

Pacemakers

Pacemakers are usually inserted subcutaneously below the left clavicle. An electrical wire connects it to the myocardium of the right atrium and/or right ventricle. The pacemaker supplies electrical stimulation which initiates myocardial depolarisation and subsequent myocardial contraction. It can be programmed externally. The battery lasts 5-10 years (only this box-part needs replacing).

Indications

For permanent pacing

- Persisting symptomatic bradycardias (e.g. sick sinus syndrome)
- Complete AV block
- Mobitz type 2 AV block
- Drug-resistant tachyarrhythmias

For temporary pacing

- Symptomatic bradycardia unresponsive to atropine
- Post-myocardial infarction 2nd/3rd degree AV block or bi/trifascicular block
- Drug-resistant tachyarrhythmias (e.g. SVT, VT)

Basic types

- **Dual-chamber** pacemaker (two leads – one in right atrium and one in right ventricle) – **paces both atrium and ventricle, used for most patients (unless they're in a group below)**
- **Single-chamber** pacemaker
 - One lead in right ventricle – **used in patients with AF (no point pacing fibrillating atrium)**
 - One lead in right atrium – **used for sick sinus syndrome with normal AV conduction (only need to replace SA node because the rest of the heart is normal)**

Note: implantable cardioverter defibrillators look like a pacemakers but have a different function – they are used for automatic defibrillation of patients who are at risk of VF or VT and sudden cardiac death (e.g. patients with coronary artery disease, previous episodes of ventricular arrhythmias, familial cardiac conditions e.g. long QT syndrome, poor ejection fraction)

Coding

3 letter codes

The pacemaker can pace the right ventricle, the right atrium or both. The pacemaker can also sense spontaneous heart depolarisations through the same lead(s), and pacing may be either triggered by that spontaneous heart depolarisation or inhibited by it.

- **Letter 1:** chamber paced (Atria, Ventricles, Dual chamber)
- **Letter 2:** chamber sensed (Atria, Ventricles, Dual chamber)
- **Letter 3:** pacemaker response (Triggered, Inhibited, Dual)

Further letters which may be used

- **Letter 4:** if rate responsive features present (Rate responsive) e.g. rate can increase during exercise
- **Letter 5:** anti tachycardia features
 - P = in tachycardia, it will pace
 - S = in tachycardia, it will shock
 - D = dual ability to pace and shock

Note Q can mean none for any letter

Common examples

- **VVI:** ventricles are paced, but pacing is inhibited when spontaneous ventricular depolarisations are sensed
- **AAI:** as above but for atria
- **DDD:** both chambers are paced, but atrial pacing is inhibited when spontaneous atrial depolarisation is sensed, and ventricular pacing is inhibited when spontaneous ventricular depolarisation is sensed (within a predetermined maximum PR interval).

ECG of paced rhythm

- The ECG of a paced rhythm has vertical pacing spikes (when it is triggered)
 - If the atrium is paced, the pacing spike is seen immediately before the P wave
 - If the ventricle is paced, the pacing spike is seen immediately before the QRS complex
 - In dual chamber pacing, both these pacing spikes are seen
- You can't interpret a paced ECG