Pre-op Device Consideration

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Western SUSSEX NHS Trust

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Cardiac Devices
Not Considered
Little scared.........

Clearly not as cool as Indiana Jones.
Too late!
Aim

- Cardiac Device Indications
- Highlight a few specific points using cases
- And.......
WE'RE ALL GONNA DIE
“Alleviate anxiety with regards to cardiac devices.”
Case 1 pre-op hernia

- 80 yr old chap
- Chronic AF on bisoprolol 1.25mg yrs
- Mildly elevated BMI
- Hypertension
- Ex-smoker near normal spirometry
Case 1

- Mildly breathless on activity-long standing
- No recent change
- Bloods normal
ECG in SR

Marked sinus bradycardia with 1st degree AV block

Septal infarct, age undetermined

Abnormal ECG
ECG in SR?
Case 1

- Complete HB with PAF
Case 1

- Stop Bisoprolol
- Need PPM
AF with Complete Heart Block
Pacemaker Indications

- AV Node Disease (conduction through heart)
- Sinus Node Disease
- Symptomatic Bradycardia
- Restore Normal Cardiac Physiology
### Pacemaker Nomenclature

**Revised NASPE/BPEG Generic (NBG) Pacemaker Code**

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chamber(s)</td>
<td>Chamber(s)</td>
<td>Response to</td>
<td>Rate</td>
<td>Multisite</td>
</tr>
<tr>
<td>Paced</td>
<td>Sensed</td>
<td>Sensing</td>
<td>Modulation</td>
<td>Pacing</td>
</tr>
<tr>
<td>O = None</td>
<td>O = None</td>
<td>O = None</td>
<td>O = None</td>
<td>O = None</td>
</tr>
<tr>
<td>A = Atrium</td>
<td>A = Atrium</td>
<td>T = Triggered</td>
<td>R = Rate</td>
<td>A = Atrium</td>
</tr>
<tr>
<td>V = Ventricle</td>
<td>V = Ventricle</td>
<td>I = Inhibited</td>
<td>Modulation</td>
<td>V = Ventricle</td>
</tr>
<tr>
<td>D = Dual</td>
<td>D = Dual</td>
<td>D = Dual</td>
<td>D = Dual</td>
<td></td>
</tr>
<tr>
<td>(A + V)</td>
<td>(A + V)</td>
<td>(T + I)</td>
<td>(A + V)</td>
<td></td>
</tr>
</tbody>
</table>

Pacing Clin Electrophysiol. 2002 Feb;25(2):260-4

@ECGTraining  
ECGMedicalTraining.com
DDD Pacemaker

Cephalic access
The Implantable Pacemaker System

- **The Implantable Pulse Generator (IPG)**: metal can (titanium) containing electronics/battery & an electrode or lead connector header
- **Lead**: Electrical connection between the pacemaker & the heart

![Diagram](image)
Ventricular Paced ECG

Retrograde P waves
Basic Rule

- If P waves are present then need an A lead
Ventricular Paced ECG

Retrograde P waves
Atrial Paced Rhythm
Dual Chamber Pacing
Case 2

- 78 yr old lady
- DDDR PPM for sinus node disease 3yrs ago
- Hypertensive, previous TIA 5yrs ago
- Pacing checks all satisfactory
Case 2

- 30mins post-op cholecystectomy
- Tachycardia caught on monitor
- Problem with PPM?
Case 2

- Highly likely to have been episode of post op AF
- Mode switch of device and no pacing
- Device check might be useful at some point down the line re. Anticoagulation
- ECG for diagnosis far more useful
Pacemakers- things to consider

- Percentage pacing
- Bipolar/unipolar pacing
- Pacing dependant
- Arrhythmias
Electromagnetic Interference (EMI)

- Can potentially cause interference with the device detection
- Inhibit pacing
- Magnet mode
- Damaging the software
- ICD inappropriate therapy
EMI

