

CRM

Patient Information on Arrhythmias and Cardiac Devices



Compilation by Dr. B. Vezi

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Contents

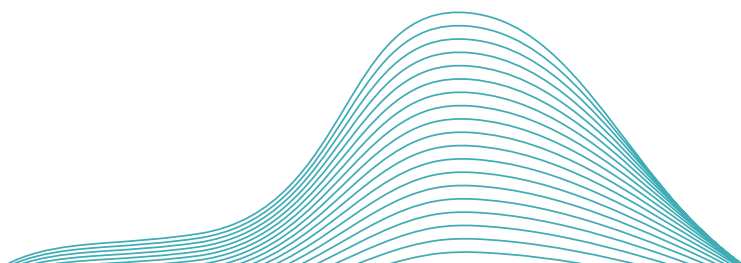
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Section 1

Conditions

Atrial Fibrillation

Atrial Fibrillation (AF or Afib) is **an abnormal heart rhythm**. The four chambers of the heart usually beat in a steady, rhythmic pattern.

Atrial Fibrillation means that the atria (upper chambers of the heart) are **fibrillating or twitching quickly and creating an irregular rhythm**.

The normal heart rate for an adult is between 60 and 100 beats every minute. When the heart is in AF, the atria can beat over 400 times every minute.

What is Atrial Fibrillation?

The electrical system of the heart is the power source that makes the heartbeat. Electrical impulse travel along a pathway in the heart and make the atria and ventricles work together to pump blood through the heart.

A normal heartbeat begins as a single electrical impulse that comes from the SA node, a small bundle of tissue located in the right atrium. The impulse sends out an electrical pulse that causes both atria to contract (tighten) and move blood into the lower ventricles. The electrical current then passes through a small bundle of tissue called the AV node (the electrical bridge between the upper and lower chambers of the heart), causing the ventricles to squeeze and release in a steady, rhythmic sequence. As the chambers squeeze and release they draw blood into the heart and push it back out to the rest of the body. This is what causes the pulse we feel on our wrist or neck.

AF occurs when the electrical impulse does not follow this order. Instead of one impulse moving through the heart, many impulses begin in the atria and fight to get through the AV node. There are two main factors that allow this abnormal electrical rhythm to occur and continue. First, the structure of the heart chambers and the electrical pathway through the heart may change. This happens more often as we get older.

Second, as the electrical pathways change, one or more “triggers” may develop. “triggers” are electrical circuits that send extra impulses at a faster than usual rate. These extra impulses are all trying to get through the AV node and the atria begin to fibrillate, or twitch, in a fast and disorganized way.

Simplified Types of Atrial Fibrillation

1 Paroxysmal AF

Paroxysmal AF refers to AF that occurs sometimes and then stops. The AF stops by itself and the heart returns to normal rhythm. The AF may last for seconds, minutes, hours or days before the heart returns to its normal rhythm. People with this type of AF usually have more symptoms than others. As the heart goes in and out of AF, the pulse rate may change from slow to fast and back again in short periods of time.

2 Persistent / Long-term Persistent AF

Persistent AF is when the AF does not stop by itself. Medications or a special type of electrical shock (called a cardioversion) is used to help the heart return to normal rhythm. If no treatment is given, the heart will stay out of rhythm.

3 Chronic AF

Chronic AF is when the AF cannot be fixed. Medications and controlled electrical shock cannot help return the heart to normal rhythm.

Risk Factors for Atrial Fibrillation

Some people who are living healthy lives and have no other medical problems do develop AF. In most cases, though, we do know the cause.

The most common causes and risk factors include:

- Older than 60 years of age
- Diabetes
- High blood pressure
- Coronary artery disease
- Prior heart attacks
- Overweight / obesity
- Sleep apnea
- Excessive exercise
- Congestive heart failure
- Structural heart disease (valve problems, heart surgery, or congenital defects)
- Untreated atrial flutter (another type of abnormal heart rhythm)
- Thyroid disease
- Chronic lung disease
- Excessive alcohol or stimulant user
- Serious illness or infection

Symptoms of Atrial Fibrillation

The symptoms of AF are different for each person. Many people feel no symptoms at all. They do not know they have AF or that there is a problem, while others can tell as soon as it happens.

This is because the symptoms depend on age, the cause of the AF (heart problems, other diseases, etc.) and on how much AF affects the pumping of the heart.

The symptoms of Atrial Fibrillation include:

- Feeling over-tired or a lack of energy (most common)
- Pulse that is faster than normal or changing between fast and slow
- Shortness of breath
- Heart palpitations (feeling like your heart is racing, pounding or fluttering)
- Trouble with everyday exercises or activities
- Pain, pressure, tightness or discomfort in your chest
- Dizziness, lightheadedness or fainting
- Increased urination (using the bathroom more often)

Complications from Atrial Fibrillation

- Stroke (generally severe)
- Heart Failure
- Poor memory
- Dementia
- Sudden death



How is Atrial Fibrillation Diagnosed?

There are several tests that can be done to check for a fast or irregular heartbeat. Your doctor may order these tests if you are having signs or symptoms of a heart problem. The symptoms include heart palpitations (feeling like your heart is racing, pounding or fluttering), shortness of breath or dizziness.

