Principles and nursing management of anticoagulation

Date of submission: 1 November 2017; date of acceptance: 30 November 2017. doi: 10.7748/ns.2018.e11060

Abstract
Anticoagulant drugs are widely used in hospital and community settings. Anticoagulation is the first-line treatment for venous thromboembolism, and anticoagulant drugs have an important role in the treatment and prevention of blood clots. However, maintaining the equilibrium between clotting and bleeding can be challenging and anticoagulants have been identified as a class of drug associated with preventable patient harm. Direct oral anticoagulants (DOACs) have become the first-line treatment for many patients requiring an anticoagulant, removing the burden of frequent tests and the many food and drug interactions associated with vitamin K antagonists such as warfarin sodium. However, DOACs have increased the complexity of decision-making regarding treatment, which also increases the risk of drug errors. This article discusses the uses, modes of action and potential side effects of anticoagulants, to improve nurses' understanding and enable them to have an active role in limiting the risk of harm from these drugs.

Keywords
anticoagulants, bleeding, blood clotting, direct oral anticoagulants, haematology, heparins, stroke, thrombosis, vitamin K antagonists, warfarin

Aims and intended learning outcomes
This article aims to improve nurses’ understanding of the uses, modes of action and potential side effects of anticoagulants so that they can take an active role in limiting the risk of harm from these drugs. Anticoagulants are one of the classes of drugs most frequently associated with preventable patient harm (National Patient Safety Agency (NPSA)* 2007a). The use of anticoagulants remains a cause for concern, especially if nurses are insufficiently trained in their use and there is an absence of robust local protocols to optimise safety for patients receiving anticoagulants. After reading this article and completing the time out activities you should be able to:
- Describe the common conditions that require anticoagulation.
- Explain how anticoagulation reduces the risk of thrombosis or stroke.
- Discuss the various anticoagulant drugs and when each might be suitable.
- Understand the potential considerations necessary when initiating a patient on an anticoagulant, including the associated risks and side effects.
- Explain the role of the nurse in optimising safety for patients receiving anticoagulants.

Relevance to the Code
Nurses are encouraged to apply the four themes of The Code: Professional Standards of Practice and Behaviour for Nurses and Midwives to their professional practice (Nursing and Midwifery Council (NMC) 2015). The themes are: Prioritise people, Practise effectively, Preserve safety, and Promote professionalism and trust. This article relates to The Code in the following ways:
- Nurses can practise effectively by improving their understanding of the safe use of anticoagulation in clinical practice. The Code states that nurses
should provide treatment to the best of their abilities, based on the best evidence available.

» The Code states that nurses should act in partnership with those receiving care, assisting them to access relevant information and support when they need it. The article encourages nurses to involve the patient in the choice of anticoagulation drugs and educate them about self-management to reduce complications.

» It aims to develop nurses’ knowledge base and outlines an evidence-based approach to anticoagulation management. The Code requires nurses to advise on, prescribe and administer medicines within the limits of their training and competence.

» It details the importance of involving the patient in any assessment of side effects and complications associated with anticoagulant drug treatment. The Code requires nurses to be aware of, and reduce as far as possible, any potential for harm associated with their practice.

Introduction
To understand anticoagulation, it is important to understand the process of blood clot formation (Marieb and Keller 2017, Tortora and Derrickson 2017). Haemostasis is a natural process that aims to limit excessive blood loss in the event of injury through the formation of a fibrin clot. This is a complex process that includes several ‘negative feedback mechanisms’ where the body activates its own inhibitory processes to ensure that the clot stops growing when necessary, meaning that the clot can be broken up so that normal blood flow can resume.

As soon as a blood vessel becomes injured, vasoconstriction commences and the body starts to develop a platelet plug to reduce the amount of blood being lost. Following an injury, subendothelial collagen is exposed, which attracts platelets. The platelets then adhere to each other (aggregation), and, with the assistance of fibrinogen, produce the platelet plug. This process is termed primary haemostasis (Key et al 2017).

Secondary haemostasis, also known as the clotting cascade, is shown in Figure 1. This is a process where a series of proteins, most of which are produced by the liver, are activated sequentially and result in the production of thrombin. Thrombin has two roles: it activates further platelets, and converts fibrinogen to fibrin, a mesh-like net that surrounds and stabilises the platelet plug, consolidating the clot (Key et al 2017). Primary and secondary haemostasis occur simultaneously and are interrelated processes (Gale 2011).

