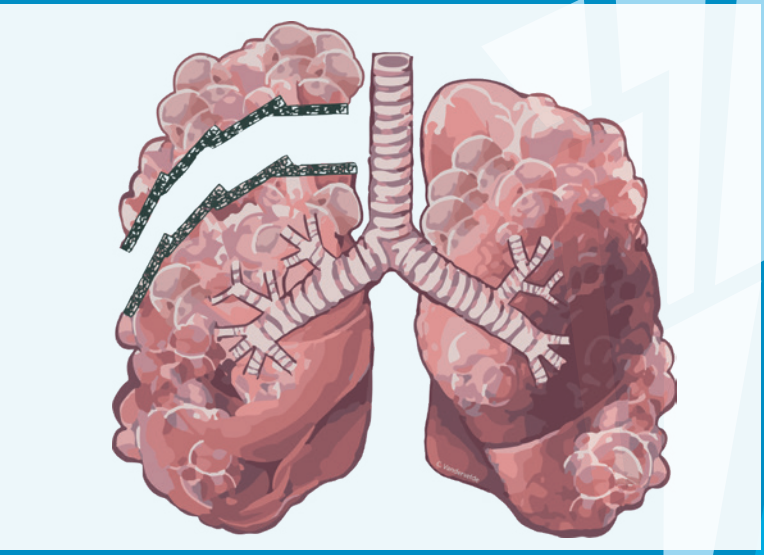
UZ LEUVEN



Lung volume reduction surgery

Patient information

Introduction

A thoracoscopic lung reduction is a procedure offered by UZ Leuven to a selection of patients with severe emphysema. Specifically, this is keyhole surgery in which dilated alveoli and parts of a badly performing lung are removed. As a result, there is more free space in the chest, so that the remaining lung can expand and function better. Thus, the diaphragm, which is the most important respiratory muscle, can function better.

Before this procedure, you will be monitored by the thoracic surgery service.

During the consultation you will already be given a lot of information about this procedure. This supplementary information leaflet is intended to enable you to read and process all this information in your own time. The leaflet certainly does not replace the personal consultation with your healthcare provider.

In this leaflet, you will find more information on preparing for the operation, the course of the procedure and your hospital stay and areas of focus after the procedure. In addition, the "enhanced recovery protocol" (ERP) is also explained, which works on better recovery after lung surgery, and prevention of complications.

Do you have any further questions after reading this leaflet? Then please don't hesitate to contact someone from the treating team.

Ward unit
Ward 12 (thoracic surgery)
(Yellow street, gate 4, level 5 or Gele straat, poort 4, niveau 5 in Dutch)

Consultation (outpatient)
Consultation 9 (thoracic surgery)
(Orange street, gate 2, level 0 or Oranje straat, poort 2, niveau 0 in Dutch)

THE MULTIDISCIPLINARY TEAM

Within the team, we offer you the best possible care throughout the entire process: before, during and after the procedure. In doing so, we focus on all aspects of your health.

Doctors

Thoracic surgeons


Prof. Ceulemans


Prof. Van Raemdonck

Pulmonologists


Prof. Janssens


Prof. Dooms


Prof. Everaerts

Anaesthetists


Prof. Neyrinck


Dr. Bouneb


Dr. De Coster


Dr. Van Loon


Dr. Coppens

Radiologist

Prof. Coolen

Medical intern (PhD-student)

Dr. Vandervelde

Project coordinator

Hannelore Geysen

Physiotherapist

Marianne Fontaine

Thoracic surgery secretary

Kim Jochmans

Senior nurse ward 12

Eva Puttevils

Occupational therapist
Kyara Van Minsel
Benja Maesen

Social worker
Eveline Vanhalewyck

Dietician
Jessica Servaes

Pastor
Joke De Waele

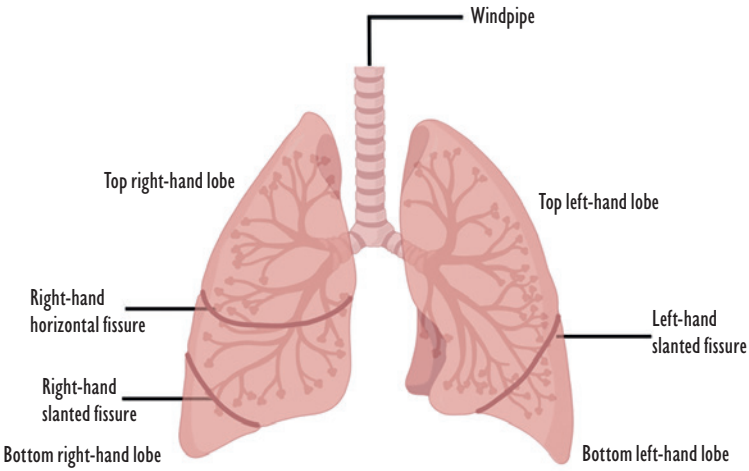
WHY DO YOU NEED A LUNG REDUCTION?

You are eligible for a thoracoscopic lung volume reduction. During this procedure, parts of the damaged and extremely inflated areas of the lung are removed, so that the remaining part of the lung can expand and function better.

To better understand how this lung volume reduction can help you, it is important to understand how the lungs function.