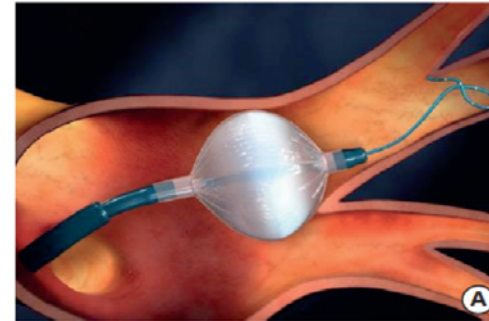
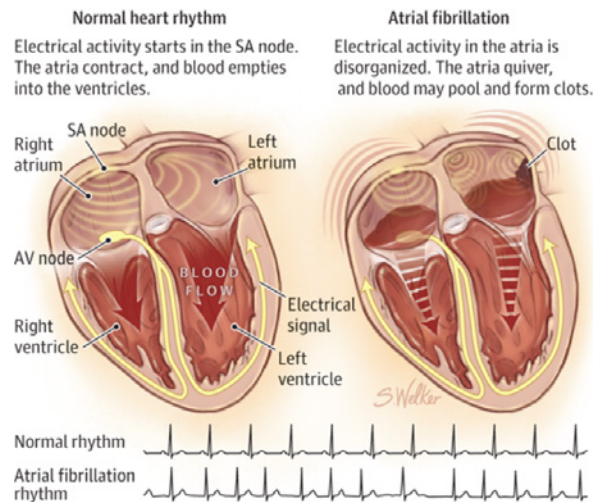
The following are examples of steps taken to deal with Atrial Fibrillation:

1 Electrocardiogram (ECG)

An ECG is a snapshot of your heart's electrical activity. Stickers (electrodes) are attached to your chest, arms and legs. These electrodes measure the rate and rhythm of your heart.

2 Holter monitor

A Holter monitor is a portable ECG. It can be worn for several days. Stickers (electrodes) are placed on your chest and are then connected to a small recording machine that is usually worn around the waist. It records the electrical activity of your heart for your doctor to review later.



Cryo-balloon used to freeze / ablate the source of AF

Success Rate of the Ablation

Largely depend on certain factors:

1 Good outcomes (±70%)

- Younger patients (<65yrs)
- Paroxysmal AF
- Normal heart structure

2 Poorer outcomes

- Older patients (>65yrs)
- Abnormal heart like heart failure, large left atrium
- Multiple co-morbidities like sleep apnea, obesity, severe lung disease, poorly controlled diabetes or hypertension

Potential Complications of the Procedure

Like any invasive procedure, cryo-ablation carries some risk. However, the risk of these complications is small in most cases.

Possible complications include:

- Problems related to threading the catheters through the blood vessels such as **bleeding, infection, blood clots, bruising, radiation burns**, and injury to the vessel(s)
- Injury to the heart as a result of the catheters; this includes a **perforation through the heart muscle** or damage to one of the valves within the heart
- Blood clots that travel to the lungs (pulmonary embolism) or brain (**stroke**)
- Heart block or failure of any electrical impulse to travel from the top parts of the heart to the bottom. This complication, if permanent, requires implantation of a **permanent pacemaker**.
- Phrenic palsy (Cryotherapy)
- New arrhythmias
- **Death** (occurs in approximately 0.1 to 0.3 percent of cases)

Post Atrial Fibrillation Ablation Care

General Information

NB! Your first appointment will be 3 months after the procedure.

However, we may have to see you early if symptoms are worse than outlined below. The medication/pills may be prescribed for the 6 months after the procedure.

- 1 The plaster or dressing should be removed the day after your procedure and does not need to be replaced.
- 2 Avoid any lifting or strenuous activity for one week as this increases the pressure in the groin area, making it more likely that the puncture site will bleed.
- 3 You may feel malaise, shortness of breath, productive/dry cough or flu-like illness, gastric changes like nausea, bloated, difficulty in swallowing, etc. These symptoms generally resolve within 14 days. It's important that you may not feel well with non-specific symptoms.
- 4 You may observe spots of blood in sputum, urine & stools. If excessive, please contact your doctor, casualty department or us.
- 5 It is rare for serious complications to occur after these procedures. The most common problem is bruising around the puncture site, which may be uncomfortable for a few days. If this becomes swollen or very red and more painful, please contact your GP immediately as the site may need further attention.



Bleeding

It is rare to have severe bleeding from the puncture site once you are at home. If bleeding does occur you must:

- lie flat
- apply pressure to the site for 10 minutes
- ask someone to call your hospital if the bleeding doesn't stop

Sedation/General Anaesthetic

As you will have been given either sedatives or a general anaesthetic, we advise you not to drink alcohol for 24 hours after the procedure. You should also avoid making any legal decisions or signing any documents for at least 24 hours.

After the Catheter Ablation (Atrial Fibrillation Specific)

It is quite common to experience Atrial Fibrillation (AF) in the first three months following the ablation. **This is not unusual and often settles. It does not necessarily mean that the procedure has been unsuccessful.**

What to do if you Experience a Recurrence of your Atrial Fibrillation Symptoms or any Palpitations

- If the attack is continuous and doesn't go away, or is severe, please consult your GP or go to the Emergency Department at your local hospital.
- Please ask for the ECG copy and arrange for it to be forwarded to your doctor. **An ECG needs to be done at the time of your symptoms.** If it is carried out when you are feeling fine it may not be as useful. If the symptoms are too short to get an ECG then you should contact the Arrhythmia Clinic. If the AF is happening frequently or not going away, it may be necessary for us to arrange a cardioversion to correct your heart rhythm.
- If the AF does not settle down in the first 3 months, it may be necessary for you to have a 2nd ablation procedure. This will be discussed with you at your follow-up appointment or with the Arrhythmia Clinic over the telephone.

You may also experience some variation with your pulse which is not Atrial Fibrillation. **This should settle with time.**

There are some potentially serious complications that can occur after an AF ablation (albeit rarely). These will have been discussed with you before you had the procedure. If you are very unwell or experience any new or unusual symptoms please seek medical attention immediately (if necessary call an ambulance and go to the hospital).

Driving

After a catheter ablation we advise you not to drive for 2 days after the procedure.

Return to Work

We advise you to take a **minimum of 1 week off work**, but it is likely that it may be up to 2 weeks before you feel strong enough to do more physical tasks.

People recover at different rates after an ablation, depending on their general health, fitness, the type of AF they had before the operation and the medication they continue to take. Although many notice an immediate improvement it may take some weeks for others to notice the benefits of a successful procedure.

