CORINNA LEA

CARDIO – THORACIC

ELECTIVE REPORT
Cardiothoracic Transplant and Thoracic Surgery
Papworth Hospital

Learning objectives

1. To gain experience and understanding of the Pre, Peri and post-operative care of cardiothoracic transplant surgery

2. To gain insight into the long term health implications of transplant surgery

3. To gain experience and understanding of the pre, peri and post-operative care of Thoracic surgery patients

Transplant - Introduction

Transplant should be considered when a patient has end stage disease, with deterioration of organ function refractory to all medical therapy. Patients are referred to the cardiothoracic transplant unit within their area. In cases of Lung or heart/lung transplant, this is accompanied by a comprehensive proforma**Error! Reference source not found.**detailing clinical investigation results and a detailed medical, social and psychological history.
A number of conditions can lead to transplant being required. Conditions that are usually considered for lung or heart-Lung transplant can be seen in table 1 below

• Idiopathic pulmonary fibrosis
• Lung fibrosis in association with connective tissue disease
• Occupational lung fibrosis
• Drug /toxic lung fibrosis
• Chronic allergic alveolitis
• Sarcoidosis
• COPD
• Emphysema
• α1 antitrypsin deficiency
• Obliterative bronchiolitis
• Idiopathic pulmonary hypertension
• Cystic Fibrosis
• Bronchiectasis
• Complex Heart Conditions involving the lungs

Table 1 Conditions Considered for Lung and Heart/Lung Transplant**Error! Reference source not found.**

Heart Transplant is usually considered if the patient is in severe heart failure (NYHA III or IV). This can be due to a number of conditions but Ischemic cardiomyopathy and dilated cardiomyopathy are most common. Congenital heart conditions that cannot be repaired surgically may also be an indication, but this is more in the context of paediatric transplant, which will not be considered here.

Pre-operative assessment

The patient will attend an outpatient assessment clinic where suitability for transplant will be assessed by the consultant. If considered suitable, an in-patient assessment lasting 2-4 days will be arranged. The in-patient assessment period not only allows the patient's clinical, social and psychological suitability for transplant to be assessed, but also provides the patient with opportunity to discuss the implications of transplant and life afterwards.**Error! Reference source not found.**
During the assessment period the patient undergoes a full clinical assessment including a number of investigations to ascertain whether their disease has progressed sufficiently to warrant transplantation, but also to confirm that the patient will be fit enough to recover from the operation and has no contra-indications. Details of the full clinical assessment are recommended in the 'National Protocol for Assessment ofCardiothoracic transplant patient'**Error! Reference source not found.** and 'The UK adult lung and heart lung proforma'**Error! Reference source not found.**
Once the clinical assessment is complete the results are discussed at a multidisciplinary team meeting. Guidelines for listing criteria are discussed in 'Guidelines for the Care of Cardiac Transplant Candidates'**Error! Reference source not found.** and 'International Guidelines for the Selection of Lung Transplant Candidates**Error! Reference source not found.**, however the decision is very patient specific.

Perioperative care

When the transplant coordinator accepts a donor offer, the timing of events must be as precise as possible to minimize ischemic time of the donor organs. Whilst the organs are being removed from the donor, the patient is taken to theatre. Ideally the recipient surgeon should be ready to implant the donor organ as soon as it arrives. Although the allowable length of ischemic time is still debated <4 hours for heart and <5.5 hours for lungs is generally acceptable**Error! Reference source not found.Error! Reference source not found.**. It is also generally agreed that the shorter the ischemic time the better the patient outcome, although one study from 2006 found that with younger recipients there was little difference in outcomes with variation of ischemic time within the accepted range**Error! Reference source not found.**. Size of the organs is also optimized as organs that are too large or too small can cause peri and post-operative complications. Guidelines for the pre, peri and post-operative care of heart transplant patients were published by ISHLT in 2010 **Error! Reference source not found.**.The anaesthetist and perfusionistplay an important role in the peri-operative management of the patient. Standard monitoring is used as well as radial arterial pressure monitoring, central venous and pulmonary artery catheters **Error! Reference source not found.**. The anaesthetist and perfusionist must communicate effectively to ensure that adequate end-organ perfusion is maintained during the operation.

Post-operative care

Post-operatively the patient is managed in intensive care. This may be for a few days or for several months if peri-operative or post-operative complications occur. Complications such as post-operative bleeding and inability to wean from bypass were two of the complications observed by this author, necessitating in a

return to theatre for exploration of bleeding and ECMO (extracorporeal membrane oxygenation)for post-operative support. Post-operative arrthymias are also common, therefore temporary pacing wires are implanted routinely at the end of surgery.

