Lung volume reduction procedures for emphysema

What is emphysema?
Emphysema is a type of chronic obstructive pulmonary disease (COPD). If you have emphysema, there is damage to the air sacs in the lungs which become baggy, trap air and become over-inflated. This makes it difficult to breathe.

What is lung volume reduction?
Lung volume reduction is a treatment for emphysema. Lung volume reduction may be:

- an operation called lung volume reduction surgery (LVRS). This is when the most damaged part of the lungs is removed so the healthier parts can work better. By removing the enlarged air spaces in the lungs, less air gets trapped which makes breathing more comfortable and efficient.
- a treatment called bronchoscopic lung volume reduction (BLVR), or sometimes endobronchial valve placement. This is where valves are placed into the airways using a bronchoscope (a flexible narrow telescope which can be passed through the nose into the lungs) to block off the worst affected part of the lung instead of removing it.

There are also new experimental types of treatment using bronchoscopes, such as using steam and foams. Your specialist will be able to discuss these options with you.

If you have severe COPD, it’s important your health care professional considers if you are someone who'd benefit from a lung volume reduction procedure. If you are, you’ll be referred to a specialist.

NHS England has now approved lung volume reduction treatments for people with severe COPD with emphysema. This means that lung volume reduction is now available in England for everyone that could benefit from it. If you live in Scotland, Wales or Northern Ireland and think you would qualify for lung volume reduction treatment, talk to your GP.

Who can benefit from lung volume reduction?
Lung volume reduction procedures are a suitable treatment for only 1-2% of people with COPD. They are only effective for people with emphysema. If you have other lung conditions as well - such as bronchiectasis, asthma or pulmonary fibrosis - that may rule you out.

Most people who are suitable for lung volume reduction have severe or very severe COPD. This means that when you do spirometry (a lung function test) your FEV1 (the amount of air you can blow out in one second) is less than half - or 50% - of what it should be.
Your health care professional will take into account **all** of the following:

- if you have a particular pattern of emphysema as shown on a CT scan
- if you have a suitable pattern of lung function tests
- if you are on the best treatment: you don’t smoke, you’ve been to pulmonary rehabilitation **and** you’re taking the best medication for you
- if you are well enough to cope with the procedure
- if you have other health problems that mean that the procedure would not work or would be too risky.

**Pulmonary rehabilitation (PR)**

PR is the most effective treatment for breathlessness. If at the end of the PR programme, you’re still limited by your shortness of breath, your health care professional may consider if you are suitable for a lung volume reduction procedure.

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**Ask for a review to think about lung volume reduction if:**

- You have severe COPD, defined as FEV1 (the amount of air you can blow out in one second) being less than 50%.
- You can walk at least 140 metres or 460 feet in six minutes. Often, this is a walk test done at the end of pulmonary rehabilitation. You may do a different walking test, called the incremental shuttle walk test, where the threshold is 80m.
- You don’t smoke.

**If you’re not sure if you might be suitable, talk to your health care professional about this information.**

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**What tests will I need to make sure I’m suitable?**

You’ll need to have tests to make sure you’ll benefit from a lung volume reduction procedure. They can include:

- A **CT scan**, which is a special X-ray to get a picture of a cross-section of your body. This is to find out if your emphysema is patchy, with areas that can be removed or blocked off. It may also show reasons why a lung volume procedure would not be effective such as pulmonary fibrosis or bronchiectasis.
- **Lung function tests** to measure:
  - how good your lungs are at taking in oxygen - this is called gas transfer.
  - how much air is trapped in your lungs at the end of a breath out - this is called your residual volume.
- A **walk test** to measure your ability to exercise. If you can’t walk 140 metres or 460 feet – the length of one-and-a-half football pitches - in six minutes, it may not be safe to go ahead with the operation. You may do a different walking test, called the incremental shuttle walk test, where the threshold is 80m.

You may also have a lung perfusion scan sometimes called a VQ scan. The scan works by injecting you with a special material that shows up areas of your lung that don’t have much blood supply. These areas don’t help your breathing, so the test can help to decide if there is a good target for treatment.

You may have some, or all, of the tests before you are referred to a specialist centre to consider lung volume reduction. This will depend on how the NHS is organised where you live.
Where are lung volume reduction procedures carried out?

Lung volume reduction is carried out in specialist centres. These centres have a team of doctors, surgeons, radiologists and other health care professionals to select the most effective treatments for you.

The results of your tests and a discussion with your specialist centre will guide the decision about whether a lung volume reduction procedure is suitable for you.

The British Lung Foundation supports research by the national network of centres who perform these procedures to study the effectiveness of these techniques.

Types of lung volume reduction surgery

Lung volume reduction surgery (LVRS)

LVRS is an operation which removes the worst affected areas of your lung so the healthier parts of your lung can work better. This means less air is trapped so your chest and diaphragm can relax down to a more normal level and your breathing will be more comfortable.

The right lung is made up of three lobes and the left lung has two lobes. Sometimes a whole lobe of the lung is removed, sometimes only part, depending on where the damage is.

The operation is usually performed using a process called VATS or video assisted thoracoscopic surgery. The surgeon makes a small cut in one side of your chest. A special tool is used to cut away and staple your lung at the same time. This will seal it and prevent or reduce any air leaks.

