



External Cardiac Pacing - Clinical Practice Standard

1. Purpose

The purpose of this policy is to establish minimum practice standards for the care and management of External Cardiac Pacing throughout the WA Country Health Service (WACHS).

Removing unwanted variation in clinical practice and following best practice guidelines has been found to reduce inappropriate care (overuse, misuse and underuse) thus improving health outcomes and reducing preventable.

Further information relating to Women and Newborn Health Services (WHNS) can be found via [HealthPoint](#) and is not covered in this policy.

2. Scope

All medical and nursing staff employed within WACHS who work in the emergency department.

All health care professionals are to work within their scope of practice appropriate to their level of training and responsibility.

Further information may be found via [HealthPoint](#) or the [Australian Health Practitioner Regulation Agency](#).

3. Procedural Information

External Cardiac Pacing is a temporary means of pacing a patient's heart during an emergency and assist in stabilising the patient until a more permanent means of pacing is achieved¹⁵. External transthoracic cardiac pacing is indicated for an acute and reversible cause. Pacing is rarely successful in asystole in the absence of P waves and should not be attempted routinely in this situation.

Where care requires specific procedures that may vary in practice across sites, staff are to seek senior clinician advice.

- External cardiac pacing does not take priority over initial basic life support measures. There should be minimal interruption to cardio-pulmonary resuscitation (CPR) when applying and assessing external pacing
- While performing CPR, external cardiac pacing is to be turned off
- In the event of ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT), defibrillation should be performed urgently

- External cardiac pacing is conducted under the direction of the Medical Officer (MO) if the Registered Nurse (RN) is not experienced with external cardiac pacing
- Patient to have continuous cardiac monitoring in place during external pacing
- Patient to have 1:1 monitoring by an experienced Registered Nurse or Medical Officer in cardiac pacing
- External overdrive pacing is only performed under MO guidance
- The RN within their scope of practice may initiate emergency external cardiac pacing without MO present when the patient is in extreme bradycardia WITH haemodynamic compromise/loss of consciousness (LOC). The RN must be competent in Advanced Life Support ^{1,2,3} and experienced with external pacing, or under the direct supervision of the Emergency Telehealth Service
- All emergency equipment is to be checked as per site procedures.

4. Considerations

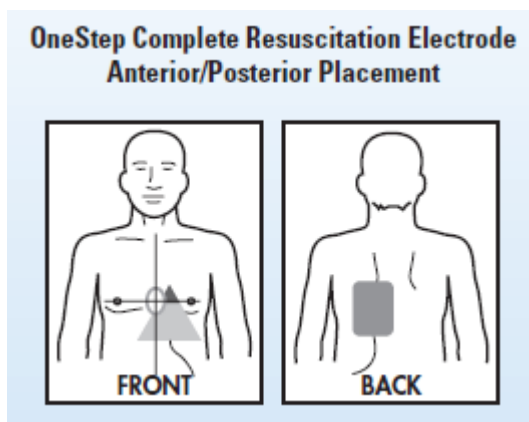
Paediatric considerations:

One step paediatric pads should be used on children up to 25 kg, for children over 8 years/25kg use the adult pads¹⁵.

Choose an appropriate paediatric pacing rate and be mindful that transthoracic impedance is reduced as there is less subcutaneous tissue therefore less milliamperes (mA) is needed for capture.

Indications are always hemodynamically compromising Sinus Bradycardia (SB) usually secondary to hypoxia or to override a Supra Ventricular Tachycardia (SVT). Place ECG electrodes well away from the pacing pads, on the shoulders/thighs.

Pad placement preference (Anterior Posterior) – the anterior pad is placed just left of the sternum, and the posterior pad is placed just left of the spine creating a “heart sandwich”¹⁶.



Follow Advanced Life Support (ALS) Algorithm and/or Activate Medical Emergency Response (MERS) procedure and/or Medical Emergency Response Team (MER) call.

If pacing fails continue cardiopulmonary resuscitation as per [Clinical Escalation of Acute Physiological Deterioration including Medical Emergency Response Policy](#) and site specific guidelines.

Prepare for transfer to a tertiary facility with Medical Officer escort

5. General Information

External cardiac pacing is defined as the delivery of a small electrical current, using pads, electrodes to the heart to stimulate myocardial contraction¹.

Cardiac pacing may be performed using an electrical stimulus or current via the following methods:

- Externally via transthoracic pads (as in this Clinical Practice Standard)
- Internal transvenous electrodes, to the endocardium (internal wall) of the right ventricle of the heart
- Internal transepical electrodes attached to the external wall of the heart (applied during cardiothoracic surgery)
- Transesophageal electrodes (Not in WACHS).

