Portsmouth Hospitals NHS Trust

REVERSIBLE CAUSES OF CARDIORESPIRATORY ARREST IN ADULTS

INFORMATION AND TREATMENT

Contents

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MANAGEMENT OF HYPOXIA
DURING CARDIORESPIRATORY ARREST IN ADULTS

Definition of Hypoxia:

A reduction of oxygen supply to a tissue below physiological levels despite adequate perfusion of the tissues by blood.

Causes and Contributing Factors of Hypoxia:

Airway Obstruction	COPD	Cardiac abnormalities
CNS depression	Kyphoscoliosis	Pneumo/Haemothorax
Asthma	Pulmonary embolism	Lung Contusion
ARDS	Infection	Muscle damage/weakness

Peri-arrest signs and symptoms of Hypoxia include:

Tachypnoea	Dyspnoea	Hypoventilation
Central Cyanosis	Agitation/confusion	Decreased conscious level
Arrhythmias	Decreased Oxygen saturation	Decreased PaO2

IMMEDIATE TREATMENT OF HYPOXIA

Standard ALS Guidelines
Ventilate the patient's lungs with high flow oxygen (15 l/min) using BVM device (two person technique).
Use pocket mask with supplemental oxygen (10 l/min) initially if a Bag Valve Mask (BVM) is not available or if there is just 1 rescuer

Ventilation rates	
CPR with unsecured airway	30 Chest Compressions to 2 ventilations (30:2)
CPR with secure airway (ETT/LMA)	Asynchronous CPR 100-120 compressions/min & 10 ventilations/min
Respiratory arrest only	10 ventilations per minute

Note: Ensure the chest is rising and there is bilateral air entry
Caution hyperventilation and insufflation of the stomach

Other treatment to consider:

Airway adjuncts e.g. oropharyngeal / nasopharyngeal airway
Endotracheal tube (by skilled personnel only) or Laryngeal Mask Airway
Use capnography if available
Identify and treat cause e.g. tension pneumothorax
Expert help if difficult airway

Post Resuscitation care:

Advanced airway management
Continue to support breathing as required
High flow oxygen (10-15 l/min) via non-rebreathe mask if self ventilating
Titrate inspired oxygen to achieve SaO2 of approximately 94-98%
If patient is COPD titrate SaO2 to 88-92%
Continuous oxygen saturation monitoring
Arterial blood gases
Portable Chest X-ray
Decision re: ongoing management, resuscitation status and location

MANAGEMENT OF HYPOVOLAEMIA
DURING CARDIORESPIRATORY ARREST IN ADULTS

Definition of Severe Hypovolaemia:

State of insufficient perfusion to vital organs caused by severe intravascular deficiency.

Causes and Contributing Factors of Hypovolaemia include:

Haemorrhage	Trauma	Anaphylaxis
Gravid uterus in Pregnancy	Burns	Sepsis
Severe Diarrhoea & vomiting		

Peri-arrest signs of hypovolaemia include:

Tachycardia	Hypotension	Oliguria/Anuria
Skin changes- pale/clammy	Prolonged capillary refill time	
Altered level of consciousness		

IMMEDIATE TREATMENT FOR HYPOVOLAEMIA

Standard ALS Guidelines
Venous access using at least 1 large bore cannula (multiple access if possible)
Consider Intra-osseous access (Obtainable from Emergency Department)
Rapid administration of intravenous fluid (colloid or crystalloid)
Replace blood – consider emergency O negative blood if necessary
Lie flat, raise lower limbs, tilt bed head down
Direct pressure to wound (if applicable)

Other treatment to consider:

Urgent surgical/orthopaedic/critical care review as appropriate
Central line insertion
Urinary Catheter
Fluid balance

Post Resuscitation care:

Routine post resuscitation care and investigations
Identify/treat cause
12 lead ECG
Continuous ECG monitoring
Cross match blood
Blood results
Decision re: ongoing management, resuscitation status and location

MANAGEMENT OF HYPOKALAEMIA DURING CARDIORESPIRATORY ARREST IN ADULTS

Definition of severe hypokalaemia: Serum potassium of less then 2.5mmol/l.