FUNCTIONING OF THE LUNGS

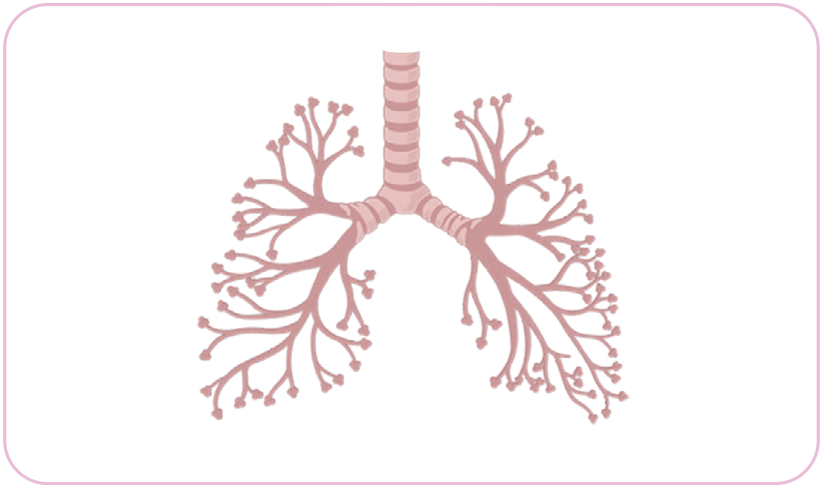
No organ or tissue can survive without oxygen. Oxygen is used in our entire body to produce energy on the basis of chemical reactions. In these chemical reactions, carbon dioxide results as a waste product: this gas has to be removed from the body. These two activities together form the gas exchange: on the one hand, we take in oxygen from the air via the lungs, which is then absorbed into our blood, and on the other hand, we breathe out the carbon dioxide which was produced in the process.



WHAT DO THE LUNGS LOOK LIKE?

Normal lungs are soft and spongy. They consist of elastic tissue, meaning that they can stretch. Both lungs are divided into lobes by parting lines (fissures). The right-hand lung is divided into three lobes (top, middle and bottom lobe). The left-hand lung consists of two lobes (top and bottom lobe).

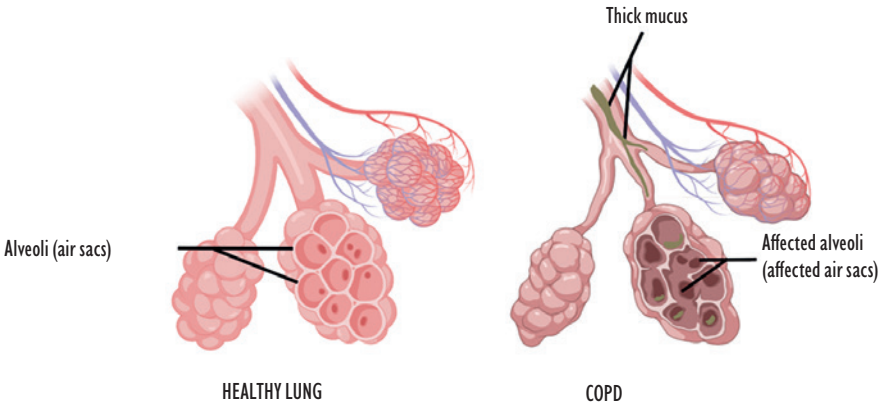
The lungs have various air passages (bronchi) which can be compared with the branches of a tree. Each branch becomes smaller and smaller, resulting in more and more branches .



The smallest branches end in small alveoli. The gas exchange takes place in these alveoli.

In the case of chronic obstructive pulmonary disease (COPD) there is both (1) a significant narrowing of the small air passages, and also (2) degradation of the alveoli which are damaged as a result. The latter is referred to as emphysema.

The alveoli that are located next to each other thus become connected to one another. This results in larger cavities filled with air, which can no longer participate in the gas exchange and thus disrupt correct lung function.



Large air-filled chambers occur in the lung lobes, which can no longer be emptied when exhaling. The chambers occupy a significant amount of space in the chest, and push the diaphragm downwards. This is referred to as “hyperinflation”, and means that the diaphragm, the most important respiratory muscle, can no longer function properly. The better-functioning part of the lung cannot develop well either. This leads to difficulty breathing, and to severe shortness of breath, especially during exertion, but sometimes also at rest.

You are not alone with this condition. In Belgium, COPD occurs in approximately 800,000 people, half of whom face emphysema. The most significant cause of COPD is smoking, but environmental factors and certain genetic conditions can also play a role.

COPD can occur in four stages, depending on the strength of your breathing:

- GOLD 1 - mild COPD
- GOLD 2 - moderate COPD
- GOLD 3 - severe COPD
- GOLD 4 - very severe COPD

The most frequent symptoms are chest tightness, coughing, shortness of breath, and fatigue. These symptoms have a serious impact on the quality of life, for example with respect to personal care (showering, cleaning teeth, dressing) and domestic tasks (cleaning, cooking). Physical exertion such as climbing stairs becomes increasingly harder to impossible. The symptoms progressively worsen. Strenuous exertion, and in time also everyday activities, increasingly require effort.

WHAT ARE THE TREATMENT OPTIONS?

In case of severe emphysema, current medication is often not enough to keep the symptoms under control and to prevent further decline. For these patients, it is appropriate to see if they are eligible for additional treatment such as a lung transplant or lung volume reduction. The latter procedure can be carried out via a surgical procedure (LVRS) or by inserting valves in the air passages via a bronchoscopy. Following referral by your pulmonologist, a multidisciplinary team will decide, on the basis of your specific tests and pathology, whether one of these treatment options is a possibility.

You will be referred for a surgical lung volume reduction.

WHAT IS LUNG VOLUME REDUCTION SURGERY (LVRS)?