- Unipolar/bipolar
- Pacing dependancy/underlying rhythm
- Bipolar diathermy
- If in doubt physically check pulse
EMI

- The best practice would be to keep diathermy down to a minimum
- 3-5 seconds bursts should be fine
- Magnet if ICD
- Can’t remember the last time switched to AOO/VOO modes!
- My cardiac techs always a little twitchy doing this- R on T
BRITISH HEART RHYTHM SOCIETY GUIDELINES FOR THE MANAGEMENT OF PATIENTS WITH CARDIAC IMPLANTABLE ELECTRONIC DEVICES (CIEDs) AROUND THE TIME OF SURGERY

Honey Thomas, Andy Turley and Chris Plummer on behalf of BHRS Council – January 2016

INTRODUCTION

The use of Cardiac Implantable Electronic Devices (CIEDs) for rhythm management include pacemakers for control of bradycardias, implantable cardioverter defibrillators (ICDs) for treatment of life-threatening ventricular tachycardias, biventricular or resynchronisation pacemakers and ICDs for treatment of heart failure using ventricular resynchronisation (CRT-P and CRT-D respectively), implantable loop recorders (ILRs) and insertable cardiac monitors (ICMs) for monitoring cardiac arrhythmias.

These devices fall into 3 categories:

1. ILRs and ICMs which allow for targeted ECG monitoring
2. Cardiac pacemakers – single lead, dual lead or biventricular
3. ICDs–single lead, dual lead or biventricular

The presence of these devices may present a problem when procedures are carried out in which the patient may be exposed to electromagnetic interference (EMI) leading to inappropriate device function. Precautions therefore need to be considered prior to these procedures for the correct management of CIED patients.

This document is intended to provide practical guidance to use when patients with CIED need to undergo surgical intervention, expanding on the MHRA guidance published in 2006. This guidance also includes advice regarding common diagnostic procedures. It is recognised that there is limited trial data to guide clinicians in some areas and most evidence is in the form of expert opinion. This document will be reviewed by BHRS on a bi-annual basis.
Case 3

- 35yr old lady genetic DCM
- Father has ICD following survival of VT arrest
- Anxious lady in view of history and has ICD for around 5yrs implanted in London with initial problems with lead fracture
Noise Reversion

viaddd DD

Verbal Noise Reversion detected
Case 3

- Inappropriate shock
- No reproducibility with arm movements etc
- Turned out it related to a time she was cleaning out aquarium and likely related to the pump! (EMI)
ICDs
ICD Basics

- Can function as a standard pacemaker as necessary
- Can treat tachy-arrhythmias via ATP and Shock (programmable)
ICD Therapy

- NICE Guidelines for complex device therapy
- Secondary prevention of those survived life-threatening arrhythmia
- Primary prevention for those at high risk of life-threatening arrhythmia
- Ischaemic Heart Disease Population
- Rare channelopathies/DCM//HOCM
ICD Therapy

- Tends to be in those with poor heart function
- Clinically may vary from NYHA I - III
- If class IV usually not eligible for ICD and probably unlikely to be considered for elective surgery
ICD Therapy

- Are likely to be on cocktail of cardiac meds
- BBlockers
- ACEinhibitors/AngII inhibitors
- Diuretics/Spironolactone/Aldosterone
- Amiodarone
ICD Therapy

- These patients are regularly followed up with ICD/Pacing clinic
- Rapid Access to HF Team
ICD Patient

- Ideally their device will never deliver treatment, it’s there as a backup
- It’s a big deal if device delivers therapy......
- With implications on outcome and driving
All shocks are bad
### Settings Programmable

