A Practical Guide –
Treatment and Prevention:
Deep vein thrombosis and pulmonary embolism
You have opened this brochure because your doctor has diagnosed you with a deep vein thrombosis or pulmonary embolism or you have been prescribed a thrombosis prophylaxis due to a knee or hip joint replacement surgery. Or maybe somebody close to you is ill and you want to learn more about the condition.

Thromboses are blood clots that can generally form in any blood vessel. The deep veins of the leg and pelvis are most commonly affected.

The primary purpose of this brochure is to inform you of the risks associated with a deep vein thrombosis or pulmonary embolism. The brochure also explains how you can actively protect yourself with the help of your doctor.

The prospects for preventing and treating thromboses and pulmonary embolisms are good today. This brochure provides an initial overview, but can never replace a personal conversation with your doctor!

Of course, more information is also available to you on the Internet at: www.gegen-thrombose.de
What is a thrombosis or pulmonary embolism?

The word “thrombosis” is a medical term already heard of by most. The term derives from the ancient Greek word “thrombós” meaning “clot”. Thrombosis is defined as the occlusion of a blood vessel due to a blood clot (thrombus). The deep veins of the leg and pelvis are most commonly affected. One of the most dangerous consequences of thrombosis is a pulmonary embolism.

Thromboses that most frequently occur in leg veins can damage the tissue of the affected leg. The blood clot can also break free and travel with the bloodstream. A pulmonary embolism occurs when the clot reaches the lungs and blocks a blood vessel. This is a life-threatening complication that can have serious health consequences. Preventing pulmonary embolisms therefore has the highest priority for doctors.

There are situations in which the risk of suffering a thrombosis is particularly high. In these situations, a thrombosis prophylaxis is recommended. Patients with an acute thrombosis or pulmonary embolism must be treated immediately.

Learn more about risk factors and pulmonary embolisms in the section “What are the risk factors?” or in “What are the consequences of a thrombosis?”
Healthy venous valves and muscular pump are of great importance

The venous valves and muscular pump support the return flow of blood through the veins of the legs. The venous valves are pocket-like protuberances of the inner wall of the vessel that function as a kind of non-return valve. They allow blood to flow in one direction only, namely back to the heart. The venous valve system is supported by the muscular pump. When the muscular structures of the feet and legs contract, pressure is exerted on the veins and the blood is squeezed back towards the heart. Movements of the muscle therefore support the venous blood stream.

Many travelers are familiar with swelling of the legs during a long flight – the muscular pump is affected by sitting for long periods of time. Improvement occurs when you get up and move – the muscular pump is activated again.

Three main factors contribute to the formation of thrombosis:

• Slowing of blood flow (e.g., immobilizing bandages, confinement to bed)
• Injuries of the vessel wall (e.g., during surgery)
• Changes in the blood

You can learn more about the risks factors in the section “What are the risk factors?”

Coagulation protects the body

Blood clots are caused when blood coagulates. It’s something we’re all familiar with, such as when you get a small cut: the wound stops bleeding quickly because the blood coagulates and a protective crust forms. The wound heals. However, the coagulation that is so important for healing can lead to serious complications when it occurs within a blood vessel. Blood clots that form in blood vessels can travel to the lungs and cause a pulmonary embolism.

How do thromboses develop?

Blood clotting ensures that wounds heal.
What are the risk factors?

Stay a step ahead of the condition by knowing your risks!
- Venous weakness / pre-existing varicose veins
- Major surgery or serious injury
- Cancer
- Longer bed rest or immobilization
- Pregnancy and confinement
- Certain types of medication (e.g., birth control pills, hormone replacement therapy in menopause)
- Congenital or acquired bleeding disorders
- Overweight
- Age over 40 years
- History of thromboses / embolisms in the family

Major surgery on the legs
Major orthopedic surgeries on the legs, such as hip or knee replacement, represent a high risk with regard to thrombosis. For one thing, these are major surgical interventions and for another, they are followed by a phase of limited mobility.
How can deep vein thrombosis be identified?

Identifying symptoms yourself

The following symptoms can be a sign of deep vein thrombosis. Please contact your doctor if you notice one or more of these symptoms:

- **Swollen legs with a feeling of heaviness and/or tension.** In rare cases, both legs are affected.
- **Pain** may also occur. This usually feels like sore muscles. The calf and/or thigh muscles are often tender to the touch and there may be foot pain.
- **Warmth or blue coloration** of the skin on the drooping leg. Unfortunately, many thromboses go unnoticed because there are often no symptoms (asymptomatic thrombosis).

Learn more about the risks factors in the section “What are the risk factors?”

