Pacemakers and ICDs

Dr C M Haworth
Associate Specialist
Anaesthesia
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.
Pacemaker codes

3 letter code (e.g. VVI)

1st = chamber paced A (atrial) V (ventricle) D (dual)

2nd = chamber sensed

3rd = action performed on sensing electrical activity
   T (trigger of pacing function)
   I (inhibition of pacing function)
   D (dual response i.e. spontaneous atrial and ventricular events inhibits pacing but a lone atrial response triggers ventricular pacing)
   O (no response)
ICD (Internal cardioverter defibrillator) basics

- Treat tachydysrrhythmias 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

• Bradydysrrhythmias 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.