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**Antiarrhythmic drugs. Part 2: rhythm control drugs**

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**Introduction**

In the first article of this three-part series, we discussed how antiarrhythmic drugs affect cardiac electrical activity, and outlined the key aspects of safe practice for the drug group as a whole. We also discussed drug classification, outlined the drugs commonly encountered in UK clinical practice, and described the difference between rate and rhythm control agents. In this second article, we examine rhythm control drugs in more detail.

Rhythm control drugs are medications that are used to terminate arrhythmias, and/or to prevent their recurrence (Bennett, 2013). Although they have a broadly similar function, the individual drugs in this group are highly variable, with some having very specific uses, and others having a wide range of indications. Rhythm control drugs also display considerable variety in their mechanisms of action, pharmacology, and safety profiles (Dan et al, 2018). One feature that they share is the potential for adverse effects; a sound knowledge of their features is therefore essential for any practitioner involved in their use.

In this article, we focus on three of the most widely used drugs; adenosine, amiodarone and flecainide. For each drug, we discuss its pharmacology and mechanism of action, consider how and when it might be used, and identify important practice points. The focus throughout is on identifying the practices that contribute to safe drug administration and prescribing in these commonly used agents.

**Adenosine**

**Overview and indications**

Adenosine is a naturally occurring molecule in the human body, with roles including energy transfer, vasodilatation and regulation of autonomic function (Layland et al, 2014). Its vasodilatory properties are widely exploited in the assessment of coronary artery disease, for example during stress testing. Adenosine also slows electrical conduction through the atrioventricular (AV) node, a property that makes it useful in the diagnosis of arrhythmias, and in the acute termination of supraventricular tachycardia (SVT) (Fogoros and Mandrola, 2018). It has no other uses in arrhythmia management.

SVT describes a regular, narrow complex tachycardia in which atrial activity cannot be determined (Page et al, 2015). Although rapidly conducted atrial tachycardia or flutter account for a small proportion of cases, more than 90% is caused by one of two reentrant arrhythmias whose circuits include the AV node; AV nodal reentrant tachycardia (AVNRT) and atrioventricular reentrant tachycardia (AVRT). These re-entrant SVTs are caused by minor congenital abnormalities in the cardiac conduction system; unlike atrial fibrillation (AF) or flutter they are not associated with underlying heart disease, and often affect young, healthy people (Whinnet et al, 2012).

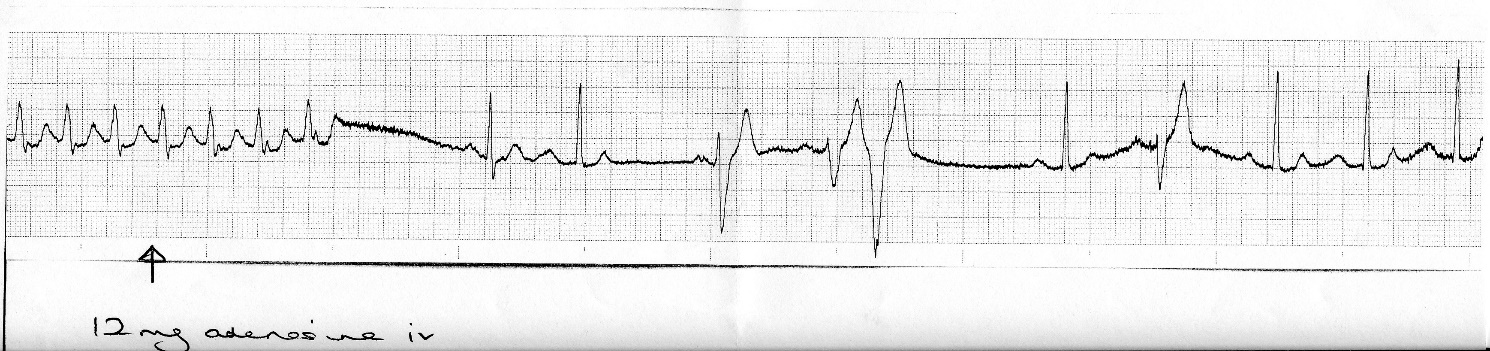
In the acute setting, re-entrant SVT can be terminated by briefly slowing electrical conduction through the AV node (Bennett, 2013). The initial approach recommended by clinical guidelines is to use vagal techniques such as the Valsalva manoeuvre; these non-pharmacological therapies can be used rapidly, do not require venous cannulation, and have few side effects (Page et al, 2015; Pitcher and Nolan, 2015). Unfortunately, they are successful in less than half of individuals, meaning that drug therapy is often needed; guidelines suggest adenosine as the first choice when vagal manoeuvres have failed (Appelboam et al, 2015).