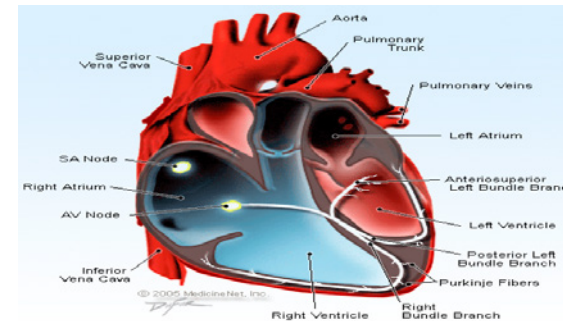
We want your heart to maintain a normal rhythm – the theory is that the longer the heart is in a normal rhythm the more likely it will stay in a normal rhythm. Occasionally your medication (which stabilises your heart rhythm) may need to be restarted or continued for a period of time after the ablation procedure.

You should continue taking your anticoagulant/blood thinners, unless advised otherwise. Any changes in your medication are either listed below or we will give you an information sheet explaining your medication.



Supraventricular Tachycardia

Paroxysmal supraventricular tachycardia (PSVT) is an occasional **rapid heart rate**.



“Paroxysmal” means from time to time.

Causes

Normally, the chambers of the heart (atria and ventricles) contract in a coordinated manner. The contractions are caused by an electrical signal that begins in an area of the heart called the sinoatrial node (also called the sinus node or SA node). The signal moves through the upper heart chambers (the atria) and tells the atria to contract.

PSVT starts with events taking place above the lower heart chambers (ventricles). PSVT can be initiated in the SA node, in the upper heart chambers (atria), in the atrial conduction pathways, or other areas.

The condition occurs most often in **young people and infants**.

The following may increase your risk for PSVT:

- Alcohol use
- Caffeine use
- Illicit drug use
- Smoking
- Endurance sports (A. Fib)

Symptoms

- Anxiety
- Chest tightness
- Palpitations (a sensation of feeling the heartbeat)
- Rapid pulse
- Shortness of breath
- Dizziness
- Fainting

Note: Symptoms may start and stop suddenly, and can last for a few minutes or several hours.

| A PSVT lasting more than half of the day is considered an incessant PSVT.

Exams and Test

A physical examination during a PSVT episode will show a **rapid heart rate**.

The heart rate may be 150 to 250 beats per minute (bpm). In children, the heart rate tends to be very high. There may be signs of poor blood circulation such as lightheadedness. Between episodes of PSVT, the heart rate is normal (60 to 100 bpm).

An ECG during symptoms shows PSVT. An electrophysiology study (EPS) is often necessary for an accurate diagnosis and to recommend the best treatment.

Because of the sporadic nature of the PSVT, its diagnosis may require 24-hour Holter monitoring. For longer recording periods, a "loop recorder" (with computer memory) is used.

Treatment

If you do not have symptoms, PSVT may not require treatment.

If symptoms occur or if you have another heart disorder, treatment may be necessary.

If you have an episode of PSVT, a technique called the Valsalva maneuver can be used to interrupt the fast heartbeat. Hold your breath and strain, as if you were trying to have a bowel movement, or cough while sitting with your upper body bent forward.

| **Splashing ice water on the face** has been reported by some people as helpful.



Emergency treatment of PSVT may include:

- Electrical cardioversion, the use of electric shock to restore a rapid heartbeat back to normal.
- Medicines through a vein, including adenosine and verapamil. Other medications may be used, such as procainamide, beta-blockers, and propafenone.

Long-term treatment of PSVT may include:

- Daily medications such as beta blockers, flecainide, moricizine, sotalol, and amiodarone.
- Pacemakers to override the fast heartbeat; very occasionally used in children with PSVT who have not responded to any other treatment.
- **Radiofrequency catheter ablation;** currently the treatment of choice for most PSVTs.

Outlook (prognosis)

PSVT is generally not life threatening, unless other heart disorders are present.

Possible Complications

The main complication is an increased risk of heart failure.

When to Contact a Medical Professional

Call your health care provider if:

- You often have a sensation of excessive palpitations and symptoms do not end on their own in a few minutes
- You have a history of PSVT and an episode does not go away with Valsalva maneuver, or if other symptoms go along with the rapid heart rate
- Symptoms return frequently
- New symptoms develop

Potential Complications for the Procedure (2%)

Like any invasive procedure, radiofrequency ablation carries some risk. However, the risk of these complications is small in most cases.

Possible complications include:

- Problems related to threading the catheters through the blood vessels such as **bleeding, infection, blood clots, bruising**, and injury to the vessel(s)
- Injury to the heart as a result of the catheters; this includes a **perforation through the heart muscle** or damage to one of the valves within the heart
- Blood clots that travel to the lungs (pulmonary embolism) or brain (stroke)
- Heart block or failure of any electrical impulse to travel from the top parts of the heart to the bottom. This complication, if permanent, requires implantation of a **permanent pacemaker**.
- Phrenic palsy (Cryotherapy)
- New arrhythmias
- **Death** (occurs in approximately 0.1 to 0.3 percent of cases)

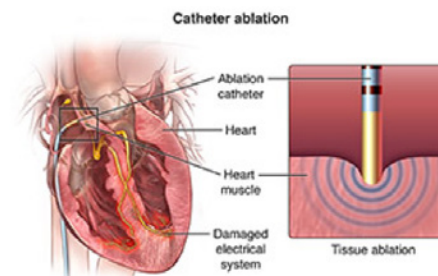
Post SVT Ablation Care

The Procedure

Catheter ablation can take between two and four hours to complete. The procedure, generally done under general anaesthesia, is done in an electrophysiology lab where you will be monitored closely. Then, the doctor will place 5 catheters through the vein (right groin) to access your heart.

After the catheters have been placed, electrodes at the ends of the catheters are used to stimulate your heart and locate the area that is causing the abnormal heart rhythm. Then the radiofrequency heat energy to destroy or “ablate” the problem area, which is usually quite small.

Other types of ablation techniques may be used, such as **cryoablation**, in which very cold temperatures destroy the problem area. After the ablation is over, the doctor will remove the catheters from your chest.



After the Procedure

After the catheter ablation, you will need to lie still for two hours to decrease the risk of bleeding. Nursing staff members may apply pressure to the site where the catheters were inserted.

Recovery from catheter ablation is usually fairly straightforward. In the days after the procedure, you may experience mild symptoms such as flu-like illness, shortness of breath, achy chest, discomfort or bruising in the area where the catheter was inserted. You might also notice skipped heartbeats or irregular heart rhythms.

