PCRS Pragmatic Guides: Bronchoscopic and surgical options for COPD - the primary care role

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Introduction

Bronchoscopic and surgical treatments for people with COPD can improve their lung and exercise capacity, and quality and length of life for many years in addition to what medical treatments can achieve.[1] As new and safer techniques become available and pathways improve, it is critical that people who may benefit can access assessment for this highly specialist care at the right time.

Primary care services diagnose and treat the majority of people with COPD without requiring specialist referral. However, any primary care COPD service should be supported by and integrated with local multidisciplinary colleagues that can include specialist physicians, nurses, therapists, pharmacists and physiologists amongst others to ensure people with COPD are offered the right treatments that might include surgery. Integration can support consistent and seamless care, through development of shared guidelines, good communication between teams and professional relationship building.[2]

COPD is a condition where treatment options need to be re-evaluated and adjusted as the pathology progresses and symptoms change. The primary care based annual and post exacerbation reviews are opportunities to revisit whether someone is being offered the right care, based on the latest guidelines and available therapies.

It is possible that you may never personally be involved in the care of a patient suitable for COPD surgery as it is approximated that about only 1% of people with COPD may be suitable for a bronchoscopic or surgical intervention currently.[1,3,4] However, the benefit can be significant for those that are suitable.

The NICE NG 115 2018 guideline updated in 2019, for the diagnosis and management of COPD provides clear referral criteria, including for bronchoscopy and surgery, and works best when it is adapted to local guidelines and available services.

This pragmatic guide has been developed to highlight to people working in primary care what bronchoscopic and surgical options are currently available, what is in the experimental pipeline, who might be suitable and how primary care can work with specialists to help patients make the right choice for them, prepare for surgery, and provide support afterwards.

Green COPD care is the right COPD care. As symptoms change, treatments will need to adapt and specialist support may be needed. Safe and effective interventional techniques in the right person can keep people active and independent. The annual COPD review is a time to reflect whether the current care is still the right care.

Top Tips

1. Think surgery, think referral when you see a patient with severe emphysema.
2. Referring people with MRC3+ breathlessness for pulmonary rehab is essential before being considered for surgery.
3. Minimally invasive options to reduce lung volume can mean as little as a 3 day stay in hospital.
4. In the right people, surgery improves lung and exercise function, improves quality of life and lengthens life.

Identifying and referring people with COPD who might benefit

In 2021/22 the prevalence of COPD on GP registers in England using QOF data was 1.9%.[5] For a GP surgery of 10,000 patients this means that such a GP surgery would have 190 patients with COPD and if 1% are suitable to be assessed for lung surgery then it means only 2 patients per practice may be suitable for an intervention. At an individual clinician level, the experience would therefore be quite limited. It is likely to be the lead COPD primary care practitioner, often a nurse who is most likely to be familiar with such a patient through annual reviews and potentially post-operative care.

Herein lies the risk of the suitable patient being overlooked due to limited exposure and experience with the treatment options. However, there is a larger cohort than those suitable for bronchoscopic or surgical intervention where primary care will need support from secondary care, whether for assessment for oxygen therapy, specialist palliative care input, for people with rapid worsening or those with diagnostic uncertainty. Within this group will sit people with severe emphysematous disease, who within a secondary care COPD specialist setting can be considered for additional therapies that include surgery.

When someone has fulfilled the criteria for pulmonary rehabilitation referral and then completed the course, between 4.9% and 18.6% are suitable for a lung volume reduction intervention (LVR) MDT review.[6] LVR is the most common bronchoscopic or surgical intervention for COPD and currently the only method approved by the NHS in England

NICE has produced a table of criteria to help primary care decide when to ask support from specialists. The ideal scenario can be seen when such criteria are applied with relevance to the COPD pathways set up locally. The development of integrated approaches with GPs and other primary care HCPs working with specialist colleagues can ensure that patients move through these pathways with consistency. Indeed, if patient COPD data is recorded consistently and shared data agreements are in place it is possible to virtually scan a COPD list at population level to identify those who would benefit from a more highly specialist review. In the new primary care network structure in England for example, a network population of 50,000 people potentially has 10 people with severe emphysematous disease that might be suitable for surgery. In order to arrive at this 10 people, a greater number would require a CT scan and other more specialised tests. Therefore, a network approach to identification may be a solution to ensure people transition from primary to secondary care at the right time.