During this procedure, the damaged and extremely inflated parts of the lung are removed, resulting in the creation of more space in the chest. That way the remaining, healthier parts of the lung can develop and function better.

Lung volume reduction surgery can be performed on one or on both lungs. This gives your diaphragm more space to function properly. The surgeon will decide, on the basis of tests, how much lung tissue should be removed.

WHO IS ELIGIBLE?

Not every patient with COPD is eligible for LVRS.
In UZ Leuven, this procedure is performed on about fifty patients annually. If there is a need for additional therapeutic options, the COPD patient's individual record is always first discussed at the multidisciplinary emphysema consultation, attended by, among others, pulmonologists, transplant doctors, thoracic surgeons and a radiologist. During this consultation, the results of the tests, the current clinical situation, and the patient's lifestyle are discussed. Based on all the findings, a decision is made as to whether you are eligible for LVRS.

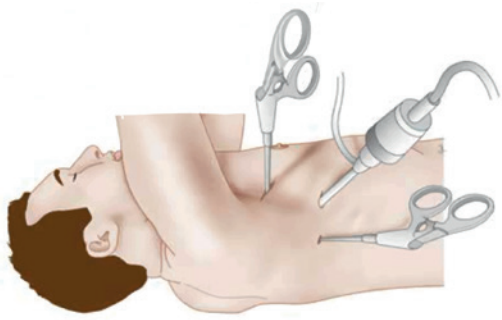
Patients who meet the following criteria are possibly eligible:

- ✔ Patients with severe emphysema, based on diagnostic tests and a significant impact on quality of life with enough general reserves
- ✔ Patients who continue to experience severe symptoms, despite faithfully adhering to their treatment
- ✔ Patients who have stopped smoking for at least 6 months
- ✔ Patients who are able to take part in a rehabilitation programme before and after the procedure
- ✔ Patients without other serious conditions (e.g. heart failure, severe pulmonary hypertension)

It is up to us as caregivers to provide you with sufficient information about the anticipated benefits and possible risks associated with the procedure. This is the only way you can make a well-informed decision.

WHAT HAPPENS DURING LUNG VOLUME REDUCTION SURGERY?

The procedure is minimally invasive, i.e. it is performed via keyhole surgery. At the time of surgery, on average three small incisions of 1 to 2 cm are made between the ribs, along which a camera and surgical instruments are inserted into your body. The video camera images are being shown on screens in the operating theatre, so the surgeon can look closely at the lung and other structures in the chest. The damaged lung tissue is removed with the aid of a large surgical stapler.



Example of access during the operation, via three ports.

Depending on the pattern of the lung damage, the surgeon's decision, and the progress of the operation, your surgery will either be on one side or on both sides. In the first instance, the surgeon starts on the side where most lung tissue has to be removed. If you are eligible for surgery on both sides, a decision is made during the procedure as to whether it is safe to also operate on the second side.

Your health and safety takes priority during the procedure. If it is not possible to operate on both sides during the same procedure, a later procedure on the other side may be considered. This always takes place in consultation with the patient. The second procedure is performed about six weeks to three months later, sometimes even a year later. It is also possible that it may be decided, for your health, to not schedule the other side immediately.

At the end of the procedure, on each side one or two tubes of 1 cm wide (thorax drains) are inserted for discharging excess fluid and air. Thus, the remaining lung tissue comes to rest against the chest wall. These thoracic drains are removed a few days after the procedure, during your hospital stay.

WHAT ADVANTAGES CAN YOU EXPECT FROM THE PROCEDURE?

You won't immediately notice an effect of the LVRS. Your body has adjusted to the disease over many years. This means that intensive rehabilitation is needed, in order to rebuild your fitness and strength. For example, you can relearn how to breathe correctly and achieve a maximum result.

The longer-term advantages of the LVRS:

- Improved lung function: you can more easily inhale deeply andyour shortness of breath will be reduced.
- More exercise capacity: for example you will be able to walk longer distances and walk more quickly.
- Better quality of life: you have more energy for everyday and social activities.

WHAT ARE POTENTIAL RISKS ASSOCIATED WITH THIS PROCEDURE?

Removing parts of the lung in people with poor lung function and poorer lung tissue is a risky procedure. LVRS is also only an option for patients for whom the advantage over the longer term is likely to be greater than the risk associated with the procedure. In 80 percent of patients for whom we perform LVRS, we expect to see functional improvement as ofthree months after the rehabilitation. In the remaining group of patients, this may be slowed by a prolonged air leak, infections after the procedure, or another complication.

TESTS BEFORE THE PROCEDURE

Before lung volume reduction surgery, the following tests are to be performed.

- Blood and urine tests in order to determine different values in the blood and urine.
- Arterial puncture: a blood test via the artery in the wrist, in order to determine the amount of oxygen and carbon dioxide in the blood.
- Questionnaire on the basis of which we can collect extra information on the impact of your illness on your daily life. This enables us to gain better insight into your illness perception.
- Thorax CT where we take images of your lungs using X-rays. A CT scan reveals more details than conventional radiography images
- Lung ventilation perfusion scan which gives us insight into the blood circulation and the airflow in the lungs via inhaled gas and an injected tracer.
- Echocardiogram: an echocardiogram of the heart, where we can see how the heart functions and what the impact of COPD is on the heart, by using sound waves.
- Lung function measurement: the lung capacity, air volume in the lungs and gas exchange are measured.
- 6-minute walking test in which you try to walk as far as possible in 6 minutes. We use this to test your exercise capacity.