Most people can return to their normal activities within a few days. Contact your doctor immediately if you have unusual severe pain or swelling, excessive bleeding or consistent irregularities in your heartbeat.

Depending on the type of arrhythmia being treated, catheter ablation can have a success rate of more than 95 percent, but some people may need to have the procedure again or other treatments for heart arrhythmias. Your doctor may want you to remain on medications to help control your heartbeat.

Heart Failure

A **diagnosis of heart failure** means that your heart is having trouble pumping enough blood to meet your body's needs.

Your heart muscles may have been weakened by damage from any of these causes (although in some cases, there is no apparent cause):

- A prior heart attack
- Coronary artery disease (clogged blood vessels)
- High blood pressure
- A virus
- An arrhythmia (irregular heart rhythm)
- Diabetes
- Diseases of the heart muscle or valves

People who have these or other risk factors for heart failure should get regular physical examinations

- Early diagnosis and treatment can stop or reverse the progression of heart failure.
- When the heart is so weak that it can't handle a normal, healthy volume of blood, heart failure sets in.
- As blood travels from the lungs to the heart, it may back up.
- If fluid stays in the lungs, breathing becomes difficult
- The build-up of fluid is the reason for the term "congestive heart failure."
- A heart that is "failing" has damaged or stretched muscles.
- The damage can impair the electrical system in the heart.
- If this happens, the heartbeat may be too fast, too slow, or unsteady.
- Heart rhythm problems are common in heart failure patients.

Diagnosis: A physical examination, medical history, blood tests and heart tests are key to diagnosis.

- Tests can determine how severe the condition is and identify the best treatments.
- Regular physical examinations are important, especially for those at high risk for heart failure.
- Early diagnosis and treatment can stop or reverse the progression of heart failure.

What are the Signs and Symptoms of Heart Failure?

In the early stages, you might not be aware of any symptoms. But as heart disease progresses, one or more of the following symptoms may begin to appear:

1 Shortness of breath (dyspnea)

A feeling of breathlessness, as if you can't get enough air, may come on during physical activity, and may even come out of nowhere when you're at rest. It may wake you up at night and leave you feeling exhausted in the morning, even after a full night of sleep. (Propping yourself up with extra pillows may help you breathe more easily at night.)

2 Fatigue

Activities that didn't feel strenuous to you before, such as walking or climbing stairs, may easily tire you out. You may even feel exhausted while resting when you haven't been active at all.

3 Chronic coughing or wheezing

Fluid congestion (a buildup of fluid in the lungs) is common with heart failure, and is the reason why doctors often refer to it as "congestive heart failure" (CHF). This congestion can make you wheeze and cough; some people cough up mucus or phlegm.

4 Fluid retention or swelling

Fluid also can build up in other parts of your body, such as your feet, ankles, legs and abdomen. Swelling, or oedema, is the most obvious sign of fluid buildup, but weight gain also may be a signal. This fluid buildup makes some people lose their appetite or feel nauseated.

5 Rapid or irregular heartbeat

Your weakened heart may try to beat faster to send more blood through your system, making you feel like your heart is racing. Or it may trigger an arrhythmia, which can cause palpitations, heart-pounding or other symptoms.

6 Confusion

The reduced blood flow to your brain may cause feelings of confusion, impaired thinking or mental sluggishness. Although heart failure is a progressive disease, treatment can slow its progression, reduce symptoms and improve quality of life.

Treatment Options May Include the Following

- Medications
- Diet and lifestyle changes
- Cardiac resynchronization therapy (CRT) or other implanted devices
- Surgery to repair structural damage
- Heart transplantation
- Treatment of underlying causes, such as clogged arteries, heart valve disease, high blood pressure and arrhythmias

Heart Failure and Biventricular Pacing aka CRT (Cardiac Resynchronization Therapy)

Improves heart failure by 70% and in the remainder, the patient progress may be retarded, i.e. less severe progression.
You continue to use your prescribed medication

What are the benefits:

- Feel better, breath better, walker longer distances, less leg swelling (better Quality of Life)
- Less hospitalization or doctor visits
- Live longer

Procedure Information

- Generally done under local anaesthesia
- Takes about 2-3hrs, it's a day procedure
- Success implant rate (>95%)
If usual approach fails, then a surgeon will implant leads via a small incision on your chest (under GA) on a separate elective day
- Complication rate (2%)
 - Infection (2-3%)
 - Bleeding / bruising
 - Lead revision due to dislodgement or high power (voltage required)
 - Pneumothorax (air trapped between lungs and chest cavity), generally self-limiting
 - Long term
 - deep vein thrombosis/clot (swelling of the arm/neck)
 - pain over the pacemaker (metal-bone overlay)

How do I Prepare for the Biventricular Pacemaker Implant?

- 1 Do not stop any medications including blood thinners, except aspirin.
- 2 Do not eat or drink anything after midnight the night before the procedure.
- 3 If you must take medications, drink only small sips of water to help you swallow your pills.
- 4 When you come to the hospital, wear comfortable clothes. You will change into a hospital gown for the procedure.
- 5 Leave all jewelry and valuables at home.

Cardiovascular Syncope

Those at risk, about **90% of people who faint**, have **cardiovascular syncope** - the most serious type of fainting disorder.

The risk of cardiovascular syncope increases with age, and those at greatest risk is people who have:

- Coronary artery disease, or CAD (clogged blood vessels to the heart).
- Angina (chest pain caused by reduced blood flow to the heart) or a prior heart attack (myocardial infarction).
- Ventricular dysfunction, a weakness in the ventricles, the heart's major pumping chambers.
- Structural heart disease, such as problems with the heart valves or muscles (cardiomyopathy).
- An abnormal electrocardiogram (ECG). An ECG is a common test that prints out a graph that shows how the heart is beating and records its electrical activity. Recurrent episodes of fainting that come on suddenly and without warning.



