

LUNG SELECTION CRITERIA

This policy has been created by the Cardiothoracic Advisory Group on behalf of NHSBT.

The policy has been considered and approved by the Clinical Governance Monitoring Group (CGMG) and the Senior Management Team of the Organ Donation and Transplantation Directorate (ODT). It has also received final approval from the Transplant Policy Review Committee (TPRC), who act on behalf of the NHSBT Board, and who will be responsible for annual review of the guidance herein.

Last updated: July 2014

Next review: [Month] 2015

The aim of this document is to provide a policy for the selection of adult and paediatric patients on to the UK national transplant list and, where necessary, criteria for their de-selection. These criteria apply to all recipients of organs from deceased donors.

In the interests of equity and justice all centres should work to the same selection criteria. Non-compliance to these guidelines will be handled directly by NHSBT, in accordance with the *NHS Blood and Transplant Organ Donation and Transplantation: Policy on Non compliance with Selection and Allocation policy (May 2011)*.

It is acknowledged that these guidelines will require regular review and refreshment. Where they do not cover specific individual cases, mechanisms are in place for selection of exceptional cases (see section 3.1.1).

Lung transplantation is an established treatment in patients who have a likelihood of poor survival or impaired quality of life secondary to end stage lung disease.

1. Conditions that are considered for transplantation

1.1 Adult patients

Most adult patients with lung disease are not managed in transplant centres. Patients referred for assessment for lung transplant will include those with the following broad categories of conditions:

- Diffuse Parenchymal Lung Disease including:
 - Idiopathic pulmonary fibrosis
 - Lung fibrosis in association with connective tissue disease
 - Occupational lung fibrosis
 - Drug / toxic lung fibrosis
 - Chronic allergic alveolitis
 - Sarcoidosis

- Lymphangioleiomyomatosis
 - Langerhan's cell histiocytosis
- Obstructive lung disease including:
 - Smoking related chronic obstructive pulmonary disease (COPD) (Emphysema and chronic bronchitis)
 - Alpha 1 antitrypsin deficiency
 - Obliterative bronchiolitis
 - Chronic asthma
- Pulmonary vascular disease including:
 - Idiopathic pulmonary arterial hypertension
 - Complex congenital heart disease with Eisenmenger's syndrome
 - Pulmonary arterial hypertension associated with connective tissue disease
 - Chronic thromboembolic pulmonary hypertension unsuitable for or unresponsive to pulmonary thrombo endarterectomy
- Suppurative lung disease including:
 - Cystic Fibrosis (CF)
 - Non-CF bronchiectasis

Patients not falling within these diagnostic categories will be considered by the local transplant multidisciplinary team (MDT) on a case by case basis.

1.2 Paediatric patients (aged less than 16 years)

There are a number of rare paediatric respiratory conditions which may not fall into the following diagnostic categories, but will be considered by the local multidisciplinary transplant team on an individual case basis.

- Pulmonary vascular disease including:
 - Idiopathic pulmonary arterial hypertension
 - Pulmonary Veno-occlusive disease
 - Complex congenital heart disease with Eisenmenger's syndrome
- Suppurative lung disease including:
 - Cystic Fibrosis
 - Non-CF bronchiectasis
- Children's Interstitial Lung Disease (ChILD) (will be considered on an individual basis)
- Obliterative bronchiolitis

2. Assessment of patients

2.1 Adult patients

Assessment is carried out by the transplant multidisciplinary team. It is highly desirable for the patient's family/carers to be involved in the assessment process. These initial assessment procedures often follow outpatient consultation and are undertaken over several days.

A number of factors are used to inform decisions around the appropriateness of transplantation in each patient context and these must all be made explicit to the patients and their relatives.

2.1.1 Stages of assessment

- 1 Referral (see appendix 1)
- 2 Pre-assessment outpatient clinic when appropriate
- 3 In-patient assessment where appropriate
- 4 Listing decision
- 5 Follow up on the waiting list where appropriate

If the patient decides to proceed to transplantation, he or she is then registered with NHS Blood & Transplant (NHSBT) and placed on the waiting list. It is the responsibility of the healthcare professional to ensure that the registration details are correct and they are accountable for the accuracy of the information provided.

If the patient is not deemed suitable and/or declines the option of transplantation, the clinician should explain to the patient and their family the options available to them. The family doctor and referring clinicians should be informed of the outcome of the assessment.

Patients have the right to a second opinion.

