CIRSE Patient Information

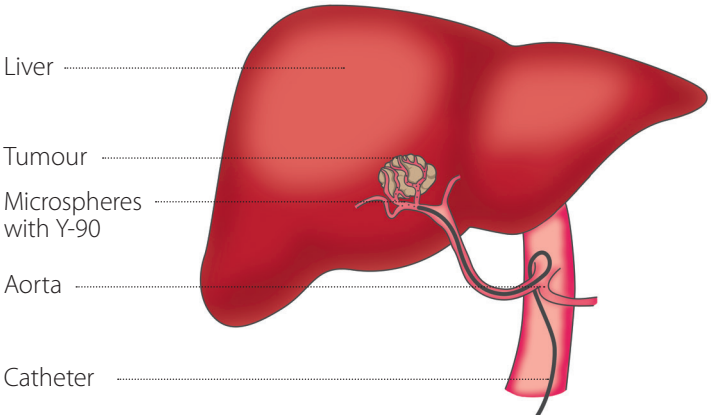
CIRSE Cardiovascular and Interventional Radiological Society of Europe

Radioembolization (TARE) and Chemoembolization (TACE)

Transarterial (through the artery) radio-embolization and chemoembolization are types of anti-cancer treatments. These procedures are also called "TARE" and "TACE". During a radioembolization procedure, an interventional radiologist injects small balls (microspheres) loaded with the radioactive isotope Yttrium (known as Y-90) or Holmium 166 into the blood vessels supplying a tumour. Because the radiation is focused only on the tumour, higher and more effective amounts of radiation can be used compared to other treatments. Similarly, during a chemoembolization procedure, an interventional radiologist injects cell-killing drugs directly into the blood vessels supplying the tumour.

What are the benefits of radio- and chemoebolization?
These treatments have several benefits for you. Your hospital stay will be shorter. Compared to surgery, you will be out of bed and mobile again more quickly. There is often less pain after the procedure when compared with surgery, and complications are also less common. Radio- and chemoembolization mostly do not affect healthy tissue or organs, and there is only little loss of liver function, if any, which will often get better. While it is still sometimes better to treat larger tumours with surgery, radio- and chemoembolization can be used in large tumours when they are in difficult locations, or when surgery or radiation treatments are not possible.

How do I prepare for the procedure?
Before the procedure, some blood tests are needed to check how your liver is working (liver function tests) and to make sure that your blood is clotting normally. You should inform your doctor about all medications that you are taking and any allergies you may have. Your doctor may temporarily stop some medications such as blood thinners before the procedure. It is also important that you do not have any infections at the time of the procedure. Within a few weeks of the procedure, a contrast-enhanced CT or MRI scan (different types of imaging) will be performed to re-check the exact extent and location of the cancer. You have to stop eating and drinking 6-8 hours before the procedure.



The procedure:
Chemoembolization is performed by interventional radiologists. Radioembolization is performed by interventional radiologists and nuclear medicine physicians. Depending on the expected difficulty and time needed for the procedure, local or mild sedation is used. Medications against nausea and pain are often given. Your vital functions will be checked regularly during the procedure. You may be given antibiotics to prevent infection. If you are receiving radioembolization, a test run will be performed two weeks before the final procedure so that the doctors can make

sure that the microspheres will not travel to places other than the tumour. If you are scheduled for chemoembolization, a test run is not necessary.

For the final treatment, you will most likely lie on your back on the angiography table. You will be given a local anaesthetic. After this, the interventional radiologist will insert a catheter (a thin tube) and a guidewire into an artery, most commonly in your groin. You will then have some images taken of your upper abdominal arteries to show the exact location of the vessels feeding the tumour. The interventional radiologist will then deliver a high dose of radiation or chemotherapy to the cancer cells directly into the arteries supplying the tumour. For radioembolization, an extra scan will be performed afterwards to make sure the microspheres have gone to the correct spot. The dose of radiation being released by the microspheres will decrease over the following two weeks.

What are the risks?
Radioembolization and chemoembolization are relatively safe procedures. The most common complication is post-embolization syndrome, which occurs in around 50% of patients. Symptoms include fatigue, low-grade fever, nausea, vomiting, and abdominal discomfort; however, these do not last long and are usually easily treated.

Less common complications include temporary liver dysfunction, a build-up of fluid, high levels of alkaline phosphatase, cholinesterase, and infection. Radioembolization may cause stomach ulcers, inflammation of the pancreas, raised blood pressure, gallbladder inflammation, or pneumonia. As with all procedures performed through an artery, there is a risk of bleeding or damage to a blood vessel.

In some cases, patients might have an allergic reaction to the iodinated contrast agents used during imaging to see the blood vessels. These contrast agents can also sometimes have a harmful effect on the kidneys, which may be temporary.

What should I expect after the procedure? What is the follow-up plan?
Most patients have some discomfort at the puncture site that may get worse during physical activity. This discomfort will go away on its own after a short amount of time. After you leave the hospital, you can resume your regular diet and activity. It is recommended that you drink about two litres of water a day during the first few days after the treatment.

You should call your doctor if:
- You feel strong abdominal pain
- You develop a fever of 38°C or higher
- You develop a draining wound at the puncture site
- You develop shortness of breath

In the weeks after the procedure, a blood test will be done to see if your liver function has changed. You will return for another imaging scan 4-12 weeks after the procedure. Thereafter, regular imaging should be scheduled to monitor the treatment changes and to make sure the tumour doesn't come back.

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Prostatic Artery Embolization (PAE)

Benign prostatic hyperplasia (BPH) is a very common disease which reduces the quality of life for many men as the enlarged prostate 'pinches' the urethra and prevents complete emptying of the bladder, resulting in the need to pass urine very frequently, including during the night, disturbing sleep. The purpose of **prostatic artery embolization** (PAE) is to limit the symptoms of BPH by reducing the blood supply to the prostate gland, causing it to shrink.

How will the procedure benefit me?

PAE aims to reduce your symptoms to an absolute minimum. Your symptoms will resolve rapidly after treatment, the prostate gland will be preserved, and medications and surgery can be avoided. Erectile and sexual functions will not be impaired by PAE, and the treatment itself has a very low complication rate.

How should I prepare before the procedure?

Some medications should be stopped or reduced – you should discuss your medications with your doctor. You should fast for at least 6 hours before the procedure, though water can be taken with your normal medications. Before the intervention you will receive some antibiotics to prevent infection.

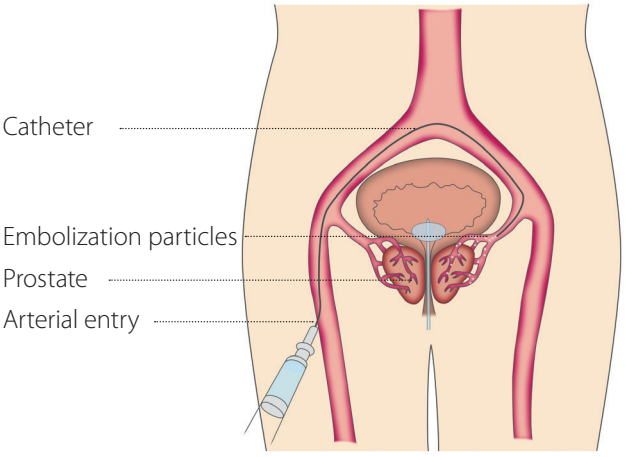
The Procedure

PAE is usually performed under local anaesthesia, occasionally with mild sedation. Immediately before the PAE, a catheter (hollow tube) will be placed through your penis into your bladder.

After sterilising and anaesthetising your skin, the interventional radiologist will make a tiny nick in your skin and then puncture an artery in your groin or wrist with a small needle.

Through this needle a thin wire is passed, and a catheter (tube) is moved forward over the wire towards the arteries supplying blood to the prostate. These arteries are outlined by the injection of a liquid that can be seen on the live x-rays (fluoroscopy) taken during the procedure. When the catheter is in the right place, very small particles (microspheres) are injected until the blood flow stops.

The embolization will be repeated for the prostatic artery on the opposite side, through the same opening in your skin. The entire procedure will take between 1 and 2 hours. The treatment will usually not cause any pain; however, some patients report some mild pain in the pelvic area, which can be easily treated with oral pain medications.



What are the risks?
Bruising or bleeding can occur at the puncture site. Very rarely, further treatment (another vascular intervention or surgery) might be needed to fix complications at the puncture site. Possible complications related to the embolization include blood in the urine and/or urinary tract infection. The risk of infection is reduced by giving antibiotics prior to the procedure. Other, very rare complications might include blood in the sperm or faeces. Usually these adverse reactions disappear on their own.

What should I expect after the procedure? What is the follow-up plan?
After a period of bed-rest and immobilisation, you will be able to leave hospital either the same or the following day.

Since PAE is a minimally invasive treatment perfomed through the skin, a small band-aid is all that is required on the skin nick. The catheter in the bladder will be removed on the day after the PAE at the latest, but possibly even on the day of the procedure.

You can expect effective, immediate relief from your symptoms.

PAE does not require any dedicated follow up. However, since your prostate is preserved, you will need to follow your normal schedule for visits at the urologist.

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Percutaneous transhepatic biliary stenting and drainage

The liver produces a liquid called bile which drains to the gut through internal tubes (called bile ducts). If these tubes get blocked, the bile builds up in the liver, causing yellow eyes and skin (jaundice) and itchy skin (pruritus). This built-up fluid can become infected, and if not drained, can lead to liver failure.

In **transhepatic biliary drainage,** a plastic tube is passed through the skin (percutaneously) of the chest/abdomen directly into the bile ducts, allowing the bile to flow into a bag outside the body. In **transhepatic biliary stenting,** a metal or plastic stent (flexible scaffold tube) is passed through the same opening in the liver (transhepatic) and placed within the blocked bile duct to keep it open. This is often done after percutaneous biliary drainage to allow the external drain and bag to be removed. If the bile is not infected, the stent is placed at the time of first drainage.

How will the procedure benefit me?

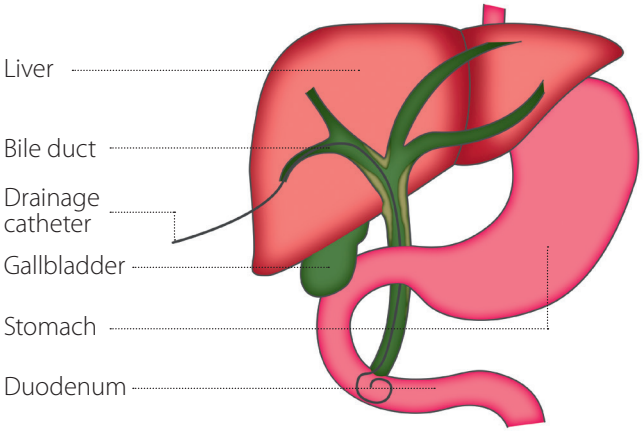
Draining bile outside the body relieves the pressure on the liver, allowing it to work normally and reducing the risk of infection and liver failure. The eyes and skin return to their normal colour and any itchiness is relieved. Biliary drainage may be also necessary in preparation for surgery or other procedures on the bile ducts. Biliary stenting provides long-term relief from bile duct obstruction, allowing the bile to drain internally to the gut in the normal fashion, with no external drain.

How should I prepare before one of these procedures?

You may need to stop taking or change the dose of some medications – it is important to discuss this with your doctor. Your physician will most likely give you antibiotics before the procedure. You will usually be required to fast the night before the procedure and may receive intravenous fluids.

The procedures

Both procedures take place in a room with x-ray and ultrasound equipment, usually in the interventional radiology department. Each may be performed either with local or general anaesthesia, or a combination of the two. The skin where the incision will be made will be disinfected, and sterile drapes will be placed over you.



