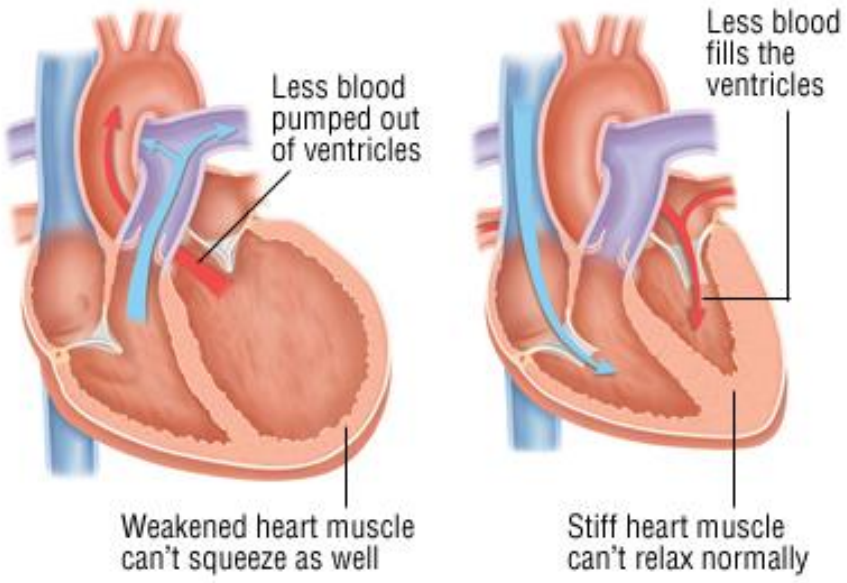
CARDIAC RESYNCHRONIZATION THERAPY (CRT) OR BIVENTRICULAR (BIV) PACING

SOUTHLAKE
REGIONAL HEALTH CENTRE

What is Heart Failure?

Heart failure is a condition where the heart muscle is weakened and is not able to efficiently pump blood. The term heart failure does not mean your heart has stopped pumping; rather, your heart muscle is not able to pump enough blood to meet your body's needs. As a result, you may feel tired, lack energy, experience shortness of breath, and notice excess fluid collecting in your body. The heart is a fist-sized organ that acts as a pump to send oxygen-rich blood throughout the body. In a healthy heart, each chamber contracts (squeezes) in a coordinated effort - the upper chambers (atria) of the heart contract first, then the lower chambers (ventricles) contract. These coordinated contractions circulate blood between the lungs and heart and to the rest of the body. If the heart is not beating in a coordinated fashion, then the body will not receive an adequate amount of blood to function properly.



