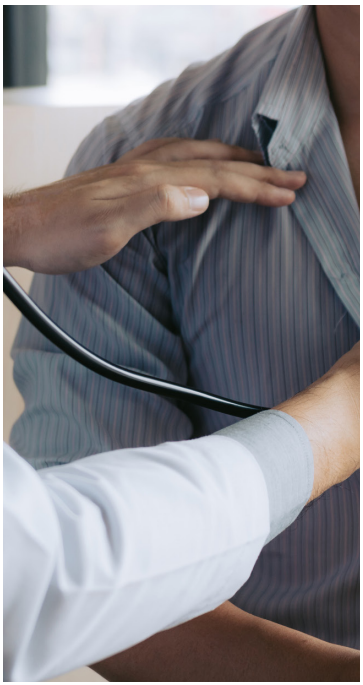
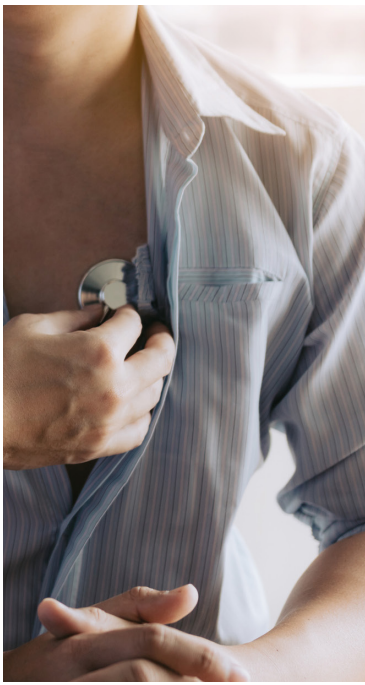
Arrhythmia Alliance
www.heartrhythmalliance.org

Diagnosing Cardiac Arrhythmias

Working together to improve the diagnosis, treatment and quality of life for all those affected by arrhythmias

www.heartrhythmalliance.org
Registered Charity No. 1107496

Glossary

Ambulatory Monitoring A longer-term wearable heart monitor which allows a doctor to track and analyse your heart rhythm during normal activity over a period of 24 hours to two weeks

Arrhythmia An irregular or abnormal heart rhythm that may be excessively fast or slow

Atria The two upper chambers of the heart

AV node Part of the electrical pathway located between the atria and the ventricles

Cardiac Physiologist A healthcare professional skilled in interpreting and providing information on your heart rhythm

Catheter ablation a procedure that scars tissue in your heart to block abnormal electrical signals. It is used to restore a normal heart rhythm.

Ectopic beat Extra beats arising from the atria or ventricles

Electrode A small, sticky pad with a connector on top which picks up the electrical signal on the skin surface

Important Information

This booklet is intended for use by people who would like to have more information about ECGs, manual pulse checks, 12 lead ECGs, extended continuous ambulatory monitoring, Holter monitor, electrophysiology studies, procedures, inherited cardiac conditions and genetic screening. You can use this information booklet to help decide with your healthcare professional which method of diagnosis is right for you.

Contents

Electrophysiologist A cardiologist who specialises in the electrical aspects of the heart, meaning the heart's rhythm

Electrocardiogram (ECG) A simple non-invasive test that records the heart's rhythm and rate

Heart rate The number of times your heart beats per minute

Holter Monitor Records the electrical activity of the heart from electrodes placed on the skin over a longer period of time

Hypertrophic Cardiomyopathy (HCM) An inherited disease of the heart, where the muscle wall of the heart becomes thickened and life threatening arrhythmias can occur

Inherited Cardiac Conditions (ICCs) Conditions that can be passed down in families via your genes

Insertable Cardiac Monitor (ICM) (previously known as Implantable Loop Recorder IRL) A small, thin device inserted under the skin to record your heart rhythm activity

Long QT Syndrome (LQTS) An inherited condition where there are problems with the electrical activity of the heart

Manual pulse check A way to check your pulse rate and rhythm by feeling the pulse in your wrist

Supraventricular Tachycardia (SVT) An abnormal fast heart rhythm originating in the heart's atrium

Syncope Unexplained loss of consciousness

Ventricles The two lower chambers of the heart. The right ventricle pumps blood to the lungs and the left ventricle pumps blood around the body

The heart during normal rhythm (sinus rhythm)