Causes and Contributing Factors of Hypokalaemia include:

Diarrhoea/vomiting
Drugs (e.g. diuretics, laxatives, steroids, insulin, salbutamol)
Renal losses
Cushing's syndrome
Hyperaldosteronism
Metabolic alkalosis
Magnesium depletion
Poor diet intake
Treatment for Hyperkalaemia

Peri-arrest signs and symptoms of hypokalaemia include:

Fatigue
Muscle weakness
Leg cramps
Rhabdomyolysis
Ascending paralysis
Respiratory difficulties

ECG features:
U waves
T wave flattening
ST elevation
Arrhythmias

IMMEDIATE TREATMENT OF SEVERE HYPOKALAEMIA IN ADULTS

Standard ALS Guidelines
Diagnosis should be made on patient's clinical condition. Do not wait for blood results.

30mmols of Potassium Chloride (KCl) to be administered intravenously over approximately 23 minutes as detailed below.

Dose of KCl:	30 mmols
Concentration of solution:	40 mmols of KCl in 500 mls of Sodium Chloride
Route:	Peripheral or central venous access
Rate of administration:	Pump to run at 999mls/hr for 23 minutes
Amount of solution administered:	375 mls of the 500ml bag

NB: The above concentration of potassium containing fluid (40mmols/500mls) is kept in the blue adult cardiac arrest drug boxes.

See Drug Therapy Guideline No 62.03: Hypokalaemia Management In Adults Including During Cardiac Arrest. (Go to Intranet, then Departments, then Pharmacy, Medicines Information).

Other treatment to consider:

Intravenous magnesium 2g (8mmol) of 50% Magnesium Sulphate

Post Resuscitation Care:
Routine post resuscitation care and investigations
Obtain blood sample for serum potassium
Continuous ECG monitoring
Review medications
Identify/treat cause

MANAGEMENT OF HYPERKALAEMIA
DURING CARDIORESPIRATORY ARREST IN ADULTS

Definition of Severe Hyperkalaemia: serum potassium above 6.5mmols/l.

Causes and Contributing Factors of Hyperkalaemia include:

Renal failure	Addison's disease	Diet
Rhabdomyolysis	Tumour Lysis	Metabolic acidosis
Hyperkalaemic periodic paralysis		
Administration of oral/intravenous potassium supplements		
Drugs (e.g. ACEI, NSAID's, Beta-blockers, trimethoprim)		

Peri-arrest signs and symptoms of hyperkalaemia include:

Muscle weakness	Flaccid paralysis	Parasthesia

ECG features: (Usually progressive):

1st Degree Heart Block	Flattened/absent P waves	Tall, peaked T Waves
ST Depression	S & T Wave merging	Widened QRS
Bradycardia	Ventricular tachycardia	

IMMEDIATE TREATMENT OF SEVERE HYPERKALAEMIA IN ADULTS

Standard ALS Guidelines

Calcium Chloride (**PEA only**): 10mls of 10% given as intravenous bolus (to protect heart)

Dextrose and Insulin: 10 units of soluble insulin e.g. Actrapid in 50mls of 50% glucose Intravenously over 15-30 minutes

See Drug Therapy Guideline No 63.03: Hyperkalaemia Management In Adults Including During Cardiac Arrest. (Go to Intranet, then Departments, then Pharmacy).

