Prevention, diagnosis and treatment of venous thromboembolism


Abstract

Venous thromboembolism (VTE) occurs more frequently in older people. For those nursing older people in a variety of settings, knowledge of VTE prevention, diagnosis and treatment is essential. This article discusses simple, practical measures that can be used to reduce the risk of VTE, including good hydration and promotion of mobilisation. It also discusses how a VTE forms, the signs and symptoms, and the methods used to diagnose and treat VTE. In recent years new drugs have been licensed to treat patients with VTE called direct oral anticoagulants. This article explores recent evidence and important considerations for their use in treatment of VTE.

Keywords

anticoagulation, cardiovascular system, deep vein thrombosis, older people, pulmonary embolism, venous thromboembolism

VENOUS THROMBOEMBOLISM (VTE) is the collective term used to describe deep vein thrombosis (DVT) and pulmonary embolism (PE). While VTE affects all ages, older people are particularly at risk with age being a strong independent risk factor for VTE (Spencer et al 2008). A survey of patients discharged from hospitals in the US in 2007-2009 showed a VTE incidence of 60 per 100,000 in those aged 18-39 compared with 359 per 100,000 in those aged 70-79 – a sixfold increase (Centers for Disease Control and Prevention 2012).

As many older people have acute and chronic health needs, this article reviews the nursing role in VTE prevention, identification of symptoms and treatment options. Best practice is discussed alongside updates in evidence and recent changes in practice.

Venous thromboembolism

Blood is able to clot so that in the event of injury, haemostasis is achieved and healing is promoted. Blood clots are a result of a sequence of chemical events known as the clotting cascade. The clotting cascade is initiated by the wound site through release of tissue factor into the bloodstream.

After a chain of chemical events, a protective clot forms over the wound which is then gradually broken down while healing occurs. Sometimes, a clot will form where it should not, such as in the deep veins of the leg (Figure 1), which is called a DVT. When all or part of a DVT becomes dislodged it can travel through the circulation to the pulmonary arteries where it is termed a PE (National Institute for Health and Care Excellence (NICE) 2010).

There are three broad reasons why clots form: venous stasis, hypercoagulability and venous trauma (Virchow 1846, MacLellan and Fletcher 2007). For example, venous trauma and immobility occur if a person has been in hospital for surgery. Cancer or thrombophilia can also cause hypercoagulability.

The extent of thrombus formation can vary, ranging from a 1-2cm thrombus in a single vein to multiple veins having much larger thrombi present (Figure 2).

Other risk factors for VTE include a history of VTE, inherited coagulation factor abnormalities and any hospitalisation episodes (Samama et al 2003).

DVTs in limbs can cause localised pain and discomfort while also carrying the risk of being dislodged and travelling to the lungs to become a PE. This will cause an interruption of oxygen supply to the body. PE is diagnosed according to its location. The term saddle PE is used to describe a clot in the main pulmonary artery, which extends into the left and right branches. Smaller PE can form in the lobar, segmental or subsegmental branches of the pulmonary tree (Rali et al 2016).

Prevention

The NHS (2016) Standard Contract requires that every person admitted to hospital...
has their VTE risk assessed. Standard risk assessment criteria can be found in a NICE (2010) clinical guideline. VTE risk assessment identifies why a patient may be at increased risk of thrombosis. Any risk of bleeding is also assessed to guide clinicians on safe prescribing of prophylaxis.

In practice, risk assessment is often combined with admission clerking and medication prescribing, and is often performed by a doctor. If a patient is deemed to be at high risk of VTE, low molecular weight heparin injections to thin the blood and anti-embolism stockings are commonly prescribed.

Use of the medications dabigatran and rivaroxaban for VTE prevention in hip and knee surgery is also an option (NICE 2008, 2009). VTE risk assessment leading to appropriate preventative treatment can significantly reduce hospital-related VTE (Roberts et al 2013).

No such risk assessment is mandated for care of older people in the community and there is a lack of evidence relating to the need to do so. Determining why older people are at risk of VTE requires more investigation (Leibson et al 2012). Despite this, simple interventions such as maintaining adequate hydration and promoting mobility could reduce the risk as immobility and dehydration are linked to VTE.

