Atrial fibrillation (AF) is a condition where the atria fibrillate in an uncoordinated way. This may lead to stagnation of blood within the atria, increasing the risk of stroke and/or transient ischaemic attacks (TIAs) (Watson et al, 2009). AF can also lead to other complications such as heart failure and poor quality of life. In non-valvular AF, the risk of stroke and other systemic embolic conditions increases fivefold (Bajmai et al, 2007). Almost 50% of patients with AF-related strokes will die within the first year (Kirchhof et al, 2007). Thromboembolic stroke is the most debilitating of all the complications because it is more severe and causes greater disability. It is imperative this condition is managed promptly and appropriately to prevent progression of AF and to reduce complications.

Once a diagnosis of AF has been confirmed by electrocardiography (ECG), other investigations need to be considered to identify the possible causes, risk factors, and potential or existing complications. This information will help to determine the type of management required to reduce the risks and deterioration.

Investigations may include a transthoracic echocardiogram. This will help identify structural cardiac disease, determine heart function, and identify the presence of clot formation (National Institute for Health and Clinical Excellence (NICE), 2006). If abnormalities are found, a further assessment using a transoesophageal echocardiogram may be needed (NICE, 2006). Providing the patient with AF is stable, these investigations and management can be initiated in primary care.

Treatments that support the management of AF follow two approaches (Iqbal et al, 2005):

- Managing the risk of stroke by preventing clot formation in a fibrillating heart
- Managing the rate and/or rhythm.

**Stroke risk assessment**

Regardless of the type of AF, a stroke risk assessment and therapy for stroke risk reduction are vital. Even though rate and rhythm control are important, it is through using antithrombotic therapy that death is prevented (Hylek et al, 2003).

A risk assessment is conducted using a stroke risk stratification scoring system. There are two recommended scoring tables: CHADS2 and CHA2DS2-VASc. The CHADS2 scoring system is based on risk factors associated with AF and stroke (Table 1). The CHA2DS2-VASc scoring system (Table 1) is a refined version identifying scores for those aged 65–74 years and >75 years. The CHA2DS2-VASc scoring system also considers gender and vascular disease. This helps determine the most appropriate treatment based on the predicted potential for stroke (Table 2).

**Stroke reduction management**

Aspirin and warfarin are the most common treatments used to prevent ischaemic stroke and report reduced mortality among patients with AF (Camm, 2011). Warfarin has a 62% risk reduction while aspirin has a 22% risk reduction. This may account for warfarin being the preferred anti-thrombotic therapy because it is significantly more effective at reducing the risk of stroke (Fuster et al, 2006; Hart et al, 2007).

Warfarin therapy requires frequent blood testing. This can lead to concordance issues with patients due to frequent blood testing and the difficulty in maintaining an INR range between 2.0–3.0, and there is increased potential for food and drug interactions.

The European Society of Cardiology (ESC) (Camm, 2007) reported that about 12,500

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**Table 1. Risk scoring system for atrial fibrillation**

<table>
<thead>
<tr>
<th>CHADS2 risk scoring system</th>
<th>CHA2DS2-VASc risk scoring system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestive heart failure</td>
<td>Congestive heart failure/left ventricular dysfunction</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Hypertension</td>
</tr>
<tr>
<td>Age &gt;75 years</td>
<td>Age &gt;75 years</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Stroke or TIA</td>
<td>Stroke/TIA/thromboembolism</td>
</tr>
<tr>
<td>If total CHADS2 maximum score ≥2, the patient should be considered high-risk</td>
<td>Vascular disease: coronary artery disease, MI, peripheral artery disease, or aortic plaque</td>
</tr>
<tr>
<td></td>
<td>Age 65–74 years</td>
</tr>
<tr>
<td></td>
<td>Sex: female gender</td>
</tr>
<tr>
<td></td>
<td>Total CHA2DS2-VASc score has a maximum score of 9</td>
</tr>
</tbody>
</table>

From: Gage et al, 2001; Lip et al, 2010
Clinical AF SERIES

Clinical AF SERIES

Table 2. Treatment recommendations based on risk scoring system

<table>
<thead>
<tr>
<th>Score 0: Low risk</th>
<th>Score 1: Medium risk</th>
<th>Score &gt;2: High risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin 75–300 mg daily</td>
<td>Warfarin (as per INR) or aspirin 75–300 mg daily, based on patient preference</td>
<td>Warfarin unless contraindicated. Aim for INR ratio 2.0–3.0</td>
</tr>
</tbody>
</table>


