Guideline Title  Transcutaneous Pacing

Summary: Temporary cardiac pacing involves electrical cardiac stimulation to treat a bradyarrhythmia until it resolves or until long-term therapy can be initiated. The purpose of temporary pacing is to increase heart rate and blood pressure; in some situations, temporary pacing can be lifesaving. Temporary pacing can be in the form of Transvenous, Epicardial or as discussed in this guideline Transcutaneous.

Approved by: ICU Medical Director

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Next Review Date: January 2018

Replaces Existing Guideline: Transcutaneous Pacing 2011

Previous Review Dates: 2003, 2011

Contents:
1. Background Information
2. Definitions
3. Introduction
4. Policy statement
5. Principles / Guidelines
   a. Indications
   b. Contraindications
   c. Precautions
   d. Equipment
   e. Procedure
   f. Troubleshooting
6. Clinical issues
7. Performance measures
8. References
9. Appendix

1. Background Information:

If electrical conduction in patient's heart is abnormal, transcutaneous pacing can temporarily restore electrical activity. By continuously monitoring cardiac rate and rhythm and delivering pacing impulses through the skin and chest wall muscles as needed, transcutaneous pacing causes electrical depolarization and subsequent cardiac contraction to maintain cardiac output until the patient receives a transvenous pacemaker. This system is composed of two adhesive conducting pads that are placed externally on the chest wall. The electrodes are incorporated into the pads and cover a large surface area over the skin. The pads are connected to an external pulse generator which delivers energy through the pads to the chest wall muscles.
2. Definitions

- **Capture**
  - Initiation of depolarisation of the ventricles by an electrical stimulus. Capture can be visualized on the monitor by a spike before every QRS

- **Output**
  - The electrical stimulus or energy generated by a pulse generator and intended to trigger a depolarisation in the chamber of the heart being paced

- **Output threshold**
  - Minimum output required to obtain capture

- **No Output**
  - The absence of energy delivery to the heart.

- **Ampere (AMP, A) / mA**
  - A measure of electrical current flowing past a point in a conductor when one volt of potential is applied across one ohm of resistance. In pacing, these currents are so small that they are expressed in thousandths of amperes (milliamperes, mA) or in millionths of amperes (microamperes, μA)

3. Introduction:
The risk addressed by this policy:

| Patient Safety |

The Aims / Expected Outcome of this policy:

| Staff caring for patients with external Transcutaneous pacing will have the knowledge and skills to provide effective and safe management |

Related Standards or Legislation

NSQHS Standard 1 Governance

Related Policies

<table>
<thead>
<tr>
<th>Number / Title</th>
<th>Title</th>
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<tbody>
<tr>
<td>LH_PD_ICU_2015</td>
<td>Management of Arrhythmias</td>
</tr>
<tr>
<td>LH_PD_ICU_2014</td>
<td>Cardiac Monitoring</td>
</tr>
<tr>
<td>LH_PD_ICU_2013</td>
<td>Temporary Epicardial Pacing</td>
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</tbody>
</table>

4. Policy Statement:

- All care provided within Liverpool Hospital will be in accordance with infection prevention/control, manual handling and minimisation and management of aggression guidelines.
- Transcutaneous pacing should only be undertaken by accredited staff who have been assessed during their ALS assessment
- Always check for a pulse with any rhythm and commence CPR if no signs of life
- For all life threatening arrhythmias call a MET: dial 666 and state ward and bed number
- Emergency trolley must be checked each shift by an RN
- Infection Control guidelines are to be followed.
- All drugs administered during an emergency (under the direction of a medical officer) are to be documented during the event, then prescribed and signed following the event.
- Medication errors are to be reported using the hospital electronic IIMS reporting system.
- Pacing or defibrillation pads must be in good contact with chest wall
5. Principles / Guidelines 1, 2, 3, 5, 8

Indications 2, 8
- Haemodynamically unstable bradycardias that are unresponsive to atropine
- Type II (Mobitz) second degree AV block with haemodynamic compromise.
- Third degree (complete) heart block with haemodynamic compromise
- A bridge to temporary pacemaker or permanent pacemaker
- Sick sinus syndrome

Contraindications
- When there are intermittent, mild symptoms and the bradycardia is well tolerated. This includes symptomatic complete heart block with an adequate and "stable" escape rhythm or symptomatic sick sinus syndrome with only rare pauses.
- In the presence of a prosthetic tricuspid valve or right ventricular infarct, circumstances in which it may not be possible to achieve right ventricular capture