Where someone is specifically being referred by primary care for assessment for COPD surgery, ensuring that referral criteria are fulfilled is obviously a basic requirement. However, there is also a need to consider the psychosocial factors that might affect any final decision to proceed. Whilst it can be assumed that a shared decision-making approach between the patient and an MDT will be carried out it can be helpful on referral to ensure wider issues in the patient's life are communicated such as housing and family or carer support. There also needs to be a discussion pre-referral about potential unsuitability for currently available procedures and the need for a back-up plan. This might involve a referral to a breathlessness management specialist or a social care team or re-assessment of co-morbidities. The proposed pathway by assessment through an MDT would enable patients with emphysema not suitable for a currently approved NHS intervention to be able to access ongoing research studies with alternative developing bronchoscopic or surgical therapies.

In this table there are three reasons for referral that directly relate to requesting an opinion about surgery. It is somewhat unlikely that during an annual assessment any primary care practitioner will make this the focus of the referral letter as other features i.e. severity of disease, speed of symptom progression and exacerbation frequency are more likely to be of concern to the patient and practitioner. As lung volume reduction is more widely performed and practiced, and the procedures becomes more prevalent, patient perceptions about the procedures are likely to change.

Based on the two NICE approved techniques of LVR there are a group of patients with particular characteristics who are more likely to be offered surgery.

Primary care has a role in ensuring that the assessment and tests required to select people with these characteristics are offered, completed and recorded accurately where this is within the usual remit of primary care activity.

Table 1. NICE 2019 guidance on who to refer for specialist COPD care

Reason	Purpose
There is diagnostic uncertainty	Confirm diagnosis and optimise therapy
Suspected severe COPD	Confirm diagnosis and optimise therapy
The person with COPD requests a second opinion	Confirm diagnosis and optimise therapy
Onset of cor pulmonale	Confirm diagnosis and optimise therapy
Assessment for oxygen therapy	Optimise therapy and measure blood gases
Assessment for long-term nebuliser therapy	Optimise therapy and exclude inappropriate prescriptions
Assessment for oral corticosteroid therapy	Justify need for continued treatment or supervise withdrawal
Bullous lung disease	Identify candidates for lung volume reduction procedures
A rapid decline in FEV1	Encourage early intervention
Assessment for pulmonary rehabilitation	Identify candidates for pulmonary rehabilitation
Assessment for a lung volume reduction procedure	Identify candidates for surgical or bronchoscopic lung volume reduction
Assessment for lung transplantation	Identify candidates for surgery
Dysfunctional breathing	Confirm diagnosis, optimise pharmacotherapy and access other therapists
Onset of symptoms under 40 years or a family history of alpha-1 antitrypsin deficiency	Identify alpha-1 antitrypsin deficiency, consider therapy and screen family
Symptoms disproportionate to lung function deficit	Look for other explanations including cardiac impairment, pulmonary hypertension, depression and hyperventilation
Frequent infections	Exclude bronchiectasis
Haemoptysis	Exclude carcinoma of the bronchus