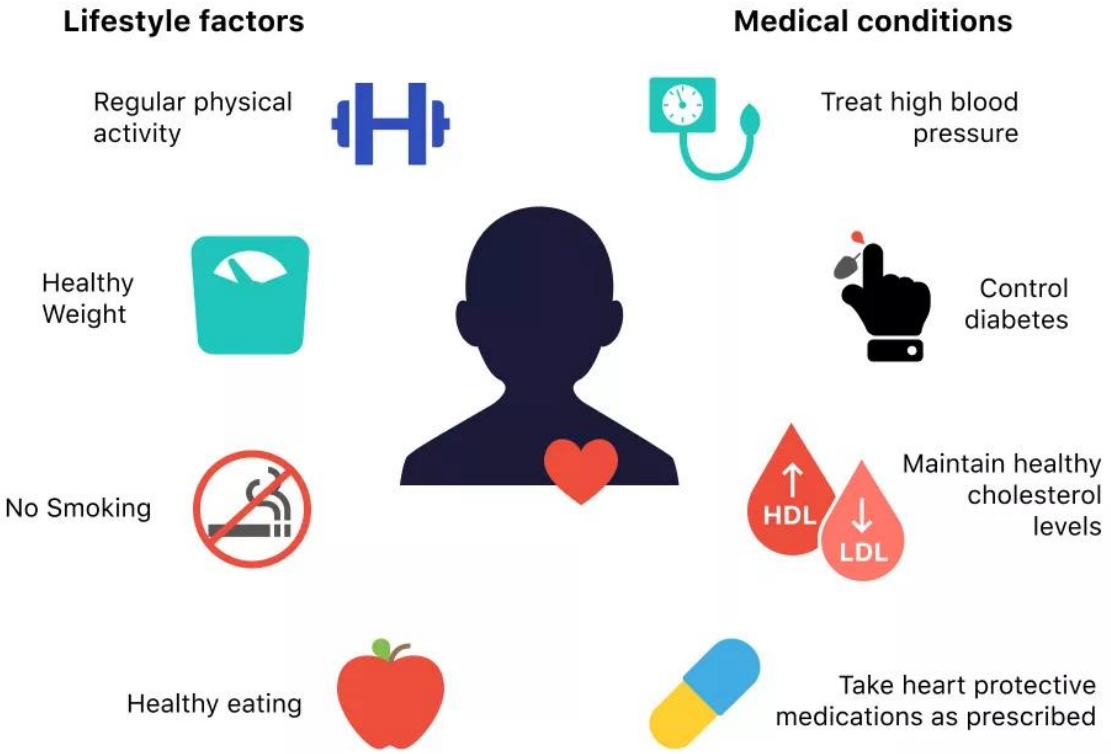
Heart failure can be caused by a previous heart attack, blockages in the blood vessels around your heart (coronary disease), high blood pressure, infection of the heart, diabetes, and heart valve problems.

The symptoms of heart failure include lack of energy, shortness of breath, difficulty breathing at night, swollen ankles/legs or abdomen, and cough.

Ejection Fraction: EF stands for "ejection fraction." It is the percentage of blood that is pumped out of the heart with each heartbeat. Your doctor determines how well your heart is pumping based on your EF number. Your EF number can change over time. You and your doctor need to check your EF regularly.

A "normal" EF is usually considered above 50%. EF 35-50% is considered "below normal." Less than 35% is "low." The most common way to measure EF is with an echocardiogram (ultrasound).

Treating Heart Failure: Heart failure is progressive. Your doctor may prescribe a variety of treatments including medications, lifestyle changes, exercise, and device therapy, or a combination of these. Your doctor can determine which option is right for you.



What is a Cardiac Resynchronization Therapy (CRT) Device?

CRT is sometimes also referred to as “biventricular” (BIV) pacing because the system pace both the right and left ventricles (lower chambers) of the heart to help them beat in a more coordinated fashion. The CRT system consists of a pulse generator connected to wires (leads) that sense and pace your heart rhythm. The pulse generator and the leads are surgically implanted. This coordinating or "resynchronization" therapy improves the heart's ability to pump blood and oxygen more efficiently to the body.

There are two types of CRT devices - a CRT pacemaker (CRT-P) and a CRT defibrillator (CRT-D). CRT-D devices, like all defibrillators, have a pacemaker function in them. Both devices help to coordinate the heart's pumping action and deliver pacing therapy for a slow heart rate. However, the CRT-D can also treat fast heart rhythms with a shock or special overdrive pacing. CRT systems consist of three components.