- Pre-operative consultation with the anaesthesiologist, because the procedure is performed under general anaesthetic. The tests include an ECG (video of your heart) and blood sampling. During this consultation we will discuss with you the medication that you can no longer take in view of the procedure. We will also give you more information on the use of a pain pump.

Take part in a study

As a patient, you can participate in various studies. The treatment team will give you more information about this.

IMPROVED RECOVERY

ENHANCED RECOVERY PROGRAMME (ERP)

The aim of this recovery programme is to improve your recovery after the operation and to enable you to resume your normal activities as quickly as possible. Active participation by you and your immediate circle plays an important role in your recovery.

The surgeon and the anaesthesiologist perform the procedure, a team of nurses, physiotherapists, a dietician and other care providers will accompany and support you.

In addition, you can have an active role in your recovery yourself. For example, you can do breathing exercises, move sufficiently, and self-report whenever you experience pain or other discomfort. Your recovery requires active involvement from you and your immediate circle.

What are the most important points of attention for improved recovery after the procedure?

- ✔ The general anaesthetic is kept as short as possible, so that you are in the recovery room only for a short time and can quickly return to the ward.
- ✔ Avoid coughing and pushing for the first 48 hours after the procedure.
- ✔ The rehabilitation starts immediately. On the day of the procedure you will do breathing exercises, you will sit upright on the edge of the bed, and you may possibly already start working with the physiotherapist.
- ✔ Getting out of bed quickly reduces the risk of typical complications such as lung inflammation or small blood clots in the legs.
- ✔ All lines (such as drains) are removed as soon as possible.
- ✔ An antibiotic treatment for five days helps prevent infections.
- ✔ You should be able to go home soon. We firmly believe that your recovery will go more smoothly in the comfort of your own home surroundings, provided that you do not require any further medical care.

PREPARATION FOR THE OPERATION
(PREHABILITATION)

PHYSIOTHERAPY

Physiotherapy is an important part of your itinerary, and starts before the operation. During your first contact with a specialist physiotherapist at UZ Leuven, your physical performance and breathing difficulties will be looked at more closely. Additional treatment can be started on the basis of this consultation. The physiotherapist will give you more of an explanation about breathing exercises and will draw up a rehabilitation plan together with you. You will be taught exercises intended for increasing your strength and fitness before the procedure (prehabilitation). The more you do these exercises, the better your recovery after the operation will be.

It is important that you commit actively to your rehabilitation and physiotherapy from the start. This part of your progression contributes 50% to the extent of your health benefit after the operation.
This means it's in your own hands.

A second phone meeting will be planned a few weeks before your proceduren. During this consultation the physiotherapist will also explain the physiotherapy and rehabilitation programme after the operation, and help to organise it together with you.

Prehabilitation: what can you do before your procedure?

- ✔ Do your breathing exercises daily.
- ✔ Do the suggested strength exercises daily.
- ✔ Find a physiotherapist who can help you in the first month after your procedure, and make an appointment with the rehabilitation specialist in your centre of choice for future rehabilitation.

DIET

Emphysema also has a significant effect on body weight. Patients are often very thin (cachetic). Therefore a diet, just like exercise, plays an important role in the preparation for LVRS. In order to be in good shape, it is also important that you follow a healthy diet.

Healthy body weight

A healthy weight is important both before and after the procedure. People who are overweight have more health risks than people with a healthy weight, and experience more disruption to their every-day activities. Too low a body weight or malnutrition can lead to a changed body composition, resulting in impaired

physical and mental functions and your recovery will not be as good. If you take in too little energy and protein, your body comes to rely on your reserves. Especially muscle tissue degradation will be a dis-advantage for you. In addition, you may develop deficits due to too little or unbalanced nutrition (e.g. deficits of vitamins and minerals).

Proper diet

A proper or adequate diet is a varied diet which gives you enough energy and nutrients to maintain a good nutritional state and which is sufficient for your everyday functioning. What this type of varied diet looks like exactly varies from person to person. Someone who is underweight or malnourished needs more kilocalories or nutrients, while someone who is overweight needs fewer kilocalories but must still consume sufficient nutrients such as protein, vitamins and minerals.

Protein

The combination of exercise and a sufficient intake of protein is important for muscle building. It is important to combine these two things: just an increased protein intake or just exercise does not have the same effect on the muscle building.

> The daily protein requirement before the operation is 1.5 g protein/kg body weight. Following physical activity, it is recommended to consume 20-30 g protein.

Protein is found in both plant-based and animal-based foodstuffs. Animal-based protein sources are meat, fish, eggs, milk and milk products. Plant-based protein sources are pulses, soya products, nuts, and grain products such as bread, pasta and rice. Potatoes and vegetables contain a smaller amount of protein.

In addition to the amount, the quality of the protein is also important. Protein of animal origin have a high biological value. That is to say that these contain all essential components (amino acids) in sufficient quantities and in a good balance.
Protein from plant sources have a lower biological value. These proteins are less easily digestible. Not all essential amino acids are present or present to a sufficient extent to build up the body's own protein.

Animal protein sources	Usual portion	Protein content (g) per portion
Meat/poultry	100 g	On average 20 g (varies depending on type)
Fish	100 g	On average 18 g (varies depending on type)
Egg	50 g	6.5 g
Pot of cottage cheese	100 g	7.5 g
Glass of milk	150 ml	5 g
Pot of yoghurt	125 g	5 g
Slice of cheese (Gouda type)	20 g	5 g

For individual advice on a good protein intake, you can ask a dietician in your area or a dietician at UZ Leuven (associated with the department).