Signs of Cardiovascular Syncope are Usually Sudden

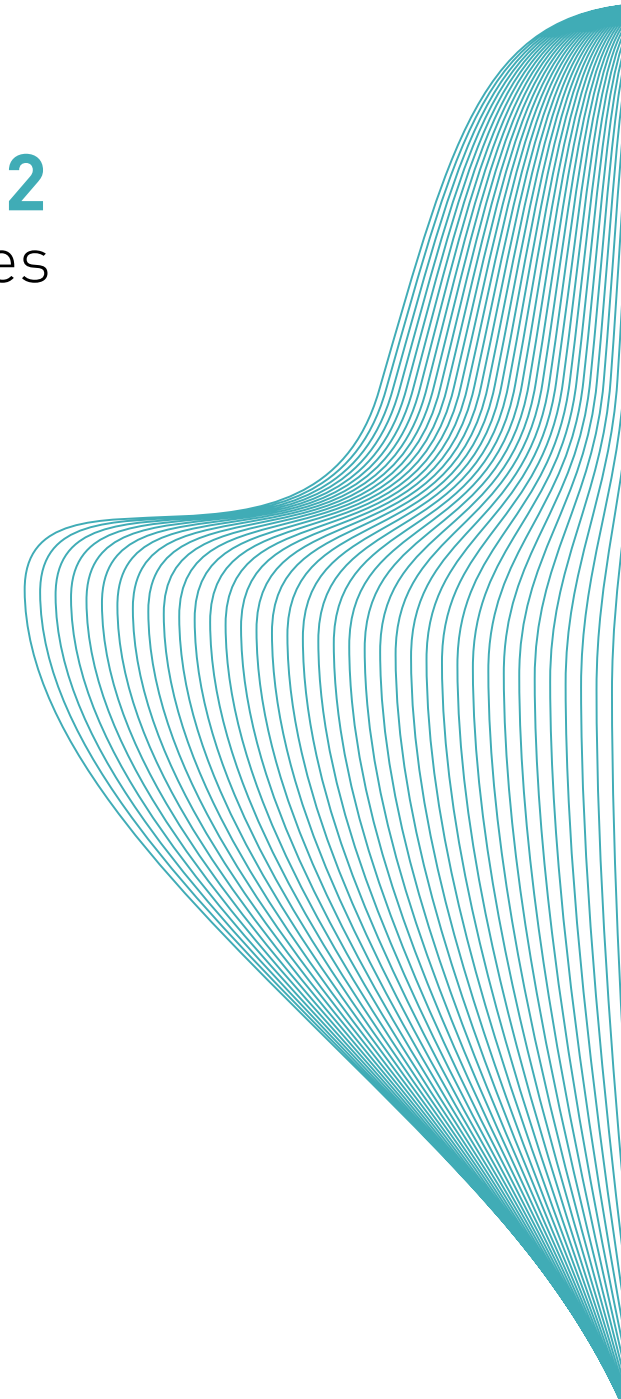
- There may be no warning signs that an individual is about to faint.
- People sometimes feel tightness in the chest, shortness of breath, apprehension or an unusual awareness of their heartbeat (palpitations).
- Palpitations may feel as if the heart is fluttering, racing, skipping beats or pounding with unusual force in the chest.
- If syncope occurs after palpitations that end abruptly, a heart rhythm disorder is often the cause.
- Fainting during physical exercise or a history of unexplained fainting in childhood may be signs that syncope is related to a heart problem.
- Orthostatic (Postural) Hypotension is a condition in which the blood pressure drops suddenly when a person stands up.
- Sometimes the underlying cause is a cardiovascular condition called “pump failure.” This means that the heart pump sometimes “fails” to maintain normal blood pressure.
- This may be due to muscle damage from a prior heart attack, inflammation of the heart, structural defects in the heart’s valves or muscle (cardiomyopathy) or medications.
- Disorders of the electrical system that regulates the rate and strength of the heartbeat can cause pump failure.
- Heart rhythm disorders (arrhythmias) include bradycardia (a too slow heartbeat), tachycardia (a rapid heartbeat) and fibrillation (a rapid heartbeat that also is chaotic, or irregular).

Cardiovascular Syncope and Long QT Syndrome Fainting are primary symptoms. They may be the only warning signs of **Long QT Syndrome (LQTS)**, an inherited electrical disorder of the heart.

LQTS is believed to be a common cause of sudden and unexplained death in children and young adults.



Section 2 Procedures



Catheter Ablation (Cautery)

- 1 Generally done under general anaesthesia but can be done under local anaesthesia
- 2 Procedure generally lasts between 2-4hrs
- 3 Destroys small area inside the heart causing palpitations/faulty signals
- 4 4-5 catheters (similar to telephone cords) are inserted via right groin, sometimes neck as well
- 5 It's a day procedure (at most spending 1 night in the hospital)
- 6 90-95% success rate, i.e. 5-10% may require a second procedure
- 7 **Complications rate ±2-3%**
 - Bruising around the groin
 - Chest discomfort/headaches (migraine if had ablation on the left side)
 - Flu-like illness and fatigue
 - Bleeding inside the heart
 - Likelihood of death or stroke is extremely small ($\pm 1\%$)
 - Need for a permanent pacemaker is extremely small ($\pm 0.5\%$)
 - Phrenic nerve damage ($\pm 2\%$)
 - Radiation/cardioversion skin burns
 - Catheter valve entrapment

Your rhythmic heartbeat is controlled by a smooth, constant flow of electricity through the heart. A short-circuit anywhere along this electrical pathway can disrupt the normal flow of signals, causing an arrhythmia (an irregular heartbeat).

Cardiac Ablation is a procedure used either to **destroy these short-circuits and restore normal rhythm**, or to block damaged electrical pathways from sending faulty signals to the rest of the heart.

Is Ablation Right for You?

Cardiac Ablation may be an option in any of these cases:

- If your arrhythmia can't be controlled with medication.
- If you can't tolerate or don't want to take the drugs used to treat your arrhythmia.
- If you have a supraventricular tachycardia (SVT) — a rapid heartbeat that begins in the upper chambers of the heart.
- (Less commonly) if you have ventricular tachycardia (VT), an arrhythmia that begins in the lower chambers. For VT, ablation is sometimes coupled with an ICD (implantable cardioverter defibrillator).

