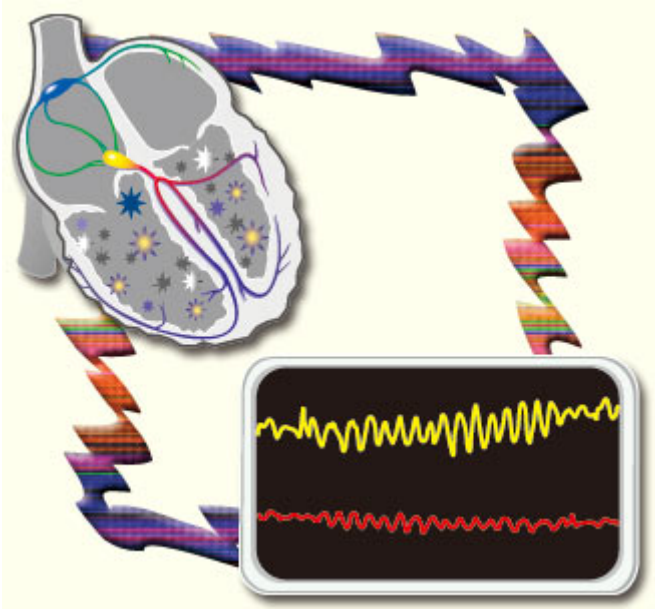
NORTH COAST
AREA HEALTH SERVICE
NSW HEALTH

PORT MACQUARIE BASE HOSPITAL

INTENSIVE AND CORONARY CARE UNIT



ADVANCED LIFE SUPPORT PACKAGE

March 2000 Adapted from the Hospital Advanced Life Support (HALS) course by Deborah Mayor. Rewritten and compiled by Fiona Anderson (Critical Care Educator) and Phillipa Williams (RN).
January 2006: Updated by Clinical Nurse Educator, Intensive and Coronary Care Unit.

ANY ATTEMPT

AT RESUSCITATION

IS BETTER THAN

NO ATTEMPT

(Philosophy of the
Australian Resuscitation Council)

CONTENTS

INSTRUCTIONS TO CANDIDATES

1) It is expected that the candidate will complete the provided reading from both the basic and advanced life support manuals prior to undertaking the assessments.
2) IV Cannulation competence is required for ALS accreditation.
3) On completion of the written assessment, return it to the Clinical Nurse Educator (CNE) for marking. You must obtain a 100% mark prior to proceeding to the clinical assessments.
4) Arrange with the CNE for some supervised practice in the clinical skills (use the clinical skills assessment tools and reading material supplied).
5) The clinical skills must be mastered before you achieve accreditation.
6) Forward the completed ALS Package in its entirety to the CNE for processing and certificate. The package will be returned to you as a continued reference.
7) Annual skills testing will be required to maintain skill competence.

INTRODUCTION

The Advanced Life Support (ALS) Package has been designed to compliment the annual assessment of ALS skills for staff in Critical Care areas of the Port Macquarie Base Hospital (PMBH) as a specialised progression from basic life support. Candidates are expected to have reviewed the basic life support manual prior to ALS progression as the ALS package assumes, in context, that BLS has been commenced. Candidates are also expected to have prior knowledge of rhythm interpretation.

"Advanced Life Support (ALS) is Basic Life Support with the addition of invasive techniques eg defibrillation, advanced airway management, intravenous access and drug therapy." (ARC PS 11.1)

When a patient suffers a cardiac arrest in-hospital, the chances of survival should be optimal. The successful management of a cardiac arrest requires a well-rehearsed team that is directed competently and efficiently by a team leader. Without adequate training and frequent refresher practice cardiopulmonary resuscitation is often poorly performed.

The Australian Resuscitation Council (ARC) and the International Liaison Committee on Resuscitation (ILCOR) have produced standardised treatment protocols and guidelines. The aim is to simplify treatment regimens in order to improve performance by hospital staff thereby increasing the number of patients who return to a quality life after suffering a cardiopulmonary arrest.

This manual has been designed to promote uniformity of teaching practices within the PMBH in conjunction with the practical training of staff in managing a cardiac arrest. If BLS and ALS are learnt in a consistent and practical manner, a more controlled management of life and death situations will be achieved.