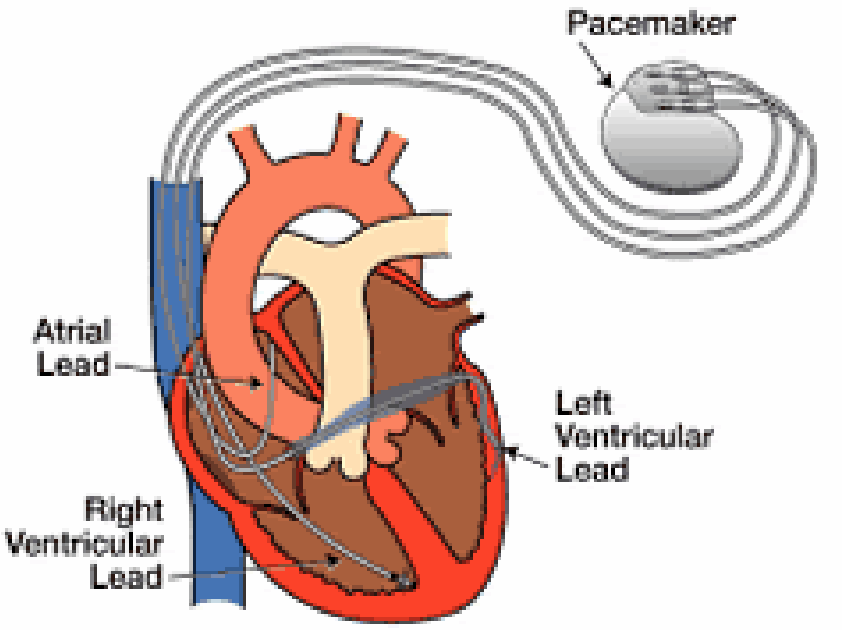
a) The Pulse Generator:

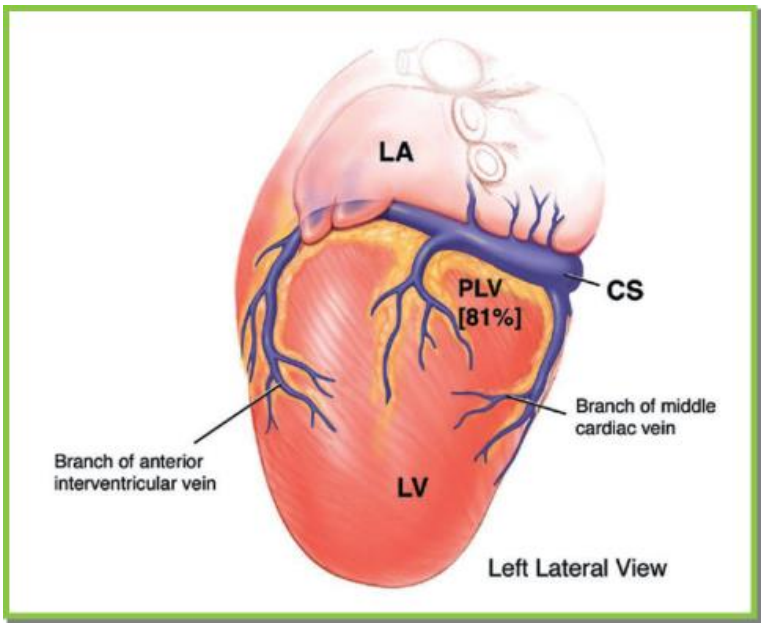
The pulse generator is about the size of a pager, is powered by a battery, and monitors the electrical signals in your heart. The device will pace your heart to maximize the coordination of the bottom chambers. The device can also store information about your heart rates and arrhythmias.

b) The Lead System:

The leads are wires threaded into veins under your collarbone and implanted into your heart that detect your heart rhythm. The tip of the lead(s) has a sensor that "sees" your heart rhythm all the time and this information is then sent to the computer in the generator. As well, any electrical energy that the pulse generator sends to the heart travels along the leads.

One of the leads must be placed in your left ventricle (LV, lower chamber). The easiest way to do this is by implanting the lead into the vein that runs behind the left ventricle called the **coronary sinus** (CS). Most of the time (90% of more), it is easy to get into this vein and place the lead in a nice branch. Sometimes, the anatomy is challenging, and we cannot find a good spot to put the lead. Your doctor will then determine what options you have if that is the case.





c) The Programmers:

The programmer is a laptop computer-like device that communicates with your CRT in the same fashion that a remote control communicates with a television set. Using the programmer, the functions and settings of your device are programmed and tested after implant. Also, when you visit the device clinic, the programmer is used to retrieve information about your heart rhythms, stored in the pulse generator. Every time you have what your device considers to be a fast, abnormal rhythm, the device stores the:

1. Date and time it occurred
2. An ECG (electrocardiogram) taken before, during and after the rhythm
3. If any therapies were delivered by the device (if it is a defibrillator)

This information helps the Clinic staff to determine if all your settings (and medications) are correct.