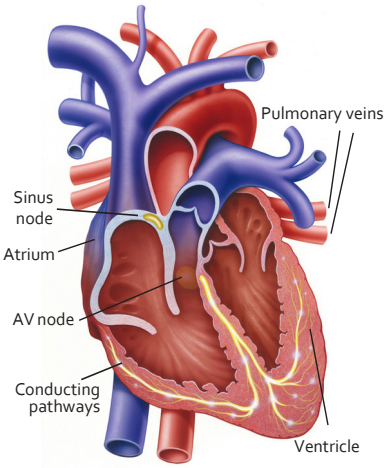
The heart is a muscular pump that delivers blood containing oxygen to the body. It is divided into two upper chambers (atria) which collect blood returning via the veins, and the two lower chambers (ventricles) which pump blood out through the aorta (main artery) and the lungs.

Normally, the heart beats in a regular, organised way, at a speed or rate of 60-100 beats per minute. This is because the heart beat is controlled by a special tissue called the sinus node. This node is in the right atrium and emits electrical impulses.

These electrical impulses spread through the atria and then into the ventricles via a connecting relay station (the AV node). The sinus node controls the timing of the heart according to the needs of the body. An example of this, is during exercise when the heart speeds up or slows down, sometimes below the 60 beats when we are sleeping.

When the heart is beating normally, it is referred to as 'sinus rhythm'. An extra beat (ectopic beat) can trigger a short circuit, and a fast heartbeat. It can travel down an extra pathway and up the normal conduction system. If this continues, palpitations can result.

The heart and normal conduction



Your pulse and ECGs

Why are your pulse and ECGs so important?

Your heart is an organ that pumps blood around your body regularly at a rate of about 70 times every minute. In order to do this, special cells in the heart create electrical impulses that make the muscles of the heart contract, which then pushes the blood around the body.

The electrical signal is coordinated in a certain way, and runs at a certain speed to maximise its effectiveness. So, when you are walking or climbing stairs, your heart will beat faster than when you are resting.

The ECG is a recording of the electrical signal from the heart and gives a lot of information about how well it is performing. It can tell us if the heart is beating regularly , that is if it is in normal rhythm, and if the heart is beating at the right speed, or rate (for example, fast enough, or too fast). The ECG can provide a lot of information about how well the heart is working. The ECG also helps trained specialists,such as cardiologists, electrophysiologists, nurses or cardiac physiologists, find any possible problems.

How can your heart rhythm be measured?

There are many ways that your heart rhythm can be measured. They range from knowing your pulse (www.knowyourpulse.org), using a smartphone app or monitor, a 12 lead ECG, a patch or Holter monitor, or for more long-term monitoring of your heart rhythm, an Insertable Cardiac Monitor (ICM).

Manual Pulse Checks – www.knowyourpulse.org

Measuring your own heart rhythm is easy once you know how. You have probably seen it done in films or on television where a nurse or doctor take the wrist of a patient and look at their watch at the same time. What they are feeling is the pulse of an artery in the wrist as it carries the blood. It expands a little with every beat of the heart as the blood flows through that part. Below is a step-by-step guide of how to take a pulse.

What you are feeling for, firstly, is the pulse rhythm regular? Does it have a tick tock rhythm, or are the beats unevenly spaced? Secondly, how fast or slow is the heart beating: below 60 beats per minute is slow and above 100 beats per minute is fast. It is often normal for the speed to vary, for example if you have just exercised, you would expect the heart to beat faster and if you are resting or are extremely fit, you can expect it to be slower.

Importantly is your pulse in a regular rhythm (and not jumping around like a fish, flip/ flopping, or can you feel palpitations).

Know Your **Pulse** in four steps

1 To assess your resting pulse rate in your wrist, sit down for 5 minutes beforehand. Remember that any stimulants taken before the reading will affect the rate (such as caffeine or nicotine). You will need a watch or clock with a second hand.

2 Take off your watch and hold your left or right hand out with your palm facing up and your elbow slightly bent.

3 With your other hand, place your index and middle fingers on your wrist, at the base of your thumb. Your fingers should sit between the bone on the edge of your wrist and the stringy tendon attached to your thumb (as shown in the image). You may need to move your fingers around a little to find the pulse. Keep firm pressure on your wrist with your fingers in order to feel your pulse.