Transhepatic biliary drainage

Biliary drainage: Using ultrasound and/or x-rays (fluoroscopy), the interventional radiologist will first guide a needle and then a wire into one of the bile ducts. This may be done in the lower right side of your chest or through the skin of your upper abdomen below the rib cage. Once the wire is in position, the interventional radiologist will slide a number of small tubes over the wire to make the path big enough so that they can then slide the drainage tube over the wire into position. If you are conscious, you will likely experience some pushing and pressure, but this should not be painful, as you will have been given a lot of local anaesthetic and strong intravenous painkillers.

The drain will be adjusted so that it can drain fluid as well as possible and then fixed in position, sometimes with stitches, sometimes with sticky dressings on the skin. A sterile dressing will be applied which will have to be changed regularly.

Biliary stenting: If you have a biliary drain in place already, a wire will be passed through the drain into the gut, the drain removed by sliding it out over the wire, and replaced with the stent. When the interventional radiologist sees that the stent is in a good position, they remove the tube and the stent expands to keep the bile duct open. If you do not have a biliary drain in place already, a bile duct will be punctured as described above to place the stent.

Before and/or after stent placement, your blocked bile duct will be dilated with a special balloon; this may be felt as a sharp, short-term pain in the upper abdomen which will be treated with strong painkillers. After the procedure, a sterile adhesive plaster is applied over the puncture site.

What are the risks?

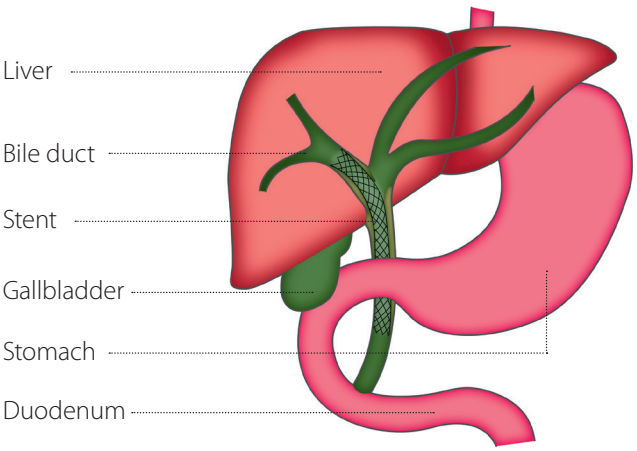
For both procedures, there is a small chance of bleeding from the puncture site through the skin, into the abdomen or into the bile ducts. If the tube has been placed between your ribs, there may be pain around the puncture site. The drain or stent can dislodge and move. Over time a stent can become blocked. It is also possible for bile ducts to become infected. Bile may leak along the tube to the skin, into the abdomen, or into the chest around the lungs. Any of these should be reported to your doctor.

What should I expect afterwards?
What is the follow-up plan?

You will be taken back to your ward for monitoring and bed rest. Mild pain at the puncture site and in the upper abdomen may be felt. Slight nausea also may be present. These symptoms will be managed with medications. You may be given more antibiotics.

If you have an external tube and bag, it is important to take care that the catheter does not get pulled out. The nurses will empty the drainage bag at regular intervals and record the fluid output.

Maintenance of your biliary catheter is extremely important; ensure that you receive clear instructions from your doctors regarding flushing the tube and changing the dressings if you are being discharged. You should also receive a plan for your follow-up which may include scheduled changes of your external tube at set intervals.



Transhepatic biliary stenting

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Central venous catheter insertion – Tunnelled cuffed catheters

Central venous catheter insertion describes the placement of a hollow plastic tube ('catheter') into a large vein in the chest. Central venous devices may be used for several purposes, including delivering nutrition or long-term medications through a vein (intravenous) or filtering blood.

How will the procedure benefit me?
The major benefit is that you will not require repeated needle sticks for injections or cannulas (little tubes that are placed in the veins of the hands or arms, that have to be changed every few days). The catheter is placed into a vein in the neck or front of the chest and passes from this point to the large veins in the middle of the chest. The catheter can be safely left in place for as long as it is needed.

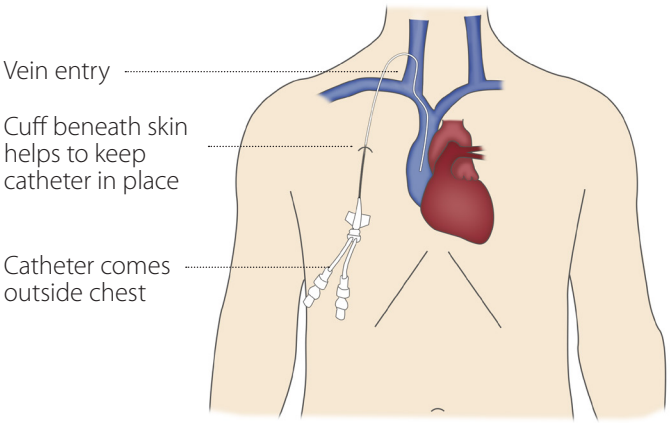
How should I prepare for the procedure?
You may be asked to fast for 6-8 hours before the procedure. If you are taking any medication, please tell your doctor, as some medications may need to be stopped or changed beforehand.

The procedure
Often, the procedure is performed awake under local anaesthesia, but sometimes you may be given sedatives which will make you feel drowsy. Local anaesthetic is used to temporarily numb the skin. In babies and children, the procedure is often performed under general anaesthesia. Generally, the procedure takes 30-45 minutes.

After the local anaesthetic has taken effect, a small cut (incision) is made in the skin and a needle passed into the vein underneath, using ultrasound to watch the needle as it is advanced into position.

A small wire is then passed through the vein to the central veins using x-rays (fluoroscopy) for guidance, followed by the central venous catheter. The "outside" part of the line is then fixed to your skin with either a temporary stitch or a special dressing (or both).

Different types of catheters may be used; among the most common are:
Tunnelled cuffed catheters
(e.g. Hickman line, Groshong line)
These catheters are placed in a large vein in the neck via a small cut in the skin. A small wire is then passed through the vein to a vein in the chest using x-rays (fluoroscopy) for guidance, followed by the central venous catheter. Instead of the catheter coming out of the skin at the neck, it is "tunnelled" under the skin of the upper chest so that it exits the skin some distance away from where it enters the neck vein.



A tunnelled cuffed catheter

What are the risks?
There is a small risk of bleeding when the incisions are made. As the central venous device has direct access to the bloodstream, infection can be a risk after the procedure.

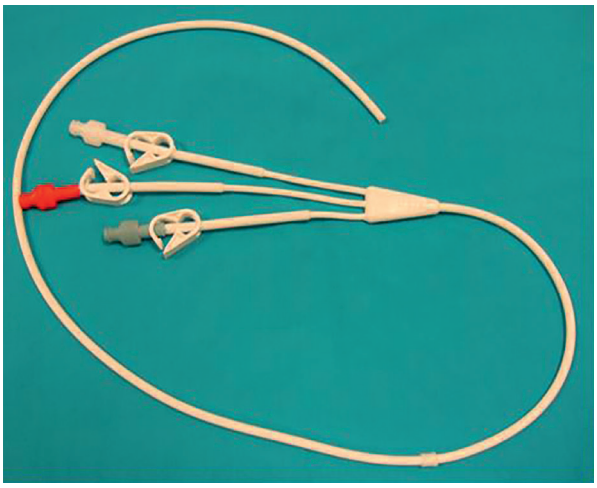
There is also a small risk of puncturing the chest and causing the lung to collapse, but this is extremely rare , and is easily treated by passing a small tube to allow the lung to reexpand.

The line can also become blocked or dislodged, which can sometimes be corrected, but occasionally requires replacement.

What should I expect after the procedure?
You will return to a ward and the central venous catheter can be used immediately. If you have not had intravenous sedation, you may eat and drink soon afterwards. After general anaesthetic, some people feel sick, vomit or have a sore throat. The area where the catheter was inserted may feel temporarily uncomfortable, but this should be easily controlled with paracetamol (if not allergic).

How do I manage the dressings?
What is the follow-up plan?
This depends on the type of dressings used. Steristrips (little sticky strips of paper) are often used and should stay in place for five days or so, at which time they are expected to drop off normally. Non-absorbable stitches need to be removed after 5-7 days. The medical staff should give you clear directions as to when any stitches/dressings need to be removed and the wound inspected. This can frequently be performed by your general practitioner or their practice nurse, so that you don't need a separate trip back to the hospital.

The tube will stay in place as long as you are getting treatment. When no longer needed, the tube is removed under local anaesthetic (in children it is often removed under general anaesthetic). There is a small risk of bleeding when the CVC is removed, but this is minimised by the staff applying pressure to the area for a few minutes afterwards.



A Hickman line

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Central venous catheter insertion – venous ports

A central venous port (also known as portacath or "implantable venous access port") is a small round plastic or metal chamber which is placed under the skin on the front of your chest which you will feel as a small bump when it is in place. The chamber has a tube (catheter) attached which is placed into a vein in the neck and passes from this point to one of the large veins in the middle of the chest.

An example of a venous port, also called a portacath

How will the procedure benefit me?

The major benefit is that you will not require repeated needle sticks for injections or cannulas (little tubes that are placed in the veins of the hands or arms, that have to be changed every few days).
Ports may be used for several purposes, including delivering long-term medications or nutrition, for taking blood tests and for injecting contrast in CT if you are having frequent scans. The port can be safely left in place for as long as it is needed.

How should I prepare for the procedure?

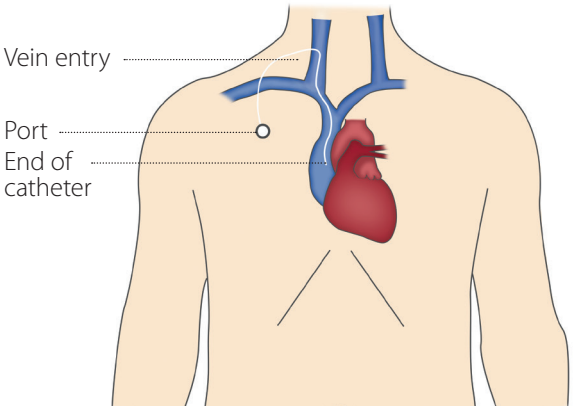
You may be asked to fast for 6-8 hours before the procedure. If you are taking any medication, please tell your doctor, as some medications may need to be stopped or changed beforehand, especially medications that affect the clotting of your blood.

The procedure

Often, the procedure is performed awake under local anaesthesia, but sometimes you may be given sedatives which will make you feel drowsy. Local anaesthetic is used to temporarily numb the skin. In babies and children, the procedure is often performed under general anaesthesia. Generally, the procedure takes 30-45 minutes.

After the skin is sterilised, local anaesthetic is given to the skin of your chest, and the chamber put in place. The catheter attached to the chamber is brought under the skin to the neck. A second tiny cut (incision) is made in the skin of the neck and a needle passed into the vein underneath, using ultrasound to watch the needle as it is advanced into position. A small wire is then passed to a vein in your chest using x-rays (fluoroscopy) for guidance. A small hollow tube is advanced over the wire, the wire is removed, and the catheter part of the portacath advanced into place in the vein.

The cut in the neck is closed with a single stitch or glue. The chest incision is closed with deep stitches and stitches or glue to the skin. Medical and nursing staff will then be able to deliver intravenous medications by feeling the 'bump' under the skin and then passing a needle through the skin into the chamber. Medications delivered into the chamber pass through the catheter into the central vein.



