A Brief Guide – Treatment and Prevention

Deep Vein Thrombosis and Pulmonary Embolism

02/21

Dear reader,

This brochure provides you with information about deep vein thrombosis and pulmonary embolism. This can occur when blood components, known as platelets, clump together and form a blood clot, i.e. a thrombus. These thrombi can develop in any part of our blood vessel system. This frequently occurs in the leg or pelvic veins, and a deep vein or pelvic vein thrombosis develops. The blood clots can be transported from these veins to the lungs via the bloodstream and trigger a pulmonary embolism.

The following pages explain why deep vein thromboses and pulmonary embolism are serious health issues, which risk factors exist and how the disorders can be treated. The brochure also provides detailed information on the prevention of deep vein thrombosis and pulmonary embolism.

Happy reading!

The brochure is intended to provide information about thrombosis and pulmonary embolism, but is no substitute for consulting your doctor.

Deep Vein Thrombosis

The word thrombosis comes from the ancient Greek word "thrombós", which can be translated as "plug".

When thrombosis occurs, blood components actually clump together, thereby forming a blood clot (thrombus), i.e. a sort of plug in a blood vessel. The thrombus can constrict or even totally block the blood vessel in question. As a result, the blood flow at this site is restricted or even cut off completely. The thrombus frequently develops in the deep leg and pelvic veins; for this reason, it is also referred to as a deep leg vein thrombosis or, more generally, a deep vein thrombosis, abbreviated to DVT.

There are several possible causes. The Berlin pathologist Rudolph Virchow realized this more than 150 years ago.

He described three factors that favor the formation of a deep vein thrombosis:

- a change in the blood stream with a **slowing of the blood flow**,
- **damage to the vessel wall** and
- an **alteration in the composition of the blood.**

These three factors, which are also known as Virchow's triad, can act alone or together and cause a thrombus to form.

Thromboses are not in any way rare. It is estimated that every year 250,000 people in Germany develop a deep vein thrombosis and approximately every 10th death in Europe is due to a deep vein thrombosis and/or a pulmonary embolism.

Possible Consequences of a Thrombosis

Deep vein thromboses are feared primarily due to the increased risk of complications and, in particular, due to the risk of developing a pulmonary embolism.

In addition, a chronic venous blood drainage disorder (chronic venous insufficiency) can develop and lead to what is known as a post-thrombotic syndrome. This complication occurs primarily following thromboses in the thigh and is the result of damage to venous valves. It can lead to impaired venous return, potentially resulting in permanent swelling of the foot or leg, which is usually associated with a feeling of tightness and heaviness. In addition, the skin on the inner ankle in particular can turn a brownish color and scarring may occur. In severe cases, a leg ulcer can develop, which tends to follow a chronic course and is difficult to treat.

Symptoms of a Deep Vein Thrombosis

Early diagnosis and treatment of a deep vein thrombosis is very important, primarily due to the possible complications and, in particular, the risk of pulmonary embolism. However, it can be difficult for sufferers to recognize the condition, since the symptoms are sometimes very varied. They can occur individually or in combination with one another. Due to the risk of complications, the general rule applies that, in case of any doubt, it is essential to consult a doctor and have the potential presence of a venous thrombosis investigated.

The following symptoms may be signs of thrombosis:

- Dragging pain and tenderness of the calf, back of the knee or groin
- Increased pain when applying pressure to the calf muscles or when flexing the foot
- Swelling of the leg to the extent that it differs in circumference from the other leg
- Shiny, bluish or purple discoloration of the affected leg
- Increased warmth of the affected leg to the extent that there is a noticeable difference in temperature compared to the other leg
- Increased emergence and visibility of the veins on the surface
- Pain when applying pressure to the sole of the foot

However, many thromboses go unnoticed, as they can also occur without symptoms (asymptomatic thrombosis).

