Lung Volume Reduction Surgery

February 2013
Presentation Outline

Lung Volume Reduction Surgery (LVRS)
  – Rationale & Historical Perspective
  – NETT Results

Current LVRS Process (from referral to surgery)
  – Diagnostic tests & Selection Criteria
  – Pulmonary Rehab
  – Clinic visits (pre & post rehab)

Post-op (Inpatient & Outpatient)
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Post-op (Inpatient & Outpatient)
Emphysema

- Enlargement of the air spaces
- Loss of alveolar walls & destruction of parts of the capillary bed
- Small, thin, narrow and atrophied walls of the airways
- Some loss of larger airways
Background Summary

“NETT”

- Between Jan 98-July 2002
- 3,777 were screened
- 1,218 were randomized
- 608 LVRS
- 610 Medical management
- In 2006 NETT reported updated analyses with a median follow-up of 4.3 years regarding survival and functional measures.
Lung volume reduction surgery and emphysema

Protocol: Median sternotomy or bilateral video-assisted thoracoscopy. Target areas identified by CT scan and perfusion scan. ~30% of each lung removed by a stapling technique.

Post-op remaining lung:
1) Improved elastic recoil
2) Improved V/Q matching
3) Decreased hyperinflation.
A Randomized Trial Comparing Lung-Volume-Reduction Surgery with Medical Therapy for Severe Emphysema

National Emphysema Treatment Trial Research Group*
Potential predictors of outcome:

- FEV1
- Diffusing capacity
- Lung volume
- pCO2
- Emphysema distribution
- Quality of life scores
- Age
- Sex
- Race
- Exercise capacity
Potential predictors of outcome?

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Findings / High Risk Groups

In 2001 NETT investigators stopped enrolling people with:

✓ Severe obstruction (FEV1 ≤ 20% of pred.)

Along with either:

• Low diffusing capacity (DLCO ≤ 20% of pred.)

Or:

• Homogenous emphysema

(High risk of mortality and little chance of benefit from LVRS)
Other NETT findings

- At 2 yr. fu, EC had improved by > 10 W in 15% of the surgical patients vs. 3% of the medical group.

- Among patients with upper-lobe predominant emphysema and low EC, mortality was lower in the surgical group than in the medical group.

- Non upper-lobe emphysema and high EC, mortality was higher in the surgical group vs. the medical group.
Other NETT findings

- At 4.3 yr. fu survival improved after LVRS compared to medical group despite the expected higher post-op immediate mortality with LVRS (0.11 deaths per person-year and 0.13 with medical group)

- In 290 patients with ULE and low EC, LVRS afforded a substantial survival advantage, improved EC and QOL

- Low UL perfusion measured by LPQ indicates a survival advantage with LVRS in patients with UL predominant emphysema
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Post-op (Inpatient & Outpatient)
The Time Frame

Evaluation
2 visits
PFT’s, CPET, 6 MW
CXR, CT, RA ABG’s
Perfusion scan, labs

Rehab
1 month
(16-20 sessions)

Other tests
6-10 weeks
Stress test, Echo,
R heart cath and or
L heart cath
Visit w the cardiologist

Rehab exit, Clinic visits
Questionnaires
UCSD, SF 36
Knowledge test

Tests
1-2 weeks
PFT’s
EKG
CPET, 6 MW
Pre-op labs
CT only if indicated

Surgery
within 2-4 weeks
of finishing rehab

Post op rehab
Within 8-9 weeks
from the surgery

Follow-up
2 weeks, 1-3 mos,
6 mos with PFT’s, yearly with PFT’s/CPET
Current LVRS Process
(From referral to surgery)

- Designated LVRS unit
- Multidisciplinary care team
  - Medical staff
  - Registered nurses
  - Unit nurse manager
  - Physical therapist
  - Occupational therapist
  - Psychologist
  - Infection control
  - Nutritionist
  - Pharmacist
  - Respiratory therapist
  - Patient care resource manager
  - Clinical Nurse Specialist
  - Social work
  - Pain management

- Inpatient and outpatient pulm rehabilitation
- Evidence-based clinical practice guidelines
**LVRS Selection Criteria**