A venous port

Venous Ports (also known as "implantable venous access port") This is a small round plastic or metal chamber with a catheter attached which is placed under the skin on the front of your chest; you will feel it as a small bump when it is in place. Putting this chamber in place requires a small incision. The catheter portion is passed into a vein in the neck. The chest incision is closed with stitches and/or glue. Medical and nursing staff will then be able to deliver intravenous medications by feeling the 'bump' under the skin and then passing a needle through the skin into the chamber. This can also be used for blood tests and for injecting contrast in CT if you are having frequent scans. At the end of the procedure the catheter is removed and site of access will be sealed. You may be asked to stay in bed for up to 12 hours in order to reduce the potential for bleeding from the artery that was punctured.

What are the risks?

There is a small risk of bleeding when the incisions are made. As the central venous device has direct access to the bloodstream, infection can be a risk after the procedure. There is also a small risk of puncturing the chest and causing the lung to collapse, but this is extremely rare and is easily treated, by passing another tube which allows the lung to reexpand. The line can also become blocked or dislodged, which can sometimes be corrected, but occasionally requires replacement.

What should I expect after the procedure?

You will return to a ward and the central venous catheter can be used immediately.

If you have not had intravenous sedation, you may eat and drink soon afterwards. After general anaesthetic, some people feel sick, vomit or have a sore throat. The area where the catheter was inserted may feel temporarily uncomfortable, but this should be easily controlled with paracetamol (if not allergic).

How do I manage the dressings? What is the follow-up plan?

This depends on the type of dressings used. Steristrips (little sticky strips of paper) are often used and should stay in place for five days or so, at which time they are expected to drop off normally. If a stitch is used in the neck, it will need to be removed after 5-7 days. Some operators close the chest incision with absorbable stitches which do not need to be removed. The medical staff should give you clear directions as to when any stitches/ dressings need to be removed and the wound inspected. This can frequently be performed by your general practitioner or their practice nurse, so that you don't need a separate trip back to the hospital.

The port will stay in place as long as you are getting treatment. When no longer needed, the port is removed under local anaesthetic (in children it is often removed under general anaesthetic). There is a small risk of bleeding when the port is removed, but this is minimised by the staff applying pressure to the area for a few minutes afterwards.

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Nephrostomy and ureteric stenting

The main purpose of **nephrostomy** and/or **ureteric stent placement** is to relieve pressure on the kidneys due to blockage of the tubes (the ureters) that drain urine from the kidneys to the bladder. At first, the pressure is relieved by placing a tube (called a nephrostomy) through the skin into the kidneys so that the urine can flow out of the body into a collection bag. In a lot of cases, it is possible to pass another tube (a ureteric stent) through the same opening in the skin from the kidney to the bladder so that the urine can drain normally on the inside, without an external bag. Placing a nephrostomy tube may also be required as a part of a procedure to remove stones from the kidney, or to divert urine away from holes in the ureters or bladder caused by stones, cancer or surgery. Placement of a nephrostomy tube or ureteric stent can be temporary or permanent, depending on the condition.

What are the benefits?

This is a quick, minimally invasive procedure with a low complication rate. It immediately relieves pressure on the kidneys so that they can return to normal function.

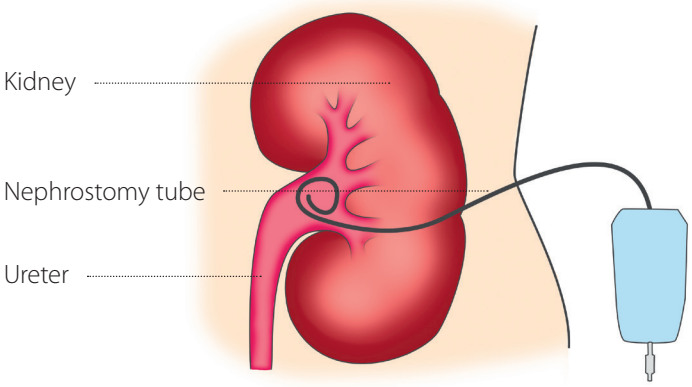
How should I prepare for the procedure?

Before having your nephrostomy catheter or ureteric stent placed, you will have specific blood tests to make sure your blood is clotting normally. If you are on anticoagulation medications, you will be instructed to stop taking them for a period of time. You should also not drink or eat anything after midnight the night before the procedure.

The procedures

The urinary system can be drained with a catheter (tube) in two ways, either via a **nephrostomy catheter** or **ureteric stent (or a combination of both).**

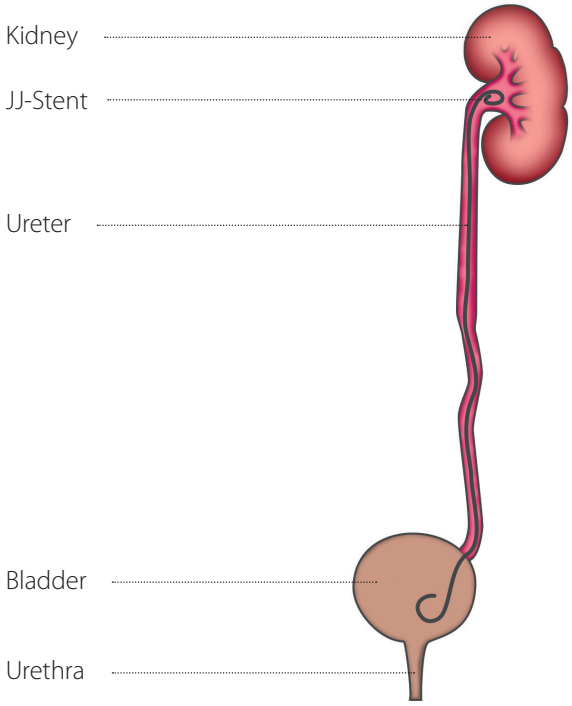
- A **nephrostomy catheter** placed to relieve pressure on the kidney and to drain infected urine, or, to drain urine from the kidney externally if the ureter is leaking following trauma. The nephrostomy is inserted through the skin of the back into the kidney. The inner end of the catheter forms a loop within the kidney and the other end extends outside the body and is attached to an external drainage bag.



A nephrostomy catheter

- A **ureteric stent** is placed if it is possible to get through the blockage in the ureter. The stent (usually a hollow tube) is directed through the blockage down to the bladder by the interventional radiologist, using x-rays for guidance.

One end of the catheter forms a loop in the kidney, and the other end loops within the bladder, allowing urine to drain directly around the obstruction from the kidney to the bladder. You will continue to pass urine as normal.



Ureteric stent

Once in the interventional radiology suite you will be placed on the procedure table face-down or on your side. You will probably receive some light sedation. After your skin has been sterilised and sterile drapes placed over you, your skin and underlying tissue will be numbed with local anaesthetic. The interventional radiologist will then use ultrasound to guide a needle into the kidney and use x-rays (fluoroscopy) to pass a wire through this needle either into the kidney itself or through the kidney into the ureter and down to the bladder. A tube can then be moved forward over this wire to its final position in the kidney or the bladder.

If you are having a nephrostomy, the part of the tube on the outside of your body will be fixed to the skin of the back and attached to a drainage bag. If a ureteric stent is placed, you may not need an external tube at the end of the procedure. The procedure will normally take less than an hour.

What are the risks?

There is a small risk of minor bleeding; significant bleeding requiring blood transfusions or surgery is rare. Less common complications are leakage of urine around the catheter inside the abdomen or blockage of the drainage catheter. If the blocked urine is infected before the procedure, septicaemia (infection in the bloodstream) can occur following insertion of the nephrostomy tube. Antibiotics are usually given before the procedure to prevent this complication.

What should I expect after the procedure? What is the follow-up plan?

After your operation you will go back to the ward for monitoring. You will generally stay in bed for a few hours.

The drainage tube will remain in place for an amount of time determined by your doctor, and you will be given instructions about the proper care of the nephrostomy catheter when you go home. If a ureteric stent has been placed, a plan should be made for its removal or exchange after a period of time, usually six months, depending on why it was placed.

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Arterial angioplasty and stenting

Angioplasty is the stretching of a blood vessel with a balloon, performed to open up a narrowing or blockage, improving the flow of blood within the vessel. **Stenting** is the insertion of a wire mesh tube, called a stent, to keep a blood vessel open.

What are the benefits?
Angioplasty and stenting are successful in 90-95% of cases, improving blood flow and relieving pain. In some patients, especially diabetics, these procedures can help heal ulcers and some wounds after surgery.

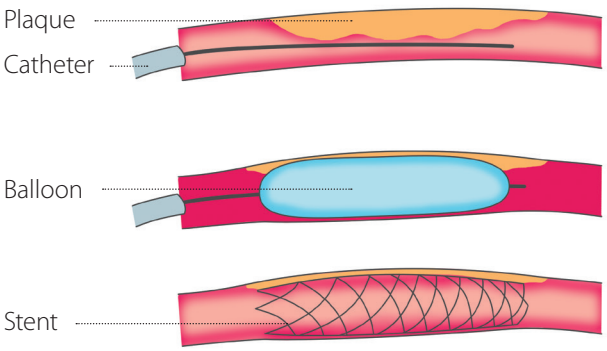
Angioplasty and stenting can be beneficial for varying amounts of time, depending on the location and severity of the disease, and depending on whether ballooning or stenting is used. You should discuss your specific situation with your doctor.

How do I prepare for the procedure?
Some medications may need to be reduced or stopped before the procedure – it is important to discuss any medications you take with your doctor. You may be asked to fast the night before the procedure.

Your blood levels, blood clotting and kidney function will be tested beforehand to ensure you are fit for the procedure.

The procedure
The procedure is performed under local anaesthesia, sometimes with sedation. Throughout the procedure, your blood pressure, heart rate and oxygen levels will be monitored. If you are diabetic, your blood sugar will also be monitored. After your skin has been sterilised and numbed with local anaesthetic, a small plastic tube (called a catheter) is passed into an artery in your groin or wrist.

Your blood is thinned with medication to prevent clotting, and then the interventional radiologist manipulates a long thin wire through the site of narrowing or blockage, using x-rays to guide the wire into position. Once the narrowing has been passed, a balloon mounted on a long thin catheter is advanced over the wire and through the narrowing. The balloon is inflated using fluid, which stretches open the artery. During the stretching, you may experience a bit of discomfort, which you should report to the interventional radiologist.



If the stretching is not successful, then, in the same way that the balloon was positioned, a wire mesh scaffold tube (called a stent) is placed to keep the blood vessel open. On some occasions, particularly where the vessel is completely blocked, the plan from the outset will be to place a stent. The vast majority of stents are permanent. At the end of the procedure, which lasts about an hour, pressure will be applied to the site of entry in the groin to stop the bleeding. Special devices, which clip, stitch or plug the hole may be used in some circumstances instead of pressure.

What are the risks?
You may bleed or bruise at the site of puncture. Rarely, the bleeding may worsen and require blood transfusions or further procedures. Rarely, at the site of angioplasty or stenting, the blood vessel may rupture and may need to be sealed with a special fabric-lined stent to stop the bleeding.

The material (atherosclerotic plaque) causing the narrowing or newly formed clot may occasionally dislodge and travel downstream causing blockage of flow, requiring an additional procedure for correction. Over time, clots or narrowing may recur at the site of angioplasty or form within stents. Though it is rare, stents can fracture.

What should I expect after the procedure? What is the follow-up plan?
After the procedure, your pulse and blood pressure will be closely monitored, and you may be asked to lie flat in bed for 3-6 hours. You will be allowed to eat and drink as usual, and if there are no complications or concerns, after monitoring, you may be allowed to go home the same day or the next morning. If you received a stent, you will probably be asked to take tablets to prevent clots forming within the stents for 3-6 months. You will return to the clinic for follow up appointments with either the interventional radiologist who performed the procedure or a vascular surgeon. Some physicians perform yearly ultrasound scans to ensure the site of angioplasty or stenting is staying open. If the artery or stent re-narrows, which happens in 10-15% of cases, then you may need to have the procedure repeated.