While haemostasis is underway, the body is preparing to halt the clotting process to ensure that the clot itself does not become too large. One of the body’s methods of achieving this is through the release of tissue plasminogen activator (tPA), which breaks down the fibrin net surrounding the clot in a process called fibrinolysis. tPA is used for its ‘clot-busting’ or thrombolytic properties in the treatment of stroke, myocardial infarction and pulmonary embolism (PE). Fibrinolysis releases fibrin degradation products such as D-dimers into the blood (fibrin degradation products are small protein fragments present in the blood after a clot is degraded by fibrinolysis) (Lin and Selby 2013). D-dimers are raised in the acute phase of clot formation and are routinely used in the clinical diagnosis of venous thromboembolism (VTE). Because of the
continued fibrinolysis observed in VTE, the presence of D-dimers remains elevated for approximately seven days (Schreiber 2002). In some instances, the process of haemostasis becomes challenging and the formation of blood clots is unwanted and associated with complications. In these circumstances, the body requires assistance from anticoagulants that act on various parts of the haemostatic system to hinder blood clotting and reduce the risk of a blood clot forming or continuing to grow.

**TIME OUT 1**

Reflect on what you have learned about the mechanisms of clotting. Imagine that you are trying to explain this in lay terms to a patient and write a draft patient information leaflet. Show this leaflet to your colleagues and request their input. In collaboration with your colleagues, consider whether the leaflet would be beneficial to share with patients in your clinical area.

**Indications for anticoagulation**

There are several common reasons that anticoagulation may be required, and they fall into two categories: treatment and prevention. Treatment with anticoagulation is used in established clots with the aim of preventing further growth and reducing the risk of associated complications, such as embolisation. Prevention, or thromboprophylaxis, aims to stop clots forming in patients considered at high risk, such as those with active cancer or who have undergone recent major surgery.

**Treatment**

Anticoagulation is the first-line treatment for VTE. VTE is an umbrella term that includes deep vein thrombosis (DVT) and PE. It occurs in approximately one in 1,000 people in the general population (Silverstein et al 1998, Martinez et al 2014), with half of these cases attributable to a hospital admission for surgery or medical illness such as pneumonia (Heit et al 2002). While DVTs commonly develop in the deep veins in the legs, they can form in any deep vein in the body. Part of the clot, or the entire clot, can break away and travel or embolise through the venous system to the vena cava (the vein that carries deoxygenated blood from the lower body to the heart’s right atrium) and through the right side of the heart to the pulmonary arteries where it can become lodged. This is known as a PE.

While DVTs that develop in the limbs can have unpleasant acute and chronic effects such as pain and swelling, they are not considered life-threatening, providing the thrombus does not break away and travel through the venous system. However, if a PE is large enough to obstruct the pulmonary circulation sufficiently, it can cause hypoxaemia and right heart failure because of the build-up of pressure in the pulmonary artery, which in turn affects the right ventricle of the heart. This can lead to collapse and death.

To prevent blood clots growing, they are treated with anticoagulants. However, it is a misconception that anticoagulants ‘dissolve’ a clot; rather, they limit the body’s capacity to clot, providing the body’s fibrinolytic system with the opportunity to break down the clot itself.

Indications for anticoagulation include: limiting the body’s capacity to clot, providing the body’s fibrinolytic system with the opportunity to break down the clot itself.

**Anticoagulants**

Anticoagulants are a large group of drugs used for the prevention and treatment of blood clots. They work by inhibiting the formation of blood clots or by preventing existing clots from getting larger.

**TIME OUT 2**

Reflect on what you have learned about the mechanisms of clotting. Imagine that you are trying to explain this in lay terms to a patient and write a draft patient information leaflet. Show this leaflet to your colleagues and request their input. In collaboration with your colleagues, consider whether the leaflet would be beneficial to share with patients in your clinical area.
patient education; and an individualised monitoring plan. Because of the various modes of action, each anticoagulant drug treatment requires slightly different considerations, which will be discussed in this article.

**Prevention**
As part of the NHS England (2013) National VTE Prevention Programme, it is mandatory for all hospitalised patients to be assessed for their risk of thrombosis and bleeding on admission to hospital so that thromboprophylaxis can be considered. In patients deemed to be at high risk of thrombosis, but low risk of bleeding, smaller doses of anticoagulants, usually low molecular weight heparin (LMWH), are used to provide thromboprophylaxis.

**TIME OUT 2**
Examine the product characteristics of the anticoagulant most frequently used in your clinical area. This will be available in the literature that comes with the product. Write a summary of the main characteristics of the anticoagulant, including the indications, actions and side effects.

**Types of anticoagulant**
There are several types of licensed anticoagulants available that work on different parts of the haemostatic system, including heparins, vitamin K antagonists and direct oral anticoagulants (DOACs).

