

# Understanding Deep Vein Thrombosis



*A Physician's Guide for the Patient*

# Understanding Deep Vein Thrombosis

## **Preface:**

You have just been diagnosed with a DVT (Deep Vein Thrombosis), but how much do you know about this condition and its treatment? DVT is a very common diagnosis, but not always well understood. When a patient learns he or she has a DVT, there is usually a lot to understand about the diagnosis and treatment. In some cases, there may be another medical condition also being treated such as cancer, recent surgery or an accident. In this hectic setting, questions and concerns can persist.

Drs. Jones and Boyle of Inovia Vein Specialty Center in Bend, Oregon, are experienced in the diagnosis and management of DVT. They have counseled numerous patients and their families about this condition. The purpose of this publication is to supplement what you and your family have already learned about DVT from your health care provider.

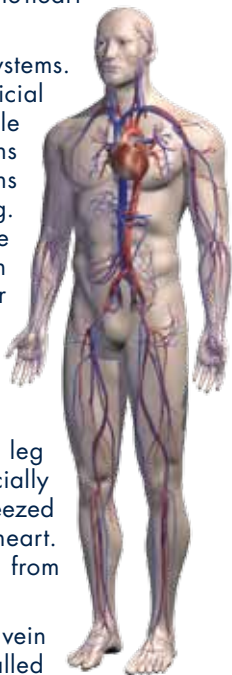
## The Function of the Circulatory System

The general function of the cardiovascular system (heart, lungs, and blood vessels) is transportation of nutrition and waste within the body. The heart pumps blood through arteries to supply oxygen and other nutrients throughout the body. Veins are needed to carry deoxygenated blood containing carbon dioxide and other waste products back to the heart and lungs.

The venous system consists of several systems. The veins next to the skin are called superficial veins, and the veins deep within the muscle are called deep veins. The superficial veins feed into the deep veins. The deep veins carry the majority of blood out of the leg. The venous system of the lower part of the body can be viewed as an upside down tree, with smaller branches joining larger and larger branches until they join the largest vein in the body—the Vena Cava—which is like the tree trunk.

Veins have a series of valves that open and close. As the leg muscles contract and relax, especially in the calf muscle, the veins in the legs are squeezed and blood is pushed up toward the heart. The valves in the veins keep the blood from flowing backward.

In addition to the superficial and deep vein systems, there are connecting veins called perforators and communicating veins. They differ by which veins they connect. For example, perforators connect a superficial vein to a deep vein and communicating veins connect vessels that are alike, e.g. superficial to superficial or deep to deep.



## What is a DVT?

DVT is an abbreviation that stands for Deep Vein Thrombosis. Simply put, it is a blood clot. If there is only one clot it is called a thrombus; if there are several clots they are called

# Understanding Deep Vein Thrombosis

thrombi. Blood clots occur in the larger deep veins and most commonly the deep veins of the legs, pelvis or arms. When a clot forms in a deep vein, it causes re-routing of the blood flow and a build up of pressure. When this happens, it can lead to swelling and can be painful because the blood flow to the heart is being blocked.

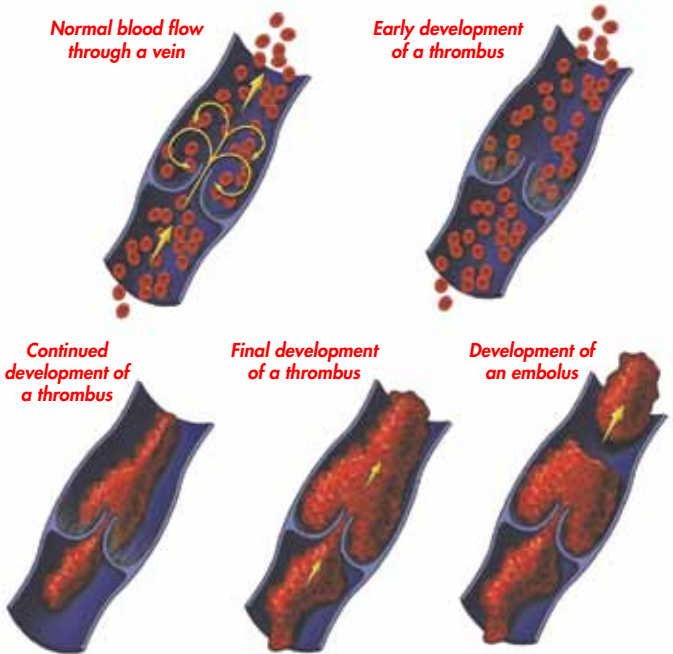


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## What causes DVT?