- **Major selection criteria**
  - Disabling dyspnea and impaired QOL
  - FEV1 ≤ 45% of predicted (≥ 15% if age ≥ 70)
  - Severe upper lobe predominant emphysema
  - Not “High Risk”
    - If FEV1 ≤ 20%, DLCO must be > 20%
  - Hyperinflated (TLC ≥ 100% and RV ≥ 150% of predicted)
  - Non-smoker > 4 months
  - RA ABG’s (PaO2 ≥ 45, PaCO2 ≤ 60)
  - Non-obese; BMI ≤ 31.1 (men) and ≤ 32.3 (women)
Other Selection Criteria

- H&P consistent with emphysema
- Stable with ≤ 20 mg prednisone QD
- Approval from a cardiologist if:
  - Unstable angina
  - LVEF < 45%, CAD or LV dysfunction per stress test
  - Arrhythmia (>5 PVCs per minute)
  - Cardiac rhythm other than sinus
  - PVCs on EKG at rest
Exclusion Criteria

✓ Pulmonary Hypertension
  (Peak systolic PA pressure ≥ 45 or mean ≥ 35)
✓ Clinically significant bronchiectasis
✓ Significant pleural or interstitial disease
✓ Giant bulla ≥ 1/3 volume on either side
✓ BMI ≥ 31.1 (male) or ≥ 32.3 (female)
✓ High risk category
✓ Unable to walk > 140 meters post rehab
✓ Homogeneous emphysema
LVRS is not covered if:

- Patient characteristics carry a high risk for preoperative morbidity and mortality
- The disease is unsuitable for LVRS
- Medical conditions or other circumstances make it unlikely for the patient to complete the preoperative and postoperative diagnostic and therapeutic procedures required for the surgery
RU lung 4.5%.
RM lung 30.7%.
RL lung 16.2%.
LU lung 6.7%.
LM lung 27.0%.
LL lung 15.0%.
The Vicious cycle of Deconditioning

↓
Activity

Steroid use and weakness

Weak muscles move slower and tire faster

↑
Deconditioning

↑
Shortness of Breath with Activity
Pre-Op Rehab Protocol

✓ 16-20 exercise sessions within 6-10 weeks
✓ 3 days per week at the facility
✓ 2 days per week at home
✓ Each session must last at least 2 hours
✓ 3 initial core sessions & final session at OSU
✓ Education sessions required
✓ Psychosocial & behavioral intervention
✓ Reach exercise goals
Components of Exercise

✓ Flexibility & Warm Up

✓ Upper & Lower Body Endurance Training
  - UBE
  - Treadmill
  - Bike or NuStep

✓ Upper & Lower Body Strength Training
  - Arm exercises with dumbbells
  - Leg exercises with ankle weights

✓ IMT as needed
Required Education

- Orientation to Rehab & LVRS
- Anatomy & Physiology of COPD
- Psychosocial Evaluation
- Benefits of Exercise
- Respiratory Muscles
- Energy Conservation & ADL
- Nutrition
- Oxygen
- Infection Control & Secretion Management
- Medication Management
- Intimacy & COPD
- Osteoporosis
- Breathing Retraining
- Advanced Directives
- Behavioral Intervention (3-4 sessions)
- Cough & deep breathing
- Pain management
Exit Evaluation

- Physician and Rehab Personnel
- Review of the goals
- Re-emphasize continuation of home exercise or maintenance
- Cough & Deep Breathing Techniques
- Post-Op Pain Management
Post Rehab Tests

✓ PFT’s (Post BD)
✓ 6 minute walk
✓ Exercise Test
✓ ABG’s & Labs
✓ EKG
✓ Other tests as deemed necessary by the physicians
Pre-op Clearance

❖ Pulmonologist
❖ Surgeon
❖ Anesthesiologist
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Post-op (Inpatient & Outpatient)
Surgery Risks

- Air Leak
- Pneumonia
- Atelectasis
- Infection
- Stroke
- Bleeding
- MI or other cardiac complications
Post-op Care

- Extubate in OR
- Out of bed within the 1st 24 hrs.
- Pain Control
- Cough & deep breathing
- Inpatient pulmonary rehab and ambulating
Respiratory / Nursing Care