**Heparins**
Heparins broadly consist of unfractionated heparin (UFH) and LMWH. Both types are administered parenterally because they are unable to be absorbed by the gut and, since the risk of haematoma is increased with intramuscular injection, must be given subcutaneously or intravenously (Lin and Selby 2013).

**Unfractionated heparin**
UFH is a polymer made up of many similar repeated units bound together. UFH has a half-life of 60-90 minutes and is therefore often given as a continuous intravenous (IV) infusion (Lin and Selby 2013). UFH works by blocking the clotting cascade. It achieves this by binding to and activating one of the body’s natural anticoagulants – antithrombin (factor III). Antithrombin then inactivates some of the clotting factors, including thrombin (factor II), resulting in fewer fibrin bonds being formed (Gale 2011).

UFH is monitored by activated partial thromboplastin time (APTT) (Box 1). UFH infusions must be monitored carefully to avoid over-anticoagulation or under-anticoagulation. Each hospital will have its own protocol detailing how often an APTT measurement should be recorded and how the UFH infusion should be adjusted according to the results. UFH should be stopped four hours before invasive procedures and can be reversed with the drug protamine sulfate in the event of major bleeding or in patients requiring emergency surgery.

**Low molecular weight heparin**
LMWH has been fractionated or divided into much smaller molecules. It has a half-life of approximately 3-6 hours and is cleared by the renal system (Lin and Selby 2013); therefore, the estimated glomerular filtration rate or creatinine clearance – depending on local policy – should be checked to ensure that any LMWH can be cleared from the patient’s body adequately before commencing this drug. LMWH is administered as a subcutaneous injection usually once daily, making it more convenient for patients than UFH and enabling its use in the outpatient setting. Like UFH, LMWH also interrupts the clotting cascade; however, it does this by inactivating factor Xa. Inhibition of factor Xa requires a much smaller molecule than activation of...
antithrombin, and results in a more subtle and predictable therapeutic effect.

LMWH has a more predictable effect so is less commonly monitored than UFH. However, if required, for example in patients who are either extremely underweight or overweight, or in those with impaired renal function, LMWH can be monitored through blood anti-factor Xa levels (Wei and Ward 2015). LMWH should be discontinued 12-24 hours before commencing any surgery or invasive procedure with an increased bleeding risk, depending on the dose, procedure and patient’s renal function.

LMWH is not completely reversible in the event of uncontrolled bleeding or where emergency surgery is required; however, protamine sulfate may have some effect in reversing anticoagulation depending on the dose and timing of administration.

### Side effects

The most significant side effect of heparins other than bleeding, which applies to all anticoagulants, is heparin-induced thrombocytopenia. This occurs more commonly with UFH than LMWH and is the result of an immune response characterised by a drop in platelet count of 50% or more (Ahmed et al 2007). Although low platelet counts are a feature of heparin-induced thrombocytopenia, it is a pro-thrombotic state and can result in life-threatening or limb-threatening thrombosis. When heparin-induced thrombocytopenia is suspected, heparin must be discontinued immediately and an alternative non-heparin-based anticoagulant prescribed, such as danaparoid sodium or argatroban monohydrate (Lin and Selby 2013).

Heparin is a natural substance found predominantly in the body’s mast cells; however, the heparin in pharmacological use is derived from bovine or porcine sources. This may have implications for patients who do not want to consume animal products. Therefore, nurses must check the suitability of heparin with patients before administration. Fondaparinux sodium is a synthetic alternative that can be offered to patients wishing to avoid animal products.

### Vitamin K antagonists

Vitamin K antagonists work by interfering with the vitamin K cycle, leading to reduced levels of vitamin K. Vitamin K is required for certain vitamin K-dependent clotting factors – such as factors II, VII, IX and X – to be active. Without sufficient levels of these factors, the body has a limited capacity to clot. Warfarin sodium is the most commonly used vitamin K antagonist in the UK and has been used in humans since the 1950s (Wardrop and Keeling 2008). Warfarin’s onset of action can take up to three to four days because of the long half-lives of some of the clotting factors affected, while the effects of a single dose can last up to five days. It is usually taken orally in tablet form, although liquid formulations are available, and requires frequent monitoring to ensure safety and therapeutic effect.