As you have learned, thrombosis means clot. There are a number of reasons why clots can form in the deep veins. Long ago it was recognized that clots form in veins for three basic reasons:(1) damage to the vein wall; (2) lack of blood movement (also called stasis), and; (3) an increased tendency to form a clot, known as hypercoagulability.

- Damage to the veins can happen in a number of settings, including recent surgeries, accidents, trauma, or injury.

- Stasis occurs when a person is immobilized for any number of reasons, including hospitalization, confinement in a nursing home or rehabilitation, sitting in an airplane or car for long periods of time without movement, or having your leg in a cast, as an example.
- Finally, and perhaps the least understood, is hypercoagulability. There are certain people who for one reason or another simply have a predisposition to form blood clots. Sometimes this is due to a genetic defect in which the body does not have the right balance of coagulation factors that either create or more likely, break down clot once it occurs.<sup>1</sup> In addition to genetic factors, some patients acquire a propensity to form clots. This is very common in some types of cancer and other diseases.

Due to a combination of these factors, a DVT is common after certain types of surgery, especially any operation in the abdomen, pelvis, and legs. This is especially true after orthopedic surgery where the DVT rate can be as high as 60% in some cases.<sup>2</sup> For this reason, there are a number of efforts undertaken to try to prevent DVT after surgery. These efforts, called DVT prophylaxis, include the use of low-dose injectable blood thinners, intermittent pneumatic compression devices (leg squeezers), compression stockings, and early ambulation (walking), all of which are designed to reduce the chance of a DVT at the time of surgery. Unfortunately, it is impossible to completely reduce the risk of DVT in all patients.

### **How Common is DVT?**

In the United States, approximately 2 million patients suffer from a DVT and approximately 600,000 will be hospitalized per year. Not all patients with DVT's are actually diagnosed, meaning many people have a DVT and don't even know it. Unfortunately, over 200,000 people die each year due to a complication of Deep Vein Thrombosis, known as a Pulmonary Embolism (PE).<sup>3</sup> A Pulmonary Embolism occurs when the clot, or a large piece of the clot, breaks free from the vein wall and travels toward the lungs and lodges in the pulmonary artery. This causes the blood flow to become obstructed. Amazingly, many of these deaths could be prevented. Pulmonary Embolism will be discussed in more detail later.

## Understanding Deep Vein Thrombosis

DVT is more common in individuals with risk factors. Common risk factors for DVT include surgery, hospitalization for acute (long-term) medical illness, nursing home confinement, trauma, active cancer, orthopedic surgery, auto immune disorders and any procedure in which a plastic catheter is inserted into the vein.

Women have an additional risk for developing a DVT. High estrogen states including oral contraceptives or hormone replacement therapy, and pregnancy are all significant risk factors to developing a DVT.<sup>4</sup> Studies show a PE is the leading cause of maternal death associated with childbirth. DVT has also been associated with long air plane flights, a condition termed the "economy class syndrome."<sup>5</sup>



*If a DVT is suspected, your physician will perform a thorough physical examination and order additional tests if necessary.*

### How Do I Know if I Have DVT and How is it Diagnosed?

The most common symptoms of DVT are pain in the calf, increasing with standing and walking as well as swelling of the lower leg. In general, the symptoms are constant in nature, meaning they do not come and go. Unfortunately, only about half of people with a DVT have a combination of the symptoms. Some patients have no symptoms at all.

