

Quick Reference Guideline

THE MANAGEMENT OF EPICARDIAL AND TRANSVENOUS PACING FOR ADULT PATIENTS

SETTING	General Intensive Care Unit (GICU), Cardiac Intensive Care Unit (CICU).
FOR STAFF	Staff managing adult patients with epicardial and transvenous pacing.
PATIENTS	All adult patients with epicardial and transvenous pacing.

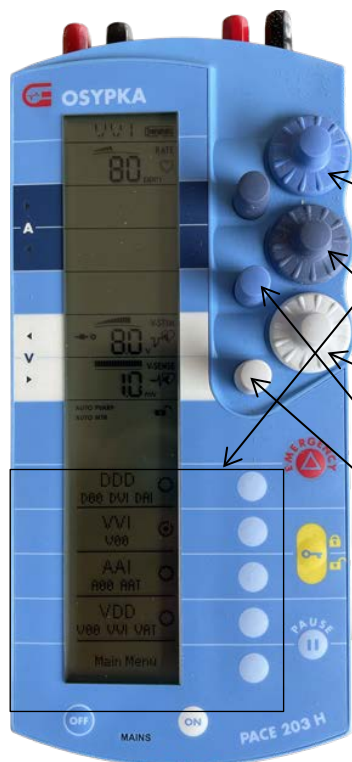
Background

This quick reference guide lays out the routine clinical management and expected monitoring and checks of patients requiring temporary pacing in the intensive care unit and emergency actions for some common pacing problems.

Basic set-up for epicardial pacing



Overview of pulse generator (pacing box) settings



3.2.1 Mode

Mode determines which leads are paced and how the pacer responds to intrinsic cardiac activity.

3.2.2 Rate

Rate determines how often the pulse generator will deliver an electrical impulse in the absence of intrinsic activity. This determines the pulse rate assuming there is mechanical capture

3.2.3 Output – (V-Stim and A-Stim)

Output determines how much energy is delivered to each pacing lead. Threshold is how much energy is required to trigger depolarisation (electrical capture) in the paced chamber and a pulse (mechanical capture).

3.2.4 Sensitivity- (V-sense and A-sense)

Sensitivity determines how much current must be detected to identify intrinsic activity in the paced chamber

Commonly used pacing modes

The table details the 2 modes most commonly seen in temporary pacing. VVI is the most common and is the focus of this guideline. Other modes may occasionally be used. **If the pacing mode is set to VOO/AOO/DOO) or the pulse generator box is left in 'emergency mode' please escalate this to a senior member of the medical team immediately**, these are typically only used in theatre or temporarily in emergencies.

Mode	Single or dual chamber	Description of the mode	Indications to use the mode
VVI (Ventricular demand pacing)	Single	<p>The ventricle is sensed and if a QRS is produced the pacemaker will not deliver an electrical impulse.</p> <p>The VVI pacemaker will only deliver an electrical impulse if there has been no electrical activity within the interval specified by the set pacing rate.</p>	<p>On demand ventricular pacing, with ventricular backup.</p> <p>Common mode used in transvenous and epicardial pacing.</p> <p>Overdrive pacing for the suppression of ectopic beats.</p>
DDD (dual chamber demand pacing)	Dual	<p>In normal intrinsic atrial and ventricular conduction no pacing response is required. Both chambers are sensed.</p> <p>If there is a loss of atrial-ventricular conduction, the pacemaker will pace the ventricle at the sensed atrial rate.</p> <p>If there is loss of atrial activity the pacemaker will pace the atrium and then the ventricles if no ventricular conduction is detected after a pre-determined delay (A-V delay).</p>	<p>All indications for pacing, with the exception of atrial tachyarrhythmias.</p> <p>Commonly used in epicardial pacing where ventricular and atrial wires in situ.</p>

Daily nursing care of the patient with temporary cardiac pacing

Registered nurses caring for patients with epicardial or transvenous pacing wires should complete the following procedures at the required frequency.

Table 3. Nursing procedures for the patient with epicardial or transvenous pacing wires and a pulse generator (pacing box).