#### V. Detection

<table>
<thead>
<tr>
<th></th>
<th>Initial</th>
<th>Redetect</th>
<th>V. Interval (Rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VF</td>
<td>On</td>
<td>18/24</td>
<td>12/16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>320 ms (188 bpm)</td>
</tr>
<tr>
<td>FVT</td>
<td>OFF</td>
<td></td>
<td>240 ms (250 bpm)</td>
</tr>
<tr>
<td>VT</td>
<td>On</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>400 ms (150 bpm)</td>
</tr>
<tr>
<td>Monitor</td>
<td>Monitor</td>
<td>20</td>
<td>450 ms (133 bpm)</td>
</tr>
</tbody>
</table>

#### PR Logic/Wavelet

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Stability</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AF/Afl</td>
<td>On</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sinus Tach</td>
<td>On</td>
<td>Onset...</td>
<td>Off</td>
</tr>
<tr>
<td>Other 1:1 SVTs</td>
<td>On</td>
<td>High Rate Timeout...</td>
<td>Off</td>
</tr>
<tr>
<td>Wavelet...</td>
<td>On</td>
<td>TWave</td>
<td>On</td>
</tr>
<tr>
<td>SVT V. Limit</td>
<td>260 ms</td>
<td>RV Lead Noise...</td>
<td>Timeout</td>
</tr>
</tbody>
</table>

#### Other Enhancements

<table>
<thead>
<tr>
<th></th>
<th>Atrial</th>
<th>RV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.30 mV</td>
<td>0.30 mV</td>
</tr>
</tbody>
</table>

#### Sensitivity

- **VF:**
  - Initial: On
  - Redetect: 18/24
  - V. Interval (Rate): 320 ms (188 bpm)

- **FVT:**
  - Initial: OFF
  - V. Interval (Rate): 240 ms (250 bpm)

- **VT:**
  - Initial: On
  - Redetect: 16
  - V. Interval (Rate): 400 ms (150 bpm)

- **Monitor:**
  - Initial: Monitor
  - V. Interval (Rate): 450 ms (133 bpm)

- **PR Logic/Wavelet:**
  - AF/Afl: On
  - Sinus Tach: On
  - Other 1:1 SVTs: On
  - Wavelet...: On
  - SVT V. Limit: 260 ms

- **Other Enhancements:**
  - Stability
  - Onset...
  - High Rate Timeout...
  - TWave
  - RV Lead Noise...

- **Sensitivity:**
  - Atrial: 0.30 mV
  - RV: 0.30 mV
Anti-Tachycardia Pacing (ATP)

Tachycardia cycle length of 340ms

Morphology Change

Start ATP at 310ms

End ATP
Surface 12lead of ATP
ICD Shock
Case 4

- 65yr old chap with CRT-D
- IHD/CABG/PCI
- Poor LV with LBBB
Case 4

- Stable NYHA II
- Colorectal Cancer requiring surgery
- Anaemia with chronic bleeding
Case 4

- Diathermy use was likely
- Theatres contacted Pacing clinic re ICD needs deactivating
- Magnet use suggested
Magnet Effects
Magnet

- Pacemaker - Asynchronous pacing VOO mode
- ICD - magnet effect is programmable, but generally disables tachy therapies with no effect on pacing
- When magnet removed back to normal settings as before
Switch off Tachy therapies?

- Busy DGH with a large population of ICD patients
- Pacing Techs not free routinely to do this
- Also need for re-activating ICD
- Slightly different against the American/European Guidelines
Switch off Tachy therapies?

- Need for monitoring while device deactivated with defib and resuscitation facilities
- May need to decant from recovery to surgical HDU?
- Risk of discharge without re-activation
- Particularly if something happens/delays further procedures etc
Case 4

- Surgery went well with no issues
- Plenty of diathermy used in short bursts
- Device taped during theatre and removed in recovery
Case 4

- Post-op chest infection treated promptly with Abx
- Degree of acute renal injury which recovered slowly
- Discharged a week later
- All well........
Case 4

- 2 Weeks later
- Increasing SOB/ marked peripheral oedema
- Bilateral pleural effusions
- Acute admission through medical take
Case 4