Because many drugs interact with warfarin and can affect the international normalised ratio (INR) (Box 2), patients taking it are advised to inform their responsible healthcare professional when existing drugs are discontinued, or new drugs are commenced. The INR should be checked 3-7 days after any medication change to assess its effects (Keeling et al 2011). Significant dietary changes without the patient seeking advice are discouraged. Alcohol can significantly increase the INR, which in turn increases the risk of injury and bleeding through intoxication, therefore moderation should be encouraged. Although rarely used in the UK, other vitamin K antagonists such as phenindione and acenocoumarol are used in other parts of Europe.

Warfarin can take some time to become therapeutic – up to two weeks in some cases. This is, in part, because of the long half-life of the vitamin K-dependent clotting factors warfarin acts on, and the challenge of predicting how sensitive individual patients will be. This means that a cautious approach to dosing is required.

When warfarin is used in the treatment of VTE, patients also require LMWH as a ‘bridging’ drug until the INR reaches a therapeutic level, usually over 2.0. Bridging involves using another drug to

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**KEY POINT**

Warfarin can take some time to become therapeutic – up to two weeks in some cases. This is, in part, because of the long half-life of the vitamin K-dependent clotting factors warfarin acts on, and the challenge of predicting how sensitive individual patients will be. This means that a cautious approach to dosing is required.
provide an anticoagulant effect before the chosen anticoagulant takes effect. As well as protecting patients from embolisation, patients also require LMWH until the INR reaches a therapeutic level because warfarin also inhibits the vitamin K-dependent anticoagulant proteins C and S, which are naturally-occurring anticoagulants. These proteins have a short half-life and are depleted before the coagulant proteins, causing a temporary procoagulant state.

The effects of all vitamin K antagonists, including warfarin, can be reversed with vitamin K, which has a two-hour onset of action if administered intravenously; vitamin K can also be administered orally in non-urgent situations. Importantly, in an emergency, for example major bleeding where immediate reversal is required, a complex of clotting factors (II, VII, IX and X) can be administered as an IV infusion (Keeling et al 2011).

While warfarin is an effective anticoagulant, its limitations include the necessity for regular monitoring, which can be a burden for patients, and its multiple interactions can be challenging to manage. There is a delicate balance to be struck in avoiding too high or too low levels of warfarin and the associated risk of bleeding or thrombosis. For these reasons, stable anticoagulant drugs – the DOACs – have been developed.

As is the case with all anticoagulants, bleeding is the most common side effect of vitamin K antagonists. Other side effects include alopecia, diarrhoea, haemorrhage and hepatic dysfunction (British National Formulary 2017).

**Direct oral anticoagulants**

In the past few years, the use of warfarin has declined as DOACs have become available. There are four DOACs licensed for use in the UK: rivaroxaban, dabigatran etexilate, apixaban and edoxaban. Dabigatran was the first DOAC to become available for use in the UK in 2012 (NICE 2012b), while edoxaban is the most recent DOAC (NICE 2015). DOACs were initially known as novel oral anticoagulants; however, the International Society for Thrombosis and Haemostasis (Barnes et al 2013) suggested they should be known as DOACs to standardise the nomenclature and because they are no longer novel. Large clinical trials comparing the four DOACs with warfarin in VTE, AF and post-elective hip and knee replacement surgery demonstrated that they were at least as effective as warfarin in preventing embolic complications, and had similar bleeding profiles (Eriksson et al 2007, Granger et al 2011, Giugliano et al 2013, Prins et al 2013).

The main benefits of DOACs are: they do not require regular blood monitoring; they have fewer drug and dietary interactions than warfarin (Baglin 2013); and their rapid onset of action means that concurrent use of LMWH as a bridging treatment is not required (Bauer 2013). DOACs also have predictable absorption and action profiles. This reduces the risk of patients becoming over-anticoagulated or under-anticoagulated, which can occur with warfarin. In many clinical areas in the UK, these drugs have replaced warfarin as first-line treatment for VTE and non-valvular AF. All but edoxaban are also licensed as thromboprophylaxis after elective hip and knee arthroplasty.

As well as new patients opting for DOACs, many existing patients who take warfarin are also switching to a DOAC, either because of the drugs’ convenience or because of the unreliability of warfarin control. NICE (2014a) guidelines state that if a patient’s warfarin therapy is only within a therapeutic range for under 65% of the time in any six-month period, they should be assessed for their suitability for a DOAC because this may provide

**Box 2. International normalised ratio (INR)**

The INR is used to monitor vitamin K antagonist treatment. The INR is based on a clotting test called prothrombin time (PT). However, PT results can vary depending on the reagent and the machine used to perform the test. To standardise the result worldwide, the INR was developed. Normal INR levels in people who are not taking anticoagulation drugs range from 0.8 to 1.2. For most patients who are receiving anticoagulation, the target range is 2.0–3.0, although this can be higher or lower depending on the indication (Lin and Selby 2013).
improved efficacy. The same is true of patients who score two INRs over 5.0, one INR over 8.0, or two INRs under 1.5 in a six-month period (NICE 2014a).