Long Term Health Care

Immunosuppression is a life-long requirement after transplant to prevent rejection of the donor organ. Usually a combination of 3 drug classes are used, a calcineurin inhibitor, a purine biosynthesis inhibitor and a corticosteroid. Table 2 below gives examples of commonly used immunosuppressive drugs

Agent	Mechanism of action	Side-effects
ATG;	Fixes numerous antigens on lymphoid cells	depletion ofcirculating lymphocytes Cytokine release syndrome Leukopenia Thrombopenia
OKT3	Fixes CD3 present on T-lymphocytes	Depletion of circulating lymphocytes Cytokine release syndrome Pro-coagulation effect Possible sensitisation with lossof efficacy
Daclizumab	Binds the **a**-chain of IL-2 receptor; blocks the proliferation induced by IL-2	Unreported
Basiliximab	Binds the **a**-chain of IL-2 receptor; blocks the proliferationinduced by IL-2	Unreported
Cyclosporin A	Binds cyclophylin; inhibits calcineurin; inhibits cytokinegene transcription	Nephrotoxicity Hypertension Hypercholesterolaemia Hypertrichosis Gingival hypertrophy
Tacrolimus	Binds FKBP-12; inhibits calcineurin; inhibits cytokine genetranscription	Nephrotoxicity Hypertension Neurotoxicity Diabetes mellitus Alopecia
Azathioprine	Inhibits purine biosynthesis and lymphocyte proliferation	Leukopenia
Mycophenolate mofetil	Inhibits purine biosynthesis and lymphocyte proliferation	Diarrhoea Leukopaenia
Sirolimus/ everolimus	Binds FKBP-12; inhibits the proliferative response tocytokines and growth factors	Hyperlipidemia Thrombocytopenia Arthralgia

Table 2 immunosuppressive drugs **Error! Reference source not found.**

Acute rejection is most likely in the first three months but after this period the immunosuppression is slowly weaned to the lowest level required to prevent chronic rejection. Whilst immunosuppression is highest, prophylaxis against organisms such as *Pneumocystis carinii*and Cytomegalovirus must be used. Co-trimoxazole and valganciclovir are commonly used.

Lifestyle changes are important after transplant. Not only will the patient be required to follow a complex drug regime but will also be kept chronically immunosuppressed. This required education to prevent infections and to know the signs and symptoms of infection and rejection to look out for. Table 3 below shows some important points that the patient must be made aware of.

Hand washing	• Practice good hand washing techniques • Wash your hands well before eatingand preparing food, after going to thetoilet, after changing nappys, andafter playing with pets. • Encourage any family and friends who are in contact with you to practice good hand washing techniques. • Wash your hands well before caringfor any wounds or doing any dressingchanges. • Avoid putting your fingers or hands in or near your mouth, particularly if you have not washed your hands recently.
Contacts	• Avoid close contact with people who have obvious illnesses such as colds and flu. • Avoid crowds, particularly when in a closed area like an indoor shopping mall, during cold and flu season or when you are highly immunosuppressed. • Do not share eating utensils, cups, glasses or toothbrushes • Do not share razors, nail clippers or other manicure equipment.
Swimming	• Transplant recipients may swim in chlorinated pools after their incision and wounds are healed and they are able to exercise. • Small standing bodies of water such as ponds or small lakes that may contain infectious organisms should be avoided. • Swimming in oceans may be permitted at six months after transplant if the water is tested to be safe for the general population by the local health department • Public hot tubs should be avoided
Pets	• If you have pets, be sure that they are healthy and have had all recommended vaccines. • Do not handle animal waste. Do not clean cages, fish or turtle tanks, or change cat litter. • Some types of pets should be avoided such as reptiles, turtles, amphibians(frogs), hamsters and guinea pigs, caged pet birds • Some transplant centres recommend avoiding all pets
Gardening	• Wear gloves when working in the garden and in soil. • Wash your hands frequently when gardening. • Some transplant centres request that gardening be avoided for three to six months after transplant until the patient's immunosuppression level is lower. • Avoid compost, wet leaves, and rotting organic matter. These materials can carry mold that can cause significant respiratory infections in immunosuppressed patients.
Travel and other advice	• Avoid sunbathing and always use a high factor sunscreen as immunosuppression increases the risk of skin cancer • Foreign travel is not recommended for 6-12 months after transplant • Keeping fit and active is important but strenuous exercise should be avoided initially • Immunization against certain illnesses is important and your transplant team will advise you on this.

Table 3 Life after transplant. Adapted from**Error! Reference source not found.**

Thoracic surgery - introduction

The indications for thoracic surgery are many and the specialty involves a huge variety of conditions and procedures. Common indications are oncological, necessitating lung or chest wall resection. Chest wall reconstruction may also be an indication after resection or trauma. Other common conditions and procedures are lung resection due to chronic lung disease, debridement of empyema and prophylactic treatment of pneumothorax.