The amount of electrical stimulation required to elicit a myocardial contraction is known as the stimulation threshold. Pacing is visible on the ECG with pacing spikes, followed by broad/widened QRS complex, also termed as pacing 'capture'.

A pulse should be palpated with each complex seen on the ECG monitor to indicate mechanical capture of the myocardium resulting in ventricular contraction with ejection of blood from the ventricles into the pulmonary and systemic circulations.

External Cardiac Pacing Definitions

Fixed Rate Pacing	A pacing stimulus is delivered to the myocardium at a programmed fixed rate. This is also known as asynchronous ventricular pacing ⁴
Demand Pacing	A pacing stimulus is delivered to the myocardium if the intrinsic heart rate falls below the rate set on the pacemaker ⁴
Threshold	Otherwise known as milliamps (Ma), is the pacing threshold and amount of energy that will stimulate a consistent electrical response in the heart ⁴
Capture	Electrical capture is the occurrence of a QRS complex following a pacing spike and is detected by examining an electrocardiogram. This is confirmed by mechanical capture whereby the pulse is palpated and confirmed as been consistent with the heart rate displayed on the monitor ⁴

6. Indications for Procedure

- Profound bradycardia e.g. complete (third degree) heart block that has not responded to pharmacological treatment⁶
- Ventricular standstill with P waves¹
- Idioventricular Rhythm
- Symptomatic sinus bradycardia and atrioventricular nodal block³
- Overdrive pacing of tachyarrhythmia^{3,7}

Asystole or extreme bradycardia with haemodynamic compromise may be related to the following conditions:

- Complete heart block
- Drug toxicity
- Conduction system degeneration
- Conduction system damage post myocardial infarction⁸

7. Contra indications for Procedure

- Burns to chest
- Open chest due to trauma or cardiac surgery⁸
- Asystolic cardiac arrest

8. Clinical Communication

Clinical Handover

Clinical Handover is the transfer of professional responsibility and accountability for some or all aspects of care for a patient, or group of patients, to any person or professional group on a temporary or permanent basis.

Information exchange should adhere to the WA [Health Clinical Handover](#) Guideline.

iSoBAR is the minimum data set that must be used in all clinical handovers initiated by WA Department of Health employees.¹¹

Critical Information

Critical information, concerns or risks about a consumer are communicated in a timely manner to clinicians who can make decisions about the care.

- Consider cultural, ethical and communication requirements
- Review patient history and diagnosis for clinical conditions, medications and psychosocial factors that could influence observations
- Refer to previous observation parameters if available for comparison

- Medical ongoing management plan
- Nursing staff to liaise with the MO if complications present and document concern on site specific appropriate charts/patient notes.

Documentation

An individualised management plan is to be documented in the patient's health records as soon as practicable, in regard to this CPS, and at a minimum must consider:

- Diagnosis
- Presence of comorbidities and treatment
- Procedural requirements
 - Record rhythm strip
 - Date and time pacing initiated
 - Underlying rhythm
 - Pacing mode and rate prescribed
 - Output threshold
 - Output setting
 - Response to pacing
 - Duration of pacing
- Any restrictions to intervention associated with Advanced Health Directives (ADH) or Goals of Care pathways
- Document patient observations on MR140 series MER –Code Blue Record/Observational Response Chart
- Management of pain if required.

Refer to the WACHS [Documentation](#) CPS.

Patient/Carer information

- To maintain patient privacy and dignity
- Offer the presence of a chaperone where appropriate to patient and clinician requirements
- Provide the opportunity for an accredited interpreter and/ or Aboriginal Liaison Officer where appropriate to the patient's language or communication requirements (See [WA Health Language Services Policy](#))
- Explain the reason/procedures for External Cardiac Pacing to the patient, family and/or carer and gain appropriate consent if time allows
 - Use of pacing to increase/provide heart rate
 - Some discomfort/pain may be felt from the pacemaker

- Discomfort to be managed with analgesia or sedation as required
- Discuss the pacemaker electrodes and cardiac monitoring electrodes are necessary

9. Pre-Procedure Key Points

- Patient identification and procedure matching processes are undertaken
- Ensure areas of pad placement are clear of all foreign objects e.g.:
 - Intravenous (IV) lines
 - Electrocardiograph (ECG) electrodes
 - Medication patches
 - jewellery

Objects placed between the pacing pad and the patients skin will alter the flow of current, increase the risk of burns to the patient and may be a cause of failure to pace the patient

- Remove excessive hair as required with surgical clippers. Removal of pads with excessive hair can be painful. Routine shaving is not recommended as nicks in the skin can lead to burns and cause excess discomfort
- If required, clean skin with alcohol solution to remove excessive salt from sweating
- Dry the patient's chest and back as required. Wet skin increases the risk of burns, electrical arcing and may cause loss/failure of pacing
- Insertion of patent IV access (peripheral or central) to allow for the rapid administration of emergency drugs and fluids.