The efficacy of adenosine in the acute termination of SVT is well-established. In a double blinded, randomised controlled trial, adenosine successfully terminated SVT in 91% of individuals, compared to only 16% using placebo (DiMarco et al, 1990). More recently, a Cochrane review evaluated the results of seven clinical trials comparing adenosine to intravenous calcium channel blockers (diltiazem or verapamil) in the termination of SVT (Alabed et al, 2017). The overall success rate was 92.9% for adenosine and 89.7% for calcium channel blockers, suggesting that both drugs were highly effective. In UK guidelines, verapamil is recommended as an alternative when adenosine is contraindicated (Pitcher and Nolan, 2015). Verapamil is associated with fewer unpleasant side-effects than adenosine but is more likely to cause hypotension (Alabed et al, 2017). It also has a longer duration of action than adenosine; although this may prevent recurrent SVT in the acute setting, adverse effects will also last longer, potentially leading to a longer stay in hospital (Alabed et al, 2017).

**Dosing and administration**

In the management of SVT, adenosine is administered as an intravenous (IV) bolus of 6mg, followed by further boluses of 12mg if this is unsuccessful (Pitcher and Nolan, 2015). The drug has a half-life of less than 10 seconds, so it must be given quickly via a large, proximal vein, followed immediately by a rapid saline flush (Wockhardt UK Ltd, 2015). The use of a three-way tap can facilitate rapid administration by ensuring that both syringes are connected to the IV line and can be given one after the other with minimal delay.

During drug administration, vital signs should be monitored and a continuous rhythm strip recorded to capture electrical events (Mullord and Sargent, 2011). Resuscitation equipment should be at the bedside as hypotension and ventricular arrhythmia are potential complications (Whinnet et al, 2015). In AVNRT or AVRT, an effective drug bolus will cause a brief pause in electrical activity followed by the return of sinus rhythm, often interspersed with ectopic beats for the first few seconds (See figure 1). If the rhythm is not re-entrant SVT, slowing of AV node conduction should reveal underlying atrial activity, for example flutter waves, making adenosine a useful aid to diagnosis (Wockhardt UK Ltd, 2015).



**Figure 1. Termination of SVT following adenosine administration**

**Safety**

Following IV administration, adenosine is rapidly deactivated within vascular endothelial cells and erythrocytes by adenosine deaminase (Layland et al, 2015). Because its metabolism does not rely on renal or hepatic function, it can be given safely to people with impaired kidney or liver function (Wockhardt et al, 2015). Adenosine is contraindicated in asthma because it can cause bronchospasm; verapamil can be used instead (Whinnet et al, 2015). Adenosine should be avoided in patients who are haemodynamically unstable, for example due to hypotension or heart failure; in these cases, direct current (DC) cardioversion is a safer alternative (Pitcher and Nolan, 2015). Other contraindications are listed in table 1.

Because of its short half-life and non-haptic elimination, adenosine has few important interactions with other drugs. Caffeine, theophylline and aminophylline block adenosine receptors, which may reduce the efficacy of the drug. Dipyridamole inhibits the action of adenosine deaminase, slowing down the elimination of adenosine and potentiating its effects (Layland et al, 2015). It should be noted that adenosine administration often causes transient but highly unpleasant side effects including chest pain and breathlessness; the patient should be warned about these before the drug is given (Appelboam et al, 2015). Flushing and headache are also common; see table 1 for a full list of common side effects.

