NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

Interventional procedures consultation document

Ex-vivo machine perfusion for extracorporeal preservation of livers for transplantation

A donor's liver for a transplant is usually stored with cold fluid and ice until it is put into the patient. In this procedure, a special machine is used to deliver oxygenated blood to the donor liver. The aim is to reduce damage to the liver after it has been removed from the donor, and to improve how it works once it has been transplanted. The machine also allows the liver's function to be assessed before it is transplanted, and may increase how long the liver can be stored before a transplant.

The National Institute for Health and Care Excellence (NICE) is looking at ex-vivo machine perfusion for extracorporeal preservation of livers for transplantation. NICE's interventional procedures advisory committee has considered the evidence and the views of specialist advisers, who are consultants with knowledge of the procedure.

The committee has made draft recommendations and we now want to hear your views. The committee particularly welcomes:

- comments on the draft recommendations
- information about factual inaccuracies
- additional relevant evidence, with references if possible.

This is not our final guidance on this procedure. The recommendations may change after this consultation.

After consultation ends:

- The committee will meet again to consider the original evidence and its draft recommendations in the light of the consultation comments.
- The committee will prepare a second draft, which will be the basis for NICE's guidance on using the procedure in the NHS.

For further details, see the Interventional Procedures Programme process guide.

Issue date: [month year]

Through our guidance, we are committed to promoting race and disability equality, equality between men and women, and to eliminating all forms of discrimination. One of the ways we do this is by trying to involve as wide a range of people and interest groups as possible in developing our interventional procedures guidance. In particular, we encourage people and organisations from groups who might not normally comment on our guidance to do so.

To help us promote equality through our guidance, please consider the following question:

Are there any issues that require special attention in light of NICE's duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity, and foster good relations between people with a characteristic protected by the equalities legislation and others?

Please note that we reserve the right to summarise and edit comments received during consultations or not to publish them at all if in the reasonable opinion of NICE, there are a lot of comments, of if publishing the comments would be unlawful or otherwise inappropriate.

Closing date for comments: 19 July 2018

Target date for publication of guidance: October 2018

1 Draft recommendations

1.1 The evidence on ex-vivo machine perfusion for extracorporeal preservation of livers for transplantation raises no major safety concerns. However, current evidence on its efficacy is limited in quantity. Therefore, this procedure should only be used with special arrangements for clinical governance, consent, and audit or research.

1.2 Clinicians wishing to do ex-vivo machine perfusion for extracorporeal preservation of livers for transplantation should:

- Inform the clinical governance leads in their NHS trusts.
- Ensure that patients understand the uncertainty about the procedure's safety and efficacy, and provide them with clear written information to support shared decision-making. In

addition, the use of NICE's information for the public is recommended.

- Audit and review clinical outcomes of all patients having ex-vivo machine perfusion for extracorporeal preservation of livers for transplantation. NICE has identified relevant audit criteria and is developing an audit tool (which is for use at local discretion), which will be available when the guidance is published.

1.3 Clinicians and centres doing this procedure must follow the relevant regulatory and legal requirements of the Human Tissue Authority.

1.4 Clinicians should enter details about all patients having this procedure into the NHSBT UK transplant registry.

1.5 Further research should report the exact method of perfusion used, graft survival and the use of marginal grafts.

2 The condition, current treatments and procedure

The condition

2.1 Liver transplantation is the treatment of choice for patients with end-stage liver disease. It may also be indicated in patients with some types of primary liver cancer. End-stage liver failure can be either acute (for example, from poisoning) or chronic (for example, because of cirrhosis from alcohol-related liver disease, metabolic, autoimmune or infectious conditions). In children, the most common cause of end-stage liver failure is congenital biliary atresia.

Current treatments

2.2 Limited availability of deceased donor livers for transplantation led to the development of techniques that increase the number of recipients who can benefit from 1 available organ. These include split liver grafts (the larger right lobe is usually grafted into an adult and the left lobe into a child) and reduced (segmental) liver grafts.

2.3 Living‑donor liver transplantation is also an option for patients who are deteriorating clinically while waiting for a deceased donor transplant.

The procedure

2.4 Ex-vivo machine perfusion preserves the donor liver outside the body under normothermic or hypothermic conditions using a perfusion machine that delivers oxygenated blood supplemented with nutrients and metabolic substrates. The intention is to:

- reduce the rate of tissue deterioration that occurs after the liver has been removed from the donor compared with that seen with conventional static cold storage
- allow for better assessment of donor liver function pretransplantation
- extend how long the liver can be stored to allow more flexibility in the timing of the transplant operation.

The aim is to improve clinical outcomes for the recipient and to enable otherwise marginal organs (such as those donated after circulatory death, steatotic livers and livers from older people) to be transplanted safely, so increasing the number of livers available for transplantation.

2.5 In this procedure, the donor liver is placed in a perfusion machine. The perfusion machine comprises a blood reservoir, a pump, blood

oxygenator, blood warming unit and monitoring equipment. Both the hepatic artery and portal vein of the liver are perfused, and effluent blood is collected and recirculated through the liver. This procedure has been used to store a donor liver for up to 24 hours, after which it can be implanted into a recipient in the conventional way.

3 Committee considerations

The evidence

3.1 To inform the committee, NICE did a rapid review of the published literature on the efficacy and safety of this procedure. This comprised a comprehensive literature search and detailed review of the evidence from 11 sources, which was discussed by the committee. The evidence included 1 randomised controlled trial, 7 matched case-control studies, 2 non-randomised control studies, and 1 case series, and is presented in table 2 of the interventional procedures overview. Other relevant literature is in the appendix of the overview.

3.2 The specialist advisers and the committee considered the key efficacy outcomes to be: graft function, patient survival and use of marginal grafts.

3.3 The specialist advisers and the committee considered the key safety outcomes to be: graft damage (including vascular damage), biliary tract complications and infection.

3.4 No patient commentary was sought because the procedure is done ex vivo, not directly to the patient.

Committee comments

3.5 The literature described different methods used for this procedure including: variation in the temperature used for machine perfusion (hypo- or normothermic); the point at which machine perfusion was started after donor liver explantation; and the duration of machine perfusion.

3.6 This procedure might allow for better assessment and more frequent use of marginal livers, so increasing the number of livers available for transplantation.

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Chairman, interventional procedures advisory committee
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