

Cardiac Arrest

Before cardiac arrest

- Many hospitals have cardiac arrest teams who will meet in the morning to allocate roles.
 - This is helpful when a cardiac arrest situation does occur as the leader is allocated, there is no need for introductions and the team members can get to work immediately.

Initial management of adult cardiac arrest:

- On finding an unconscious individual, follow the three SSS's: safety, shake, shout
 - Safety: ensure it is safe to approach
 - Shake: ask the patient "Are you alright?" whilst gently shaking their arm
 - Shout: if the patient responds, assess them from an ABCDE perspective; if they do not respond, shout for help and put out a cardiac arrest call
- Open the airway with a head tilt/chin lift manoeuvre, palpate the carotid pulse and look, listen and feel for breathing for 10 seconds
 - If there is a risk of a cervical spine injury, open the airway using a jaw thrust whilst an assistant applies manual in-line stabilisation (MILS)
- If there is no pulse, no signs of life, or if in any doubt, commence cardiopulmonary resuscitation (CPR) immediately in a ratio of 30 compressions to 2 ventilation
 - compressions should be applied to the lower half of the sternum to a depth of 5-6 cm at a rate of 100 per minute; ventilations should ideally be applied via a bag-valve-mask (BVM) attached to an oxygen supply, but if these are unavailable can be given via a pocket mask or mouth-to-mouth
- Attach defibrillator pads and pause CPR to analyse the rhythm; further management will depend of whether the rhythm is shockable (ventricular fibrillation [VF] or pulseless ventricular tachycardia [VT]) or non-shockable (asystole or pulseless electrical activity [PEA])

Management of shockable rhythms (VF and pulseless VT):

- On recognising a shockable rhythm, resume chest compressions immediately
- Warn all other individuals to stand clear and remove any oxygen delivery device whilst the defibrillator is charged to 150 J (biphasic – most machines)
- Once the defibrillator is charged, instruct the individual performing chest compressions to stand clear and then deliver the *first shock*
- Resume CPR immediately and continue for two minutes
- After two minutes, pause CPR to check the rhythm; on recognising a shockable rhythm, resume chest compressions immediately
- Warn all other individuals to stand clear and remove any oxygen delivery device whilst the defibrillator is charged to 150 J
- Once the defibrillator is charged, instruct the individual performing chest compressions to stand clear and then deliver the *second shock*
- Resume CPR immediately and continue for two minutes
- After two minutes, pause CPR to check the rhythm; on recognising a shockable rhythm, resume chest compressions immediately
- Warn all other individuals to stand clear and remove any oxygen delivery device whilst the defibrillator is charged to 150 J
- Once the defibrillator is charged, instruct the individual performing chest compressions to stand clear and then deliver the *third shock*
- Resume CPR immediately and continue for two minutes
- After the *third shock*, give adrenaline 1 mg IV (10 ml of 1:10,000) and amiodarone 300 mg IV
- Continue giving adrenaline after alternate shocks ie *fifth, seventh, ninth, eleventh* etc
- If organised electrical activity is seen during a rhythm check, seek evidence of return of spontaneous

circulation (ROSC); if present, commence post-resuscitation care; if absent (PEA), resume CPR immediately and switch to the non-shockable algorithm

- If asystole is recognised during a rhythm check, switch to the non-shockable algorithm

Management of non-shockable rhythms (asystole or PEA):

- On recognising asystole, resume chest compressions immediately and continue for two minutes; on recognising organised electrical activity, seek evidence of ROSC and if absent (PEA), resume chest compressions immediately and continue for two minutes
- After the *first rhythm check*, give adrenaline 1 mg IV (10 ml of 1:10,000)
- After two minutes, pause CPR to check the rhythm; on recognising asystole, resume chest compressions immediately and continue for two minutes; on recognising organised electrical activity, seek evidence of ROSC and if absent (PEA), resume chest compressions immediately and continue for two minutes
- After two minutes, pause CPR to check the rhythm; on recognising asystole, resume chest compressions immediately and continue for two minutes; on recognising organised electrical activity, seek evidence of ROSC and if absent (PEA), resume chest compressions immediately and continue for two minutes
- After the *third rhythm check*, given adrenaline 1 mg IV (10 ml of 1:10,000); continue giving adrenaline after alternate rhythm checks ie fifth, seventh, ninth, eleventh etc
- If a shockable rhythm is identified during a rhythm check, switch to the shockable algorithm but continue giving adrenaline after alternate rhythm checks: do not withhold until after the third shock

Factors to consider during CPR:

- Ensure good quality CPR with minimal interruptions
- Establish and maintain a patent airway
 - Consider airway adjuncts, supraglottic airway devices and definitive airways such as an endotracheal tube
 - Once a definitive airway has been established, compressions and ventilations can be delivered continuously and simultaneously
- Establish intravenous (IV) access and take bloods including a venous blood gas (VBG)
 - If IV access fails, use intraosseous (IO) access. You should switch to IO if access cannot be gained in under two minutes.
 - if unable to obtain venous blood, do a femoral stab, which can be sent for all routine bloods and an arterial blood gas (ABG)
- Recognise and treat reversible causes (4 H's and 4 T's)
 - Hypoxia: ensure a patent airway and delivery of high flow oxygen
 - Hypovolaemia: commence IV fluid resuscitation
 - Hypo/hyperkalaemia and other metabolic derangements: check the VBG for any metabolic derangements and correct accordingly
 - Hypothermia: check the patient's temperature and if low re-warm to 32-34 °C
 - Tension pneumothorax: auscultate the patient's lung fields during ventilations and perform needle decompression as indicated
 - Tamponade (cardiac): obtain a bedside echocardiogram (echo) and perform pericardiocentesis as indicated
 - Toxins: check the patient's drug chart and/or enquire about recent medications in the collateral history
 - Thrombosis: obtain a bedside ultrasound and identify symptoms and risk factors in the collateral history
- Organise your team
 - Delegate the tasks of airway management and ventilation, chest compressions, defibrillator operation, drug administration and time keeping to appropriate individuals; effective chest

compressions are tiring so alternate individuals as necessary; as the team leader maintain an overview of the whole resuscitation attempt: stand at the foot of the bed, give clear instruction and do not get drawn in to performing individual tasks

Management of adult cardiac arrest in special circumstances:

- Hyperkalaemia
 - Calcium chloride 10 ml of 10% IV
 - Sodium bicarbonate 50 ml of 8.4% IV
 - Insulin-dextrose IV infusion (10 units of actrapid in 50 ml of 50% dextrose)
- Hypokalaemia
 - Potassium 20 mmol IV over 10 minutes followed by 10 mmol IV over 5-10 minutes
 - Also give magnesium 2 g IV if concurrent hypomagnesaemia suspected
- Hypocalcaemia
 - Calcium chloride 10 ml of 10% IV
 - Also give magnesium 2 g IV if concurrent hypomagnesaemia suspected
- Opiate toxicity
 - Naloxone 0.4 mg IV; repeated doses up to 4 mg may be required
- Tricyclic antidepressant toxicity
 - Sodium bicarbonate 50 ml of 8.4% IV
- Local anaesthetic toxicity
 - 1.5 ml/kg of 20% lipid emulsion IV
- Hypothermia
 - Palpate the carotid pulse and look for signs of life for up to one minute
 - Re-warm patient to 32-34 °C
 - Withhold drugs until temperature >30 °C
 - If VF/VT persists beyond 3 shocks, withhold further shocks until temperature >30 °C
- Hyperthermia: use active cooling methods
 - Dantrolene can be used in neuroleptic malignant syndrome or malignant hyperthermia
- Trauma
 - Intubate early and manage hypovolaemia with fluids and haemorrhage control
 - Consider ED thoracotomy in specific circumstances
- Asthma
 - Intubate early
 - Consider tension pneumothorax early and manage accordingly
- Pregnancy
 - Manage by physically pushing the foetus to the left (left lateral no longer used) to relieve inferior vena cava (IVC compression).
 - If the foetus is >20 weeks gestation, emergency delivery via Caesarean section should occur within five minutes of cardiac arrest
 - If the foetus is <20 weeks it should not pose to much of a problem for resuscitation or place too many physiological demands on the mother and CPR can continue without Caesarian section

Post-resuscitation care:

- Following return of spontaneous circulation (ROSC) make sure everyone doesn't leave; there is still lots to be done
- Assess the patient from an ABCDE perspective
- Airway
 - The patient should by not have an ET tube in place. Ensure a patient airway and aim for normoxia and normocarbida
 - Obtain ABG samples to guide this
- Breathing

- Ensure sats reasonable (aim over 94%) and titrate oxygen to achieve this
- Auscultate the chest
- Obtain a chest radiograph (CXR)
- Circulation
 - Obtain further IV access and bloods as necessary and measure the lactate
 - Continue fluid resuscitation
 - Auscultate the heart
 - Obtain a 12 lead electrocardiogram (ECG) and bedside echo
 - If myocardial infarction (MI) is the suspected cause of cardiac arrest, early percutaneous coronary intervention (PCI) should be considered
- Disability
 - Recheck pupils
 - Measure blood glucose and correct any hyper/hypoglycaemia
 - Control any seizures with benzodiazepines, anti-convulsants or anaesthetic agents such as thiopental;
- Exposure
 - Therapeutic hypothermia should be considered for all comatose survivors of cardiac arrest. However, this is a controversial area and should be discussed with the intensive care department.
- Consider whether further resuscitation attempts would be effective or in the patient's best interests if they were to arrest again; if not then consider a Do Not Attempt CPR (DNACPR) order after discussing the matter with the patient and their loved ones
 - If this is not possible due to a low level of consciousness, a decision will have to be made in their best interests

Common questions concerning adult cardiac arrest:

- Outline your initial approach to an unconscious individual
- Once cardiac arrest has been identified, what procedure should be initiated without delay?
- In what ratio are compressions and ventilations initially performed during CPR?
- How does this change after establishment of a definitive airway?
- What duration should CPR continue for between rhythm checks?
- Which are the shockable rhythms?
- Which are the non-shockable rhythms?
- What is the dose of adrenaline given in cardiac arrest?
- When is adrenaline given in shockable rhythms?
- When is adrenaline given in non-shockable rhythms?
- When, and at what dose, is amiodarone given in cardiac arrest?
- Outline the reversible causes of cardiac arrest
- How would you alter the management of cardiac arrest in a patient with hyperkalaemia?