LUNG TRANSPLANTATION: What the Internist Needs to Know

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Outline

• Introduction
• History of Lung Transplantation
• Evaluation of Candidacy and Listing
• Post Operative Care
• Complications
Introduction

• Lung transplantation has become accepted therapy for the treatment of carefully chosen patients with end stage lung disease who have not benefited from available therapies
• > 80% of patients survive the 1st year
• > 50% of patients survive beyond 5 years
• Majority of recipients return to productive activities

Adult Lung Transplantation


Survival comparisons by era
1988-94 vs. 1995-99: \( p = 0.0009 \)
1988-94: vs. 2000-6/06: \( p < 0.0001 \)
1995-99 vs. 2000-6/06: \( p < 0.0001 \)

1988-1994: 1/2-life = 3.9 Years; Conditional 1/2-life = 6.9 Years
1995-1999: 1/2-life = 4.5 Years; Conditional 1/2-life = 7.2 Years
2000-6/2006: 1/2-life = 5.5 Years; Conditional 1/2-life = 7.1 Years

ISHLT 2008
J Heart Lung Transplant 2008;27: 937-983
History of Lung Transplantation
History of Lung Transplantation

- Lung was the last of the major organs to be successfully transplanted

- 1963: 1st Human lung transplant
  - 58 year old prisoner with lung cancer
  - Survived only 18 days

- 1980: 40 attempts, but only 9 survived >2 wks

Hardy JD et al, JAMA 1963
Deron F et al, J Thorac Cardiovasc Surg 1971
History of Lung Transplantation

• Cyclosporine era-1981
• First long-term survivors reported in 1982 by Stanford group
  – 3 patients received combined Heart-lung transplant
• Single Lung Transplant by Cooper in Toronto,
  – first patient survived 6.5 years
• Double sequential developed in c. 1988

Reitz BA et al, *NEJM* 1982
Toronto Lung Transplant Group, *NEJM* 1986
NUMBER OF LUNG TRANSPLANTS REPORTED
BY YEAR AND PROCEDURE TYPE

NOTE: This figure includes only the lung transplants that are reported to the ISHLT Transplant Registry. As such, this should not be construed as representing changes in the number of lung transplants performed worldwide.
AVERAGE CENTER VOLUME
Lung Transplants: January 1, 2000 - June 30, 2007

ISHLT
2008

J Heart Lung Transplant 2008;27: 937-983
Evaluation of Lung Transplantation Candidacy & Listing
Indications for Lung Transplantation

- Chronic end-stage lung disease
- Failed medical management
- For most patients the ultimate “treatment” rather than cure
  - Trading one medical challenge for another
  - Do not expect normal life expectancy in most patients
Indications for Lung Transplantation

- **Pulmonary Vascular Disease**
  - Idiopathic pulmonary arterial hypertension
  - Pulmonary hypertension secondary to systemic disease
  - Eisenmenger’s syndrome

- **Obstructive Lung Disease**
  - COPD
  - Alpha-1-anti-trypsin deficiency

- **Suppurative Disease**
  - Cystic Fibrosis
  - Bronchiectasis

- **Restrictive Lung Disease**
  - Idiopathic pulmonary fibrosis
  - Fibrosis secondary to connective tissue disorders
  - Sarcoidosis
  - Eosinophilic granuloma
  - Lymphangioleiomyomatosis
  - Occupational disease
  - Hypersensitivity pneumonitis
  - Bronchiolitis obliterans
ADULT LUNG TRANSPLANTATION
Indications By Year (Number)

Transplant Year

Number of Transpl:

CF
IPF
COPD
Alpha-1
PPH

J Heart Lung Transplant 2008;27: 937-983
Absolute Contraindications

- **Malignancy**
  - Within 2 years [except basal & squamous skin cancer]
  - 5+ years disease free for Breast >Stage 2, Colon > Dukes A, Melanoma >Level III, Renal cell extra-capsular
- Advanced **organ dysfunction** (kidney, liver, heart)
- Significant **chest wall/spinal deformity**
- Major **psychosocial derangement**
- Current **tobacco or drug use**
- **Non-curable infections:**
  - HIV, Hepatitis B and C, Burkholderia cepacia

*J Heart Lung Transplant* 2006; 25: 745-55
Relative Contraindications

- Age > 65 years
- Critical or unstable condition
- Severe limited functional status
- Colonization with highly resistant or virulent bacteria
- Severe obesity: BMI > 30 or < 18
- Severe osteoporosis

*J Heart Lung Transplant* 2006; 25: 745-55
AGE DISTRIBUTION OF LUNG TRANSPLANT RECIPIENTS (1/1985-6/2007)

Recipient Age

0-11 12-17 18-29 30-39 40-49 50-59 60-65 66+

% of transplant

0 5 10 15 20 25 30 35

ISHLT 2008

J Heart Lung Transplant 2008;27: 937-983
Case 1: Is the patient a candidate for Lung Transplantation?

