Guideline Title:  Arrhythmia Management

Summary
Arrhythmias compromise cardiac output, which therefore decrease coronary artery perfusion and increases myocardial oxygen demand. Some Arrhythmias may result in no cardiac output which requires CPR. ICU patients may require management of arrhythmias; these will be classified as shockable and non shockable rhythms.

Approved by:    ICU Medical Director Prof Michael Parr

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Replaces Existing Guideline: Management of Arrhythmias_ 2011

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1. Background Information:
An arrhythmia is any rhythm that is not normal sinus rhythm with normal atrioventricular (AV) conduction. Normal sinus rhythm originates from the sinus node in the upper portion of the right atrium. During sinus rhythm, the P waves and QRS complexes are normal on the electrocardiogram (ECG), and the rate is between 60-90bpm. Common arrhythmias encountered are:

- Bradycardias including sinus bradycardia
- Atrioventricular (AV) block
- Atrial premature beats (APBs)
- Ventricular premature beats (VPBs)

Non Shockable Rhythm’s
  - Asystole
  - PEA

Shockable Rhythm’s
  - Ventricular Tachycardia
  - Atrial fibrillation (AF) and atrial flutter
  - Supraventricular tachycardia (SVTs)
  - Non-sustained ventricular tachycardia (NSVT)
  - Ventricular fibrillation (VF)
Common arrhythmias that will be described in this guideline are classified as shockable and non shockable rhythms.

2. Definitions
   - **Shockable Rhythm’s**
     - Those responsive to defibrillation
   - **Non Shockable Rhythm’s**
     - Those unresponsive to defibrillation
   - **CPR**
     - Cardiopulmonary Resuscitation

3. Introduction:
The risk addressed by this policy:

   Patient Safety

The Aims / Expected Outcome of this policy:

Staff caring for ICU patients will have the knowledge and skills to manage a patient with an Arrhythmia

Related Standards or Legislation

- NSQHS Standard 1 Governance
- National Standard 4 Medication Safety
- National Standard 9 Recognising & Responding to Clinical Deterioriation in Acute Health Care

Related Policies

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<th>Description</th>
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<td>LH_PD2013_C03.12</td>
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</tr>
<tr>
<td>LH_PD2013_C03.01</td>
<td>Drug Administration</td>
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<tr>
<td>LH_PD2013_C03.00</td>
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<td>LH_PD_ICU_2015</td>
<td>Transcutaneous Pacing</td>
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<td>LH_PD_ICU_2015</td>
<td>Defibrillation and cardioversion</td>
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<td>LH_PD_ICU_2014</td>
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<td>LH_PD_ICU_2011</td>
<td>Adrenaline</td>
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<td>LH_PD_ICU_2014</td>
<td>Sodium Bicarbonate</td>
</tr>
<tr>
<td>LH_PD_ICU_201</td>
<td>Amiodarone</td>
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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.
   - 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.
   - Shockable Rhythms include: Ventricular Fibrillation (VF), Unconscious Ventricular Tachycardia (VT), and Tachycardia’s with haemodynamic instability. The management of these rhythms should be according to the Australian Resuscitation Guidelines (ARC) as set out below.
   - Non Shockable rhythms include: Asystole, Pulseless Electrical Activity (PEA). The management of these rhythms should be according to the Australian Resuscitation Guidelines (ARC) as set out below.
   - Medications are to be prescribed and signed by a medical officer unless required during an emergency.
   - Medications are to be given at the time prescribed and are to be signed by the administering registered nurse.
   - Parenteral medication prescriptions and the drug are to be checked with a second registered nurse prior to administration.
   - 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.
   - Adverse drug reactions are to be documented and reported to a medical officer.
   - Medication errors are to be reported using the hospital electronic IIMS reporting system.
   - Guidelines are for adult patients unless otherwise stated.