<u>Procedure</u>	<u>Required frequency of completion</u>	<u>Rationale</u>	<u>Additional information</u>
Check the battery status of the pulse generator (pacing box) on the screen. Ensure the pulse generator has sufficient battery.	Complete once at the start of the shift with the safety checks.	To prevent pulse generator and pacing failure (Reade, 2007).	
Battery change (e.g. 9 V battery in the Osypka 203H).	As required, when the low battery symbol is displayed on the screen.	To prevent pulse generator and pacing failure.	Osypka 203H pulse generator can be changed promptly during pacing, as it has 30 seconds back up when the battery is removed.
Ensure that a spare battery (e.g. 9 V battery in the Osypka 203H pulse generator), is present in the patients bed space. This should be taped to the top of the equipment cabinet.	Complete once at the start of the shift with the safety checks.	To ensure a spare battery is immediately available in the event of battery failure. To ensure the battery is easily identifiable if required urgently.	
Ensure continuous ECG monitoring for all paced patients. Check ECG, BP, SaO2% monitor alarm settings are ON and correctly set. Ensure the pacemaker mode is turned ON, and pacing spikes are seen on the ECG monitor.	Complete once at the start of the shift with the safety checks.	To ensure pacing failure or arrhythmias are promptly detected. Electrical interference from the environment can affect the ability to see pacing spikes clearly. Pacemaker mode applies a high frequency filter, allowing clearer rhythm and pacing analysis (Reade, 2007).	
Carefully check all the connections are tightly secured from the pacing wires to the pulse generator.	Complete once at the start of the shift with the safety checks. Check each time the patient is moved.	To prevent accidental disconnection and pacing failure.	
Inspect the pacing wires entry site for signs of infection. Inform a senior member of the medical or nursing team if signs of infection are found.	Complete once at the start of the shift with the safety checks.	To monitor for signs of infection.	

Ensure that a registered nurse is in charge of the safe movement of the pulse generator during repositioning within the bed or mobilising. Check all the connections of the pacing system are correctly secured after repositioning.	Each time the patient is repositioned within the bed or mobilised.	To prevent accidental disconnection and pacing failure.	
Record pacing observations under vital signs on the computer information service (CIS).	Complete hourly pacing observations. Include mode, rate, output, sensing and pacing activity.	To accurately record the pacing requirements of the patient.	

Daily medical care of the patient with temporary cardiac pacing

The medical team caring for patients with epicardial or transvenous pacing wires should complete the following checks at the required frequency and document in the patient record. Checks should be performed by a member of the medical team trained to perform pacing checks or pacing technicians.

<u>Procedure</u>	<u>Required frequency of completion</u>	<u>Rationale</u>
Assess and record underlying cardiac rhythm.	Daily on consultant ward round If the patient is pacing dependent then the consultant should be present on the unit when these checks are performed.	To assess for ongoing need for temporary pacing and to record underlying rhythm to inform need for permanent pacing.
Review pacing mode, rate and need for ongoing pacing.	Daily on consultant ward round.	To optimise pacing mode and rate to patient condition.
Check output threshold and set amplitude with a margin of safety above the threshold (typically 25-50% above the threshold). If threshold is rising above 10V consider referral to cardiology to explore need for alternative methods of pacing.	Daily on consultant ward round If the patient is pacing dependent then the consultant should be present on the unit when these checks are performed.	To monitor for rising output threshold and ensure the margin of safety in set pacing output to avoid loss of capture.
Check the sensitivity settings. This should typically be set at 1mV. Consider checking the R wave amplitude and setting the ventricular sensitivity (V-sense) to 1/3 of the R wave amplitude. This will not be possible if there is no underlying rhythm. In this case set the sensitivity to 1mV.	Daily on consultant ward round.	To provide a margin of safety to avoid under-sensing and risk of R-T.

Emergency set-up of VVI pacing

Emergency VVI pacing can be instituted in severe bradycardia in patients with epicardial pacing wires in situ following cardiac surgery

Seek help immediately from a senior member of the medical team.