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| **Contraindications** | **Cautions** | **Common side effects** |
| * Asthma or chronic obstructive pulmonary disease * Sinus node disease or second / third degree AV block (unless pacemaker present) * Decompensated heart failure * Severe hypotension * Long QT syndrome | * Likely to tolerate hypotension poorly, e.g. hypovolaemia, heart failure, recent myocardial infarction, left main coronary stenosis, severe aortic stenosis. * First degree AV block or bundle branch block. * Atrial fibrillation or flutter in the presence of an accessory pathway. * Increased effects following heart transplant or use of dipyridamole * Prolonged QT interval | * Bradycardia, AV block, ectopic beats * Chest pain or pressure * Dyspnoea * Flushing * Headache * Dizziness * Nausea * Apprehension |

**Table 1. Adenosine: contraindications, cautions and common side effects (Wockhardt UK Ltd, 2015)**

**Amiodarone**

**Overview and indications**

Amiodarone is an iodinated benzofuran, initially developed for the management of angina (Connolly, 1999). Although its principal effect is potassium channel blockade, making it a class III drug, it also blocks sodium and calcium channels, as well as alpha- and beta-adrenergic receptors (Dan et al, 2018). It prolongs the action potential and repolarisation time, widening the QRS and prolonging the QT interval. Its calcium channel and beta-blocking effects slow depolarisation of the sinus and AV nodes, reducing heart rate during sinus rhythm and atrial arrhythmia, and prolonging the PR interval (Zaidel, 2019).

The multiple physiological effects of amiodarone give it a wide range of antiarrhythmic activity against both atrial and ventricular arrhythmias. It is widely used to terminate AF after cardiac surgery, to prevent paroxysmal AF, and to prevent AF recurrence following DC cardioversion (Kirchof et al, 2016). Evidence from multiple, small clinical trials suggests that it has a similar efficacy to other rhythm control drugs in AF management, although in cardioversion of acute AF it is both slower and less effective than flecainide (Aliot et al, 2011; Connolly, 1999). Despite its efficacy in AF management, its use is often limited to patients with structural heart disease, for reasons that are discussed below.

In ventricular arrhythmia, amiodarone is recommended for the acute management of ventricular tachycardia, and is part of the treatment algorithm for cardiac arrest due to shockable rhythm (Pitcher and Nolan, 2015; Resuscitation Council UK, 2016). There is limited evidence for these indications, although the existing data, alongside clinical experience, suggests that amiodarone is as effective as other drugs and has a better safety profile (Connolly, 1999). This is largely due to a lack of significant negative inotropic effect, and a low risk of proarrhythmia, even in individuals with impaired left ventricular (LV) function or cardiomyopathy (Zaidel, 2019). These properties are in stark contrast to the other rhythm control drugs, making amiodarone the drug of choice in patients with structural heart disease. In the long-term prevention of sudden cardiac death, amiodarone is modestly effective, but was inferior to implantable cardioverter defibrillator (ICD) therapy in clinical trials (Priori et al, 2015). In patients with an ICD, amiodarone is widely used in the management of frequent shocks.

**Dosing and administration**

Amiodarone is highly lipophilic, and has a large volume of distribution (Goldschlager et al, 2000). It is extensively stored in adipose tissue as well as the heart, lungs, liver and skin. Because of this widespread storage of the drug, it takes a significant time to achieve steady state plasma levels, even when loading regimes are used (Zaidel, 2019).

In acute administration, amiodarone can be given IV with a typical dose of 300mg over one hour, followed by 900mg over a further 23 hours (Joint Formulary Committee, 2019). The drug can cause phlebitis when given peripherally so administration via a central line is recommended; if this is not possible, it should be well-diluted (Norton et al, 2013). Serious adverse events are rare during acute use of the drug, although hypotension due to vasodilatation can be a problem (Zaidel, 2019). This is linked to speed of administration; rapid bolusing should be avoided except during resuscitation. In cardiac arrest, a rapid bolus of 300mg is given following three unsuccessful shocks (Resuscitation Council UK, 2016). Like all antiarrhythmic drugs, amiodarone can cause bradycardia and heart block, so continuous monitoring of ECG and vital signs are essential during IV administration (Sandau et al, 2017).