When a DVT is suspected, the health care provider will take a thorough medical history and perform a physical examination including asking questions about any family history of blood clots or bleeding problems. A number of tests are available to check for a DVT. The most common exam performed is a vascular ultrasound. This is a non-invasive imaging study where ultrasound images are able to determine if there are blood clots in the leg veins.<sup>6</sup> It is a safe and accurate test. Sometimes it will be performed in conjunction with a blood test. In a few cases, more advanced imaging techniques such as Venography, CT scan or MRI are utilized to look at the deeper veins. In general, if you are concerned about the possibility of a blood clot in your leg, call your physician or seek immediate medical attention.



*Calf swelling, redness) and leg warmth are indications of a DVT*

### How is DVT Commonly Treated?

There are several common treatment options considered once DVT is diagnosed. In general, blood clots in larger veins, especially behind the knee, in the thigh and pelvis are normally treated with drugs sometimes commonly referred to as blood thinners. Whereas smaller clots, close to the ankles might not have blood thinners prescribed. This is a decision made between you and your health care provider.

## Understanding Deep Vein Thrombosis

Several types of blood thinners are commonly used. The first is an injectable low molecular weight heparin (LMWH), typically injected below the surface of the skin of the abdominal wall. It is used as the first medicine with a newly diagnosed blood clot because it quickly inhibits clot formation and works for a longer duration than regular heparin. In addition, an oral medication called Warfarin (such as Coumadin®) which is a pill taken by mouth may also be prescribed. It is less expensive than LMWH, but does require frequent blood tests to check the medication levels. Both of these medications have the risk of bleeding, and therefore are used with caution in patients that have bleeding tendencies or recent surgery or trauma. Your doctor and/or pharmacist will discuss this with you prior to starting the medications and advise you of the risks associated with each of these.

In some cases, when blood thinners cannot be utilized (due to risk of bleeding, for example after surgery or trauma), your physician will arrange for a small filter to be placed in to your Vena Cava to block any clot from traveling to the heart as an embolism. If the clot can be adequately managed with blood thinners, the filter is not necessary. The filters are temporary, and can be removed after a short period of time when they are no longer needed.

If a very large clot occurs in the leg or the pelvis, intravenous medications called thrombolytics occasionally are used to break up and dissolve the clot more quickly.<sup>7</sup> This is most effective shortly after the blood clot is diagnosed, but carries significant risk of bleeding so this is only utilized in a small minority of cases.

Since lack of mobility (stasis) is a contributing factor to clot formation, most patients are encouraged to be active rather than being advised to keep still or initiate bed rest. Patients being treated on an outpatient basis are advised to start wearing compression stockings immediately. Compression therapy leads to rapid relief of symptoms such as edema. Most patients can resume walking immediately and experience relief within 30 minutes. A minimum of 20–30 mmHg calf- or thigh-length stocking is typically prescribed. Wearing a stocking while ambulatory poses no additional risk as PE is no more frequent in ambulatory patients as compared with

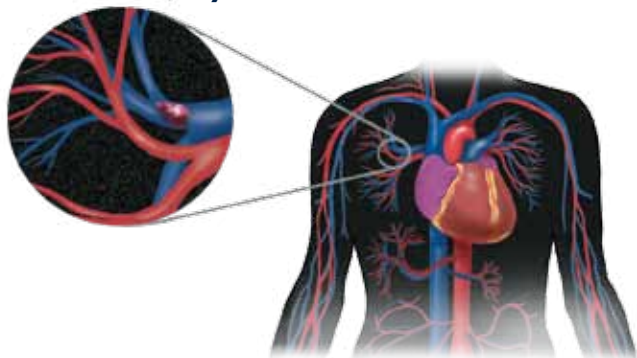
patients resting in bed.<sup>8</sup> This type of compression garment can be purchased at a durable medical equipment store, pharmacy, or directly from some medical practices, and it requires a prescription.

### Other Risks of a DVT?

One of the most dangerous complications of a DVT is that the clot (embolus) can break free in the vein and travel to the lungs. This is known as a Pulmonary Embolism, or what health care workers call a PE. A Pulmonary Embolism can be a fatal complication of a DVT. Please note that all PE's are not fatal. What determines the seriousness of a PE is the size of the clot and which pulmonary artery is blocked. Blocking blood flow in the lungs will cause heart failure. When you are diagnosed as having DVT, the doctor will often assess the risk by determining the size of the vein with the clot. Usually, the closer the vein is to the heart or lungs the bigger the vein, which in turn means potential for a larger clot. This increase in size increases the risk should an embolus break loose.