If there is haemodynamic compromise pull emergency buzzer

- GICU- consultant or Airway resident
- CICU consultant or Registrar



- 1 Screw tighten the grey leads to the patient's ventricular wires
- 2 Screw tighten the pins of the grey leads into the **Ventricle (V)** ports on the pacing box
- 3 Turn on
- 4 Unlock
- 5 Check the box has defaulted to the following settings, if not, select them as follows:
 - a) Ensure **unlocked**
 - b) Select **VVI** mode
 - c) Set the **RATE** dial to **80ppm**
 - d) Set the **V-SENSE** dial to **1.0mV**
 - e) Set the **V-STIM** dial to **8.0V** and increase until capture
- 6 Monitor for consistent capture at 80bpm, then seek help immediately

Ensure senior medical team assessment of patient after instituting emergency pacing and cardiology input considered

Loss of paced rhythm

Loss of pacing can be recognized by the return of patients underlying rhythm and may be associated with severe bradycardia and haemodynamic instability.

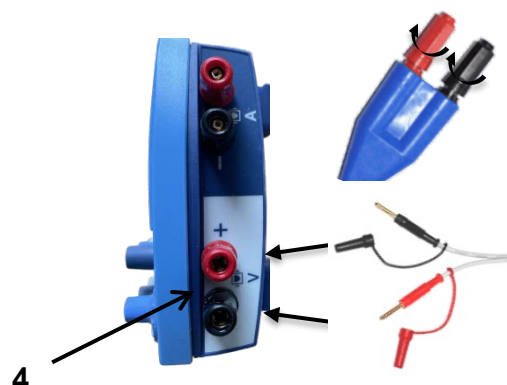
Seek help immediately from a senior member of the medical team.

- GICU- Consultant or airway resident
- CICU- Consultant or registrar

If there is haemodynamic compromise pull emergency buzzer

If the patient is unresponsive ensure ALS followed while pacing issues addressed

Ensure cardiology +/- cardiac surgery registrar contacted and coming to review



1 Press the emergency button on the pulse generator box

No pacing capture

2 Check all connections from patient to pacing box

No pacing capture

3 Check battery indicator and replace if depleted

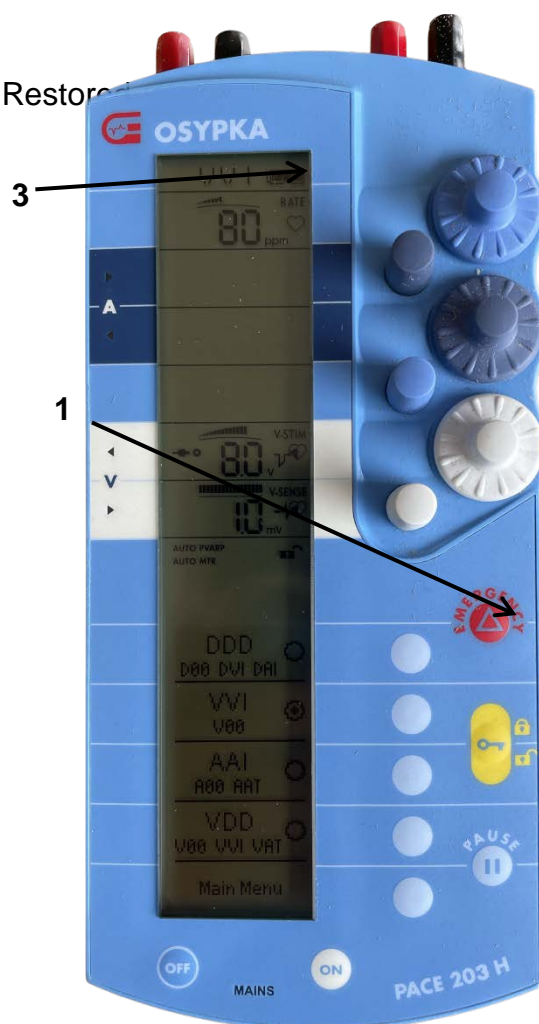
No pacing capture

4 Trial switching polarity by swapping the positive and negative terminals of the ventricular wires at the pulse generator

No pacing capture

5 Consider transcutaneous pacing

Pacing Restored



Reassess and ensure senior medical and cardiology input to review safety of ongoing pacing. **Ensure the pulse generator box is not left in emergency mode** after adequate rhythm is restored.