Other treatment to consider:

Sodium Bicarbonate: 50mmols of 8.4% I.V bolus (if severe acidosis or renal failure)

Haemodialysis: Consider if cardiac arrest is resistant to medical treatment or if patient in established renal failure/oliguric acute renal failure

Post Resuscitation care:
Routine Post resuscitation care and investigations
Regular serum potassium samples
12 Lead ECG
Continuous ECG monitoring
Review Medications
Identify/Treat cause

MANAGEMENT OF HYPOTHERMIA
DURING CARDIORESPIRATORY ARREST IN ADULTS

Definition of Hypothermia:

When the body core temperature is below 35°C and is classified as;

- mild 32-35°C
- moderate 28-32°C
- severe less than 28°C

Causes and Contributing Factors of Hypothermia include:

Exposure to cold/wet/windy environments
Immersion in cold water
Prolonged surgery

Drugs and alcohol increase susceptibility to hypothermia

Peri-arrest signs and symptoms of hypokalaemia include:

Clinical history
Low core body temperature (<35°C)
Irregular, slow, small volume pulse
Unrecordable blood pressure

ECG Changes (usually progressive)
Sinus Bradycardia
Atrial Fibrillation
Ventricular Fibrillation
Asystole

IMMEDIATE TREATMENT OF HYPOTHERMIA

Standard ALS Algorithm with following modifications;

- Remove wet clothes
- Ventilate lungs with warm humidified oxygen (40-46°C)
- Consider early tracheal intubation
- Check for signs of life (palpate major artery, check ECG) for up to 1 minute
- Provide warm, dry environment and blankets
- Active external and internal warming:
  - Warm I.V Fluids
  - Bair Hugger
  - Gastric, Peritoneal, Bladder, and Pleural Lavage
- Drugs:
  - Withhold if core temperature below 30°C
  - Double the interval if temperature 30-35°C
- Defibrillation: Withhold after 3 shocks until core temperature above 30°C
- Monitor electrolytes and glucose

Post Resuscitation care:

Routine post resuscitation care and investigations
Do not over-warm the patient

MANAGEMENT OF TENSION PNEUMOTHORAX DURING CARDIORESPIRATORY ARREST IN ADULTS

Definition of Tension Pneumothorax:

The progressive build up of air within the pleural space, usually due to lung laceration, which allows air to escape into the pleural space but not return.

Causes and Contributing Factors of Tension Pneumothorax include:

Chest Trauma	CVP line insertion	Barotrauma
Tuberculosis	Asthma	Emphysema
Cystic Fibrosis		

Peri-arrest Signs and Symptoms of Tension Pneumothorax:

The diagnosis should be made clinically.

Dyspnoea	Chest Pain	Cyanosis
Tachycardia	Raised JVP	Tracheal deviation
Diminished breath sounds on affected side		Hypotension
Hyper-resonance on affected side		Anxiety

Note: A simple pneumothorax will become a tension pneumothorax if the patient receives positive pressure ventilation.

IMMEDIATE TREATMENT OF TENSION PNEUMOTHORAX:

Standard ALS Guidelines

Needle thoracocentesis:
Insertion of a large bore cannula into second intercostal space, mid-clavicular line on affected side by appropriately trained person.

And/Or

Thoracostomy:
Scalpel and blunt dissection in the 4^{th} or 5^{th} intercostal space just anterior to the mid axillary line.

Other treatment to consider:

Chest Drain Insertion

Post Resuscitation care:

Routine post resuscitation care and treatment
Chest X-ray
Safe management of Chest Drain

MANAGEMENT OF CARDIAC TAMPONADE DURING CARDIORESPIRATORY ARREST IN ADULTS

Definition of Cardiac Tamponade:

The compression of the heart caused by blood or fluid accumulation in the space between the myocardium and the pericardium. This prevents the ventricles from expanding fully, so they cannot adequately fill or pump blood.

Causes and Contributing Factors of Cardiac Tamponade include:

Heart Surgery
Acute MI
Pericarditis
SLE
Thrombolysis
Dissecting thoracic aortic aneurysm
End-stage lung cancer
Heart tumours
Radiotherapy to chest

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Peri Arrest Signs and Symptoms of Cardiac Tamponade:

Anxiety
Collapse
Ascites
Tachycardia
Pulsus Paradoxis
Tachypnoea
Chest pain
Peripheral oedema
Muffled heart sounds
Hypotension
Distended JVP
Cyanosis

IMMEDIATE TREATMENT OF TAMPONADE

Standard ALS Guidelines
Pericardiocentesis – to be performed by cardiology medical staff trained in procedure.
Contact on-call Cardiology Registrar in normal working hours (Bleep 0189)
Out of hours, contact on-call Cardiology Consultant via switchboard.