AUSTRALIAN RESUSCITATION COUNCIL

ADULT CARDIORESPIRATORY ARREST

BLS Algorithm
if appropriate

Precordial thump
for witnessed/monitored arrest

Attach Defib - monitor

Assess rhythm/pulse

VF / VT

Defibrillate x 3
as necessary

Manual Monophasic:
1st time 200/200/360J
Subsequent 360/360/360J

Manual Biphasic:
150/150/150J

SAED:
Use Preset Levels

CPR
Correct reversible causes

NON VF/VT

CPR
Correct reversible causes

CORRECT REVERSIBLE CAUSES

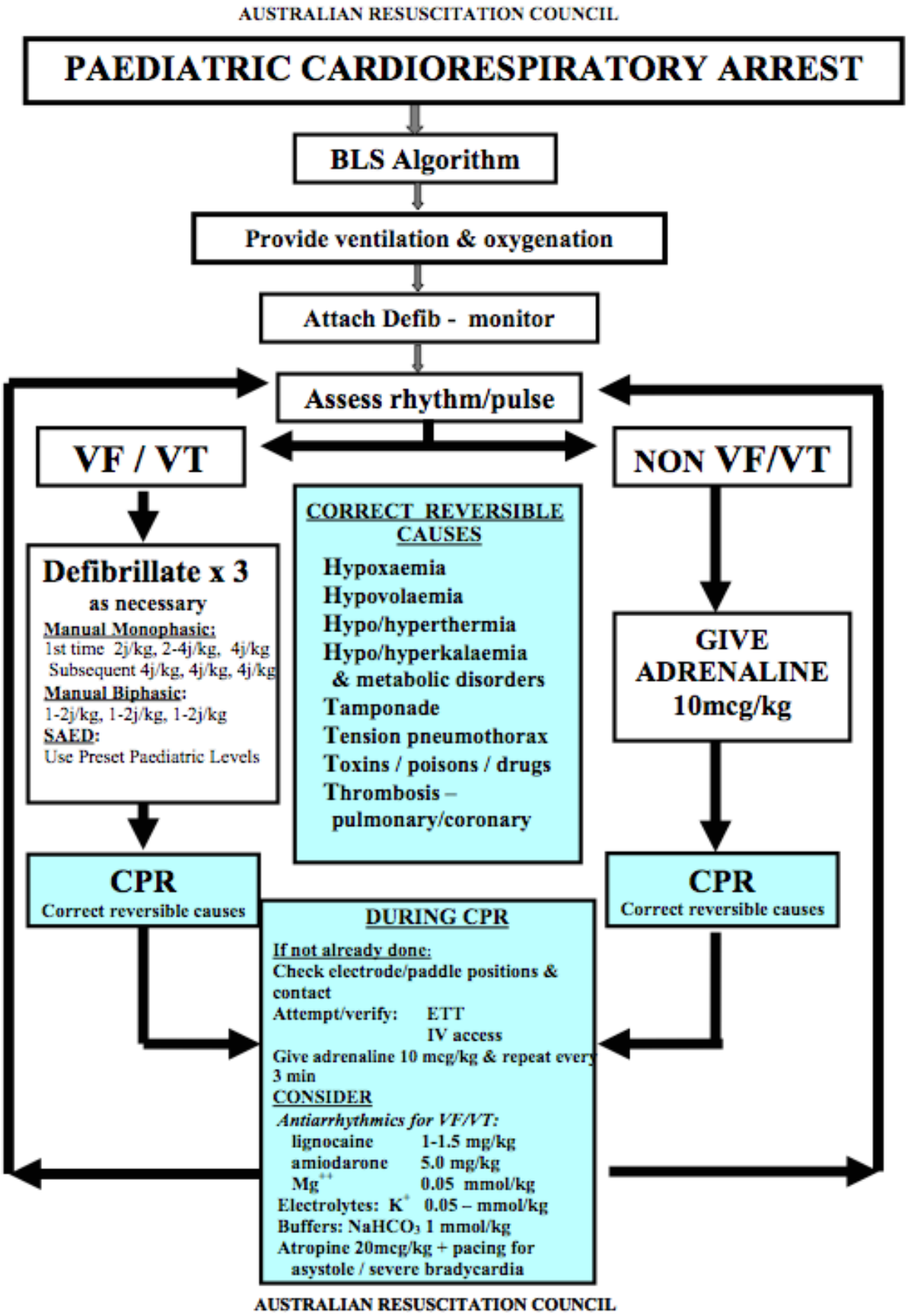
- Hypoxaemia
- Hypovolaemia
- Hypo/hyperthermia
- Hypo/hyperkalaemia & metabolic disorders
- Tamponade
- Tension pneumothorax
- Toxins / poisons / drugs
- Thrombosis-pulmonary / coronary

DURING CPR

If not already done:
- Check electrode/paddle position & contact
- Attempt/verify/secure: airway, IV access
- Give adrenaline 1mg & repeat every 3 min

CONSIDER
- Antiarrhythmics for VF/VT:
  - Lignocaine 1-1.5 mg/kg
  - Amiodarone 300 mg
  - Mg^{++} 5 mmol
- Electrolytes: K^{+} 5 mmol
- Buffers: $NaHCO_3$ 1 mmol/kg
- Atropine 1-3 mg + pacing for asystole / severe bradycardia

AUSTRALIAN RESUSCITATION COUNCIL


AUSTRALIAN RESUSCITATION COUNCIL
PAEDIATRIC CARDIORESPIRATORY ARREST
BLS Algorithm
Provide ventilation & oxygenation
Attach Defib - monitor
Assess rhythm/pulse
VF / VT
NON VF/VT
Defibrillate x 3
as necessary
Manual Monophasic:
1st time 2j/kg, 2-4j/kg, 4j/kg
Subsequent 4j/kg, 4j/kg, 4j/kg
Manual Biphasic:
1-2j/kg, 1-2j/kg, 1-2j/kg
SAED:
Use Preset Paediatric Levels
CORRECT REVERSIBLE CAUSES
Hypoxaemia
Hypovolaemia
Hypo/hyperthermia
Hypo/hyperkalaemia
& metabolic disorders
Tamponade
Tension pneumothorax
Toxins / poisons / drugs
Thrombosis –
pulmonary/coronary
GIVE ADRENALINE 10mcg/kg
CPR
Correct reversible causes
CPR
Correct reversible causes
DURING CPR
If not already done:
Check electrode/paddle positions & contact
Attempt/verify: ETT
IV access
Give adrenaline 10 mcg/kg & repeat every 3 min
CONSIDER
Antiarrhythmics for VF/VT:
lignocaine 1-1.5 mg/kg
amiodarone 5.0 mg/kg
Mg++ 0.05 mmol/kg
Electrolytes: K+ 0.05 – mmol/kg
Buffers: NaHCO3 1 mmol/kg
Atropine 20mcg/kg + pacing for asystole / severe bradycardia
AUSTRALIAN RESUSCITATION COUNCIL