Pre-operative assessment

Elective patients will attend a pre-operative assessment clinic. During this the indications for surgery are assessed and the procedure, outcomes and possible complications are discussed with the patient. As with all surgery the risk versus potential outcome must be considered and the patient must be assessed to ensure they are fit for surgery. Respiratory function must be assessed to ensure that adequate oxygenation can be maintained if single lung ventilation is required. Lung mechanical function, pulmonary parenchymal function and cardiopulmonaryreserve are the three major considerations for respiratory function**Error! Reference source not found.**. In complex cases the patient may be discussed at MDT. Oncology patients are always discussed at MDT as the cancer must be staged and the decision made as to whether surgery could be potentially curative, palliative, or whether the cancer is inoperable. Non small-cell Lung Cancer is staged using the TMN criteria as seen in table 4 below

<table>
<tr><td>Sixth Edition
T/M Descriptor</td><td>Proposed
T/M</td><td>N0</td><td>N1</td><td>N2</td><td>N3</td></tr>
<tr><td>T1 (<2 cm)</td><td>T1a</td><td rowspan="2">IA</td><td rowspan="2">IIA</td><td rowspan="5">IIIA</td><td rowspan="7">IIIB</td></tr>
<tr><td>T1 (>2–3 cm)</td><td>T1b</td></tr>
<tr><td>T2 (<5 cm)</td><td>T2a</td><td>IB</td><td>IIA (IIB)</td></tr>
<tr><td>T2 (>5–7 cm)</td><td>T2b</td><td>IIA (IB)*1</td><td>IIB</td></tr>
<tr><td>T2 (>7 cm)</td><td rowspan="3">T3 ↓</td><td>IIB (IB)</td><td>IIIA (IIB)</td></tr>
<tr><td>T3 invasion</td><td>IIB</td><td>IIIA</td></tr>
<tr><td>T4 (same lobe nodules)</td><td>IIB (IIIB)*2</td><td colspan="2">IIIA (IIIB)</td></tr>
<tr><td>T4 (extension)</td><td rowspan="2">T4 ↓</td><td colspan="2">IIIA (IIIB)</td><td>IIIB</td></tr>
<tr><td>M1 (ipsilateral different lobe)</td><td colspan="2">IIIA (IV)</td><td colspan="2">IIIB (IV)#1</td></tr>
<tr><td>T4 (pleural effusion)</td><td rowspan="2">M1a ↓</td><td colspan="4" rowspan="2">IV (IIIB)#2</td></tr>
<tr><td>M1 (contralateral lung)</td></tr>
<tr><td>M1 (distant)</td><td>M1b</td><td colspan="4">IV</td></tr>
</table>

Table 4 Proposed TNM system by the International Association for the Study of Lung Cancer (IASLC). Taken from**Error! Reference source not found.**

X-ray, CT and PET scans are used to stage the patient. Treatment recommendations are considered depending on the staging of the tumor, as described below in table 5. If surgical treatment is indicated this often involves adjuvant chemo/radiotherapy.

Treatment Recommendations and Future Research Directions in the Management of Non-Small Cell Lung Cancer

Stage	Standard Management	Future Directions
Stage I	Surgical resection	Adjuvant therapy (chemotherapy/radiation or a combination of the two) Chemoprevention
Stage II	Surgical resection	Same as stage I
Stage IIIA	Chemoradiotherapy Surgical resection in selected patients	Neoadjuvant combined-modality therapy to downstage primary tumor
Stage IIIB	Chemoradiotherapy	Neoadjuvant combined-modality therapy to downstage primary tumor
Stage IV	Cisplatin-based chemotherapy* Surgical resection if solitary metastatic lesion with resectable primary tumor	More efficacious single-agent and combination chemotherapy

Table 5 Treatment recommendations of NSCLC. Taken from**Error! Reference source not found.**

Peri-operative care

The main consideration that differs from other surgical specialties is the requirement of single lung ventilation. This can be achieved by using a double lumen endobronchial tube or a single lumen endobronchial tube**Error! Reference source not found.**. The double lumen tube has the advantage that the lungs can both be ventilated independently as required.

Post-operative care

An important aspect of post-operative care for the thoracic patient is pain control. Thoracotomy is said to be one of the most painful surgical procedures and poor post-operative pain control can lead to complications from shallow breathing, ineffectual cough, and poor mobilisation**Error! Reference source not found.**. The use of thoracic epidural for control of post-operative pain is widely used and has shown to be extremely effective**Error! Reference source not found.**. The epidural is inserted prior to induction of general anaesthesia and this pre-emptive approach is effective for both peri and post-operative pain control.

References**Error! Reference source not found.**