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

Patients will be placed on the transplant list on the day on which all required details are received by NHSBT. Discrepancies or missing information will be followed up with the local centre and might cause a delay.

2.1.2 Consent process

When a patient is considered a suitable candidate for transplantation, the transplant team will obtain consent for the procedure. This process will include:

1. The approved hospital consent form for surgical intervention listing the nature of the procedure, potential benefits to the patient and frequent or serious complications. It is good practice to supplement the consent with written information.

2. Guidance on Consent is given in the document from NHSBT and the British Transplantation Society. Candidates should be presented with a list of nationally agreed criteria for organs

routinely used for lung transplantation and will be asked to give prior written consent to accept donor organs from these categories. Candidates may choose to decline certain types of donor organs (such as lungs from smokers) after appropriate counselling outlining the consequences of their choice. Their views must be clearly documented and respected.

3. It is important for a potential transplant recipient and their family/carer to be offered full information on donor risks and the procedures relating to donor organ selection. All donors are fully characterised by the Specialised Nurses in Organ Donation, according to local and international guidelines, and assessed very carefully by the Intensive Care Consultants, the retrieval team and the implanting team for suitability for transplant. This process is in place to assess the function of the organ(s) after implantation and ensure an appropriate balance of risk and benefit for the recipient.

Because of the impact of delay in implanting lungs, transplant candidates will be consulted only about those donors whose lungs are of higher risk. Examples of this include:

- Donors with larger lung volume may be considered for smaller recipients and the donor lungs may be reduced in size by trimming them. This is considered a higher risk procedure.
- Any donor who has a medical condition where there is no evidence of the risk of disease transmission
- Donors with a history of some cancers

In such cases, the discussions and outcome should be clearly recorded in the hospital notes.

4. Consent to add the candidate's details to the UK Transplant Registry.

5. Consent, if appropriate and where given, for participation in Research and Development (R&D) Ethics Committee approved clinical studies (local or national).

6. Consent to obtain and store photographic images of candidates for the benefit of the MDT, depending on local practices, where appropriate.

2.1.3 The waiting list

The patient should receive detailed, consistent explanations, and key information pertaining to the waiting period for transplantation, which is recorded in accordance with National Standards (see Appendix 2).

2.2 Paediatric patients

Paediatric patients (aged <16 years) undergo a similar assessment process involving a multidisciplinary team approach with full family involvement. Patients will undergo most of the investigations and assessments listed in the adult section, but they will not usually be seen in a pre-assessment clinic.

3. Selection criteria

3.1 Rationale for choice of selection criteria

To ensure justice and equity, patients listed for transplantation should meet agreed minimal listing criteria. It is recognised that transplantation may be indicated for some patients who do not meet these criteria. In such cases, patients should be referred to the Appeals Panel (see below)

3.2 Clinical criteria for selection for adult lung transplantation

There is a broad spectrum of conditions considered for lung transplantation and therefore indications for transplantation may vary. In addition to the disease-specific criteria, patients listed for transplantation will have:

- A potential survival benefit from transplantation or a potential significant improvement in the quality of life as a result of transplantation, AND
- A projected post-operative survival >5 years with a quality of life acceptable to the recipient

3.2.1 Disease-specific criteria for selection

Patients can be listed for lung transplantation if this is supported by the MDT and they meet the criteria listed below.

It is recognized that guidelines will not cater for every individual so, in order to demonstrate transparency and equity for all potential transplant candidates, those who do not fulfil the criteria below can be listed according to the Appeals procedure (see section 5).

3.2.1.1 COPD

- Forced expiratory volume (FEV)₁ of less than 20% predicted despite maximal medical therapy and either diffusing capacity of the lungs for carbon monoxide (DLCO) of less than 20% predicted or homogenous distribution of emphysema
- History of hospitalisation and, in particular, an increasing frequency of this for exacerbations associated with acute hypercapnia (PaCO₂ exceeding 6.5 kPa) and worsening hypoxia
- Pulmonary hypertension (defined as a mean pulmonary artery pressure of >25 mmHg in the presence of normal pulmonary capillary wedge/left atrial pressure) or cor pulmonale (evidence of right ventricular decompensation leading to fluid retention)
- BODE score greater than 7. BODE is a composite, multidimensional assessment tool which was derived in a large population of COPD patients. The score ranges from 0-10, a higher score indicating worse functional reserve and poorer prognosis. COPD patients in the upper most quartile gain the most survival advantage from lung transplantation
- Worsening hypoxia (PaO₂<7.5 kPa) and hypercapnia (PaCO₂>6.5 kPa) requiring increasing oxygen demand of >10 L/min despite continuous non-invasive ventilation (NIV)
- pH persistently <7.30 despite optimal continuous NIV
- Refractory right heart failure despite all pharmacological interventions to support the right ventricle

