



Lung volume reduction procedures for emphysema

Lung volume reduction is a treatment that aims to reduce the amount of air trapped in the lungs. It can help some people with **chronic obstructive pulmonary disease**. But only 1-2% of people with COPD are suitable for these procedures.

If you have COPD, you will usually have a mixture of chronic bronchitis, where the airways in your lung are damaged, and emphysema where lung tissue is damaged. **Lung volume reduction is a treatment for emphysema**. 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.

The procedure may be:

- an operation called lung volume reduction surgery or
- a treatment where valves are placed into the airways using a bronchoscope

There are other types of treatment using bronchoscopes such as coils, steam and foams. These are really experimental at present – your specialist will be able to discuss the options.

What is emphysema?

Healthy lungs are made up of millions of tiny air sacs (alveoli) with elastic walls. This is where oxygen is taken into the body and the waste gas, carbon dioxide, is expelled. Cigarette smoke and other particles you breathe in can damage the walls of these air sacs.

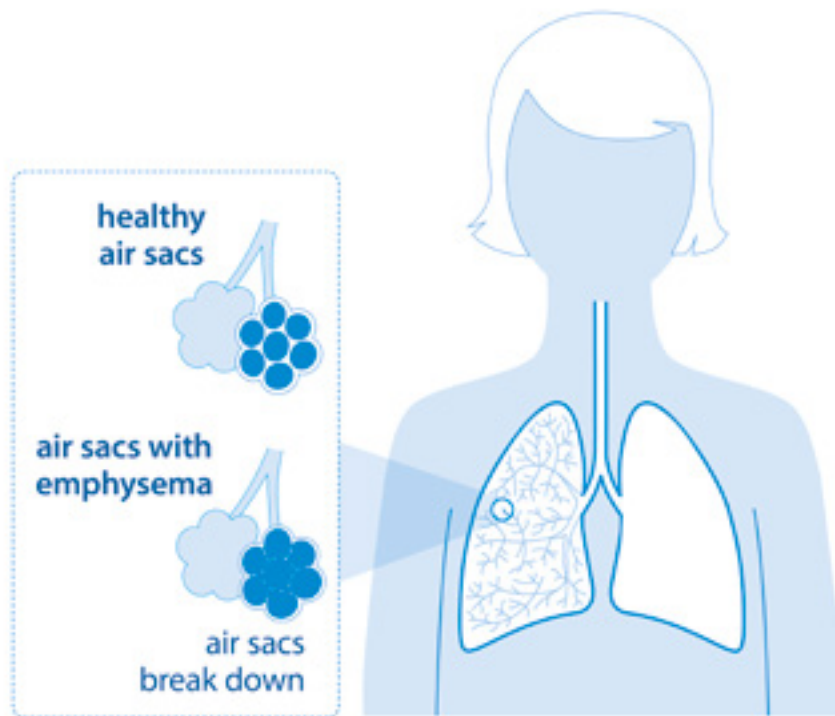
If you have emphysema the walls of these air sacs are damaged. The sacs break apart and merge into each other, producing holes in the lung.

If the emphysema has caused extensive damage, it is sometimes called **bullous emphysema**. This is because a hole bigger than 1 cm across is called a bulla.

If the pattern of damage is fairly even throughout the lung, it is sometimes called **homogenous emphysema**.

Where the pattern of damage is uneven, it's called **heterogeneous emphysema**.

The damaged parts of the lung are baggy and trap air. If you have emphysema, when you breathe in, the damaged part of your lung inflates more and can get in the way of the healthier parts of your lung. The increase in the amount of air inside your chest is called hyperinflation. You can find it uncomfortable to breathe as your chest becomes hyperinflated.



Who will 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 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. See what your results should look like at [blf.org.uk/support-for-you/breathing-tests/spirometry-and-reversibility](https://www.blf.org.uk/support-for-you/breathing-tests/spirometry-and-reversibility).

Your health care professional will take into account if:

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

Pulmonary rehabilitation is the most effective treatment for breathlessness. If at the end of the programme, you're still limited by your shortness of breath, your health care professional should consider if you might be suitable for a lung volume reduction procedure.