**HPI**
- 35 y/o male with CF
- Increased SOB x 2 weeks
- Copious green-yellow sputum
- Using nebs 3-4x/day
- Increased O2 requirements
- No fevers

**PMHx**
- CF with Severe obstructive lung disease
- Hospitalized 2-3x per year for exacerbations
- Pancreatic insufficiency
Case 1:
Is the patient a candidate for Lung Transplantation?

<table>
<thead>
<tr>
<th>Exam</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• SaO2 84% on 5L, 94% on 50% FM</td>
<td>• HCO3 31</td>
</tr>
<tr>
<td>• Lung: diffuse early inspiratory crackles</td>
<td>• WBC 13.5</td>
</tr>
<tr>
<td></td>
<td>• 7.35, PCO₂ 68, PO₂ 49</td>
</tr>
<tr>
<td></td>
<td>• FEV₁ 1.0 (23% pred), FVC 2.7 (50% pred)</td>
</tr>
</tbody>
</table>
Case 1

Is this patient a candidate for lung transplantation?

A. No, it’s too early
B. No, it’s too late
C. Yes, he should be referred, but it may not be time to list him
D. Yes, he should be listed ASAP
E. Need more information
Refer Patients in the Transplant Window

- Too Early
- Transplant Window
- Too Late

Clinical Status vs Time

- Too Early: 0 - 2 years
- Transplant Window: 2 - 5 years
- Too Late: 5+ years
Timing of Referral

Referral suggested when:

1. Patients have < 50%, 2- to 3-year predicted survival

   AND /OR

2. NYHA class III or IV level of function
Timing of Referral

- Early referral is highly desirable as it allows for:
  - Orderly process for assessment
  - Management of areas of concern
  - Patient education

- Optimizing management of underlying disease and any associated comorbidity, can lead to improved patient outcomes
Disease Specific Guidelines

Cystic Fibrosis

Referral Guidelines

- FEV$_1$ < 30% predicted
- FEV$_1$ > 30% with
  - Increasing exacerbations
  - ICU admission
  - Rapid fall in FEV$_1$
  - Recurrent hemoptysis

Transplant Guidelines

- PaCO$_2$ > 50 mmHg
- PaO$_2$ < 55 mmHg
- Pulmonary Hypertension

J Heart Lung Transplant 2006; 25: 745-55
Disease Specific Guidelines
COPD

Transplant Guidelines
• BODE index of 7-10
  OR
• FEV$_1$ < 20% pred. & DLCO of < 20% pred.
• Hospitalizations and PCO$_2$ > 55 mmHg
• Pulmonary hypertension

J Heart Lung Transplant 2006; 25: 745-55
Celli, BR. NEJM 2004;350:1005-1012
Disease Specific Guidelines
Pulmonary Fibrosis

Referral Guidelines
- UIP
- Fibrotic NSIP

Transplant Guidelines
- 10% drop in FVC over 6 months
- DLCO < 39%
- Desaturation with 6MWT

*J Heart Lung Transplant 2006; 25: 745-55*
Disease Specific Guidelines
Pulmonary Arterial Hypertension

Referral Guidelines
• NYHA III or IV
• Rapidly progressive disease

Transplant Guidelines
• Functional status:
  – NYHA III or IV (despite therapy)
  – Low exercise tolerance (< 350m in SMW)
  – Syncope, hemoptysis or right heart failure
• CI < 2 L/min m2
• RAP > 15 mmHg

J Heart Lung Transplant 2006; 25: 745-55
How are patients listed?

**Lung Allocation Score (LAS)**

- Score based on multiple clinical variables from patient
- Designed to reflect
  1. Seriousness of patient's medical condition before transplant AND
  2. Likelihood of success after a transplant
- Calculated with
  1. *Waitlist Urgency*: predicts # of days individual is expected to live during the next year on the waiting list
  2. *Post-Transplant Survival*: predicts # of days individual is expected to live during the 1st year after lung transplantation
To determine your lung allocation score, please complete the form below. Please note that the accuracy of your score is based on the amount of information you provide.