Post Resuscitation

Routine post resuscitation care and investigations

Cardiology review/care

MANAGEMENT OF TOXINS
DURING CARDIORESPIRATORY ARREST IN ADULTS

Definition
An accidental, deliberate or therapeutic exposure to levels of a substance harmful to the patient.

Causes and Contributing Factors of Toxins include:

Accidental Overdose/Poisoning	Intentional Overdose/Poisoning
Drug interactions	Chemical, Biological, Radiological exposure

Peri-arrest signs and symptoms of Toxins include:

Airway Obstruction	Respiratory Depression	Hypotension
Cardiac arrhythmias	Hypo/hyperthermia	Hypoglycaemia
Decreased conscious level	Convulsions	Nausea/Vomiting

IMMEDIATE TREATMENT OF TOXINS
Ensure Safety of Rescuers
Standard ALS guidelines

Contact either:
- **TOXBASE**: www.toxbase.org. (password required)
  The Emergency Dept (ED) and Medical Assessment Unit have access.
  Emergency Dept: Ext (7700) 6366
  MAU: Ext (7700) 6286
- **UK National Poisons Information Service:** on 0844 892 0111 (No password required)

Treat other Reversible Causes

Other Treatment to Consider:

Antidote as appropriate
- Contact pharmacy on (7700) 6117 or via switchboard out of hours
- ED stock many antidotes
- See Pharmacy intranet page (Go to Intranet homepage, then Departments, then pharmacy) for list of drugs kept in emergency cupboard

Monitor temperature closely

Post Resuscitation Care:
Routine post resuscitation care and investigations
Monitor conscious level closely, protect airway
Bloods: electrolytes, glucose, ABG etc.
Paracetamol and salicyilate screen
Other toxicology screen as required
Activated Charcoal if within 1 hour
Consider Gastric Lavage
Urine alkilisation
Manage Arrhythmias

MANAGEMENT OF THROMBOSIS (PULMONARY) DURING CARDIO-RESPIRATORY ARREST IN ADULTS

Definition of Thromboembolism

An embolus is part of a blood clot that has broken away and is causing a partial or complete obstruction of the pulmonary artery/ arteries

Causes and Contributing Factors of Thrombosis include

Cancer	Cardiac failure	Pregnancy
Tobacco smoker	Obesity	Contraceptive pill/HRT
History of thrombosis	Major surgery	

Peri-arrest signs and symptoms of Pulmonary Embolis include:

Shortness of breath	Chest pain	Haemoptysis
Swollen/tender calf	Hypoxia	

IMMEDIATE TREATMENT OF PULMONARY EMBOLISM IN ADULTS

Standard ALS Guidelines

The following dose is indicated in adults if cardiac arrest has occurred or is thought to be imminent

Alteplase: 50 mgs Alteplase reconstituted with 50 mls solvent (water for injection)
Administer as a slow intravenous bolus

See Drug Therapy Guideline No 51.03: Alteplase for Pulmonary Embolism in Imminent or Actual Cardiac Arrest for full details. (Go to Intranet, then Departments, Then Pharmacy)
If a fibrinolytic drug is given consider performing CPR for at least 60-90mins before terminating the resuscitation attempt

Location and stock of Alteplase can be found on the PHT Intranet → Departments → Pharmacy → Out of Hours →Does Another Ward Stock What I Need or via this electronic link: Finding Drugs When Pharmacy is Closed.

Other treatment to consider:

Heparin therapy should be initiated (or resumed) only when aPTT values are less than twice the upper limit of normal; see guideline.