SECTION 1:

UNIVERSAL TREATMENT ALGORHYTHM

UNIVERSAL TREATMENT ALGORITHM

The Universal Treatment Algorithm sequence of interventions is based, whenever possible, on sound information. Valid scientific evidence supports only three interventions as unequivocally effective in adult cardiopulmonary resuscitation. These are:

- Defibrillation – if the rhythm is ventricular fibrillation or pulseless ventricular tachycardia.
- Oxygenation and ventilation of the lungs through a patent secure airway such as a tracheal tube.
- Chest compressions.

The Universal Treatment Algorithm presents these interventions simplistically and recommends a specific sequence of events that hospital staff should follow. On arrival of the cardiac arrest team, the first priority should be to establish the patient's rhythm to determine if defibrillation is indicated.

There are only considered to be two types of rhythms in a cardiac arrest:

- Those that **DO** require defibrillation ie. VF/VT
- Those that **DO NOT** require defibrillation ie. Non VF/VT (EMD or asystole)

Therefore there are only two treatment pathways described by the ARC: VF/VT & Non VF/VT.

NON VF/VT

STEP 1. Defibrillation

- Commence monitoring

STEP 2. Airway

- Assist with tracheal intubation.
- Secure airway via LMA as substitute for tracheal intubation in the absence of trained medical staff.

STEP 3. Breathing

- Provide 100% O_2

STEP 4. Circulation

- Establish IV access
- Perform CPR
  - Minimise interruptions to CPR, intubation attempts should not take any longer than 20secs.

STEP 5. Drugs

- Administer 1mg Adrenaline every 3mins

STEP 6. Reversible Causes

- Identify and treat reversible causes – 4H's and 4T's
- Initiate specific interventions eg: external pacing, decompression of tension pneumothorax

STEP 7. Algorithm cycle

- Recommence at **STEP 1** at 1minute then every 3minutes of CPR during the cardiac arrest.

VF / VT

STEP 1. Defibrillation

- Commence monitoring
- If witnessed, monitored VT/VF arrest, consider precordial thump where defibrillator is not immediately available.
- Perform safe defibrillation monitoring patients' response and repeat x3 without interruption where rhythm is not reverted to life sustaining.
- Commence CPR if there is any delay between defibrillation deliveries.

STEP 2. Airway

- Assist with tracheal intubation.
- Secure airway via LMA as substitute for tracheal intubation in the absence of trained medical staff.

STEP 3. Breathing

- Provide 100% O_2

STEP 4. Circulation

- Establish IV access
- Perform CPR

STEP 5. Drugs

- Administer 1mg Adrenaline every 3mins
- Consider Atropine in asystole

STEP 6. Reversible Causes

- Identify and treat reversible causes 4H's & 4T's
- Initiate specific interventions eg:
  - External pacing
  - Decompression of tension pneumothorax
- Monitor for changes in rhythm

STEP 7. Algorithm cycle

- Recommence at **STEP 1** at every 1minute of CPR during the cardiac arrest.

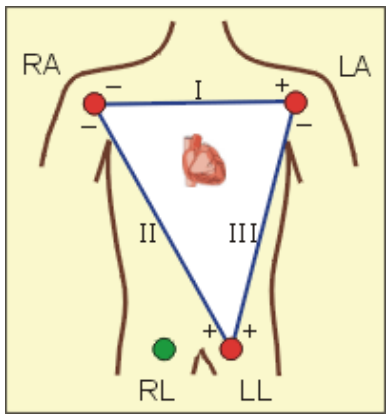
SECTION 2:

DEFIBRILLATION

MONITORING / DEFIBRILLATION

CARDIAC MONITORING

When there is time to institute ECG monitoring, adhesive ECG electrodes should be attached to the patient's chest for three lead monitoring to commence on the defibrillator/monitor. Electrode positioning will record standard leads I, II, and III of the conventional ECG as illustrated opposite:



http://www.hst.aau.dk/brobygger/limb_leads.htm

It is important to obtain sight of the cardiac rhythm as soon as possible following cardiac arrest and this can quickly be achieved through the defibrillator by placing pads/paddles on the patients' chest.

DEFIBRILLATOR

There are several available defibrillators throughout Port Macquarie Base Hospital however their difference is identified by their method of energy delivery or more specifically the waveform used. This is classified as Monophasic or Biphasic.

Monophasic Defibrillators
These deliver energy in only one direction; from the sternal pad/paddle to the apex pad/paddle.

Biphasic Defibrillators
These deliver energy in two directions using a variety of waveform technologies. This enables the defibrillator to deliver the required peak current to overcome measured thoracic impedance that can vary from-15 – 143ohms, and depolarise cardiac muscle. This results in:

- Less joules of electricity needed to defibrillate the patient (150J only),
- More effective first shock, and
- Less damage to the myocardium.