4 Count for 30 seconds, and times by 2 to get your heart rate in beats per minute. If your heart rhythm is irregular, you should count for 1 minute and do not times the number.

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4. Count the beats for 30 seconds, and times this by 2 to get your heart rate in beats per minute. If your heart rhythm is irregular, you should count for 1 minute and do not times the number.

We recommend you practice doing this when you feel healthy and fine. If you feel unwell, you may want to take your pulse to reassure yourself. Look out for the following things:

- Is it regular? Does it have a 'tick-tock' regular beat?
- Does it seem particularly slow or fast considering the situation? *Remember*, below 60 beats per minute is slow and above 100 is sometimes considered fast. The heart beats faster during walking and exercise and slower when we sleep.
- Is it jumping around? Is it fast, then slow, is it irregular?

If your pulse is irregular and seems either particularly fast or slow, call NHS 111 and give them the information you have from taking your pulse, as well as letting them know how you feel. You can also pass this information on to your doctor to help them better understand and monitor in case you have an underlying arrhythmia (irregular heart rhythm).

ECG recorder and smartphone apps

In 2017, research found that 85% of the UK adult population now owns a smartphone. Smartphones have all kinds of interesting health associated apps including those that can record your heart rate or take an ECG.

AliveCor Kardia mobile ECG is currently the main mobile application used in the UK and recommended for use by NHS England. It allows electrode attachments to connect with a compatible mobile device (smartphone or tablet computer) and transmit, record, auto-analyse, store and view an ECG recording using a dedicated app. The ECG is captured digitally and can be viewed and emailed to your doctor for a diagnosis. The app also has built in AF detection algorithms that provides an instant interpretation to the user.

Unlike other devices, Kardia Mobile documents the symptoms and rhythms at the moment they occur – and is the only device to offer this "symptom +rhythm" correlation, which is important to a Cardiologist who is making the diagnosis. All other devices require follow-on ECG or symptom diaries/ human memory. Please note : DO NOT use an AliveCor Kardia Mobile if you have an implanted heart device such as a pacemaker, ICD, S-ICD, CRT or similar implantable device.

There are several smartphone apps that determine heart rate using the built-in camera, but these are not yet validated. These apps use the smart phone flash or light source and camera to obtain a recording of pulse waves.

12 Lead ECG

The 12 lead ECG is a very useful way for doctors and other health specialists to gain more information about how your heart is performing. The test is painless, easy and simple to carry out, it is often performed in the GP surgery or local hospital by a nurse or physiologist and only takes a few minutes. You will need to remove your outer clothes so that sticky electrodes can be attached to your skin to pick up the electrical signals from your heart, so wear something loose and easy to remove if you expect to have an ECG.

The recording is made on a special machine that has a number of wires coming from it that connect to the electrodes attached to your chest. There is a screen and a printer to print out the ECG.

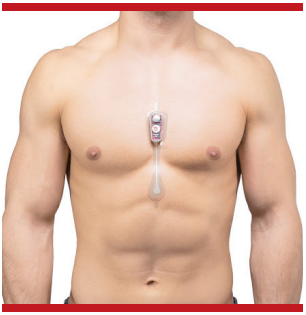
The electrode is a small, sticky pad with a connector on top that is used only for you and picks up the electrical signal on the skins surface. Good contact between the electrode and the skin is required, so the specialist may want to clean the skin lightly or remove any hair. After that, all you have to do is lie down, relax and breathe and let the specialist do their work. Within minutes it will be done and your doctor will have the information they need to help with your any diagnosis and potential treatment.

The 12 lead ECG shows whether the heart is beating fast or slow and also shows if the rhythm is regular. Because there are many electrodes on the chest and legs, this gives different views of the electrical activity of the heart and allows a specialist to understand better if there is anything unusual.

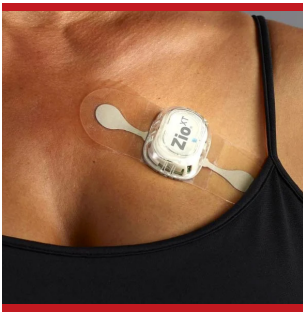
"The Fibricheck app detected an irregularity in my heart rate, but it was the 12 lead ECG that finally diagnosed I had Atrial Fibrillation"

Michael in Cambridgeshire

Extended continuous ambulatory monitoring



Often, irregular heart rhythms, arrhythmias,come and go. The irregular heart rhythm is not always there. It may not be found during a routine 12-lead ECG. Therefore a longer period of heart rhythm monitoring is needed to find the irregular heart rhythm. A continuous ECG Monitor may be required to find an arrhythmia, to enable your doctor to diagnose or reassure that there is no irregularity. There are heart monitors that can be worn for longer.



