Disclosures

• None
Outline

• Patient selection with disease specific consideration: When to refer? When to list?
• Contraindications for transplant
• Relative risk factors that impact candidacy
• Process of transplant evaluation and listing at NMH
• Survival after transplant
• NMH outcomes data compared to regional centers
Timing of transplant referral
“Transplant Window”

• High (>50%) risk of death from lung disease within 2 years if lung transplantation is not performed
• High (>80%) likelihood of 5-year post-transplant survival from a general medical perspective provided that there is adequate graft function
Timing of transplant referral

- Sick enough to justify the risks of transplantation, BUT healthy enough to survive transplant surgery

- Referral should be initiated before the need for transplant becomes urgent
Advantages of Early referral

“Referral ≠ transplant listing”

• Provide comprehensive transplant education and setting expectation - discussing risk vs benefit of transplant
• Address modifiable barriers – obesity, malnutrition, medical comorbidities, psychosocial concerns, rehab
• Comprehensive assessment of other organ functions
• Rule out occult malignancies
• Vaccination
Absolute contraindications for transplant

- Critical or unstable medical condition
- No significant organ dysfunction
- Pan resistant organisms
- Obesity BMI > 32 (for COVID ARDS BMI < 35) or BMI < 17
- Smoking/Substance abuse
- Active malignancy within 2 years (5 years for some tumors)
- Active HIV, Hep B, Hep C with liver dysfunction
- Symptomatic osteoporosis
- Psychosocial concerns – non adherence, lack of support, etc
Risk factors that impact transplant candidacy
Variable criteria based on transplant center and experience

• Age >70 years
• Multi vessel CAD that requires bypass during transplant
• BMI >35 or BMI <16
• Esophageal dysmotility
• Chest wall deformity
• LVEF<40%
• Limited potential for post transplant rehabilitation
Who is a candidate? Indications for Transplant

Chronic obstructive pulmonary disease
Guidance for referral

• BODE index cited as the prognostic model of choice by ISHLT
• BODE score 5-6 with additional risk factors: frequent exacerbations, increase in BODE>1 over 2 years, FEV1 20-25% pred
• Poor QOL

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<td>FEV1 (% of predicted)†</td>
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<tr>
<td>Distance walked in 6 min (m)</td>
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<td>MMRC dyspnea scale‡</td>
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Chronic obstructive pulmonary disease

Indications for listing

- BODE score 7-10
- FEV<20% pred
- Presence of moderate to severe pulmonary hypertension
- Three or more severe exacerbations over the past year
- Chronic hypercapnia (Paco2>50mmHg)
Special consideration for COPD
Simultaneous referral for LVR and transplant

- Lung volume reduction (LVR) either surgical or bronchoscopic approach

- Optimize patients suitability as a future transplant candidate

- Prior LVRS can pose technical challenges due to adhesions

- No major difference in post-transplant survival outcomes compared to patients who had undergone transplant alone

Interstitial lung disease
Referral should be made at the time of diagnosis

• Idiopathic pulmonary fibrosis (IPF) 3-5 year survival after diagnosis when untreated

• Non IPF ILD: variable prognosis based on histological dx or HRCT patterns

• Clinical predictors for survival in non- IPF ILD: FVC and DLCo decline, Hospitalization, frailty, o2 use and functional symptoms
Interstitial lung disease

Transplant listing

• Any form of pulmonary fibrosis with one of the following in 6 months:
  - decline in FVC >10%
  - decline in DLCo>10%
  - decline in FVC>5% with CT progression
  - >50m decline in six minute walk
• Desaturation <88% on 6 minute walk
• PH on echo or RHC
• Hospitalization for acute exacerbation
• Pneumothorax
Interstitial lung disease

Special consideration

- Close attention to extra pulmonary manifestation
- Renal disease
- GI motility disorders
- Occult malignancies
- Familial disorders - telemereopathy
Cystic fibrosis and non CF bronchiectasis
Mortality predictors and referral

• FEV1 is the best individual predictor of mortality

• CF Median survival of 6.6 yrs after reaching FEV1<30%

• Other predictors of mortality: Infections, BMI<18, female sex, DM, >1 exacerbation per year, hemoptysis, malnutrition, co2 retention

• Predictors of survival may need re-evaluation with use of highly effective CFTR modulators
Cystic Fibrosis and non CF bronchiectasis