5. **Principles / Guidelines**
   a) **Equipment**
      - Emergency trolley with defibrillator
      - Drugs from emergency trolley
         - Adrenaline
         - Atropine
         - Lignocaine
         - Sodium Bicarbonate
         - Amiodarone
         - Calcium
         - Potassium
         - Magnesium
      - Airway equipment
         - Intubation checklist
      - Staff with established roles:
         - Team leader
         - Bedside nurse
         - Airway nurse / doctor
         - Documentation nurse
         - Runner
b) Procedure\(^{1,3,4}\)

I. Non Shockable Rhythm’s

Asystole

- Asystole is defined as a complete absence of electrical and mechanical cardiac activity.

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent</td>
<td>Absent</td>
<td>Absent or present</td>
<td>N/A</td>
<td>Absent</td>
</tr>
</tbody>
</table>

Management:

- Check two or more ECG leads for trace and amplitude
- Commence CPR if no signs of life
- Cannulate
- Intubate
- Adrenaline 1mg immediately then every 2\(^{nd}\) cycle
- Follow ARC guideline for non shockable rhythms (See Appendix)
- Consider and correct 4 H’s and 4 T’s (see Appendix)

PEA (Pulse less electrical activity)

- PEA is defined as any one of a heterogeneous group of organized electrocardiographic rhythms without sufficient mechanical contraction of the heart to produce a palpable pulse or measurable blood pressure.

Management:

- Commence CPR if no signs of life
- Cannulate
- Intubate
- Adrenaline 1mg immediately then every 2\(^{nd}\) cycle
- Follow ARC guideline for non shockable rhythms (See Appendix)
- Consider and correct 4 H’s and 4 T’s (see Appendix)
Bradycardias
- Bradycardia is defined conservatively as a heart rate below 60 beats per minute, but symptomatic bradycardia generally entails rates below 50 beats per minute
- Includes sinus bradycardia, heart blocks, idioventricular, and junctional rhythms

Sinus bradycardia
- Heart rate of less than 60 bpm
- Normal p wave, QRS complex

Management:
- Only if haemodynamically unstable
- Signs and symptoms of inadequate perfusion include hypotension, altered mental status, signs of shock, ongoing ischaemic chest pain, and evidence of acute pulmonary oedema
- Atropine 500mcg up to 3mg
- Consider 4H's and 4 T's

Heart blocks
1\textsuperscript{st} degree heart block
- All p waves are conducted
- PR interval greater than 0.20 sec
- There is no block just a delay in conduction

www.ceufast.com
Management:
- Only if haemodynamically unstable
- Atropine 500mcg up to 3mg
- Consider 4H's and 4 T's

2\textsuperscript{nd} degree Heart Block
- Type 1 or Mobitz I or Wenckebach
- Progressive delay of conduction of the AV node until conduction is completely blocked
- PR interval is longer with each beat until QRS is dropped

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Type 2, Mobitz II
- 2 – 4 p waves before each QRS
- Potential to progress to 3rd degree heart block
- Ventricular rate less than atrial rate

![ECG Image](https://www.ceufast.com)

Management:
- If haemodynamically unstable;
- Atropine 500mcg up to 3mg
- Adrenaline 100mcg
- Consider 4H’s and 4 T’s
- Transcutaneous pacing

3rd degree Heart Block
- No P waves are conducted
- Disassociation between p wave and QRS complex

![ECG Image](https://www.ceufast.com)

Management:
- If haemodynamically unstable
- Atropine 500mcg up to 3mg
- Adrenaline 100mcg
- Consider 4H’s and 4 T’s
- Transcutaneous pacing (See Appendix)
Junctional rhythm:

- p wave often absent. "buried" in the QRS complex
- p waves may be upside down or after the QRS

AV node has intrinsic automaticity that allows it to initiate and depolarize the myocardium during periods of significant sinus bradycardia or complete heart block

<table>
<thead>
<tr>
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<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-60 bpm</td>
<td>Regular</td>
<td>inverted, absent or after QRS</td>
<td>&lt;.12</td>
<td>&lt;.12</td>
</tr>
</tbody>
</table>

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Management:

- Treat underlying cause
- Treat symptoms as for bradycardias (See Appendix)

II. Shockable Rhythm's

Unconscious/ Pulseless Ventricular Tachycardia (VT)