Diagnostic Options

In the event of a suspected thrombosis, doctors can establish whether a blood clot has formed using the following examinations:

1. Compression ultrasound
This is an ultrasound examination in which the doctor presses on the vein with a probe to check whether it is "free" or whether there is a thrombosis.

2. Color Doppler ultrasound
In this procedure, the blood stream is visualized in color by means of ultrasound to identify potential disturbances.

3. D-dimer test
Blood tests are used to screen for D-dimers – specific substances in the blood that are formed when blood clots develop.

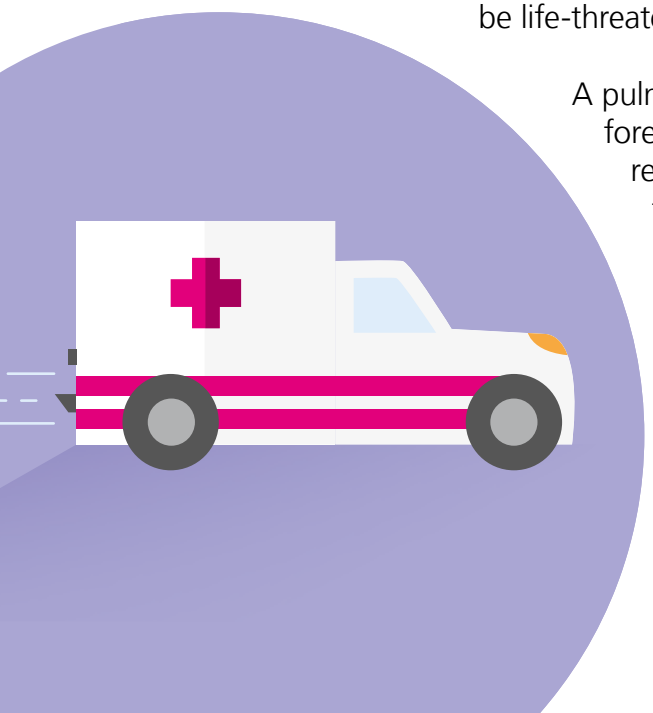
4. Phlebography
This method involves injecting an X-ray contrast agent into the back of the foot and following its distribution through the venous system by means of X-ray. The procedure is only rarely used nowadays.

Pulmonary Embolism – an Emergency

A pulmonary embolism involves a partial or complete blockage of a pulmonary artery by a foreign body. Most cases are due to a thrombus that becomes dislodged from the region of the leg or pelvic veins and reaches the pulmonary artery via the blood-stream. The blood clot is then referred to as an "embolus".

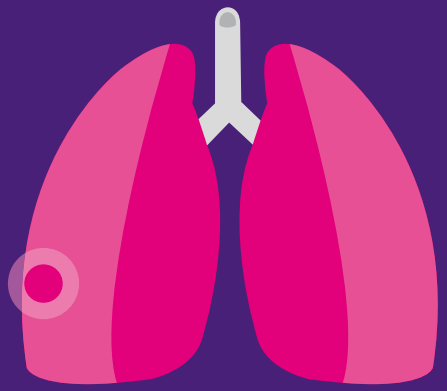
In the lung, the blood clot can block a vessel. The result is a backlog of blood to the heart, which often manifests itself in acute breathlessness and an accelerated pulse rate. The symptoms depend on the extent of the embolism.

If only a very small branch of the pulmonary artery is affected, the pulmonary embolism may also follow a clinically silent course, in which case the patient has no signs of illness. A persistent blockage of a main trunk of the pulmonary arteries, however, can be life-threatening.



A pulmonary embolism is therefore a medical emergency and requires the person affected to be hospitalized immediately. In addition, every effort must be made to prevent a further pulmonary embolism.

Possible Consequences of a Pulmonary Embolism



A pulmonary embolism can lead to acute heart failure; there is therefore an acute danger to life.

