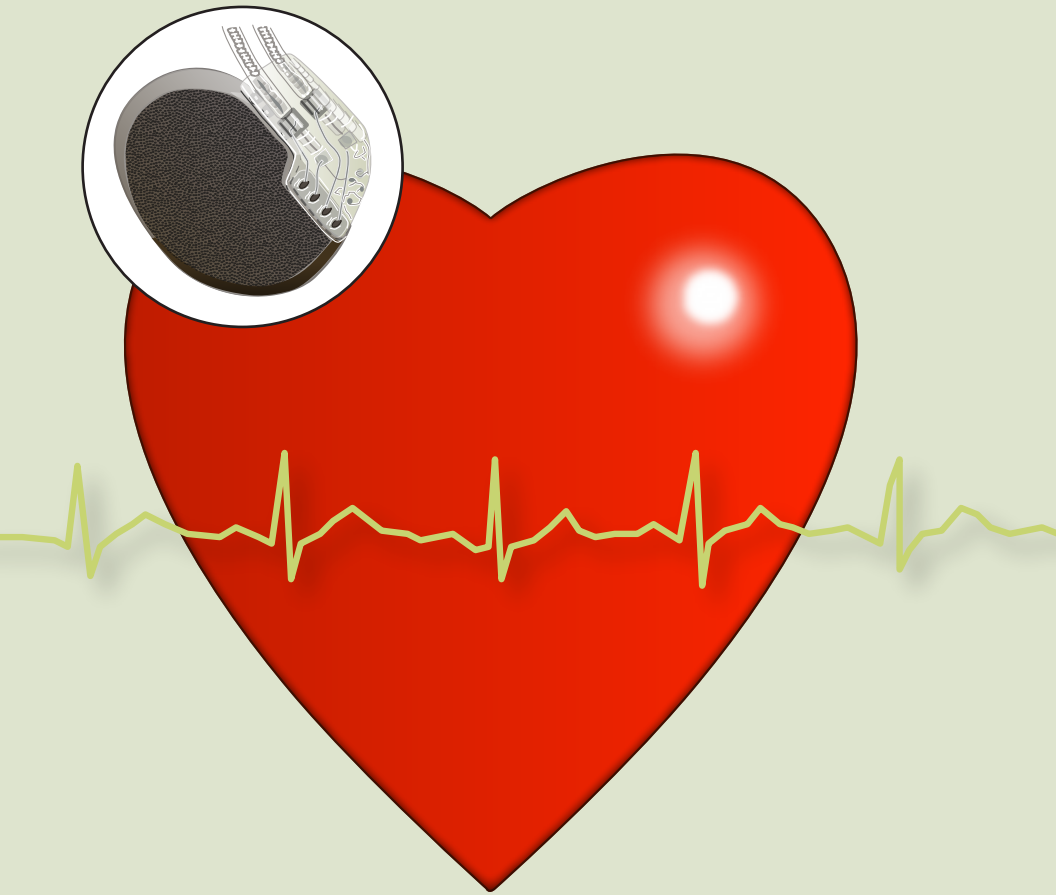
CHU Sainte-Justine
Le centre hospitalier universitaire mère-enfant

Université de Montréal

Permanent
PACEMAKER



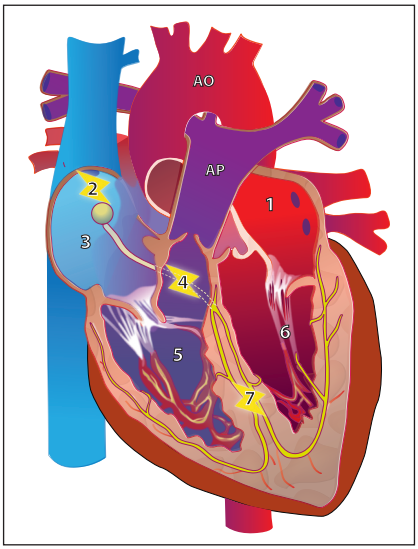
This leaflet is intended for patients with permanent pacemakers and their parents.

It serves as an information tool and a guide that offers some advice in order to live safely.

General Information

The natural rhythm of the heart

The heart is "naturally" equipped with its own pacemaker, the sinus node (see diagram below [2]). It emits regular electrical signals that produce heartbeats. These signals stimulate the heart muscle that contracts to pump blood towards the lungs and other parts of the body. The sinus node is very sensitive to the body's need for oxygen and, to meet this need, it increases or decreases the emission frequency of electrical signals. The signal emitted by the sinus node travels through the two upper chambers of the heart (right atrium [3], left atrium [1]) and then goes through the atrioventricular node (A-V node [4]) and the two lower chambers of the heart (right ventricle [5], left ventricle[6]). The pathway of the electrical impulse travels through a conduction system (conduction pathway [7]).