In oral drug initiation, a loading regime is usually employed to achieve steady state plasma levels more quickly; eight to ten grams of drug are usually required to achieve adequate loading (Fogoros and Mandrola, 2018). Typically, 200mg is given three times daily for one week, followed by 200mg twice daily for a further week. The usual maintenance dose is 200mg once daily, although higher doses may be used, especially in intractable ventricular arrhythmias (Joint Formulary Committee, 2019). Observational data suggests that as little as 100mg daily may be effective in maintaining sinus rhythm in patients with atrial fibrillation (Memom et al, 2018).

**Safety**

The chemical structure of amiodarone and its widespread organ storage give rise to multiple potential unwanted effects (see table 2). Of these, pulmonary and liver toxicity are probably the most feared as they can lead to organ failure (Goldschlager et al, 2000). The risk of significant complications increases with larger doses and longer duration of treatment; using the smallest effective dose and limiting the duration of therapy therefore reduces risk (Bennett, 2013). The risks of treatment must be weighed against potential benefits; long term therapy is easier to justify if there is life threatening arrhythmia or a risk of deteriorating heart function, and harder if the sole aim is symptom management (Bennett, 2013). Alternative options such as pacing and ablation should always be explored. It should be noted that amiodarone has an elimination half-life of approximately 50 days; therapeutic and unwanted effects will therefore persist for weeks after administration ceases (Accord Healthcare Ltd, 2017).

Prior to long term drug initiation, a number of baseline investigations are recommended (Goldschlager et al, 2000). These include physical examination, 12-lead ECG, chest x-ray, lung function tests, and ophthalmologic examination (Goldschlager et al, 2000). Blood should be taken for liver, thyroid and renal function. Ongoing surveillance measures are described in table 2. There is evidence that screening is poorly adhered to in practice; although blood tests are often organised, ophthalmic and pulmonary tests are less commonly perfomed (Lavon and Goldman, 2019). Although guidelines suggest a yearly ECG, earlier surveillance is suggested as the maximal effects of amiodarone at the sinus and AV node may be apparent within two weeks of drug initiation (Connolly, 1999). Patients should be counselled about the risks of treatment, and the symptoms that should trigger urgent evaluation.

Amiodarone is contraindicated in bradycardia or severe conduction system disease (unless a pacemaker is present), in iodine sensitivity, known thyroid disease, and pregnancy/lactation (Joint Formulary Committee, 2019). The drug is metabolised in the liver by CYP3A4 and CYP2C8 to form an active metabolite, desethylamiodarone (DEA), and is excreted in the bile and faeces (Zaidel, 2019). No dose reduction is required in renal impairment although serum potassium should be monitored as hypokalaemia increases the risk of proarrhythmia (Joint Formulary Committee, 2019). Amiodarone and DEA inhibit multiple hepatic pathways, increasing the plasma levels of some drugs when co-administered (Zaidel, 2019). Table 3 outlines the interactions most relevant to cardiac patients. Grapefruit juice inhibits the metabolism of amiodarone, increasing plasma levels; it should therefore be avoided (Accord Healthcare Ltd, 2017).

