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Short Communication

Anaesthetic management in patients with cardiac implantable electronic devices

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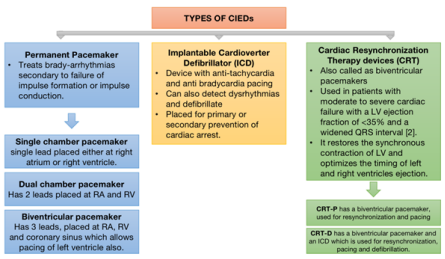
ABSTRACT

Cardiac Implantable Electronic Devices (CIEDs) are special devices which are implanted in to human body to treat various cardiac rhythm disorders and heart failure. Anaesthesiologists are now starting to encounter more patients with CIEDs undergoing various surgeries. Hence, it is of paramount importance to know about these devices and its management peri-operatively. Good communication between the anaesthetist, CIED team and surgeon is essential. Understanding the basic functioning of CIEDs and making a detailed preoperative plan can help anticipate and avoid most of the complications. Knowledge about managing intraoperative complications such as dysrhythmias is essential. All these combined with a vigilant monitoring even in the postoperative period is the key for a successful outcome.

1. Introduction

Cardiac Implantable Electronic Devices (CIEDs) are special devices which are implanted in to human body to treat various cardiac rhythm disorders and heart failure. In India, the recent survey shows that about 37,000 cardiac device implantations take place annually.[1] As a result, Anaesthesiologists are now starting to encounter more patients with CIEDs undergoing various surgeries. Hence, it is of paramount importance to know about these devices and its management peri-operatively.

1.1. Types of cieds



1.2. Pre-op evaluation

Any patient with CIED requiring anaesthetic care must undergo a detailed systematic preoperative evaluation.[2,3]

1.3. Investigations

ECG

1. Atrial pacing are identified by a spike just before the P wave.

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Table 1: CIED pre-operative check list summary

1	Type of device used- PPm, ICD, CRT
2	Latest CIED interrogation date-12 month for PPM, 6 month for ICD/CRT
3	Manufacturer details-know with pacemaker ID card
4	Date of insertion of the device
5	Battery life of the pacemaker
6	Pacing percentage-higher percentage indicates higher pacemaker dependency
7	ICD –number of previous shocks given
8	Magnets-device compatibility with magnets

2. Ventricular pacing identified by a spike just before a broad QRS complex.
3. If no intrinsic rhythm then patient is pacemaker dependent.

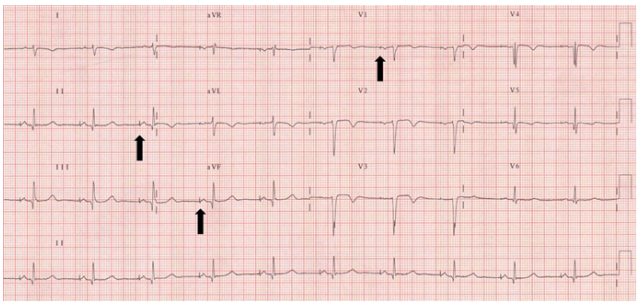


Image showing sole atrial pacing

(Image courtesy - BJA Educ, Volume 16, Issue 11, November 2016, Pages 388–396, https://doi.org/10.1093/bjaed/mkw020)

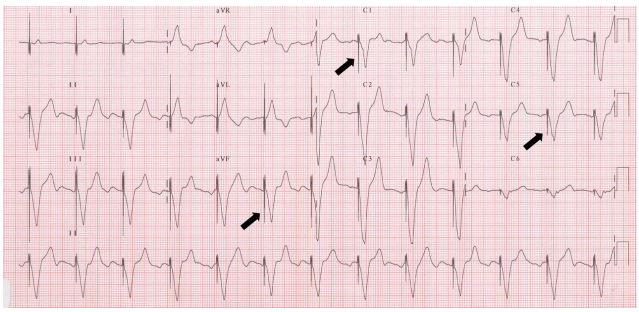


Image showing sole ventricular pacing

(Image courtesy - BJA Educ, Volume 16, Issue 11, November 2016, Pages 388–396, https://doi.org/10.1093/bjaed/mkw020)

Chest radiograph

1. Type of CIED used using number of leads seen
2. ICDs have thick radio-opaque shock coils

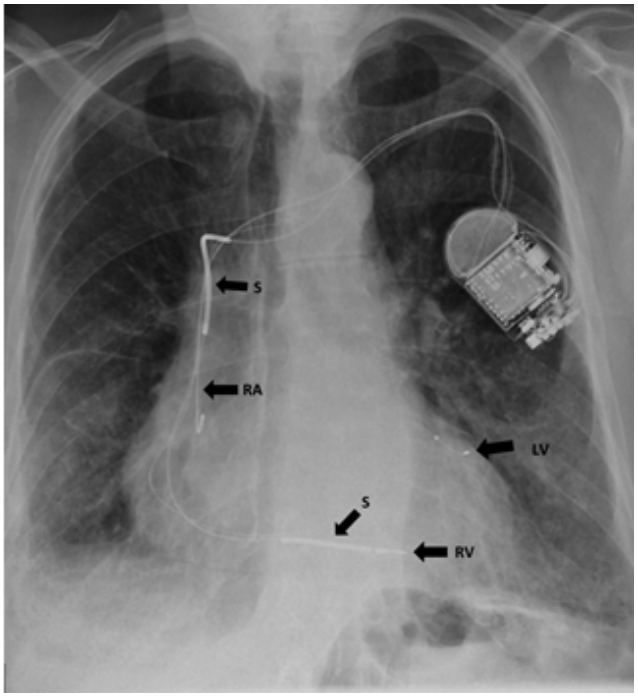


Image showing CRT-D device: shock coils (S) are noted with leads in RA, RV and coronary sinus