As with all anticoagulants, the main side effect of all DOACs is bleeding; however, they are associated with a reduced risk of intracranial haemorrhage compared with warfarin (Raschi et al 2016). While the DOACs share many similarities, there is some variance in their properties, as shown in Table 1.

TIME OUT 3
Consider the use of DOACs for patients in your clinical area. Using the information in Table 1, familiarise yourself with the main differences between each of the DOACs and consider which one would be the most appropriate for these patients. Consider whether patients might require the drug to be crushed, whether they might prefer to take the drug with food, and whether they are taking any contraindicated drugs.

DOACs are not suitable for all patients. Dabigatran was trialled in patients with mechanical heart valves and was terminated early because of excess thromboembolism and bleeding in the dabigatran patient group (Eikelboom et al 2013). Instead of DOACs, patients with mechanical heart valves are recommended to take warfarin (Keeling et al 2011). DOACs are also not licensed in pregnancy, paediatrics, cancer or valvular AF (defined as moderate-to-severe mitral stenosis) (Kirchhof et al 2016). Heart valve disease is linked to a high risk of AF, and both conditions are associated with a high risk of thromboembolism (De Caterina and Camm 2014).

### TABLE 1. Properties of each direct oral anticoagulant

<table>
<thead>
<tr>
<th></th>
<th>Dabigatran etexilate</th>
<th>Rivaroxaban</th>
<th>Apixaban</th>
<th>Edoxaban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target-clotting factor</td>
<td>IIa</td>
<td>Xa</td>
<td>Xa</td>
<td>Xa</td>
</tr>
<tr>
<td>Half-life</td>
<td>12-17 hours</td>
<td>5-9 hours</td>
<td>12 hours</td>
<td>10-14 hours</td>
</tr>
<tr>
<td>Dosing regimen</td>
<td>Twice daily (bd)</td>
<td>Once daily (od)</td>
<td>bd</td>
<td>od</td>
</tr>
<tr>
<td>Standard dosing in acute venous thromboembolism treatment</td>
<td>150mg bd after five days of parenteral anticoagulation</td>
<td>15mg bd for 21 days then 20mg od</td>
<td>10mg bd for seven days then 5mg bd</td>
<td>60mg od after five days parenteral anticoagulation</td>
</tr>
<tr>
<td>Standard dosing in atrial fibrillation</td>
<td>150mg bd</td>
<td>20mg od</td>
<td>5mg bd</td>
<td>60mg od</td>
</tr>
<tr>
<td>Take with or without food</td>
<td>With or without food</td>
<td>With food - treatment dose only</td>
<td>With or without food</td>
<td>With or without food</td>
</tr>
<tr>
<td>Is there a reversal agent?</td>
<td>Yes – idarucizumab</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Should the drug be stored in a multicompartment pill box?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Can the drug be crushed?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Contraindicated concomitant drugs</td>
<td>Ketoconazole, ciclosporin, itraconazole, dronedarone, tacrolimus, rifampicin, St John's wort, carbamazepine, phenytoin</td>
<td>Ketoconazole, itraconazole, voriconazole, HIV protease inhibitors (for example ritonavir), rifampicin, phenytoin, carbamazepine, phenobarbital, St John's wort</td>
<td>Ketoconazole, itraconazole, voriconazole, HIV protease inhibitors (for example ritonavir), rifampicin, phenytoin, carbamazepine, phenobarbital, St John's wort</td>
<td>Reduce dose to 30mg daily with concomitant: ciclosporin, dronedarone, erythromycin, ketoconazole</td>
</tr>
</tbody>
</table>

(Adapted from Czuprynska et al 2017)
Although DOACs are associated with fewer drug interactions than other anticoagulants, there remains the possibility of over-anticoagulation or under-anticoagulation when certain drugs are taken concurrently, so nurses should always check the product summary for possible interactions. Similarly, patients who are either extremely underweight or classed as obese should not be prescribed a DOAC until more is understood about the drugs’ absorption and elimination in these patients (Martin et al 2016).

Dabigatran is the only DOAC that has a specific reversal agent – idarucizumab – which reverses the anticoagulant effect. In the event of major bleeding in patients taking one of the other three DOACs, a prothrombin complex concentrate, which is used for emergency reversal of warfarin, can be administered, although local guidelines or haematology advice should be consulted (Makris et al 2013). DOACs should be stopped 24-48 hours before any surgical procedure, depending on the patient’s renal function and the procedure in question. Because LMWH has a similar duration of action to the DOACs, it is rare that LMWH would be used as a bridging drug before any procedure (Heidbuchel et al 2013).