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Image-guided percutaneous biopsy

Percutaneous biopsy describes the taking of a tiny piece of tissue from a part of the body with a needle passed through the skin. It is a safe, effective and accurate procedure for the diagnosis of various diseases, replacing the need for open surgery to make a diagnosis in the majority of cases.

Percutaneous (through the skin) biopsy is used to obtain a tissue sample to determine if a lesion is cancerous (malignant) or not. If the lesion is cancerous, the tissue can be used to classify a malignancy in order to determine the treatment required. It can also be used to:

- identify tumour markers and cell types of tumours
- analyse the mutational status of tumours
- evaluate patients with known or suspected infection
- determine the nature and extent of diffuse or systemic diseases
- match organ tissue before a transplant
- look for signs of organ rejection following a transplant

How will I benefit from the procedure?

Percutaneous biopsy can accurately and safely obtain a sample from even a very small abnormality; it will spare you from surgical biopsy, which is more invasive and requires longer hospitalisation and recovery times. The result of the biopsy will help your doctor to identify the cause and extent of your disease, establish a diagnosis and decide on a therapeutic plan.

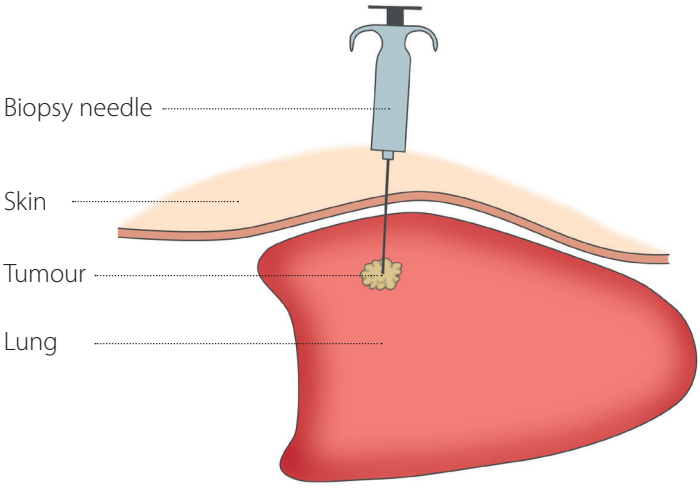
How should I prepare for the procedure?

Most percutaneous biopsies are performed in an outpatient setting with minimal preparation. You should talk with your doctor about any medications you take, as some may need to be adjusted or stopped before the procedure.

You may be instructed not to eat or drink for 6-8 hours before the biopsy. If needed, a blood sample may be drawn for appropriate blood tests. You may want someone to accompany you and drive you home afterwards. This is mandatory if you have been sedated.

The procedure

The procedure is performed under image guidance, most often using ultrasound, CT or fluoroscopy (live x-rays) or a combination. The Interventional Radiologist will first review any CT, MRI, or PET-CT you may have already had to identify the exact location of the target lesion and determine the shortest and safest path for the biopsy.



In some cases, a small cannula may be placed in a hand or arm vein in order to give you intravenous medications, and you will be connected to a monitor to record your vital signs. You will be put in a comfortable position and your skin will be prepared and draped using a sterile technique. Your skin and the underlying structures will be injected with local anaesthetic.

Sometimes intravenous sedation and/or pain relief medications are given. If necessary, a very small incision is made. Then, the biopsy needle is inserted and a small tissue sample is taken. During the process, your doctor will need your cooperation and may give you some instructions (e.g. to hold your breath). In many cases, more than one tissue sample is taken. Occasionally, the interventional radiologist may use a guide needle to inject material at the end of the procedure to reduce the risk of bleeding. Bleeding afterwards is usually very short-lived and managed by applying firm pressure with the fingertips. A small dressing is then applied at the puncture site. In some cases, post-procedure imaging may be needed. The tissue samples are then prepared and sent to the relevant laboratory department.

What are the risks?
Percutaneous biopsy is a safe procedure with a low complication rate. Possible complications (common for all biopsies) include local bruising, bleeding (usually minor), infection, perforation, unintended adjacent organ injury, tract seeding or failure. Every patient and every case is different. Your doctor can give you more information and answer questions regarding your specific biopsy.

What should I expect after the procedure? What is the follow-up plan?
After sedation you will regain control of your physical and mental faculties quickly. You may be asked to stay in a hospital bed and be monitored for 1-6 hours. You may be asked to stay in a certain position for a few hours in order to avoid complications. In the case of procedures at higher risk for bleeding (e.g. renal biopsy), blood tests may be required. If the doctors are concerned, they may keep you in the hospital overnight.

You will need a follow-up appointment to meet your doctor to receive your results and find out what, if any, further treatment you need.

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Percutaneous fluid and abscess drainage

A fluid collection is an abnormal build-up of fluid in a part of the body that can happen from many different causes. An **abscess** is a type of collection that is infected and has a wall around it developed by the body to stop the infection from spreading.
Abnormal fluid collections, such as abscesses, may be **drained** by the placement of a tube (also called a drain or catheter) through the skin (percutaneous) or body orifice (rectum or vagina) into the collection. Interventional radiologists do this in a minimally invasive way, using imaging techniques such as ultrasound or CT to guide them.

The purpose of drainage is:

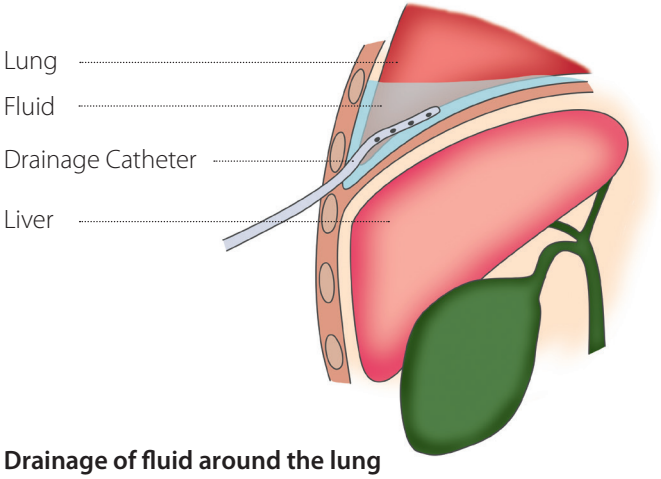
- to establish a diagnosis, i.e. to find out exactly what type of fluid it is
- to relieve symptoms and to cure/drain an infected fluid collection
- to stabilise a patient's condition to allow the safe performance of another procedure and to improve its outcomes

How will I benefit from the procedure?
Percutaneous drainage is usually the safest, least invasive and most effective way to drain abnormal fluid collections from your body. It usually spares you from longer, more invasive surgical operations with higher complication rates.

How should I prepare before the procedure?
Prior to the procedure, you should report all medications that you are taking to your doctor, and alert them to any allergies. You should also inform them about other medical conditions (including pregnancy) or recent illnesses. Your doctor may instruct you to stop taking aspirin or blood thinners for a specific period of time before your procedure. Other medications may also need to be adjusted (e.g. insulin).

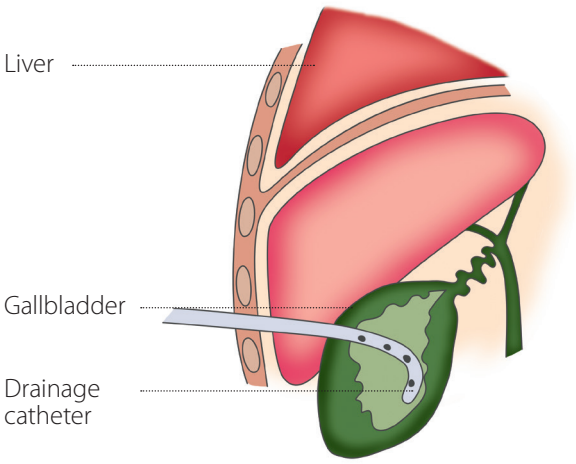
You may be instructed not to eat or drink for 6-8 hours before the procedure. A blood sample may be taken for appropriate blood tests. Your kidney function may also be checked if the doctor thinks you may need intravenous contrast for a CT scan.
If you are an outpatient, you should have a relative or a friend to accompany you and drive you home afterwards.

The procedure
The procedure is performed under image guidance, meaning the interventional radiologist uses ultrasound, CT, fluoroscopy or a combination to guide the drain into position via the shortest and safest path. During the procedure, the part of your skin that will be punctured is marked. The skin will be cleaned with sterilising fluid and local anaesthetic injected into and under the skin. After the anaesthetic has taken effect, if necessary, a tiny incision (3-4 mm) is made and the tissues under the skin spread a little to allow the tube to be placed. A needle is then placed through the skin into the collection. When the tip of the needle is in the collection, a wire is passed into it, the needle removed and the tube put into the collection by sliding it over the wire.



Drainage of fluid around the lung

The wire is then removed. During the process, your doctor will need your cooperation and may give you some instructions (e.g. hold your breath). The tube is attached to a small drainage bag on the outside of your body into which the fluid flows out through the tube. The tube is secured to your skin with fixation devices including sticky tape and occasionally sutures to prevent the tube from falling out or getting pulled out. Other dressings are placed on top of this.



Drainage of fluid from the gallbladder

What are the risks?

Image-guided fluid and abscess drainage is a safe procedure with a very low complication rate. Rare complications include injury to structures close to the collection. Injury to blood vessels may cause bleeding (haemorrhage). Bacteria escaping into the bloodstream may infrequently cause septic shock which is managed with fluids, antibiotics and other medications.

What should I expect after the procedure?

If the collection has been painful, you can anticipate almost immediate relief, and if you have had fevers, draining the pus will make you feel better almost immediately. If you were sedated, you will regain control of your physical and mental faculties quickly.

How do I manage the drain and dressings? What is the follow-up plan?

When you are being discharged, you should receive clear instructions about how to empty and change your drainage bag, how to flush your catheter and when to seek immediate medical advice. You may need a course of antibiotics.

Your doctor will need to see you in order to check your catheter, to change your dressing, evaluate your symptoms and check the remaining amount of fluid in your body with an ultrasound or CT. Sometimes you may be required to maintain the drainage catheter for weeks or months. When most of the fluid has been drained the tube can be removed via a quick, simple and painless process.

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Percutaneous gastrostomy

When a patient cannot eat or drink normally, they can be fed via a tube (called a gastrostomy) placed directly into the stomach through the wall of the abdomen. Percutaneous (through the skin) **gastrostomy** is also performed to provide drainage (gastric decompression) when food and liquid cannot exit the stomach normally due to an obstruction of the opening of the stomach into the small intestine.

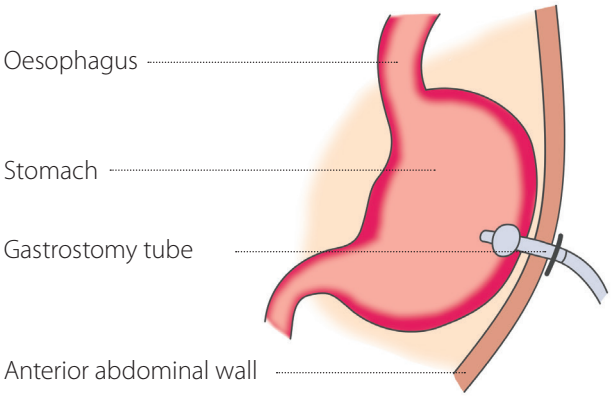
How will the procedure benefit me?
After the procedure, you can be fed through the gastrostomy tube and supplied with all the calories and nutrients that your body needs. If you are vomiting because the normal exit of the stomach is blocked, the vomiting will be stopped by draining your stomach through the tube.