Post Resuscitation care:

Routine post resuscitation care and investigations
See drug therapy guideline on further management
Expert help
Embolectomy can be considered

MANAGEMENT OF CARDIAC ARREST IN PREGNANCY

Causes of Cardiac Arrest in Pregnancy:

Cardiac Disease	Sepsis	Amniotic fluid embolism
Pulmonary Embolism	Haemorrhage	Ectopic Pregnancy
Psychiatric Disorders	Hypertensive disorders of pregnancy	

Peri-Arrest Interventions

Use the A-E Approach
Seek expert help immediately
After 20 weeks gestation the pregnant uterus can cause compression of the inferior vena cava (IVC) so place the women in the left lateral position if or manually displace the uterus to the left
Give high flow oxygen and maintain SaO2 94-98%
Give fluid bolus if there is hypotension or evidence of hypovolaemia
Re-evaluate the need for any drugs being given

During Cardiac Arrest

Standard ALS Guidelines

Summon expert help via 2222 'Adult Cardiac Arrest' team and the 'Maternal Crisis' Team to your location.
If the fetus is viable also call the 'Neonatal Crisis' team

After 20 weeks gestation the uterus can press down against the inferior vena cava impeding venous return, cardiac output and uterine perfusion:

If the woman is known to be 20 weeks pregnant or more, then IVC compression should be relieved either by manually displacing the uterus to the left with 1 or 2 hands (keeping the chest supine) as below.

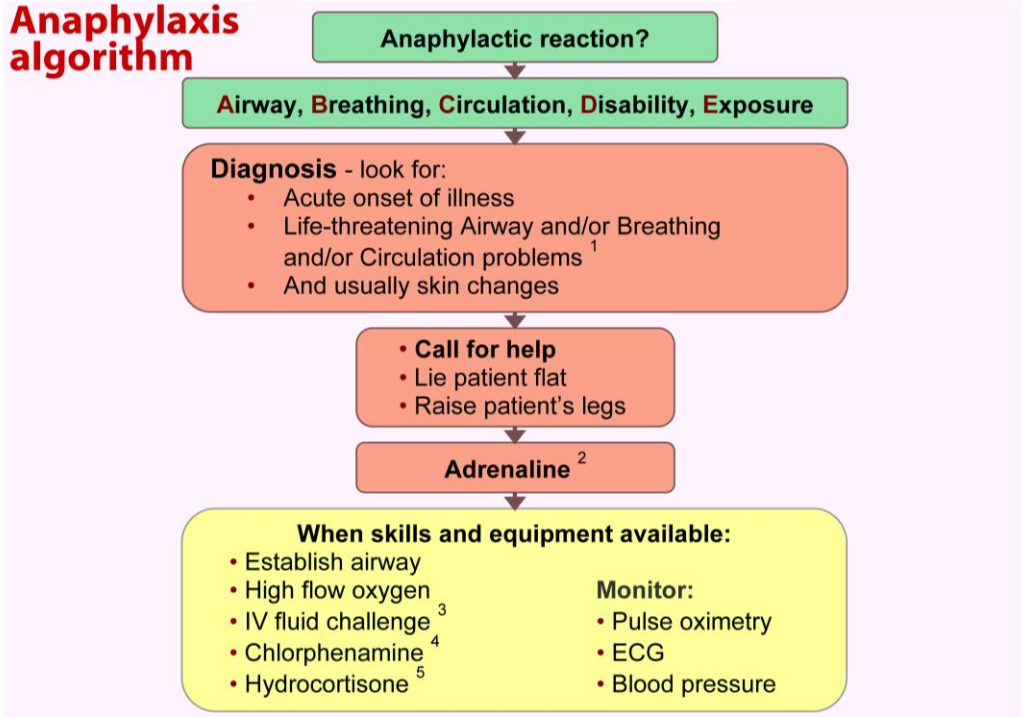
Or by tilting the mother (head to toe) to the left (15-30 degrees) provided she is on a firm surface e.g. tilting table or spinal board, so that the efficacy of chest compressions is not compromised.