**TIME OUT 4**
Imagine that you have a patient who asks you about the main differences between warfarin and DOACs. Write a list of the main differences you would outline to the patient, and incorporate these into a teaching session for your colleagues.

**Antiplatelet drugs**
Although often regarded as anticoagulants because they colloquially ‘thin the blood’, antiplatelet drugs such as aspirin and clopidogrel are not classed as anticoagulants. These drugs tend to be more effective at preventing and treating arterial clots such as myocardial infarctions, rather than venous clots (Keeling et al 2011).

**Initiating anticoagulation**
Before a patient commences an anticoagulation drug, the nurse should decide whether this is appropriate through careful consideration of the thrombosis and bleeding risks. For example, before anticoagulation drugs are administered for AF, a patient’s risk of stroke and bleeding should be assessed. NICE (2014a) guidelines recommend stratifying patients’ risk of stroke using the CHA$_2$DS$_2$-VASc score, which provides an indication of an individual’s risk of stroke annually (Table 2) (Lip et al 2010). Patients should only be prescribed anticoagulation drugs if their CHA$_2$DS$_2$-VASc score is one or more for a man, or two or more for a woman (Kirchhof et al 2016). A patient’s risk of bleeding should be calculated using the HAS-BLED score (Table 3), with a score of three or more indicating increased bleeding risk on anticoagulation, anticoagulation decisions should be made with caution, and frequent clinical review.

Calculating the scores in Tables 2 and 3 requires the nurse to take a thorough medical, medication and social history. Aspects of the patient’s history that the nurse should consider include:
» The patient’s risk of falls.
» The availability of assistance in the event of a bleed.
» Whether the patient has the manual dexterity necessary to take drugs.

**KEY POINT**
Before a patient commences an anticoagulation drug, the nurse should decide whether this is appropriate through careful consideration of the thrombosis and bleeding risks.
Whether the patient has the necessary cognitive ability to understand how the drugs are administered and to remember when to take them, particularly in the case of warfarin, which often involves complicated dosing regimens.

Blood screening should take place before commencement of anticoagulation drugs, and include the following (Blann et al 2003):

- Full blood count – checks that the patient’s haemoglobin levels are stable within accepted parameters and that their platelet count is normal.
- Renal function tests – establishes that the patient’s renal system can metabolise and clear the drugs, particularly LMWH and DOACs.
- Liver function tests – ensure that the patient’s baseline clotting level is normal and that they can metabolise the drugs, particularly warfarin.
- Coagulation screen – checks that the patient’s baseline clotting level is normal.

Once a patient’s risk of stroke and bleeding have been established, this, as well as the benefits of anticoagulation treatment, should be discussed with them so that they can make an informed decision about optimal treatment. NICE (2014a) guidelines state that, for most patients, the risk of stroke outweighs the risk of bleeding, although this decision should be made on an individual basis.

**TIME OUT 5**

Read the NPSA (2007a) document, Actions That Can Make Oral Anticoagulant Therapy Safer. Consider what actions you and your team could take in your clinical area to make anticoagulants safer for patients.

When it has been decided that a patient should commence anticoagulant drug treatment, a decision regarding the appropriate drug should be made, in collaboration with the patient wherever possible (NICE 2009). Since these decisions are becoming increasingly complex as more DOACs come onto the market, NICE (2014b) has developed a decision tool for patients that considers a range of clinical and social factors, emphasising that the indication may dictate the most appropriate drug. Table 4 summarises some of the common indications for anticoagulation and recommended anticoagulant type for these conditions.

The patient should be consulted on any treatment decisions, including the choice of drug. In the author’s clinical experience, it is important to include the following information in any consultation with the patient:

- The patient’s understanding of their underlying condition.
- The action of the drug.
- Potential side effects and the required action.
- How and when to take the drug.
- How the drug will be monitored.
- The potential duration of treatment.
- What to do if a dose is missed.
- Where to obtain repeat prescriptions.
- Action to take in the event of a bleed.
- Any drug or dietary interactions.
- Action to take if an invasive procedure is required while undergoing anticoagulation treatment.
- Which over-the-counter drugs are safe or should be avoided. For example, non-steroidal anti-inflammatory drugs and anti-platelet drugs should be avoided in patients undergoing anticoagulation treatment, unless specifically prescribed.
- Where to obtain further information.

