Clinical Guidance

Paediatric Critical Care: Emergency Transcutaneous Pacing

Summary:
This guideline refers to emergency transcutaneous pacing via external pads and Zoll devices to provide information regarding the set up and process of establishing emergency pacing where other methods are not available. This modality of pacing should be used for the shortest period of time and, where persistent pacing is required, a more definitive and reliable method should be sought (e.g. temporary epicardial pacing, transvenous pacing). Always discuss with PICU/STRS consultant and ensure referral to cardiology team.

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Disclaimer: This clinical guideline has been produced by the South Thames Retrieval Service (STRS) at Evelina London for nurses, doctors and ambulance staff to refer to in the emergency care of critically ill children. This guideline represents the views of STRS and was produced after careful consideration of available evidence in conjunction with clinical expertise and experience. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.	

Change History		
Date	**Change details**	**Approved by**

Emergency Transcutaneous Pacing

Note: this guideline is intended for use with ZOLL X Series (top left) on STRS and ZOLL R Series (bottom right) on PICU but principles may be applicable to other devices.

Indication: symptomatic bradycardia not responsive to pharmacologic therapies - may include complete heart block, permanent pacemaker failure and drug induced bradycardia.

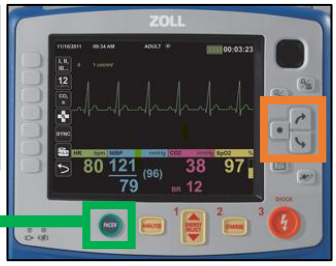
Contra-indication: asystole or PEA cardiac arrest (follow resuscitation guidelines).

Special circumstances: bradycardia due to hypothermia (prioritise re-warming), extensive burns/trauma (might be difficult to place pads adequately), severe drug toxicity/electrolyte imbalance (unlikely to achieve capture, prioritise clearance/correction).

Step-by-step (please note terminology and layout differ between ZOLL X & R Series, these are highlighted with **[X]** & **[R]** where applicable)

- Apply pads:
  - Size: Paediatric pads for infants/children < 8 years / < 25 kg, adult pads for children > 8 years / > 25kg
  - Position: anteroposterior (over precordium – between scapulae) is recommended for infants and children; anterolateral (below right clavicle – left mid axillary line/below left breast) may be used for bigger children or if unable to place anteroposterior (e.g. trauma)
  - Pads must have good contact with skin, must not be touching each other or any other electrode, and not placed over other implanted devices (e.g. permanent pacemaker system, vagal nerve stimulator, etc)
- Apply 4-lead ECG cable from ZOLL (leads must be attached to detect patient's intrinsic rhythm).
- Turn on ZOLL and ensure ECG rhythm reading in leads I, II or III (amplitude must be enough to detect R wave to deliver 'Demand' pacing, therefore, the lead with highest amplitude should be selected)
- Press button **[X]** / Turn knob **[R]** to select ***Pacer***
  - **[X]:** opens Pacing Menu, use **arrows/select button** to navigate (top right picture)
  - **[R]:** displays Pacing Settings on bottom of screen, use **button/knobs** to navigate (bottom picture)

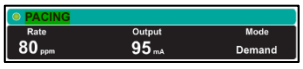
ZOLL X



- Select *mode*:
  - **Demand [X] / Pace [R]** (preferred)
    - Only works if reading from ECG on ZOLL
    - Synchronises with patient's intrinsic rhythm
    - Pacing pulse is delivered at set rate (provided patient's own rate is lower than set rate, otherwise pacing pulse will be inhibited)
    - Note: loss of ECG reading from ZOLL automatically reverts to 'Fixed mode'
  - **Fixed [X] / Async Pace [R]**
    - Does not require ECG reading from ZOLL to deliver pacing
    - Does not synchronise with patient's intrinsic rhythm - higher risk of delivering pacing pulse on T wave and causing VT/VF
    - Pacing pulse is delivered at set rate regardless of patient's own rate

ZOLL R

- Set pacing rate that is appropriate for patient age/condition (usually 100bpm for infants/children or >10-20bpm above patient's rate)
- Set pacing output:
  - Conscious patients: start at minimal output (e.g. 10-20 mA)
  - Unconscious/sedated patients: start at higher output (e.g. 100 mA)
- Turn on pacer **[x]** (pacing window is displayed – picture to the right)



- Immediately assess for electrical capture on the monitor (pacing spike followed by QRS; note QRS will appear wide with extended or inverted T wave) AND mechanical capture with palpable pulse (femoral, brachial or radial) at desired rate
  - Increase output in increments of 10 mA until both electrical and mechanical capture achieved
- Assess physiological impact of the paced rate on cardiac output (BP, SpO2, perfusion, pulse rate and volume) and adjust accordingly
- Once consistent capture achieved, turn down output (mA) until capture lost (lowest current at which you have consistent capture) to assess threshold then set output to 10mA above this as a safety measure

Considerations

- Check pulse routinely ensuring it matches electrical activity (i.e. pulse felt with every QRS).
- Do not check carotid pulses as pacing can cause contraction of neck muscles which could be difficult to distinguish from pulse.
- It is safe to touch the patient whilst externally pacing; however, do not touch the gelled area of the pacing pads to avoid electrical shock.
- Transcutaneous pacing is uncomfortable/painful, ensure adequate analgesia +/- sedation and appropriate airway management.
- Pacing for longer than 30 minutes may cause skin burns - close assessment of skin integrity is required (some redness of the skin can be normal).
- If prolonged pacing required, pads position must be changed at least every 8 hours.
- Note: pacing is turned on once settings adjusted on ZOLL X whereas pacing turns on automatically when 'Pacer' selected on ZOLL R.

Trouble shooting

- Can't see ECG on ZOLL
  - Ensure all 4 leads attached, check lead integrity and connections
  - Ensure electrodes in date/not dry
- Loss of capture
  - Ensure correct pads placement & adequate skin contact
  - Increase output (mA)
  - Optimise analgesia and sedation with appropriate airway management if patient moving/non-compliant

References: 1. Zoll Z Series Operator's Guide. 2. Zoll R Series Operator's Guide. 3. R Doukky. Using transcutaneous cardiac pacing to best advantage. J Crit Illn 2003. 4. Starship Child Health – Pacemakers (temporary) for a child