Guideline: Critical Care

Adrenaline

Document Number: SWSLHD_GL2014_009

Functional Sub-Group: Clinical

Summary: This guideline has been developed to ensure standardized preparation and administration of Adrenaline throughout the SWSLHD.

Approved by: Clinical Quality Council

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Replaces Existing Guideline: No

Previous Review Dates: None
Contents:

1. Introduction
2. Aims/Expected Outcomes
3. Principles
4. References and Links

Appendices

Appendix 1 – Adrenaline Dosage calculations
1. **Introduction:**

Adrenaline is a naturally occurring catecholamine which stimulates the alpha (α) and beta (β) receptors in the sympathetic nervous system. Adrenaline is used in resuscitation situations to improve cardiac output, blood pressure, bronchodilation and in cardiac arrest.

**The risk addressed by this policy:**

Patient Safety

2. **The Aims / Expected Outcome of this policy:**

Adrenaline will be administered safely and without adverse side effects.

**Related Standards or Legislation**

- NSQHS Standard 1 Governance
- National Standard 4 Medication Safety

**Related Policies (if relevant)**

PD2013_043 Medication Handling in NSW Public Hospitals

3. **Principles**

- All care provided within SWSLHD will be in accordance with infection control, manual handling and minimisation and management of aggression guidelines.
- Medications are to be prescribed and signed by a medical officer/authorised nurse practitioner (NP) unless required during an emergency.
- All drugs administered during an emergency (under the direction of a medical officer/authorised nurse practitioner) are to be documented during the event, then prescribed and signed following the event.
- Medications are to be given at the time prescribed (as close to the time as is possible when multiple drugs require ‘same time’ administration and, when the nurse is caring for more than one patient, recognition is given to a possible short delay to administration – antibiotics and other lifesaving drugs are to be prioritised) and are to be signed by the administering nurse.
- Parenteral medication prescriptions and the drug are to be checked with a second registered or endorsed enrolled nurse prior to administration. The “rights of drug administration” must be followed: right: patient, drug, dose, route, administration, time, reason for the drug and documentation.
- Inotropic medications should only be administered by accredited nursing staff.
- Adverse drug reactions are to be documented and reported to a medical officer.
- Medication errors are to be reported using the hospital electronic reporting system: IIMS.
- Guidelines are for adult patients unless otherwise stated.
- **This guideline is for administration of drugs in critical care areas only.**

**Actions**

- Adrenaline is a naturally occurring catecholamine with alpha and beta effects.
- α stimulation causes peripheral, renal, splanchnic and pulmonary vasoconstriction
- β-1 stimulation causes an increase in heart rate, contractility and excitability
- β-2 stimulation causes an increase in bronchodilation and vasodilation in skeletal muscles.
• It is administered in cardiac arrest to cause peripheral vasoconstriction via its alpha-adrenergic action (increases available cardiac output to myocardium and brain).
• It may facilitate defibrillation by improving myocardial blood flow during CPR.

Indications
• Ventricular fibrillation / pulseless ventricular tachycardia after initial counter shocks have failed (after 2nd shock then after every second cycle).
• Asystole and PEA (pulseless electrical activity) in initial cycle (and then every second cycle).
• Acute severe asthma / bronchospasm / stridor
• Profound bradycardia
• Septic, anaphylactic and cardiogenic shock

Contraindications
• Contraindications are relative as this drug is used in life threatening emergencies.
• None in the emergency situation but exercise caution in patients with cardiovascular disease.
• Patients taking monoamineoxidase inhibitors (MAOIs), or within 14 days of such treatment, will exhibit a greatly exaggerated response to adrenaline.
• Hypersensitivity to the product.

Precautions
• Use with caution in patients who are elderly and with hypertension, diabetes mellitus, hyperthyroidism and psychoneurosis
• Inter-arterial administration must be avoided as marked vasoconstriction may result in gangrene. Intramuscular injection into the buttocks should be avoided as gas gangrene is a possibility.

Significant Interactions
• Tricyclic antidepressants, some other antidepressants, some antihistamines and thyroid hormones may potentiate the effects of adrenaline, especially on heart rhythm and rate.
• Beta-blockers. The administration of adrenaline to patients receiving non-selective beta-blockers may result in severe hypertension, followed by a reflex bradycardia. Propanolol inhibits the bronchodilator effect of adrenaline.