What is a pacemaker?

It is a small electronic device that continuously monitors the heart rhythm. It emits an electrical signal to restore a normal heart rate as needed.

Why use a pacemaker?

To allow people with a heart rhythm that is too slow or irregular to carry out normal activities.

What causes heart rhythm to be too slow?

The natural pacemaker, the sinus node, does not send nerve impulses or sends them too slowly (sinus node disease). The impulse can also be blocked in the AV node (heart block) while it is being transmitted from the atrium to the ventricle.

What are the possible signs of a heartbeat that is too slow or irregular?

- Signs of fatigue while exercising and at rest
- Weakness
- Shortness of breath
- Dizziness
- Fainting

Features of a permanent pacemaker

Pulse generator (pacemaker case)

This main part of a pacemaker contains the battery and the processor circuit that controls the rhythm of the pulses sent to the heart. A wire connected to a generator converts the energy of the lithium battery into electrical impulses. The pacemaker is capable of detecting the patient's natural rhythm and only intervenes when necessary.

This feature extends the battery life and prevents the pacemaker from interfering with the heart's natural rhythm.

Electrode probe

This flexible and isolated wire is connected to the generator, which transmits electrical impulses to the heart. The heart is stimulated by the small metal electrode located at the end of the wire that is implanted in the heart muscle.

Battery life

The battery life is eight to ten years. Most of the time, only the pulse generator (case) is changed. The conducting wires are then checked.

Special features of pacemakers

There are two types of pacemakers:

- **Single chamber** (rarely used): a pacemaker wire is placed in the atrium or the ventricle, depending on the child's problem. This type of pacemaker detects the child's natural heart rhythm and sends a pulse to this chamber only when it's necessary.
- **Dual chamber** (the most frequently used): two pacemaker wires are inserted, one in the atrium and the other in the ventricle. This type of pacemaker allows the atrial and ventricular contractions to be coordinated and thus imitates the normal heart contraction process. If the natural impulse is not produced within a normal period of time, the pacemaker sends an electrical impulse to the atrium or ventricle, or both at the same time.

There are two ways of implanting a pacemaker:

- **Endovenous implantation:** the intervention takes place in the cardiac catheterization room, under fluoroscopy. The electrode probe is installed in the right atrium and/or the right ventricle through a large vein located on the upper chest (left subclavian vein). The impulse generator is placed on the upper chest in a small tissue pocket that the surgeon or cardiologist has prepared for this purpose. Once the pacemaker has been implanted, the child leaves the catheterization room and goes to the recovery room. The patient is then brought to his or her room. It can occur that a child needs to go to Intensive Care if observation on a cardiac monitor is necessary.

- **Epicardial implantation:** this method is mainly used for children who are underweight or have a deformity that prevents endovenous implantation. The intervention is carried out in the operating room. The pacemaker wire is inserted on the outer surface of the heart by making an incision on the side of the thorax (thoracotomy). The impulse generator is placed on the upper belly in a small tissue pocket that the surgeon has prepared for this purpose. Once the surgery has been completed, the child is brought to Intensive Care for a minimum of 2 days and is then brought to his or her room.

Length of hospital stay

- **Endovenous implantation:** approximately 24 hours, since it is minor surgery that is carried out in the cardiac catheterization room.
- **Epicardial implantation:** approximately 5 days, given that this surgery is carried out in the operating room.

Once back home

Caring for surgical incisions

- **Endovenous implantation:** the dressing that covers the incision must stay in place for 3 days. The stitches will dissolve. You have to change the dressing if it is wet or dirty (we will provide you with some dressings upon discharge from the hospital). Once the dressing has been removed, the adhesive bandage strips (Steri-Strips) remain; we will remove them at the first appointment, or 14 days after the procedure if they have not already come off on their own.
- **Epicardial implantation:** surgical wounds (left side and top of belly) take a few weeks to heal. The stitches used are absorbable. We will remove the adhesive bandage strips (Steri-Strips) that cover the wound at the first appointment or 14 days after the surgery if they have not already come off on their own.
- **For both methods of implantation:** bathing or showering is permitted. Nevertheless, you must avoid getting the wound wet for 2 weeks. Applying a cream that contains vitamin E on the incisions 2 to 3 weeks after the procedure can accelerate the healing process. However, exposing the incisions to the sun is to be avoided for at least one year as this could compromise the healing process.