(Image courtesy - BJA Educ, Volume 16, Issue 11, November 2016, Pages 388–396, https://doi.org/10.1093/bjaed/mkw020)

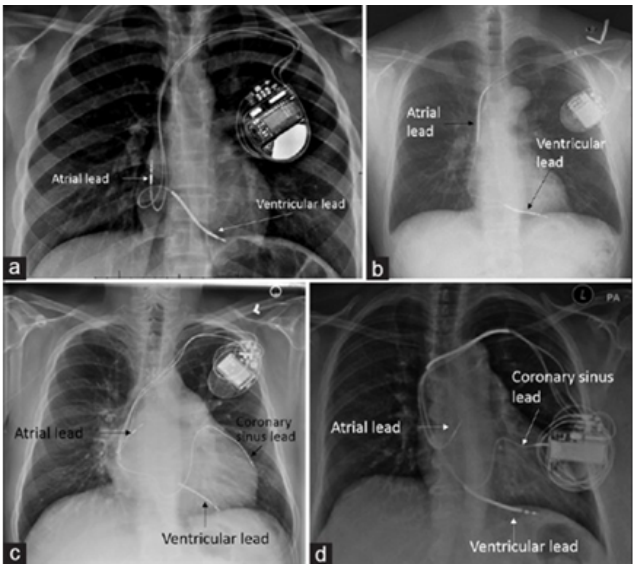


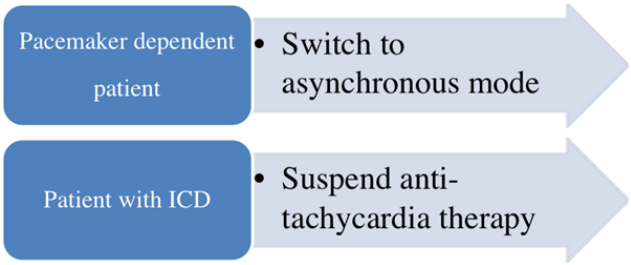
Image showing (a) Dual chamber pacemaker with leads in RA and RV

1. (a) ICD with shock coils
   (b) CRT with leads in RA, RV, coronary sinus
   (c) CRT-D three leads with shock coils

(Image courtesy - Indian Journal of Anaesthesia 61(9):p 736-743, September 2017.)

2. Technical Support

Reprogramming of the device and device interrogation is done preoperatively basing on the dependency of patient for the pacemaker and in view of EMI during surgery.



Asynchronous mode delivers a pacing stimulus at a fixed rate set. It prevents EMI being perceived as native rhythm by pacemaker. Suspending anti-tachycardia therapy in ICD prevents unwanted delivery of shocks in response to EMI. Device reprogramming can be done by either medical grade magnets or by maually reprogramming the device by trained personnels.[4]

3. Intra-Op Management

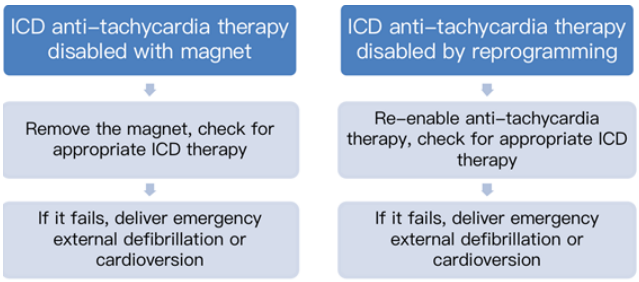
1. Vigilant monitoring of the patient with respect to the CIED device
2. Anticipating and preventing potential CIED dysfunction due to EMI
3. Managing intraoperative dysrhythmias
4. All the standard recommended monitors are to be attached including arterial line and cardiac output monitoring.

3.1. EMI

Electromagnetic Interferences are defined as interference of pacemaker function by the signals generated from external sources which can be misinterpreted as an intrinsic rhythm and this can cause inhibition of the pulse generation by pacemaker even when the patient needs it. This is called *Oversensing.*[5] In ICDs oversensing leads to inappropriate antitachycardia therapy such as defibrillation.[6] Common sources of EMI and the precautions to be takes are discussed below.

ELECTROCAUTERY	Current flow interferes with pacemaker function. Management •Use monopolar cautery in short bursts with a pause of 10 seconds. •The pathway from cautery to return electrode should not pass near the CIED and the current field should be at the right angles to pacing leads [8].
EXTERNAL CARDIOVERSION AND DEFIBRILLATION	Large amounts of energy damaging CIED and cardiac tissue are produced Management •Place the shock paddles >15 cms from the pulse generator [9] •Delivering current path should be perpendicular to the plane of the pacing system. •Modern CIEDs with voltage regulators such as Zener diodes protect the pacemaker circuitry.
MAGNETIC RESONANCE IMAGING (MRI)	•Newer pacemakers are MRI conditional which can be used in certain well defined conditions [10]. Precaution to be taken by checking pacemaker pre and post MRI.

4. Managing Intra-Operative Arrhythmias



5. Post-Op Management

Apart from regular postoperative management, monitor rate and rhythm continuously and keep all resuscitations equipments ready. The device should be interrogated and should be reprogrammed to its preoperative settings. Post operative checks may not be needed if EMI was not generated.

6. Conclusion

With increasing number of CIEDs being implanted everyday, the need to understand the management of these devices has become crucial. Good communication between the anaesthetist, CIED team and surgeon is essential.[7–9] Understanding the basic functioning of CIEDs and making a detailed preoperative plan can help anticipate and avoid most of the complications. Knowledge about managing intraoperative complications such as dysrhythmias is essential. All these combined with a vigilant monitoring even in the postoperative period is the key for a successful outcome.

7. Source of Funding

None.

8. Conflict of Interest

None.

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