Paediatric Life support
Algorithms

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16th April 2016
Paediatric Cardiac Arrest is rare

• 20/100,000 Children per year
• 100 X higher if hospitalized
• 2-6% of PICU patients
Why are arrests different in children?

• Paediatric arrest is a rare event
• Causes are different
• Drug doses are different
• CPR techniques are different
• Many hospitals and operating theatres are poorly set up to deal with a paediatric cardiac arrest
• Stressful!!
Why do children arrest?

- Respiratory obstruction
  - Foreign body
  - Asthma
  - Croup

- Respiratory depression
  - Convulsions
  - Poisoning
  - Raised ICP

- Fluid loss
  - Blood loss
  - Burns
  - Vomiting

- Fluid maldistribution
  - Sepsis
  - Anaphylaxis
  - Cardiac failure

- Respiratory failure
- Circulatory failure

Cardiac arrest
Resuscitation Guidelines
Basic Life Support

D
Dangers?

R
Responsive?

S
Send for help

A
Open Airway

B
Normal Breathing?

C
Start CPR
30 compressions : 2 breaths

D
Attach Defibrillator (AED)
as soon as available, follow prompts

Continue CPR until responsiveness or normal breathing return

January 2016
Advanced Life Support for Infants and Children

Start CPR
2 breaths : 15 Compressions
Minimise Interruptions

Attach
Defibrillator / Monitor

Assess Rhythm

Shockable

Shock (4 J/kg)

Shocked

Return of Spontaneous Circulation?

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 to 4 J/kg)

Drugs
Shockable
* Adrenaline 10 mcg/kg after 2nd shock (then every 2nd loop)
* Amiodarone 5mg/kg after 3 shocks

Non Shockable
* Adrenaline 10 mcg/kg immediately (then every 2nd loop)

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
Targeted Temperature Management

January 2016
Advanced Life Support for Adults

Start CPR
30 compressions : 2 breaths
Minimise Interruptions

Attach
Defibrillator / Monitor

Assess Rhythm

Shockable

Shock

CPR for 2 minutes

Non Shockable

Return of Spontaneous Circulation?

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 loop)
* Amiodarone 300mg after 3 shocks

Non Shockable
* Adrenaline 1 mg immediately
  (then every 2nd loop)

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
Aim for: SpO2 94-98%, normocapnia and normoglycaemia
Targeted temperature management

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How to do good CPR....

• Firm surface
• Lower sternum
• 1/3 of AP diameter of chest
• Compression time = Relaxation time
• 15:2
• Minimize interruptions
Airway

Chin lift Infant

Jaw Thrust
etCO2 = Cardiac Output
Defibrillating Children
Pad Size

- 4.5 cm diameter for infants and children weighing <10 kg.
- 8–12 cm diameter for children weighing >10 kg (older than one year)
- Shouldn’t be touching
- Anteroposterior for < 1yo
“SHOCKABLE”

Ventricular Fibrillation/Tachycardia

**Figure 6.4.** Ventricular fibrillation

**Figure 6.5.** Ventricular tachycardia
“Non-Shockable”

Pulseless Electrical Activity

Asystole
4 Joules/kg
Advanced Life Support for Infants and Children

**Start CPR**
- 2 breaths:15 Compressions
- Minimise Interruptions

**Attach Defibrillator / Monitor**

**Assess Rhythm**

**Shockable**
- **Shock** (4 J/kg)
- CPR for 2 minutes

**Non Shockable**

**Return of Spontaneous Circulation?**

**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 to 4 J/kg)

**Drugs**
- **Shockable**
  - Adrenaline 10 mcg/kg after 2nd shock (then every 2nd loop)
  - Amiodarone 5mg/kg after 3 shocks
- **Non Shockable**
  - Adrenaline 10 mcg/kg immediately (then every 2nd loop)

**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
- Targeted Temperature Management

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Emergency IV access
Adrenaline
0.1ml/kg of 1 in 10,000
Amiodarone
5mg/kg
Magnesium Sulphate
50% solution  0.05-0.1ml/kg
(0.1-0.2mmol/kg)
Consider and Correct

Hypoxia
Hypovolaemia
Hyper / hypokalaemia / metabolic disorder
Hypothermia / hyperthermia
Tension pneumothorax
Tamponade
Toxins
Thrombosis (pulmonary / coronary)
Crystalloid iv fluid bolus

Packed Red Cells
Post Resuscitation Care

• Go back over ABCDE
• Myocardial dysfunction – inotropes?
• Aim for ‘normoxia’
• Aim for normo-glycaemia
• Temperature control
When to stop....