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Birth (DOB)</td>
<td>01/09/1972</td>
</tr>
<tr>
<td>Height</td>
<td>5 ft 6 in</td>
</tr>
<tr>
<td>Weight</td>
<td>150 lbs</td>
</tr>
<tr>
<td>Lung Diagnosis Code</td>
<td>CYSTIC FIBROSIS</td>
</tr>
<tr>
<td>Functional Status</td>
<td>Performs activities of daily living with SOME assistance.</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Insulin dependent</td>
</tr>
<tr>
<td>Assisted Ventilation</td>
<td>BIPAP</td>
</tr>
<tr>
<td>Requires supplemental O₂</td>
<td>At rest</td>
</tr>
<tr>
<td>Amount</td>
<td>6 L/min, 6%</td>
</tr>
<tr>
<td>Percent Predicted FVC</td>
<td>40%</td>
</tr>
<tr>
<td>Pulmonary Artery Systolic Pressure</td>
<td>30 mm Hg</td>
</tr>
<tr>
<td>Mean Pulmonary Artery Pressure</td>
<td>20 mm Hg</td>
</tr>
<tr>
<td>Pulmonary Capillary Wedge Mean</td>
<td>10 mm Hg</td>
</tr>
<tr>
<td>Current PCO₂</td>
<td>45 mm Hg</td>
</tr>
<tr>
<td>Highest PCO₂</td>
<td>50 mm Hg</td>
</tr>
<tr>
<td>Lowest PCO₂</td>
<td>40 mm Hg</td>
</tr>
<tr>
<td>Change in PCO₂</td>
<td>25 %</td>
</tr>
<tr>
<td>Six minute walk distance</td>
<td>1000 feet</td>
</tr>
<tr>
<td>Serum Creatinine</td>
<td>1.0 mg/dl</td>
</tr>
</tbody>
</table>

** LAS Score: 39.9878 **
To determine your lung allocation score, please complete the form below. Please note that the accuracy of your score is based on the amount of information you provide.

DOB: 01/09/1972
Height: 5 ft 6 in 167.6400 cm
Weight: 150 lbs 68.039 kg
Lung Diagnosis Code: CYSTIC FIBROSIS
Functional Status: Performs activities of daily living with SOME assistance.
Diabetes: Insulin dependent
Assisted Ventilation: Continuous mechanical
Requires supplemental O₂: At rest
Amount: 60 L/min
Percent Predicted FVC: 40%
Pulmonary Artery Systolic Pressure: 30 mm Hg
Mean Pulmonary Artery Pressure: 20 mm Hg
Pulmonary Capillary Wedge Mean: 10 mm Hg
Current PCO₂: 45 mm Hg
Highest PCO₂: 50 mm Hg
Lowest PCO₂: 40 mm Hg
Change in PCO₂: 25%
Six minute walk distance: 1000 feet
Serum Creatinine: 1.0 mg/dL

LAS Score: 73.4003
Lung Transplant
Post Operative Care
Immunosuppression Therapy

Maintenance Immunosuppression Therapy

1. Steroid:
   - Prednisone

2. Calcineurin inhibitor:
   - Tacrolimus (Prograf)

3. Antiproliferative agent:
   - Mycophenolate mofetil (Cellcept) or
   - Azathioprine (Imuran)
Prophylactic Therapy

1. **Bacterial**: Usually Vancomycin and Zosyn

2. **CMV**: Ganciclovir → Valgancyclovir

3. **PCP / Toxoplasma**: Septra

4. **Aspergillus**: Voriconazole & inhaled amphotericin B
Post Lung Transplant Complications

- Pulmonary
- Nonpulmonary
Case 2: Post Lung Transplant Complication
Pulmonary Complications: Immediate Post-Op

- Primary graft dysfunction or ischemia-reperfusion injury
- Anastomotic complications
- Infections
- Pleural space fluid collections
- Acute Rejection
Primary graft dysfunction
Primary graft dysfunction

• Major source of morbidity and mortality early after lung transplantation
• Occurs in as many as 10 - 20% of cases
• Presentation similar to adult respiratory distress syndrome or acute lung injury
Case 3: Post Lung Transplant Complication

- 59 y/o male s/p DLTx for IPF 1 month ago
- Increased SOB and low grade fever > 2 weeks
- Dry non-productive cough
Case 4: Post Lung Transplant Complication

- 24 y/o female s/p DLTx for CF 2.5 yrs ago
- 2-3 weeks of increasing dyspnea, “chest tightness” & dry cough
- O2Sat 94-95%
- Low grade fever
What is the diagnosis?