Scan the code to find
a dietician in Flanders (Dutch website).

Plant-based protein sources		Usual portion	Protein content (g) per portion
	Tofu	100 g	13.5 g
	Lentils	100 g cooked	9.7 g
	Chickpeas	100 g cooked	7.7 g
	Beans	100 g cooked	7.7 g
	Handful of mixed nuts	20 g	3.6 g
	Glass of soya drink	150 ml	4.5 g
	Glass of almond drink	150 ml	0.6 g
	Glass of oat drink	150 ml	0.5 g
	Hummus	25 g	1.6 g
	Oatmeal	40 g	5.4 g
	Slice of wholemeal bread	35 g	4 g
	Pasta	150 g cooked	8 g
	Quinoa	150 g cooked	7.8 g
	Rice	150 g cooked	4.3 g
	Potatoes	150 g cooked	3 g
	Vegetables	200 g	2.4 g
	Piece of fruit	125 g	0.9 g

Protein sources with a low biological value

Protein sources with a high biological value

Bron: www.nice-info.be

YOUR HOSPITAL STAY

On average, patients are in hospital for one week for LVRS. Depending on your recovery, this may be shorter or longer. You will be monitored by the multidisciplinary team of surgeons, nurses, anaesthesiologists, physiotherapists, occupational therapists and dieticians.

DAY BEFORE THE PROCEDURE

You will be admitted to the ward the day before the procedure. The nurse will accompany you to your room and give you the necessary information. They will first check whether all the necessary tests have been performed. Possibly, a number of tests may additionally be planned for the day before the procedure, such as a scan of the lungs or an electrocardiogram. A blood test will also be taken. The evening before the procedure the surgeon or the assistant surgeon will explain the operation to you and will mark the side(s) to be operated on. From midnight you will fast, i.e. from then on you may not eat or drink anything else.

Are you anxious or unable to sleep? Talk to the nurse. In consultation with the doctor, you may be able to have relaxing medication.

DAY OF THE PROCEDURE

About an hour before the start of the procedure, you will be taken to the preparation room of the operating theatre. The exact time depends on the operation schedule; usually the procedure will take

place in the morning. It is important that you have fasted. You will still use your inhalation therapy (puffers) on the day of the procedure. The anaesthesiologist also decides in advance whether you must also take other medication on the day of the operation.

You will then be taken to the operating theatre, where the anaesthesiologist will sedate under. Under local anaesthetic, via an injection in your back, the anaesthesiologist also inserts the pain pump catheter (an epidural catheter). After the operation, you will be woken in the operating theatre and taken to the recovery room (post-anaesthesia care unit, or PACU), where you will continue to be observed for a number of hours. As soon as possible after the operation, and with the approval of the surgeon, physiotherapy can begin. The physiotherapist will visit for the first time in the recovery room, in order to do breathing exercises.

The physiotherapist will teach you the technique known as 'huffing', which allows mucus to be brought up gently, without coughing. Coughing increases the build-up of pressure in the lungs, meaning that you run the risk of damaging your lungs after the operation.

When you feel well enough, you can sit upright on the edge of the bed. You can possibly also stand up and take a few steps on the spot. Movement is the best way to activate your lungs. When you are sufficiently awake, alert and clinically stable, you will return to your room on the ward. This is usually still on the day itself.

You will have various tubes (lines) in your body after the procedure:

- Thorax drains (one or two on each side): these are drains at the height of the chest cavity, which discharge wound fluid and air to the outside, where it is collected.
- Heart monitoring
- Bladder catheter
- Drip in your arm or hand to deliver medication and fluid
- Nasal cannula for delivering oxygen
- Pain pump via a catheter

CONTINUED STAY ON THE WARD

Monitoring after the procedure

You will be closely monitored day and night by the nurses on the ward. The doctors visit mornings and evenings to check that you are recovering well from the operation. Don't hesitate to ask the healthcare providers questions. Over the course of the day, your parameters will be checked regularly (e.g. oxygen concentration in your blood, temperature, blood pressure and heart rate). All the tubes and your surgical wounds will be continuously checked and taken care of. Medication will be administered at regular intervals.

You will also take your puffers and certain home medication. An antibiotic treatment of five days will be started as standard, in order to prevent possible infections. A blood test will be performed on the first day after the procedure and on the day that the pain pump is removed. There may possibly be an extra blood test, for example if you suddenly have a fever.

Focus: avoid pressure on the lungs

It is very important to not put the lungs under too much extra pressure, or to push, in the first days after the procedure. That is to say: don't cough too violently, but instead 'huff' according to the technique taught you by your physiotherapist. In order to bring up phlegm more easily, you will also be administered an aerosol three times a day. For this, medication is sprayed, via a mouthpiece, at the level of the windpipe and the lungs. After this you will be give mild laxatives, to prevent you having to push on the toilet. If you feel sick, medication can also be given to prevent vomiting.