Table 2. NHS England commissioning guidance referral for LVR

Referral Criteria
Evidence of symptomatic hyperinflation due to emphysema with impaired quality of life. Medical Research Council (MRC) Dyspnoea Scale 3 or more
Non-smoker at least 4 months
Completion of a Pulmonary Rehabilitation programme within last 12 months or ongoing participation in a post-PR exercise programme.
Six-minute walk distance >140m or Incremental Shuttle Walk Test (ISWT) >80m
Forced Expiratory Volume in one second (FEV1) <50% predicted
Carbon Monoxide Diffusion Capacity (DLco) or Carbon Monoxide Transfer Coefficient Kco > 20% predicted
Residual Volume (RV): Total Lung Capacity (TLC) > 55%
RV> 150%
PaCO2<7KPa (partial pressure of carbon dioxide)
Body Mass Index (BMI)> 18
Unsuitable for surgery criteria
Severe co-morbidities such as renal, hepatic or cardiac failure, or other chronic respiratory disease such as pulmonary fibrosis
Severe progressive disease including disseminated malignancy
Severe pulmonary hypertension

NICE NG115 2019 guidance advises

1. **Any patient referred for assessment for LVR must have completed pulmonary rehabilitation (PR). They must be able to complete a 6-minute walk distance of 140 metres.**

In 2021/22, using available QOF data within the UK, 75.6% of people eligible for PR were referred.[5] The RCP Wales COPD audit showed that in 2018 to 2020 56.4% of suitable people were referred for PR.[7] The subsequent audit revealed this had reduced to 5.6% as a result of the pandemic. This was highlighted as a key improvement target for Wales. People attending PR will have the advantage of being more likely to be identified as suitable for LVR because they will be seen by specialist respiratory physiotherapists and other respiratory practitioners.

2. **They have severe COPD as measured by spirometry airflow findings i.e. FEV_1<50% of predicted**

The RCP Welsh COPD audit from data collected in GP practices in 2018 to 2020 demonstrated that 11.5% of people with a new diagnosis in the previous 2 years had a record of spirometry that would allow a severity assessment to be made. In the subsequent audit this had reduced to 1.9% as a result of the cessation of spirometry due to the pandemic. This was highlighted as a key improvement target for Wales.[7]

3. **Breathlessness affects their quality of life despite optimal medical treatment**

Optimisation of medical therapy should include:

- Vaccination against influenza, pneumococcus and COVID-19 according to current public health guidance.
- Treatment of tobacco dependence and prevention of relapse.
- Pulmonary rehabilitation
- Optimal inhaled and oral therapies according to local and national guidelines.

All of the above treatments can be organised and monitored in primary care with a small percentage requiring specialist advice about pharmaceutical therapies.

4. **Hyperinflation is assessed by lung function testing with body plethysmography and emphysema is confirmed on an unenhanced CT chest**

Body plethysmography is a lung function test that would not be requested by primary care but would be part of the pre-assessment testing after referral to secondary or tertiary care. However, the identification of emphysema is within the remit of primary care in certain circumstances.

The 2019 NICE guideline on diagnosis of COPD recommends a CXR is performed to exclude other pathology. Hyperinflation is sometimes reported on CXR and in the presence of other COPD diagnostic criteria is suggestive of emphysema but not diagnostic.

The RCP Welsh COPD audit from data collected in GP practices from 2018 to 2020 demonstrated that 33.3% of people with a new diagnosis of COPD in the previous 2 years had a record of a CXR either 6 months before or 6 months after diagnosis. In the subsequent audit this had reduced to 6.4% due to pandemic factors.[7]

A CT is required to diagnose emphysema. CT chest availability by GP referral varies across the UK but where it can be requested by primary care then a CXR showing hyperinflation would be an indication for request. In recent years NICE has reviewed the evidence for GP referral for CT rather than CXR when suspecting serious disease such as lung cancer and COPD. The guidance however remains that CXR is the primary care imaging of choice in this circumstance.[8] However, in order to improve access to cancer diagnostic services as a result of post pandemic backlogs, NHS England will be allowing GPs better access to CT which may reveal more emphysema also due to common symptoms and causation for cancer.[9]

The globally relevant GOLD COPD report suggests that in a resource constrained system people suspected as having COPD should also have a CT when:

- They have persistent exacerbations - 2 or more per year
- Symptoms are worse than their lung function-based disease severity grade
- There is an FEV_1 < 45% predicted
- There is hyperinflation on CXR
- They would fulfil the criteria for lung cancer screening

In 2022, the national screening committee for the UK made a recommendation for the first time that people with a high risk for lung cancer should be screened by CT.[10] This is likely in coming years to translate into more people receiving a diagnosis of emphysema, which is also the group that when other features are present can benefit from LVR.