Pulmonary embolisms are the third most common cause of death in the field of cardiovascular diseases – after heart attacks and strokes. It is estimated that in Germany alone, around 40,000 people die each year from the consequences of a pulmonary embolism. For this reason, the emergency services must always be contacted if this condition is suspected.

Once the acute danger has passed, long-term complications, such as pulmonary hypertension, may arise if the clot has not totally dissolved. This chronic thromboembolic pulmonary hypertension (CTEPH) is also a long-term life-threatening condition.

Symptoms of Pulmonary Embolism

Signs of a possible pulmonary embolism should be taken very seriously due to the possible consequences of the condition. Symptoms include:

- Breathlessness
- Chest pain
- Syncope (fainting)
- Fever
- Cough and/or bloody sputum

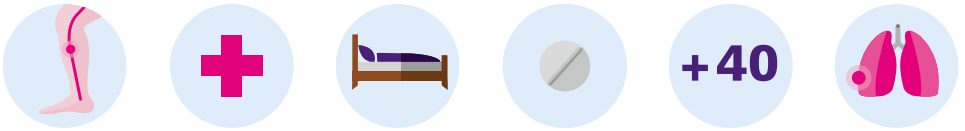
The symptoms depend on the size of the blood clot and its location in the lungs.

Diagnostic Options

Various examinations can be performed to diagnose a pulmonary embolism, such as:

- An X-ray of the chest, an ECG and a blood gas analysis
- Computed tomography
- Lung scintigraphy
- Echocardiography, i. e. an ultrasound of the heart
- Determination of D-dimers in the blood

Risk Factors for Deep Vein Thrombosis and Pulmonary Embolism



There are a variety of factors and situations that can promote the development of a thrombosis and/or pulmonary embolism. Known risk factors are:

- Venous insufficiency and varicose veins
- Major surgery and severe injuries
- Cancer
- Long-term confinement to bed or general immobilization of the legs
- Pregnancy and childbirth
- Taking the contraceptive pill or taking hormone preparations during menopause
- Congenital or acquired blood clotting disorders
- Obesity
- Age over 40 years
- A history of thromboses and/or embolisms in the family

Treatment of Thromboses and Pulmonary Embolisms

The treatment of thrombosis or pulmonary embolism involves alleviating sufferers' symptoms and, in particular, averting the development of secondary complications. In addition, every possible measure must be taken to prevent the recurrence of a thrombosis or pulmonary embolism.

Compression therapy: For both acute and chronic deep leg and pelvic vein thrombosis, compression therapy must be used to support the legs in their function. Compression therapy should be initiated as early as possible. It is designed to relieve the symptoms and to reduce the swelling in the legs. In addition, the frequency and severity of post-thrombotic syndrome can be significantly reduced.

Thrombolysis: In the event of a thrombosis or a pulmonary embolism, an attempt can be made to dissolve the thrombus by means of medicinal treatment with enzymes, which are administered as an infusion. The procedure is known as thrombolysis. It is not used regularly and in practice is only employed in emergency situations, not least because the substances in question are associated with a high risk of bleeding.

Thrombectomy: In addition to medicinal dissolution (thrombolysis), there is also the possibility of removing the clot mechanically via a catheter. The procedure is known as thrombectomy. The catheter is usually advanced through a small incision in the groin into the blood vessel to remove as much of the thrombus as possible from the blood vessel and thereby allowing the blood to flow again unhindered. Thrombectomy is also reserved for special emergency situations.

Anticoagulation: The first and most important measure in the treatment of thrombosis involves the inhibition of blood clotting (anticoagulation) by administering blood-thinning medications (anticoagulants). These are intended to prevent the progression of the thrombosis and its consequences. Treatment is continued for a period of several months to prevent the recurrence of thromboses.

Anticoagulation – Medicinal Therapy

If a thrombosis or pulmonary embolism is present, the acute treatment is adapted to the severity of the condition and often, in the case of a pulmonary embolism, primarily involves stabilizing the patient's situation and eliminating the risk to life.

