Lung Transplantation: An Overview

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Background

• 1983-First successful human lung transplant performed in Toronto

• 1990-First lung transplant in Massachusetts performed at BWH
Background

- > 16,000 transplants performed nationally since 1988
- 374 to date at BWH

http://www.optn.org/latestData/rptData.asp
Indications
General selection criteria

- Individuals with advanced lung disease
  - NYHA Class III
  - Unacceptable quality of life
  - 50% survival < 3 years despite maximal medical therapy
  - Accelerated clinical course
Recipient Selection
Contraindications

• Co-morbidities:
  – CAD: unstable, inducible, uncorrectable
  – Renal insufficiency
  – Cirrhosis
  – Connective tissue disease with limiting systemic involvement
  – Malignancy
  – Chronic Infection: Hepatitis, HIV
Mutual Education

- Goals/expectations
- Severity of illness
- Nutritional status
- Bacterial colonization
- Psychosocial considerations
Disease Specific Indications

• Pulmonary fibrosis:
  – FVC or TLC ≤ 65% or decline in FVC by 10%
  – DLCO ≤ ~55%
  – Pulmonary HTN
  – Consider at diagnosis

• Pulmonary hypertension:
  – Mean PAP ≥ 55 mm Hg
  – RA ≥ 15 mm Hg
  – CI < 2 L/min/m²
  – NYHA III/IV
ADULT LUNG TRANSPLANTATION
Indications By Year (%)

CF
IPF
COPD
Alpha-1
IPAH
Re-Tx

% of Transplants

0 20 40 60 80 100


Transplant Year

ISHLTI

2009

JHLT 2009; 28: 989-1049
### Evaluation Process

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
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<tbody>
<tr>
<td>Arrange Screening Visit</td>
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<td>MD Pulmonary CCD</td>
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<td>MD Surgery CCD or TC</td>
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<td>Social Work Evaluation</td>
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<td>Initial Meeting with Coordinator, education</td>
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<td>In-Patient Evaluation</td>
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<td>Out-patient completion</td>
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<td>Listing Meeting</td>
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<tr>
<td>Listing patient visit</td>
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<tr>
<td>Completion of work / Activation of Patient</td>
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</table>
Core Evaluation

- History and physical
- Full PFTs
- Cardiac Cath
- ECHO
- Chest CT
- Quantitative V/Q
- Pulmonary Rehab
- Bone densitometry

- Sputum culture/synergy testing
- Consults: Thoracic surgery, Psychiatry, Social Work, Nutrition
- Blood work: tissue typing, virology titers (Hepatitis, CMV, EBV, HIV)
The Outpatient Evaluation

• TB testing
• Age appropriate cancer screening
• Dental exam and clearance
• PH probe
• Bone Densitometry
• Six Minute Walk Test
The Assessment

- Weight
- Steroid Dose
- Infections
- Functional Status
- Pain management concerns
- Support System
- Compliance
- Psychiatric/Substance use
The Role of Pulmonary Rehabilitation

- Optimize cardiac status
- Optimize muscle strength
- Optimize lung function
- Assess oxygen needs
- Patient education
- Establish exercise as a routine therapy
- Incorporate exercise into daily life
The Role of the Support Team

• Physical support
• Medical support
• Emotional support
• Reliable support
• Transportation
• Rehabilitation/recovery
• Duration variable
Waiting and the LAS Score
Lung Allocation Score

• Instituted May, 2005
• Goals of organ allocation
  – Efficient and equitable allocation of lungs to transplant candidates
  – Maximize the net transplant benefit for candidates that receive a lung transplant
Components of the LAS Score

- Age
- BMI
- Diagnosis
- PAP
- PCWP
- Functional status – NYHA
- Tbili
- 6MW
- FVC
- Supplemental Oxygen
- Ventilator use
- Cr
- DM
- pCO2

Waiting Time

- 1,807 candidates registered with UNOS
- 1,316 actively awaiting transplant
- 45 active in region 1
- Median time to transplant 2000 – 1,663 days
- Median time to transplant 2007 – 141 days

http://www.ustransplant.org/annual_reports/current/waitlist_outcomes.htm
Survival in the LAS Era

Figure 1. Kaplan–Meier survival estimates between pre-LAS and LAS groups.