Adverse Effects
• Tachycardia.
• Anxiety, restlessness, tremor, weakness, dizziness, headache
• Nausea, vomiting, flushing and redness of face and skin.
• Hypertension and increased afterload.
• Exacerbation of myocardial ischaemia.
• Tissue necrosis if extravasation from vein occurs.
• Reduced blood flow to the skin and gut, leading to ischaemia and possible necrosis. (Observation and pressure area care is of vital importance).
• Renal vasoconstriction may reduce renal blood flow and glomerular filtration rate.
• Hypokalaemia and hyperglycaemia.

Presentation
• Adrenaline 1:1 000 (1mg) in 1mL ampoules
• Adrenaline 1:10 000 (1mg) in 10mL pre-loaded syringes
• Adrenaline 1:10 000 (1mg) in 10mL ampoules
Administration Guidelines

**Cardiac Arrest.**

**Adult Dose.**
- Initial dose is 1mg (1mL of 1:1000 or 10mL of 1:10,000) and this dose should be repeated at regular intervals (every 2nd cycle – which is every 4 minutes).
- It should be given IV or IO (Intraosseous). If unable to administer IV or IO and ETT is present, administer 3-10 times the dose down the ETT.

**Paediatric Dose.**
(The optimal dose and frequency in children is unknown).
- The initial and subsequent dose is 10micrograms/kg with a maximum single dose of 1mg. (Give 0.1ml/kg of 1:10,000). Administer IV or IO every 2nd cycle (which is every 4minutes).
- The ETT dose is 100micrograms /kg (use 1:1000 to avoid large volume into the child’s lungs).

**Neonatal Dose.**
- Administer 10 – 30micrograms/kg (0.1 - 0.3mL/kg of the 1:10,000). This is given if adequate ventilation and chest compressions have failed to increase the heart rate to > 60 bpm within a minute. Dose can be repeated every few minutes if HR < 60bpm.
- The Umbilical venous catheter is the most rapidly accessible intravascular route.
- If administering via ETT dose is 50 -100 microgram/kg (0.5 -1mL/kg of 1:10,000).

**Acute Severe Asthma**

**Nebulised Dose.**
- 5mg (5mL of 1:1000 ampoules) adrenaline neat nebulised.

**IM injection.**
- 0.5mg (0.5mL of 1:1000 ampoule) adrenaline IM injection

**IV Injection.**
- 0.5mg (0.5L of 1:1000 ampoule dilute in 10ml 0.9% sodium chloride) and administer as slow IV injection.

**IV infusion.**
- Dilute 4mg adrenaline to 50mL sterile 0.9% sodium chloride, to make a final concentration of 80micrograms/mL
- **Commence at 5mL/hr**, and titrate the infusion using prescribed parameters, as per the medical officer, documented on the Management plan.
- If necessary, increase the infusion by 0.5 to 1mL every 2 minutes, while closely monitoring the patient for the desired effect.
- If sudden bronchospasm occurs, the patient may require further bolus dose(s) as above, in addition to increasing the infusion.
- Weaning the infusion should not be contemplated until the patient has been stabilised and documented discussion with the medical officer occurs
- Decrease the infusion by no more than 0.2 to 0.5mL/hr, no more frequently than every 30 minutes, while observing the patient closely for signs of deterioration.
**Septic / Cardiogenic / Anaphylactic Shock**

**Bolus dose**
- If profoundly shocked, give 50 - 100 micrograms adrenaline (0.5ml to 1mL of 1:10,000 ampoule) as a slow IV bolus every 30 seconds until acceptable perfusion is restored
- Then commence an infusion.

**IV infusion**
- Dilute 4mg adrenaline to 50mL sterile 0.9% sodium chloride to make a final concentration of 80micrograms/mL.
- **Commence at 3-5mL/hr**, and titrate the infusion using prescribed parameters as per the medical officer, documented on the Management Plan. These parameters include:
  - Systolic and mean arterial blood pressure
  - Heart rate
  - Systemic vascular resistance
  - Cardiac index
  - If necessary, increase the infusion by 0.5 to 1mL every few minutes, while closely monitoring the patient for the desired effects

**Note:**
- If sudden and severe hypotension occurs, check that the syringe is not empty or leaking, lines are not kinked, the pump is not turned off or access lost.
- If the problem is related to the patient, increase the infusion rate until desired MAP is achieved. If patient fails to respond, contact the medical officer. Try always to increase infusion rate and to not to bolus adrenaline infusions.
- When the patient is stable, increase the background infusion rate as above.
- Instituting an adrenaline infusion for treatment of hypotension should always be in the presence of adequate fluid resuscitation.
- Weaning an adrenaline infusion should commence as soon as the patient is stable. Aim to administer the lowest dose that achieves the desired effect.
- **Decrease the infusion rate by 0.5 -1mL no more frequently than every 10-15 minutes.** In certain clinical situations depending on the patient’s clinical status it may be possible to wean the rate of the infusion faster.
Clinical Considerations