Refer:

[Peripheral Intravenous e Cannulae \(PIVC\) Management CPS](#)

[Central Venous Access Device \(CVAD\) CPS](#)

- External pacing can be associated with discomfort such as burning sensation on the skin and skeletal muscle contractions so patients who are conscious and hemodynamically stable should be given small doses of midazolam before initiation of pacing¹⁹.

Infection Control Considerations

Staff are to comply with the specific requirements for hand hygiene, aseptic non-touch technique and personal protective equipment.

Refer to:

[Personal Protective Equipment \(PPE\) Procedure](#)

[Infection Prevention and Control Policy](#)

10. Staffing Requirements

- Medical support via Electronic Telehealth Service (ETS) if experienced medical officer not onsite

- Patient's with external cardiac pacing require a visual observation at all times and cannot be left unattended by an experienced clinician
- Staff must be current Advanced Life Support Competency^{1,3-5} and familiar with patients with symptomatic cardiac arrhythmias causing haemodynamic instability, or be supervised by experienced Medical officer or ETS
- Education available via LMS - ETS Help – External Cardiac Pacing (ETSOO40 EL1, CPD 1.5 hours).

11. Equipment

- Defibrillator with external pacer and multifunction cable (plugged into power source)
 - Battery lasts up to 2 hours while cardiac monitoring but less when defibrillating or externally pacing
- External pacing pads– check expiry date
- ECG monitoring electrodes
- ECG Monitoring cable for connection to defibrillator

Reminder:

- Equipment must be appropriate for the age/size of the patient (adult or [paediatric](#))
- Equipment must be checked, serviced and calibrated in accordance with manufacturer's recommendations to ensure reliability and accuracy

12. Procedure

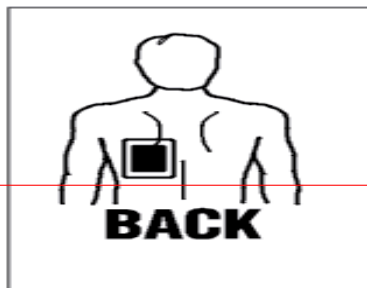
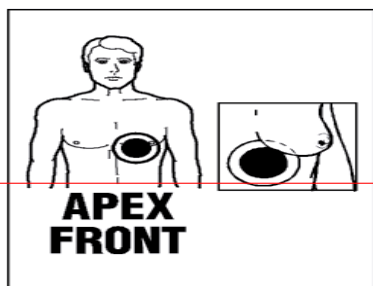
Pad Placement

- Use new pads for pacing
 - From one edge of pad, roll onto skin
 - Ensure good contact with no trapped air
 - Roll patient onto side to place posterior pad (as patient condition allows)
- Anterior posterior pad placement is the preferred pad placement. Position of pads will affect the electrical current required to obtain ventricular capture
- If the patient required defibrillation prior to the decision to provide external pacing and therefore already have defibrillation pads in the sternal and apex positions it is acceptable to use these for external pacing recently. However, re applied pads may have reduced skin contact and therefore potentially impeding electrical current being transmitted and decreasing the effectiveness of external pacing
- Ensure pacing pad placement is 8cm away from implanted defibrillators and permanent pacemakers to reduce risk of interference and damage to implanted devices⁹

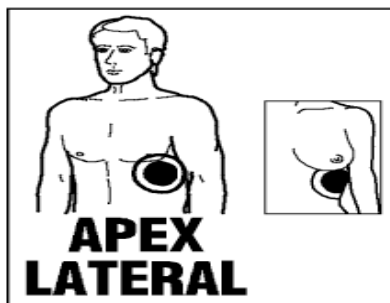
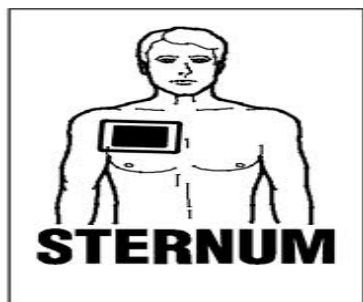
- External pacer may only be used if implanted defibrillator and or pacemaker is not functioning
- The pacing pad should be placed under large breasts, not across the top of the breast – ensure the area is dry
- Avoid bony structures e.g. sternum, scapula and thoracic spine
- Pads/electrodes should be replaced during external cardiac pacing in accordance with the manufacturer's instructions or site guidelines as this ensures maximum efficiency of pacing.