Pads / Paddles
The multi-function electrode (MFE) pads enable monitoring, defibrillation and pacing to occur without the need of additional monitoring electrodes or changes in the application of the pads (NOTE: at PMBH the stat-padz pre-connected to the Zoll cannot pace and must be changed to pro-padz). They provide a greater surface area for energy delivery and significantly reduce or remove skin complications from current delivery. The benefits of performing defibrillation and pacing without being in contact with the patient, ie using paddles, are obvious however this advantage remains reliant upon the ALS performer maintaining the safety considerations and confirming that no-one is in contact with the patient prior to shock delivery.

DEFIBRILLATION

Defibrillation is performed in accordance with the ARC recommendations as including energy levels indicated on the ALS algorithm. These recommendations are as follows:

- Shocks are delivered in sets of 3.
- No CPR is provided during the delivery set unless there is a delay of greater than 20secs.
- Energy levels are delivered as below:

	Monophasic	**Biphasic***
1st shock	200J	**150J**
2nd shock	200J	**150J**
3rd shock	360J	**150J**
Subsequent shocks	360	**150J**

**There is currently no evidence to recommend any other energy levels for biphasic defibrillators.*

- Precautions are maintained (details below)
- Shock delivery is confirmed via patients' motor response or evidence on defibrillator / cardiac monitor. (ARC PS 11.3)

http://www.zoll.com/MseriesCCT.htm

The **ZOLL** M series CCT (opposite) is a hands free *biphasic* defibrillator. The "Lead Select" on the defibrillator must be changed to "Pads" for monitoring only. This is achieved by pressing the "Lead Select" button repeatedly as it scrolls through the selection.

*****The pre-connected 'stat-Padz' are unable to perform pacing and will need to be changed to "pro-padz".***

Paediatric pads are available for children <15Kg (approx 4years).

There are several *monophasic* defibrillators available at PMBH however their individual use will not be pursued in this manual. The principles of their use are the same as that for the ZOLL.

Skin Preparation

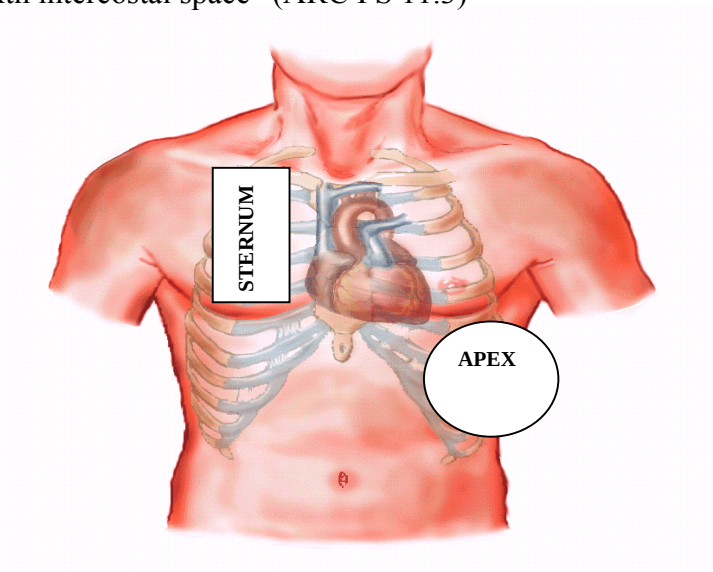
It is important that the pads are placed over clean, dry skin where possible. This will ensure effective adherence to the skin and decrease the chance of arcing and/or burns.
Arcing is where the electricity is attracted from one electrode to the other through the air and can result in explosive noises, patient burns and impaired transmission of current.
When applying pads:

- Shave excess hair if required, this is achieved quickly through shaving an X at the site of the pad placement.
- Ensure pads are in direct contact with patients' skin, **free from any obstruction** such as GTN patches, ECG dots, cables or IV lines.
- Do not place pads over breast tissue, this increases impedance.
- *Smooth hand across pad following placement on the patients' chest.*

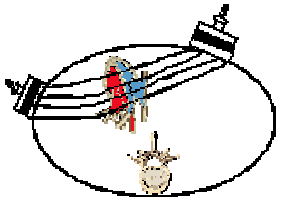
Pad/Paddle Placement

Correct placement of the pads is essential for successful defibrillation. The diagram below demonstrates anterior – anterior placement.

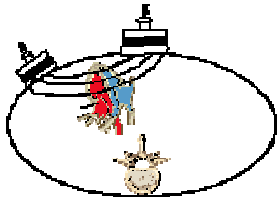
- The 'Sternum' pad/paddle is placed "right parasternal area over the second intercostal space" (ARC PS 11.3).
- The round 'Apex/lateral' pad/paddle is placed "on the midaxillary line over the sixth intercostal space" (ARC PS 11.3)



Placement of the apex pad/paddle is of key importance as demonstrated by the illustration below.