3.2.1.2 Cystic Fibrosis and bronchiectasis

- FEV₁ below 30% predicted or a rapid and irreversible decline in FEV₁

- Exacerbation of pulmonary disease requiring at least one intensive care unit (ICU)/high dependency unit (HDU) admission
- Pneumothorax in association with advanced disease
- Haemoptysis not controlled by embolisation
- Progressive increase in medical therapy to maintain survival including an increased frequency of the need for intravenous (IV) antibiotics due to increased/worsening exacerbations
- Worsening hypoxia ($\text{PaO}_2 < 7.5 \text{ kPa}$) and hypercapnia ($\text{PaCO}_2 > 6.5 \text{ kPa}$) requiring increasing oxygen demand of $> 10 \text{ L/min}$ despite continuous NIV
- pH persistently < 7.30 despite optimal continuous NIV
- Refractory right heart failure despite all pharmacological interventions to support the right ventricle

3.2.1.3 Idiopathic pulmonary fibrosis

Histologic or radiographic evidence of IPF and any of the following:

- A 10% or greater decrement in forced vital capacity (FVC) during 6 months of follow-up
- DLCO of less than 60% with clinical deterioration and/or a greater than 15% decline in DLCO over 6-months of follow-up
- A rapid decrease in pulse oximetry below 88% during a 6-minute walk test
- Short rapid decline in symptoms pre-diagnosis
- Associated pulmonary hypertension (as defined in 3.2.1.4)
- Persisting hypoxia ($\text{PO}_2 < 8 \text{ kPa}$) despite continuous O_2 at 10 L/min
- Refractory right heart failure despite all pharmacological interventions to support the right ventricle

3.2.1.4 Pulmonary arterial hypertension

- Presentation in or deterioration to World Health Organisation (WHO) functional class III or IV without an improvement on medical therapy over 3 months
- Declining 6-minute walk distance to less than 350 m despite maximal medical therapy
- Worsening refractory right heart failure as defined by increasing fluid retention despite optimal medical management with disease modifying therapy and diuretics
- Requirement for continuous intravenous (IV) inotropic support
- Recent (within 3 months) right heart catheter study showing right heart catheter evaluation of right atrial pressure $> 20 \text{ mmHg}$ and $\text{CI} < 2.0 \text{ L/min/m}_2$ despite optimisation of therapy

Urgent candidates may remain ambulant at home.

3.3 Selection criteria for paediatric lung transplantation

Selection will be based on the balance of risk of death without a transplant and expected post-operative survival or quality of life gains. In general, listing for transplant is advisable when patients have a less than 50% 2-year predicted survival and a poor quality of life.

A complicating factor in paediatric practice is that some of the conditions affecting children are individually rare and decisions have to be based on general principles rather than condition-specific data.

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

Process for the selection of variants

Multiple organ transplants

Comment [KA1]: Do you want to add anything under these headings? If so, we will renumber and include these.

3.4 Contraindications

Concurrent extra-pulmonary comorbid medical, mental health and social conditions are relevant to whether to list a patient for transplantation if, despite full supportive therapy, these factors will affect the patient's quality of life, prospect for survival post-transplant, or likelihood of compliance with medical treatments and clinical follow-up.

In complex cases and where uncertainty remains, discussion between centres to share opinion across the UK is encouraged.