We try to maximize the percentage of the time that your device is pacing the heart so that we can provide you the most benefit. If there are heart rhythms that are interfering with our ability to pace the heart, we may treat these with medications, or with a procedure called an ablation.

Implanting the CRT

Usually, the pulse generator is implanted in the upper chest area on the left side, but it may also be implanted in the right upper chest.

A CRT implantation is generally considered relatively minor surgery and the operation itself usually takes about an hour.

It is performed as day surgery, meaning you arrive for the surgery and leave after the surgery on the same day. You can expect to spend a few hours at the hospital on the day of surgery.

The risks of the procedure include bleeding, infection, damaging the lung or heart which would require a drain, or the leads coming out of position after surgery ("dislodgement") which would require another procedure. These complications are typically 1% or less.

Sometimes, the lead can slip out of place and pace your diaphragm (called "phrenic stimulation"). **This can lead you to feel a thumping sensation while the device is working**. If this happens, we need to change the programming of wire or change the wire position.

PRE-OPERATIVE INSTRUCTIONS

These are general guidelines for you to follow before you have your CRT implanted or a replacement procedure. Be sure to follow any specific instructions from your physician and the Defibrillator Clinic.

Some general instructions will include:

Do not eat or drink anything the night before your surgery (this includes gum, candy, and water).

Medication is usually taken as prescribed in the morning of your surgery with sips of water.

Blood thinners may be stopped one or two doses in advance of the surgery. Check with the CRT Clinic or your physician beforehand for clarification.

You will usually be given antibiotics just before the procedure. Be sure you notify the CRT Clinic if you have any allergies to medications like penicillin.

POST-OPERATIVE INSTRUCTIONS

A nurse will give you post-operative instructions after your surgery. You must follow these post-operative instructions in addition to other instructions from the CRT clinic or your physician. These precautions are necessary for a healthy recovery from surgery.

WOUND CARE

Your incision will usually be closed with dissolvable stitches. If not, the stitches will need to be removed in 7 - 10 days by your family doctor or CRT clinic nurse our first follow-up appointment. Invisible stitches will dissolve on their own and will not need removal.

If you notice any signs of redness, swelling, localized pain, or oozing from the incision or opening of the incision, **YOU MUST REPORT IT TO US IMMEDIATELY**. If you are unsure, call us anyway.

Try not to get the wound wet for the first 4 days. You may take a shower after the first 4 days. For the first 4 days, we recommend taking a sponge bath and avoiding wetting the wound.

Keep the wound covered (fresh dressing daily) for about 4 days, then leave it open to the air.

Do not allow a doctor or nurse to place a needle into your device pocket at any time, even if it appears infected.

EXERCISE AND ACTIVITY

Do not raise the arm on the side with the incision above the level of your shoulder for approximately 1 month. Remember that activities like brushing your hair, or reaching for a high cabinet, or golfing can all stretch that arm.

Do not lift heavy objects (more than 5-10 pounds) with your affected arm for 6 weeks.

But you must continue to move that arm a little. If you do not, the shoulder will give you problems that may require up to 6 months of physiotherapy.

We suggest the following shoulder exercise: hold your arms outstretched at your sides and make small circles in the air. Do this exercise for 10 - 15 rotations, 4 times per day.

PAIN MANAGEMENT

You should 'be able to manage the pain with either plain Tylenol or Extra Strength Tylenol for a few days. If you find that your pain is still unmanageable, please call us.

RESUMING ACTIVITIES AND RETURNING TO WORK

You and your physician will decide when you may resume your regular activities and return to work. If you have been hospitalized for a period of time, try to increase your activity slowly.