Table 3. HAS-BLED bleeding risk scoring system

<table>
<thead>
<tr>
<th>Hypertension</th>
<th>Abnormal renal and liver function 1–2 (1 point for each)</th>
<th>Stroke</th>
<th>Bleeding</th>
<th>Labile INRs (unstable/high or abnormal clotting time)</th>
<th>Elderly (&gt;65 years)</th>
<th>Drugs or alcohol 1–2 (1 point for each)</th>
<th>Score &gt;3: high risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1–2 (1 point for each)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>The patient should be regularly reviewed following initiation of warfarin</td>
</tr>
</tbody>
</table>


Strokes a year are a result of AF (i.e. about 1 in 6 strokes). About 46% of AF patients should be using warfarin but are not receiving it (NICE, 2006; NHS Stroke Improvement Programme, 2010). Providing education, support and frequent follow-up to re-evaluate the risk of stroke is crucial and patients should be informed of this when starting anticoagulation therapy.

The risk of bleeding is a determining factor in patient suitability for warfarin, particularly in the elderly population. The risk of falls in this group may be one of the reasons why the prescribing of warfarin is poor (Dharmarajan, 2006). Data from the Birmingham atrial fibrillation study (BAFTA) found that a patient may need to fall about 300 times a year for the risk of intracranial haemorrhage to outweigh the benefit of oral anticoagulation therapy. This equates to almost one fall daily (Mant et al, 2007).

The HAS-BLED risk scoring tool has been devised based on the Euro Heart Survey (Pisters et al, 2010), and is useful for clinicians who have concerns prescribing warfarin because of the potential bleeding risk (Table 3).

New therapies

Direct thrombin inhibitors such as dabigatran work by inhibiting the formation of fibrin which is needed for clot formation. The advantages of direct thrombin inhibitors include less monitoring and fewer food and drug interactions (Weitz, 2010).

The RE-LY trial (Connolly et al, 2009) showed that dabigatran was superior to warfarin and had a similar rate of major bleeding compared with warfarin. However, systemic embolism and life-threatening bleeding, including intracranial bleeding, was significantly reduced (Martí-Fàbregas and Mateo, 2009).

Oral factor Xa inhibitors, such as apixaban, rivaroxaban and edoxaban are being developed. Studies, including ARISTOTLE (Granger et al, 2011) and ROCKET AF (Patel et al, 2011), reported a reduction in thromboembolic complications and an acceptable bleeding risk when comparing efficacy and safety to warfarin in relation to the CHADS2 risk score. Warfarin may become a treatment of the past as these new therapies are proving to be beneficial in the elderly population.

Pharmacological and non-pharmacological management of AF depends on the following:

- Type of AF
- Symptoms and overall health
- Underlying cause
- Age of the patient.

Acute symptomatic onset of AF should be managed in secondary care. Such patients require electrical and/or pharmacological cardioversion.

Management: rate or rhythm?

The choice of whether to treat rate or rhythm will be dependent on the type of AF and a number of other factors (Table 4). Rate control can be managed in general practice, whereas rhythm control requires referral to specialist care.

Rate control

Beta-blockers

Beta-blockers such as bisoprolol and metoprolol work by reducing the release of adrenergic hormones and noradrenaline, which increase heart rate (Ogbru, 2012). These beta-blockers are commonly used to achieve strict rate control (Corley et al, 2004) and can be initiated in primary care. Evidence suggests that beta-blockers only have a modest effect in preventing the recurrence of AF, with the exception of exercise-induced AF and thyrotoxicosis (ESC, 2010).

If beta-blockers fail to control the rate, adjunct therapy, e.g. digoxin, can be used. However, this is dependent on age. If control is still inadequate, the patient should be referred to specialist care. Further management will include class I (propafenone and flecainide) or class III (sotalol) agents, which may help manage the rhythm but can have some rate-controlling properties.

Rate-limiting calcium-channel antagonists

Calcium-channel antagonists, e.g. verapamil and diltiazem, are effective for acute and chronic rate control in AF. They are thought to be superior to beta-blockers (Camm et al, 2007). Antagonist drugs should be avoided in...
patients with systolic heart failure as they may reduce the force of contraction in the heart muscle, exacerbating heart failure (ESC, 2010).

Calcium-channel antagonists are usually prescribed as second-line treatment when standard beta-blockers have been unsuccessful. They can also be prescribed when rate control is needed during exercise, aiming to target a resting heart rate of less than 90 beats per minute (110 beats per minute for those with recent-onset AF) and less than 200 beats per minute minus age during exercise (NICE, 2006). They should not be used together with beta-blockers as this could precipitate bradycardia and heart blocks.