A. Acute Rejection
B. Cytomegalovirus infection
C. Respiratory viral infection
D. PCP
E. Pulmonary edema
Acute Rejection

• More common in lung transplant than other solid organ transplants
• 60-75% have an episode in 1st year
  – Vascular organ
  – Lungs are exposed to environment
  – Lung graft contains a large amount of antigen presenting cells and lymphocyte network
Acute Rejection

- Clinical signs non-specific
- CXR usually unremarkable
- FEV$_1$ drop occurs in both rejection and infection (sensitivity 60-75% in DLTx)
- Diagnosis made by TBBX (Sensitivity 80%)
- Transbronchial biopsies for surveillance remains a controversial topic, 66% of centers perform surveillance

Hopkins PM. J Heart Lung Transplant 2002;21:1062-7
Pulmonary Complications: Early Post Lung Transplant

- Acute Rejection
- Anastomotic complications
- Infections – bacterial, fungal, viral, opportunistic
- Chronic Rejection: Bronchiolitis Obliterans Syndrome
Anastomotic complications
Case 5: Post Lung Transplant Complication

62 y/o female who is one year s/p DLT for Pulmonary Fibrosis

3 weeks of increasing LUQ discomfort

SOB and cough

Low grade fevers
Case 5: Post Lung Transplant Complication

What is the diagnosis?

A. Pneumococcal pneumonia
B. MRSA Pneumonia
C. Nocardia
D. Aspergillus
E. Rhizopus
F. Cancer
Bronchoscopy revealed nodular polypoid lesions
Nocardia asteroides
• Broncholitis Obliterans (BO)
  – 50-60% of recipients who survive 5 years
    • Possibly universal
  – Can begin early after transplant (median 16-20 months)
  – Accounts for >30% of deaths after 3rd year
FREEDOM FROM BRONCHIOLITIS OBLITERANS

For Adult Lung Recipients (Follow-ups: April 1994-June 2005)
Conditional on Survival to 14 days

% Freedom from

Years

ISHLT 2006
J Heart Lung Transplant 2006;25:880-892
<table>
<thead>
<tr>
<th>Probable Risk Factors</th>
<th>Potential risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Rejection</td>
<td>CMV infection</td>
</tr>
<tr>
<td>Lymphocytic bronchitis</td>
<td>Community respiratory infection</td>
</tr>
<tr>
<td>CMV pneumonitis</td>
<td>Donor antigen-specific reactivity</td>
</tr>
<tr>
<td>Anti-HLA pretransplantation</td>
<td>Medical non-compliance</td>
</tr>
<tr>
<td></td>
<td>GERD</td>
</tr>
<tr>
<td></td>
<td>Older donor age + longer ischemic time</td>
</tr>
</tbody>
</table>

What used to be the size of the dotted line has been scarred down to the central dark lumen.
### CHRONIC REJECTION AFTER LUNG TRANSPLANT:

**BRONCHIOLITIS OBLITERANS**

<table>
<thead>
<tr>
<th>BOS 0</th>
<th>FEV(<em>1) &gt; 90% and FEF(</em>{25-75}) &gt; 75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOS 0-p</td>
<td>FEV(<em>1) 81-90% or FEF(</em>{25-75}) &lt; 75%</td>
</tr>
<tr>
<td>BOS 1</td>
<td>FEV(_1) 66-80%</td>
</tr>
<tr>
<td>BOS 2</td>
<td>FEV(_1) 51-65%</td>
</tr>
<tr>
<td>BOS 3</td>
<td>FEV(_1) &lt; 50%</td>
</tr>
</tbody>
</table>
Case 6: Post Lung Transplant Complication

- 64 year old man who underwent double lung transplantation for IPF. Post operative course complicated by aspiration
- Recovering, but then noted to develop a flattened affect
- Progressive decline in mental status
- Myoclonic jerking movements in arms
- Status epilepticus
Case 6: 
Post Lung Transplant Complication

Head CT Scan
Brain MRI (T2)

Case 6:
Post Lung Transplant Complication

What is the diagnosis?