JHLT 2009; 28: 769-775
Donor Considerations
Standard Donor Criteria

- Age < 55
- ABO compatibility
- Clear CXR
- PaO2 ≥ 300 mm Hg on FIO2 100%, PEEP 5 cm H2O
- ≤ 20 py smoking
- Absence of chest trauma
- No aspiration or sepsis
- No prior cardio-pulmonary surgery
- Gram stain negative for organisms
- Absence of purulent secretions on bronch

Consensus Report ISHLT, JHLT, 11/03
Limitations of Donor Criteria


Expansion of Donor Consideration

• Absolute Criteria:
  – PaO2/FIO2 > 300
  – Absence of radiographic infiltrate
  – Absence of copious prurulent secretions on bronchoscopy

• Institution of Donor Management Protocol

AJRCCM 2006; 174: 710-716
Summary

• The evaluation of transplant recipients is complex, and a multi-disciplinary team approach is optimal
• Proper preparation requires optimization of medical, psychosocial, functional, and logistical concerns
• Organ donation is a national, regional and institutional priority
• “Every donor is a (potential) lung donor”
Choice of Procedure

• Single
  – provides adequate organ replacement and maximizes organ utilization
  – performed via lateral thoracotomy using single-lung ventilation
  – CPB can be avoided in most cases
  – Societal issues of organ availability

• Bilateral:
  – provides maximal functional lung tissue
  – performed as sequential single lung transplants via sub-costal approach
  – CPB can be avoided in some cases
  – Survival advantage
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.

ISHLT 2009

JHLT 2009; 28: 989-1049
Post Transplant Management: The Balance of Competing Risks
Outcomes
ADULT LUNG TRANSPLANTATION

1988-1994: 1/2-life = 4.2 Years; Conditional 1/2-life = 7.0 Years
1995-1999: 1/2-life = 4.7 Years; Conditional 1/2-life = 7.3 Years
2000-6/2007: 1/2-life = 5.7 Years; Conditional 1/2-life = 7.6 Years

Survival comparisons by era
1988-94 vs. 1995-99: p = 0.0010
1988-94: vs. 2000-6/07: p < 0.0001
1995-99 vs. 2000-6/07: p < 0.0001

N at risk = 162
N at risk = 810
N at risk = 765

ISHLT 2009; JHLT 2009; 28: 989-1049
ADULT LUNG TRANSPLANTATION
Kaplan-Meier Survival by Procedure Type
(Transplants: January 1990 – June 2007)
Diagnosis: Idiopathic Pulmonary Fibrosis

IPF/Single lung (N=3,054)
IPF/Double lung (N=1,640)
N=66
N=27
p = 0.0004
N at risk at 5 years = 241
N at risk at 5 years = 659

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ADULT LUNG RECIPIENTS

Functional Status of Surviving Recipients
(Follow-ups: April 1994 – June 2008)

No Activity Limitations
Performs with Some Assistance
Requires Total Assistance

1 Year (N = 6,820) 3 Year (N = 4,333) 5 Year (N = 2,492) 10 Years (N = 422)

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ADULT LUNG RECIPIENTS
Employment Status of Surviving Recipients
(Follow-ups: April 1994 – June 2008)

ISHLT 2009

JHLT 2009; 28: 989-1049
Summary

- Lung Transplantation is a therapeutic consideration for appropriate patients with advanced lung disease
- Management involves balancing competing risks
- The main benefits of lung transplantation involve the impact on quality of life
Transplant Teams:
Continuing a Tradition
of Excellence