelioma )
- (c) Diffuse hepatic haemangioendothelioma unresponsive to alternative treatments
- (d) Langerhans cell histiocytosis
- (e) Mitochondrial respiratory chain disorders with chronic liver disease (selected) but without discernible disabling extrahepatic disease
- (f) Intestinal failure associated liver disease

The use of transplantation for the rarer indications should be audited regularly and new indications should in general be developed by consensus.

## **3. Assessment**

- 3.1 Assessment is carried out by the transplant multi-disciplinary team and will involve the patient and their family. These initial procedures often follow out patient review and are usually undertaken over 4-5 working days.
- 3.2 The decision whether or not to register a patient on the waiting list will be made after discussion with the multi-disciplinary team, the patient's family and, with age appropriate language, the patient themselves. This should allow informed consent to be given by the patient's family and where appropriate the patient themselves.
- 3.3 The ability of the child's family to comply with instructions and follow-up plans are relevant factors, which must be considered in the transplant assessment process. However the aim of the process is to identify support required to enable successful transplantation. Children should not be disadvantaged by family factors beyond their control.

3.4 Age is not itself a contraindication, but the outcome of transplantation in the neonatal period is inferior to transplantation later in childhood.

3.5 Patients should be kept under review while on the waiting list as their condition may deteriorate to the point that transplantation becomes inappropriate or unnecessary. In these circumstances the patient would be removed from the transplant list only after discussion with their family and, where appropriate, the child themselves.

#### **4. Patient registration**

4.1 Patients can be placed on a UK transplant list only following registration with NHSBT. Patients who have not been registered should not be offered an organ. Patients are required to consent to transfer of their data onto the UK Transplant Registry, which is maintained by NHSBT on behalf of transplant services in the UK and holds detailed information about each patient awaiting any organ transplant in order that they may have an up to date status of the state of the transplant list.

#### **5. Allocation of Donor Livers**

5.1 The principles through which donor livers will be allocated are discussed and agreed through the NHSBT Liver Advisory Group network. Copies of the protocol<sup>1</sup> (which is updated from time to time) are available from NHSBT.

Published: October 2002  
Last Revised: April 2010

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<sup>1</sup> Donor Organ Sharing Scheme. Operating Principles for Liver Transplant Centres in the UK and Republic of Ireland. Prepared by the NHSBT Liver Advisory Group.