3.4.1 Absolute contraindications

- Solid organ and haematological malignancies within 5 years of listing for transplantation with the exception of cutaneous squamous and basal cell tumours and selected paediatric malignancies
- Untreatable advanced dysfunction of any other major organ system that may impact the chances of the patient surviving the operative and peri-operative process, and will affect 5 year survival (e.g., heart, liver or kidney), unless considered for a combined multi-organ transplant. This includes coronary artery disease not amenable to percutaneous intervention/bypass grafting, or associated with significant impairment of left ventricular function. However heart-lung transplantation could be considered in *highly selected* cases where the multidisciplinary team that the patient is appropriate.
- Unstable critical clinical condition (such as active septicaemia, shock, unstable condition on mechanical ventilation or extra-corporeal membrane oxygenation)
- Significant chest wall/spinal deformity impeding adequate surgical access at implantation or preventing optimum ventilation post-operatively
- Colonisation with *Burkholderia cenocepacia*
- Uncontrolled extra-pulmonary manifestations of a systemic disease (e.g. vasculitis, oesophageal dysmotility and severe skin involvement with ulceration in systemic sclerosis) that will prevent a successful outcome after transplantation
- Substance addiction or abuse (e.g., tobacco, alcohol or narcotics) that is either currently active or was active within the last 6 months
 - Those who continue to smoke will not be accepted for listing as smoking has many deleterious effects on the peri-operative course of a recipient and will reduce lung

graft function and survival. Active smokers will be supported to quit and to remain abstinent, with involvement from their GP, the referring respiratory physician and the local smoking cessation services, as appropriate. Those who achieve abstinence should be reassessed and may be listed as clinically indicated. Patients should undertake to continue abstinence after transplantation

- Excessive alcohol use and dependency is associated with medical problems and poor compliance. Illicit drug use is also associated with medical complications and non-compliance that affects patient and graft survival. Patients with evidence of alcohol and illicit substance abuse should be assessed by a healthcare professional expert in substance abuse and offered treatment. When treatment goals are achieved, the patient should be re-considered for listing. Those with a high likelihood of return to alcohol or substance abuse, despite support, are not suitable transplant candidates.
- Documented non-adherence or inability to comply with medical therapy, office follow-up, or both
- Mental health or a psychological condition that fails to respond to treatment and is associated with poor outcomes, poor quality of life or the inability to cooperate or comply with medical therapy
- Absence of consistent or reliable social support that cannot be organised, despite attempts to, that would affect post-transplant survival or quality of life as indicated above

3.4.2 Relative contraindications

Relative contraindications allow issues of concern to be factored in without necessarily attempting to weigh issues against one another in the absence of good evidence. The importance of potential contraindications should be discussed openly between all members the transplant team and interpreted with clinical judgement on a case by case basis:

- Patients over 60 years of age will need careful evaluation but age *per se* is not a contraindication to listing. Age, however, is an independent risk factor for peri-operative morbidity and mortality, and evidence exists that older patients have worse short- and medium-term survival, likely due to comorbidities. The presence of other relative contraindications can combine to increase the risks of transplantation above a safe threshold. Individual cases will be assessed on their merit but recipient age will be a factor in candidate selection. The International Society for Heart and Lung Transplantation proposed a guideline of less than 60 years of age for a bilateral lung and heart-lung transplant and less than 65 years for single lung transplant but this does not obviate the need for assessment of each patient and a decision based on that individual
- Severely limited functional status with poor rehabilitation potential
- Chronic infection with highly resistant virulent bacteria, mycobacteria, fungi or viruses
- Severe obesity defined as a body mass index (BMI) exceeding 30 kg/m²

- Malnutrition with BMI less than 17 kg/m²
- Severe or symptomatic osteoporosis (defined as bone mineral density > 2 SD less than predicted for the patient's age with or without low impact fractures)
- Mechanical ventilation – carefully selected candidates on mechanical ventilation/extracorporeal support without other acute or chronic organ dysfunction, who are able to actively participate in a meaningful rehabilitation program, may be successfully transplanted
- Limited coronary artery disease without ventricular impairment, if the patient is considered for lung transplantation only. Patients with an isolated single vessel coronary artery lesion may undergo percutaneous intervention before transplantation or coronary artery bypass grafting concurrent with the procedure
- Chronic renal impairment with glomerular filtration rate (GFR) <50 ml/min, unless the patient is a candidate for combined lung-renal transplant
- Poorly controlled diabetes mellitus with end-stage organ damage
- Other medical conditions that have not resulted in end-stage organ damage, such as diabetes mellitus, systemic hypertension, active peptic ulcerative disease, gastroesophageal reflux or diverticulitis should be optimally treated before transplantation
- Regular chronic high-dose oral corticosteroids, defined as >15 mg per day
- Very extensive pleural disease, with or without previous thoracic surgery
- A high burden of lung cavities with aspergillomas, especially if associated with extensive pleural thickening
- Human immunodeficiency virus (HIV) infection is a relative contraindication to transplantation, and the decision to list will depend on factors such as CD4 count, effectiveness of therapy, history of HIV-related infections and other co-morbidities
- Patients with viral Hepatitis B and C may be considered for transplantation in light of recent advances in treatment and after consideration of the degree of liver and other organ damage