Dehydration
Most international guidelines for VTE prevention include dehydration as a risk factor for VTE, although empirical evidence to support this is lacking. A study by Kelly et al (2004), in patients who had experienced a stroke, demonstrated a link to increased rates of VTE in those who were dehydrated. Good hydration affects many other areas of health (El-Sharkawy et al 2015) and should be prioritised in hospitals and community settings.

Consideration should be given to people whose mobility is limited and who require assistance to toilet. People may reduce their fluid intake to reduce toileting episodes or incontinence. Offering people assistance with mobilising and hydrating before they ask may go some way to overcoming this issue.

Immobility
After the second world war a sixfold increase in PE was linked to people sitting in deckchairs for long periods in air raid shelters (Simpson 1940). Immobility limits the calf muscle pump causing reduced blood flow in the lower limbs.

In a study of healthy patients in their early twenties, immobility in the sitting position reduced blood flow in the popliteal vein by 40% (Hitos et al 2007). Although some people may find it difficult to mobilise, any movement of the legs could be beneficial. Wang et al (2016)

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**Figure 1. Veins of the right leg**

**Figure 2. Thrombus formation in a leg vein**

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**KEY POINTS**

Up to one third of patients with a DVT have a PE without any symptoms

Signs and symptoms of VTE may include redness, swelling and pain and heat in the limb. Coughing, chest pain or breathlessness may also be present

Nurses in community settings can be proactive in contacting their local anticoagulation clinic for advice when changes in people’s health, diet or medications occur that might affect warfarin

Common anticoagulants include enoxaparin, warfarin and rivaroxaban

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found that regular ankle movement after lower limb surgery increased blood flow and decreased incidence of VTE. While the study participants were young people undergoing surgery, regular reminders to exercise (according to an individual’s own ability), or encouragement to join age-specific exercise classes within their capabilities, could be beneficial in preventing DVT in older people.

Identification and diagnosis

Should a person develop a DVT affecting the limbs, they may experience pain, heat, oedema and skin redness (Fraser and Anderson 1999). The limb could be visibly larger than the other (Figure 3) or both limbs could be larger than normal if the DVT is bilateral.

People who have a PE can exhibit symptoms of breathlessness, coughing blood and chest pain (Konstantinides et al 2014). PE usually results in hospitalisation due to the potential seriousness of the event and symptoms experienced, although some are asymptomatic and found incidentally. It is important to consider that approximately one third of patients with a DVT have a PE without any symptoms (Stein et al 2010).

Symptoms of a PE can, in some cases, be minor. In others it will be clear the person is in distress with difficulty breathing. Occasionally, the PE can be so large the person collapses and dies. Studies show that 13% of patients with a PE die within 30 days, rising to 35% at three years (Spencer et al 2008). Many patients describe ongoing breathlessness, reduced capacity and an ongoing rehabilitation process after discharge. Paul Robinson, a former England goalkeeper, described his recovery from a PE after discharge. Paul Robinson, a former England goalkeeper, described his recovery from a PE after taking up to 18 months (NHS Choices 2016).

In community settings, immediate transfer to hospital for diagnosis and treatment is required if symptoms of a DVT or PE are present. Staff nursing older people in hospital should be aware which patients are at risk and any symptoms should be assessed by a doctor without delay. If a DVT is suspected, due to the risk of a PE also being present, the person should be questioned why they have any symptoms of PE – chest pain, coughing up blood or breathlessness.

VTE is usually diagnosed through a combination of clinical examination and radiological scanning. Ultrasound scans are used to diagnose DVTs, while a computerised tomography pulmonary angiogram scan or a ventilation perfusion scan, known as a V/Q scan, is required to visualise the individual clots or their effect on blood flow through the lungs (Rali et al 2016).

Treatment

VTE is treated through the use of anticoagulants. These allow the clot to stop increasing in size and the body to start breaking it down in a process called fibrinolysis.

As anticoagulation increases the risk of bleeding, nurses should observe and encourage patients to report any signs of unusual bleeding or bruising. Nurses should familiarise themselves with the information provided by anticoagulation specialists on potential adverse effects of anticoagulation so that patient safety can be maintained.

After diagnosis, anticoagulation treatment will begin usually for three months. If the VTE was provoked by a long period of immobility or surgery, anticoagulation treatment is often stopped after this period. If the VTE was unprovoked, further investigations and a longer treatment period may be needed.

Cancer-associated VTE is relatively common with one study showing that 17% of patients presenting with a VTE also had cancer (Gussoni et al 2013). VTE has also been identified as a leading cause of death in patients with cancer, equal to deaths from infectious complications (Khorana et al 2007).