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| **Organ** | **Adverse effect** | **Incidence** | **Diagnosis** | **Surveillance / comments** |
| **Heart** | Bradycardia, heart block. | 5% | Slow pulse, dizziness, fatigue, breathlessness. 12-lead or ambulatory ECG. | ECG at baseline and then yearly. More likely if co-administered with other anti-arrhythmic drugs. Stop drug or implant pacemaker. |
| **Lung** | Pulmonary toxicity | 1-20% | Dyspnoea, dry cough, crackles, fever, weight loss. Pulmonary infiltrates on chest x-ray / reduced DLCO at lung function test. | Chest x-ray and lung function test at baseline. Yearly chest x-ray. Repeat lung function test if symptoms develop. Stop drug and initiate corticosteroids. |
| **Gastrointestinal** | Side effects | 30% | Nausea, anorexia, constipation. | Common cause of drug intolerance |
| Liver toxicity | <3% | Increase in liver enzymes (small rise expected). Hepatic failure rare but potentially fatal. | Liver function test at baseline and 6 monthly. Stop drug if ALT > 3 times baseline value |
| **Thyroid** | Hypothyroidism | 1-22% | Fatigue, weight gain, cold intolerance, constipation, dry skin, depression. Raised TSH and low T4. | Thyroid function test at baseline and 6 monthly. Can continue amiodarone and give levothyroxine. |
| Hyperthyroidism | <3% | Weight loss, heat intolerance, anxiety, exacerbation of arrhythmia/angina/heart failure. Low TSH with raised T4 and T3. | Drug usually stopped. Carbamazepine or steroids required depending on underlying pathology. Urgent thyroidectomy if severe cardiac impairment. |
| **Skin** | Photosensitivity | 25-75% | Sunburn with less than normal exposure | Patients should cover up and use sun block. |
| Phototoxicity | <10% | Blue-grey discolouration of skin exposed to sunlight (mostly face) | Usually associated with longer term therapy and higher doses. |
| **Central nervous system** | Neurological toxicity | 3-30% | Ataxia, paraesthesia, peripheral neuropathy, memory problems, sleep disturbance, tremor. | Common cause of drug intolerance. |
| **Eyes** | Corneal microdeposits | >90% | Usually asymptomatic; halo vision in <5% makes night driving difficult. | Baseline ophthalmic evaluation, repeated if symptoms occur. Optic neuritis rare (1%). |

**Table 2. Common adverse effects associated with amiodarone (Accord Healthcare Ltd; Bartalena et al, 2018; Goldschlager et al, 2000). Incidence and surveillance from Goldschlager et al (2000). ALT = Alanine aminotransferase; DLCO = Diffusing capacity of the lungs for carbon monoxide; T3 = Triiodothyronine; T4 = thyroxine; TSH = thyroid stimulating hormone.**

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| **Drug** | **Effect of co-administration** | **Suggested action** |
| Atorvastatin, simvastatin | Increased statin plasma levels; muscle toxicity possible | Change to a different statin, e.g. fluvastatin, pravastatin, rosuvastatin |
| Beta blockers, diltiazem, verapamil | Additive effect on sinus and AV node; risk of bradycardia and heart block | Avoid combined therapy or ensure regular monitoring of the ECG |
| Dabigatran | Increased dabigatran plasma levels: risk of bleeding | Careful follow up; no dose reduction recommended |
| Digoxin | Increased digoxin plasma levels: risk of bradycardia, heart block, digoxin toxicity. | Halve the dose of digoxin and monitor plasma levels |
| Drugs which prolong the QT interval | Increased risk of Torsades de Pointes | Avoid combined therapy |
| Flecainide | Increased flecainide plasma levels: increased risk of toxicity and ventricular arrhythmia | Avoid if possible, otherwise halve the dose. Monitor patient closely, consider plasma level monitoring. |
| Warfarin | Increased warfarin plasma levels; increased INR and risk of bleeding | Reduce warfarin dose and check INR frequently until stable. |

**Table 3. Common amiodarone interactions in cardiac patients (Accord Healthcare Ltd, 2017)**

**Flecainide**

**Overview and indications**

Flecainide is a class IA antiarrhythmic drug introduced in 1982 (Aliot et al, 2011). It blocks sodium channels, mildly prolonging the action potential and slowing conduction through atrial and ventricular myocardium (Fogoros and Mandrola, 2018). It also slows conduction through the AV node and accessory pathways, although it has no effect on sinus rate. On the ECG, a mild prolongation of the PR interval and QRS are seen (Bennett, 2013). The QT interval is slightly prolonged because of QRS widening, but the JT component (the ST segment and T-wave) is not extended as the drug has no effect on repolarisation (Alliot et al, 2011).