We know many people who might have been suitable have not been considered for treatment in the past. Some patients said they had to 'fight for a referral'.

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

- You have severe COPD, defined as FEV1 less than 50%
- You can walk at least 140 metres or 460 feet in 6 minutes. Often, this is a walk test done at the end of pulmonary rehabilitation.
- You don't smoke

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

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**. Read more about it at blf.org.uk/support-for-you/breathing-tests/gas-transfer-tlco.
 - 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 6 minutes, it may not be safe to go ahead with the operation. Read about the walk test at blf.org.uk/support-for-you/breathing-tests/tests-to-measure-your-exercise-capacity#walk

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 helps to decide where and when to operate.

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.

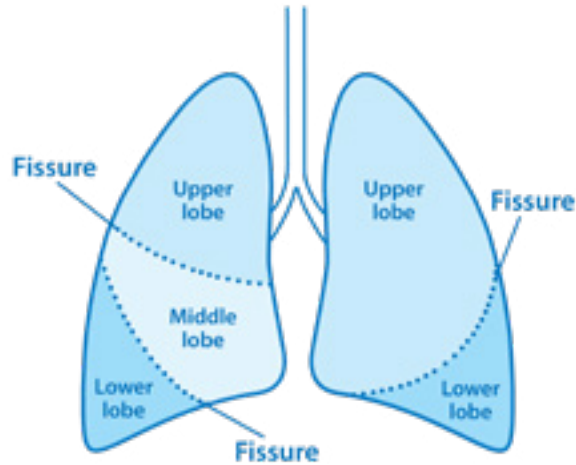
The results of your tests and a discussion with your specialist centre will guide the decision about whether a lung volume reduction procedure is suitable for you.

The British Lung Foundation supports research by the national network of centres who perform these procedures to study the effectiveness of these techniques. These specialist centres include Birmingham, Bristol, Cambridge, Cardiff, Glasgow, Liverpool, London (Royal Brompton) and Wolverhampton. More centres may join in the future. Find out more at uklvstudy.wordpress.com/

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. By removing the swollen air spaces, 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 3 lobes and the left lung has 2 lobes. Sometimes a whole lobe of the lung is removed, sometimes only part.



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.



An image showing someone who has had lung volume reduction surgery

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

Lung volume reduction surgery is called bullectomy in people who have a large bulla. (A bulla is a hole bigger than 1 cm across.) This is when a bulla occupies more than a third of the lung – often with little disease in the rest of the lung.

Benefits and risks

Clinical trials have shown that when people are carefully selected to make sure they are suitable, there are many benefits. 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 is hard to be precise about how much any one person will benefit. Most people do benefit and some describe it as 'turning the clock back a few years'. About 20% of people having the procedure don't feel they have benefited.

This 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 problems it can also mean a long 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 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 it collapses. Instead of being big, baggy and getting in the way of your breathing, the target area now occupies a tiny space in your chest. This can achieve the same effect as removing the area of lung by surgery, but is not such a big procedure as an operation.

The procedure itself takes less than an hour. But you'll stay in hospital for 3 nights 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, the lobe won't collapse even though the airways have been blocked. This is called collateral ventilation.

People with collateral ventilation will not benefit from getting valves. So it is 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 Chartis™ assessment.

If there is collateral ventilation, lung volume reduction surgery is still often an option.

Benefits and risks

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 3 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.

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. Clinical trials are underway. 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.

Experimental techniques

Other **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
- placing wire coils called lung volume reduction coils to 're-tension' floppy areas of lung where air gets trapped. This enables them to empty more effectively
- targeting the nerves in the lung to improve airway relaxation

To see if you are suitable, you will take the same tests. 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.

Get in touch with us to find support near you.

Helpline: 03000 030 555

Monday to Friday, 9am-5pm

Ringing our helpline never costs more than a local call and is usually free, even from a mobile.

helpline@blf.org.uk

blf.org.uk

British Lung Foundation
73-75 Goswell Road
London EC1V 7ER

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We value feedback on our information. To let us know your views, and for the most up to date version of this information and references, call the helpline or visit **blf.org.uk**