

# Non-Transplant Surgery in the Lung Transplant Recipient

Perioperative management of the lung transplant recipient necessitates consideration of the patient's chronic immunosuppressed state as well as a thorough assessment of graft (dys)function.

## ANESTHETIC CONSIDERATIONS

- Physiology and function of the transplanted lung
  1. impaired cough reflex and potential for aspiration
  2. impaired mucociliary function
  3. potential for allograft dysfunction (bronchiolitis obliterans)
- Underlying pathophysiology of native lung
- Potential for residual RV dysfunction
- Immunosuppressive medications and resultant end-organ dysfunction
- Considerations for lung isolation
- Strict aseptic technique due to increased susceptibility to infections

## ANESTHETIC GOALS

1. Minimize injury to allograft and native lung
  - meticulous aseptic technique
  - avoid instrumentation of lung
  - lung protective ventilation (PIP <30cmH20)
  - avoid excessive intraoperative fluids

## PRIORITY RESUSCITATION HISTORY EXAM LABS PFTS (ETC) REGIONAL

### HISTORY & PHYSICAL

- Why are they coming for surgery?
  - early following transplant → hemorrhage, anastomotic leaks, abscess
  - airway complications
  - bronchoscopy for biopsy or suspected infections
  - post-transplantation lymphoproliferative disease
  - tumour excision
  - intra-abdominal abscesses
  - other
- Function of the transplanted lung → evidence of **bronchiolitis obliterans (chronic rejection)**
  - clinically presents as: dyspnea, fatigue, fever, cough, sputum production and decreased exercise tolerance
  - spirometry should plateau ~ 3 months post surgery and should remain stable
  - decline of 10-15% of FEV1 indicator of BO
  - results of **transbronchial lung biopsy**
    - role of routine biopsy unclear
    - negative bx does not necessarily rule out BO
- Function of native lung
- Evidence of bronchial narrowing (wheeze, hoarseness)
- Evidence of co-existing disease given immunosuppressives
  - Cyclosporine → **nephrotoxicity**, hepatotoxicity, HTN, diabetes
  - Azathioprine → **Myelosuppression**, hepatotoxicity, neoplasia
  - Corticosteroid → osteoporosis, DM, infections
  - Mycophenolate → leucopenia, GI upset
  - Tacrolimus → nephrotoxicity, HTN, hyperglycemia

### INVESTIGATIONS

- CBC → myelosuppression, leukopenia
- lytes, BUN, Cr → nephrotoxicity
- glucose → glucose intolerance
- CXR may show evidence of rejection or infection (but may be clear in presence of both)
- Spirometry and ABG mandatory
  - evidence of ↓ FEV1 or ↑ PaCO2 or ↑ A-a gradient suspicious for rejection and mandates further investigation

### OPTIMIZATION

- any evidence of rejection or infection mandates investigation by transplant pulmonologist unless absolutely emergent surgery
- stress dose of steroids
- perioperative administration of pulmonary medications → bronchodilators etc

### ANESTHETIC OPTIONS

- **Regional Anesthesia**
  - theoretical benefits as avoids instrumentation of airway and antecedent risks of pulmonary infection
  - avoid aggressive volume overload due to disruption of pulmonary lymphatics

### ANESTHETIC SETUP

- standard CAS monitors
- no increased need for arterial line or central line monitoring
- ensure all lines placed in sterile fashion

### ANESTHESIA MANAGEMENT

- avoid nasotracheal intubation given increased risk of bacterial contamination
- LMA or mask anaesthesia may be okay but recognize risk of silent aspiration given denervation of allograft
- Caution re: difficult ETT placement due to anastomotic stenosis
- avoid placement of ETT or EBT cuff at level of anastomosis
  - avoid placement of EBT on side of allograft

- allograft should be ventilated in lung protected fashion (low Vt, PEEP, minimize plateau pressures)
- **Lung Isolation**
  - in SLTx, transplant allograft will have normal compliance (or reduced if rejection) and native lung will have underlying pathology
    - COPD → risk of dynamic hyperinflation and risk of compression of allograft with PPV
    - Restrictive Lung will have decreased compliance and risk of volutrauma / barotraumas to allograft
  - thus, consider lung isolation and potentially two ventilators to allow independent lung ventilation (or ventilate allograft with CPAP to native lung)
- **Pulmonary Blood Flow**
  - allograft receives 60-80% of both ventilation and perfusion
  - risk of hypoxemia, particularly if lateral position with allograft in dependent position
  - this is particularly true if allograft needs to be deflated for surgery

#### COMPLICATIONS

1. Hypoxemia
2. Injury to native lung → pneumothorax, dynamic hyperinflation
3. Injury to transplant lung
  - pneumonia
  - pulmonary edema

#### PATHOPHYSIOLOGY OF THE TRANSPLANTED LUNG

12. **Pulmonary Function** is dramatically improved in patients transplanted for either obstructive or restrictive disease and peaks by 6 months
  - amount of residual dysfunction will depend on single- (SLTx) vs. double-lung transplant (DLTx), degree of contralateral disease and function of transplanted lung
    - Obstructive disease → FEV1 ↑ to 50-60% predicted
    - Restrictive disease → mild restriction still present
  - arterial hypercapnia and ventilatory response to pCO<sub>2</sub> persists for weeks but eventually normalizes (persistent hypercapnea suggests allograft dysfunction or diaphragmatic dysfunction)
  - arterial oxygenation returns to normal
  - 60-70% of PBF directed to transplanted lung
13. **Pulmonary hemodynamics**
  - both SLTx and DLTx have immediate and sustained normalization of PAP and PVR
  - remodeling and improvement of RV function
14. **Innervation**
  - transplanted lung is denervated distal to bronchial anastomosis and reinnervation does not occur
  - in SLTx, carinal receptors remain intact
  - rarely, bronchial hyper-responsiveness may occur
  - impaired mucocilliary transport → perioperative chest physio important
15. **Pulmonary Lymphatics**
  - disrupted, therefore, prone to pulmonary edema
  - require meticulous fluid management perioperatively

#### COMPLICATIONS OF LUNG TRANSPLANT

1. **Primary Graft Failure (15-35%)**
  - low pressure pulmonary edema secondary to ischemia-reperfusion injury
  - occurs within minutes to several days after donor lung reperfusion
  - may necessitate and increased duration of post-op ventilation
  - may be aggravated by pulmonary HTN in contralateral lung
  - conflicting evidence that iNO may help prevent PRR
2. **Pneumonia**
  - may be nosocomial (from donor) or community acquired due to immunosuppression
  - high risk of viral, fungal and complicated bacterial pneumonias
3. **Acute Graft Rejection (50%)**
  - nonspecific, subtle symptoms that can only be definitively diagnosed on transbronchial biopsy
  - usually occurs within days or weeks following transplant
  - treated with high-dose IV corticosteroids or OKT3
  - high prediction of chronic rejection
4. **Bronchial Stenosis**
5. **Chronic Graft Rejection (aka Bronchiolitis obliterans)**
  - chronic rejection and present in majority of patients to some degree (60-70 patients who survive 5 years)
  - uncommon in first 6 months
  - 2 year mortality from diagnosis is 40%
  - characterized by progressive dyspnea, increasing airflow obstruction on spirometry and progressive impairment in gas exchange

#### REFERENCES

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