Diagnostic options for doctors

If thrombosis is suspected, doctors can use the following tests to determine if a blood clot has formed:

- **Compression sonography:** This ultrasound examination is used most frequently. Using an ultrasonic probe, the doctor presses on the vein and checks if it is “open” or if there is a thrombosis.
- **Color doppler sonography:** This is also an ultrasound procedure. The flow of blood is displayed in color.
- **Computed tomography and magnetic resonance imaging** can also be used.
- **D-dimers** are degradation products present in the blood after a blood clot. They can be detected in the blood (laboratory test).
- **Phlebography:** This method is used to depict the course of the vessel and flow conditions. Contrast medium is injected into a vein on the back of the foot. This method is rarely used.

Questions are best clarified in a personal conversation with your doctor.
Pulmonary embolism
A pulmonary embolism is one consequence of a thrombosis that is most dangerous because it can be fatal. In Germany, approx. 40,000 people die each year due to a pulmonary embolism. The risk of an embolism can be minimized by adhering to thrombosis prophylaxis or reacting to the signs of a thrombosis (section “How can deep venous thrombosis be identified?”). However, if a pulmonary embolism occurs, immediate action is required.

Symptoms of a pulmonary embolism
- Accelerated pulse,
  racing heart,
  anxiety,
  sweating
- Shortness of breath
- Drop in blood pressure
- Pain in the chest area
- Cough (possible expectoration of blood)
- State of shock
- Fever

If you are well informed, you can react quickly in case of emergency.

Respiratory function can be impaired in the event of a pulmonary embolism.

1 d’Konstantinides S., Klinikarzt 2012, 41: 396-401
To diagnose a pulmonary embolism, various tests are carried out, including:

- Chest X-rays, ECG and blood gas analysis
- Compression sonography
- Computed tomography and magnetic resonance imaging
- Test for D-dimers
- Pulmonary scintigraphy
- Echocardiography

The doctor decides which of these test methods is used in the respective case. Since a pulmonary embolism is a very serious clinical condition it must be treated immediately.

- **Pulmonary scintigraphy**: This procedure can be used to test pulmonary blood flow and ventilation. The results can then be used to diagnose a possible pulmonary embolism.
- **Echocardiography**: This heart ultrasound examination is a routine method of diagnosing heart diseases. The graphic representation of the heart action can be used, among other things, to identify pathological changes or damage.

Learn more about treatment on page 17.

**Symptoms of a pulmonary embolism**

Due to nonspecific symptoms, identifying a pulmonary embolism can be difficult. However, patients often express symptoms such as difficulty breathing, chest pain, syncope (fainting), fever, cough and/or bloody discharge. The symptoms usually depend on the size of the clot (embolism) and personal health.
What are the consequences of a pulmonary embolism?
The size of the blood clot and the personal health of the patient play an important role in the further course of a pulmonary embolism. If the blood clot is not completely dissolved, the condition can evolve into a chronic stage, so-called chronic thromboembolic pulmonary hypertension. This is an increase in blood pressure in the pulmonary circulation that can lead to heart failure.

Treatment of deep vein thrombosis and pulmonary embolism: What are the options?

Treatment of an existing thrombosis
The treatment of an existing thrombosis is mainly aimed at preventing complications, such as a pulmonary embolism.

Good therapeutic options are available today. Crucial for the success of treatment is, however, that you strictly keep to the therapy instructions.

Treatment of an existing pulmonary embolism
Patients must be taken to a hospital immediately in the event of a pulmonary embolism. Treatment usually consists of oxygen, pain medication and so-called anticoagulants.

Some patients also receive lysis therapy. Certain medicines are used to dissolve the blood clot causing the restriction. In exceptional cases, surgical treatment is also considered.
Prevention of deep vein thrombosis and pulmonary embolism: What are the options?

**Prevention following surgery: Injections or tablets provide protection**

Anyone who has had surgery in a hospital knows the process: After surgery, the nurse administers an injection. It is normally an injection of heparin, a blood thinner that prevents a thrombosis. After major surgeries, thrombosis prophylaxis is part of “basic clinical care”.

And for good reason: the risk of dangerous complications can be significantly reduced in this way. For some time now, there are therapies that can be taken as a tablet in addition to injection. These tablets are currently only administered after new hip or knee replacement surgery.

To ensure that the tablets have the right effect, it is very important that they are taken regularly and as instructed by the doctor.

**Prevention following surgery: Non-drug therapies**

As easy as it may seem: An important preventative measure is early mobilization, i.e., physical activity. Some patients may ask why they are encouraged to get up on the day after surgery. The aim of this measure is active thrombosis prophylaxis.

Other important measures include compression dressings or rather wearing compression stockings. The external pressure (compression) that dressings or stockings exert supports the muscular pump. Even if regarded as annoying or uncomfortable, compression stockings are a helpful tool in preventing and treating thromboses.

Your doctor will decide on the nature and duration of further measures.

**Compression therapy**

Compression stockings and venous dressings ensure that venous valves close and blood circulation starts again. Compression therapy can prevent the development of post-thrombotic syndrome.
Prevention and treatment of deep vein thrombosis and pulmonary embolism: What medications are available?