To avoid risk of electrical shock to staff do not touch gelled area while the unit is pacing

Anterior-Posterior Pad Placement



Anterior-Lateral Pad Placement



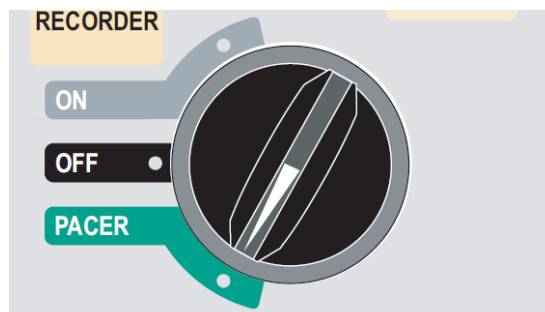
- MO may request a variation of the anterior pad to a higher placement

Procedure - Demand External Pacing

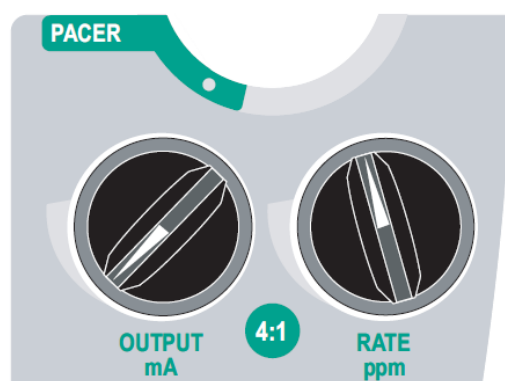
Refer to site specific defibrillator operational manual for instructions on use:

1. Turn defibrillator on
2. Connect pacing electrodes to multi-function cable
3. Apply ECG electrodes to the patient and connect to 3 lead ECG monitor cable on the external pacing defibrillator

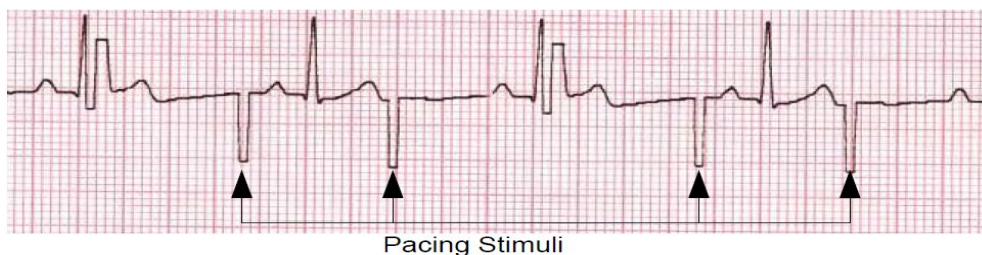
4. ECG automatically defaults to lead II for best complex and R wave visualisation
 - Press lead size to adjust complex size
 - Detection is indicated by flashing heart with each R wave
5. Turn mode selector to PACER –the PACER OUTPUT is automatically set at 0 mA



6. Set PACER RATE to 10-20 ppm greater than the patients intrinsic heart rate, if no heart rate exists use 70-90¹⁸ ppm – External cardiac pacing rate will be determined by MO



- The pacer increments or decrements by a value of 2 ppm when the dial is turned
- The stimulation threshold is dependent on the type of pacing used, the position of the pads and physiological conditions such as myocardial hypoxia electrolytes disturbances and pH imbalance 10
- Observe the pacing stimulus marker on the display or strip and verify that it is well positioned in diastole