Peri-mortem Caesarean section

Should be initiated after 4 minutes of confirmation of cardiac arrest when the gestational age is >20weeks

Resuscitation Council (UK)

Anaphylaxis algorithm



[1] Life-threatening problems:

Airway:	swelling, hoarseness, stridor
Breathing:	rapid breathing, wheeze, fatigue, cyanosis, SpO_2 < 92%, confusion
Circulation:	pale, clammy, low blood pressure, faintness, drowsy/coma

[2] Adrenaline *(give IM unless experienced with IV adrenaline)*

IM doses of 1:1000 adrenaline (repeat after 5 min if no better)

• Adult	500 micrograms IM (0.5 mL)
• Child more than 12 years:	500 micrograms IM (0.5 mL)
• Child 6 -12 years:	300 micrograms IM (0.3 mL)
• Child less than 6 years:	150 micrograms IM (0.15 mL)

Adrenaline IV to be given **only by experienced specialists**
Titrate: Adults 50 micrograms; Children 1 microgram/kg

[3] IV fluid challenge:
Adult - 500 – 1000 mL
Child - crystalloid 20 mL/kg

Stop IV colloid if this might be the cause of anaphylaxis

	[4] Chlorphenamine (IM or slow IV)	[5] Hydrocortisone (IM or slow IV)
Adult or child more than 12 years	10 mg	200 mg
Child 6 - 12 years	5 mg	100 mg
Child 6 months to 6 years	2.5 mg	50 mg
Child less than 6 months	250 micrograms/kg	25 mg

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www.resus.org.uk • Registered Charity No. 286360

https://www.resus.org.uk/anaphylaxis/

Things to Remember

- Patients who have had a suspected anaphylactic reaction should be treated and then observed for at least 6 hours in a clinical area with facilities for treating life-threatening ABC problems.

- After a suspected drug‑related anaphylactic reaction or severe cutaneous reaction, take blood samples for mast cell tryptase. A serum sample (red or yellow top) for tryptase estimation (one bottle will suffice). The samples can be transported at room temperature to the laboratory where they will be stored until the series is received.

Sample 1	Taken **as soon as possible** after reaction, ideally within 30 minutes
Sample 2	**Ideally 1-2 hours** post-reaction – and ideally no later than 4hrs (in accordance with NICE guidance)
Sample 3	**24 hours** post-reaction (required as a baseline to exclude mastocytosis).

- Regardless of the trigger the anaphylactic reaction must be reported using the current Safety Learning Event reporting system (DATIX).

- If drug related use medication as the incident category on the DATIX system, retain packaging, note the batch number and complete a MHRA 'yellow card' https://www.gov.uk/report-problem-medicine-medical-device

- The patient must be reviewed by a senior clinician and a decision made about the need for further treatment or a longer period of observation.

- Before discharge from hospital all patients must:
  - Be reviewed by a senior clinician.
  - Be given clear instructions to return to hospital if symptoms return.
  - Be considered for anti-histamines and oral steroid therapy for up to 3 days.
  - Be considered for an adrenaline auto-injector (see below), or given a replacement.
  - Have a plan for follow-up, including contact with their general practitioner.

Essential reading if administering medicines

- For further information see the Anaphylaxis and Management of Drug Allery Drug Therapy Guideline No: 188 Drug Therapy guidelines

- Resuscitation Council (UK) (2008) *Emergency treatment of anaphylactic reactions. Guidelines for healthcare providers*. Resuscitation Council (UK): London. https://www.resus.org.uk/anaphylaxis/

- Current PHT Cardiopulmonary Resuscitation Policy. See section 6.8. On the intranet under clinical policies Home Policies and Guidelines

For non-prescribers

- Current PHT (PGD) for Adrenaline (Epinephrine) Injection 1:1000. On the intranet, go to Departments – Pharmacy - Patient Group Direction PGD & PSD Library