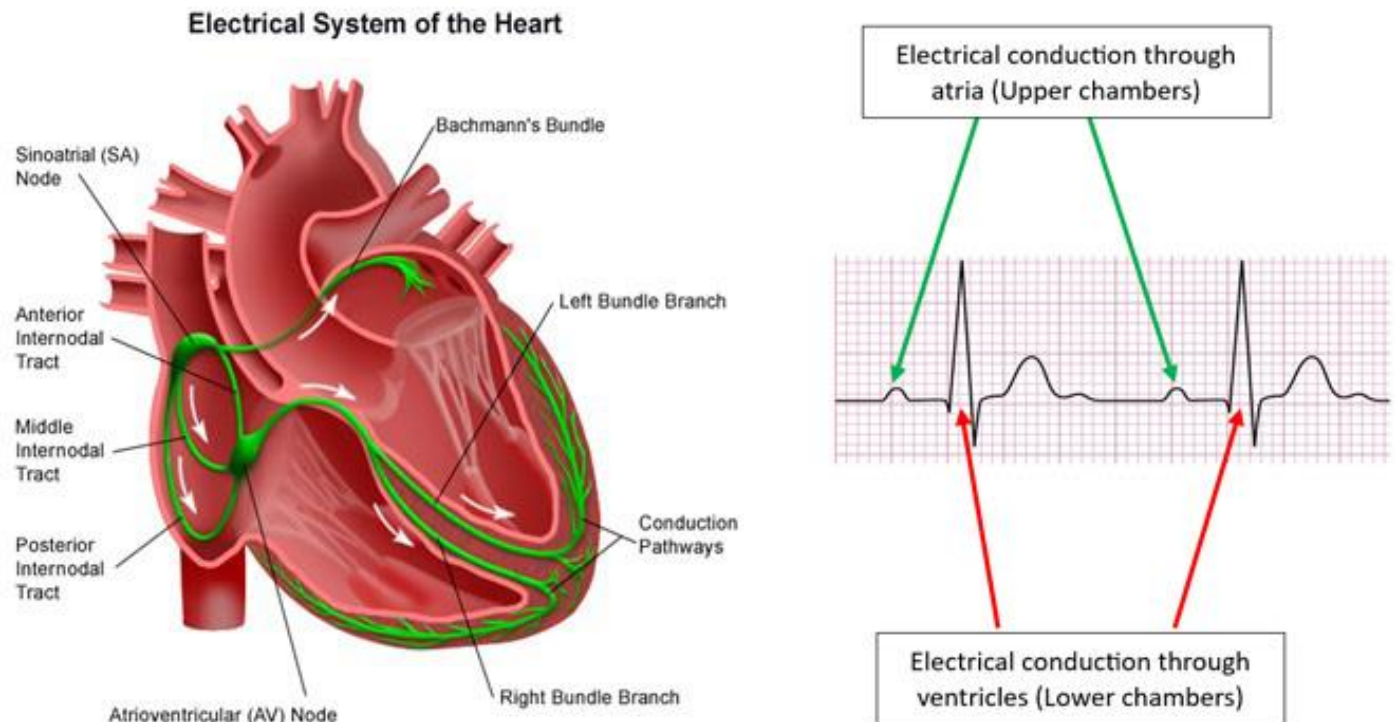


Heart block and pacemaker implantation

The heart's electrical conduction system

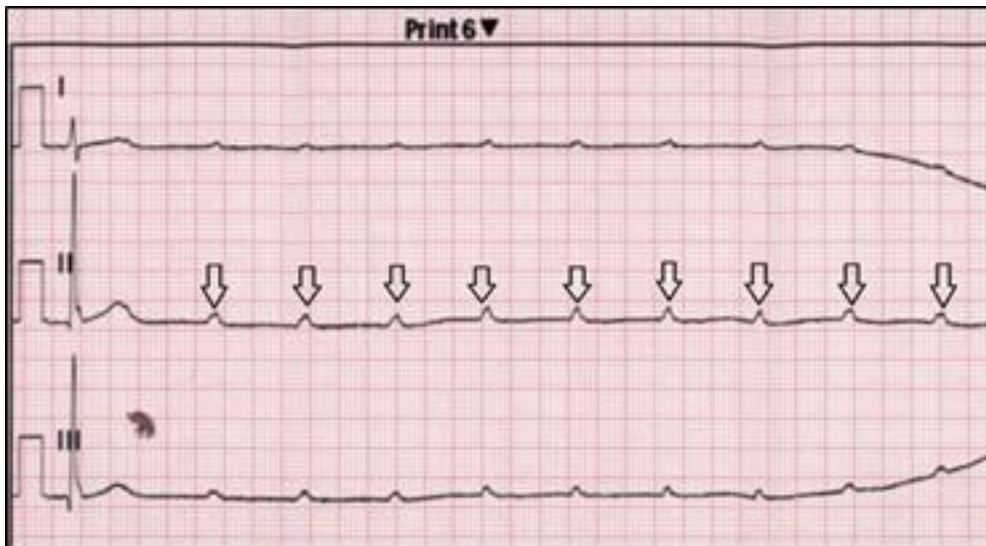
With every heartbeat, electrical impulses are transmitted from the upper heart chambers (atria) to the lower heart chambers (ventricles) through what is called the *specialized conduction tissue*. The electrical impulse is what causes the heart muscle to contract.