- Albumin and Hb a little low, Potassium 3.0
- Diuretics had been halved
- ACE inhibitors stopped
- Decompensated Heart Failure compounded by post-op recovery
Case 4

- Device check demonstrates multiple runs of NSVT
- One VT requiring ATP
- Avoidable??
Case 4- Probably Avoidable

- All appropriate changes to medications during inpatient spell
- Perhaps patient should stay an extra day or two in hospital till ACE inhibitors re-started
- Ensure Hb at least 10+
- Patient/surgical juniors need to be aware to contact Heart Failure Team prior to discharge
Case 4

- Recovered promptly with IV diuretics
- Medications optimised
- Even though patients actually functioning well
- Please be aware there is minimal cardiovascular reserve
- Post-op Surgical F1 may not quite appreciate this!
Cardiac Resynchronisation (CRT)
Correct Electrical Disynchrony
# NICE Guideline and Patient Preference

**Table 1** Treatment options with ICD or CRT for people with heart failure who have left ventricular dysfunction with an LVEF of 35% or less (according to NYHA class, QRS duration and presence of LBBB)

<table>
<thead>
<tr>
<th>QRS interval</th>
<th>NYHA class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
</tr>
<tr>
<td>&lt;120 milliseconds</td>
<td>ICD if there is a high risk of sudden cardiac death</td>
</tr>
<tr>
<td>120–149 milliseconds without LBBB</td>
<td>ICD</td>
</tr>
<tr>
<td>120–149 milliseconds with LBBB</td>
<td>ICD</td>
</tr>
<tr>
<td>≥150 milliseconds with or without LBBB</td>
<td>CRT-D</td>
</tr>
</tbody>
</table>

LBBB, left bundle branch block; NYHA, New York Heart Association
CRT-D or P

- Only real difference is aim for 100% pacing
- NOT as needed like brady PPM
- Sometimes patients need the BBlockers etc to ensure they achieve this maximum pacing
- Try not to stop rate lowering agents
- Watch out for post-op AF
So Far

- Patients with CIED are all followed up by cardiac services
- So “in our system”
- Often if patients deteriorate automatically trigger a review of notes/ need for Cath/Echo/OPA
- However those without devices are far more of a worry for me!
Case 5

- 73yr old lady
- Background of COPD
- Ex-smoker stopped 20yrs ago
- Low BMI 45kg
- Old LBBB
- Echo report 2005 essentially normal good LV mild MR, normal Right Heart and pressures
Old LBBB dating back to at least 2005
Case 5

- Admitted with Upper GI bleed
- Hb fallen from 16 to 11 over the course of 3 months
- NSAIDs for OA
- Increasing SOB
- Likely NSAIDs related or possibly underlying malignancy
Case 5

- Shortly after OGD acute deterioration
- Severe SOB/Pulmonary Oedema
- Acute metabolic acidosis
- Peri-arrest
“Oh Bug....r!!!
Case 5

- Transferred to ITU
- Responded promptly to CPAP and IV Diuretics
- Cardiology called
Torrential Mitral Regurgitation
Case 5 In Hindsight

- Probably her underlying deterioration was from cardiac cause
- 2 litres of fluid resuscitation for her GI Bleed didn’t help!
Case 5

- Once offloaded
- Medically optimised
- Angiogram demonstrated 2 vessel disease
- Surgical turndown re low BMI/COPD etc
- Angioplasty to the large Cx and LAD
- PAP fell during angioplasty
- Waiting for her echo in the next few weeks
To Summarise
Don't Worry too much about the CIED

- Check the Patient pacing card
- Review cardiac letters
- Previous pacing checks
- Echo and angiogram results
- New cardiac symptoms SOB, chest pain, palpitations
Any Concerns please contact Pacing team
Cardiac Devices

- We rarely re-programme devices
- Magnets frequently used
Watch out for the patient without a device.....that needs one.....or has underlying cardiac pathology