Correct paddle position
(current passes through the ventricles)



Incorrect paddle position
(current misses part of the ventricles)

SAFETY PRECAUTIONS (ARC PS 11.3)

The ARC provides clear guidance for the maintenance of staff and patient safety:

- AVOID charging the paddles unless they are placed on the victims' chest.
- AVOID placing the defibrillator pads over ECG electrodes (risk of burns or sparks), ECG leads (may melt), medication patches, an implanted device (eg. a pacemaker), or a central line insertion site.
- AVOID having, or allowing any person to have, any direct or indirect contact with the victim during defibrillation (a shock may be received).
- AVOID defibrillation if victim, operator and/or close bystander are situated in an explosive/flammable environment.
- AVOID allowing oxygen from resuscitator to flow into the victims' chest during delivery of the shock (risk of fire). ARC PS 11.3

PROCEDURE

Zoll M series CCT

1. Apply pads
2. Select '**1 DEFIB'**
3. Call loudly and clearly "**STAND CLEAR**"
4. Perform **VISUAL CHECK** of the environment to ensure optimal safety of staff and patient, identifying hazards for their immediate removal PRIOR to shock delivery.
5. Press '**CHARGE**' and listen for confirmation sound that charge is ready.
6. Press '**SHOCK**' to deliver energy.
7. Observe for **evidence** of shock delivery: patients' motor response or evidence on defibrillator / cardiac monitor
8. **Review** monitored rhythm and prepare for further shock deliveries.

PRE – ARREST RHYTHMS

The European Resuscitation Council has provided guidelines for initial management of common pre-arrest rhythms that are intended to be simple and appropriate to most countries. The guidelines are presented as three algorithms:

1. bradycardia
2. broad complex tachycardia
3. narrow complex tachycardia

These rhythms have the potential to compromise cardiac output and the blood pressure is an important guide as to whether intervention is required. If the patient is exhibiting signs of physical compromise (regardless of the rhythm) then oxygen must be administered and IV access established.

Bradycardia

The recommendations for the management of bradycardias and heart blocks depend upon recognising whether or not there is an appreciable risk of asystole occurring. If asystole is considered a definite risk atropine is recommended. If required, expert help should be sought to achieve transvenous pacing. If the patient's condition is considered too critical for the placement of a ventricular pacing wire, external pacing may be appropriate. If asystole is not a definite risk, then atropine is once again recommended and close observation of clinical signs is necessary.

Broad Complex Tachycardia

Faced with a broad complex tachycardia, the default position must be an assumption that it is ventricular in origin. The first determinant of management is whether of not there is a palpable pulse. If a pulse is palpable, expert help should be sought. If adverse signs are present, the dysrhythmia must be regarded as an emergency. In most cases synchronised cardioversion, following sedation of the patient, will be appropriate. In the absence of adverse clinical signs, an antiarrhythmic may be administered. It is important to check the plasma levels of potassium and magnesium, and administer infusions of each if necessary.

Narrow Complex Tachycardia

This is almost always a supraventricular tachycardia (SVT), which is both less frequent and somewhat less hazardous than VT. Vagal manoeuvres may terminate SVT, but in the context of resuscitation the hazards must be emphasised. The pharmacological treatment of choice for regular SVT is adenosine. If adenosine is not successful in establishing a satisfactory rhythm, expert help should be sought. At this point, management will depend on whether or not adverse clinical signs are present, as with broad complex tachycardia. If adverse signs are present, the patient should be sedated and treated by cardioversion.

RHYTHM INTERPRETATION

VENTRICULAR FIBRILLATION - Shockable

Description: VF is asynchronous, chaotic ventricular activity, which produces no cardiac output. It produces a completely disorganised ECG trace with impulses occurring irregularly at a rate of 300-500 per minute without any rhythm or coordinated pattern. This causes the myocardium to quiver ineffectively. Initially VF can be treated quickly with defibrillation but as it continues the heart becomes anoxic and depressed and the rhythm deteriorates to asystole.
Management: Approximately 85% of all cardiac arrests are due to VF and the only definitive treatment is defibrillation. Follow the VT/VF arm of the algorithm.

PULSELESS VENTRICULAR TACHYCARDIA - Shockable

Description: Ventricular Tachycardia is a series of three or more consecutive premature ventricular contractions occurring at a rapid rate. The rhythm is due to a repetitive discharge of an ectopic focus in the ventricle and usually indicates myocardial irritability.
The QRS complexes are wide and bizarre and although the ventricular focus serves as the dominant pacemaker; the atria continues to discharge independently. As a result, the P waves (if seen) bear no relationship to the QRS complex. The rate is usually 150-220 per minute. At rates exceeding 180 per minute VT is more likely to become pulseless as there is no time for ventricular filling or emptying.
Management: If left untreated pulseless VT deteriorates to VF. Defibrillation following the VT/VF arm of the algorithm should be followed.

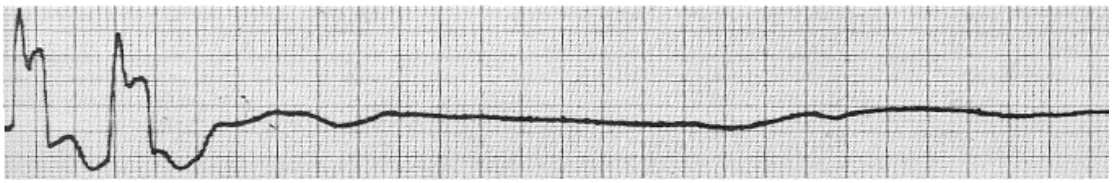
PRECORDIAL THUMP **(ARC PS 11.2.2)**

Where **pulseless** VT/VF is observed to occur in the case of a monitored arrest the use of a single precordial thump may be appropriate within the first 15secs where a defibrillator is not immediately available.

