Artificial Pacemaker

1. Artificial Pacemaker

An artificial pacemaker is a medical device designed to regulate the beating of the heart. The purpose of an artificial pacemaker is to stimulate the heart, by mild electrical impulses, when the heart's natural pacemaker, the so called sinus node, is not working properly. The sinus node itself also produces electrical impulses that cause the heart to beat.

The first implantation into a human was made in 1958 by a Swedish doctor team. The device failed after 3 hours. The world's first implantable pacemaker patient, Arne Larsson, survived the first tests and died in 2001 after having received 22 different pacemakers during life time. The early devices suffered from battery problems and so every patient required an additional operation every 24 months to replace the batteries. Modern pacemakers weight less than 30 grams and the batteries last about 7-10 years before needing to be replaced.

Pacemaker patients can eventually return to normal activities after receiving a pacemaker. In fact patients with pacemakers usually feel better and may be able to do more than before. Every patient is given a pacemaker ID card to carry, which contains information regarding the pacemaker.

Modern pacemakers are well protected from most electrical appliances such mobile phones, radios, television, microwave ovens, computer, etc. But there are also devices which could affect the proper functionality of pacemakers, such as powerful magnets and some medical equipment like MRI (Magnetic resonance imaging).

1.1. The need of a pacemaker

Pacemakers are needed in case of heart diseases and can slow down, raise or in case of disorder normalize the beat of the heart.

- **Bradycardia**
  Bradycardia names the condition, in which the heart beat is to slow, caused by the war and tear of age or heart block.
- **Atrial fibrillation**
  Atrial fibrillation is a common heart rhythm disorder in which the upper chambers of the heart beat rapidly and chaotically.
- **Heart failure**
  Heart failures are conditions in which the heartbeat is not sufficient to supply the normal volume of blood and oxygen to the brain and body.
- **Syncope**
  Syncope describes a suffer disease where the heart rhythm of patients becomes very slow and ends in faint.

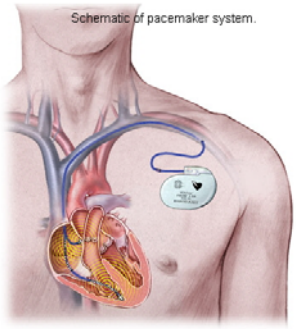
1.2. Methods of pacing

There are different methods of pacing.

- **External pacing**

External pacemakers can be used for stabilization of a patient, but the implementation of an internal pacemaker is usually required. The external cardiac pacing is performed by placing two pads on the chest wall. Electrical impulses stimulate any muscle, including the heart muscle, will make it contract. External pacemakers should not be confused with a defibrillator.

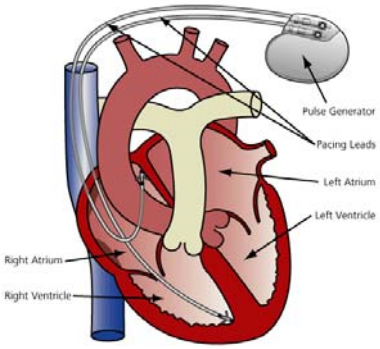
- **Temporary internal pacing**
  An alternative to external pacing is temporary internal pacing. One end of a wire is placed into the right heart chamber or the right atrium of the heart. The other end is attached to a pacemaker outside the body. This method is often used as bridge to a permanent pacemaker placement.
- **Permanent pacemaker placement**
  The placement of a permanent pacemaker involves the placement of one or more pacing wires within the chambers of the heart. One end of each wire is attached to the muscle of the heart the other one is plugged to an internal pacemaker. Commonly the generator is placed just below the collarbone. The pre-determined rate and settings of the pacemaker can be adjusted at any time.



1.3. Types of pacemaker

There exist three basic types of pacemakers to serve different purposes.

- **Single-chamber pacemaker**
  Only one wire is placed into a chamber of the heart.
- **Dual-chamber pacemaker**
  Two wires are placed in two chambers of the heart. One paces the atrium and one paces the ventricle. This type can coordinate the function between atrium and ventricles and matches the natural pacing of the heart.



- **Rate-responsive pacemaker**
  This type of pacemakers has sensors that automatically adjust to changes in person's physical activity. So the pacemaker will only get active when the beat per minutes is under a defined level or when there is a disorder in rhythm.
- **Other**
  There are also pacemakers that have the function of a defibrillator and could save the life of patients in case of heart attacks or cardiac standstills.

2. Brain Pacemaker

Brain pacemakers are used to treat people who suffer from epilepsy or Parkinson's disease or clinical depressions. The pacemaker is implanted into the brain to send electrical signals into the tissue. Depending on the area of the brain that is targeted, the treatment is called deep brain stimulation or vagus nerve stimulation.

3. Stomach Pacemaker

Stomach pacemaker, officially called as gastric electrical stimulators, are uses to stimulate the stomach. This type of peacemaker is used in case of chronic nausea or vomiting. There

is also the possibility to use a different type of pacemaker that is plugged to the midriff to treat chronic hiccup.

4. References

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