**Digoxin**

Digoxin is an effective treatment which controls resting heart rate. However, it is not effective during exercise. It can be used in combination with a beta-blocker or diltiazem, a calcium channel antagonist, which may be effective in patients with or without heart failure. It is not used routinely but tends to be used as an adjunct therapy when other rate-controlling drugs are ineffective (ESC, 2010). It is used more in elderly sedentary patients.

**Rhythm control**

**Anti-arrythmic drugs**

Anti-arrythmic drugs are useful for younger patients who are symptomatic and haemodynamically unstable, where the arrhythmia may be life threatening. Anti-arrythmic drugs can be used to convert AF back to sinus rhythm successfully in these patients because the arrhythmia has not been sustained over a long period of time and therefore the likely hood of remodelling and damage to the heart tissue itself is remote.
Propafenone and flecainide
Propafenone and flecainide are anti-arrhythmic drugs. Propafenone can be used to prevent recurrent AF. Flecainide can be used for paroxysmal AF and is effective at maintaining sinus rhythm after electrical cardioversion.

However, the side effects of propafenone and flecainide include prolongation of QT syndrome and proarrhythmia. Both drugs can be used in patients without significant structural heart disease but propafenone should not be used in coronary artery disease or heart failure patients (ESC, 2010) because of cardiac toxicity, heart failure, conduction disturbances, and proarrhythmia side effects which are increased in patients with cardiac disease (Podrid and Anderson, 1996).

Sotalol
Sotalol is a class III anti-arrhythmic drug used to prevent recurrences in non-permanent AF, e.g., lone AF, paroxysmal AF, and persistent AF (Cosio et al, 2008). Sotalol should not be used solely for rate control (NICE, 2006), although the anti-arrhythmic properties of this drug are thought to be a result of improved rate control (ESC, 2010).

Sotalol is less effective than amiodarone. Therefore, it is used in non-permanent AF and in those with no underlying cardiac disease. Sotalol should be used with caution as it can cause prolongation of QT syndrome and proarrhythmia.

Pill in the pocket
Flecainide, propafenone and occasionally sotalol can be used in paroxysmal AF (NICE, 2006). Patients require education and support to enable them to understand when to self-medicate and when to seek help. The patient must have no history of left ventricular dysfunction, or valvular or ischaemic heart disease. Suitable patients will report a history of infrequent symptomatic episodes of paroxysmal AF, a systolic blood pressure >100 mmHg and a resting heart rate above 70 beats per minute (NICE, 2006).

Amiodarone
Amiodarone is a class III drug used for rhythm control when usual methods have been ineffective or if the patient has coronary artery disease or left ventricular dysfunction. Amiodarone contains iodine which can cause severe adverse events including thyroid dysfunction, bradycardia and pulmonary effects. Amiodarone may continue to be used inadvertently for rate control when patients have lapsed into permanent AF. If standard agents i.e. beta-blockers and rate-limiting calcium-channel blockers are suitable, then amiodarone should be discontinued in this setting.

New agents
Dronedarone is similar to amiodarone in its anti-arrhythmic properties. However, it does not contain iodine, which is thought to cause the side effects of amiodarone (Fogoros, 2011). Dronedarone can be prescribed for non-permanent AF for patients who are not controlled on first-line therapy (usually beta-blockers) and have at least one of the following cardiovascular risk factors (NICE, 2010):

- Hypertension requiring at least two different classes of anti-hypertensive drugs
- Diabetes
- Previous history of transient ischaemic attack/stroke or systemic embolism
- Left atrial diameter of >50 mm
- Left ventricular ejection fraction of <40%
- Over the age of 70 years and does not have unstable heart failure of NYHA class III or IV.

The ATHENA trial demonstrated that dronedarone reduced the risk of cardiovascular hospitalization and death by 24% in comparison to standard care (beta-blockers and placebo) with no difference in the rate of serious adverse events (Hohnloser et al, 2009). Data suggest that this drug is effective in the treatment of non-permanent AF and appears to have fewer side effects but is less effective than amiodarone (NICE, 2010).

Dronedarone is predominantly metabolized in the liver. Reports from the Medicines and Healthcare products Regulatory Agency (MHRA) (2011) has indicated a risk of liver failure and deteriorating heart failure when using dronedarone. Therefore, liver and cardiac function should be monitored closely.