Although flecainide is effective in both atria and ventricles, its principal use is in the acute management of AF, especially when the rhythm is paroxysmal (Aliot et al, 2011). In acute onset AF, cardioversion to sinus rhythm can be achieved within an hour of IV flecainide infusion, with a randomised controlled trial showing a success rate of 90% compared to 72% for propafenone, and 64% for amiodarone (Martinez-Marcos et al, 2000). Other trials have shown success rates between 52 and 95% (Aliot et al, 2011). Cardioversion can also be achieved using oral flecainide, allowing selected patients with infrequent episodes of paroxysmal AF to manage their arrhythmia using a “pill in the pocket” approach; the drug is taken at symptom onset, potentially avoiding hospital attendance (Alboni et al, 2004).

When AF is more frequent, flecainide taken daily has comparable success to other anti-arrhythmic drugs; in a meta-analysis by Hohnloser and Zabel (1992), long term rhythm control was achieved in 49% of patients. Flecainide can also be used to prevent AF recurrence after DC cardioversion; to manage AV re-entrant arrhythmias; to slow or terminate pre-excited AF; and to supress frequent ventricular ectopy in structurally normal hearts (Bennett, 2013).

Flecainide is rarely used in the management of sustained ventricular arrhythmia unless the heart is structurally normal and the patient free of coronary artery disease (Andrikopoulos et al, 2015).

**Dosing and administration**

The intravenous dose of flecainide is 1-2mg/Kg body weight, given over 10 minutes (Bennett, 2013). The drug has excellent oral bioavailability, with around 90% of the drug reaching the circulation (Accord-UK Ltd, 2019). It should be taken on an empty stomach. Orally, the drug is typically started at 50mg twice daily, with a licensed maximum daily dose of 300mg in supraventricular arrhythmias and 400mg in ventricular arrhythmias (Joint Formulary Committee, 2019). A once daily, 200mg sustained release capsule is available.

Continuous monitoring of cardiac rhythm and frequent measurement of vital signs are recommended during in-hospital drug administration (Sandau et al, 2017). This is not practical when the drug is started on an out-patient basis, however careful follow-up of the patient, with 12-lead ECG, should be organised.

**Safety**

In people with structurally normal hearts, flecainide has a good safety profile with a risk of ventricular arrhythmia below 3% (Aliot et al, 2011). The drug is contraindicated in coronary artery disease and left ventricular impairment because of increased mortality seen during the CAST trial (CAST investigators, 1989). In this trial, flecainide was compared to placebo in the suppression of ventricular ectopy following myocardial infarction; an increase in mortality was seen in the treatment arm. Flecainide has negative inotropic effects, so should be avoided in patients with heart failure or haemodynamic compromise (Bennett, 2013).

Other contraindications to flecainide use include permanent AF; severe bradycardia; significant conduction system disease (unless a pacemaker is present); severe hypotension; haemodynamically significant valve disease; and Brugada syndrome (Joint Formulary Committee, 2019). Flecainide will occasionally convert AF to atrial flutter, which may conduct 1:1 due to slowing of the flutter circuit. Co-administration with an AV slowing agent (usually a beta-blocker) is common practice to reduce the risk of rapidly conducted flutter (Alliot et al, 2011).

The elimination half-life of flecainide is approximately 20 hours; the majority of the drug is metabolised in the liver prior to renal excretion, however 30% is excreted unchanged and 5% leaves the body in faeces (Andrikopoulos et al, 2015). Elimination slows with increasing age and declining liver and kidney function. A maximum daily dose of 100mg is suggested in the elderly; in people with significant hepatic impairment; and in individuals whose creatinine clearance is 35 ml/min/1.73 m2 or less (Accord-UK Ltd, 2019). Plasma level monitoring is suggested by the manufacturer when there is impaired hepatic or renal function but this is rarely used in clinical practice (Accord-UK Ltd, 2019).

Flecainide has a narrow therapeutic index so toxic effects can develop quickly if over-dosing or drug accumulation occur. Unwanted effects include visual disturbance, dizziness and nausea; in severe overdose cardiac arrest can occur (Andrikopoulos et al, 2015). QRS widening is an expected effect of the drug, but if the increase is greater than 25% the risk of ventricular arrhythmia is increased, and dose reduction or drug cessation should be considered (Bennett, 2013). Important drug interactions are summarised in table 4.

