



# Medicine for Managers

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## Arrhythmias

As the name suggests a cardiac arrhythmia (also known as a dysrhythmia) is an abnormality in the heart rhythm and is a term used to describe a variety of conditions where the heartbeat is irregular, too fast or too slow. The disorder is thought to affect more than two million people in the UK and for most the disorder does not affect normal activity if appropriately treated.

There are a number of principal types of arrhythmia which are basically:

- **Bradycardia**, where the heart beats more slowly than normal
- **Heart Block**, where the heart beats slowly because of a conduction abnormality
- **Tachycardia**, where the heart beats faster than normal
- **Fibrillation**, where the heart develops a rapid, irregularly irregular rhythm

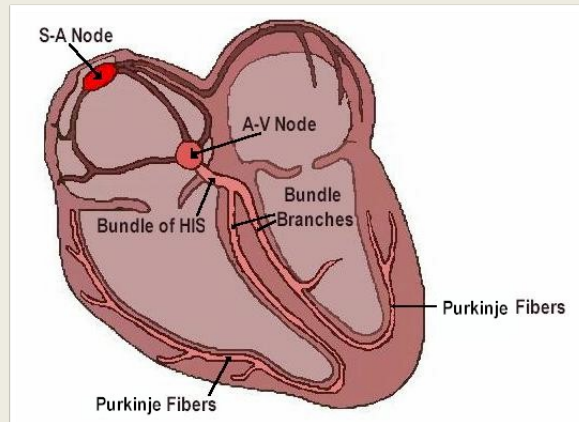
To appreciate the nature of abnormal heart rhythms, it is necessary to understand how the heart beat works.

You will recall that the heart has two atria through which blood travels into two ventricles.

Blood from the left ventricle is pushed out into the general circulation and from the right ventricle into the lung circulation.

Within the heart is an electrical conduction system which consists of four principal parts:

- A sinu-atrial (S-A) node
- An atrio-ventricular (A-V) node
- A bundle of His (pronounced 'hiss')
- The Purkinje (pronounced Perk-in-jay) system of fibres.



Each time the heart beats this complex system spreads electrical impulses throughout the heart muscle and, between stimuli, the heart relaxes.

This phase, called **diastole**, allows the heart to fill with blood.

A **heart beat** then occurs which is set in motion within the heart muscle at the **sinu-atrial (S-A)** node.

This may be regarded as the heart's own natural pacemaker. The heart rate is the number of electrical signals initiated by the S-A node in a minute. The electrical charge so initiated spreads across the muscle fibres of the right and

left atria, causing the atria to contract and push the blood through into the ventricles.

The signal arrives at the **atrio-ventricular (A-V)** node during the completion of the ventricles filling with blood. It then spreads down the **Bundle of His**, at the lower end of which it divides into left and right branches, through the **Purkinje Fibres**. These fibres then spread out through the two ventricles dispersing the electrical signal and the ventricles contract.

As the signal passes and the muscle response occurs, the heart then relaxes and fills with blood again, waiting for the next signal to set the whole cycle off again.

## *Amazing isn't it!*

A fault in any part of the electrical system will affect the normal function of the heart and may in some cases be serious or even fatal.

### **Benign Arrhythmias**

It is possible to have an arrhythmia without heart disease. Some people have a marked **sinus arrhythmia** which is not in any way sinister and is simply the variation in heart rate associated with breathing in and breathing out.

Another often benign condition rejoices in the name **Premature Ventricular Contractions (PVCs)**.

Most people are aware that sometimes the heart 'skips a beat'. More accurately it is a premature beat which is weaker than the previous one and is perceived as 'missed'.

Such events can be related to stress, too much caffeine or nicotine and too much exercise.

There is a more significant form of PVC which is associated with heart disease and may cause frequent premature beats and associated

symptoms. In such cases the patient should be evaluated by a cardiologist. However, in most people such events are usually harmless and only rarely need any treatment.

