Lung Volume Reduction Surgery

Dr Kathryn Mulryan, Mr Joseph Mc Loughlin & Prof. Karen Redmond,
Department of Thoracic Surgery, Mater Misericordiae University Hospital, Dublin

Irish Thoracic Society

Introduction

Lung Volume Reduction (LVR) is a surgical technique aimed to improve symptoms for patients with advanced emphysema that have failed optimal medical therapy. LVR reduces residual volume allowing patients to take a deeper breath at rest and particularly on exertion.
It can be carried out via:
1. Bronchoscopic lobar reduction with endobronchial valves (EBV) or
2. Keyhole surgery with resection of hypo-perfused emphysematous tissue.

Epidemiology

HSE's NHQRS Annual Report 2019 estimates that almost 500,000 people aged 40 years and over in Ireland have COPD. (1)
200,000 have moderate or severe disease and that only half are likely to be diagnosed. (1, 2)
Although many symptoms of COPD can be managed in the community and in general practice, those with more serious exacerbations or other co-morbidities need specialist care in hospital. Ireland has the highest rate of hospital admissions with COPD in comparison to other countries in the OECD. 367.6 people in every 100,000 (standardised for age and sex) were hospitalised in Ireland in 2015, as compared to 187.2 in 100,000 for countries in the OECD. COPD is the commonest disease-specific cause of emergency hospitalisation of adults in Ireland, and in 2016 accounted for 15,262 (3.6%) of all emergency hospitalisations. (3)

Indications

- Symptomatic Gold Stage III / IV
- Ex – Smoker > 3 months
- Optimal medical therapy and inhaler compliance
- FEV1 < 50% predicted
  DLCO > 20% predicted
  Residual Volume >150%
- Ability to complete pulmonary rehabilitation

Contraindications

- Age > 80 (relative)
- Active smoker
- Severe PAH (> 55mmHg) or moderate PAH (41-55mmHg) with RV dysfunction
- Clinically significant bronchiectasis or fibrosis
- Significant cardiac disease
- Severe co-morbid illness or malignancy

Work -Up

- CT Thorax (<1.5mm slices non-contrast for StratX* report to calculate emphysema index and fissure integrity) and to exclude malignancy
- PFTs (FEV1 with bronchodilator response/body box RV and TLC/DLCO)
- Echocardiogram to assess pulmonary arterial pressure and RV function
- +/- ABG
- Six Minute Walk Test, identify oxygen requirements, ensure compliance with pulmonary rehabilitation programme

COPD MDT

Surgical Candidate

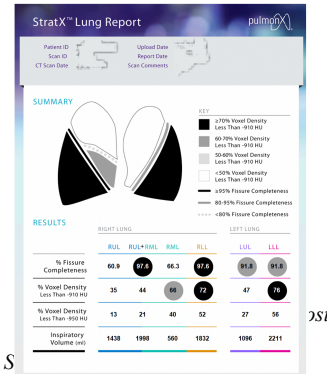
1. StratX Report generated to determine suitability for EBVs, reviewing fissure completeness between lobes, emphysema index, and inspiratory volumes
   - fissure completeness report of ≥ 85% - 95% requires correlation with a bronchoscopic balloon measurement (Chartis™) which checks for collateral ventilation (CV). If CV negative, consider EBVs.
2. Perfusion (Q) scan with zonal perfusion calculations including oblique views or SPECT CT
   - To identify perfusion defects, hypo-perfused segments and / or lobes
3. Bronchoscopy
   - Evaluation for tracheobronchomalcica
   - Bronchoalveloar lavage +/- targeted antibiotic
   - Chartis™ evaluation if indicated by StratX

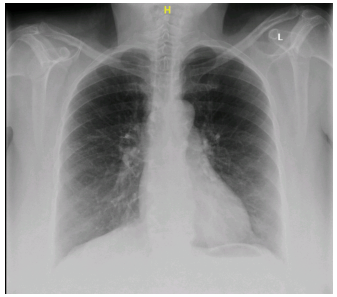
Fissures Complete → **Bronchoscopic LVRS**

Fissures Incomplete → **Surgical LVRS (Robotic or VATS)**

Bronchoscopic Intervention

EBVs allow air and mucous to exit the treated area but prevent air entry. The target lobe is evaluated for completeness of the interlobar fissure using a balloon Chartis™ bronchoscopic assessment following a StratX report. One-way valves are placed into targeted segmental airways (endobronchial valves; EBVs).



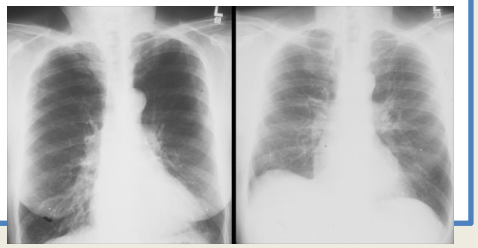


Post RL

S

Surgical Intervention

Excision of emphysematous portions of the lung is carried out using stapling devices. This can be performed using either thoracotomy, VATS or robotic approaches. Major short-term complications of lung volume reduction surgery (LVRS) include death, reintubation, arrhythmias, mechanical ventilation for more than two days, pneumonia, and persistent air leak. Mortality rate of 5.5% in NETT trial 2003 is overcalculated compared to 2021 figures (2.2% in postoperative period) (4).



Post bilateral surgical LVRS

Bridge to Lung Transplant

Single and double lung transplant result can provide very good quality of life outcomes. Median survival is 75% at 5 years post LVRS (4) whilst for lung transplant median survival is 49% years (4). LVRS procedures can be used to defer the time to transplant in suitable candidates to extend long term survival.

(1) Programme NC, for Respiratory. End to End COPD Model of Care. Internet 2019 [Available from: https://www.lenus.ie/bitstream/handle/10147/627097/end-to-end-copd-model-of-care-december-2019.pdf?sequence=1&isAllowed=y] Accessed August 2020.
(2) An Roinn Slainte (Department of Health). National Healthcare Quality Reporting System Annual Report 2019. Internet 2019 [Available from https://assets.gov.ie/36031/6cab12022e2c4b05947dfd7761ca3d1a.pdf] Accessed August 2020.
(3) Activity in Acute Hospitals. Activity in Acute Public Hospitals in Ireland: 2016 Annual Report; Health Pricing Office Health Service Executive; . http://www.hpo.ie/latest_ hipe_nprs_reports/HIPE_2016/HIPE_Report_2016.pdfSep 2017.
(4) Patel N, DeCamp M, Criner GJ. Lung transplantation and lung volume reduction surgery versus transplantation in chronic obstructive pulmonary disease. Proc Am Thorac Soc. 2008;5(4):447-53.

https://irishthoracicsociety.com/
ITS HERMES FLASHCARD SERIES 2021