Bronchoscopic Lung Volume Reduction: indications, effects and prospects
Introduction

Patients with advanced COPD and emphysematous changes continue to have exertional breathlessness despite optimal therapy.

Lung volume reduction surgery is shown to improve exercise capacity and quality of life.

But not without risk.
National emphysema treatment trial (NETT):

- 16% excess mortality in the most severe disease.
- 5% early mortality and significant morbidity even in low risk patients.

Relevance of Bronchoscopic lung volume reduction (BLVR) - Safer alternative.
Bronchoscopic lung volume reduction (BLVR)

Technique:
Involves placing a device to obstruct the airway(s) leading to the most hyperinflated, emphysematous parts of the lung.

Rationale:
Endobronchial obstruction should cause these areas to collapse and thus, by reducing hyperinflation alleviates symptoms without surgery.
Available devices:

- Airway blockers
- IBV valves (The Spiration Implantable Intrabronchial Valve)
- Emphasys second generation endobronchial valves (EBVs)
- Emphasys third generation ‘Zephyr’ endobronchial valves
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Case Series

Snell et al.

- 10 patients with UL emphysema
- All segmental bronchi of UL bilaterally
- No major complications.
- None had significant atelectasis in CT Thorax.
- Decrease in UL blood flow (99m Tc perfusion scan)
- Improvement in gas transfer
- No change in lung volume and obstruction.
- Follow up bronchoscopy – design defect.
Hopkinson et al.

- 19 patients, used second generation EBVs.
- Decrease in FRC (7.1 (1.5) to 6.6(1.7))
- Increase in diffusing capacity ( 3.3(1.1) to 3.7(1.2) mmol/min/kPa.)
- Increase in cycle endurance time at 80% of peak workload.
- Reduction in end expiratory lung volume at peak exercise.
- Complications: pneumothorax in 2 patients.
Wan et al.

- 98 patients, used second generation EBVs (average 4 valves inserted)
- Improvement in exercise tolerance and lung function.
- Patients with most gas trapping at baseline (RV > 225%) had greatest improvement.
- Unilateral treatment had better results.
- Treatment of entire lobe had better results than targeting segments.
- Complications: pneumothorax in 3 patients.
Findings from other case series:

- Increase in FEV1, VC, six minute walk distance, MMRC and QoL.
- Decrease in O2 requirement in patients on LTOT.
- Radiological atelectasis rare or not reported in most of the series.
- Complications: pneumothorax (most common), pneumonia, bronchospasm, bronchial hypersecretion, granulation tissues.
Mechanisms of success and failure

Infrequent occurrence of atelectasis:

- Significant gas exchange between the obstructed and unobstructed segments through alveolar-lobar pores - collateral ventilation (more common in emphysematous lung than normal).

- Collateral ventilation more frequent within the lobes than between different lobes – explains why targeting / occluding the whole lobe is more effective than segmental occlusion.
Improved diffusing capacity because:

- Recruitment of previously ‘compressed’ alveoli.
- BLVR may result in decrease in swings intrathoracic pressures – improvement in cardiac function – increase in pulmonary capillary volume. (similar to LVRS).
- Just a measurement error? – due to knock down of most affected parts.
• Valve insertion may direct airflow into less affected areas – reduces dynamic hyperinflation during exercise.

• LVRS improves inspiratory capacity by improving inspiratory muscle function, whereas BLVR improves diaphragm function.

• Causes of pneumothorax:
  Pleural adhesions and subsequent parenchymal tear on collapsing.
  Rapid expansion and rupture of bullae in adjacent lobes.
Other indications

Use of EBVs to close persistent air leaks:

Air leaks following lung resections (aspergilloma, LVRS), malignancy, Empyema.
Other bronchoscopic approaches to treat emphysema

- The airway bypass technique – stenting between cartilaginous airways and emphysematous lung. (multicentre RCT to start by the end of 2006).

- Lung volume reduction by causing scarring in targeted areas by chemical agents – animal data available, no study on human yet.
Conclusion

No RCT results available.

VENT: Endobronchial Valve for Emphysema Palliation Trial
Southern Illinois University School of Medicine
Memorial Medical Center
St. Johns Hospital, USA.

Useful in heterogeneous disease only – due to collateral ventilation
All the best..