REFERENCES	<p>Use and Application of Pace 203H; Design- OSPYKA PACE 203H Instructions for Use Manual</p> <p>Biotronik. (2012) <i>Quick Reference Guide Reocor D</i>. Available at: https://www.biotronik.com/en-gb/products/external-devices/reocor. (Accessed 23rd July 2023).</p> <p>Burns, E. Buttner, R. (2022) <i>Pacemaker Rhythms – Normal Patterns</i>. Available at: https://litfl.com/pacemaker-rhythms-normal-patterns/ (Accessed: 23rd July 2023).</p> <p>European Society Cardiology (2021) 2021 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy. <i>European Heart Journal</i>, 00, pp. 1-94.</p> <p>Hill, J. (2015) <i>Transvenous Pacemaker Placement</i>. Available at: www.tamingthesru.com/transvenous-pacemaker. (Accessed 11th July 2023).</p> <p>Khorsandi, M., Muhammad, I., Shaikhrezai, K., Pessotto, R. (2012) Is it worth placing ventricular pacing wires in all patients post- coronary artery bypass grafting? <i>Interactive Cardiovascular and Thoracic Surgery</i>, 15, pp. 489-493.</p> <p>Mark, N.M. (2021) <i>Temporary / External Cardiac Pacing</i>. Available at: www.onepager.com (Accessed: 13th July 2023).</p> <p>Reade, M.C. (2007) Temporary epicardial pacing after cardiac surgery: a practical review. Part 1: General considerations in the management of epicardial pacing. <i>Anaesthesia</i>, 62, pp. 264-271.</p> <p>Reade, M.C. (2007) Temporary epicardial pacing after cardiac surgery: a practical review. Part 2: Selection of epicardial pacing modes and troubleshooting. <i>Anaesthesia</i>, 62, pp. 364-373.</p> <p>Royal College of Physicians. (no date) <i>Temporary cardiac pacing for CMT</i>. Available at: https://www.rcplondon.ac.uk. (Accessed: 23rd July 2023).</p> <p>Soar, J., Deakin, C. D., Nolan, J. P., Perkins, G. D., Yeung, J., Couper, K., Hall, M., Thorne, C., Price, S., Lockey, A., Wyllie, J., & Hampshire, S. (2021) <i>Advanced Life Support</i>. 8th edn. London: Resuscitation UK.</p> <p>Tjong, F.V.Y., De Ruijter, U.W., Beurskens, N.E.G., Knops, R.E. (2019) A comprehensive scoping review of transvenous temporary pacing therapy. <i>Netherlands Heart Journal</i>, 27, pp. 462-473.</p> <p>Yartsev, A. (2021) <i>Anatomy of the temporary pacemaker circuit</i>. Available at: https://derangedphysiology.com/cardiothoracic-intensive-care. (Accessed: 13th July 2021).</p> <p>Yartsev, A. (2020) <i>Sensitivity and output settings of the temporary pacemaker</i>. Available at: https://derangedphysiology.com/cardiothoracic-intensive-care. (Accessed: 23rd July 2021).</p> <p>Yartsev, A. (2018) <i>Single and dual chamber pacing modes</i>. Available at: https://derangedphysiology.com/cardiothoracic-intensive-care. (Accessed: 20th July 2021).</p>
RELATED DOCUMENTS AND PAGES	<p>Management of Temporary pacing in Intensive care: Full clinical guideline</p> <p>Clinical Standard Operating Procedure (SOP) Removal of epicardial pacing wires post cardiac surgery.</p> <p>Standard Operating Procedure (SOP) Competency Assessment for Registered Nurses in the removal of temporary pacing wires following cardiac surgery.</p>

AUTHORISING BODY	Surgery Governance Body.
SAFETY	See safety section.
QUERIES AND CONTACT	Nurse in Charge General Intensive Care (A600) Extension 27238.
AUDIT REQUIREMENTS	Re-audit of completion of pacing checks following implementation of guideline

Plan Elements	Plan Details
The Dissemination Lead is:	Geoff Ball
Is this document: A – replacing the same titled, expired guideline, B – replacing an alternative guideline, C – a new Guideline:	New guideline
If answer above is B: Alternative documentation this guideline will replace (if applicable):	N/A
This document is to be disseminated to:	Medical and nursing Staff GICU and CICU
Method of dissemination:	Mystaff and Sharepoint
Is training required and how will this be delivered:	Training already undertaken

Document Change Control				
Date of Version	Version Number	Lead for Revisions	Type of Revision	Description of Revision
04/07/24	1.00	Geoff Ball	Major	New document