A longer-term, wearable heart monitor allows a doctor to track and analyse your heart rhythm during normal activity. The monitor has a small sticky patch that you can wear on the upper left side of your body for up to two weeks, during which time the monitor will record and store information from your heartbeat and rhythm. You can also press a button on the monitor to help your doctor to see if your symptoms related to any irregular heart rhythm. At the end of the wearing the monitor you can remove it, A report will be sent to your doctor who can review it. If an irregular heart rhythm is found then the doctor will discuss with you if any treatment is needed.

Who should have a extended monitoring?

For an individual whose symptoms are infrequent, the 24/48-hour monitor would not be appropriate. However, a monitor that will span up to two weeks is more likely to detect an episode. The device is small and provides enough information without interfering with your everyday life.

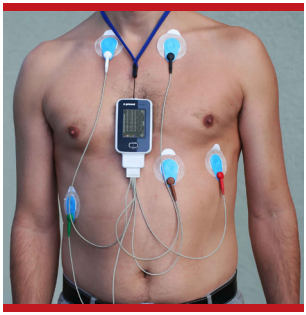
How is it fitted?

The patch can be applied by your GP/ nurse or at home. The skin is cleaned so the patch will stick effectively and remain in place for the prescribed period. You will be asked to record any symptoms by pressing a button on the patch and noting it in a booklet.

Will it affect my day-to-day activities?

This monitor is made wearing for a long time with as little impact on a person's daily life and lifestyle. There are no wires or batteries to charge. You will be able to continue most normal activities, including showering and exercise, but not swimming. The only bit you need to do is press a button to when you get symptoms and send the patch when you have finished.

Holter Monitor



The Holter monitor is worn for one, two or sometimes three days (24, 48 or 72 hours). A specialist will place electrodes on your chest. The wires are connected to a small, battery operated mobile recording device. This will normally slip into a holder on a belt around your waist or other comfortable position.

The electrodes will need to stay in place for the whole time the recording is taking place, and you may also be asked to keep a diary of how you feel and if you have any symptoms. This can then be compared to your heart rhythm.

You can go about your normal day when you are wearing the recorder, but swimming and showering are not recommended, as the recorder needs to be kept dry.

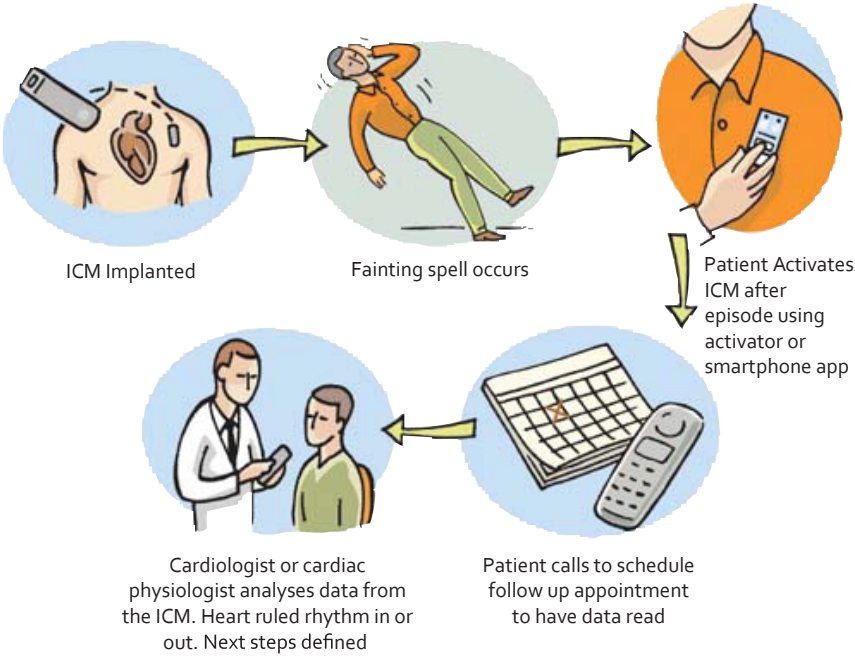
Once the recording has been made, a specialist will review the recordings over the whole period and see if there is anything out of the ordinary with your heart rhythm during that time.