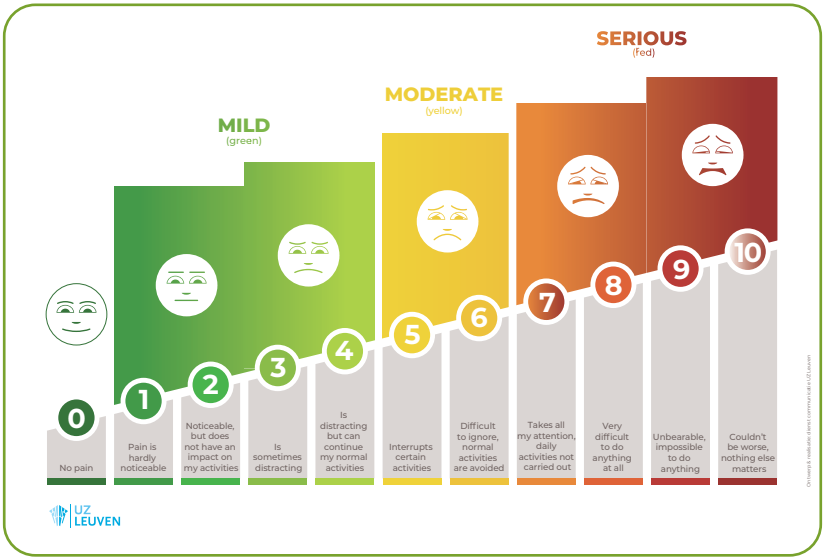
Pain control: pain pump

Your pain relief is important. For the first days after the operation, you will have an (epidural) pain pump. You will receive a continuous dose of a long-acting local anaesthetic, via a small line (catheter) which is inserted via an epidural immediately before the operation. This especially numbs the part of the body that was operated on, without too many general side-effects.

For most patients, a strong morphine-type painkiller is also added to this local anaesthetic, in order to amplify the pain-killing effect. This pump administers a continuous dose of the medication. If you still feel pain, you can administer an extra dose of painkillers yourself, by pressing the button.

Some people experience side-effects from the pain pump. This may include nausea, vomiting, itchiness and dizziness. These symptoms usually result from the added painkiller, which can possibly also be removed from the pump. If high doses of pain medication are used, this can lower blood pressure. Very occasionally patients may suffer hallucinations. A team of specialist (pain) nurses will monitor you to identify these side-effects and to find solutions for lessening and neutralising the side-effects. The aim is for you to be in as little pain as possible.

It is important for you to be able to breath without pain. Do you still have sudden pain or lasting pain despite the administered painkillers? Then definitely tell the nurse this.



If you are in pain, you will find it much more difficult to breathe deeply and move. This can result in breathing problems or lung inflammation, which may considerably extend your hospital stay. In other words: less pain ensures better movement and breathing, and therefore fewer complications, and ultimately a better recovery. Patients who do not have pain heal more quickly and better.

Pain control: other pain medication

You will be given water tablets (diuretics) to remove possible excess fluid in the body via the urine.

On the second day after the operation (operation on one lung), or day three after the operation (operation on both lungs), the pain pump is removed. You will be given other pain medication to replace the pain pump.

The World Health Organisation classifies pain medication into three stages. You will continue to be given pain medication for a few days for mild pain, prescribed by the lowest stage (paracetamol, NSAIDs such as Brufen®). You will be given this medication even if you don't feel pain immediately. If you nonetheless still experience pain with this medication, extra painkillers from the third stage will be prescribed (morphine-type painkillers). The doctor will decide what medication is best suited for you at that point.

Always tell the nurse or doctor whenever you are still in pain despite the medication. We always try to find the right pain medication, taking into account the type of pain medication, the dosage, and the timescale.

Lines

Typically, in the case of emphysema, the lung tissue of patients is severely damaged and is of a very poor quality. During the procedure, the lung tissue is inevitably affected. Due to its fragility, there is a risk of wounds on the lung, with the result that air escapes into the chest upon each inhalation (air leak). Because of this, one or two lines (thorax drains) are inserted after the procedure. Once the wounds on the lung have healed, the possible air leak should also stop.

The doctor will remove the thorax drains once the amount is less than 200 ml per 24 hours and there is no longer any air leak present.

This is usually done in the room and is not particularly painful: three or four jabs are performed to close the wound with staples. For as long as you have thorax drains, a lung scan will be taken daily. This is done in bed for the first day(s) after the procedure. When you have fewer lines and are more mobile, the lung scans will be taken in the radiology department.

Lines such as the bladder tube, the heart monitoring device and the drip can usually be removed on the second day after the operation.

Multidisciplinary approach

When you are back on the ward, you can continue to practise, together with the physiotherapist, getting out of bed and walking along the corridor. This happens at least twice a day. The occupational therapist will also visit on the first days after the procedure, in order to help you become more independent again in everyday activities such as washing and dressing.

The physiotherapist and occupational therapist may possibly give you advice on the use of **aids**, such as a walking frame for walking. If necessary, they may take care of applying for these aids for you at home. It is also the aim for you to do the physiotherapist's exercises throughout the day independently and regularly. Before you go back home, you will also practise walking up and down the stairs. During your stay you can ask for the separate leaflet on physiotherapy in thoracic surgery, which explains the different exercises.

The **dietician** will assess whether you are consuming enough calories and nutrients every day. You will be given various tips, for example relating to frequent, small meals, and an energy-rich diet. Supplementary feeding may possibly be started.

The **social worker** will visit to arrange certain practical matters before you are discharged. An LVRS is followed by a rehabilitation period which is important for further development after the operation. In order to be able to rehabilitate as well as possible, it is important for you to be surrounded by family.

If you are alone or wish to recover in a rehabilitation centre, you can talk to the social worker about this. You can rehabilitate in the Koninklijk Elisabeth Instituut (Queen Elisabeth Institute) (KEI). The social worker can also help you for questions about administration or finance.

Scan the code to visit the KEI website (in Dutch).

A hospital admission is often thought-provoking. Do you need a quiet, confidential conversation? Then you can count on the listening ear of a **member of** our **pastoral staff**.