PROCEDURE

The clenched fist is held approximately 25-30cm above the sternum and then brought down sharply so the inside (medial, ulna) side of the fist makes contact with the mid-sternum of the victims chest.
Contraindications: Recent sternotomy, chest trauma or **presence of a pulse**.

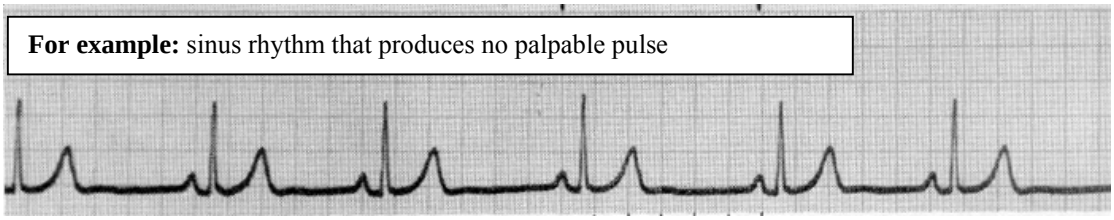
ASYSTOLE – Non-shockable



Description: There is no electrical stimulus to cause the heart muscle to contract that is recognised as a total absence of any atrial or ventricular activity on the monitor. The prospects of recovery from asystole are poor.

Management:
Recovery of patients who have primary cardiac disease is very unlikely to occur after 15 minutes of unsuccessful CPR. Important exceptions are cases of hypothermia, near drowning, or poisoning, all of which should be excluded before resuscitation attempts are abandoned.

PULSELESS ELECTRICAL ACTIVITY (PEA) – Non-shockable



Description: There is normal electrical activity with the absence of mechanical activity manifested by no pulse.

Management:
Treatment of the underlying cause. Mechanical causes of PEA potentially have the best outlook.

CARDIOVERSION

Cardioversion is a term used to describe synchronised defibrillation, and where defibrillation is used to terminate a cardiac arrest rhythm cardioversion is used to convert either narrow or broad complex tachycardias to a slower rhythm. Cardioversion synchronises the shock delivery to occur with the R wave of the ECG. The refractory period is thereby avoided and the risk of inducing ventricular fibrillation, through 'R on T' or shock delivery during the T wave, is minimised. The pads/paddles are applied to the chest wall in the same way as for defibrillation but the energy levels required are lower because the transthoracic impedance is significantly higher for patients with cardiac arrest compared to those undergoing elective cardioversion.

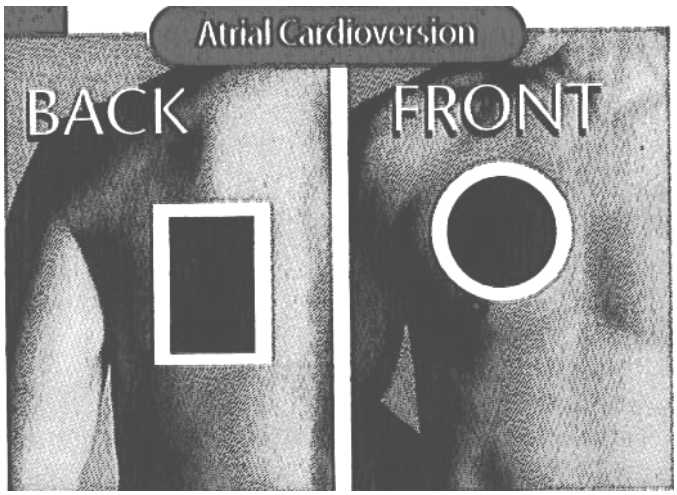
PROCEDURE

Zoll M series CCT

1) Place pads/paddles anterior/posterior placement (as below) or as per defibrillation (page 5 of this document).

*****The ZOLL pre-connected 'stat-Padz' are unable to perform pacing and will need to be changed to "pro-padz".***

2) Turn defibrillator to '**DEFIB**'
3) Select required joules as per Medical Officer (MO).
4) Select '**SYNCHRONISE**' on the defibrillator and observe for marker on the monitor indicating R wave recognition.
5) Administration of sedation by MO.
6) Call loudly and clearly "**STAND CLEAR"** or **"CHARGING**"
7) Perform **VISUAL CHECK** of the environment to ensure optimal safety of staff and patient identifying hazards for their immediate removal PRIOR to shock delivery.
8) **CHARGE** the defibrillator by pressing the '**CHARGE**' button.
9) Press and hold the '**SHOCK'** button recognising that a **DELAY** in shock delivery will occur, as the defibrillator waits for an R wave.
10) Observe for evidence of shock delivery: patients' motor response or evidence on defibrillator / cardiac monitor
11) Assess patients' haemodynamics and continue monitoring and support.



ZOLL Medical Pro-Padz

NON-INVASIVE CARDIAC PACING

EXTERNAL CARDIAC PACING

External pacing delivers an electrical current through the chest wall to the myocardium causing depolarisation so that muscular contraction can occur.

Indication: primarily used for the emergency treatment of symptomatic bradycardia and conduction blocks not responding to pharmacological therapy (atropine) or asystole. If there are delays in intravenous access, or atropine is not reversing the bradycardia, external pacing should not be delayed.