CT is an essential test as lung cancer is more common in people with COPD and 30% of people with COPD also have signs of bronchiectasis on CT.[11] This would affect their suitability for LVR but also would influence their medical therapies.

Bronchoscopic and surgical procedures for COPD

The 2019 NG115 COPD diagnosis and management guidance from NICE[1], includes positive recommendations for bronchoscopic and surgical interventions. The focus is mainly on the techniques that reduce lung volume, a treatment for lung hyperinflation due to severe emphysematous COPD. The 2023 global GOLD COPD strategy report[11] also explores lung volume reduction techniques and in addition considers interventions that target different pathological pathways that cause COPD symptoms. This includes 'airways predominant' treatments that deal with problems such as excessive airway collapse and mucus production.

NICE NG115 states that, people with severe emphysematous COPD show improvements in lung function, exercise capacity, quality of life and long-term mortality as a result of lung volume reduction.

The 2023 GOLD report explores and makes recommendations on a wide range of surgical techniques based on evidence and expert opinion which will be included in this guide. However, many are experimental or not yet available and so we highlight the NICE NG115 recommendations that consider what was available within the NHS in England in 2019.

A review of the literature shows that COPD interventional treatments are now developing at some pace. In 2021 NICE IPG714 provided new guidance on bronchial nerve ablation techniques.[12]

In England there are currently two procedures which are considered suitable for commissioning which is lung volume reduction by i) surgery or ii) endobronchial valve for severe emphysema in adults.[4] The other surgical options mentioned here are not available in the NHS, are considered experimental and will require randomised controlled trial evidence before guidance can support their use.

Procedures to reduce mucus production

Liquid nitrogen cryospray

This experimental procedure may help with chronic bronchitis type COPD. The bronchial wall epithelium is frozen up to a depth of 0.5mm to ablate the mucus producing glands, without scarring the airway.[11]

Rheoplasty

Rheoplasty is an experimental therapy that delivers short bursts of high frequency electrical energy to the airway epithelium in order to achieve the same effect of liquid nitrogen cryospray.[11]

Procedures to reduce exacerbations

Targeted lung denervation[11]

The aim is to produce permanent bronchodilation and decrease mucus production by ablating the parasympathetic nerve where it runs along and adjacent to the outside of the mainstem bronchus.

Airway dilation depends on a balance of autonomic nervous system signals from its sympathetic and parasympathetic arms. Inhaled therapies e.g. beta agonists and muscarinic antagonists also use these pathways to achieve dilation. In addition, the parasympathetic drive affects mucus production. Impairing the parasympathetic supply to the airway increases dilation and reduces mucus distal to the point of ablation.

The ablation is carried out by activating a high radiofrequency signal via an electrode placed within the bronchial lumen adjacent to the parasympathetic nerve via a bronchoscope. It is considered to be a day case procedure.

In 2021, NICE IPG 714 advised there was insufficient trial evidence to recommend this procedure, however it supported development of RCTs that compare it with 'sham' interventions. The safety and adverse effect profile of this procedure requires better documentation before it can be recommended.[12]

Procedures to relieve breathlessness

Giant bullectomy

This is an uncommon intervention but one that is recommended by NICE. It is performed when an emphysematous bulla is so large that it occupies one third of the space that the lung would normally occupy in its hemithorax space (See Figure 1). Removal allows the compressed healthier lung to re-inflate which in turn improves cardiac function and musculoskeletal involvement in breathing. NICE NG115 recommends bullectomy for emphysematous bullae based on the committee's knowledge and experience as trial evidence is too limited.