Admissions and Pre-Procedure Protocol

EP Study and Ablations

- 1 Keep NPO for the a.m. procedure or light fluid breakfast for the p.m. procedure
- 2 Signed informed consent
- 3 IV line (either left or right arm)
- 4 ECG baseline & immediately post-procedure or **whenever the HR is < 40 or > 100/min**
- 5 **Bloods**
 - a. Full Urea and creatinine
 - b. INR if on warfarin
 - c. Hb, WCC and Platelets
 - d. Glucose
 - e. B-HCG for the female patients under 40yrs
- 6 Shave both groins
- 7 **If allergic to contrast medium or shell-fish:**
Give: Phenergan 25mg IV+100mg Hydrocortisone (solucortef) stat



Cardioversion

What is an Electrical Cardioversion?

Cardioversion is a brief procedure where an electrical shock is delivered to the heart to convert an abnormal heart rhythm back to a normal rhythm.

Cardioversion is used in emergency situations to correct a rapid abnormal rhythm associated with the following:

- faintness
- low blood pressure
- chest pain
- difficulty breathing
- loss of consciousness

Why Do I Need a Cardioversion?

Each normal heartbeat starts in an area of the heart known as the sinus node which is located in the upper right chamber of the heart (right).

The sinus node contains specialized cells that send an organized electrical signal through the heart resulting in a perfectly timed, rhythmic heartbeat.

In patients with Atrial Fibrillation, the atria fibrillate (or “quiver”) due to chaotic electrical signals that circulate throughout both atria. This typically results in a fast and irregular heartbeat.

While some patients have no symptoms, others may experience shortness of breath, lightheadedness and fatigue.

Depending on your specific medical history and symptoms, your physician may recommend cardioversion to return your heart to a normal rhythm.

What are the Different Types of Cardioversion?

1 Cardioversion can be “chemical” or “electrical”.

① **Chemical cardioversion refers to the use of antiarrhythmia medications to restore the heart’s normal rhythm.**

Antiarrhythmia medications work by modifying the heart’s electrical properties to reduce the frequency of abnormal heart rhythms and to help restore a normal rhythm.

Your doctor may decide to start your antiarrhythmia medication as an outpatient, or they may choose to admit you to the hospital to give you an intravenous or oral antiarrhythmia medication while your heart rhythm is closely observed.

The decision of whether or not you need to be admitted to the hospital depends on your symptoms, the specific medication your doctor chooses, and your underlying heart disease.

② **Electrical cardioversion (also known as “direct current” or DC cardioversion) is a procedure whereby a synchronized (perfectly timed) electrical shock is delivered through the chest wall to the heart through special electrodes or paddles that are applied to the skin of the chest and back.**

The **goal** of the cardioversion is to disrupt the abnormal electrical circuit(s) in the heart and to restore a normal heartbeat. The shock causes all the heart cells to contract simultaneously, thereby interrupting and terminating the abnormal electrical rhythm (typically fibrillation of the atria) without damaging the heart. This split-second interruption of the abnormal beat allows the heart’s electrical system to regain control and restore a normal heartbeat.

Electrical cardioversion is performed in a hospital setting such as an emergency room, intensive care unit, recovery room, special procedure room or Electrophysiology Laboratory.

A cardiologist, a nurse and/or an anesthesiologist are present to monitor your breathing, blood pressure and heart rhythm. Special cardioversion pads are placed on your chest and back.

The defibrillator allows the medical team to continuously monitor your heart rhythm and to deliver the electrical shock to restore your heart’s rhythm back to normal.

Conversion of Atrial Fibrillation to Normal Rhythm

- Since the shock can be painful, an anesthesiologist or specially trained nurse administers intravenous sedation.
- Once you are asleep (but still breathing on your own), the physician charges the defibrillator to a specified energy level and then delivers the shock by pressing a button on the defibrillator.
- The shock is transmitted along the cable to the pads on the chest where the energy is delivered across the chest wall to the heart muscle
- Additional shocks at higher energy levels can be delivered if the first shock does not restore the rhythm back to normal.
- Rarely, minor skin redness can occur at the site of the cardioversion pads where the electrical energy was delivered.
- Patients typically awake quickly without any recollection of the shocks, due to the amnesic effects of the sedatives.
- Because of residual effects of the anaesthetic medications used, patients are advised not to drive or make any important decisions for the rest of the day.
- A responsible adult should be available to provide transportation home. The anesthetic agents typically used for the procedure are short acting; therefore most patients are able to go home an hour or so after the procedure.

A **normal heart rhythm** can be restored more than **90% of the time**, although abnormal rhythms may recur in about half the patients within one year.

The **success** of **electrical cardioversion** often depends on the duration of Atrial Fibrillation and the underlying cause (heart disease).

Cardioversion is not appropriate for every patient with **Atrial Fibrillation**.

Are There Any Other Things I Should Know Before My Cardioversion?

Because the upper chambers of the heart are fibrillating (quivering) and do not squeeze uniformly in patients with Atrial Fibrillation, there is a potential risk that blood clots may form.

The process of restoring a normal rhythm could potentially dislodge a blood clot from the heart resulting in a heart attack or a stroke.

Fortunately, thinning the blood prior to cardioversion can prevent most blood clots.

This is a process called **“anticoagulation”**. Anticoagulant medications include **aspirin, heparin or warfarin (Coumadin®)**.



Warfarin

Warfarin is a pill taken daily and dosed according to blood test results.

This test, referred to as the INR or International Normalized Ratio, monitors the “thinness” or “thickness” of the blood and typically should be in the 2.0 - 3.0 range (a normal INR in someone who is not on warfarin is typically around 1.0).

If the INR is too low, there may be an increased risk of forming a blood clot. If the INR is too high, there may be an increased risk for bleeding.

Heparin

Heparin is a blood thinner that can be given as an intravenous solution or shots in the skin.

It acts more quickly and its effects are reversed more rapidly than Coumadin®.

Frequently, patients are placed on heparin until Coumadin® becomes effective, as this may take several days.