### **Bradycardia** (Brad-ee-car-dee-ah)

This is a condition where the heart beats at an unusually **slow** rate. The 'normal' heart rate is between 60 and 100 beats per minute and, if it is beating more slowly, then it may be defined as bradycardia.

For those of you who do a marathon each morning before breakfast and have a pulse rate of 36, this is perfectly normal and is a sign of fitness. However, under other circumstances there are significant and often treatable causes of bradycardia including:

- Damage to the heart electrical system due to arterial disease or heart attack. The slow rate may be due to an abnormal S-A node.
- An under-active thyroid-hypothyroidism
- Potassium deficiency
- Sleep apnoea
- The use of beta-blocking drugs such as atenolol or propranolol.

It is more commonly a problem of the elderly.

The result is that the patient experiences dizziness, tiredness, weakness and may faint or suffer episodes of breathlessness.

Diagnosis is confirmed on ECG.

Treatment of bradycardia commonly involves treatment of the underlying cause but in those conditions that are resistant to treatment or where the fundamental problem is unclear, a pacemaker may be necessary to increase the heart speed and eliminate the symptoms.

### **Heart Block**

This is a specific type of abnormality where there is either a delay or a complete block of the electrical impulses as they travel from the sinu-atrial node to the ventricles.

It may occur anywhere in the pathway and may be a fault in the S-A node or the A-V node or anywhere in the Bundle of His. The result is that the heart rate is slowed, often dramatically and the heart may also beat irregularly.

The symptoms of heart block depend on the severity of the condition. In mild cases there may be no symptoms whereas in more severe cases, symptoms similar to those of bradycardia are experienced and they may be severe resulting in chest pain and collapse.

If the heart block is complete or if there are symptoms associated with the condition, it may be treated by the insertion of a pacemaker.

### **Tachycardia** (Tack-ee-car-dee-ah)

This is a condition where the heart beats at an unusually fast rate at rest (about 100 beats per minute at rest).

The disorder, usually with a regular but rapid rhythm, may originate from above the ventricles or within the ventricles because of an electrical abnormality.

There are various types with complicated and unmemorable names but in essence the problem is similar in most.

What happens is that there are one or more additional (abnormal) pathways between the atria and the ventricles or actually within the ventricles which means that extra stimuli result in extra heart beats leading to the rapid rate. Tachycardia may be associated with exercise,

anaemia, sudden stress, smoking, high blood pressure, excess alcohol, excess caffeinated drinks and recreational drugs.

The problem is also commonly associated with heart disease due to arterial atheroma. An overactive thyroid (hyperthyroidism) may also be the cause.

The clinical consequences are usually the development of palpitations, fainting and if prolonged, heart failure. In people with heart disease and the elderly, the additional strain placed on the heart by the increased rate may have potentially very serious consequences which may be fatal.

Diagnosis is again confirmed by ECG followed by more detailed investigation to establish the exact cause and the most appropriate treatment.

### **Fibrillation**

Fibrillation is a rapid, irregular and unsynchronised contraction of muscle fibres and this is a very significant event when it affects the heart.

When it is occurring direct inspection will reveal the muscle fibres of affected parts of the heart twitching.

**Atrial Fibrillation** is a common irregular heart rhythm which causes the atria, the upper chambers of the heart, to contract abnormally.

It is often preceded by **atrial flutter** which is an arrhythmia caused by one or more rapid circuits in the atrium.

It is usually more organised and regular than atrial fibrillation and occurs most often in those patients with heart disease. In atrial fibrillation the normal synchronous working of the

*A fibrillating heart appears like a bag full of worms all moving around...*

chamber(s) is lost and the contractions are random and often very fast so that the chamber cannot recover between contractions. The fibrillation may be **paroxysmal** (occurring in intermittent episodes which usually stop within 48 hours) or **persistent** (usually lasting more than seven days).