This intervention can be carried out using video-assisted thoracoscopic surgery (VATS) which is less invasive than open chest surgery and with lower risks.

Lung volume reduction surgery[1,3,11]

Hyperinflation of the lung is a key manifestation of emphysema. Emphysematous sections of the lung do not deflate easily because the damaged terminal bronchioles and alveoli lose the inherent elasticity that usually enables recoil, pushing air out, during expiration. The air therefore becomes trapped in these terminal portions of the bronchial tree imposing excessive pressure on any healthy lung within that hemithorax. The extra effort that must be exerted to ensure oxygen reaches the remain-

Figure 1. Right hemithorax emphysematous bulla suitable for surgery

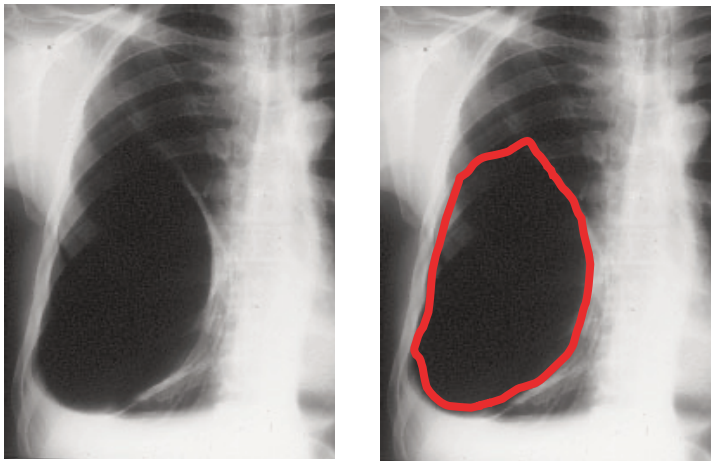
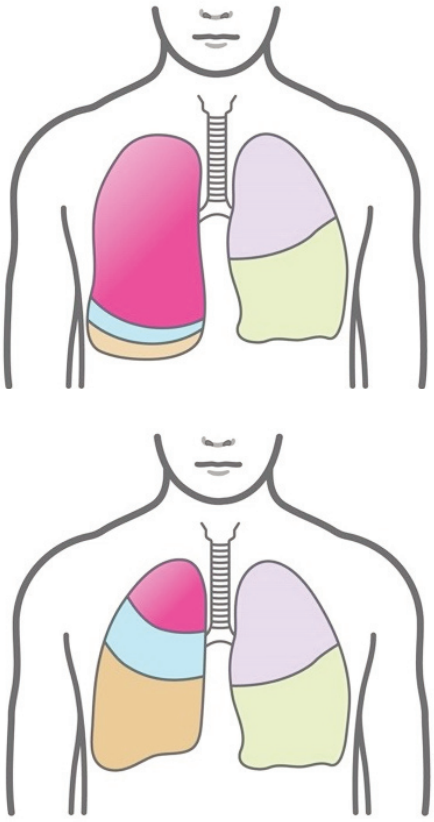


Figure 2. Before (top) and after (bottom) illustrations of a right upper lobe volume reduction procedure - from University Hospitals Coventry and Warwickshire patient information leaflet



ing healthy alveoli leaves a person fatigued, less active and more breathless. Cardiac function and circulation within the thorax are also affected due to the abnormal pressures created adding to the symptom burden.

LVRS, can be performed via open surgery e.g. video assisted (VATS) and robotically assisted (RATS) and also through even less invasive bronchoscopic techniques, described below. The aim with all techniques is to reduce the impact of the most emphysematous lung parts by resecting them e.g. via open surgery or VATS/RATS or by deflating them and shifting ventilatory effort to the healthier lung (See Figure 2).