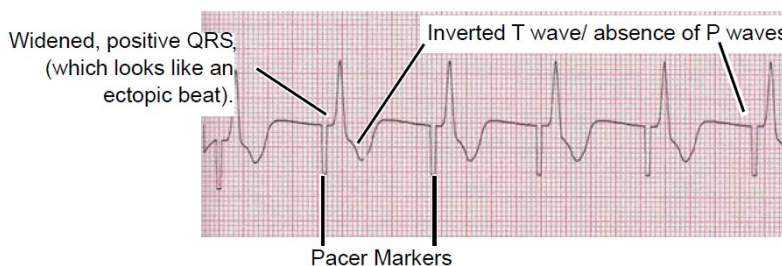
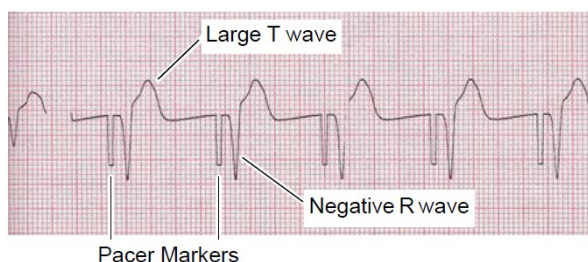
7. Increase current steadily, reviewing rhythm throughout for changes in morphology, until point of capture evident (threshold). Capture is evidenced by every pacing spike being followed by a broadened QRS complex

Determination of electrical capture should only be performed by viewing the ECG trace on the R series display with its ECG connection directly attached to the patient. Use of other ECG monitoring device might provide misleading information due to the presence of pacer artefacts.

8. Mechanical capture is determined by palpation of the peripheral pulse – Use femoral artery and right brachial or radial artery
 - A condition called ‘pulseless electrical activity’ (PEA), occurs when the electrical activity fails to cause a myocardial contraction. Normal electrical activity is seen on the ECG monitor with no associated pulse on palpation and is a medical emergency. Absence of a pulse in the presence of good electrical capture requires Cardiopulmonary Resuscitation

Determine Optimal Pacing Threshold

9. Determine consistent external pacing – observe pacing spike and electrical capture.



- The ideal pacer current is the lowest value that maintains capture – usually 10% above threshold. Typical threshold currents range from 40-80 mA
- Lower stimulation currents produce less skeletal muscle contraction and are better tolerated

Standby Demand Pacing

- The use of standby pacing is determined and may be utilised when intermittent episodes of extreme bradycardia or asystole require temporary pacing
- Pacing spikes will only be observed when the patients intrinsic rhythm is less than the pacing rate set on the external pacer
- Turn the pacing rate below the patient's heart rate - External Cardiac Pacing rate will be determined by MO
 - The pacing rate should be set at a level sufficient to ensure adequate cardiac output
 - Check thresholds periodically
- Ensure ECG leads connected as machine will default to non - demand mode without.

Asynchronous Pacing

Asynchronous pacing should only be used in emergency situations when there is no other alternative, as in this mode there is a risk of R on T phenomenon which may cause ventricular arrhythmia such as Ventricular Tachycardia (VT) or Ventricular Fibrillation (VF). In asynchronous pacing mode, electrical stimuli are delivered to the myocardium irrespective on the patient's intrinsic cardiac rhythm.

- With asystole start with full output. If capture occurs, slowly decrease output until capture is lost (threshold) then add 2 mA or 10% more than the threshold as a safety margin²⁰.

The device will not deliver an emergency or elective cardiac shock while in the pacing mode, turn selector switch to DEFIB to defibrillate the patient.

Patient Management

- Liaise with MO for management plan (consider patient destination for ongoing management).

Refer to:

[WACHS Admission, Discharge and Inter-hospital Transfer Clinical Practice Standard](#)

[WACHS Assessment and Management of Interhospital Transfers Policy](#)

- Patient to be under constant visual observation by experienced clinical staff
- Assess patient pain/discomfort levels:
 - Assess pain score from 0 to 10, with 10 being most severe.
 - MO to prescribe analgesia and sedation if required.
 - Nursing staff to administer analgesia/sedation as required. The preferred management for patient analgesia during transthoracic pacing is fentanyl. Small amounts of Midazolam can be used to improve patient tolerance but as a sedative it may alter the neurological status of the patient, which may in turn obscure the neurological assessment and therefore appropriate management.
- Ensure continuous cardiac monitoring
- Physiological Observations 15/60 for 1/24 and more frequently if required
- Assess and document Glasgow Coma Scale (GCS) 15/60 for 1/24 and more frequently if required
- Inspect the skin around the pacing patches every 30 minutes for burns injury. Prolonged pacing (in excess of 30 minutes) particularly in adults with restricted blood flow may cause burns – **Do not touch the gel area whilst pacing is in operation**
- Full patient assessment is required to determine if cardiac output is meeting end-organ needs
- Minimise magnetic interference

13. Potential Problems During or Post Procedure

- If pacing does not work, there may be failure to capture/pace. Temporary pacing wire or permanent pacemaker may be required

14. Compliance Monitoring

Evaluation, audit and feedback processes are to be in place to monitor compliance.