A. Intracranial bleed
B. Reversible Posterior Leukoencephalopathy (RPLE)
C. Toxoplasmosis
D. Meningitis / encephalitis
E. Post Transplant Lymphoproliferative Disorder (PTLD)
Reversible Posterior Leukoencephalopathy

Clinical features
• Acute to subacute onset
• Neurological symptoms
  – Headache
  – Altered mental status / confusion / drowsiness
  – Visual disturbances
  – Seizures - usually generalized tonic-clonic
• Systemic signs
  – Hypertension
  – Metabolic derangements: Hypomagnesemia & Hypocholesterolemia
Case 7: Post Lung Transplant Complication

- 67 y/o male with a lung transplant 3 years ago presents with complaints of rapidly progressive nodular lesions on scalp and forehead
2 weeks later

Rapidly progressing nodular ulcerated lesions covering 60% of scalp
What is the diagnosis?

A. Infection
B. Drug Reaction
C. Cancer
### MALIGNANCY POST-LUNG TRANSPLANT FOR ADULTS
Cumulative Prevalence in Survivors (Follow-ups: April 1994 - June 2005)

<table>
<thead>
<tr>
<th>Malignancy/Type</th>
<th>1-Year Survivors</th>
<th>5-Year Survivors</th>
<th>7-Year Survivors</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Malignancy</td>
<td>7968 (96.2%)</td>
<td>1756 (87.5%)</td>
<td>723 (81.3%)</td>
</tr>
<tr>
<td>Malignancy (all types combined)</td>
<td>316 (3.8%)</td>
<td>252 (12.5%)</td>
<td>166 (18.7%)</td>
</tr>
<tr>
<td>Malignancy Type*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td>70</td>
<td>132</td>
<td>101</td>
</tr>
<tr>
<td>Lymph</td>
<td>152</td>
<td>54</td>
<td>31</td>
</tr>
<tr>
<td>Other</td>
<td>73</td>
<td>71</td>
<td>51</td>
</tr>
<tr>
<td>Type Not Reported</td>
<td>21</td>
<td>10</td>
<td>2</td>
</tr>
</tbody>
</table>

Other malignancies reported include: adenocarcinoma (2; 2; 2), bladder (2; 1; 0), lung (2; 4; 2), breast (1; 5; 4); prostate (0; 5; 3), cervical (1; 1; 1); liver (1; 1; 1). Numbers in parentheses represent the number of reported cases within each time period.

* Recipients may have experienced more than one type of malignancy so sum of individual malignancy types may be greater than total number with malignancy.

ISHLT 2006

J Heart Lung Transplant 2006;25:880-892
Complications: Non-Pulmonary

• **Neuro:** AMS, Seizures (Reversible Posterior Leukoencephalopathy), tremor, neuropathy
• **Malignancies:** esp. Skin cancer, PTLD
• **GI:** Gastroparesis, GERD / aspiration, diarrhea, ileus, bowel perforation
• **CV:** Atrial tachyarrythmias, hypertension
• **Renal:** Renal insufficiency / failure, RTAs
• **Endocrine:** Diabetes, Hyperlipidemia
• **Heme:** Leukopenia / Anemia
# POST-LUNG TRANSPLANT MORBIDITY FOR ADULTS

Cumulative Prevalence in Survivors within 1 and 5 Years Post-Transplant (Follow-ups: April 1994 - June 2007)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Within 1 Year</th>
<th>Total number with known response</th>
<th>Within 5 Years</th>
<th>Total number with known response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>52.10%</td>
<td>(N = 9,982)</td>
<td>85.30%</td>
<td>(N = 2,538)</td>
</tr>
<tr>
<td>Renal Dysfunction</td>
<td>25.3%</td>
<td>(N = 10,305)</td>
<td>37.0%</td>
<td>(N = 2,798)</td>
</tr>
<tr>
<td><strong>Abnormal Creatinine &lt; 2.5 mg/dl</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>17.20%</td>
<td></td>
<td>23.40%</td>
<td></td>
</tr>
<tr>
<td><strong>Creatinine &gt; 2.5 mg/dl</strong></td>
<td>6.40%</td>
<td></td>
<td>10.00%</td>
<td></td>
</tr>
<tr>
<td><strong>Chronic Dialysis</strong></td>
<td>1.70%</td>
<td></td>
<td>3.10%</td>
<td></td>
</tr>
<tr>
<td>Renal Transplant</td>
<td>0.00%</td>
<td></td>
<td>0.50%</td>
<td></td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>22.20%</td>
<td>(N = 10,639)</td>
<td>53.60%</td>
<td>(N = 2,829)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>25.70%</td>
<td>(N = 10,269)</td>
<td>35.50%</td>
<td>(N = 2,582)</td>
</tr>
<tr>
<td>Bronchiolitis Obliterans</td>
<td>9.10%</td>
<td>(N = 9,699)</td>
<td>33.70%</td>
<td>(N = 2,128)</td>
</tr>
</tbody>
</table>
ADULT LUNG TRANSPLANT RECIPIENTS: Cause Of Death
(Deaths: January 1992- June 2005)