The evidence supports LVRS, in particular, for those with predominant upper lobe emphysema who also have low pre-operative exercise tolerance, after completing pulmonary rehabilitation.

Selection of the right candidate is vital as mortality increases with some patient characteristics when compared to optimal medical management. People with low BMI, a very low FEV_1 (<20% predicted) and emphysema that affects more parts of the lung more diffusely (homogenous emphysema) have higher mortality.

People with significant co-morbidity such as pulmonary fibrosis, pulmonary hypertension and heart failure may not be suitable.

The most common adverse effect post operatively is air leaking from where the lung tissue has been excised. Other problems include pneumonia, DVT and coronary thrombosis.

In appropriately selected people, LVRS prolongs survival by 2 years. Currently, fewer people are receiving this surgery than it is estimated would benefit. This is due to lack of referral, availability, and fears about the risks of thoracic surgery itself and the amount of post procedure support available.

Endobronchial one-way valve (EBV)[1,3,11]

In this NICE NG115 recommended bronchoscopic treatment, a one-way valve is placed in one or more of the larger airways supplying the most diseased hyperinflated emphysematous lung (See Figures 3 and 4) . The components of these valves include a nickel-titanium alloy known as nitinol and silicone.

This permits trapped air to be released from the affected lobe during expiration but prevents re-inflation on inspiration and so collapsing the diseased lobe. This treatment has best results when there is no ventilatory connection between the affected lobe that is being treated and the adjacent lobe. An intact interlobular fissure is therefore predictive of a longer survival, better exercise capacity and better quality of life.

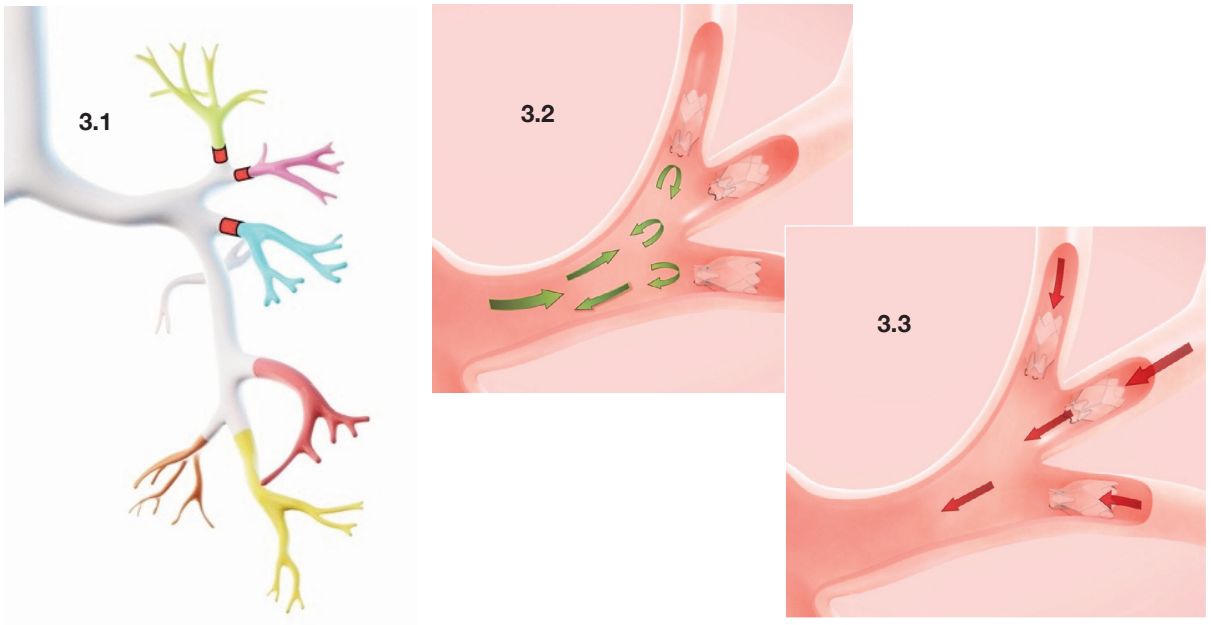
In general, in the NHS in England, EBV is offered before LVRS due to the lower risk profile, resulting from an endoscopic approach and the fact it is reversible. Pneumothorax is a more common adverse effect seen with this procedure because the acute volume reduction in one lobe can result in sudden volume expansion in the adjacent lobe which can cause tearing of lung tissue.