POSSIBLE COMPLICATIONS AND SYMPTOMS

Every operation involves certain risks. For an LVRS, these are risks that can occur in any type of lung surgery. The surgeon will discuss with you before the procedure.

- An ongoing air leak, meaning that the thorax drain(s) has/have to remain in place slightly longer, and you will stay in hospital for longer than planned. In exceptional circumstances, you will have to have another operation for this.
- Subcutaneous emphysema: the occurrence of air in the subcutaneous tissue, which results in swelling. This may be frightening for you, but this complication is not dangerous and usually goes away spontaneously after a few days. Sometimes an applicator (VAC) is inserted for this, which can suction air from under the skin.
- Lung inflammation (pneumonia). In order to prevent this, intensive respiratory physiotherapy, antibiotic treatment for five days, good pain relief, and coughing up phlegm effectively are very important.
- (Post-operative) bleeding, which may require another operation.
- Deep vein thrombosis: a clot in the blood vessels in the legs, for which you will be given anticoagulants.
- Cardiac arrhythmia: this is usually temporary and can be treated with medication.
- Site infection, requiring adjusted wound treatment and possibly antibiotics.

- Chronic pain syndrome. It is normal for you to need pain relief for the first two to three weeks after the operation. However, it is possible that this pain may last for up to three months after the operation. This pain feels like bruising of the ribs and is to do with the fact that the chest takes on a different shape after the operation. Local application of Flexium® and Voltaren® patches can alleviate the pain.

DISCHARGE FROM HOSPITAL

When the thorax drains have been removed and you are sufficiently recovered, you can leave the hospital. The doctors and nurses will arrange everything for your discharge.

It is normal that, at the beginning, you will experience more shortness of breath during exercise, and lower oxygen saturation measurements. Don't let this discourage you: by doing regular breathing exercises and keeping mobile, you can quickly make progress. When discharged, you should be able to walk, cycle and do stairs independently.

Sometimes we use additional oxygen during exercise, in order to make it easier for your body to move more. If necessary, this can also be provided in your home. In consultation with your physiotherapist, the oxygen can be gradually reduced, depending on your recovery.

When discharged, you will receive the following paperwork as standard:

- Letter from your GP and referring pulmonologist with a report of the procedure and the progress of your hospital stay
- Proof of admission to the department
- Prescription for respiratory physiotherapy (60 appointments with e-pathology)
- Prescription for home care (for wound treatment, if required)
- Prescription for the pharmacy
- Summary of the medication you need to take
- Summary of the planned appointments to monitor you further. You will be given an appointment for a consultation with your surgeon, in order to check the healing process. This usually takes place about four weeks after your procedure. Before this appointment, you must have a lung scan taken at the radiology department, half an hour before the appointment with the doctor. This scan can then be reviewed during the consultation.

If you still require additional paperwork (for example for insurance, sickness fund, your employer, etc.), then ask the nurse or doctor for this in good time, so that you can be given it when you are discharged. Don't hesitate to ask questions if anything is unclear to you when you are discharged.

BACK HOME

WOUND CARE

When you are discharged, the nurse will dress your wounds with dressings that are suitable for showering at home. Do not have a bath for the first four weeks, to avoid the wound being soaked. Also avoid lifting heavy items (e.g. bottles of water, shopping), and sports requiring the upper body (e.g. tennis, rowing, etc.) for the first four weeks.

The wounds are closed with staples, which must be removed 14 days after the procedure. The staples used to close the thorax drain wound can be removed by your GP from 14 days following removal of the last thorax drain.
This is stated in the discharge letter to your GP.

In exceptional circumstances, it is possible that one or more wounds may not heal or may become inflamed. It is best to contact your GP if you experience one or more of the following symptoms:

- Red, hot and swollen skin around the wound
- Increasing wound pain
- Weeping wound
- Fever

PAIN RELIEF

You may have to still take painkillers regularly for a while at home, depending on the pain. It is important for you to be able to breath without pain. You will receive a medication plan when you leave hospital. In case of intense pain which is not lessened by painkillers, it's best to contact your GP. They will receive an extensive medical report about your hospital stay and can perfectly assess your situation and if necessary contact the hospital.

PHYSIOTHERAPY AND REHABILITATION

When you are discharged you can start immediately with physiotherapy at home or in a clinic. You will have two to three physio sessions per week until your first follow-up appointment with the surgeon. After this, you will start with outpatient respiratory rehabilitation, preferably at your referring centre (with your pulmonologist).

Under www.mijnlongreva.be you can find the centres you can go to for respiratory rehabilitation, and how you can contact the centre. Plan the appointment with the rehabilitation doctor in good time, as you have discussed with the physiotherapist before the procedure. Rehabilitation takes three to ten months on average.

Moving and exercising for short times at regular intervals at home promotes rapid progress and a smooth rehabilitation.

Scan the code to visit the webpage on lung rehabilitation (in Dutch).

WHAT HAPPENS IF THERE ARE PROBLEMS AT HOME?

If a serious acute problem arises, such as severe pain (despite pain-killers), serious shortness of breath, loss of blood or fluid via the wound, etc., then it's best to contact the hospital.

For other problems, you can first go to your GP, who may possibly refer you back to the surgeon. What if you are unable to contact your GP? Then you can contact the UZ Leuven emergency department and ask for an on-call doctor: Tel. (+32) (0)16 34 39 00.

FOLLOW-UP

Immediately after being discharged from hospital, you may start breathing exercises, shoulder and chest mobilisation and interval training with your physiotherapist until the following consultation.