3.4.3 De-selection criteria

Following selection, the criteria below are reasons for removing a previously suitable candidate from the waiting list:

- Failure of adherence to guidelines relating to smoking and/or illicit drug use

- The development of comorbidities sufficient to impact on the expected 50% probability of survival at 5 years
- The development of absolute and/or relative contraindications as listed in sections 3.4.1 and 3.4.2
- The patient no longer wishes to remain on the active waiting list

It is not possible to define all appropriate de-selection criteria.

3.5 Selection for re-transplant

Re-transplants will need special consideration dependent on the circumstances that gave rise to the need for re-transplant, as results after re-transplant are worse than for first transplants and only limited benefit may be achieved. Re-transplants are only undertaken when there is evidence of irreversible graft failure and the risk of mortality from that exceeds the significantly increased post-operative mortality after re-transplantation.

Registrations for second or subsequent transplants are subject to the same selection criteria for the first transplant: candidates must have minimal contraindications with no other untreatable major organ system dysfunction and must retain good post-operative rehabilitation potential.

Patients requiring re-transplantation will not have access to the super-urgent/urgent allocation scheme.

4. Follow-up on list

All patients will need to be regularly reviewed to ensure that they continue to meet the selection criteria and have not improved or become too sick to benefit from transplantation. When the clinical situation alters such that a patient no longer meets these criteria, the patient's name must be removed from the local list. Patients remaining on the transplant list will be re-assessed at intervals by the local respiratory physicians and/or the transplant centre, during their wait for a donor organ.

4.1 Monitoring

The responsibility of the referring physician does not end with referral. This should be clearly highlighted to the patient and his/her referrer. All patients who are actively listed should be reviewed at least *3-monthly* by their referring consultant, and information regarding changes in clinical status communicated to the transplant team on a regular basis.

Ongoing pulmonary rehabilitation is essential whilst the patient is listed.

During the waiting period the transplant centre will maintain contact with the patient and his/her family to offer support, information and guidance according to their needs. Review of patients on the waiting list will be as clinically indicated. Some transplant centres may opt to conduct periodic outpatient monitoring, typically every 3–6 months but centre arrangements vary depending on local agreements and travel distances.

4.1.1 Re-assessment on list

It has to be recognised that patients awaiting a lung transplant are, by definition, ill and their condition may deteriorate to the extent that the probability of good quality 5-year survival becomes unacceptably low. In these circumstances, the patient will be removed from the transplant list but only after full discussion with them. Such patients, although in greatest need, are at greatest risk of not benefiting after transplantation.

Paediatric patients should be kept under review while on the transplant 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 patient themselves.

5. Appeals process

5.1 *Second opinion after refusal*

When patients referred for consideration of suitability for lung transplant are declined access to listing for transplantation by the local transplant team the patient has the right to a second opinion and this should be facilitated by the referral team or the transplant team, according to the individual circumstances.

5.2 *Appeals panel*

It is recognised that no system can describe every clinical situation and an equitable system must allow for consideration for individual cases in a transparent and equitable way.

For patients who do not fall into the criteria for listing for transplantation detailed in this policy, the case should be taken to the Cardiothoracic Advisory Group Lung Allocation Scheme Adjudication Panel to decide whether the patient may be registered.

The referring centre must provide the CTAG Chair (or Deputy if appropriate) with information of the patient's condition which will subsequently be circulated to the panel. The patient may be registered if the majority agree on the case for listing, but where the panel remains undecided, the CTAG Chair has the overriding vote. When a patient is accepted onto the waiting list, the CTAG Chair should send email confirmation of the registration to the relevant Statistical Lead at NHSBT for audit purposes. The decisions of the Adjudication Panel will be presented at each meeting of the CTAG.

6. Audit

The details of any guidelines and policies concerning selection and allocation will inevitably change with time. CTAG will review these guidelines annually and propose changes if necessary. These changes will be proposed to NHSBT and, after approval, be implemented. It should be noted that, depending on the changes agreed, there may be a delay between agreement of change and implementation.