Endobronchial nitinol coil placement[13]

This is a more recently developed technique and remains experimental. It offers the potential for people with both upper and lower lobe emphysema and in multiple sites. Interlobar fissures do not need to be intact and collateral ventilation can be present.

Nitinol is an alloy of nickel and titanium and is used because of its extreme elasticity. Between 5 and 15 coils are inserted in a typical procedure. The coil is passed in its compressed form via a bronchoscopic catheter and on arriving at the chosen bronchial site it is released where it springs open. The coil then pulls against the bronchial walls as it recoils to its resting position which then

Figures 3.1/2/3. One-way EBVs showing placement in three large airways (3.1) which will restrict air entry into (3.2) and allow escape (3.3) in 3 segments of the upper lobe of the left lung.



prevents air entering the lung distal to it during inspiration and so reducing the volume taken up by the diseased part.

NICE IPG 517 advise that that it is only offered as part of a clinical trial as it is not clear from the evidence whether it is better than currently approved lung volume reduction surgery. It is not currently recommended for commissioning by NHS England. They concluded that in line with NICE NG115, coils and other novel technologies should remain within the research setting. Significant complications can include pneumonia, pneumothorax, haemoptysis and exacerbations.

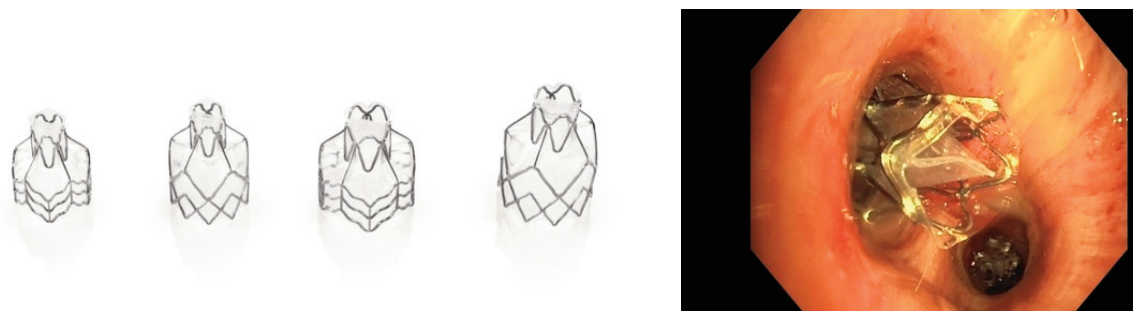
Large airway stenting[11]

This technique remains experimental and has not been reviewed by NICE IPG 517. In this bronchoscopic procedure a perforation is made in the wall of a large airway near to an area of emphysematous lung. A tube made of inert material is then inserted to maintain this aperture. Air will flow both ways but the lower resistance enabled by expired air emptying directly into a large calibre airway will enable better escape of trapped gas on expiration.

Thermal vapor ablation[14]

Bronchoscopic thermal vapour (steam) ablation is an experimental procedure for upper lobe emphysema and is usually done using general anaesthesia. The most severely affected and hyperinflated lung segments are targeted. A catheter is used to deliver a dose of thermal vapour. A balloon at the tip of the catheter is inflated to seal off and protect tissue proximal to the

Figure 4. One-way EBV showing its elasticity and placement in a main bronchial airway



targeted area. The thermal vapour released distal to the balloon ablates the diseased emphysematous tissue. As the tissue dies and becomes remodelled with natural repair processes over 4-6 weeks the space left can be taken up by healthier lung. This treatment can be repeated over time, targeting different segments as the patient's disease progresses. There is an initial worsening of respiratory symptoms in the first 2 to 4 weeks due to the intended surgical inflammatory response.