Insertable Cardiac Monitor

Another way to record a long-term ECG that will give the doctor even more information is to use an Insertable Cardiac Monitor (ICM). An ICM is implanted for arrhythmias that happen very rarely, perhaps every few months. Or perhaps you experience recurrent fainting events and there is a concern this could be because of an abnormal heart rhythm. There is a need to capture a faint and see if it because of a heart rhythm problem.

The ICM is a small, thin device that is inserted under the skin and can record an ECG for up to three years. You can activate this yourself when you feel unwell or the ICM can record automatically if it detects something unusual or during a fainting event. Your doctor will advise you on how it is set and what to do.

Further guidance is available in our **Insertable Cardiac Monitor (ICM) booklet**.



Electrophysiology (EP) studies

Why do I need an electrophysiology study?

An electrophysiology study is a procedure by a heart rhythm cardiologist (electrophysiologist) in a hospital. This is mostly done in one day. Electrophysiology studies investigate the electrical activity of your heart to find where an arrhythmia (abnormal heartbeat) is coming from.

Recording wires are carefully placed in the heart, through needle punctures into the veins normally in the groin. These recording wires are used to look at the function of the heart's electrical system. It can help your doctor to find abnormal heart rhythms and help the doctor make decisions about future treatment.

What can happen if an abnormality in the electrical system of my heart is found?

If the abnormal heart rhythm comes from the upper chambers of the heart, this is known as supraventricular tachycardia (SVT). These types of heart rhythm disturbances are usually not life threatening, but can cause unpleasant symptoms and interfere with your quality of life.

If the abnormal heart rhythm comes from only the lower, pumping chambers of the heart (the ventricles), it can be dangerous, particularly if it is related to fainting, and especially if you have a heart condition such as a previous heart attack scar.

What does the procedure involve?

Before the Study

Your doctor may ask you to stop taking some medicines before the test. You will also have some routine checks such as blood tests, a physical examination, and an ECG. Before the procedure, you will meet with your doctor or nurse to talk through what will happen, including any risks and benefits. You will be able to ask questions before signing a consent form.

During the Study

The test will take place in a special room called a cardiac catheter laboratory. A team of doctors, nurses, and technicians will look after you and help during the procedure.

An electrophysiology (EP) study is done under local anaesthetic, which means the area will be numbed but you will stay awake. You may also be given medicine to help you relax. Small tubes (catheters) are gently inserted into a vein in your groin, and sometimes in your neck or chest. Fine wires are passed through these tubes into your heart, guided by x-ray. If you could be pregnant, it is very important to tell your nurse beforehand, as x-rays may delay the procedure.

The wires record the electrical signals in your heart. The doctor may give your heart extra beats using a pacemaker to see where any abnormal rhythm starts. This may bring on palpitations but is a normal and important part of the test. This process is called cardiac mapping.

After the Study

The wires and tubes are removed, and pressure is applied to prevent bleeding. You will then rest in bed on the ward for a few hours. The procedure usually lasts 45 to 60 minutes.

Sometimes, your doctor may recommend doing a treatment called catheter ablation straight after the study. This avoids needing a second procedure later. If this is planned, it will have been explained to you in advance, and you will have given consent.

What are the benefits of an EP study?

- It helps your doctor find out why you have abnormal heart rhythms.
- It gives your doctor important information to plan the best treatment for you.

What are the risks of an EP study?

The test is very safe. Serious problems are very rare (less than 1 in 1,000). Possible risks include:

- Abnormal heart rhythms during the test
- Small blood clots
- A small bruise or infection where the tube goes in (usually the groin)
- If you have also had an ablation, your doctor will explain any extra risks.

How long will I stay in hospital?

- Most people go home the same day.
- You should feel well enough to do normal activities the next day.
- Do not lift heavy objects for two weeks.

Can I drive after the procedure?

- If you have an ablation, you may have driving restrictions.
- If your heart rhythm could cause fainting, you must not drive until your doctor says it is safe.
- Do not drive for two days after the procedure to give your groin time to heal.