How should I prepare before the procedure?
If you are taking aspirin or blood thinners your doctor may instruct you to stop taking them for a specific period of time before your procedure. Other medications may also need to be adjusted (e.g. insulin if you are a diabetic). A blood sample will be drawn for various tests, including to ensure that your blood is clotting normally. You will be instructed not to eat or drink for 6-8 hours before the procedure. You may be given barium liquid to make the colon easier to see under image guidance. If you cannot drink, this liquid will be delivered through a nasogastric tube (tube from a nostril to the stomach).

The procedure
A gastrostomy is usually performed using a combination of local anaesthesia and intravenous pain relief and sedation.

During the procedure, you will be positioned comfortably on your back and connected to a machine to monitor and record your vital signs. You will be given fluids and the medications intravenously.

If not already in place, you will require a nasogastric tube through which air will be injected into the stomach to make it clearly visible on screen to the Interventional Radiologist. The site for a very small incision on the abdominal wall will be determined using x-rays, the skin prepared with a sterile solution and local anaesthetic given.



Gastrostomy tube

Guided by the images on the screen, the interventional radiologist will puncture the wall of the stomach and insert a very small 'anchor' attached to a thread which, when pulled, brings the walls of the stomach and the abdomen close together. They are kept together by stitching the external portion of the thread to the skin. Depending on the operator, a number of these anchors may be placed. Once the stomach wall is 'anchored' in this way, a needle is inserted and a guidewire passed through it.

The needle is then removed and a series of dilators inserted over the wire to gradually make the hole in the stomach wall big enough to take the gastrostomy tube, which is then slid into place over the wire. The correct location of the gastrostomy tube is finally confirmed and then fixed to your skin.
The tube through your nose can then be removed, either straight after the procedure or back in the ward.

What are the risks?
When performed on suitable patients, gastrostomy is generally considered a safe procedure with a low complication rate.
The most common complications include skin infection around the gastrostomy entry point and bruising. Other complications include bleeding, dislodgment of the tube, stomach bloating, nausea and aspiration. It is possible, but rare, that the colon could be injured during the placement of the tube, which can lead to severe peritonitis. If the gastrostomy tube is placed through the liver, you may experience bruising in your liver.

What should I expect after the procedure? What is the follow-up plan?
You may experience some discomfort around the catheter in the first few hours following the procedure. If you had been sedated, you will regain control of your physical and mental faculties quickly. You may have a drainage bag and you will need to take care not to pull out the tube. When the tube can be used for feeding will depend on your hospital.

You and your family will be instructed how to recognise and prevent infection around the tube, how to prepare and insert food through the tube, what to do if the tube becomes blocked or if it gets pulled out. You will be advised at what stage the sutures attached to the stomach 'anchors' can be cut at the skin (between 48 hours and 1 week depending on the hospital). A follow-up plan should be discussed with your doctor, as they will need to see you regularly in order to check your stoma and tube condition, your nutritional state, feeding regime and your weight.

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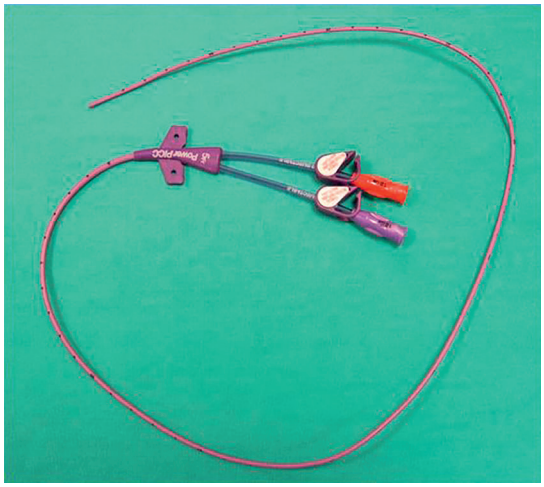
Peripherally inserted central catheters

PICC stands for **p**eripherally **i**nserted **c**entral **c**atheter. These are long, thin, flexible tubes (catheters) which are inserted into a vein in your arm (peripherally), and threaded into the central veins in the chest. A PICC provides short and medium-term access to the venous system for medications and medical fluids.



An example of a PICC

How will the procedure benefit me?

Placing a PICC is a relatively simple procedure with very few potential complications. Once in place, a PICC is a safe, stable and effective way to deliver intravenous (IV) medications which can remain in the body for weeks or months, doing away with the need to subject your veins to the numerous needle pricks necessary if the PICC was not there. Some medications are potentially harmful to the inner lining of your smaller veins; PICC lines allow these medications to be delivered directly to larger veins that are less likely to be damaged.

How should I prepare before the procedure?

You should tell your doctor about any medications you are taking, any allergies you have, and if you are pregnant. Relevant blood testing will be performed if necessary.

The procedure

The procedure will be performed in the department of interventional radiology (IR). You will be asked to lie on the examination table and you will be connected to monitors that will track your heart rate, blood pressure and pulse during the procedure. The PICC may be inserted in either arm; you will be asked to stretch this arm out beside you on a support. Ultrasound imaging is used to identify and choose the most suitable vein, and a mark made on your skin.

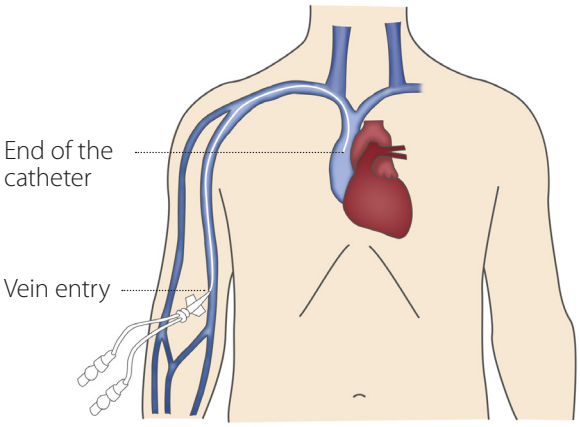
A tourniquet is placed loosely around the arm. The skin is cleaned with sterilising fluid and the area covered with sterile drapes with an opening at the site of insertion. The tourniquet will then be tightened on your arm, and, using the ultrasound probe, the appropriate vein is again located. Local anaesthetic is administered to the skin and tissues between the skin and the wall of the vein. This is the only painful part of the procedure. Once the stinging of the anaesthetic wears off, all you will feel is a little pushing and pressure. Intravenous pain relief medications and sedation are not usually required, but can be given if necessary.

Once the anaesthetic has fully taken effect, a needle is inserted into the vein, through which a skinny guide wire is passed. A tube is passed over the guidewire, through which the PICC is then advanced into position using fluoroscopy (live x-rays) to position the catheter exactly. Only rarely is it necessary to inject a liquid (an iodine-based contrast agent) to outline your veins on screen. Once the PICC is in the correct position, the catheter is checked to make sure blood can be withdrawn, and sterile water can be injected.

The insertion sited is cleaned, the catheter is dressed and a securing device applied. Components of the dressing usually include an adhesive device to keep it in place, and a transparent dressing which allows you to see the insertion site.

What are the risks?
PICC line insertions have a relatively low complication rate. Occasionally, the catheter may irritate the lining of the vein, causing inflammation. This becomes more likely if the PICC is left in place for a long time (2 months or more). Any device inserted into the vascular system increases the risk of thrombus or clot formation, either in the vessel or in the catheter, which could result in partial or complete blockage.

Blockage of the catheter is the most common complication, which can be prevented by adequate care and managed easily usually by flushing, or, occasionally by swapping it for a new one. Damage to the catheter can occur with any PICC, most often from improper care. Following the instructions for the care of the PICC is key to preventing catheter damage post-insertion.



PICC in place

What should I expect after the procedure? What is the follow-up plan?
Most patients who receive PICC lines are free to leave the hospital shortly after the procedure.

You will be advised on the following key aspects of care:
- Keeping the insertion site clean, dry, and covered with a bandage
- Following instructions for changing the bandage. Usually this is done weekly; however, more frequent dressing changes may be needed, especially if the dressing becomes damp, dirty, loosened, or is no longer adherent.
- Avoiding lifting or activities that may loosen the PICC
- Wearing a PICC sleeve / tubigrip to prevent it from catching on things
- Looking out for complications

In some instances, you may need to clean and flush the line regularly to keep it clear and to stop you from developing any problems. You will be given clear instructions if you are required to do this.

Your doctor will tell you how long the PICC should remain in place, and let you know the plans for its removal.

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Uterine artery embolization

Fibroids are benign overgrowths of the uterus which are very common and may not cause problems, but if they become large or numerous, can result in painful symptoms. **Uterine artery embolization** is a procedure in which interventional radiologists can pass a fine tube (catheter) into the blood vessels supplying the uterus (uterine arteries) and inject some fluid containing very small particles (embolic material) in order to block the small arteries and starve the fibroids of their blood supply. This makes the fibroids shrink significantly.

How will I benefit from UAE?

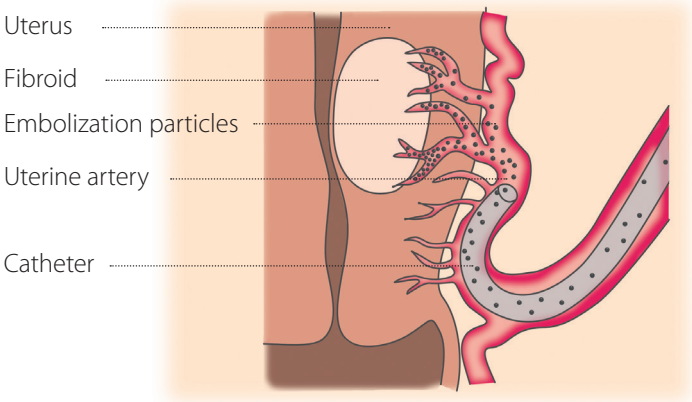
About 80% of women report a significant improvement in their quality of life and symptoms one year after the procedure. Some women have the procedure as they wish to try to get pregnant; in this case, you should seek advice from your fertility consultant, as they may advise you to not get pregnant for six months following the procedure.

How should I prepare before the procedure?

You should inform your doctor about which medications you take, as some may need to be stopped or reduced. You may be asked to have some routine blood tests or more scans before the procedure. You need to let your team know if you have an IUD (intrauterine device or "coil"). You may be required to fast before the procedure.

The procedure

A nurse will check your vital signs, and the team will place a small needle (cannula) in your arm so that you can be given medications in your vein. In many hospitals, a syringe containing pain-relieving and anti-nausea medications will be connected to the cannula and attached to a pump, so that you can deliver pain medications to yourself by pressing a button during and after the procedure. This is known as Patient Controlled Analgesia – PCA. It is not possible to overdose oneself with these devices. In addition, at the start of the procedure, you may be given an intravenous sedative or tranquilliser to help you relax.



Catheter delivering embolization particles

The doctor or nurse will clean your groin with antiseptic solution and cover you with sterile drapes. After giving local anaesthetic into your groin or wrist, the doctor will then insert a needle into the artery and feed a soft tube or catheter into the uterine artery on each side in turn, guided by the image on the x-ray screen. The doctor may be able to reach each uterine artery from one groin only, or might need to puncture the artery in the other groin.

Once the doctor is confident that they have placed the catheter in the correct position in the uterine artery, they will inject the embolic material. While this embolization is going on and for several hours afterwards you may experience severe cramping pain.

The doctors and nurses will give you strong painkillers for this, usually via the cannula in your arm, and occasionally your rectum. If you have a PCA, you can deliver your own medications (you cannot overdose).