Patient discomfort can vary according to several factors including the patient's anxiety and perception of pain, the polarity of the electrodes and the level of current required for capture. Discomfort associated with pacing has two components: cutaneous nerve stimulation which results in tingling, stinging, pinching, or burning sensations and skeletal muscle contraction which may be felt as tapping, twitching or thudding sensations. Skeletal muscle contractions can occur with energy levels as low as 10mA and most patients have difficulty tolerating pacing when the current is above 50mA. Unfortunately capture thresholds are generally above this level (40 – 80mA) and therefore analgesia and sedation should be routinely considered for conscious patients.

Pacing Terminology

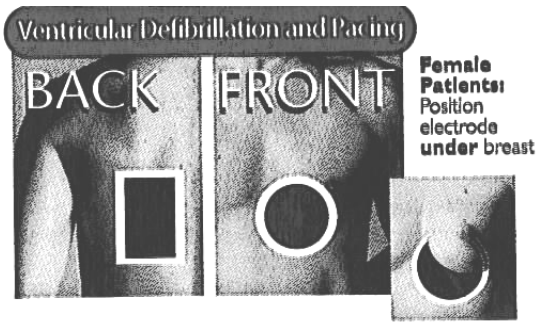
Capture: Depolarisation of the heart by an artificial electrical stimulus. A wide QRS complex followed by a tall broad T wave evidences electrical capture. Mechanical capture is myocardial contraction and is evidenced by a pulse and signs of improved cardiac output.

Demand Pacing: The pacemaker is capable of sensing spontaneous cardiac activity so that the pacing stimuli are only delivered when necessary.

Non-Demand Pacing: The pacemaker delivers a pacing stimulus at a set rate independent of the heart's electrical or mechanical activity. It may be referred to as fixed rate or asynchronous pacing. Because of competition between the paced beats and intrinsic rhythm, there is a risk of ventricular arrhythmias. Therefore this mode is rarely used.

Sensing: The pacemaker is set on demand mode, and senses the patient's intrinsic cardiac rhythm. A mark is placed on the QRS complex if sensing is achieved.

PROCEDURE



Zoll M series CCT.

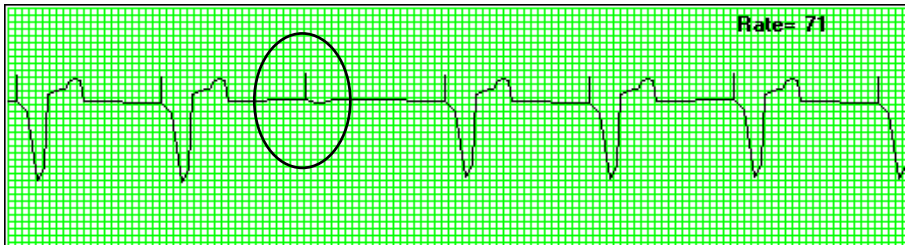
1. Apply MFE pads as opposite (anterior / posterior) or as per defibrillation (anterior / anterior), smoothing your hand across the pads to assist with adherence.
2. Attach the pads to the defibrillator if not already pre-connected.
3. Apply monitoring leads in addition to MFE pads if chosen (not required – only recommended).
4. Select 'PACER'
5. Set 'PACER RATE' (defaults to 70ppm) to selected rate turning knob clockwise.
6. Set 'PACER OUTPUT" (defaults to 0mA) turning knob clockwise until consistent capture identified.
7. Assess for mechanical activity associated with paced rate – palpate carotid pulse.

Additional Options:

- 'ASYNC' can be selected to activate asynchronous pacing if required.
- Pressing and holding the '4:1' button allows the operator to view underlying intrinsic rhythm by reducing the ppm to ¼ of the rate.

Troubleshooting

Failure to capture



- Increase the current (mA)
- Alter the electrode position – change to anterior
- Consider metabolic acidosis or hypoxia
- Patient may not be viable

Failure to sense:

- Increase the ECG size
- Select a different pacing lead
- Reposition electrodes

SECTION 3:

AIRWAY

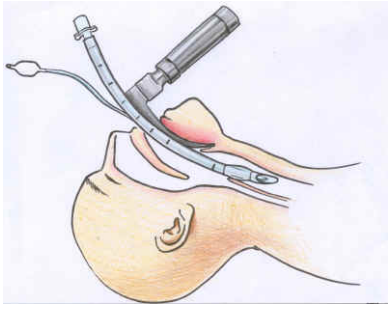
AIRWAY

Airway management in a patient requiring resuscitation is the first priority of BLS and remains the first priority, following defibrillation where indicated, in ALS. Tracheal intubation remains the 'Gold standard' technique for airway control during cardiopulmonary resuscitation as it enables the delivery of 100% oxygen through a protected airway. Intubation attempts should not delay CPR for any longer than 20 seconds.