Failure to comply with this policy document may constitute a breach of the WA Health system MP0031/16 Code of Conduct (Code). The Code is part of the [Employment Policy Framework](#) issued pursuant to section 26 of the [Health Services Act 2016](#) (WA) and is binding on all WACHS staff which for this purpose includes trainees, students, volunteers, researchers, contractors for service (including all visiting health professionals and agency staff) and persons delivering training or education within WACHS.

WACHS staff are reminded that compliance with all policies is mandatory.

15. Records Management

[Health Record Management Policy](#)

16. Relevant Legislation

(Accessible via: [Western Australian Legislation](#) or [ComLaw](#) sites)

- *Carers Recognition Act 2004*
- *Disability Services Act 1993*
- *Guardianship and Administration Act 1990*
- *Health Practitioner Regulation National Law (WA) Act 2010*
- *Occupational Safety and Health Act 1984*
- Occupational Safety and Health Regulations 1996
- *Pharmacy Act 1964*
- *Poisons Act 1964*
- Poisons Regulations 1965
- *Privacy Act 1988*
- *Public Sector Management Act 1994*

17. Relevant Standards

[National Safety and Quality Healthcare Standards](#)

Clinical Governance Standard: 1.8, 1.23, 1.25, 1.27-

Recognising & responding to Acute Deterioration Standard: 8.1, 8.2, 8.4

18. Related WA Health Policies

- [Clinical Alert \(Med Alert\) Policy](#)
- [Recognising and Responding to Acute Deterioration Policy](#)
- [Clinical and Related Waste Management Policy](#)
- [Clinical Handover Policy](#)
- [Clinical Incident Management Policy](#)
- [WA Health Consent to Treatment Policy](#)

19. Relevant WACHS documents

- [WACHS Assessment and Management of Interhospital Patient Transfers Policy](#)
- [WACHS Escalation of Acute Physiological Deterioration including Medical Emergency Response Policy](#)
- [WACHS Clinical Observations and Assessments CPS \(Physiological, Neurovascular, neurological and Fluid Balance\)](#)
- [WACHS MR140 Medical Emergency response – Code Blue Record](#)
- [WACHS MR140A Observation Response Chart \(A-ORC\)](#)

- [WACHS MR140B Maternal Observation and Response Chart \(M-ORC\)](#)
- [WACHS MR184 Interhospital Clinical Handover From](#)
- [WACHS MR184C Interhospital Transfer Maternal Form](#)

20. Policy Framework

[Clinical Governance, Safety & Quality](#)

21. Acknowledgement

Acknowledgment is made of the previous SMHS / WACHS site endorsed work used to compile the External Cardiac Pacing Clinical Practice Standard 2015.

22. References

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23. Definitions

Carer	A person who provides personal care, support and assistance to another individual who needs it because they have a disability, a medical condition (including a terminal or chronic illness) or a mental illness, or are frail and/or aged
Patient	A person who is receiving care in a health service organisation

24. Appendices

Appendix 1: [Trouble Shooting](#)

Appendix 1: Trouble Shooting

Problem	Possible Cause
Alarm - Poor pad contact, check pads displayed on screen	<ul style="list-style-type: none"> The multi-function cable is not connected to pacing unit The cable is faulty The pads are not connected to the multi-function cable Pads are not making adequate skin contact Pads may be dry & need replacing (after 8 hours of use)
No stimulus marker present on ECG trace	<ul style="list-style-type: none"> Unit not in pacer mode The pacer rate is set faster than the patient's heart rate
No ventricular capture beat after the stimulus marker on the ECG	<ul style="list-style-type: none"> Check patients pulse Pacing mA to low Pads not making good contact with patient Check ECG configuration is in best lead Pad placement needs moving
Patient in DEMAND pacing is paced intermittently	<ul style="list-style-type: none"> ECG electrode connection faulty Patient R to R interval changing Pacing rate close to patient rate
Heart rate display reads 0 with pacing capture	<ul style="list-style-type: none"> Check patients pulse Select different ECG lead configuration is in best lead

This document can be made available in alternative formats on request for a person with a disability

Contact:	Project Officer, Clinical Practice Standards (R. Phillips)		
Directorate:	Medical Services	EDRMS Record #	ED-CO-15-92680
Version:	2.00	Date Published:	22 October 2019

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