**TABLE 2. Calculating a patient’s risk of stroke using the CHA2DS2-VASc score**

<table>
<thead>
<tr>
<th>Initial</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Congestive heart failure or left ventricular systolic dysfunction</td>
</tr>
<tr>
<td>H</td>
<td>Hypertension – blood pressure consistently above 140/90 mmHg, or hypertension being treated with medication</td>
</tr>
<tr>
<td>Aa</td>
<td>Age – ≥75 years</td>
</tr>
<tr>
<td>D</td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>Ss</td>
<td>Stroke, transient ischaemic attack or thromboembolism</td>
</tr>
<tr>
<td>V</td>
<td>Vascular disease – for example peripheral artery disease, myocardial infarction, aortic plaque</td>
</tr>
<tr>
<td>A</td>
<td>Age – 65-74 years</td>
</tr>
<tr>
<td>Sc</td>
<td>Sex category – female</td>
</tr>
</tbody>
</table>

(Adapted from Lip et al 2010)
All patients should be informed of the date of their next appointment to ensure consistency in clinical monitoring. They should also be provided with the details of their anticoagulation service, a relevant patient information leaflet and an alert card to carry at all times. It is important to inform patients that if they experience a minor bleed, for example a shaving cut, the bleeding may take longer to stop. If a patient experiences major bleeding, they should call an ambulance or go straight to their local emergency department.

DOACs have a rapid onset of action, so they should never be administered concurrently with LMWH. Some patients, particularly those who have experienced recent cardiac or vascular events, may require concurrent use of DOACs and antiplatelet agents. This is because they may be at risk of both VTE, which requires an anticoagulant, and atherothrombosis, which requires an antiplatelet agent (Valgimigli et al 2018).

**Follow-up care**

All patients taking anticoagulant medication should understand how and where they will receive follow-up care. For patients taking warfarin, this will involve undergoing an INR blood test, either by finger-prick or venous blood test at a local clinic such as an outpatients’ clinic, the local phlebotomy or anticoagulation department, or GP surgery. When taking warfarin as an outpatient, most patients will require their INR to be checked twice-weekly for the first two weeks, with test intervals increasing as the patient becomes stable. Testing can continue for a maximum of 12 weeks (Keeling et al 2011).

Although no routine monitoring is required for patients taking DOACs, some form of follow-up is required, particularly for patients who are new to the medication. This may be undertaken by the patient’s GP or local anticoagulation clinic. With DOACs, the focus of any follow-up is to ensure patients are tolerating the treatment without side effects, and, where necessary, to check their renal function. Each DOAC has a standard and a reduced dose. Each DOAC has individual criteria for its reduced dose, for example patients with renal impairment or low body weight, or who are also taking drugs that may interact with a DOAC; therefore, the British National Formulary (2017) should always be consulted before treatment commences.

**TIME OUT 6**

List the factors you would check if you were caring for a patient who was undergoing anticoagulant treatment. Consider their suitability for anticoagulation, the

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<th>TABLE 3. HAS-BLED score</th>
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(Adapted from Pisters et al 2010)

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<th>TABLE 4. Common indications for anticoagulation and recommended anticoagulant type</th>
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<tr>
<td>Indication</td>
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<tr>
<td>Venous thromboembolism (VTE) in pregnancy or while breastfeeding</td>
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<td>VTE with active cancer</td>
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<td>Valvular atrial fibrillation (AF) (moderate-to-severe mitral stenosis)</td>
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<tr>
<td>Mechanical valve</td>
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<tr>
<td>Left ventricular thrombus</td>
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<tr>
<td>VTE</td>
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<tr>
<td>Non-valvular AF</td>
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(Adapted from NICE 2012a, Watson et al 2015, Kirchhof et al 2016)
appropriate of the chosen drug, the dose, and any psychological and social factors that could affect their follow-up care.

Role of the nurse
There are various types of anticoagulation service in the UK, including hospital-based and community-based models, with some being a mixture of the two (Fitzmaurice and Murray 2001, Kar and Williams 2016). All feature nurses and pharmacists, with independent prescribing increasing the flexibility of the care provided. Many nurses will encounter patients undergoing anticoagulation treatment and their main role is to promote patient safety. When a patient is being discharged from hospital, it is essential that the nurse provides some basic information, including (NPSA 2007b):

- Their prescribed dose.
- When they will receive clinical follow-up.
- That the main side effect of anticoagulation treatment is bleeding.

- Action to take if they experience bleeding.
- That they should only take the prescribed dose.
- That they should avoid running out of medication.