These heart rhythm disturbances can be treated in a variety of ways and your doctor will discuss treatment options with you, either before or after he/she has performed your electrophysiology study.

Genetic Testing

What is an Inherited Cardiac Condition (ICC)?

An Inherited Cardiac Condition, or ICC, is a heart problem that can be passed down in families through genes. Genes are like instructions that tell our bodies how to grow and work. Sometimes a "spelling mistake" in a gene can cause heart conditions such as Hypertrophic Cardiomyopathy (HCM) or Long QT Syndrome (LQTS). If one parent has the gene change, there is about a 1 in 2 chance their child will have it too. Many people with ICCs feel fine, but some can have serious heart problems, which is why regular heart checks are important.

What is genetic testing?

Genetic testing is a special medical test that looks for the "spelling mistake" in your genes that can cause an ICC. For example, a correctly spelled gene might read "THE CAT SAT MAT," but a gene with a mistake could look like "THE CAT TSA TMA T." Sometimes doctors can find the mistake, but sometimes they cannot with today's technology. If they cannot, your sample may be stored so it can be tested again in the future when new methods are available.

Why is consent needed?

Before you give a sample for genetic testing, you will be asked to give written permission, called consent. Your results will not be shared without your agreement. In some cases, results can also help other family members decide whether they should be tested, but this would only be done with your permission.

Different types of genetic tests

There are two main types of genetic tests. The first is called genetic screening, which is usually done for the first person in the family to be tested. If a gene change is found, relatives may then have familial testing, also called pre-symptomatic testing, to see if they have the same gene change. The process and what it means for each person can be different, so it is always explained carefully by the doctor or genetic team.

Genetic screening

Genetic screening is a test that can be offered if you have been diagnosed with an inherited cardiac condition (ICC). Your cardiologist may suggest it after looking at test results like an ECG or echocardiogram.

The goal is to look for changes in your genes (like "spelling mistakes" in your body's instruction book) that might explain why you have the condition. Finding these changes may not change your own treatment, but it can help show if other family members are at risk.

Possible Results of Genetic Screening:

1. **A gene change is found that explains your ICC**. This means close relatives can be offered testing before they show symptoms.
2. **No gene change is found.** You still have the ICC, but the exact cause is not yet known. Your sample may be stored in case new tests are discovered.
3. **A gene change is found, but doctors are not sure if it causes your ICC.** More family testing may be needed.

Pre-symptomatic Genetic Testing

If a gene change is found in your family, close relatives can choose to be tested:

- If they have the same change, they may develop the ICC and should see a cardiologist. Their children may also need testing.
- If a gene change is not found, they are not at risk and do not require further heart checks.

This process of testing family members is called cascade screening. It helps spot people at risk early, so they can get the right treatment.

Genetic counselling

Genetic counselling is a meeting with a specialist to help you understand the genetic side of your inherited heart condition (ICC). You can talk about what the condition means for you and your family, and whether genetic testing is the right choice.

This is especially important if you are thinking about testing before symptoms appear *(pre-symptomatic testing)*. Finding out you may be at risk, even when you feel well, can be a big change. The test can only show if you are more *likely* to develop the condition. It cannot tell you if you will get symptoms, when they might start, or how serious they might be.

If your test shows you have the gene change, you will usually see a heart specialist. This may affect things like insurance, exercise, lifestyle, or even career choices, so it is important to think about these before testing. A counselling session usually lasts 30–45 minutes. The counsellor may draw a family tree and ask about health history, so bring any family or medical information you can.

How is Genetic Testing Done?

- A sample is taken (usually blood or a cheek swab).
- It is sent to a lab where scientists check for gene changes linked to ICC.
- **Genetic screening** looks at certain genes to find the possible cause of your ICC. This can take several months.
- **Pre-symptomatic testing** checks only for the specific gene change already found in your family. Results usually take about a month.

Your results are sent back to your counsellor or doctor. They will contact you (by appointment, phone, letter, or email) and explain what the results mean, answer questions, and talk about next steps.

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Working together to improve the diagnosis, treatment and quality of life for all those affected by arrhythmias

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To view our patient resources, scan the QR code below:

Please remember that this publication provides general guidelines only. Individuals should always discuss their condition with a healthcare professional. If you would like further information or would like to provide feedback, please contact Arrhythmia Alliance.

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If you would like further information or would like to provide feedback please contact Arrhythmia Alliance.