Occasionally, a pulmonary embolus is found when no DVT is noted in the legs. This can occur when the entire clot has broken off and traveled to the lung, or if the clot is coming from a source other than the legs, such as pelvic or the arm veins. A rare condition, known as a paradoxical embolus,

### Site of Pulmonary Embolus



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## Understanding Deep Vein Thrombosis

occurs when a small clot passes through a small hole that nearly 20% of all individuals have in their heart (the foramen ovale), which allows the clot to bypass the lungs and travel to the brain, causing a stroke.

The treatment for a PE will often require blood thinners and may require hospitalization. On a rare occasion, a surgical procedure may be required to remove the clot.

### What are the Long-Term Complications of DVT?

While most patients are aware of and fear the potential short-term complications of a DVT, few understand that blood clots in the veins of the legs can cause long-term problems. After the first episode of a DVT, most of the clot that blocks the vein will dissolve away (recanalize) within 2-3 months. This leads to long-term changes in the structure of the vein and in many cases, failure of the veins to function as conduits taking blood back up to the heart.<sup>10</sup> As stated earlier, clots can damage the valves causing reversal of blood flow in the veins. This valve damage results in high pressure in the lower leg and contributes to the development of chronic pain and swelling in the legs. These changes cause damage to the wall which increase the chance of developing another blood clot.<sup>11</sup> This condition is known as Post-Thrombotic Syndrome (PTS). Post-Thrombotic Syndrome varies from mild swelling to incapacitating swelling with pain and ulceration.<sup>12</sup> Up to 60% of patients with a history of DVT develop PTS; and about 10% of these people will have skin break down in the lower part of the leg, called a venous stasis ulcer.<sup>12</sup>

### How do Graduated Medical Compression Stockings Help After the Diagnosis of DVT?

Evidence suggests that the risk of Post Thrombotic Syndrome can be significantly reduced by the routine use of graduated medical compression stockings after a DVT.<sup>12</sup> Graduated compression stockings are, therefore, very important in the treatment of DVT. Ideally, a person with a new diagnosis of DVT should wear a graduated compression stockings immediately after the time of diagnosis. Wearing the stockings helps to minimize swelling and it can also improve the long-term health of the leg.

It is important that high-risk ambulatory patients wear true graduated compression stockings with a minimum compression level of 20-30 mmHg, as opposed to anti-embolic stockings (sometimes referred to as TED hose) which, depending on the manufacturer, deliver in the range of 8-18 mmHg. When a patient is up and walking, the pressure generated in the veins after a DVT can be significantly higher than when they are laying down. The primary difference between anti-embolic and graduated compression stockings is that anti-embolic are designed for a bed-ridden patient and graduated compression stockings are for patients who are able to walk and require a higher compression level to aid the venous blood flow, against the pull of gravity, back to the heart and lungs. The increased compression applied to the leg allows for better control of symptoms, especially swelling, aching and tiredness.

Graduated medical compression stockings should be worn for up to 2 years (or longer when the patient is at "high risk") after the time of diagnosis to help prevent or manage the symptoms of Post Thrombotic Syndrome. The stocking should be put on in the morning and taken off in the evening. It is important to remember that the elasticity in the compression stocking decreases over time, and therefore new stockings should be purchased every 4-6 months. Proper care can extend the life of the stockings.



### How Can I Prevent DVT?

In most cases, Deep Vein Thrombosis is a preventable disease. People undergoing surgery and in the hospital for an extended period of time may be at risk for developing blood clots. Your health care provider will guide you on the best ways to minimize your risk of developing DVT in these situations.<sup>13</sup>

If you are not hospitalized, you can still develop blood clots. Smoking cessation, weight loss and exercise can decrease

# Understanding Deep Vein Thrombosis

your risk of developing a blood clot. When you travel for a long period of time (over 4 hours), you are at increased risk of developing a blood clot. You can decrease this risk by getting up and walking or doing foot flexes every 30 minutes. For people with no severe venous insufficiency, wearing a low level (15-20 mmHg or 20-30 mmHg) of graduated compression stockings while traveling has been shown to decrease the rate of blood clots in the legs. Remember, if you have had a prior blood clot, you are at increased risk of developing another blood and should wear a 20-30 mmHg or higher graduated medical compression stocking.