Usually, you can return to light work within a few days. But heavier work may require 2-4 weeks off work.

MEDIC ALERT BRACELET

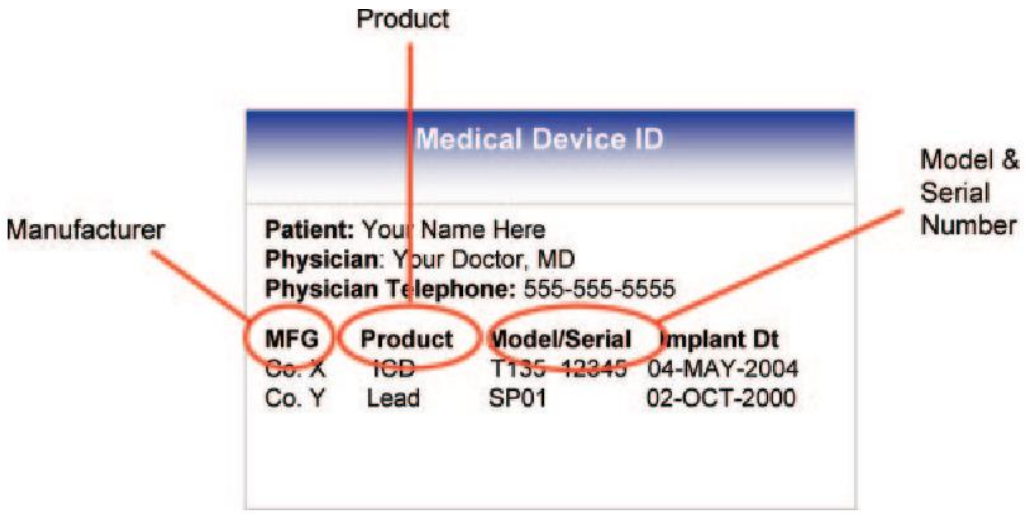
A Medic Alert bracelet/necklace identification should always be worn. Should you fall unconscious, the Medic Alert identification will let people know that you have a CRT and also give information about any other health problems you have.

You should receive a Medic Alert application before leaving the hospital at the time of your implant. If you already have a Medic Alert, you must contact them so the information in their files can be updated.

CRT IDENTIFICATION CARD

You will be given a temporary CRT identification card on the day of your surgery. You should receive your permanent card within 4-8 weeks after the operation.

You should always carry your CRT Identification card. The card contains important information about your device and will need to be seen at some medical appointments, by airport security officers, and in case of a medical emergency.



DIARY AND MEDICATION LIST

Please keep a diary with the following information and bring it to all your CRT clinic visits:

1. Your current medications including the dosage (the amount)

2. Doctor appointments and tests performed

3. Any treatment that is given by the CRT device. Include the time and date and what you were doing when you received the shock (if you have a defibrillator).

How do I Follow-up with my CRT?

You will follow-up in the CRT clinic. Your first clinic appointment will be approximately 2-4 weeks after your CRT device is implanted. We will check if the device and leads are operating properly and check your wound.

Follow-ups after that will be at 6 months and then every 6-12 months after that unless there is a problem. Some of your follow-ups may be in person, but others may be done by remote monitoring (see image and description later).

What to bring to each clinic visit:

1. Ontario Health Card

2. A current and complete list of all your medications (including the dosages), or all your pills in their original containers

3. Your diary (see earlier)

At the clinics, the information stored in your CRT will be read through the programmer by placing a wand over the device.

Your device and leads will also be checked to ensure that they are functioning properly, and the battery voltage is good. Your wound will be examined and any symptoms you are having will be discussed.

Feel free to ask us any questions at that time.

Please note that the clinic is not meant to replace the care you receive from your family doctor and your cardiologist in your community. A letter will be sent to your doctor after each clinic visit.

What is Remote Monitoring?