Prior to performing cardioversion, your physician will determine your risk of blood clot formation (and thus, your risk of stroke or heart attack) and choose an anticoagulant medicine.

In patients with Atrial Fibrillation, or flutter, that has been present for a while, the blood must be adequately **thinned** for at **least 3-4 weeks** prior to the cardioversion to reduce the risk of stroke.

Because it takes many hours for blood clots to form, cardioversion can be safely performed without blood thinning medication in patients who have had their heart rhythm problem for **less than 48 hours**.

Occasionally, your physician may recommend a special ultrasound of the heart (called a transoesophageal echocardiogram or TEE).

During a transoesophageal echocardiogram, a special probe is placed in the oesophagus.

It allows your physician to directly visualize the atria to scan for potential blood clots.

Typically, anticoagulation is continued after the cardioversion for an additional **4 weeks to 6 months**, even if the cardioversion is successful.

Conclusion: Cardioversion is a **safe** and **effective** treatment to restore the heart rhythm back to normal.

What to Expect When Preparing for a Cardioversion?

- 1 You should have nothing to eat or drink for at least eight hours prior to the procedure.
- 2 Take your regularly scheduled medications the morning of the procedure, unless your medical practitioner has told you otherwise.
- 3 Your medications should only be taken with enough water to get the tablets down.
- 4 If you are diabetic, you should discuss your insulin or other diabetes medication dosing with your medical practitioner.
- 5 Bring a list of all your medications with you.
- 6 Do not apply any lotions or ointments to your chest or back as this may interfere with the adhesiveness of the shocking pads.
- 7 Most medical centres will not let you drive yourself home after receiving sedation/anaesthesia; Therefore you should arrange a ride home that day. For the remainder of the day, you should not operate a car, heavy machinery, or make any important decisions.
- 8 You may experience some minor chest discomfort and/or skin irritation following the procedure.
- 9 An ointment can be applied to the area to reduce the discomfort.

Pacemakers

What is a Pacemaker?

A **pacemaker** contains a powerful battery, electronic circuits and computer memory that together generate electronic signals.

The signals, or pacing pulses, are carried along thin, insulated wires, or leads, to the heart muscle. The signals cause the heart muscle to begin the contractions that cause a heartbeat.

A pacemaker is implanted just below the collarbone in a procedure that takes about two hours. It is programmed to stimulate the heart at a pre-determined rate, and settings can be adjusted at any time.

Routine evaluation, sometimes even via telephone, ensures the pacemaker is working properly and monitors battery life, which is generally runs from **five to ten years**.

What Happens After the Procedure?

- 1 The morning after your implant, you may have a chest X-ray to insure the leads are in proper placement.
- 2 Your device will be checked by the device clinic or a company representative to insure the device is at the optimal settings.
- 3 You will be shown how to take care of you wound site. Keep it clean and dry to prevent the chance of infection.
- 4 After 7 to 10 days, you may take a shower.
- 5 Look at the wound every day to make sure it is healing well.

Call your doctor if you see any of the following:

- Increased bleeding, oozing, opening at the incision site or wound feels hot/looks red
- If the wound appears to be opening at the incision site
- Fever or chills

How Long Does a Pacemaker Last?

6 - 12 years

This is affected by how much energy is required to pace the heart and how the system is programmed.

What Electrical Equipment is Safe to Use?

Most home appliances in good working order are safe to use.

This includes:

- microwave ovens
- blenders
- toasters
- electric knives
- ultrasonic dental cleaners
- televisions
- VRCs
- electric blanket
- electric stove
- garage door openers

Office equipment and most medical equipment are safe to use.

The pacemaker will work properly during chest and dental x-rays, diagnostics ultrasound, CT scan, mammography, and fluoroscopy.



Permanent Pacing

Permanent pacing with an implantable pacemaker involves **transvenous placement** of one or more pacing electrodes within a chamber, or chambers, of the heart.

The procedure is performed by the incision of a suitable vein into which the electrode lead is inserted and passed along the vein, through the valve of the heart, until positioned in the chamber.

The procedure is facilitated by fluoroscopy which enables the physician or cardiologist to view the passage of the electrode lead.

After satisfactory lodgement of the electrode is confirmed, the opposite end of the electrode lead is connected to the pacemaker generator.

There are three basic types of permanent pacemakers, classified according to the number of chambers involved and their basic operating mechanism:

1 Single-Chamber Pacemaker

In this type, only one pacing lead is placed into a chamber of the heart, either the atrium or the ventricle.

2 Dual-Chamber Pacemaker

Here, wires are placed in two chambers of the heart. One lead paces the atrium and one paces the ventricle. This type more closely resembles the natural pacing of the heart by assisting the heart in coordinating the function between the atria and ventricles.

3 Rate-Responsive Pacemaker

This pacemaker has sensors that detect changes in the patient's physical activity and automatically adjusts the pacing rate to fulfil the body's metabolic needs.

The pacemaker generator is a hermetically sealed device containing a power source, usually a lithium battery, a sensing amplifier which processes the electrical manifestation of naturally occurring heartbeats as sensed by the heart electrodes, the computer logic for the pacemaker and the output circuitry which delivers the pacing impulse to the electrodes.

Most commonly, the generator is placed below the subcutaneous fat of the chest wall, above the muscles and bones of the chest. However, the placement may vary on a case by case basis.

3 Rate-Responsive Pacemaker (continued)

The outer casing of pacemakers is so designed that it will rarely be rejected by the body's immune system. It is usually made of titanium, which is inert in the body. The whole thing will not be rejected, and will be encapsulated by scar tissue, in the same way a piercing is.

Modern Pacemakers usually have Multiple Functions

- The most basic form monitors the heart's native electrical rhythm.
- When the pacemaker fails to sense a heartbeat within a normal beat to beat time period, it will stimulate the ventricle of the heart with a short low voltage pulse.
- This sensing and stimulating activity continues on a beat by beat basis.
- The more complex forms include the ability to sense and/or stimulate both the atrial and ventricular chambers.

From this the basic ventricular "on demand" pacing mode is VVI or with automatic rate adjustment for exercise.

