

Pacemakers and ICDs

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Pacemaker basics

- Provide electrical stimulus causing cardiac contraction in absence of spontaneous electrical activity
- Pulse generator with sensing, timing and output circuits and a battery
- Pacing leads in right atrium or right ventricle or both
- 2 modes; Asynchronous (fixed rate) or synchronous (demand)

Fixed rate or demand?

- Fixed rate

Risk of VF/VT if pacing occurs at same time as endogenous T wave

Not affected by diathermy

- Demand

Minimal risk of VF/VT

Electrical interference by diathermy may inhibit pacing

Single chamber or dual chamber

- Dual chamber pacing used in any situation where dyssynchrony of atrial and ventricular contraction results in cardiac failure (e.g. poor LV function)
- Dual chamber pacing used in cardiac resynchronisation therapy for the treatment of chronic heart failure.
- Single chamber (ventricular) pacing used in most situations where temporary pacing is required.

ICD (Internal cardiovertor defibrillator) basics

- Treat tachydysrhythmias by overdrive pacing and/or defibrillation.
- Also equipped with a demand pacing system
- ICD box with sensing, timing and output circuits and a battery
- Atrial and ventricular leads

Indications for permanent pacemaker

- Sick sinus syndrome
- Symptomatic bradycardia
- AF with slow ventricular rate
- Complete heart block
- Prolonged QT syndrome
- Cardiac resynchronisation therapy with biventricular pacing in heart failure

Indications for temporary pacemaker

- Bradydysrhythmias following MI etc.
- Anaesthesia in patients with bi-fascicular block who are thus prone to severe bradycardias
- Periop. cardiac surgery

Indications for ICD

- Survivors of VF/VT cardiac arrest where cause not completely reversible
- Syncope of undetermined origin with inducible VF/VT
- Poor LV function post MI
- VT/VF arrest post MI with inducible VT/VF
- Hypertrophic cardiomyopathy

Magnet inhibition

- Placing magnet over a permanent pacemaker in the past would temporarily reprogram it to a fixed rate, however with newer models the effect of a magnet will vary depending on the manufacturer.
- Magnet applied to ICD may turn off defibrillation function but not affect pacing (manufacturer dependant).

Anaesthesia in patients with pacemakers

- Diathermy – monopolar diathermy may result in inhibition of pacing, therefore temporary conversion to a fixed rate for the duration of surgery may be necessary. Bipolar diathermy does not usually affect pacing if site is distant from leads/box
- Patient shivering, positioning may result in lead displacement and pacemaker failure
- TENS usually safe providing pads and stimulator are situated away from the box
- External pacing via pads must be available should the permanent system fail perioperatively

Anaesthesia in patients with ICDs

- Disable defibrillation if diathermy is to be used
- Do not use TENS
- Have external defibrillator and pacemaker available

MRI

- MRI can result in heating of pacemaker and ICD leads and is therefore contraindicated.