Important!

- If there is any pain, swelling or leakage from the incisions, contact the Cardiac Surgery or Cardiology Department as soon as possible.
- **Never** apply ice on the site where the pacemaker is located.

Convalescence and resuming activities and exercises

- **Endovenous implantation:**
  - No convalescence is required. The child can return to school 2 or 3 days after the procedure.
  - Stretching activities involving the left arm can be resumed gradually. **Contact sports must be avoided.**
- **Epicardial implantation:**
  - A 6-week convalescence period is required. The child can return to school with the consent of the cardiologist.
  - Do not lift the child by grasping him or her under the arms for a period of 6 weeks.
  - After the convalescence period, the child wearing the pacemaker can resume all the activities and sports he or she desires **with the exception of contact sports**.

Medication

No medication is required after a pacemaker has been installed unless required by another health problem. If your child is in pain, you can give him or her acetaminophen (children's Tylenol® or Tempra®) or ibuprofen (Advil® or Motrin®).

Monitoring

Visits to the doctor

Following implantation of the pacemaker, you must bring your child to the cardiologist regularly for check-up visits. The cardiologist will also check the pacemaker's programming, which will be changed over the years as your child grows. Programming is carried out through a magnetized device that sends a signal through the skin. This is not painful. The check-up visits will take place:

- 2 weeks after installation of the pacemaker;
- then every 2 months for the first 6 months;
- every 6 months after that.

Take your child's pulse daily

- You must take your child's pulse once a day, on the neck or wrist, for one minute. It will probably be easier for you to do it at bedtime.
- Your child's physician will let you know, before the hospital discharge, what the expected heart rate is (number of heart beats per minute). If the heart rate is higher or lower, or if it is irregular, call the doctor.

Recognizing the signs of a defective pacemaker

It is very unlikely that the pacemaker is defective, given the close monitoring carried out at each medical visit.

The signs that you need to watch for are:

- abnormal, slow or irregular pulse
- fatigue
- prolonged weakness
- shortness of breath
- dizziness
- fainting

If you notice one of these signs, please contact the Cardiology or Emergency Department.

The period following implantation of the pacemaker

What you need to know:

- **Electrical appliances, home appliances or other appliances:**
  - There is no risk with commonly-used household electrical appliances, including microwaves and electronic games. They do not interfere with the pacemaker.
  - We want to warn you, however, about cell phones. The cell phone must not be in direct contact with the pacemaker. Therefore, you

must never hold or place the cell phone on the chest or abdomen on the side of the pacemaker.

- **Restrictions:**
  - Avoid using magnets near the pacemaker case (risk of pacemaker deprogramming);
  - Avoid undergoing magnetic imaging tests, such as magnetic resonance imaging (MRI) due to the strength of the device's magnets;
  - Avoid activities that require being close to an intense magnetic field (for example, working with hydro-electric cables, using a blowtorch or high voltage industrial equipment).
- **Instructions:**
  - The patient must wear a "Medic-Alert" bracelet (or other type);
  - Always have the identification card on you; it will be mailed to your home by the pacemaker manufacturer. You will find important information on it regarding your pacemaker, as well as the name of the treating physician. The identification card will be useful in the event of an accident or during a trip.
- **Note:**
  - A deprogrammed pacemaker automatically shifts to basic programming. IT DOES NOT STOP FUNCTIONING.

If you have any doubts regarding a device, we recommend that you keep the person wearing the pacemaker away from this source. Nevertheless, if the pacemaker is deprogrammed, it does not mean that it has stopped working. The pacemaker will always find basic programming that is sufficient to make your child's heart function. The pacemaker will then be reprogrammed upon the next visit with the cardiologist.

Conclusion

We hope that this information leaflet has answered your questions. However, if certain aspects remain unclear, please discuss them with the cardiologist, cardiac surgeon or nurse.

Telephone numbers to remember

Cardiology	514 345-4654
Cardiac Surgery	514 345-4676
Nurse in Cardiac Surgery	514 345-4931 extension 4939
Nurse in Cardiology	514 345-4931 extension 3473
Emergency (CHU Sainte-Justine)	**514 345-4611**

Remember that a child who wears a pacemaker is a perfectly normal person who needs to continue to develop and flourish.

Notes

Date of implantation: _____

Implantation: ❑ Epicardial

❑ Endovenous

Scheduling: _____

Pacemaker: ❑ Single chamber

❑ Dual chamber

Next appointment

Date: _____

With: _____

Location: _____

Notes

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