Other interventions
Cardioversion
Direct current cardioversion is a controlled synchronized shock administered under light anaesthesia. This shock disrupts the abnormal electrical conduction pathway. Cardioversion should be considered for symptomatic patients, especially when patients are unstable as it can help restore sinus rhythm and improve long-term outcomes (Fuster et al, 2006). In patients with
Clinical AF SERIES

Table 5. Quality and Outcomes Framework guidance

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Points</th>
<th>Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFI: The practice can produce a record of patients with AF</td>
<td>5</td>
<td>—</td>
</tr>
<tr>
<td>Initial diagnosis</td>
<td>10</td>
<td>40–90%</td>
</tr>
<tr>
<td>AF diagnosis after 1 April 2008 with ECG or specialist confirmed diagnosis</td>
<td>12</td>
<td>40–90%</td>
</tr>
</tbody>
</table>

From: NICE, 2011.

permanent AF, normal rhythm is unlikely to be restored.

Catheter ablation therapy
Evidence is emerging for the effectiveness of catheter ablation therapy. Ablation therapy offers patients a way of restoring sinus rhythm by using a choice of techniques. These techniques include freezing (cryoablation) and/or burning (cauterizing) areas around the pulmonary veins to stop the source that precipitates AF (ESC, 2010). Usually, this is offered when other options have failed. This procedure can help resolve symptoms but not ‘cure’ the abnormal rhythm. The STOP AF trial (Medtronic, 2010) reported an 80% reduction in symptoms in paroxysmal AF.

Ablation of the atroventricular (AV) node can be used as a rate-control strategy. The disadvantage of this approach is that it is irreversible and patients require a permanent pacemaker (Linden, 2011).

Intra-cardiac devices
When pharmacological rate controlling treatments have failed, pacemakers can be used, particularly in AV node ablation.

Specialist services
Certain patients, who require rhythm control strategies, should be referred to specialist services for further management. These patients can be identified by (NICE, 2006):

➤ Continued symptoms
➤ Paroxysmal or persistent AF
➤ Lone AF
➤ Age (below 50 years)
➤ Left ventricular systolic dysfunction
➤ Underlying electrophysiological disorders, i.e. Wolff Parkinson White syndrome.

Treatment in primary care
Managing hypertension, heart failure or inflammation to prevent or delay remodelling of the heart may prevent the onset of AF. Such management may also reduce the frequency of recurrences and progression to permanent AF (Savelieva and Camm, 2007).

The Quality and Outcomes Framework (QOF) allocates points for achieving AF-specific indicators in general practice (Table 5). The AF register should be maintained to ensure timely recall and follow-up. GRASP-AF is a computerized tool that can be accessed from the NHS Improvement website. The tool analyses patients on the AF register and applies a CHADS2 risk score. A list of patients can then be generated to identify who may benefit from anticoagulation therapy.

Follow-ups should include routine assessment of stroke risk, medication concordance and adherence, and optimization of drug therapy. AF patients also require regular support and education about lifestyle including:

➤ Dietary advice tailored to the individual, including information on dietary interactions with warfarin. The importance of a balanced diet to promote weight loss and reduce salt intake, which will help precipitating causes i.e. hypertension and heart failure should also be discussed
➤ Advice about alcohol intake. which is known to precipitate AF (Samokhvalov et al, 2010) and may contribute to weight gain. It is important that patients are advised regarding the recommended intake of alcohol and its association with AF
➤ Advice about caffeine intake. Some studies suggest caffeine precipitates AF (Di Rocco, 2011) while other studies are unable to find a direct association (Klatsky et al, 2011; Shen et al, 2011). Until clear evidence regarding this issue can inform guidance further, practitioners should advise patients to reduce or avoid caffeine substances if it may be a precipitating cause of AF
➤ If Paroxysmal AF is known to be precipitated by high endurance exercise then advice should be given to the patient so he/she understands the importance of when to take their medication to reduce the risk of stroke (Camm, 2010)
➤ A smoking assessment should take place because of its arthrogenic risk profile in cardiovascular disease.

Conclusions
Patients with AF are at an increased risk of stroke and thromboembolic events. A thromboembolic stroke is the most debilitating of all stroke events and 50% will die within the first year (Kirchhof et al, 2007). Evidence suggests that oral anticoagulants are poorly used in primary care in favour of antiplatelet therapy (Gladstone et al, 2009). However, there is strong evidence to support the use of antico-
agitation in the prevention of stroke. There are validated tools such as the CHADS2 and the CHA2DS2-VASc available to inform a stroke risk assessment and stroke risk reduction measures.

Conflict of interest: The author has received sponsorship from several pharmaceutical companies for educational meetings.

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Cosio FG, Aliot E, Botto GL et al (2008) Delayed rhythm control for atrial fibrillation may be a cause of failure to prevent recurrences: reasons for change to active antarrhythmia treatment at the time of the first detected episode. Europace 10: 21–7