If a patient has switched from warfarin to a DOAC while in hospital, the nurse should ensure that arrangements are made to safely discard the warfarin to avoid the risk of double anticoagulation, where a patient may take home the DOAC but mistakenly keep taking their warfarin. This is a particular risk in patients who use multicompartment pill boxes or have their medications administered by carers.

Before a DOAC is administered, the patient’s creatinine clearance should be calculated to ensure that they are able to excrete the drug sufficiently. The patient’s weight and height are required to perform this calculation; therefore, the nurse is required to record these measurements accurately (South East London Area Prescribing Committee 2017).

References


Previously, warfarin was the only choice of anticoagulant. While the availability of new anticoagulant drugs has broadened the choice of treatment available to nurses working in anticoagulation clinics, it has also meant that new guidelines, pathways, decision support tools and patient group directions have had to be developed alongside training in patient safety and choice. For nurses, the challenge is to absorb the knowledge and skills required to provide patients with the information necessary for them to choose the appropriate anticoagulant treatment.

Because they are often on the front-line of anticoagulation services, nurses have the capacity to influence the future design of such services to ensure they are person-centred and provide optimal care.

**Conclusion**

Anticoagulant drugs are associated with the potential for harm if healthcare professionals such as nurses are not adequately trained in their use. While the advent of DOACs has provided patients with increased treatment choice, it has also increased the complexity of prescribing, which requires support and training for healthcare professionals as well as the use of clinical protocols and pathways. Nurses are well-placed to optimise the care for patients undergoing anticoagulation treatment by ensuring that information is available for patients to make informed decisions, thereby improving adherence and making sure care remains person-centred.

TIME OUT 7

Nurses are encouraged to apply the four themes of The Code (NMC 2015) to their professional practice. Consider how providing anticoagulant treatment relates to The Code.

**TIME OUT 8**

Now that you have completed the article, you might like to write a reflective account as part of your revalidation.

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**References**

- east-london-area-prescribing-committee/Documents/Creatinine%20clearance.pdf
Chronic Disease Management

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<td>Manchester</td>
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<td>Birmingham</td>
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<td>Bristol</td>
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Principles of anticoagulation
TEST YOUR KNOWLEDGE BY COMPLETING SELF-ASSESSMENT QUESTIONNAIRE 928

1. Anticoagulant drugs are:
   a) Able to be prescribed safely by all registered nurses and healthcare assistants  
   b) Used in a wide range of settings to manage blood pressure  
   c) Frequently associated with preventable patient harm  
   d) Simple to administer without the need for protocols  
   c) Sepsis  
   d) Deep vein thrombosis

7. Unfractionated heparin works by:
   a) Releasing proteins that promote the clotting cascade  
   b) Enabling the production of additional fibrin  
   c) Binding to and activating one of the body’s natural anticoagulants, antithrombin (factor III)  
   d) Activating clotting factors including thrombin (factor II)  

8. The most commonly used vitamin K agonist is:
   a) Warfarin sodium  
   b) Dabigatran etexilate  
   c) Apixaban  
   d) Edoxaban

9. What is one of the main benefits of direct oral anticoagulants?
   a) They have a gradual onset of action  
   b) They do not require regular blood monitoring  
   c) They protect the patient against the development of type 2 diabetes  
   d) They substantially improve the patient’s immune system

10. ‘Double anticoagulation’ refers to:
    a) A case where anticoagulation is required to treat blood clots in two separate locations in the patient’s body  
    b) A patient taking concurrent anticoagulant medications in error, for example warfarin and a direct oral anticoagulant  
    c) A situation where the patient’s blood has become too thin  
    d) The provision of two doses of medication at once to accelerate the anticoagulation process

How to complete this assessment

This self-assessment questionnaire will help you to test your knowledge. It comprises ten multiple choice questions that are broadly linked to the article starting on page 50. There is one correct answer to each question.  
* You can test your subject knowledge by attempting the questions before reading the article, and then go back over them to see if you would answer any differently.  
* You might like to read the article before trying the questions. The correct answers will be published in Nursing Standard on 14 February.  

Subscribers making use of their RCNi Portfolio can complete this and other questionnaires online and save the result automatically. Alternatively, you can cut out this page and add it to your professional portfolio. Don’t forget to record the amount of time taken to complete it.

You may want to write a reflective account based on what you have learned. Visit rcni.com/reflective-account

This self-assessment questionnaire was compiled by
Jason Beckford-Ball

The answers to SAQ 928 on Organisational culture, which appeared in the 17 January issue, are:
1. a 2. b 3. a 4. d 5. c 6. a 7. d 8. c 9. a 10. b