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NHSBT
Organ Donation and Transplantation
Patient Selection and Allocation Policies
Lung: Selection

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APPENDIX 1

Suggested process for assessment of patients for lung transplantation

General guidelines for lung transplantation referral

In general, referral for transplant assessment is advisable when patients have a <50% 2-year predicted survival in the absence of transplantation or they persist in New York Heart Association (NYHA) class III or IV level of function despite maximal medical therapy, or both. When a patient is accepted, survival to transplantation depends on the waiting time governed by donor lung availability and the underlying disease. Waiting time tends to be variable and based on many factors such as height and blood group. The overriding principle in allocating a compatible organ to a patient is based on clinical need, benefit, utility, transparency and avoidance of futility.

Appropriate and timely referral for consideration of transplant is essential. It allows an orderly process of assessment, the management of areas of concern to optimise the candidate's condition, and patient education before active listing. An experienced multidisciplinary team, attending to the details of the underlying disease and any associated comorbidities, can lead to improved patient outcomes regardless of whether the patient receives a transplant. It is important to stress that the decision to refer should not be based on a single factor, because no simple, single-point determinant is sufficiently predictive of early mortality. Rather, it is recommended to rely on a variety of clinical (e.g., rate of infection, ICU hospitalisation, oxygen need, weight loss), laboratory (e.g. PaO₂ and PaCO₂) and functional findings (e.g. pulmonary function tests, echocardiography, exercise capacity).

Pre-assessment outpatient clinic

Most new referrals for consideration of suitability for lung transplant assessment require a pre-assessment outpatient clinic consultation conducted in the transplant centre or agreed satellite clinics. The pre-assessment outpatient clinic appointment should be offered within three months of referral unless the patient is clearly unsuitable, on account of documented clear contraindications, and a consultant physician or surgeon has made this decision. Every effort will be made to run these unsuitable cases by the local transplant MDT to ratify this decision. The decision not to offer this appointment should be communicated promptly in writing to the referral source. The purpose of this pre-assessment consultation is attention to detail and the avoidance of extensive inpatient investigations if the patient is clearly unsuitable for transplantation at initial clinic review.

Inpatient assessment

Potential transplant candidates usually undergo initial investigations in their local hospital. The results of investigations are requested from the referring hospital but some lung transplant units also opt to admit such patients for detailed assessment over a 2–4 day period. During their admission patients will undergo repeated investigations depending on their primary disease and individual need. At all stages of the assessment, the patient and family are offered opportunities

to meet as many members of the transplant MDT as appropriate, and are encouraged to ask questions and engage in all discussions.

Objectives of assessment procedures

- To assess the patient's clinical, social and psychological suitability as a transplant recipient the transplant MDT must reach the conclusion that the general condition of the patient is such that lung transplantation allows the patient a realistic chance of increased survival and a good quality of life
- To impart factual information to the patient and his/her family concerning all aspects of transplantation. Patients will need to be given extensive information about the reason for their assessment for transplantation, the risks associated with the transplant procedure and post-operative immunosuppression, as well as the perceived benefits in their clinical context both in terms of survival gains and quality of life improvements. This information must be in an easily understandable format commensurate with their ability to assimilate and understand the information given
- To meet hospital staff and transplant patients
- To provide an opportunity for the patient, and his or her family, to begin to come to terms with the prospect of transplantation and its subsequent management

Investigations conducted

The multidisciplinary team

The importance of multidisciplinary involvement in the assessment of the patient and the care received is paramount. The assessment should involve a whole spectrum of healthcare professionals where everyone has a key role to play including:

- Respiratory physicians
- Cardiologists
- Cardiothoracic surgeons
- Anaesthetists
- Radiologists
- Microbiologists
- Transplant co-ordinators
- Transplant nurses
- Dieticians
- Physiotherapists
- Occupational therapists
- Social workers
- Psychologists (if indicated, psychiatrists)
- Pharmacists

Clinical assessment

Potential candidates are put through a full history and examination including the following:

Past/Concurrent History

- Unresolved pulmonary infarction/infection or consolidation
- Cardiac condition: cause, previous cardiac surgery and current therapy

- Peripheral or cerebrovascular disease
- Malignancy
- Diabetes mellitus
- Hypertension
- Renal disease
- Liver disease
- Gastro-oesophageal reflux, peptic ulceration, gastrointestinal (GI) bleeding
- Diverticular disease, GI sepsis
- Unresolved sepsis in any site
- Metabolic bone disease, previous fractures
- Herpes virus infection (active or past)
- Past surgical history
- Previous blood transfusion