NICE IPG 652 advise that it is only offered as part of a clinical trial as it is not clear from the evidence whether it has better outcomes than other forms of lung volume reduction surgery.

Lung transplantation[1,11]

COPD is the reason for lung transplantation in 30.6% of cases globally. People, selected for this NICE NG115 recommended procedure have usually been assessed as not suitable for LVR, which should be a first choice as it has lower morbidity and mortality. However, previous LVR should not be a barrier to having a lung transplant.

The selected patient is more likely to be prone to very frequent exacerbations associated with CO2 retention, very low FEV1 (< 15-20%) and with co-morbid pulmonary hypertension.

Based on current evidence the indication for the treatment is primarily to improve quality of life rather than extend life. Those with alpha 1 antitrypsin deficiency (AATD), however, are an exception and younger people (<60) having bilateral transplants may also see improved lifespans. On average, people live for 5.9 years after lung transplant surgery for COPD.

A balance between improved quality of life versus living with a transplanted organ needs to be considered carefully. The most common complications are acute rejection, bronchiolitis obliterans, infections and lymphoid system tumours.

Preparing for an intervention

Once a patient has been identified as potentially suitable for an intervention they will be seen in a tertiary service that will include assessment by a multidisciplinary team. Factors that impact on any decision to proceed include:

- Functional capacity and fitness for the procedure
- Co-morbidity
- CT results
- Lung function results
- Result of the walk test
- Results of a lung ventilation-perfusion scan (VQ)
- Assessment of collateral ventilation between target area and adjacent lung.

Information will be given about what the procedure involves depending on the technique used, recovery time, complications and expected outcomes.

Figure 5. Scar from a thoracoscopic (VATS) left lung volume reduction surgery

Image source: Asthma and Lung UK - Lung volume reduction surgery (LVRS)

LVRS using the videoscopic or robotic thoracoscopy route is a significant surgery that requires a general anaesthetic and a longer hospital stay. EBV insertion is bronchoscopic but also tends to be done under general anaesthetic and involves a shorter stay. It takes about an hour to insert the valve(s).

Asthma and Lung UK have a good web page providing more advice about LVRS via the VATS technique and EBVs. This includes a 15-minute patient video by Prof Hopkinson from Imperial College, London where much of the research into lung surgery for COPD has been performed to date.

There are helpful patient leaflets from other lung surgery units in the UK including University Hospitals Coventry and Warwickshire and Cambridge University Hospitals .

Helping people after an intervention

- LVRS using the minimally invasive VATS technique usually requires a 4-10 day stay in hospital and a chest drain will be in situ to allow air to escape from the thoracic cavity whilst healing completes. It takes 1-3 months to recover fully from LVRS with people experiencing more breathlessness, coughing and pain.
- The EBV procedure usually involves a 3-day stay in hospital and recovery is 2-3 weeks. About 25% will have an air leak post op and may need to have a temporary chest tube until it drains. Patients should commence an inpatient post-op exercise programme prescribed by a physiotherapist and are usually referred back to PR to enhance post-op recovery.

Post-intervention people will benefit most if they continue to be medically optimised. All should have a self-management plan regularly reviewed that includes discussion around symptoms,

tobacco use, vaccinations, inhaler technique, exercise and exacerbation management.

References and more information

PCRS delivered a webinar hosted by expert speaker Beverley Bostock, Gloucester and Dr Neil Greening at the University of Leicester. You can watch the webinar on demand; simply click on the QR code or use this link - https://qrco.de/beZJqV

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