Left: The specialized conduction system of the heart (green) allows for the organized flow of electricity through the upper chambers, and subsequently the lower chambers. This results in synchronized contraction of the atria and ventricles. Right: ECG recording of the heart showing the normal flow of electricity through the atria (green arrows) and then the ventricles (red arrows). ECG – *electro* (electricity) – *cardio* (heart) – *gram* (recording).

What is heart block?

Heart block happens when the specialized conduction system of the heart becomes diseased, and as a result, electrical impulses cannot be transmitted through the heart normally. Heart block should not be confused with coronary artery disease, where narrowing's ("blockages") occur in the arteries around the heart muscle. If heart block occurs, electrical impulses cannot reach the ventricles, which are the major pumping chambers of the heart. Complete heart block can therefore result in prolonged episodes of very slow ventricular contraction and therefore very slow heart rate leading to the heart pumping blood as slow as 30 beats per minute, or even no heartbeat for a number of seconds.



ECG example of complete heart block. Each of the arrows indicate a contraction of the atria, but no ventricular contractions are seen because the electrical connection between the atria and ventricles are "blocked" (Heart block). In the absence of electrical impulses to the ventricles (lower pumping chambers), the heart does not pump at all.

What causes heart block?

In the majority of cases, heart block is caused by age related degeneration of the specialized conduction system of the heart, which commonly occur in patients older than 60 years of age. In a small minority, heart block can be caused by previous heart attacks, electrolyte abnormalities, hereditary diseases, or other rarer causes.

What are the consequences of heart block?

Complete heart block can be a medical emergency. If no electrical impulses reach the lower pumping chambers (ventricles), there may be no contraction of the ventricles, and this could result in fainting spells (blackouts), or death. Left untreated, heart block has a very poor prognosis (high risk of heart failure and death).

How is heart block treated?

In most circumstances, heart block can be easily treated through the placement of a pacemaker. Pacemakers ensure that electrical impulses reach the ventricles, even in the setting of diseased specialized conduction tissue. Once a patient has received a pacemaker, they can usually continue to live a normal life.

What is a pacemaker?

Various types of pacemakers exist. In the simplest form, a thin electrical wire (pacing lead) is connected to your ventricles from the inside. The pacing lead is connected to a small box ('header') that is buried under your skin. The header contains the battery and the monitoring functions of the pacemaker.

In such cases, the pacemaker 'monitor' the electrical activity in the ventricles. If electrical impulses fail to reach the ventricles in a timely manner because of heart block, the pacemaker will discharge a small electrical impulse that will cause the heart to contract normally.

More complicated pacemaker systems exist, including pacemakers with 2 (for synchronized top/atrial and bottom/ventricular contractility) and even 3 leads (atrial and both left and right ventricles contract in synchronized fashion). These options will be discussed with you by your cardiologist.