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| **Drug** | **Effect of coadministration** | **Suggested action** |
| Amiodarone | Increased plasma levels of flecainide – risk of toxicity | Reduce flecainide dose by half and monitor plasma levels. |
| Antidepressants including fluoxetine and paroxetine | Increased plasma levels of flecainide – risk of toxicity | Avoid concomitant use |
| Antiepileptics: phenytoin, phenobarbital, carbamazepine | 30% increase in flecainide elimination | Monitor effectiveness |
| Antihistamines: mizolastine, astemizole and terfenadine | Increased plasma levels of flecainide – risk of toxicity | Avoid concomitant use |
| Antivirals: ritonavir, lopinavir and indinavir | Increased plasma levels of flecainide – risk of toxicity | Avoid concomitant use |
| Beta blockers | Additive negative inotropic effects. | Caution and careful patient assessment |
| Bupropion | Increased plasma levels of flecainide. | Caution; consider dose reduction |
| Class I antiarrhythmics | Additive effect increases risk of proarrhythmia. | Do not coadminister with other class I drugs. |
| Digoxin | Plasma levels of digoxin increased by 15%. Increased risk of digoxin toxicity. | Measure plasma level of digoxin at least six hours after administration. |
| Diltiazem, verapamil | Additive negative inotropic effects. | Coadministration is not recommended. |
| Diuretics, corticosteroids, laxatives | May cause hypokalaemia, increasing risk of ventricular arrhythmia | Monitor electrolyte levels |

**Table 4. Important flecainide interactions (Accord-UK Ltd, 2019)**

**Conclusion**

Rhythm control drugs are a heterogenous group with a variety of uses including the acute termination of supraventricular and ventricular arrhythmias, and the prevention of their recurrence. Some drugs, like adenosine, have a very narrow range of use, while others, such as amiodarone, have numerous indications. Their pharmacology is equally diverse, with a variety of mechanisms of action and wide variation in half-life, elimination and dosing.

The common factor in rhythm control drugs is the potential for serious adverse effects; drug selection must be guided by patient assessment, a knowledge of underlying cardiac function, and a careful weighing of risk and benefit. Renal and hepatic function are also important in predicting safe therapy, and should be combined with a knowledge of pharmacokinetics and potential interactions with other drugs. Careful monitoring is essential once drug therapy has been initiated, alongside patient education and advice on when to seek help.

In the final article of this series on antiarrhythmic drug therapy, we turn our attention to the rate control agents, evaluating three of the most commonly used drugs.

**Key points**

* Rhythm control drugs are used to terminate arrhythmias and to prevent their recurrence. They are a heterogenous group of drugs with diverse indications, mechanisms and unique features.

* Adenosine is an ultra-short acting drug used to terminate re-entrant supraventricular tachycardia. It also has a role in acute arrhythmia diagnosis. It should be avoided in asthma.
* Amiodarone is a very long acting drug that is extensively stored within the body. It has a plethora of uses, and is the drug of choice when there is left ventricular systolic dysfunction or cardiomyopathy. Multiple adverse effects are possible during long term use, which limit its use in patients with structurally normal hearts. In intravenous use it should be given via a central line whenever possible.
* Flecainide is highly effective at terminating new-onset atrial fibrillation, and is widely used in the management of paroxysmal AF. Adverse effects are rare in individuals with normal hearts, making it a good choice in this population. It should be avoided if there is structural heart disease as increased mortality has been demonstrated in this patient group.
* All rhythm control drugs have the potential for adverse effect, including fatal arrhythmia. Careful patient assessment, monitoring and follow-up are required.

**CPD questions**

1. The next time you care for a patient prescribed an antiarrhythmic drug, find out the indication for the drug and consider the patient’s medical history and test results. Does the prescription seem appropriate in light of what you know about the drug?
2. Evaluate the monitoring arrangements for patients administered antiarrhythmic drugs in your clinical area. Are they adequate to detect adverse drug effects? If not, how could monitoring be improved?
3. Make sure that you are familiar with the normal ranges for renal, thyroid and liver function tests, and can recognise the significance of changes in organ function.

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