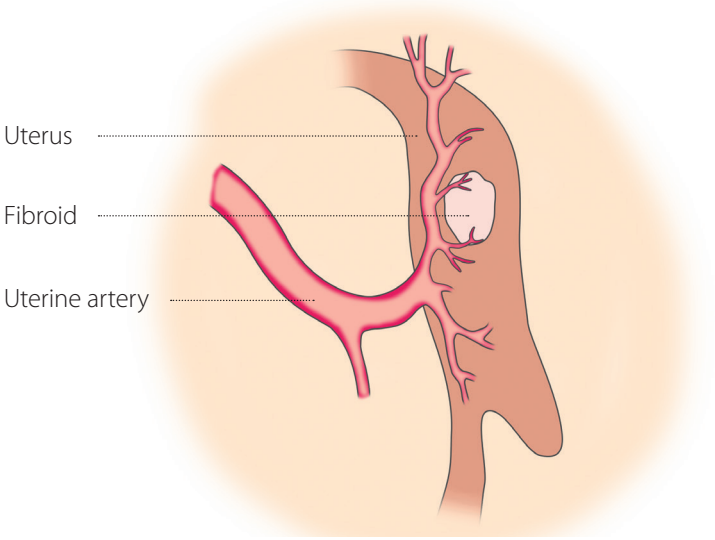
The procedure takes about an hour to perform. When the doctor has finished, they will remove the tube and press on your groin until any bleeding has stopped. You will need to keep your legs still and lie flat for 4 hours afterwards to let the puncture site recover quickly and prevent bleeding.

What are the risks?
Infection occurs in up to 2% of patients. The signs are severe pain, pelvic tenderness and a high temperature. Most infections can be treated with antibiotics. Extremely rarely, if infection is very severe, an operation to remove the womb (hysterectomy) may be required.

2-4% of women, especially those above 45, experience early menopause. Most women find it takes about six to nine months to resume regular periods.

What should I expect after the procedure? What is the follow-up plan?
Once on the ward, the nurses will monitor you. Once you are able to eat and drink, walk around, go to the toilet without help, and control your pain with oral medication, you will be allowed home. Some women do need to stay in hospital longer than 24 hours. When you go home you are advised to rest for a few days. Most patients feel some pain afterwards, which can range from very mild to severe cramps. You will likely also have a slight fever; which is entirely expected in the first 24-72 hours.

Pain and fever can be controlled by oral painkillers and anti-fever medications. Pain and fever can be controlled by oral painkillers and anti-fever medications. Vaginal discharge can occur afterwards due to the fibroid breaking down. This can persist for up to two weeks or can be intermittent for a few months. If the discharge becomes smelly, and is associated with a fever, there is the possibility of infection and you should see your doctor urgently.



After embolization, the fibroid will begin to break down.

The interventional radiology or gynaecology team may arrange to follow up with you in about 4-6 weeks, and you may have another MRI or ultrasound scan after 6-9 months to assess the effect of the embolization.

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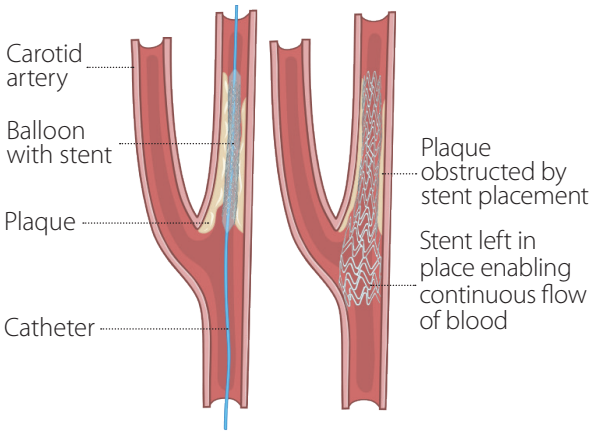
Carotid stenting

The carotid artery is the blood vessel in the neck that supplies blood to the brain. Narrowing or blockage of this vessel can cause temporary loss of vision, a mini-stroke, or a full stroke. The narrowing is usually caused by thickening and hardening of the wall of the artery caused by a gradual build-up of fat and calcium (plaque) on the inner lining which reduces blood flow when the vessel gets too narrow. Bits of the plaque or bits of clot can become loose, break off and travel to the arteries of the brain and cause a blockage. This blockage starves that piece of brain of blood. Stenting is a minimally invasive (pinhole) procedure where a wire mesh tube called a stent is put inside the carotid artery to open it up and keep it open. The procedure is done using X-rays to guide the stent to the right position in the interventional radiology unit.



Carotid artery stenting

What are the benefits of carotid stenting?

Placing a stent into the carotid artery at the place it is most narrow helps to improve the blood flow to the brain. When the stent has been placed, the plaque is trapped between the stent and the wall of the artery. These two effects significantly reduce the risk of suffering a stroke.

Another option for treating this condition is called carotid endarterectomy, which is an open surgical operation. You should discuss your condition with your doctor to find out the best treatment option for you. Some people may end up having both endarterectomy and stenting if endarterectomy is performed first and is not successful.

How do I prepare for the procedure?

It is important to discuss the medications you currently take with your doctor, as some medications need to be stopped before the procedure, particularly if you take any medications that slow the heart rate (e.g. bisoprolol).

Before carotid stenting is performed, you will need to start taking blood thinning medications called anti-platelet agents, like aspirin and clopidogrel.

You will need to let the nurses and doctors know about any allergies you have, especially if you are allergic to contrast – the liquid that your interventional radiologist injects into your arteries to see them on the screen.

Blood tests will be performed before the procedure to make sure that you are not anaemic, that your blood is clotting normally and that your kidneys are working normally.

The procedure

The procedure starts with the interventional radiologist getting into your arteries through a very small hole made in either your groin

(femoral artery) or your wrist (radial artery). Your skin will be disinfected, and local anesthetic will be given. Sometimes, you may be given sedation to make you sleepy during the procedure. You will also be given a medication to thin the blood during the procedure. Your blood pressure, heart rate, and oxygen levels will be monitored during the procedure.

When the local anaesthetic has numbed your skin, a small tube called a sheath will be placed into the artery under the incision. Everything else that is used for the procedure – the wires, catheters and the stent will be passed through this tube, which makes the procedure more comfortable for you. A narrow plastic tube called a catheter will be inserted into the blood vessel through the sheath. The catheter is used to guide a wire to the carotid artery. The position of the wire is monitored using X-rays, and contrast is injected during the procedure to see your blood vessels on screen. Once the wire is in a good position, the collapsed stent is slid over the wire to the narrowing in the artery and then opened. This opening up is sometimes helped by sliding a small balloon into place and inflating it inside the stent to open the stent completely and apply it to the walls of the artery.

At the end of the procedure, the wires, catheters, and the sheath will be removed, and pressure applied at the groin or wrist to prevent bleeding. Sometimes, a special device (plug) may be used to prevent bleeding.

What are the risks?
There may be bleeding or bruising at the site of the puncture. In case of a lot of blood loss, you may need a blood transfusion. In some cases, there can be a small out-pouching of the blood vessel at the site of the puncture. This can be treated with ultrasound and injection of a clotting medication, or by an open operation.

If a part of the plaque which causes narrowing of the vessel breaks off and travels up into the blood vessels in the brain during the procedure, it can cause a stroke.

The other risks include infection, allergic reaction to the contrast (X-ray dye) or kidney injury due to the contrast.

What should I expect after the procedure? What is the follow up-plan?
You will be closely monitored for a few hours after the procedure to ensure there are no immediate complications. You may be asked to lie flat for a few hours. You can eat and drink as usual. If there are no complications, you will be allowed to go home the same day or the following day. You will need to take medications to prevent a blood clot from forming forming within the stent. One of these medications will need to be taken for your rest of your life.

You will have follow-up appointments for a scan to make sure the stent is staying open. This may then be done on a yearly basis, as decided by your doctor.

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Vertebroplasty for osteoporotic vertebral compression fractures (OVCFs)

Osteoporotic vertebral compression fractures (OVCFs), can happen due to ageing, especially in post-menopausal women, or due to long-term use of medications such as steroids, hormones, or anti-cancer drugs which result in bones losing calcium. This loss of calcium leads to bones that are less dense and break more easily, even with minor injuries. OVCFs are generally very painful, especially when you are moving. The goal of vertebroplasty is to fix the fracture, similar to the function of a cast in a broken arm or leg. Vertebroplasty is a procedure which involves the injection of bone cement (a bio-compatible resin called Poly-Methyl-Methacrylate, or PMMA for short) into the fractured vertebra, sticking the broken pieces of bone together. The cement hardens within a few minutes of the injection, resulting in fast pain relief and improved mobility.

How will vertebroplasty benefit me?

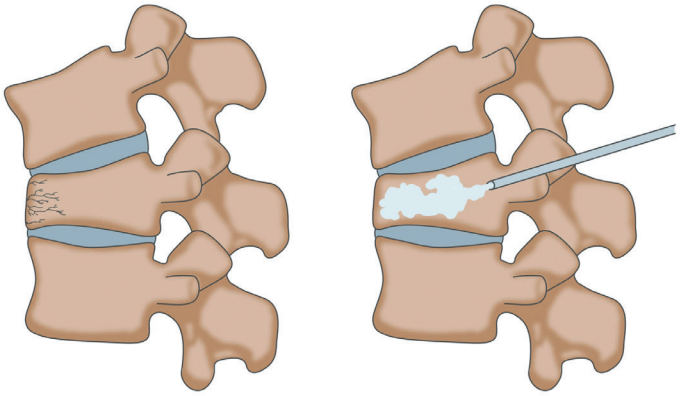
Vertebroplasty is a minimally invasive procedure done using image guidance to guide the needle and cement into the broken bone. It is performed through one or two 3-4 mm incision(s), so there are no major scars. Once the cement has hardened in the injured vertebra, you can start to move again and return to your normal daily activities.
This is possible thanks to the fast pain relief granted by the procedure.

A word of caution: vertebroplasty exclusively treats the consequence (the fracture), but not the underlying cause (i.e., osteoporosis). You will need to talk to your doctor about the diagnosis and long-term treatment of any underlying causes.

How should I prepare for the procedure?

The procedure will be scheduled after a consultation with your interventional radiologist who will examine you to check all places along the spine that are affected by fractures and are causing pain. A spine MRI (or bone scintigraphy, if MRI cannot be used) is needed. A brief consultation with the anaesthesiologist will take place a few days before the intervention. The procedure will either be done under local anaesthesia and conscious sedation, or under general anaesthesia.

Percutaneous vertebroplasty



1. Vertebral fracture 2. Cement injection

The procedure

You will lie down on your stomach in a dedicated interventional room that has an X-ray machine. Using X-rays allows the doctor to see exactly which vertebra or vertebrae need treatment.

Antibiotics will be injected through a vein just before the cement injection to prevent infections. After anaesthesia, your interventionalist will place one or two bone needle(s) in each fractured vertebra. A few millilitres of cement will then be injected through these needles in each affected vertebra to fill as much of the fracture as possible. The cement should not leak outside of your vertebrae. Once the injection is finished, the needles are removed and you will be moved to a ward to rest for a few hours. 3-6 hours after the end of the procedure, your pain should be relieved and you should be able to walk again. The procedure is usually done during one day at the hospital without having to stay overnight.

What are the risks?
General anaesthesia always comes with some risks which you can discuss with the anaesthetist. Accidental injuries to nearby organs could occur (lungs, muscles, nerves, etc.), and cement leakage could occur which could be particularly dangerous if it leaks into the spinal canal.

Rarely, cement can travel to the lungs from veins in and around the spine. Infections at the treated vertebral site are rare but can occur. Overall, significant side effects occur in less than 1 in 200 patients.

What is the follow-up plan?
1-4 weeks after the treatment, a follow-up consultation will take place in your interventional radiologist's office to make sure that your pain has been relieved and that you have been able to return to your normal daily activities. If you experience sudden pain, a new spine MRI will be needed to check for new fractures, which may occur close to or far away from the treated site due to the underlying osteoporotic disease.