- Use a dedicated lumen of a central line. It can be administered peripherally only in an emergency situation.
- Label correctly with right patient, right drug, diluent and concentration. Do not co-infuse fluids/drugs. May only be co-infused with other inotropic or vasopressor agents such as noradrenaline, dobutamine or vasopressin.
- If adrenaline extravasates, need to immediately refer to senior medical officer. The infusion will need to be ceased and recommenced via alternate site, this will require input by senior clinicians as the patient may be haemodynamically unstable and dependant on the adrenaline infusion. The immediate management will involve:

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**Nebulised Dose**\(^{12}\) Consider nebulised adrenaline if airway obstruction occurs.
- 5mg (5mL of 1:1000 ampoules) adrenaline neat nebulised.

**IM injection**\(^{12,13}\)
- 0.2 - 0.5mg (0.2 - 0.5mL of 1:1000 ampoule) adrenaline IM injection

**Bolus dose:**
In severe anaphylaxis, slow and cautious intravenous administration of adrenaline may be necessary to ensure absorption. A dose of 25 – 50 micrograms of the 1:10,000 solution may be given as an intravenous bolus. Then commence an infusion

**IV Infusion:**
- Dilute 4mg adrenaline to 50mL sterile 0.9% normal saline to make a final concentration of 80micrograms/mL. **Commence at 5mL/hr,** and titrate the infusion using prescribed parameters as per medical officer, documented on the Management Plan. These parameters include:
  - Air entry
  - Assessing for bronchospasm (Airway pressures)
  - Airway oedema
  - Heart rate
  - Systolic and mean arterial pressure
- If necessary, **increase the infusion by 0.5 to 1mL every 2 minutes,** while closely monitoring the patient for the desired effects.

**Stridor**
- 0.5mg (0.5mL of 1:1000 ampoule) diluted in 2mL of 0.9% sodium chloride via nebulizer\(^{13}\).
- **Dose for Croup:** 0.5mL/kg 1:1000 adrenaline to a maximum of 5mg (5mL 1:1000 adrenaline) \(^{12,13}\) neat nebulised, repeated as needed to reduce inspiratory stridor at rest and marked chest wall retractions.

**NOTE:** Medical Officer orders may differ from the recommended dosage and route in this guideline. This will be based on an assessment of the patient and individual situation. Discussion and confirmation of dose and route will prevent errors and ensure patient safety and optimal outcomes.

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**Single strength infusion = 4mg adrenaline in 50ml 0.9% sodium chloride (80micrograms /ml)**

**Double strength infusion = 8mg adrenaline in 50ml 0.9% sodium chloride (160micrograms /ml).**

Refer to APPENDIX 1.
Monitoring – the site will be observed, elevated and monitored to determine whether further treatment is required.

Conservative management – this may involve the usage of hot or cold compresses or antidotes (if possible).

Surgical management – this is managed by the plastics team.

- Arterial blood pressure (ABP) monitoring should be utilised for patients requiring inotropic support to enable continuous monitoring of blood pressure.

**Syringe Change** - When changing from a near completed infusion to a new syringe:

- Always use a double pump for syringe change.
- Commence new infusion *prior* to the completion of the old infusion.
- Observe MAP. When this begins to rise (eg: if MAP increases from 70 to 75), decrease the old infusion rate and cease the old infusion once MAP stabilised.
- Closely monitor BP and titrate infusion rate accordingly.

5. References and links

11. MIMS Online, CIAP: NSW Health Department, Copyright MIMS Australia Pty Ltd 2013. [http://www.mims.hcn.net.au/](http://www.mims.hcn.net.au/)
15. Liverpool Hospital Intensive Care Unit Guidelines. 2013. Adrenaline, SWSLHD.

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**APPENDIX 1**

**Adrenaline 80 micrograms/mL Infusion**

*(Single strength – 4mg adrenaline/50mL)*

*(All calculations are in micrograms/kg/min, correct to 2 decimal places)*

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Adrenaline 160 micrograms/mL Infusion

(Double strength – 8mg adrenaline/50ml)

(All calculations are in micrograms/kg/min, correct to 2 decimal places)

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