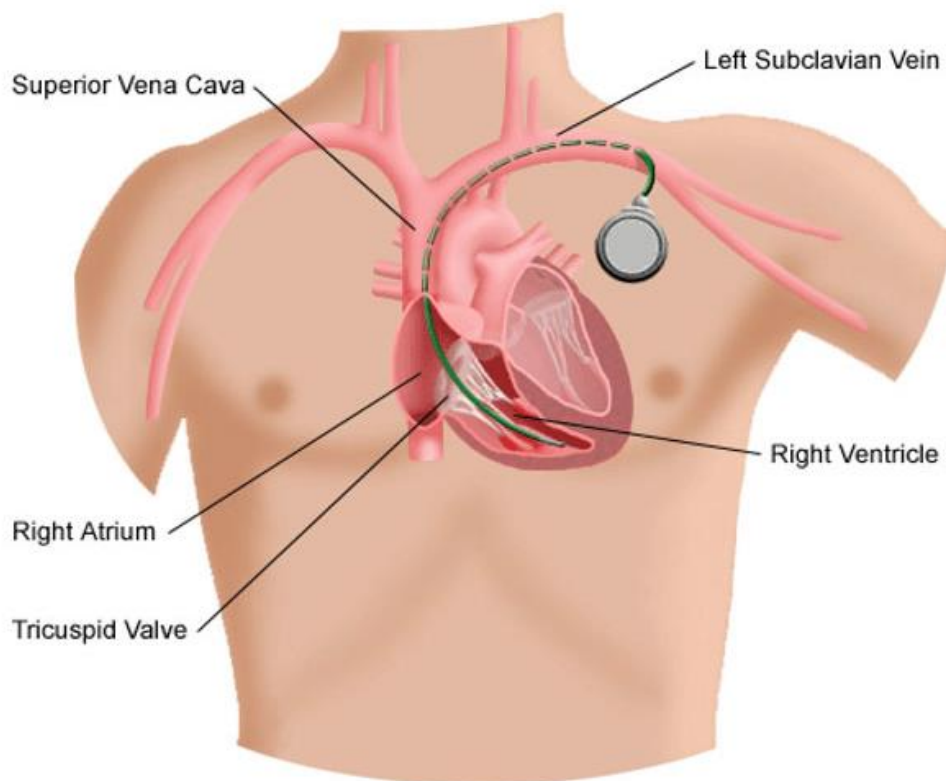


Illustration of a pacemaker. The 'header' is implanted beneath the skin just below the clavicle on either the left or right side. Connected to the header is the pacing lead, that enters the bloodstream and is connected to the inside of the heart at the opposite end. The header monitors the hearts own 'intrinsic' electrical activity, and, if due to heart block no electrical impulse reaches the ventricle, discharges a small electrical impulses through the pacing lead that will result in contraction of the heart.

The implantation procedure and aftercare

Pacemaker implants are usually done while the patient is awake. A local anaesthetic will be injected at the site where the header is implanted, and the procedure should not be painful. An anxiolytic can be offered if needed. The implant usually takes between 30-60minutes.

After the procedure, there may be some postoperative bruising or tenderness. Paracetamol can be used to relief minor pain or discomfort. The wound will be dressed with a showerproof dressing which should

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stay on for 7-14 days. After this, the dressing can be removed, and the wound can be lightly washed with soap and water. The arm on the side of the implant should not be elevated above the level of the shoulder for approximately 14-30 days, after which you should be able to resume all normal activities. The sutures in the wound are self-absorbing; so please do not attempt to remove them. Try and avoid twisting, turning, flipping the header box around as this can cause tension on and dislodgment of the lead.

Follow-up arrangements will be made with you to see either your cardiologist, or a specialized cardiac technologist. During these visits, the wellbeing of the pacemaker system and remaining battery life will be tested. It is very important to continue with at least annual pacemaker follow up checks, as a depleted battery can be a life-threatening event. It is also possible to set-up "remote monitoring", especially for patients who live remotely. You will need access to WIFI to enable this.

What complications may occur?

Pacemaker implants are generally safe and simple procedures. Some procedural complications such as bleeding & lung collapse happen rarely. Over time the main risk is that of infection of the pacemaker system. This is fortunately an uncommon albeit dreaded complication, which would require removal of the whole system followed by reimplantation after completing a course of antibiotics. Other complications include dislodgement of the lead which would also require a reimplantation procedure.

Life after a pacemaker

Following a 14–30-day period of restriction in the arm movement on the side of the implant, we encourage you to resume a normal lifestyle. Modern pacemaker systems are remarkably reliable and safe, and you should not live in fear that the system will fail. The system battery usually lasts around 8-15 years, depending on various factors. If the battery reaches end-of-life, it can easily be replaced. You will receive an alert card, that you can keep with you in the case of a medical emergency. The pacemakers are not affected by usual daily activities such as medical detectors, microwaves, cell phone signals or vibrations of driving or an active lifestyle. Modern pacemakers are also safe when patients have to undergo MRI scans. If you have any concerns, contact your cardiologist so that a review can be scheduled.

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