For more than 80 years, blood thinners have been used for prevention and treatment of deep vein thromboses and pulmonary embolisms.

A brief overview:

**1930s**
- Heparins (injection/infusion)

**1950s**
- Vitamin K antagonists (tablets for oral administration)

**Early 1980s**
- Low-molecular weight heparins (injection)

**Late 1980s / 90s**
- Factor Xa inhibitors block the coagulation factor Xa enzyme.
- Thrombin inhibitors coagulation enzyme thrombin (factor IIa).

**Since 2008**
- Natural / synthetic indirect Xa inhibitors (injection)
- Direct thrombin inhibitors (injection/infusion)
- Direct Xa inhibitors (tablets for oral administration)
- Direct thrombin inhibitors (Capsules for oral administration)

Conclusion: In addition to heparins and vitamin K antagonists, two new active substance classes are used today that “block” certain coagulation factors in the blood (factor Xa inhibitors and thrombin inhibitors).

What are coumarins (vitamin K antagonists)?

Besides a regular pill regimen, therapy with vitamin K antagonists requires continuous monitoring of the blood clotting status, reflected in the INR values (international normalized ratio), formerly Quick values. The doctor decides individually what therapy is best suited for the patient after careful consideration of the benefits and risks.

To achieve a protective effect, an INR of 2 - 3 is the goal. If clotting is inhibited more, the risk of bleeding increases. If coagulation is inhibited less, the risk of thrombosis goes up. To prevent both, INR values are regularly checked. Everyone reacts differently to vitamin K antagonists, requiring individual dosing.
Coumarins – Important to know!

There are some factors that influence the effect of vitamin K antagonists that must be taken into account:

- Taking several medications
- Food with a high vitamin K content such as: Green lettuce, cauliflower, beans, broccoli, parsley, endive, lamb’s lettuce, lentils, chard, leeks, Brussels sprouts, red cabbage, sorrel, chives, spinach, savoy cabbage, onions, etc.
- Lifestyle habits such as: Smoking, alcohol or dietary supplements.

Conclusion: Therapy with vitamin K antagonists provides protection, but requires significant effort and a high degree of discipline.

Treatment of deep vein thrombosis and pulmonary embolism: What medications are available?

Direct oral factor Xa inhibitors and direct thrombin inhibitors

There are effective alternatives to vitamin K antagonists for treating thromboses and pulmonary embolisms.

They have already proven their anticoagulant effect in the treatment of other conditions. For both therapies, routine monitoring for clotting is no longer necessary. This is a medical advance requiring less effort and making everyday life much easier for patients. There are also no food restrictions and hardly any interactions with other drugs.

Both therapies have different dosing schedules and a different mechanism of action.

The factor Xa inhibitor blocks an enzyme that plays a central role in clotting. The thrombin inhibitor blocks thrombin.

Please talk to your doctor about the therapy option best suited for you.
What can you do yourself?

There are some basic rules in preventing a thrombosis and lowering the risk of a pulmonary embolism:

Find below important recommendations for actively counteracting the formation of leg vein thromboses.

• Follow the mnemonic **SSB-RLR**:
  - **S**tanding and **S**itting is **B**ad - **R**ather **L**ie or **R**un
• Exercise as often and regularly as possible. Running, walking, swimming or cycling are effective.
• Keep your weight under control because obesity is stressful on veins, but also the heart and circulation.

**Exercises for muscular venous pump activity**

After an injury or surgery, you should start moving as soon as possible. Active movement exercises help to activate the muscles and train the muscles and the veins in the legs. Movements of the muscles from the soles of the feet to the thighs support the veins in their effort to pump blood. This “muscular pump” is the most powerful driving force for your veins. The following generally applies even if a limb is bandaged or casted: Your other limbs can move!

1. Exercise: Bend and stretch your toes
   You are lying on your back, your arms loose beside the body, the tips of your toes pointing upwards. Now bend and stretch the tips of your toes. **15 repetitions.**

2. Exercise: Roll your heels and the tips of your toes
   Sit on a chair with your feet flat on the floor. Lift the tips of the toes of both feet and press your heels on the floor. Hold briefly, then roll both feet onto the tips of your toes with pressure and lift your heels. **15 repetitions.**

**Important:**
You can perform these exercises several times a day ... the more often, the better. Ask your doctor what other exercises can also help.
Additional questions?

This brochure provides just a brief insight into the topic of deep vein thrombosis and pulmonary embolism. It cannot replace a personal conversation with your doctor. Should you have other questions, please talk to your doctor – you also have the option of calling our toll-free Bayer Service number or visiting our web site at:

Toll-free Service number: 0800-927 35 86 (8 AM – 6 PM on workdays) www.gegen-thrombose.de
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