About four weeks after your procedure you will return to the hospital for a consultation with your treating surgeon. On the day of the consultation, a lung scan will be taken at imaging 1 (Orange street, gate 3, level 0). During this consultation, the surgeon will discuss how the recent time has been for you, and will perform a clinical examination. Of course, you can also ask questions during this appointment. If this consultation is positive, you can start with your planned course of rehabilitation, for which you return to the hospital each time. This course lasts for up to six months after the procedure.

After three months you will have another consultation with your surgeon and a series of additional tests will be planned for assessing the effect of your treatment (lung function measurement, walking test, CT scan, etc.). If there are no results of note, your file will be transferred, after this consultation, to the UZ Leuven pulmonologists. You will visit them for a check-up after six months, one year, two years and three years after the procedure. These check-up appointments will always involve a number of tests (lung function measurement, walking test) and a consultation where the pulmonologist will discuss the results with you.

Follow-up in the intervening time and in the long term will be carried out by your own pulmonologist and GP.

COURSE OF TREATMENT OVERVIEW

1. Referral

You will be referred by your own pulmonologist or another treating doctor. In this first consultation we will explain the various treatment options to you and we will look at whether, on the basis of a clinical test and tests already carried out, you are eligible for lung volume reduction. We may possibly request further tests, which may take place at UZ Leuven.

2. Tests and diagnosis

You will have various tests. You may possibly have already had a number of these tests. It's still important to repeat these tests in order to be able to plan for your illness and possible treatment as correctly as possible.

3. Multidisciplinary consultation

A pulmonologist, surgeon, radiologist and the coordinator are present at this consultation. We will discuss whether you are eligible for lung volume reduction (valves or surgery) on the basis of the tests.

4. Consultation

You are eligible for LVRS. In the consultation, we will go over the operation in detail and inform you of why you are a suitable candidate for the procedure. We will discuss with you the anticipated advantages and possible risks. You will also visit the anaesthesiologist. You will be referred to a cardiologist if you have not yet had a consultation there.

5. Preparation for the procedure

It is important that you prepare for the operation. The physiotherapist of the team will guide you with this before the procedure takes place.

1. Hospitalisation

You will be admitted the day before the procedure. We will go over various things with you. If you still have questions, don't hesitate to ask them.

2. Operation

You will be taken to the operating room. After the operation, you will return to the recovery room. The physiotherapist will visit you here: this is when the rehabilitation starts.

3. Discharge

You can return home after on average a week. At home, you will start immediately with physiotherapy. Some patients go to the KEI for a short period of rehabilitation - this is discussed together with the social worker.

4. Physiotherapy

You will continue your rehabilitation with the physiotherapist at your home, with the physiotherapist in your surroundings, or in the KEI, until you have another consultation.

1. Check-up appointment with the surgeon

You will have another follow-up with your treating surgeon after about a month. You will have a lung scan taken beforehand. You will be given the green light if you can recover further and more intensively. From now, you will start in the rehabilitation centre.

2. Rehabilitation centre

For a minimum of three months, you will rehabilitate in a recognised rehabilitation centre. This will be two to three times a week. You must exercise every day. This means that on the days when you are not in rehabilitation you must do your exercises and walk.

3. Check-up appointment with the surgeon

Three months after the procedure we will perform the first functional tests at UZ Leuven. You will have another blow test, a walking test of six minutes, and a lung scan. If the results are positive, you will no longer be monitored by the surgeon. The pulmonologists at UZ Leuven will now monitor you at fixed times.

4. Check-up appointment with the pulmonologist

Three months after the procedure you will also visit the UZ Leuven pulmonologist for a check-up. This will also take place after six months, one year, and then annually. In the interim, we recommend that you visit your own pulmonologist regularly for monitoring.

PRACTICAL INFORMATION

- Your family can telephone you directly. The nurse will give you the telephone number for the room.
- Please don't forget to bring the puffers that you use at home. You need to take these the morning of your operation.
- On ward 12 (thoracic surgery) you are allowed to bring personal items with you, such as pyjamas, slippers, toiletries, etc. Also bring your medication from home, or a list of your home medication, so that you are prescribed the correct medication during your stay.
- Visits are permitted on ward 12 (thoracic surgery). The most recent visiting guidelines can always be found at www.uzleuven.be/en/visits.

Scan the code to visit this webpage.

MOST IMPORTANT CONTACTS

Do you have any further questions or comments? Then you can always get in touch with Professor Laurens Ceulemans, project coordinator Hannelore Geysen, your treating doctor, the nurses of the hospital department, or the thoracic surgery secretary.

Thoracic surgeon
Prof. Laurens Ceulemans
laurens.ceulemans@uzleuven.be

Project coordinator
Hannelore Geysen
+32 (0)16 34 47 01
hannelore.geysen@uzleuven.be

Social worker
Jessica Servaes
+32 (0)16 34 86 20

Dietician
Eveline Vanhalewyck
+32 (0)16 34 47 15

Pastor
Joke De Waele
+32 (0)16 34 13 42

Thoracic surgery secretary
+32 (0)16 34 34 25
secr.tho@uzleuven.be

Ward 12
+32 (0)16 34 65 30

Ward 12 secretary
+32 (0)16 34 53 26

Consultation 9
+32 (0)16 34 48 51

Emergency department
+32 (0)16 34 39 00

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Responsible publisher
UZ Leuven
Herestraat 49
3000 Leuven
tel. 016 33 22 11
www.uzleuven.be

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