Worcestershire Acute Hospitals NHS Trust

Peri-operative Management of Implanted Cardiac Devices

Key Document code:	WAHT-KD-017	
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Approved by:	Pre-op Directorate Governance Meeting	
Date of Approval:	4th January 2021	
Date of review: **This is the most current version and should be used until a revised document is in place**	12th November 2025	

Key Amendment

Date	Amendment	Approved by
21st January 2019	Inclusion of advice for edoxaban. Additional information for the management of medicines for diabetes	Medicines Safety Committee
25th June 2020	Document extended for 6 months during COVID-19 period.	QGC
4th January 2021	Pre-operative assessment Key Documents approved for 3 years	Pre-op Directorate Governance Meeting
27th December 2023	Extended document by 6 months whilst under review. Updated document owner.	Dr Harsha Mistry
12th November 2024	Document extended for 12 months whilst awaiting National Guidelines to inform if changes are required	Dr Harsha Mistry

Introduction

Intra-cardiac devices are common and the population of patients receiving these devices is older and has significant co-morbidity. It is inevitable therefore that a significant number will present requiring non-cardiac surgery.

Surgery carries a number of challenges for these patients, including

- Effects of diathermy
- Effects of inotropes / other drugs
- Effects of anaesthetic agents
- Effects of fluid shifts / anaemia
- Very rarely surgery is close to the site of the device and may directly threaten it (ie breast / chest wall surgery). **Any surgical plans involving areas very close to the device site should be discussed with a cardiologist before booking surgery.**

Details of Guideline

Classification

Implanted cardiac devices are classified as:

1. Simple Pacemaker Systems

2. Implantable Defibrillators (ICDs) and Cardiac Resynchronisation Therapy Devices (CRTDs)
3. Cardiac Re-synchronisation Therapy Pacemaker devices (CRTPs)

1. *Simple Pacemaker Systems*

'Simple' (bradycardia) pacemakers are to treat / prevent bradycardia only. The only significant risk is with diathermy, which may inhibit pacing (ie cause asystole), or rarely may damage the system if diathermy is used close to the device.

2. *Implantable Defibrillators (ICDs) and Cardiac Resynchronisation Therapy Devices (CRTDs)*

These devices, as well as having a pacing function, treat arrhythmias to prevent sudden death and may deliver a shock to the heart to achieve this. There is no risk to the operating team (unless the device itself is exposed) from shocks delivered.

The main device risk relates to diathermy which will be sensed by the device and will often be misinterpreted as an arrhythmia – resulting in inappropriate pacing and / or shock delivery. This may be dangerously pro-arrhythmogenic for the patient. For this reason it is crucial to disable shock therapies (i.e. ICD or CRTD) prior to surgery.

The other consideration for these patients is that most will have significant cardiac disease and the risks of anaesthesia / surgery should, wherever possible, be discussed with the patient's cardiologist prior to surgery.

3. *Cardiac Re-synchronisation Therapy Pacemaker devices (CRTPs)*

These devices function as bradycardia pacemakers as well as re-synchronising the heart's contraction, as a treatment for heart failure. Whilst management and device considerations are the same as for bradycardia pacemakers, these patients will often have advanced cardiac disease and so should, wherever possible, be discussed with the patient's cardiologist before surgery.

Effects of Magnets

Medical magnets are available from CCU and are also held in the cardiopulmonary department and A&E.

For bradycardia pacemakers, magnets do various things dependent on programming and model and essentially there is no role for a magnet with bradycardia pacemakers and CRTP devices. In most cases the magnet will convert a pacemaker to fixed rate (asynchronous) pacing which is not generally recommended and can be arrhythmogenic (R on T phenomenon).

For ICDs and CRTDs, magnets will disable tachycardia therapies (including shock therapy) whilst the magnet is in place. There should be no effect on bradycardiac pacing. Normal device function should resume after magnet removal. Magnets can therefore be used in the emergency setting to disable therapies that may be harmful during surgery but it is preferable to program the device wherever possible (i.e. Mon – Fri, 9 – 5) instead. The device will only be inhibited as long as the magnet is in position.

Different manufacturers and different models have different responses to magnets and there is no place for magnets in the routine perioperative care of ICD/CRTD's (within normal working hours).

Table 1. Response of ICD and CRTDs to Magnet therapy

Make of ICD/CRTD	**Response to magnet application**
Medtronic	Should deactivate ICD. Pacemaker function is unaffected. Removal of magnet should reactivate ICD. May produce audible tone (siren) to indicate magnet presence.
St Jude	Dependent on programming, may deactivate ICD. Pacemaker function is unaffected.
Boston Scientific	Dependent on programming, may deactivate ICD. Pacemaker function is unaffected. May produce audible R-wave tones to highlight that device is deactivated
Biotronik	Magnet will disable ICD. After 8 hours of magnet being present the ICD can revert to normal function. In this case the magnet needs to be removed and reapplied.