Precautions
- Patient may get skin damage, pain, and discomfort from continual pacing
- Be aware of electrical hazards, the presence of water, metal, oxygen and flammable substances
- Avoid placing pads over ECG electrodes, ECG leads, CVC sites, implanted devices, medication patches
- Do not use pads if electrodes are damaged

Equipment
- Defibrillator (with pacing function)
- Multi function adult pads (pads that can defibrillate and pace)

- Emergency trolley
- IV access
- Mask size 3 or 4 and resuscitation bag
- Suction equipment
- Some sedation may be required to tolerate transcutaneous pacing and must be prescribed by medical team

Procedure 1, 5
- If patient is conscious, explain procedure and inform them that they may experience possible discomfort such as tingling, stinging or kicking sensation which is the result of cutaneous nerve stimulation.
- If the patient is in cardiovascular collapse or rapidly deteriorating, it will be necessary to start pacing without sedation.
- Determine patient's intrinsic rate and rhythm (if any). Obtain 12 lead ECG
- Prepare appropriate sedation if required, as prescribed by ICU Registrar / Consultant and administer when directed
- Place patient in supine position
- Apply supplemental O2 (if patient not already ventilated or has O2 therapy insitu)
- Remove clothing from chest, shave excess hair (chest and/or back) and ensure skin is clean and dry.
- Remove pads from package and separate lead wires
- Remove pad protective liner

Zoll M Series CCT Defibrillator. mayapedia.me.com

- Apply the Zoll defibrillator ECG electrodes to patients chest, avoid large muscles e.g. Pectoralis major (see fig)
- Ensure there are no IV lines or ECG electrodes under the pads
- Pads are not repositionable. Replace with new pads if they need to be repositioned
- Replace pads every 8 hours
- Attach defibrillator pads by placing one edge securely on the patient smoothly from that edge to the other ensure not to trap air bubbles between the gel and skin.

Recommended Method for Applying Pacing Electrode to the Skin
For transcutaneous pacing the pads should be placed Anterior–Posterior (AP) as this is the preferable position for maximum current flow (ARC Guideline 2010)

- Posterior pad is placed left lateral of the spine and just under the scapula
- Anterior pad is placed mid clavicular, 4th intercostal space, lateral to the sternum

- Turn Zoll defibrillator dial to **Pacer** mode

- Set rate dial 70-90bpm
- Set Pacer output
  - Increase output until the ECG tracing indicates a ventricular response exhibited by a pacing spike followed by a widened QRS complex and broad T wave, which is electrical capture
  - Add 10mA or set output 10% higher than output threshold
- Ensure electrical capture, spike before every QRS, as well as mechanical capture which would be indicated by an increase in heart rate, blood pressure and level of consciousness
- Follow Management of Bradycardia Algorithm ARC Guideline 11.9 November 2010. (See Management of Arrhythmia guideline Liverpool ICU 2015)

**Troubleshooting**

- If pacing is not working or capturing
  - Consider the 4 H's and 4 T's (see Appendix 1 and 2)
  - Check pad placement
  - Check if there is adequate skin contact. Clean and shave as necessary
  - Change the defibrillator pads
  - Ensure output setting is adequate
  - Ensure rate setting is adequate
  - Ensure defibrillator battery is not depleted

6. **Clinical Issues:**

- Continue to monitor patient’s heart rate and rhythm while Pacing is insitu.
- Assess perfusion by monitoring blood pressure, heart rate and level of consciousness (if applicable).
- Check capture by palpating the femoral pulse (mechanical capture as opposed to electrical capture). Chest muscle contraction may cause pseudo pulse and be mistaken for capture.
- Assess patient's level of pain and ensure adequate analgesia/ sedation is ordered.
- Periodically check area where electrodes are placed for signs of burns or tissue damage especially in patients with shock.
- Maintain electrical safety
- Maintain bed rest with close monitoring.
- Perform regular 12 lead ECG’s (8th hourly or prn in accordance to changes in patient’s condition).
- Replace multifunction pads after **8 hours** of continuous pacing (dependent upon pacing rate and current. Manufacturers recommendation: Adult Stat Pads Electrodes Tyco Healthcare)
- Document all settings on pacing checklist form
• Many factors (e.g., obesity, myocardial ischemia, metabolic derangement, pneumothorax, poor skin-to-electrode contact) can increase the pacing threshold, and some of those conditions are correctable
• Once capture has been verified on monitor by a spike before every QRS, patients haemodynamics must also be assessed ensuring electrical and mechanical capture.
• Electrical hazards (jewelry, water, ECG electrodes, GTN patches) must be removed
• Avoid placing pads over ECG electrodes, ECG leads, CVC sites, implanted devices, medication patches
• Move patients limbs away from metal fixtures e.g. bed rails

7. **Performance Measures**
All incidents are documented using the hospital electronic reporting system: IIMS and managed appropriately by the NUM and staff as directed.

