Device Technology Improving Cardiac Outcomes

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Outline

- Implantable Cardiac Defibrillator
- Cardiac Resynchronisation Therapy
- Volume threshold
- Loop recorder
- Left Ventricular Assist Device



Implantable Cardiac Defibrillator (ICD)

Purpose:

Detect and treat life threatening Ventricular Arrhythmia's eg VT, VF

Which patients ?

- Post Cardiac arrest (community)
- High Risk cardiac conditions
- Heart Failure with LVEF, 35% ^{1,2} (on maximal therapy)
- Conduction abnormalities eg Long QTc familial arrhythmia conditions





ICD Implantation

Comprises generator / battery unit and right ventricular lead (min)

- Same basic procedure as Pacemakers
- Sterile theatre with Xray screening
- Sub clavicular / subcutaneous approach
- Anaesthesia / sedation
- Induction of VF / defibrillation testing





Implantable Cardiac Defibrillator (ICD)



Tip of lead in right ventricle of Heart

How do ICD's work

- Monitors heart rate
- Can differentiate / interpret (& misinterpret) heart rhythm...
- Programmed to respond to a predetermined high heart rates with Anti Tachycardia Pacing (ATP) +/- Defibrillation
- Individualised programming configurations.
- Can programme to pace low heart rates
- Activation results in shock wave between the coil/s and the battery unit.
- Pacing team alert if heart rate zones are breached or device activated
- Pt may not be aware of ICD activation
- Remotely monitored / pt initiated downloads



Programming

- Individualised heart rate zones set with specific therapies
- Most devices have three programmable zones
 - VF zone. Defibrillation only.
 - Fast VT zone. Brief ATP then defibrillation.
 - VT zone. Multiple ATP therapies then defibrillation.
- These must be carefully considered and individualised
- Annual clinic program check, 6 monthly remote check



Anti Tachy Pacing (ATP)



ATP (cont)



ICD Sensing Arrhythmia



Suddn



Issues to be addressed with patients

- Nature and prognosis of disease
- Importance of ongoing medical therapy
- ICD's have morbidity associated with them and do not make pts feel better
- Inappropriate shocks eg VT storm
- Driving restrictions
- Occupational considerations
- Travel
- Practical safety issues

Doe, John			
123 Main St.			
Any Town, MN	55555		
mplant Date	Serial#	Model#	
01/02/2010	PTN600772A	RVDR01	
01/02/2010	LFP005555V	5086MRI52	
01/02/2010	LFP005556V	5086MRI58	

Follow Up



- Life long follow up at Pacemaker / ICD clinic to monitor device function
- Patients must be seen following a device therapy
- Remote monitoring
- Follow up with clinician to monitor disease therapy and other comorbidities
- End of Life care plan (incorporating deactivating device)



Cardiac Resynchronisation Therapy (CRT)

Purpose

- Permanently pace Atria and both ventricles to optimise pump contractility & improve cardiac output
- CRT-P alone, or an ICD can be incorporated ie CRT-D

Which patients

• LVEF not improved (ie <35%) following re echocardiogram on maximal HF meds for 3 months.

12

 Benefit greater with delayed conduction ie broad QRS, L)BBB, or long P-R interval^{1,²}

1. Cleland JG, et al. Eur Heart J. 2013;34(46):3547-56. 2. Woods B, et al. Heart. 2015;101(22):1800-6

How CRT works

Resynchronisation is achieved by pacing both the left and right ventricles simultaneously







CRT in action



Volume threshold lead

- Sensor incorporated in ICD / CRT Right ventricular lead
- Measures thoracic impedance & fluid index
- Threshold alerts are individually set
- Change in impedance or fluid index increase triggers alert to pacing team
- Pt is contacted and reviewed eg. weight, symptoms, medications
- Clinic / GP review if required



Impedance alert graph



But there's more



Ummm.....



Cardiac Loop Recorder

Purpose

- Detect infrequent /elusive arrhythmia not found on ECG, holter monitor or event recorder
- Unravel transient /mystery symptoms eg dizziness, syncope, palpitations



How do Loop Recorders work

- Records electrical signals from heart continuously for up to 3 years
- Diagnostic tool used when other common tests have not detected cause for symptoms
- Remote monitoring / wireless
- Pt activated symptom alert recorder, direct to pacing team





Loop Recorder Implantation

- Subcutaneous insertion
- Left pectoral chest wall
- Local anaesthesia
- Antibiotic cover
- Can be removed







Left Ventricular Assist Device (LVAD)

Which patients

- Those in big trouble.... LV pump failure
- Pt must be accepted onto active heart transplant wait list (AkId)
 - National guidelines re eligibility for assessment
 - LVAD is bridge to cardiac transplant for patients with intractable, severe HF symptoms
 - Maximal guideline-directed medical therapy
 - ICD implanted
 - No major comorbidities to increase mortality risk 1,2
- Pt may return home from AkId whilst waiting transplant
- Battery dependant (literally)

1.Moss AJ, et al. N Engl J Med. 2002;346:877-83. 2.Bardy GH, et al. N Engl J Med. 2005;352(3):225-37.

How does an LVAD work



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The Future....



Beyond today....

Fully automated systems pacing systems

- Programming "over the web"
- Leadless pacemakers
- Externally powered devices
- New therapies designed to repair conduction system
- Genetic developments

Thank You



Ablation