Social history

- Social support network
- Housing
- Employment
- Social care benefits received
- Smoking, past and current
- Drugs/alcohol use

Routine observations

- Temperature
- Heart rate
- Blood pressure
- Height
- Weight and nutritional status

Pulmonary assessment

- Detailed lung function test including flow volume loop, lung volumes, gas diffusion and plethysmography
- 6-minute walk test with oximetry
- Arterial blood gases
- Respiratory muscle function tests

Cardiac function assessment

- Electrocardiography (ECG)
- Transthoracic echocardiography (occasionally transoesophageal)

Additionally, patients may undergo any or a combination of the following tests as per local protocols:

- Ejection fraction assessment by locally validated nuclear cardiology technique
- Cardiac catheterisation: coronary angiogram and left ventricular (LV) gram

- Right heart catheter
- Cardiac computerised tomography (CT)
- Cardiac magnetic resonance imaging (MRI)

Microbiology assessment

- Sputum culture and sensitivity
- Midstream specimen of urine (MSU) for urinalysis, C&S
- Nose swab
- Methicillin-resistant staphylococcus aureus (MRSA) screen

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Radiology

- Chest x-ray
- Thoracic CT scan
- Ventilation/perfusion scan in single lung transplant candidates
- Abdominal Ultrasound Scan
- Dual-energy X-ray absorptiometry (DEXA) bone density scan

Dental assessment

- Full dental examination including orthopantomogram (OPG)
- Advice on dental hygiene
- Restorative work and extractions as necessary

Haematology blood tests

- Blood group
- Antibody screen
- Full blood count
- APTT
- PT, INR
- Fibrinogen

Biochemistry blood tests

- Urea and electrolytes
- Creatinine
- Uric acid
- Calcium phosphate
- Liver function tests
- Thyroid function tests
- Fasting blood glucose
- Fasting blood lipids
- Alpha 1- antitrypsin (if indicated)

Serology blood tests

- HIV
- Hepatitis B and C

- Syphilis
- Rubella
- Toxoplasma
- Epstein Barr Virus
- Varicella-Zoster
- Herpes simplex
- Cytomegalovirus

Immunology blood tests

- Auto-immune screen
- Aspergillus serology
- Human leucocyte antigen (HLA) typing
- Lymphocytotoxic antibody screen

Psychosocial assessment

- Letter from GP confirming compliance with past therapy
- Interview with social worker/psychologist

If there is a history of prior psychiatric disease, the advice of a psychiatric team, preferably the patient's own team, should be sought to assess the potential impact of such diagnoses on compliance and outcomes.

Other

- Creatinine clearance or GFR (radio-isotope clearance, according to local practice)
- Dietician review
- Physiotherapy assessment

Final decision

The decision to place a patient on the waiting list is discussed, agreed and documented at a multi-disciplinary meeting as soon as the results of the inpatient assessment become available. A shared MDT decision card is being developed between the five adult lung transplant centers. This will capture the decision to accept or decline a patient to the lung waiting list and the category to which they are accepted, setting out the criteria used by the local MDT to assign super-urgent vs. urgent vs. elective status to a candidate and any deviations or variations from these criteria (see separate lung allocation document).

The patient and relatives will be informed of the outcome and given the opportunity to discuss it with a representative of the transplant team. A number of factors are used to inform decisions around the appropriateness of transplantation in each patient context and these must all be made explicit to the patients. Such discussions should always be undertaken in a private area.

APPENDIX 2

Suggested management on the waiting list

At all stages the patient is encouraged to ask questions. The following key areas must be discussed with the patient as appropriate:

- Reliable contact numbers for the patient and next of kin (a combination of landlines and mobile phone numbers is preferable)
- The patient's responsibility to make him/herself available to be contacted by the transplant centre at any time. This is discussed with the transplant co-ordinator
- Patients are requested to inform the transplant centre of any changes in their circumstances, for example:
 - If they become unwell
 - If they are admitted to hospital
 - Any changes in medication
 - Holidays

An information booklet should be provided to the patient. This will explain:

- Preparation for admission for surgery
- Maintenance of regular contact
- Reporting changes in circumstances
- What to do when called for surgery
- The operation
- Wards and departments after the operation
- Accommodation for partners
- Publicity and the media

During the waiting period the transplant centre will maintain contact with the patient and his/her family to offer support, information and guidance according to their needs. Patients on the waiting list will be reviewed as clinically indicated.