Management of patients with intra-cardiac device attending for emergency surgery

It is essential to identify the type of device the patient has prior to surgery. If the patient presents during normal working hours, contact cardiopulmonary department on ext. 30310. Wherever possible the physiologists can identify the device and reprogram as required for surgery.

Outside of normal hours, device identification can be via previous BlurSpier/EZ note correspondence, a patient carried device ID card, the on-call cardiac physiologist (contacted via on call cardiologist) or a chest X-ray.

If the surgical site is close to the device site it should be discussed with a consultant cardiologist prior to surgery.

For out of hours surgery where re-programming is not possible see below:

Patients with Pacemakers or CRTP for out of hours emergency surgery

Proceed with surgery with the following precautions:

- Ensure familiarity with local external defibrillation, temporary pacing and cardiopulmonary resuscitation equipment

- Avoid diathermy if unnecessary
- If diathermy essential use bipolar wherever possible
- If mono-polar diathermy is judged essential, limit cautery to short bursts, utilise more cutting than coagulating current and place the return electrode as far as possible from the pacemaker / CRTP
- If asystole occurs with diathermy that is essential, use diathermy in short bursts to minimise the physiological effect of the pauses
- Monitor ECG from the outset of the procedure
- Ideally monitor with an invasive arterial line (an oxygen saturations trace is less accurate but acceptable) and when diathermy is used the anaesthetist can observe the pressure trace to note asystole and alert the surgeon when required.
- Consider having the device checked in cardiopulmonary department as soon as feasible after surgery (ext. 30310). In most cases a pace-maker/CRTP check is not required after surgery unless it has been re-programmed or an adverse event occurred during surgery.
- If you believe the patient has a CRTP you should double-check it is not a CRTD as if it is you will need to follow the guideline below

Patients with ICD or CRTD patient for out of hours emergency surgery

Proceed with surgery with the following precautions:

- Take all the precautions outlined above
- Attach patient to an external defibrillator and monitor continuously. Obtain a medical magnet from CCU and tape it in place over the device securely with micropore (the device will usually be on the left side of the chest, an inch or so below the clavicle; locate the rough area by finding the scar, and palpate the device on the chest wall). Make sure the magnet is well secured. It should be noted that magnet effects vary between ICD/CRTD models and depends on how they are programmed. Magnets are therefore not recommended for routine use. See Table 1 for more information on CRTD/ICDS and their response to magnets.
- The external defibrillator pads should be positioned at least 8cm from the ICD or CRTD. An antero-posterior pad position may be appropriate. It is imperative that all staff are aware that the patient in effect does not have a defibrillator whilst the magnet is in situ.
- The anaesthetist should take responsibility for removing the magnet from the patient once surgery is complete. Generally speaking it should be removed as soon as the wound is closed / dressed.
- Have the device checked in cardiopulmonary department as soon as practically possible after surgery (ext. 30310). The device should be interrogated before the patient is transferred to a non-monitored setting. Until the device has been interrogated, the patient should remain on a monitor in an environment with a defibrillator immediately available.

In the event of a true ventricular arrhythmia occurring whilst the magnet is in place, either defibrillate externally as you would for a patient without an ICD / CRTD, or remove the magnet – the device should then detect and treat the arrhythmia. (If you remove the magnet and no treatment is delivered, you should defibrillate externally – but do check it is indeed a dangerous arrhythmia. It is possible that diathermy has damaged the device resulting in non-treatment). In case of monitored Ventricular Fibrillation or pulseless Ventricular Tachycardia developing, it may be appropriate to deliver 3 initial stacked shocks before commencing CPR, as per Adult Life Support guidelines.

Management of patients with intra-cardiac device attending for elective surgery

Wherever possible, notify the pacing technicians in the cardiopulmonary department as soon as the date for surgery is known (ext 30310).

At preoperative clinic, the nurses should obtain the following information for future reference:

- Type of device and manufacturer
- Serial number
- Implanting hospital and follow up hospital
- Date of last follow up
- Device location (usually left or right pre-pectoral region)

Patients with Pacemakers or CRTP for elective surgery

If the surgery date is not within 12 months of the last Pacemaker check, a check should be arranged prior to surgery. If the surgical site is close to the device site it should be discussed with a consultant cardiologist prior to surgery.