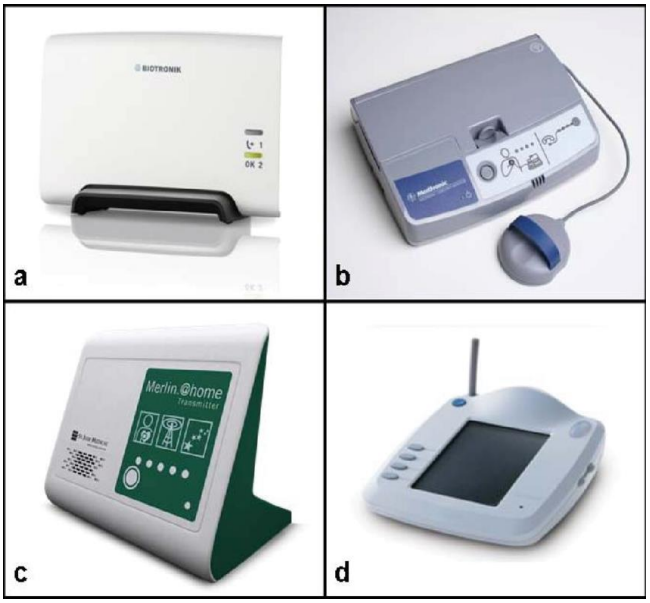
A remote monitor is a portable device that you either take home or it is delivered to you. It usually sits at your bedside and allows you to send information stored in your device to your clinic. It may be connected to a telephone landline or a cellular or Wifi Accessory.

Your CRT device information is then transmitted to a secure Internet website where your clinic can access and review information about how your heart and device are working.

The remote monitor provides the same device information to your doctor that an in-clinic office visit provides. Information in your device may also be sent automatically, using wireless communication. This process is silent and usually happens at night while you're asleep.

Automatic, wireless monitoring can also notify your clinic of irregular heart activity or conditions with your device, such as a low battery. Your clinic may program your device to send such notifications to help manage your care.

Remember, remote monitoring is not meant to be an emergency service and will only be read during regular clinic hours.



How long will the battery last? Does it need to be replaced?

On average, your device's battery will last 4-10 years. The average is about 5-6 years. It depends on how much the device is used. When we interrogate your device, we will find out how much battery is remaining. We always replace the battery when there is still more than 3 months of battery life remaining.

When your battery needs replacing, we replace the entire generator (see above). The wires will remain in place and will not be routinely changed.

For the battery replacement procedure, you will come in for day surgery, just like your original implant. However, battery replacement usually takes less time.

Living with your CRT

The idea of having a CRT is so that you can live your life as normally as possible.

But you should be aware of some practical items you will encounter in everyday life.

a) Other Surgery

Before you undergo any surgical procedure, you must contact the CRT clinic since reprogramming may be necessary. Certain equipment may interfere with the functioning of your CRT device. If you are unsure about any other treatment you may undergo, don't hesitate to call us to discuss your concerns.

b) Travel

Your CRT will not prevent you from traveling to most countries in the world. If you need emergency care, just go to the nearest hospital and show them your CRT wallet ID card and they will be able to contact someone to come and read your defibrillator.

Remember to show your CRT identification card to airport security to avoid being searched with a handheld wand. Please request a manual search. Plan to add an extra 5 - 10 minutes to your pre-boarding time to get through security.

c) Dental Work

You should let your dentist know that you have an implanted device before any dental work. Your dentist may prescribe antibiotics before dental work to prevent any infection from getting into the bloodstream.

What is electromagnetic interference (EMI)?

Your CRT device is sensitive to strong electrical and magnetic fields/currents. Strong electrical and magnetic currents will interfere with the proper functioning of your CRT. This is called "electromagnetic interference" or EMI.