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Percutaneous sclerotherapy for vascular malformation

Vascular malformations are abnormal clusters of blood vessels that develop before birth which can cause disfigurement, pain, swelling, bleeding, and infection.

Sclerotherapy (sometimes referred as "sclero") is a minimally invasive procedure which can be used to treat vascular malformations. During the procedure, the interventional radiologist inserts a small needle through the skin into the abnormal blood vessel under image guidance and injects a special liquid (sclerosant), which will make the blood vessel scar down and shrink.

Sclerotherapy can be used on its own or in combination with other therapies such as laser, embolization, or surgery.

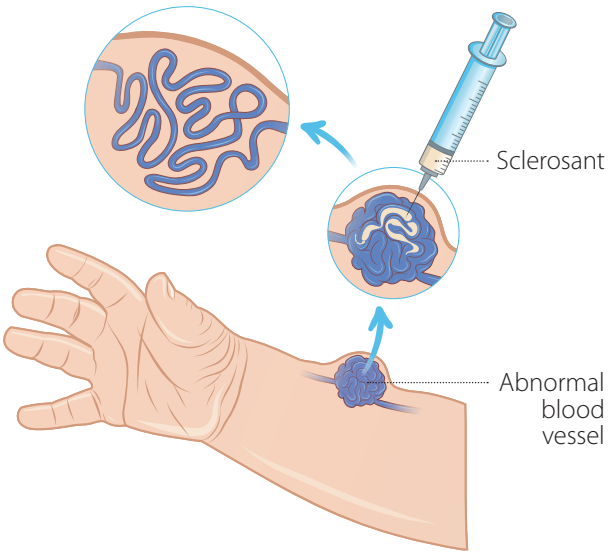
What are the benefits of percutaneous sclerotherapy?
Compared to surgical methods, sclerotherapy most often uses a small needle and there is minimal scarring. The abnormal vascular spaces in vascular malformations will usually seal up and shrink after sclerotherapy. Sometimes the malformations can get bigger, and sclerotherapy may be repeated in multiple sessions.

How do I prepare for the procedure?
Before the procedure, the interventional radiologist will meet with you and discuss how and why the procedure is done as well as the potential benefits and risks. They will also discuss what will be done to reduce these risks and will help you to think about your options. It is important that you understand all the potential risks and benefits of sclerotherapy and that all your questions are answered.

It is important that you are healthy on the day of the procedure. If you start to feel unwell or have a fever within two days before sclerotherapy, you should let your doctor know.

The procedure
You may be given sedation or pain relief medicine depending on the treatment options used during sclerotherapy.

The interventional radiologist will find the vascular malformation with ultrasound and insert a needle through your skin into the abnormal blood vessel. A special dye (called contrast) may be injected into the vascular malformation. The dye is a clear, colourless liquid that makes the blood vessels visible on X-ray images (fluoroscopy). The interventional radiologist can then use fluoroscopy as a guide for the sclerotherapy injection.



Percutaneous sclerotherapy

Next, through the same needle, the interventional radiologist will inject a special liquid called sclerosant directly into the abnormal blood vessel. Sclerosant causes clotting and shrinking of the blood vessel. The interventional radiologist can give injections of the sclerosant into different areas of the vascular malformation if needed. Several different sclerosants are currently available. Depending on your condition, the interventional radiologist may use a single sclerosant or a combination of sclerosants.

Each treatment will take about one to two hours, sometimes longer, depending on the complexity of the vascular malformation.

What are the risks?
Sclerotherapy is generally considered a low-risk procedure.

The risks of sclerotherapy can include:
- swelling (to be expected)
- pain
- skin blisters, ulcers, scars, or skin staining
- nerve damage
- kidney damage
- interruption of blood supply to the treated area
- heart and lung complications
- loss of the treated limb (very rare)

What should I expect after the procedure? What is the follow-up plan?
After sclerotherapy, most patients can go home on the same day.

The areas that were injected are normally swollen for one week and bruised for two to three weeks following the procedure. The skin close to the abnormal blood vessel may blister or be sore. If skin blisters or blackening develops, you should let the interventional radiologist know.

You may have a bath or shower the day after the procedure. Use unscented soap to clean the treated area.

You may feel local pain or discomfort after sclerotherapy, which may last one or two days. If needed, you may take paracetamol or ibuprofen for pain relief. If the pain is so severe that it does not respond to these medications, you should seek medical attention from your interventional radiologist.

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Minimally invasive treatments for renal cell cancer

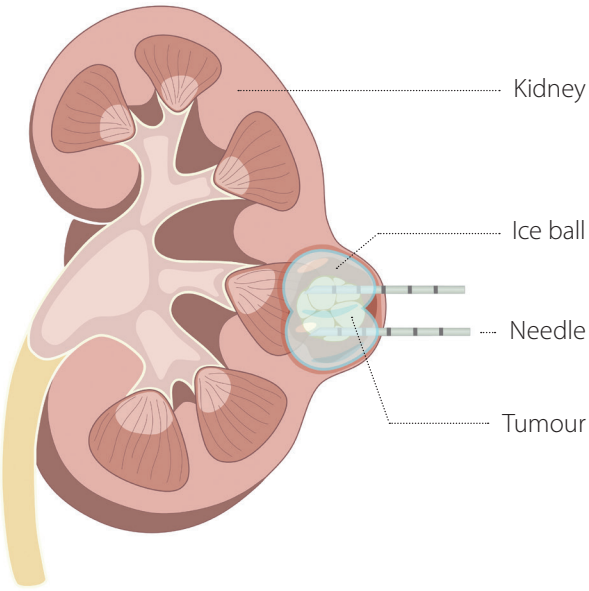
Renal cell cancer (RCC) is a common cancer of the kidney. In its early stages, while it is still only in the kidney and has not spread to other parts of the body, it can be treated minimally invasively by killing the cancer cells with either heat or cold (thermal ablation). RCC is often found at this early stage due to the widespread use of radiological imaging such as ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI).

What are the benefits of minimally invasive treatment of RCC?

Minimally invasive treatment of RCC has several benefits for you. Your hospital stay will be shorter, or it might be possible to perform your treatment on an outpatient basis. You will be out of bed and mobile again more quickly compared to surgery. There is often less pain after the procedure compared with surgery, and complications are less common. As thermal ablation only destroys the cancer and not healthy tissue, there is only little loss of kidney function, if any. If the cancer is in an early stage, minimally invasive treatment is as effective as surgery. Surgery might be needed for larger tumours.

How do I prepare for the procedure?

Before the procedure, some blood tests are needed to check how well your kidneys are working (renal function tests) and to make sure that your blood is clotting normally. A biopsy (tissue sample) may be requried in some cases. You should tell your doctor about all medications that you are taking and any allergies you have. Your doctor may temporarily stop some medications, such as blood thinners, before the procedure. It is also important that you do not have an infection at the time of the procedure. A type of imaging, either a contrast-enhanced CT or MRI scan, will be performed a few weeks before the procedure to find out the exact extent and location of the cancer and to select the best approach for ablation. You must stop eating and drinking 6-8 hours before the procedure.



Kidney cryoablation

The procedure

The procedure is performed by interventional radiologists. Depending on the expected complexity and time needed, the procedure can either be done under local or general anaesthesia. You will most likely lie on your back, as this offers the easiest and safest route to the kidneys. For the treatment, one or a few thin needles are put through your skin into the cancer. Your doctor controls the placement of the needles either using CT or ultrasound (image guidance). Once the needle(s) are in place, energy is put through the needles to either freeze, as in the case of

cryoablation, or heat up the tumour, as during radiofrequency or microwave ablation. Either way will kill the cancer cells. If the tumour is bigger than 4cm, your doctor may perform an additional treatment called embolization. This helps the thermal ablation to work better in larger tumours. When the ablation is finished, the needle(s) will be removed and the interventional radiologist will use image guidance to check that the treatment has worked. The dead tissue is left in place and your body will remove the dead tumour and replace it with scar tissue. If the tumour is bigger than about 4 cm, your doctor may do another treatment called embolization. This means a tube (catheter) is placed via the groin artery into the tumour to block the blood supply to the tumour with small plastic particles. This helps the treatment work better in larger tumours.

What are the risks?
The typical side effects of this treatment are pain at the puncture points and a minor fever. Sometimes, there will be a little blood in the urine. Some patients feel like they have a cold or flu. These symptoms can easily be managed with medications, including simple paracetamol, and normally go away within a few days.

Rare complications include skin burns or freezing, bleeding, and damage to the urine collecting system or nearby organs such as the bowel or the lung. These complications may require additional treatment or, very rarely, surgery. In patients with only one kidney, temporary renal (kidney) failure has been reported. Another rare complication is damage to the nerves of the abdominal wall, which may cause prolonged pain.

What should I expect after the procedure? What is the follow-up plan?
Most patients have some discomfort at the puncture site that may feel worse during physical activity. This side effect will go away quickly. After you are sent home, you can resume your regular diet and activity.
It is recommended to drink about two litres of water a day during the first few days after the treatment.

You should call your doctor if:

- You feel worsening abdominal pain (this could be caused by renal colic due to a clot blockage in the urinary tract)
- Your urine turns dark red
- You develop a fever of 38°C or higher
- You develop a draining wound at the puncture site
- You develop shortness of breath

In the weeks after the procedure, a blood test will be done to see if your renal function has changed. You will return for imaging with contrast-enhanced CT or an MRI scan 4-12 weeks after the procedure. After that, regular contrast-enhanced CT or MR imaging will be scheduled to monitor the treatment changes and to make sure a tumour does not come back in the same area.

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Venous stenting

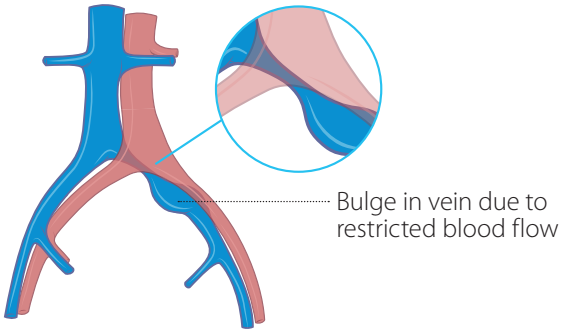
Our bodies have vessels called arteries which bring blood pumped from the heart to the rest of the body. The tubes that bring the blood back to the heart are called veins. Veins can become narrowed or blocked for several reasons: a blood clot inside the vein, scarring in the wall of the vein, or something pressing on the vein. This compression is usually caused by a mass such as cancer or, less often, a neighbouring artery. Narrowing or blockage can also occur if a person has a long-term device in their chest veins such as a portacath or dialysis catheter.

When a vein becomes blocked, the blood from that part of the body can't drain away properly. This causes swelling, pressure, or even thrombosis, for example, in the legs, arms, face, or neck, depending on which vein is blocked. If the main vein in the chest (the superior vena cava) is blocked, in addition to a puffy face, you might develop voice hoarseness and shortness of breath. You might also see bulging veins on your chest and neck.

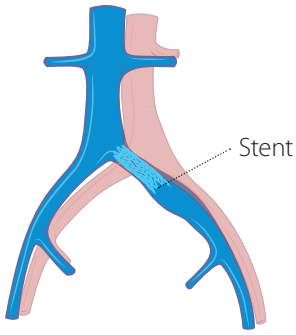
Your doctor or specialist may recommend a procedure called 'venous stenting'. This involves putting a wire mesh tube (stent) into the vein which opens it up, stops it from collapsing and allows the blood to flow normally from that part of the body back to the heart.