- Breathing Treatments (evaluators & staff)
- Home meds & O2
- Incentive Spirometry – C & DB
- Secretion Mobilization
- Vital Signs
- Input & Output
- Ambulation (X 4 daily)
- CXR (portable)
- CBC with differential & platelets – Chem 7
OSUMC Performance Measures – JCAHO Certification

- Post-operative Complication Rate
- Mortality ninety (90) days post-procedure
- Overall patient satisfaction at discharge
- Quality of life score at 1 year post-op
Post-Op Rehab Protocol

- 6 -10 rehab sessions
- 2 times per week at the facility
- 3 times per week at home
- First session at OSU
- No UBE & limited arm exercise for 4-6 weeks post-op
- Wean oxygen as appropriate
- Get back to pre-LVRS exercise level
Follow-up

- Clinic visit with the surgeon
- Clinic visit with the pulmonologist
- 6 month clinic visit with same day PFT’s
- 1 yr. and yearly after up to 7 yr. clinic visits with same day PFT’s & CPET
“J”

✔ 55 y.o. former smoker
✔ Severe dyspnea; on O2; wheelchair, nursing home for 18 months
✔ FEV1 = 0.64 (16% pred)
✔ TLC = 10.8 (144% pred)
✔ RV = 7.76 (340 % pred)
✔ Room air ABG  pO2 = 68; pCO2 50
PFT’s 7/04

✓ FEV1 = 0.64
✓ TLC = 10.8
✓ RV = 7.76
✓ Room air ABG
  pO2 = 68, pCO2 = 50

PFT’s 2/05

✓ FEV1 = 1.50
✓ TLC = 7.85
✓ RV = 3.78
✓ Room air ABG
  pO2 = 104, pCO2 = 38
Oxygen

- 18 out of 22 bi-lateral LVRS patients from 1/1/2008 – 6/30/2010 using oxygen prior to surgery
  - 12/16 patients (75%) were able to stop using O2 after surgery
  - 13/16 patients (81%) were able to stop or reduce use of O2 after surgery
  - 1 patient who did not require O2 prior to surgery did require it for approximately 9 months after surgery
Average FEV1 at baseline vs. 6 & 12 months post LVRS
N= 76 (2004-2012)
Average PaO2 at baseline vs. 6 & 12 months post LVRS
N= 76 (2004-2012)
Average PaCO2 at baseline vs. 6 & 12 months post LVRS
N= 76 (2004-2012)
Average DLCO at baseline vs. 6 & 12 months post LVRS
Average 6MW distance at baseline vs. 6 & 12 months post LVRS
Average UCSD score (QOL) at baseline vs. 6 & 12 months post LVRS (Lower scores are better)

Series 1

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Clinician’s Guide to Lung Volume Reduction Surgery

Background

The Ohio State University Wexner Medical Medical Center has been re-certified by The Joint Commission as one of the locations in the United States able to provide lung volume reduction surgery (LVRS). This surgery reduces the size of the lungs damaged by emphysema by removing some of the most diseased parts of the lungs. Having LVRS will allow the remaining lung to function more normally.

Ohio State’s Wexner Medical Center was one of 17 centers nationwide that participated in the National Emphysema Treatment Trial (NETT) study which examined the risks, benefits and appropriate selection criteria for the lung volume reduction surgery.

Notify Physician

Notify the House Officer for the following:

- Systolic Blood Pressure greater than 180, less than 90
- Diastolic Blood Pressure greater than 90, less than 60
- Heart Rate greater than 120, less than 60
- Respiratory Rate greater than 24, less than 8
- Temperature greater than 101.5°F
- Oxygen saturation less than 88% at rest or with increased oxygen requirement
- pO₂ less than 60, or if pCO₂ is greater than 55
- Chest tube output greater than 100 ml/hr
- Urinary output less than 30 ml/hour or less than 240 ml/8 hours

Selection Criteria

Labs and Imaging
How To Access The LVRS Pathway from OneSource

- Open “All Applications” tab
- Click on “Clinical Practice Guidelines” link
- Click on “Evidence-Based Practice Resources - Indexed by Category/Condition”
- Expand the “Respiratory Conditions” tab
- Expand “Lung Volume Reduction Pathway” tab
- Click on the “Pathway Document”