• Consider
  – Duration of CPR
  – Cause of arrest (esp drowning, poisoning)
  – Pre-existing medical conditions
  – Witnessed arrest
  – Duration of untreated arrest “no flow” time
  – ECMO
Anaphylaxis during Anaesthesia

Immediate Management

**DR Danger and Diagnosis**
Response to stimulus
Unresponsive Hypotension or Bronchospasm
Cease triggers including Chlorhexidine & Colloid
Stop procedure. Use minimal volatile if GA.

**S Send for help and organise team**
Call for Help and Anaphylaxis box
Assign a designated Leader and Scribe
Assign a Reader of this card

**AB Secure Airway**
Breathing - 100% oxygen
Intubation: airway oedema or compromise
Confirm FiO₂ is 100%

**C Circulation: CPR if no pulse**
Give IV fluid bolus
If no pulse give 1mg Adrenaline IV (Paed 10 mcg/kg) and follow ALS protocol
IV Fluid: 20mls/kg bolus repeat as required

**D Drugs: Adrenaline**
IV Bolus, repeat if needed
Prepare Infusion

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No IV access or haemodynamic monitoring: Consider IM Adrenaline
1:1000 (1mg/ml) into lateral thigh

- Adult = 0.5ml (500mcg)
- <12 years = 0.3ml (300mcg)
- <6 years = 0.15ml (150mcg)

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### IV Adrenaline BOLUSES

Draw up 1mg in 10ml
Adrenaline (1:10,000) = 100mcg/ml
Give dose below every 1-2 minutes prn:

<table>
<thead>
<tr>
<th>Grade 2 – Moderate Hypotension or Bronchospasm</th>
<th>Grade 3 – Severe Hypotension or Bronchospasm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult 5-20 mcg = 0.05 - 0.2 ml</td>
<td>Adult 100-200 mcg = 1 - 2 ml</td>
</tr>
<tr>
<td>Child 1 - 5 mcg/kg = 0.01 - 0.05 ml/kg</td>
<td>Child 5 - 10 mcg/kg = 0.05 - 0.1 ml/kg</td>
</tr>
</tbody>
</table>

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**Adrenaline INFUSION** *If requiring repeated doses of Adrenaline prepare and start infusion:*

- **Adult** 0.05 to 0.4 mcg/kg/min
- **Child** 0.1 to 5 mcg/kg/min

Example Infusion 3mg/50mls = 60mcg/ml with 1ml/hour = 1mcg/min (70 kg Adult 3.5 – 28 ml/hour)

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If NOT RESPONDING see ‘Refractory Management’
### Anaphylaxis during Anaesthesia

#### Refractory Management

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ensure possible triggers removed</strong></td>
</tr>
<tr>
<td>Chlorhexidine including impregnated CVCs</td>
</tr>
<tr>
<td>Colloid stop if running at time of reaction</td>
</tr>
<tr>
<td>Latex none in theatre</td>
</tr>
<tr>
<td><strong>Consider other diagnoses</strong></td>
</tr>
<tr>
<td>See ‘Diagnostic Card’ in Anaphylaxis Box</td>
</tr>
<tr>
<td><strong>Monitoring</strong></td>
</tr>
<tr>
<td>Consider Insert Arterial line and CVC</td>
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<tr>
<td>Consider TOE/TTE to assess filling</td>
</tr>
<tr>
<td><strong>Request more help if required</strong></td>
</tr>
<tr>
<td>Consider calling arrest code</td>
</tr>
<tr>
<td><strong>Resistant Hypotension</strong></td>
</tr>
<tr>
<td>Continue Adrenaline and IV fluid bolus 50 ml/kg</td>
</tr>
<tr>
<td>Noradrenaline infusion 0.1mcg/kg/min</td>
</tr>
<tr>
<td>Metaraminol infusion if noradrenaline not available</td>
</tr>
<tr>
<td>Vasopressin bolus 1-2 units (0.03units/kg) then infusion 2 units per hour</td>
</tr>
<tr>
<td>Glucagon 1-5mg over 5 min (βblocker reversal) (Child 20-30mcg/kg to max 1mg)</td>
</tr>
<tr>
<td>Consider cardiac bypass where available</td>
</tr>
<tr>
<td><strong>Resistant Bronchospasm</strong></td>
</tr>
<tr>
<td>Salbutamol IV bolus 100-200mcg</td>
</tr>
<tr>
<td>+/- Salbutamol infusion 5-25mcg/min (Child 5mcg/kg/min for 1 hour then run infusion at 1-2mcg/kg/min)</td>
</tr>
<tr>
<td>Consider:</td>
</tr>
<tr>
<td>Auto PEEP (disconnect from ventilator)</td>
</tr>
<tr>
<td>Tension pneumothorax (decompress)</td>
</tr>
<tr>
<td><strong>Pregnancy</strong></td>
</tr>
<tr>
<td>Lateral tilt</td>
</tr>
<tr>
<td>Caesarean section if arrest or peri-arrest</td>
</tr>
</tbody>
</table>