- No detectable cardiac output
- Wide, regular QRS complex

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Management:

- Commence CPR
- Shock
- CPR 2mins
- Follow ARC guideline for Shockable rhythms (See Appendix)
- Consider and correct 4H,s and 4T,s
Ventricular Fibrillation (VF)
- no detectable cardiac output
- asynchronous ventricular activity
- rapid rate and disorganised with no uniform ventricular activity

Management:
- Commence CPR
- Shock
- CPR 2mins
- Follow ARC guideline for Shockable rhythms (See Appendix)
- Consider and correct 4H,s and 4T,s

Supraventricular Tachycardia’s (SVT)
- Tachycardia arising from atria or AV junction
- Used to describe fast narrow-complex tachycardias
- Usually caused by a re-entry circuit returning to the atria

Management:
- ABC
- Cannulate
- Monitor haemodynamics
- 12 lead ECG
- Treat reversible causes (see Appendix)
- If haemodynamically unstable consider cardioversion
- Refer to tachycardia algorithm (See Appendix)
Rapid Atrial Fibrillation
- Rate 100- upwards
- Irregular rhythm
- P waves fine or unable to see
- Haemodynamically unstable

**Table:**

<table>
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<tr>
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<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 150 bpm</td>
<td>Irregular</td>
<td>Fibrillatory (fine to course)</td>
<td>N/A</td>
<td>&lt;12</td>
</tr>
<tr>
<td>Slow to rapid</td>
<td></td>
<td></td>
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</tbody>
</table>

Management:
- ABC
- Cannulate
- Monitor haemodynamics
- 12 lead ECG
- Treat reversible causes (see Appendix)
- If haemodynamically unstable consider cardioversion
- Refer to tachycardia algorithm (See Appendix)

Conscious Ventricular Tachycardia
- Usually regular, rate greater than 100
- Wide or broad QRS complexes greater than 3 small squares
- Patient is conscious
- Patient has cardiac output

Management:
- ABC
- Cannulate
- Monitor haemodynamics
- 12 lead ECG
- Treat reversible causes (see Appendix)
- If haemodynamically unstable consider cardioversion
- Refer to tachycardia algorithm (See Appendix)
c) Clinical Issues:
- Minimal disruption to resuscitation i.e. CPR
- Monitor patient at all times
- Attend to 12 lead ECG daily and if rhythm changes
- Intravenous access preferred for drug administration
- Central venous access utilised if present
- Arterial access for specific blood samples and BP monitoring
- Emergency trolley to be checked each shift by RN

d) Contraindications:
- Where a valid prescription for ‘Do not resuscitate’ or ‘Do not intubate’ exists and there have been no changes to the patient’s circumstances since the prescription was made

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

7. References / Links


4. Australian Resuscitation Council Guidelines 2010


Author: ICU CNE (P.Nekic)
Reviewers: ICU Staff Specialists, NM, ICU – CNC, ICU-CNE, NUM, CNS’s,
Endorsed by: ICU Medical Director – Prof Michael Parr
8. Appendix

Shockable and Non shockable rhythm Algorithm

Advanced Life Support for Adults

**Start CPR**
- 30 compressions : 2 breaths
- Minimise Interruptions

**Attach Defibrillator / Monitor**

**Assess Rhythm**

**Shockable**
- CPR for 2 minutes
- Shock

**Non Shockable**
- CPR for 2 minutes
- CPR for 2 minutes

**Post Resuscitation Care**

**During CPR**
- Airway adjuncts (LMA / ETT)
- Oxygen
- Waveform capnography
- IV / IO access
- Plan actions before interrupting compressions (e.g. charge manual defibrillator)

**Drugs**
- Shockable
  - Adrenaline 1 mg after 2nd shock (then every 2nd cycle)
  - Amiodarone 300 mg after 3rd shock
- Non Shockable
  - Adrenaline 1 mg immediately (then every 2nd cycle)

**Consider and Correct**
- Hypoxia
- Hypovolaemia
- Hyper / hypokalaemia / metabolic disorders
- Hypothermia / hyperthermia
- Tension pneumothorax
- Tamponade
- Toxins
- Thrombosis (pulmonary / coronary)