General household appliances are safe to use, provided they are properly grounded, and are in good condition. Examples of appliances and other household objects that will not interfere with your device include microwaves, cordless phones, TV/DVD players, TV remotes, AM/FM radios, computers, photocopiers, fax machines, Wifi internet, toasters, hairdryers, electric razors and toothbrushes, sewing machines, heating pads, lawnmowers, and leaf-blowers.

Cellular phones rarely interfere with your CRT. You are in no danger if others near you using cell phones or if you use a cell phone and hold it to your ear. Cell phone antennae should be kept at least 6 inches (15 cm) away from your CRT device. Do not put the cell phone in the breast pocket of your shirt or jacket on the side where your CRT is implanted. If your CRT is in your abdomen, do not clip the phone to your belt near the device. When using a cell phone, place the phone on the ear that is opposite to the side where your device is implanted. In other words, if your CRT device is on the left side of your chest or abdomen, use the phone on the right side of your head.

When should you worry about EMI?

Before undergoing any of the following procedures, please contact the CRT clinic:

Diathermy - This test employs electrical currents to body tissue. The electrical fields could potentially interfere with device functioning.

Electrocautery - This is a medical instrument used during surgery to stop bleeding. Electrocautery should only be used if your device is turned off.

Lithotripsy - This is the procedure by which stones (e.g. kidney stones) are broken up. Your device may require re-programming.

Radiation therapy – Radiation is sometimes used in the treatment of cancer. If the radiation will be aimed directly over the device, it could disrupt the device. Radiation aimed away from the device is usually acceptable. The device may require re-programming.

The following items may be used, but **you should exercise caution**:

Car engine repair: use caution when near the coil, distributor, or spark plug cables of a running engine. Turn off the engine before making any adjustments to the distributor. DO NOT LEAN on running electrical engines.

Large stereo speakers: do not lift them close to your device.

Soldering guns, demagnetizers: 6 inches away from your device. Metal detectors 24 inches.

CB, Amateur HAM radios: you should keep a distance between the radio antenna and your device. It depends on the location/power. Portable (1 foot), car (3 feet), home (10 feet).

Retail and library security systems: to prevent the effects of these systems on your device, just walk normally through them. Do not linger near or lean against these detectors. It is unlikely that your device will set off retail or library security systems. However, always carry your device ID card.

Is there anything I cannot do with my device?

Heavy electrical or industrial equipment often produces EMI. This equipment may affect how your device works. Check with your doctor before working with the following equipment:

Dielectric heaters - used in industry to bend plastics.

Electric arc welding equipment

Electric steel furnaces used in factories

Induction furnaces such as kilns

Industrial magnets

Power plants - large generators, transmission lines, transmission buildings, and turbines

Gas-powered chain saws

Can I have an MRI?

Most devices implanted today are “compatible” with magnetic resonance imaging (MRI). The device may require some programming before and after your MRI. You should always have your device checked before and after an MRI.

Certain types of MRI protocols or MRI aimed directly at the device may not be allowed by your device manufacturer. Older devices and leads may not ever be “compatible” with MRI.

Some centers will perform an MRI on any type of device (whether compatible or not) but you need to consult with the MRI department doing your test.

If you have abandoned leads, or broken leads, or certain types of adapters, you may not be able to have an MRI at all.

Can I drive with my device?

Initially, you may not be allowed to drive a car right after your surgery (usually 7 days). Further restrictions on driving will depend on your condition.

Remember that the CRT does not prevent your rhythm problem. Rhythm problems can still occur and if they do, the device may treat them.

But if you have a rhythm problem requiring treatment from your device, your driving may be restricted for 1-6 months depending on the condition. Your driving would likely be restricted for longer or forever if you did not have the device.

Commercial driving (large trucks, commercial vehicles, large passenger vehicles like buses) may be restricted by your condition whether you have the device or not.

Where should I contact you?

You can contact us at the CRT clinic:

Southlake Regional Health Centre
Medical Arts Building
Suite 602, 581 Davis Drive
Newmarket, Ontario, L3Y 2P6
Phone: 905-895-4521 ext 2860