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**Once stable refer to ‘Post Crisis Management’**

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ANZAAG-ANZCA Anaphylaxis Management Guidelines Version 1.1 June 2013
# AAGBI Safety Guideline
## Management of Severe Local Anaesthetic Toxicity

### 1 Recognition
- **Signs of severe toxicity:**
  - Sudden alteration in mental status, severe agitation or loss of consciousness, with or without tonic-clonic convulsions
  - Cardiovascular collapse: sinus bradycardia, conduction blocks, asystole and ventricular tachyarrhythmias may all occur
  - Local anaesthetic (LA) toxicity may occur some time after an initial injection

### 2 Immediate management
- Stop injecting the LA
- Call for help
- Maintain the airway and, if necessary, secure it with a tracheal tube
- Give 100% oxygen and ensure adequate lung ventilation (hyperventilation may help by increasing plasma pH in the presence of metabolic acidosis)
- Confirm or establish intravenous access
- Control seizures: give a benzodiazepine, thiopental or propofol in small incremental doses
- Assess cardiovascular status throughout
- Consider drawing blood for analysis, but do not delay definitive treatment to do this

### 3 Treatment

#### IN CIRCULATORY ARREST
- Start cardiopulmonary resuscitation (CPR) using standard protocols
- Manage arrhythmias using the same protocols, recognising that arrhythmias may be very refractory to treatment
- Consider the use of cardiopulmonary bypass if available

#### GIVE INTRAVENOUS LIPID EMULSION (following the regimen overleaf)
- Continue CPR throughout treatment with lipid emulsion
- Recovery from LA-induced cardiac arrest may take >1 h
- Propofol is not a suitable substitute for lipid emulsion
- Lidocaine should not be used as an anti-arrhythmic therapy

#### WITHOUT CIRCULATORY ARREST
- Use conventional therapies to treat:
  - Hypotension
  - Bradycardia
  - Tachyarrhythmia

#### CONSIDER INTRAVENOUS LIPID EMULSION (following the regimen overleaf)
- Propofol is not a suitable substitute for lipid emulsion
- Lidocaine should not be used as an anti-arrhythmic therapy

### 4 Follow-up
- Arrange safe transfer to a clinical area with appropriate equipment and suitable staff until sustained recovery is achieved
- Exclude pancreatitis by regular clinical review, including daily amylase or lipase assays for two days
- Report cases as follows:
  - In the United Kingdom to the National Patient Safety Agency (via www.npsa.nhs.uk)
  - In the Republic of Ireland to the Irish Medicines Board (via www.imb.ie)
- If lipid has been given, please also report its use to the international registry at www.lipidregistry.org. Details may also be posted at www.lipidrescue.org

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Your nearest bag of Lipid Emulsion is kept ____________________________

This guideline is not a standard of medical care. The ultimate judgement with regard to a particular clinical procedure or treatment plan must be made by the clinician in the light of the clinical data presented and the diagnostic and treatment options available.

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An approximate dose regimen for a 70-kg patient would be as follows:

**IMMEDIATELY**

- Give an initial intravenous bolus injection of 20% lipid emulsion 100 ml over 1 min
- Start an intravenous infusion of 20% lipid emulsion at 1000 ml.h⁻¹

**AFTER 5 MIN**

- Give a maximum of two repeat boluses of 100 ml
- Continue infusion at same rate but double rate to 2000 ml.h⁻¹ if indicated at any time

_Do not exceed a maximum cumulative dose of 840 ml_

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This AAGBI Safety Guideline was produced by a Working Party that comprised:
Grant Cave, Will Harrop-Griffiths (Chair), Martyn Harvey, Tim Meek, John Picard, Tim Short and Guy Weinberg.

This Safety Guideline is endorsed by the Australian and New Zealand College of Anaesthetists (ANZCA).
References

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Thank you