Transplant listing

• FEV1<25%

• >30% decline in lung function in FEV1 over 12 months

• Recurrent exacerbation requiring IV antibiotics

• PH on echo and/or right heart catheterization

• FEV1<40% with one of the following: 6 mwd <400m, paco2>50mmHg, hypoxia, PH, malnutrition, hemoptysis, pneumothorax
Cystic Fibrosis and non CF bronchiectasis

Special consideration

• Infections with resistant organisms – especially Burkholderia cepacia complex, nontuberculous mycobacteria, and fungal

• Non CF bronchiectasis prognosis is variable compared to CF

• Extra pulmonary manifestation of disease – nutrition, diabetes, sinus, occult malignancies

• Lower threshold for referral and listing for females and those with short stature, diabetes, or increasing antibiotic resistance
Pulmonary arterial hypertension
Guidance for referral

• Serial risk assessment and response to vasodilator therapy
• REVEAL 2.0 score of >8 despite appropriate therapy
• 2015 ESC/ERS with “intermediate” or “high risk” category
• Unable to achieve “low risk” status despite maximal PAH therapy within 6-months
• RV dysfunction on echo
• IV or SC prostacyclin therapy initiation
• Scleroderma associated PAH
Pulmonary arterial hypertension

Transplant listing

• ESC/ERS high risk category or REVEAL risk score >10 on appropriate PAH therapy

• Progressive hypoxemia

• Renal dysfunction (early) due to PAH
COVID ARDS and Post-COVID pulmonary fibrosis

Evolving area for transplant consideration – Referral/listing

• ~4-6 weeks of maximal support with evidence of irreversible lung damage
• Single organ failure
• BMI < 35
• Awake, participating in physical therapy
• Cleared COVID with 2 negative PCR samples from BAL
• Rehab potential
• Assess routine comorbidities
Challenges with COVID ARDS

- ECMO complications
- Psychosocial burden
- Malnutrition associated with critical illness
- Critical illness myopathy
- HAP/VAP organisms
- Bleeding complications related to pleural adhesions
- Highly sensitized patients partly due to blood product requirement during critical illness
- Prolonged rehab course and vent dependence post transplant
Transplant work up process at NMH

5 day evaluation

• Initiate 5 day evaluation after in person consultation
• Routine blood work, viral and hepatitis serologies
• Cardiac: Echo, right/left heart cath, +/- cardiac MRI
• GI: esophageal manometry or esophagram
• PFT, CT chest, +/- Sinus CT, sniff test, +/- diaphragm USG
• Bone densitometry
• Routine age appropriate cancer screening
• Consultation: transplant ID, thoracic surgery, dental, dermatology, GI, cardiology, HLA lab
Transplant listing and lung allocation score
MDM discussion for listing

- Lung diagnosis
- Date of birth
- New York Heart Association Class
- Assisted ventilation
- Height and weight
- Diabetes
- Supplemental oxygen

- Percent predicted FVC
- Six minute walk distance
- Serum creatinine
- Right atrial pressure
- Mean pulmonary artery pressure
- Cardiac index
Number of lung transplants by year and type

For recipients who survived to 1 year, the median survival is 8.7 years.
Disease specific transplant survival

Survival (\%)

Years after transplant

Median survival:
A1ATD: 7.0yrs; CF: 9.5yrs; COPD: 5.9yrs; IIP: 5.2yrs; ILD-not IIP: 6.3yrs; IPAH: 6.3yrs

p < 0.05 for all pairwise comparisons except:
A1ATD vs. ILD-not IIP, A1ATD vs. IPAH, COPD vs. ILD-non IIP, ILD-non IIP vs. IPAH
Transplant survival

• infection and “graft failure” remain the leading causes of death in the first post-transplant year

• death after 5 years is predominantly from chronic rejection, malignancy, and infection
## UNOS data – Regional centers
### Transplant volume

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SRTR data – Regional outcomes

- Northwestern 89.8% 1 year survival
- Loyola 80.9% 1 year survival
- University of Wisconsin 87.8% 1 year survival
- University of Michigan 87.1% 1 year survival
- University of Iowa 88.7% 1 year survival
- Henry Ford 86.1% 1 year survival
- Indiana 87% 1 year survival
SRTR data - national outcomes (50 and above)

- Northwestern 89.8% 1 year survival
- Duke University 87.9% 1 year survival
- Cleveland Clinic 88.8% 1 year survival
- Temple 88.1% 1 year survival
- Stanford 90.4% 1 year survival
Questions?
Thank You
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