The stent is collapsed around a long thin tube called a catheter when it is being put into the vein, but is opened up when it is in the right position. The stent is put into the vein through a very small cut in the skin (using ultrasound to see the vein under the skin) and is guided to the right position using X-rays. The interventional radiologist performing the procedure will make sure that you don't get any more X-rays than are necessary.

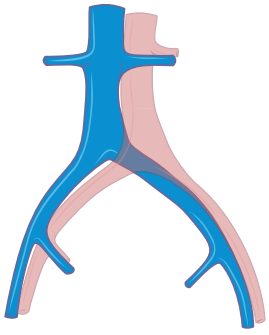
What are the benefits of venous stenting?
The benefits can be seen rapidly, usually immediately or within the first 12 to 24 hours after the procedure. If the main vein in the chest (superior vena cava) is being treated, the puffiness of the face, hoarseness of voice, difficult breathing, and arm swelling will get better quickly. If the main vein in the abdomen (inferior vena cava) or the big veins in the pelvis (iliac veins) are being treated, the leg swelling, heaviness, and difficulty walking caused by the swelling will get better quickly.



A. Venous narrowing due to compression by artery



B. Stent inserted to widen the narrowed vein and enable blood flow



C. Widened vein and normal blood flow post stenting

** These images show a stent placed in a common iliac vein stenosis. Stents can be placed in other parts of the body, depending on your condition and symptoms.*

How do I prepare for the procedure?
Some hospitals will ask you to take a shower just before the procedure. You may be asked to shave your groin. You will need to let the nurses and doctors know about any allergies you have, especially if you are allergic to contrast – the liquid that your interventional radiologist injects into your veins to see them on the screen. You will be put on blood thinners (anticoagulants) before the procedure and will usually continue taking them until after the procedure. It is a good idea to speak to the treating doctor or someone from their team if you do not fully understand the instructions.

The procedure
You will be placed on your back, or sometimes on your belly, on an X-ray table. The procedure will be performed either under local anaesthesia with painkillers or under sedation. If the vein has been blocked for a long time, you may receive general anaesthetic. A tiny incision (around 5 mm) will be made either in the arm, the groin, or the calf, depending on which vein is being treated. A small tube called a sheath will be placed into the vein under the incision. Everything else that is used for the procedure – the wires, stent and balloon, will be passed through this tube, which makes the procedure more comfortable for you.

If there are blood clots, they will be removed by sucking them out through this tube before the stent is placed. If clots need to be removed, this adds time to the procedure, which might then last up to two hours.
To put the stent in, the interventional radiologist must first pass a metallic wire across the blockage. The doctor then slides the collapsed stent over the wire and guides it to the blockage. When the stent is in the right place, it is opened. This opening is often helped by sliding a small balloon into place and inflating it inside the stent to open the stent completely and stick it to walls of the vein. Once this has been done, the doctor will take more pictures to show that the stented vein is now open and that the blood is now flowing freely. Any tubes going through your skin will then be removed so that the only thing left behind is the stent.

What are the risks?
There is a possibility that your doctor will not be able to get the wire through the blockage and might need to try again later. There is a possibility of causing a tear of the vein which could lead to internal bleeding. If this happens, the bleeding can be controlled by sliding a balloon into position and inflating it for a few minutes. You may need a blood transfusion. After the procedure, the stent may become blocked and need to be unblocked. Any of these events may increase the time you spend in hospital.

What should I expect after the procedure? What is the follow-up plan?
Your symptoms should get better quickly. You will be asked to keep the treated leg or arm straight for an hour or so after the procedure and you will be advised not to lift anything heavy for 48 hours. You will be put on blood thinners for six months or more. Your doctor will check that the stent is fully open and working well by doing a CT scan sometime after the procedure. It is important to note that if the symptoms come back, there is a possibility that your stent is blocked and you should contact your doctor immediatly.

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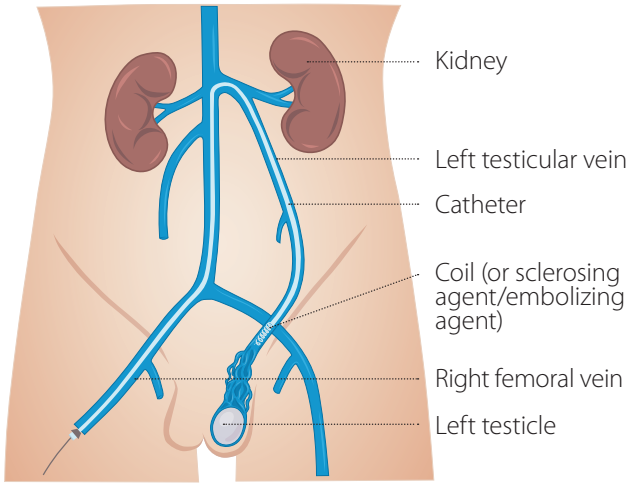
Venous embolization for varicocele

Veins are the blood vessels that bring blood from a part of the body back to the heart. Veins have valves that make sure that the blood keeps moving towards the heart. If the valves don't work properly, the blood sits in the vein and makes it bulge, like varicose veins in the leg.

If the valves in the veins of the scrotum (the sac containing the testes) do not work properly, the blood doesn't flow out of the veins normally and causes them to become bigger and bulge under the skin. Many men report that this makes the scrotum feel like a bag of worms.

Medically, these bulging veins are called varicoceles. Some men with varicoceles feel a dull ache in the scrotum that gets worse when standing. Varicoceles can also decrease the quality of a man's sperm and increase the chances of him being infertile.



Varicocele

What are the benefits of venous embolization for varicoceles?
Varicocele embolization is a minimally invasive treatment that avoids open surgery. Embolization also offers quicker recovery times, with most patients returning to normal activities within a few hours or days. The procedure can relieve symptoms such as pain or discomfort caused by the varicoceles and can also improve fertility.

How do I prepare for the procedure?
To prepare for varicocele embolization, it is important to tell your doctor about any allergies and to follow your doctor's instructions about eating and drinking, as you may need to fast before the procedure. Inform your doctor about any medications you are taking, especially blood thinners, as these may need to be stopped for a short time beforehand.

The procedure
The varicocele embolization procedure will block the abnormal veins and relieve your symptoms. The interventional radiologist will numb your skin with local anaesthetic and will then pass a tiny tube called a catheter into a vein in the arm, neck, or upper thigh. X-rays will help the interventional radiologist to guide the tube into the veins coming from the scrotum. X-ray contrast (dye) will be injected to show the veins clearly on screen. The clinician will then block the veins with coils, foam, or other materials that are put in through the same tiny tube.

When the procedure is done, the interventional radiologist will remove the catheter and a small dressing will be put on the puncture site. In total, the procedure usually takes around an hour or less to complete.

You should be able to return home within 2 to 4 hours after the procedure. You will be advised not to do anything that takes a lot of effort, like heavy lifting, for two days, after which you will be able to return to your normal activities. Your doctor may ask you not to have sex for 2-3 weeks. You may feel some discomfort for a few days after the procedure, but this should be minor.

What are the risks?
Varicocele embolization is generally a safe and effective procedure when performed by a fully trained specialist; however, like any medical treatment, there are some risks.

Less than 4 out of 100 patients who undergo the procedure will have minor bleeding, minor infections, or temporary pain or swelling in the scrotum or testes. In very rare cases, the glue or coils may move to other areas of the body. If this happens, the interventional radiologist will try to remove them from the other part of the body.

Always follow your doctor's advice and let them know if you have concerns or unusual symptoms after the procedure.

What is the follow-up plan?
After varicocele embolization, your follow-up plan will probably include a clinic visit and an ultrasound to assess your recovery and to make sure that the procedure was successful.

Varicoceles can come back in 5-10% of patients even after a successful embolization. This is similar to the number that return after surgical procedures. If the varicocele does come back, embolization can be repeated.

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Venous embolization for pelvic congestion syndrome

Pelvic congestion syndrome (PCS) is a common cause of chronic pelvic pain which affects around 10 million women world-wide. The pain is usually worse when standing, during sexual intercourse, or during menstrual periods. Lower limb pain may also occur.

Patients with PCS have chronic pelvic and lower back pain lasting for more than six months which happens because of a dilation of the ovarian veins in the pelvis and around the womb. These veins do not drain the blood normally and so the blood 'pools' in the pelvis giving the person a heavy, painful sensation.

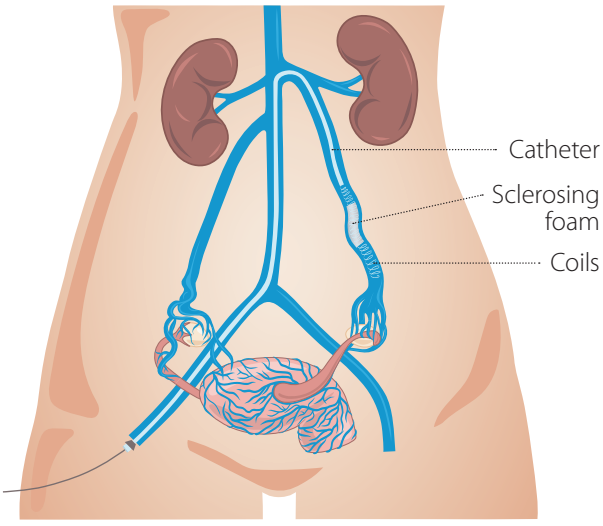
What are the benefits of venous embolization for PCS?
The dilated veins can be closed by a procedure called embolization which blocks the dilated blood vessels and causes them to shrink back to normal size, resulting in an improvement of the back and pelvic pain, including the pain felt during sexual intercourse.

How do I prepare for the procedure?
Pelvic vein embolization is a minimally invasive, outpatient procedure performed through a tiny cut in the skin. The procedure lasts between 60 and 90 minutes.

The procedure is performed under sterile conditions, meaning your skin will be sterilized and the area covered with surgical drapes. Local anaesthesia will be given to the skin in the groin, arm or neck, depending on where the interventional radiologist will introduce the catheter. Once the skin is numb, the vein beneath the skin is punctured using ultrasound to see the vein clearly. From your perspective, it will feel like having a blood sample taken.

The procedure
A thin long tube called a catheter (like a long hollow piece of spaghetti) is put through the skin into the vein and guided to the ovarian and pelvic veins using X-rays.

Once the tube is in the ovarian vein, a liquid that can be seen on X-rays is injected into the vein and pictures will be taken. At that time, you will be asked to contract your stomach muscles and push like you were passing a bowel motion.



If the pictures confirm the diagnosis, the ovarian veins will be blocked. Different types of materials are used for this treatment, including coils (like tiny springs) or liquids which turn solid in the vein.

More pictures will then be taken to confirm that the vein is successfully blocked and that the procedure has been a success.

Immediately afterwards, the catheter will be removed. The interventional radiologist or nurse will press on the puncture site for five minutes. Once there is no sign of bleeding, a small dressing will be applied.

What are the risks?
Only 2-3% of patients will experience complications from this procedure which are usually minor (bleeding or infection).

Even though it is very rare, the most important risk during the procedure is unplanned movement of the blocking material from the ovarian vein through the circulation to one of the blood vessels in the lung. Rest assured that your doctor will take every precaution to prevent and minimize this risk.

The symptoms of PCS may return in 10 to 40% of cases. If this happens, the procedure can be repeated.

What should I expect after the procedure? What is the follow-up plan?
Depending on the puncture site, a two to six hour period of resting in bed will be recommended.

During the first five to seven days after the procedure, you may feel pelvic discomfort or more pain than usual. This is due to the body's inflammatory reaction around the pelvic veins. This pain usually does not last for very long, and anti-inflammatory and painkiller medications will help a lot.

During the first week after the procedure, you will be asked to rest and avoid sexual relations, gym exercise, and carrying heavy weights. After the first week you can gradually increase your activity to normal levels.

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