NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

Interventional procedures consultation document

Ex-situ machine perfusion for extracorporeal preservation of lungs (ex-vivo lung perfusion) for transplantation

A donor lung for transplantation is usually stored in a cold liquid after it has been removed to preserve lung function for a limited period of time, until the lung can be transplanted.

In this procedure, a machine is used to treat the donor lung with an oxygenated solution and keep it at normal body temperature. The aim is to reduce damage to the donor lung, increase the time the lung can be stored, and allow assessment of how well the lung works before it is transplanted. This procedure may also allow more donor lungs to be used for transplantation.

NICE is looking at ex-situ machine perfusion for extracorporeal preservation of lungs (ex-vivo lung perfusion) for transplantation.

NICE's interventional procedures advisory committee met to consider the evidence and the opinions of professional experts, who are consultants with knowledge of the procedure.

This document contains the draft guidance for consultation. Your views are welcome, particularly:

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

NICE is committed to promoting equality of opportunity, eliminating unlawful discrimination and fostering good relations between people with particular protected characteristics and others.

This is not NICE's final guidance on this procedure. The draft guidance may change after this consultation.

After consultation ends, the committee will:

- meet again to consider the consultation comments, review the evidence and make appropriate changes to the draft guidance
- prepare a second draft, which will go through a resolution process before the final guidance is agreed.

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

Closing date for comments: 12-02-2021

Target date for publication of guidance: May 2021

1 Draft recommendations

1.1 Evidence on the safety and efficacy of ex-situ machine perfusion for extracorporeal preservation of lungs for transplantation is adequate to support the use of this procedure provided that standard arrangements are in place for clinical governance, consent and audit. Find out what standard arrangements mean on the NICE interventional procedures guidance page.

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

1.3 Clinicians should enter details about all patients having this procedure and details about the device used into the NHS blood and transplant organ donation and transplantation registry.

2 The condition, current treatments and procedure

The condition

2.1 Lung transplantation is usually done in patients with non-malignant advanced or end-stage pulmonary diseases (such as severe pulmonary fibrosis, cystic fibrosis, pulmonary hypertension and obliterative bronchiolitis) that is minimally responsive or unresponsive to treatment and who have a life expectancy of less than a year. This improves patients' quality of life and prolongs survival.

2.2 On average, 20% of potential deceased donor lungs in the UK are used for transplantation. The rest are considered unsuitable, usually because of complications associated with attempts to save the donor or injury which happens in association with death. Limited availability of deceased donor lungs that meet standard criteria for transplantation results in up to 30% of patients clinically deteriorating and dying while waiting for a lung transplant.

Current treatments

2.3 Standard lung transplantation protocol involves cold preservation to maintain the donor lungs. Various other strategies are used to increase the available pool of deceased donor lungs and these include brain death donor lungs from extended criteria donors and donors after circulatory death. Living donor lobal or lung transplant is another option.

The procedure

2.4 Ex-situ machine perfusion for extracorporeal preservation of lungs (ex-vivo lung perfusion, EVLP) is a technique of lung preservation that may allow donor lungs to be preserved for longer in better physiologic conditions, and may allow marginal donor lungs or

pulmonary grafts which are working poorly to be improved and reconditioned so that they can be used in lung transplantation.

2.5 Ex-situ machine perfusion for extracorporeal preservation of lungs is done once the lungs have been removed from the donor after cold pulmonary flush using surgical techniques. An adequate donor left atrial cuff and pulmonary artery are preserved to allow anastomosis to the recipients' organs.

2.6 After being transferred in cold solution and being ischemic for a period of time, the lungs are placed in a specially designed organ chamber and connected to a modified heart-lung bypass machine, a ventilator and filtration or EVLP system. A specialised nutrient solution (perfusate) is pumped from the filtration or EVLP system through a perfusion circuit (gas exchange membrane, heat exchanger and leukocyte filter) under optimal colloid pressure through the pulmonary artery to the lungs. Pulmonary effluent from the left atrium drains back to the EVLP system and is recirculated. Perfusion flow is then gradually increased, pulmonary artery pressure is carefully monitored, and protective controlled mechanical lung ventilation with low tidal volume and positive end expiratory pressure is started. The lungs are gradually rewarmed to body temperature while reaching a targeted flow. EVLP is possible for a number of hours after removal from the donor. During this period, the lungs can be assessed and if necessary, treated to remove unwanted fluid, and to re-expand areas of lung that have collapsed (atelectatic areas). If EVLP treated lungs recover well enough, they may be considered suitable for recipient transplantation in the conventional way.

2.7 Ex-situ machine perfusion is administered using different devices or machines and protocols which vary in equipment used, perfusate composition, perfusion and ventilation settings (target flow, temperature, pressure).

3 Committee considerations

The evidence

3.1 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 7 sources, which was discussed by the committee. The evidence included 3 meta-analyses, 3 retrospective cohort studies and 1 prospective case series. It is presented in the summary of key evidence section in the interventional procedures overview. Other relevant literature is in the appendix of the overview.

3.2 The professional experts and the committee considered the key efficacy outcomes to be: lung function after transplantation, patient survival after transplantation and quality of life.

3.3 The professional experts and the committee considered the key safety outcomes to be: primary graft dysfunction and prolonged lung recovery (for example, needing extracorporeal membrane oxygenation [ECMO]).

Patient commentary was sought but none was received.

Committee comments

3.4 The committee noted that there is more than 1 device used for this procedure.

3.5 The intention of the procedure is to allow better assessment and more frequent use of marginal lungs, so increasing the number of lungs available for transplantation.

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Chair, interventional procedures advisory committee

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