VVIR - this mode is suitable when no synchronization with the atrial beat is required, as in Atrial Fibrillation.

The equivalent atrial pacing mode is AAI or AAIR which is the mode of choice when atrioventricular conduction is intact but the natural pacemaker the sinoatrial node is unreliable - sinus node disease (SND) or sick sinus syndrome.

Where the problem is atrioventricular block (AVB) the pacemaker is required to detect (sense) the atrial beat and after a normal delay (0.1 - 0.2 seconds) trigger a ventricular beat, unless it has already happened - this is VDD mode and can be achieved with a single pacing lead with electrodes in the right atrium (to sense) and ventricle (to sense and pace).

These modes AAIR and VDD are unusual in the US but widely used in Latin America and Europe. The DDDR mode is most commonly used as it covers all the options though the pacemakers require separate atrial and ventricular leads and are more complex, requiring careful programming of their functions for optimal results.

Admissions and Pre-Procedure Protocol

Device Implant (PPM, ICD and CRT)

- 1 Keep NPO for the a.m. procedure or light fluid breakfast for the p.m. procedure
- 2 Signed informed consent (usually left on the notice board at the front desk)
- 3 IV line on the LEFT ARM, unless no veins available
- 4 No ECG electrodes on the left upper chest area below the left shoulder
- 5 Shave and (alcohol) clean both left and right infra-clavicular regions
- 6 ECG baseline & immediately post-procedure or **whenever the HR is < 40 or > 100/min**
- 7 **Bloods**
 - a. Full Urea and creatinine
 - b. INR if on warfarin
 - c. Hb, WCC and Platelets
 - d. Glucose
 - e. B-HCG for the female patients under 40yrs
- 8 **If allergic to contrast medium or shell-fish:**
Give Phenergan 25mg IV+100mg Hydrocortisone (solucortef) stat
Give sedation Ativan 1mg PO

Discharge & Follow-Up Care

Before you leave the hospital, you will need to have your intravenous line removed and you will require an antibiotic and painkiller prescription to take to your pharmacist.

In a week or so, you will receive a call/email from your doctor regarding follow up.

Discharge Checklist

Before you leave, make sure you have received information about:

- Medication changes
- Activity over the next few weeks
- Driving restrictions & Return to work

Caring for Your Insertion Site

The area around your insertion site, including the incision, must stay dry. Avoid taking a shower until it is partially-healed—usually a week. You may take a bath but keep the insertion site completely dry.

Remove the initial dressing 7 days after your procedure. Leave the area open—do not put any creams or ointments on it, however, topical antibiotic cream like Bactroban may be applied.

There are no stitches to be removed. If some stitches stick out, please get them removed by your GP, Casualty or come to us.

Mild discomfort at the insertion site is normal and may be treated with Paracetamol or Stilpane.

Call your doctor if you have any of these problems:

- A lump that keeps getting bigger
- Redness, tenderness or warmth around the incision
- Pus or yellowish fluid seeping from the incision
- Severe pain at the incision site
- Chills or fever

Activity Guidelines

It can take up to four weeks for the pacemaker leads inside your heart to become firmly embedded.

To minimize dislodging the leads, follow these activity guidelines:

Timeline	Avoid these Activities	You can do these Activities
First 24 hrs	Avoid moving your shoulder on the side of the insertion.	You can bend your elbow.
First two weeks	Do not lift your affected arm over your head.	After the first 24 hours, you can move your arm freely below your shoulder.
First four weeks	Do not lift anything heavier than 5 kg Avoid vigorous activities, such as golf, tennis, swimming or sweeping.	After two weeks, you can begin to do most of the regular activities you did before the procedure.

Driving

Do not drive for the first 48hrs following your procedure. Some patients cannot drive for a longer period of time. It is important that you talk to your GP about when you will be able to drive again. If you are in doubt, please be on the safe side and do not drive. Ask about driving at your first clinic appointment.

Follow-Up Appointment at the Pacemaker/Defibrillator Clinic

You will need to be seen in the Pacemaker/Defibrillator Clinic within two to four weeks after your pacemaker insertion.

You will receive a follow-up appointment card from the Pacemaker/Defibrillator Clinic within 2 weeks. If you do not receive an appointment card, call the clinic.

At the same time, please schedule an appointment with your family doctor to talk about your pacemaker and how it may affect any other health problems you have.

Implantable Loop Recorder

An **implantable loop recorder** is a small device that is implanted under the skin to help identify the causes of fainting.

Syncope (or fainting) is a temporary loss of consciousness.

Certain heart disorders can cause fainting, such as abnormal heartbeats called arrhythmias.

An implantable loop recorder is a small device that is inserted under the skin below the collar bone (usually on the patients left side).

The Procedure to Implant the Device is Simple

- A local anaesthetic is injected into the area.
- A small incision is made and the device is inserted.
- The skin is then sutured closed.
- The device continuously records heart activity similar to an ECG for up to 2 years.

If the patient experiences an episode of fainting, the device is activated to save the recording before, during, and after the episode. The recordings can then be **evaluated by a physician** to help determine the cause of fainting.



Potential Complications of the Procedure

Like any invasive procedure, **radiofrequency ablation and device implantation carry some risk**. However, the risk(s) of these complications is small in most cases.

Possible complications include:

1 All Procedures (Ablation and Devices, e.g. Pacemakers, ICD)

- Problems related to threading the catheters through the blood vessels such as bleeding, infection, blood clots, bruising, and injury to the vessel(s).
- Injury to the heart as a result of the catheters; this includes a perforation through the heart muscle or damage to one of the valves within the heart.
- Blood clots that travel to the lungs (pulmonary embolism) or brain (stroke).
- Death (occurs in approximately 0.1 to 0.3 percent of cases).

2 SVT Ablation

- Heart block or failure of any electrical impulse to travel from the top parts of the heart to the bottom. This complication, if permanent, requires implantation of a permanent pacemaker.
- Phrenic palsy (Cryotherapy for Atrial Fibrillation ablation)
- New arrhythmias

Compilation by Dr. B. Vezi

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