Separately from this, anticoagulant medications are used to try to dissolve the thrombus or embolus. Treatment with anticoagulants is then continued for several months to prevent the recurrence of thrombi and/or embolisms. Anticoagulants are active substances that reduce the tendency of blood cells to clot. They make the blood less thick and prevent blood cells from clumping together and thereby forming blood clots.

Heparin and vitamin K antagonists

Anticoagulation is possible with various active substances. The most well-known example is probably heparin, which is injected under the skin (subcutaneously). It is often used for a couple of days immediately after surgery. The treatment often used to overlap with the administration of what are known as vitamin K antagonists (better known as Marcumar®), as these active substances require a few days to exert their full effect. Treatment with vitamin K antagonists is then continued for several months. As well as requiring the tablets to be taken regularly, it requires blood tests to monitor blood clotting. This is because the action of the substances not only differs on a case-by-case basis but can also be affected by a number of factors. These include taking other medications (potentially including over-the-counter medications) as well as the consumption of foods with a high vitamin K content such as spinach leaves, cauliflower, beans, broccoli, lentils, red cabbage and many others. With vitamin K antagonists, regular blood tests – and, where necessary, adjustment of the dose of the active substance – are required to ensure a high degree of efficacy but without unduly increasing the risk of bleeding.

NOACs – modern anticoagulants

More recent anticoagulants known as NOACs (non-vitamin K antagonist oral anticoagulants) offer an alternative. This term refers to substances that reduce the clotting of the blood independently of vitamin K by inhibiting a specific enzyme in the clotting cascade. The active substances exert their effect very rapidly, with the result that overlapping heparin injections are not necessary. Treatment with a NOAC also does not require any routine monitoring of blood clotting and there are few if any interactions with other medications and no dietary restrictions. The medications are also taken as tablets and in some cases, it is sufficient to take a single daily tablet to obtain effective protection. In this way, medicinal thrombosis prevention can be achieved in a simple and straightforward manner in everyday life.

About Bleeding

One inevitable side effect of anticoagulation is that the tendency to bleed is somewhat increased. This applies to all anticoagulants and is directly attributed to the mechanism of action of these substances.

This should not cause an excessive fear of bleeding, though, as anticoagulants do not inhibit blood clotting, but only slow it down.

As a result, bleeding can occur more easily, for example nosebleeds or gum bleeds. Furthermore, bleeding from injuries may be somewhat heavier than before. If bleeding does occur, this will be treated as in any other case.

Nevertheless, it is advisable to carry an appropriate patient passport with you at all times. That way, in case of an emergency situation like a major injury or accident, the doctor is immediately informed that you are taking an anticoagulant.

General Preventive Measures

Apart from taking an anticoagulant, there are general options for preventing thromboses.

Here are a few tips:

- **The following mnemonic applies: SSB-BSS**
  Sitting and **S**tanding is **B**ad – **B**etter **S**tretch out or **S**troll
- Regular physical activity is important and walking, hiking, swimming and cycling represent beneficial forms of exercise in terms of thrombosis prevention.
- Excess weight should be reduced, as one of its effects is to put stress on the veins.

During prolonged periods of immobility, for example during long-haul flights or a long car journey, the following actions are recommended:

Exercises to activate the muscle-vein pump.

Ask in your doctor which exercises can help you.

Any Questions?

The brochure provides only a brief overview of topics regarding deep vein thromboses and pulmonary embolism. It cannot, and is not in any way intended to, replace the conversation with your doctor. This is important because the doctor can assess your individual situation and choose the treatment that is best for you.

However, the information provided is intended to help you take the risk of thrombosis and pulmonary embolism seriously, to recognize a developing thrombosis yourself and to encourage you to apply the possible preventive measures consistently.

If you have any further questions, please ask your doctor. There is also the option of calling our hotline free of charge or visiting our website.

0800-927 35 86 (8 a.m. to 6 p.m. on workdays)

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