After the device has been checked, proceed with surgery with the following precautions:

- Ensure familiarity with local external defibrillation, temporary pacing and cardiopulmonary resuscitation equipment
- Avoid diathermy if unnecessary
- If diathermy essential use bipolar wherever possible
- If mono-polar diathermy is judged essential, limit cautery to short bursts, utilise more cutting than coagulating current and place the return electrode as far as possible from the pacemaker / CRTP
- If asystole occurs with diathermy that is essential, use diathermy in short bursts to minimise the physiological effect of the pauses
- Monitor ECG from the outset of the procedure
- Ideally monitor with an invasive arterial line (an oxygen saturations trace is less accurate but acceptable) and when diathermy is used the anaesthetist can observe the pressure trace to note asystole and alert the surgeon when required
- Consider having the device checked in cardiopulmonary department as soon as feasible after surgery (ext. 30310). In most cases a pace-maker/CRTP check is not required after surgery unless it has been re-programmed or an adverse event occurred during surgery.
- If you believe the patient has a CRTP you should double-check it is not a CRTD as if it is you will need to follow the guideline below

For patients with CRTP devices, whilst there are no shocks possible with these devices, patients may have extensive cardiac disease and a discussion between anaesthetist and cardiologist is recommended, ideally well before surgery, to allow treatment optimisation. Following this, the standard precautions as per pacemaker patients above apply. **If you believe the patient has a CRTP device, you should make sure it is not a CRTD as those patients require different management.**

Patients with ICD or CRTD for elective surgery

Many of these patients will have extensive cardiac disease and so a discussion between anaesthetist and cardiologist is recommended, ideally well before surgery, to allow treatment optimisation.

Obtain the following information for future reference:

- Type of device and manufacturer
- Serial number
- Implanting hospital and follow up hospital

- Date of last follow up
- Device location (usually left or right pre-pectoral region)

If the surgery date is not within 6 months of the last check, the ICD/CRTD should be checked prior to surgery.

Wherever possible, please notify the pacing technicians in the cardiopulmonary department as soon as the date for surgery is known via (ext. 30310).

The device should be reprogrammed before as close to the surgical time as possible – this should be discussed with the cardiopulmonary physiologists.

Device reprogramming will result in all tachycardia (including shock) therapies being disabled until reprogrammed back on again – **in effect the patient does not have an ICD at this time and must be monitored with a defibrillator available throughout**. It must be documented in the notes that therapies have been programmed off.

After programming, proceed with surgery with the following precautions:

- Staff should be aware that the patient does not have a functioning defibrillator
- Ensure familiarity with local external defibrillation, temporary pacing and cardiopulmonary resuscitation equipment
- The patient should be attached to a defibrillator if possible during surgery (if impossible due to the surgical field, a defibrillator must be immediately available).
- Avoid diathermy if unnecessary
- If diathermy essential use bipolar wherever possible
- If mono-polar diathermy is judged essential , limit cautery to short bursts, utilise more cutting than coagulating current and place the return electrode as far as possible from the pacemaker / CRTP
- If a malignant arrhythmia (i.e. VT or VF) occurs, it will not be treated by the device and standard measures, including external defibrillation, will be necessary. Ideally the external defibrillator pads should not go over the device, but this is less important than timely successful defibrillation.
- Ideally monitor with an invasive arterial line (an oxygen saturations trace is less accurate but acceptable) and when diathermy is used the anaesthetist can observe the pressure trace to note asystole and alert the surgeon if required
- If asystole occurs with diathermy that is essential, use diathermy in short bursts to minimise the physiological effect of the pauses

After surgery, the device should be checked and reprogrammed to re-enable tachycardia (including shock) therapies; this should take place as soon as reasonably practical after surgery (arrange by calling cardiopulmonary department on ext. 30310). This should occur before the patient leaves recovery to go to an un-monitored setting. This should be documented clearly in the notes when done. Until the device has been reprogrammed, the patient should remain on a monitor in an environment with a defibrillator immediately available.

Appendix 1.

Guidelines for specific surgeries (taken from British Heart Rhythm Society Guideline 2016)

Specialty	Pacemaker recommendation	ICD/CRTD recommendation
General surgery (Lower abdomen/lower limbs/arms distal to elbow)	**No post-operative check unless programming has been altered or adverse event occurred**	**Deactivation of ICD and reactivation post-operatively**
General surgery (upper abdomen/head or neck/arms proximal to elbow)	**Consider reprogramming if patient is pacemaker dependent and there is prolonged diathermy close to device.** **No post-operative check unless programming has been altered or adverse event occurred**	**Deactivation of ICD and reactivation post-operatively**
Ophthalmic Surgery (with unipolar diathermy)	**No post-operative check unless programming has been altered or adverse event occurred**	**Deactivation of ICD during surgery and reactivation post-operatively**
Dental surgery	**No action required unless diathermy use is anticipated** **No post-operative check unless programming has been altered or adverse event occurred**	**Deactivation of ICD may be appropriate if diathermy is anticipated with reactivation post-operatively**
Lithotripsy (Follow general measures as for patients undergoing diathermy)	**Avoid focussing beam near pulse generator** **If lithotripsy triggers on R wave, consider disabling atrial pacing during treatment** **Check device within one month after treatment.**	**Avoid focussing beam near pulse generator** **Consider deactivation of ICD and reactivation post-operatively to avoid inappropriate shock**

Electroconvulsive Therapy	**Interrogate within one month after treatment**	**Deactivation of ICD with checks and reactivation immediately after procedure**

Appendix 2.
Flowchart for elective peri-operative management of intra-cardiac devices