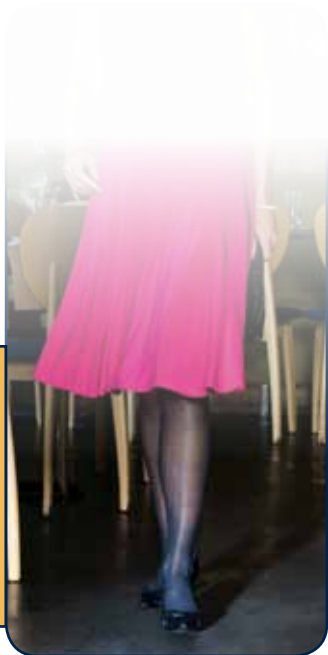
## Conclusion

In summary, although the diagnosis of DVT is serious, by recognizing the symptoms and seeking immediate medical attention, Deep Vein Thrombosis can be treated and managed. Reducing your risk factors will help prevent DVT and wearing graduated compression stockings will minimize the symptoms of venous disease.

Following a diagnosis of DVT, you can significantly improve the health of your legs by living an active lifestyle, eating a healthy diet and wearing graduated medical compression stockings. And, unlike in the past, today's stockings are lightweight and fashionable.

We hope this booklet has answered your questions regarding DVT and its complications. If you have additional questions or concerns, please contact your health care professional.

**Live Well!**



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## Understanding DVT: A Physician's Guide for the Patient

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### Andrew Jones, MD.

Dr. Jones is a board certified general surgeon with a special interest in the management of venous disease. He completed medical school at the University of Minnesota Medical School, where he graduated with honors. He then went to Oregon Health and Science University for his general surgery training and did additional training in minimally invasive surgery.



Shortly after moving to Bend, Dr. Jones developed an interest in varicose veins and venous disease, which is the focus of his practice. He currently performs a wide variety of vein procedures, including endovenous treatment of varicose veins and spider veins. Dr. Jones also manages a large number of patients with Deep Vein Thrombosis, and believes patient education is one of the keys to this disease process.

In addition, Dr. Jones is involved with new product development for venous disease. Through this involvement, he hopes to improve the care of their vein patients and patients around the world by producing new technologies.

### **Edward Boyle, MD**

After graduating from the University of Minnesota Medical School, Dr. Boyle began his surgical internship and residency training at the University of Washington Department of Surgery. During his tenure at the University of Washington, Dr. Boyle completed a cardiovascular research fellowship where he developed basic science and clinical research programs, primarily focusing on blood vessel disorders.



As a researcher he has published over 80 manuscripts in peer reviewed medical journals and textbooks, mostly on the subject of vascular biology. In addition to his clinical work, Dr. Boyle is active in surgical innovation, and is a Boyle founder of medical device companies that relate to minimally invasive surgical techniques.

Dr. Boyle is the founder of Inovia Vein Specialty Center. He has focused his practice on the management and treatment of vein disease, with a special interest in the management of endovenous ablation and DVT's.

## **Additional Sources of Information:**

The Surgeon General's Call to Action to Prevent Deep Vein Thrombosis and Pulmonary Embolism, 2008, U.S. Department of Health and Human Services.

The American College of Chest Physicians (ACCP) published their first consensus conference guidelines on antithrombotic therapy in 1986 and has updated these guidelines approximately every 3 years as a supplement to the journal *Chest*. These guidelines are widely accepted as an authoritative source of information and considered by many to be the textbook for antithrombotic therapy. The most recent guidelines are from the 8th consensus conference, published in 2008.

For information regarding graduated compression socks and stockings: [www.sigvarisusa.com](http://www.sigvarisusa.com)

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