You will be given a general anaesthetic and will stay in hospital for about 10 days to recover. Immediately afterwards, you’ll have tubes called chest drains in your chest to stop fluid or air building up. These can usually come out after a few days, but sometimes it takes longer for the lung to heal.

Bullectomy

If you have a large bulla (a large airspace in the lung bigger than 1 cm across) you might have heard LVRS called “bullectomy”. It’s when a bulla occupies more than a third of the lung – often with little disease in the rest of the lung.

Benefits and risks of lung volume reduction surgery (LVRS)

Clinical trials have shown that when people are carefully selected to make sure they are suitable, there are many benefits to LVRS. The operation can help them live longer, increase their ability to be active and improve their quality of life, compared with people who don’t have the operation.

It’s hard to be precise about how much any one person will benefit. It’s thought that most people do benefit, however, about 20% of people having the procedure don’t feel they have benefited.

LVRS is a significant operation and it does carry a risk of complications that could be life-threatening. Surgeons usually quote a 1% risk of death associated with the procedure, though this risk will vary between individuals. If there are complications during the surgery, it can also mean a longer stay in hospital to recover from the operation. This is why there are very careful criteria to select patients.
Bronchoscopic lung volume reduction (BLVR) with valves

BLVR is also called endobronchial valve placement.

The procedure involves placing small one-way valves into the airways that supply the worst affected part of your lung (the target area). The surgeon uses a fibre optic camera called a bronchoscope to insert the valves. You will be sedated for this, or sometimes be given a general anaesthetic.

The valves block air from entering the target area of lung, so the lobe collapses. Instead of being big, baggy and getting in the way of your breathing, the target area now takes up only a tiny space in your chest, making more room for healthier parts of the lung. This can achieve the same effect as removing the area of lung by surgery, but is not such a big procedure as an operation. It’s also a reversible procedure.

The procedure to put the valves in itself takes less than an hour. But you’ll stay in hospital for three nights after to be observed.

Who is suitable for treatment with valves?

Valve placement and LVRS are suitable for similar groups of people.

The key difference is that valve therapy only works if it is possible to block off the target lobe of the lung completely. If air can get into the target lobe from the lobe next to it, even though the airways have been blocked, it won’t shrink down. This is called collateral ventilation. This is sometimes shortened to CV, so you might hear the terms “CV positive” and “CV negative”.

People with collateral ventilation will not benefit from getting valves. So, it’s important to identify this by:

- Seeing if the lines that separate the lobes of the lung, called fissures, are intact from a CT scan. This is sometimes called “fissure integrity”.
- Measuring collateral ventilation using a special balloon catheter placed during a bronchoscopy. This procedure is called a ChartisTM assessment.

If there is collateral ventilation – CV positive - lung volume reduction surgery still may be an alternative option to treatment with valves.

Benefits and risks of bronchoscopic lung volume reduction (BLVR)

In carefully selected people, endobronchial valves can improve lung function, exercise capacity and quality of life.

The main complication of valve placement is when a small tear or air leak occurs. This can mean that the lung on that side collapses, called a pneumothorax. It happens in about 25% of cases.

Pneumothorax may cause chest pain and increase your breathlessness. But sometimes it just shows up on a chest X-ray without you having any symptoms. If this does happen, it can clear itself, or you may need to have a tube inserted into your chest to let the air escape. This could mean a few days in hospital.

Usually, if a pneumothorax occurs, it will be soon after the procedure. That’s why you will be observed in hospital for three days afterwards. If it happens after you have gone home, your team will give you written advice about how to get immediate medical attention.

What’s better: valves or surgery?

We know that both treatments can be effective in carefully selected people, improving breathlessness and quality of life. Your team of health care professionals will review your lung function, the pattern of emphysema and other factors about your case before advising which the best option is.
To date, there are no trials directly comparing valves and surgery. Lung volume reduction surgery has been undertaken for more than 20 years and there is evidence that it can help people live longer. Specialists believe it is likely that there is a similar benefit from valve treatment too. But so far there have been no long-term studies to prove this. The results from clinical trials are expected to be available soon and may help with decision making.

**Experimental techniques**

New experimental techniques, which use bronchoscopy, are being developed in clinical trials. These include:

- using steam to scar the worst areas of lung and shrink them down
- targeting the nerves in the lung to improve airway relaxation.

To see if you are suitable, you will take the same tests that people do for valves and surgery. These techniques are also being evaluated in specialist centres and are only available at the moment as part of clinical trials. If you are interested in them, talk to your GP or specialist.

**Lung volume reduction webinars**

Thinking about whether people with COPD might benefit from LVR should be a routine part of the assessment at the end of pulmonary rehabilitation (PR) programmes for anyone who has emphysema and is still limited by breathlessness. Dr Nick Hopkinson, our medical director, has produced two webinars to explain what these procedures involve:

- Watch the patient webinar – this is an introduction to lung volume reduction. It is especially useful for anyone with COPD who is doing pulmonary rehabilitation to help them to understand what lung volume reduction procedures are. Watch the webinar at www.youtube.com/watch?v=Ed71q3pjUtc
- Watch the health care professional webinar - an introduction to lung volume reduction, for health care professionals. This is particularly intended for physiotherapists and other health care professionals who are involved in pulmonary rehabilitation to help them to discuss surgery or endobronchial valves with participants as well as understanding who they should be recommending for a lung volume reduction respiratory review. Watch the webinar at www.youtube.com/watch?v=5mzEbnJn_6I