<table>
<thead>
<tr>
<th>CAUSE OF DEATH</th>
<th>0-30 Days (N = 1,273)</th>
<th>31 Days - 1 Year (N = 1,886)</th>
<th>&gt;1 Year - 3 Years (N = 1,581)</th>
<th>&gt;3 Years - 5 Years (N = 910)</th>
<th>&gt;5 Years (N = 1,001)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRONCHIOLITIS</td>
<td>5 (0.4%)</td>
<td>87 (4.6%)</td>
<td>414 (26.2%)</td>
<td>263 (28.9%)</td>
<td>265 (26.5%)</td>
</tr>
<tr>
<td>ACUTE REJECTION</td>
<td>65 (5.1%)</td>
<td>37 (2.0%)</td>
<td>26 (1.6%)</td>
<td>5 (0.5%)</td>
<td>7 (0.7%)</td>
</tr>
<tr>
<td>LYMPHOMA</td>
<td>1 (0.1%)</td>
<td>51 (2.7%)</td>
<td>35 (2.2%)</td>
<td>14 (1.5%)</td>
<td>31 (3.1%)</td>
</tr>
<tr>
<td>MALIGNANCY, OTHER</td>
<td>1 (0.1%)</td>
<td>50 (2.7%)</td>
<td>94 (5.9%)</td>
<td>73 (8.0%)</td>
<td>89 (8.9%)</td>
</tr>
<tr>
<td>CMV</td>
<td>0</td>
<td>69 (3.7%)</td>
<td>21 (1.3%)</td>
<td>4 (0.4%)</td>
<td>3 (0.3%)</td>
</tr>
<tr>
<td>INFECTION, NON-CMV</td>
<td>270 (21.2%)</td>
<td>685 (36.3%)</td>
<td>395 (25.0%)</td>
<td>172 (18.9%)</td>
<td>180 (18.0%)</td>
</tr>
<tr>
<td>GRAFT FAILURE</td>
<td>361 (28.4%)</td>
<td>359 (19.0%)</td>
<td>278 (17.6%)</td>
<td>169 (18.6%)</td>
<td>170 (17.0%)</td>
</tr>
<tr>
<td>CARDIOVASCULAR</td>
<td>131 (10.3%)</td>
<td>82 (4.3%)</td>
<td>53 (3.4%)</td>
<td>43 (4.7%)</td>
<td>52 (5.2%)</td>
</tr>
<tr>
<td>TECHNICAL</td>
<td>107 (8.4%)</td>
<td>50 (2.7%)</td>
<td>11 (0.7%)</td>
<td>2 (0.2%)</td>
<td>3 (0.3%)</td>
</tr>
<tr>
<td>OTHER</td>
<td>332 (26.1%)</td>
<td>416 (22.1%)</td>
<td>254 (16.1%)</td>
<td>165 (18.1%)</td>
<td>201 (20.1%)</td>
</tr>
</tbody>
</table>
ADULT LUNG RECIPIENTS

Functional Status of Surviving Recipients

(Follow-ups: April 1994 – June 2007)

1 Year (N = 6,863) 3 Year (N = 4,355) 5 Year (N = 2,503) 10 Years (N = 419)

- No Activity Limitations
- Performs with Some Assistance
- Requires Total Assistance

ISHLT 2008

J Heart Lung Transplant 2008;27: 937-983
ADULT LUNG RECIPIENTS
Employment Status of Surviving Recipients
(Follow-ups: April 1994 – June 2007)

0%
20%
40%
60%
80%
100%

1 Year (N=8,204) 3 Year (N=4,952) 5 Year (N=3,029) 10 year (N=635)

Working (FT/PT)
Working Part Time
Working Full Time
Retired
Not Working

ISHLT 2008
J Heart Lung Transplant 2008;27: 937-983
Key Points

• Lung Transplantation may be the final therapy option for advanced lung disease
• Patients must be carefully selected with factors varying by their underlying disease
• Early referral is an important for favorable outcomes
• Post lung transplant complications need to be recognized and treated aggressively
• Chronic rejection and infection remain major obstacles in long term survival
• Lung Transplant in correctly selected patients can improve duration and quality of life