In a proportion of patients it is of long-standing or permanent.

Cardiac efficiency and performance is therefore reduced. It is associated with the production of abnormal impulses which override the S-A node's normal pacemaker function thereby preventing normal control of the heart.

The result for the patient is an often rapid, irregularly irregular pulse. Causes include high blood pressure, heart disease with atherosclerosis, cardiomyopathy and pericarditis (inflammation of the heart covering).

It is more common with overactive thyroid, asthma, lung disease, diabetes and pulmonary embolism. The condition affects about 1 in 50 adults in the UK and incidence increases with age.

### *Patients with atrial fibrillation are more at risk of having a stroke.*

This is because the fibrillating chamber does not empty effectively and eddies of blood tend to increase the risk of a clot developing in the atrium.

The clot may then pass into the ventricle and, if on the left side, into the systemic circulation and to the brain.

Treatment of atrial fibrillation may be by one of several methods:

- Medication. Digoxin was the mainstay of treatment for many years but there are now more modern drugs including flecainide, amiodarone and the beta blocker sotalol. They may not be fully effective.
- Cardioversion. This is a technique used on some patients in an attempt to restore normal rhythm. It involves giving a controlled shock to the heart normally in hospital where the patient can be fully monitored. Because the technique increases the risk of the formation of a blood clot the patient is anticoagulated before the treatment and for a period thereafter, even if normal rhythm is restored.
- Catheter ablation. This is a newer technique involving the passage of a catheter into the atrium. The catheter contains wires which monitor and record areas of abnormal electrical activity and high frequency radiowaves, which generate heat, are then applied to the area to destroy it. The procedure is usually done under general anaesthetic. It may be used if medication is ineffective and is more commonly used for older people.

**Ventricular Fibrillation** occurs when it is the ventricles which quiver ineffectively and the result is that the blood pressure plummets cutting off blood flow and oxygen to vital tissues.

It is a medical emergency, causes rapid collapse and sudden cardiac death.

Fibrillation is often preceded by ventricular tachycardia (where the heart beats too fast) resulting in chest pain, breathlessness, dizziness, nausea and leading to loss of consciousness.

A patient with these symptoms needs immediate medical attention because the

development of fibrillation is likely and collapse and death may occur quickly. A defibrillator is essential equipment to deliver an electric shock to the heart which stops the fibrillating and allows the heart to resume a normal beat.

Some people get very short-lived episodes of ventricular tachycardia but if it lasts more than 30 seconds it is likely to cause all the symptoms and progress to fibrillation.

Factors predisposing a patient to fibrillation include a previous episode, a previous heart attack, cardiomyopathy, use of illicit drugs and disturbances in blood chemistry

Diagnosis can usually be quickly made by ECG but, if the situation is not an emergency, the usual battery of tests including echocardiography, coronary angiogram and CT or MRI scan will be undertaken.

The emergency treatment for an episode of fibrillation is

**cardiopulmonary resuscitation (CPR).**

Increasingly in the workplace and in first aid courses, CPR is being taught.

It requires rhythmic compressions of the chest at a rate of 100 compressions per minute.

Fashions change and when I qualified it was necessary to sing 'Nellie the Elephant' to get the rhythm.

More recently it has been the Bee Gee's 'Stayin' Alive'. It may be something else now.

The compressions should be maintained until a defibrillator is available.

Once the emergency is overcome, management switches to preventing a recurrence.

There are a variety of medications to control abnormal rhythms but another option is to have implanted a cardioverter-defibrillator which is capable of identifying electrical signs of dysrhythm and sending out electrical shocks to restore normal rhythm.

Coronary angioplasty and coronary bypass surgery are also used.

Much research continues into arrhythmias.

**The British Heart Rhythm Society** is dedicated to improving all aspects of cardiac arrhythmia care. It was formed over ten years ago and is the amalgamation of several arrhythmia and electrophysiological groups.

The website is

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