**Post Resuscitation Care**
- Re-evaluate ABCDE
- 12 lead ECG
- Treat precipitating causes
- Re-evaluate oxygenation and ventilation
- Temperature control (cool)

December 2010
## Management of Reversible causes: 4 H’s

<table>
<thead>
<tr>
<th>4 H’s</th>
<th>MANAGEMENT</th>
</tr>
</thead>
</table>
| **Hypoxia** | - Check and maintain airway  
- Insert Guedel, ETT, LMA, surgical airway if required  
- Check oxygenation and ventilation |
| **Hypovolaemia** | - Replace blood or fluid loss  
- Replacement of blood with:  
- Crystalloid/ Colloid  
- Blood Products  
- Anaphylaxis:  
- Management of ABC  
- Adrenaline (IMI, S/C, or IV)  
- Hydrocortisone  
- Correct hypovolaemia |
| **Hypo/Hyperkalaemia** | **Hypokalaemia** | - Potassium of less than 3.5mmol/L  
- Replace Potassium  
- K 5 mmol as slow bolus IV in severe hypokalemia |
| | **Hyperkalaemia** | - IV calcium, 10 mLs 10% CaCl2, up to 3 ampoules, each over 5 minutes  
- Hyperventilation: CO₂ + H₂O ⇄ H₂CO₃ ⇄ H⁺ + HCO₃⁻  
- 50mLs 50 % glucose + 10 units Actrapid over 10-15 minutes.  
- NaHCO₃ to correct acidosis  
- Nebulised salbutamol |
| **Hypo/Hyperthermia** | **Hypothermia** | - Active core re-warming  
- Warmed humidified oxygen  
- Warmed intravenous fluids  
- Peritoneal lavage  
- Extracorporeal warming  
- Pleural lavage  
- Extracorporeal warming  
- Peritoneal lavage  
- Pleural lavage  
- Pleural lavage |
| | **Hyperthermia** | - Cooling Blankets  
- Cooling packs or ice to head, axilla, chest, groin and legs  
- Cooled IV fluids |

## Management of reversible causes: 4 T’s

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

If appropriate, give oxygen, cannulate a vein, and record a 12-lead ECG

![Algorithm Diagram]

Tachycardia Algorithm (with pulse)

**Tachycardia Algorithm (with pulse)**

**Synchronized DC Shock**
- Up to 3 attempts

**Unstable**
- Amiodarone 330 mg IV over 10-20 min and repeat shock followed by:
- Amiodarone 930 mg over 24 h

**Stable**
- Is patient stable?
  - Signs of instability include:
    1. Reduced conscious level
    2. Chest pain
    3. Systolic BP < 90 mmHg
    4. Heart failure
    (Rate-related symptoms uncommon at less than 150 beats min⁻¹)

**Broad QRS is QRS regular?**
- Broad
  - Seek expert help
  - Possibilities include:
    - AF with bundle branch block
    - Pre-excited AF
    - Consider antiarrhythmic therapy
    - Polymorphic VT (e.g., torsade de pointes)
      - Give magnesium 2 g over 10 min

**Narrow QRS is Rhythm regular?**
- Narrow
  - Regular
  - Use vagal manoeuvres
  - Adenosine 6 mg rapid IV bolus; if unsuccessful give 12 mg; if unsuccessful give further 12 mg
  - Monitor ECG continuously
  - Probable atrial flutter
  - Probable atrial fibrillation
  - Control rate with:
    - β-Blocker IV or digoxin IV
    - Amiodarone 330 mg IV over 20-60 min; then 930 mg over 24 h

- Irregular
  - Irregular narrow complex tachycardia
  - Probable re-entry PSVT
  - Record 12-lead ECG in sinus rhythm
  - If recurs, give adenosine again and consider choice of anti-arrhythmic prophylaxis

- Seek expert help

**Note:**
- Cardioversion of AF present for > 48 hours at risk of stroke
- Magnesium should be given rather than amiodarone if the rhythm is torsades.