For those nursing older people in the community, being prepared with patients’ past
and present medical problems and current medications will assist hospital specialists in safe diagnosis and treatment of VTE.

Types of anticoagulation
Low molecular weight heparin, for example, enoxaparin, tinzaparin or dalteparin, is an anticoagulant that is administered as a daily injection. In clinical experience it is not a common option for patients who require long-term treatment.

Warfarin is one of the best known oral anticoagulants. Warfarin’s action on the blood is measured using a standard laboratory test called the international normalised ratio (INR). The INR test uses a venous or capillary blood sample and is a measure of how long the blood takes to clot.

The INR of a healthy person not taking warfarin is around 1. Patients on warfarin are advised to take a dose that increases this level to between 2 and 3. In certain circumstances, such as when a person has a metallic heart valve, the target is higher. As warfarin affects each person differently, patients may be on different doses while achieving the same INR range.

Although each patient has a target INR, the actual range can fluctuate independently for a variety of reasons. Simple medication changes can increase or decrease the action of warfarin, as can a patient becoming unwell.

Large variations in diet can also alter the action of warfarin. While patients should eat nutritious food, a sudden increase in food high in vitamin K, such as green, leafy vegetables inhibits the action of warfarin and reduces the INR level. Conversely, a sudden absence of the same food would increase the INR. For this reason, consistency in diet is important for patients taking warfarin.

Due to variations in medications, health and food, obtaining INR tests in a timely manner is vital to maintaining the safety of older patients on warfarin. Nurses caring for older people in community settings should be proactive in contacting the local anticoagulation service for advice when changes occur in medications, health or food.

In recent years, a new generation of oral anticoagulants has been licensed for use in patients with VTE. Known collectively as direct oral anticoagulants (DOACs), these drugs do not require INR monitoring.

There are currently four DOACs available: rivaroxaban, apixaban, dabigatran and edoxaban. These medications anticoagulate in a predictable manner with fewer dietary and drug interactions. Consequently, there is no requirement for regular monitoring as in the case of warfarin.

Blood tests are only needed at the point of initiation and on a 6-12 monthly basis to ensure liver and kidney function is adequate.

References

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DOAC medications have been shown to be as effective as warfarin in treating VTE and some have a lower risk of major bleeding complications (van der Hulle et al 2014). As there is a set dose, DOACs can be added to dosette boxes with the exception of dabigatran. DOACs have also been licensed for stroke prevention in patients with atrial fibrillation and are being used as an alternative to warfarin, however their use in these patients is outside the scope of this article.

**Chronic health problems**

Post-thrombotic syndrome (PTS) is a long-term complication of DVT, which can cause symptoms similar to an acute DVT such as pain, swelling and heaviness of the leg (Kearon 2003).

Graduated compression stockings were thought to prevent the development of PTS but in 2015 NICE updated its 2012 guideline in line with recent evidence that showed this was not the case (Kahn et al 2014). PE can also have long-term effects on a person’s health as a result of chronic thromboembolic pulmonary hypertension (CTEPH).

Up to 4% of patients who experience PE have CTEPH (Pengo et al 2004), which can cause breathlessness and heart failure. Treatment options include removing the clot surgically or using medications to dilate the pulmonary arteries and reduce symptoms.

**Conclusion**

Risk of VTE increases with age and while age itself is a risk factor, there are many variables contributing towards the development of VTE. It is possible to reduce VTE that occurs as a result of hospitalisation through identification of those at risk using a national risk assessment tool. Identification of risk allows preventative treatment with chemo-prophylaxis such as low molecular weight heparin and mechanical prophylaxis such as anti-embolism stockings. Although not often prescribed, maintaining good hydration and promoting mobilisation are interventions that nurses should always promote.

Nurses caring for older people should be able to identify the signs and symptoms of VTE and understand the importance of swift diagnosis and treatment – to prevent further extension of the VTE or, in the case of DVT, to prevent the formation of PE. Nurses often represent patients to other healthcare specialists and, as such, need to have as much health history information as possible to guide diagnosis and treatment in the event of a suspected VTE.

As a result of reading and reflecting on this article, nurses should feel empowered to educate those in their care about preventing VTE and, should a patient develop VTE, help the person safely through diagnosis to ongoing anti-coagulation treatment.