8. **References / Links**
2. Temporary cardiac pacing. Brian Olshansky, MD uptodate.com 2015
http://www.acep.org

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**Reviewers:** ICU CNC, CNE’s, NM, NUM’s, CNS’s & ICU Staff Specialists  
**Endorsed by:** ICU Medical Director – A/Prof. Michael Parr
### Appendix

#### Management of Reversible causes: 4 H’s

<table>
<thead>
<tr>
<th>4 H’s</th>
<th>MANAGEMENT</th>
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<tbody>
<tr>
<td><strong>Hypoxia</strong></td>
<td>- Check and maintain airway</td>
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<td></td>
<td>- Insert Guedel, ETT, LMA, surgical airway if required</td>
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<td></td>
<td>- Check oxygenation and ventilation</td>
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<tr>
<td><strong>Hypovolaemia</strong></td>
<td>- Replace blood or fluid loss</td>
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<tr>
<td></td>
<td>- Replacement of blood with:</td>
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<td></td>
<td>- Crystalloid/Colloid</td>
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<td>- Blood Products</td>
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<td>- Anaphylaxis:</td>
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<td></td>
<td>- Management of ABC</td>
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<td></td>
<td>- Adrenaline (IMI, S/C, or IV)</td>
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<td></td>
<td>- Hydrocortisone</td>
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<tr>
<td></td>
<td>- Correct hypovolaemia</td>
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<thead>
<tr>
<th><strong>Hypo/Hyperkalaemia</strong></th>
<th><strong>Hypokalaemia</strong></th>
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<tbody>
<tr>
<td></td>
<td>- Potassium of less than 3.5mmol/L</td>
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<tr>
<td></td>
<td>- Replace Potassium</td>
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<th><strong>Hyperkalaemia</strong></th>
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<tr>
<td></td>
<td>- IV calcium, 10 mLs 10% CaCl2, up to 3 ampoules, each over 5 minutes</td>
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<td></td>
<td>- hyperventilation: CO2 + H2O ⇄ H2CO3 ⇄ H+ + HCO3-</td>
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<td></td>
<td>- 50mls 50% glucose + 10 units Actrapid over 10-15 minutes.</td>
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<td></td>
<td>- NaHCO3 to correct acidosis</td>
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<td></td>
<td>- Nebulised salbutamol</td>
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<thead>
<tr>
<th><strong>Hypo/Hyperthermia</strong></th>
<th><strong>Hypothermia</strong></th>
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<tbody>
<tr>
<td></td>
<td>- Active core re-warming</td>
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<tr>
<td></td>
<td>- Warmed humidified oxygen</td>
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<td></td>
<td>- Warmed intravenous fluids</td>
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<tr>
<td></td>
<td>- Peritoneal lavage</td>
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<tr>
<td></td>
<td>- Extracorporeal warming</td>
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<tr>
<td></td>
<td>- Pleural lavage</td>
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<th><strong>Hypo/Hyperthermia</strong></th>
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<tbody>
<tr>
<td></td>
<td>- Cooling Blankets</td>
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<tr>
<td></td>
<td>- Cooling packs or ice to head, axilla, chest, groin and legs</td>
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<tr>
<td></td>
<td>- Cooled IV fluids</td>
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#### Management of reversible causes: 4 T’s

<table>
<thead>
<tr>
<th>4 T’s</th>
<th>MANAGEMENT</th>
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<tbody>
<tr>
<td><strong>Tamponade</strong></td>
<td>- Pericardiocentesis</td>
</tr>
<tr>
<td></td>
<td>- open sternotomy wound if post cardiac surgery</td>
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<tr>
<td><strong>Tension</strong></td>
<td>- Thorococentesis</td>
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<tr>
<td><strong>Pneumothorax</strong></td>
<td>- Chest tube insertion if there is time or a large bore needle through the 2nd intercostal space in the mid-clavicular line</td>
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<tr>
<td><strong>Toxins/tablets</strong></td>
<td>- Antidote</td>
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<tr>
<td></td>
<td>- Charcoal (within 1 hr of ingestion)</td>
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<td></td>
<td>- Supportive measures ABCDEFG</td>
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<tr>
<td><strong>Thrombus</strong></td>
<td>- Thrombolysis, embolectomy or cardiopulmonary bypass to allow operative removal of the clot.</td>
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