TRACHEAL INTUBATION

The role of the ALS nurse may include some or all of the following:

1. Prepare the patient
2. Prepare the equipment
3. Assist the Doctor
4. Drug administration
5. Performance of cricoid pressure
6. Patient monitoring
7. Tube securing
8. Assessment of tube position.



http://www.aic.cuhk.edu.hk/web8/Intubation.jpg

Equipment Preparation

- Collect equipment
  - Personal protective equipment (gloves, goggles, apron)
  - Endotracheal tubes (ETT)
    - Female size 7.0 –8.0mm, Male size 8.0 –9.0mm
  - Laryngoscope
    - Check light source and have spare bulbs and batteries
  - 10mL syringe
  - Stethescope
  - Tapes/ties
  - Suction equipment
    - Yankeur sucker and Y-suction catheters
  - Water soluble lubricant
  - Magill's forceps
  - Introducer
    - Either soft 'bougie' or semi-rigid stylets
- Test ETT cuff
- Lubricate tip of ETT
- Test and prepare suction with Yankaeur attached
- Test laryngoscope light source.

Patient Preparation:

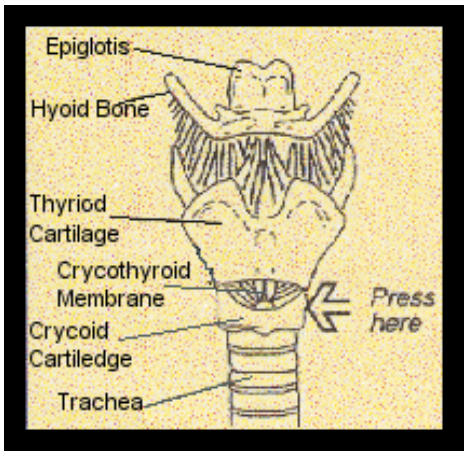
- Position patient with neck slightly flexed, place small pillow under the occiput to extend the head if required.
- Pre-oxygenate: 100% O_2 via bag-mask

PROCEDURE

1. Prepare equipment.
2. Prepare patient.
3. Administer drugs as requested.
4. Commence cricoid pressure.
5. Hand laryngoscope and Yankaeur suction to Doctor.
6. Pass the ETT to the Doctor to their dominant hand, in the position for insertion, ensuring they are not required to look away from the patients' airway.
7. Inflate ETT cuff when requested.
8. Release cricoid pressure when requested.
9. Pass the manual ventilation bag with high flow O_2 to the Doctor for continuation of ventilation.
10. Assist with or carry out securement of ETT with tapes/ties
11. Assess tube position – as below.
12. Document the position/length of the tube at the patient's upper teeth.

Cricoid Pressure

- Assists to prevent aspiration of regurgitated gastric contents and may assist in viewing the vocal chords.
- Apply cricoid pressure only if requested and *do not let go until told to do so (following ETT cuff inflation)* with the exception of active vomiting where cricoid pressure must be released as it may lead to oesophageal rupture.
- Placing the thumb and forefinger on the cricoid cartilage (located below the thyroid cartilage as illustrated below) the complete cricoid ring is forced backwards occluding the oesophagus against the body of the cervical vertebrae.



http://www.resus.org.au/
(Policy Statement 11.2.3)

http://pearls.ddo.jp/gallery/main.php?g2_view=core.ShowItem&g2_itemId=30129

Tube position can be assessed by:

- Equal bilateral chest movement should be observed.
- Auscultation of the chest, apices and bases bilaterally.
- Capnography / $ETCO_2$
- Other indicators:
  - SpO_2%
  - ABG's
- Direct visualisation of the glottis using a laryngoscope, observing the tube pass through the vocal cords.

SECTION 4:

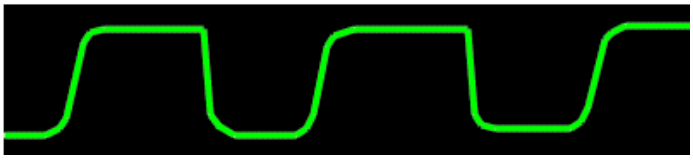
BREATHING

BREATHING

MANUAL VENTILATION / OXYGENATION

High concentration O_2 (100%) delivered via a bag-valve device incorporating a self-inflating bag and a non-rebreathing valve mechanism (Ambubag / Laerdel / Air Viva) should be initiated as soon as it is available. The ARC recommends that mechanical ventilators not be used in the initial management of cardiac arrest and that the patient should be manually ventilated (PS 11.5).
Care must be taken not to hyperinflate the lungs causing volume or pressure injury and the use of a single hand to provide the manual ventilation breath is recommended to avoid this.

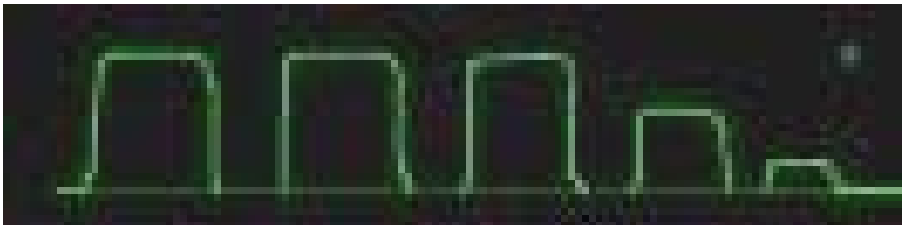
CAPNOGRAPHY



http://www.capnography.com/Clinicalapplication/clinicalapplication2.htm

Capnography comprises the continuous analysis and recording of carbon dioxide (CO_2) concentrations in respiratory gases. The waveform above provides a visual example of a normal respiratory waveform associated with endotracheal intubation.

In addition to auscultation of breath sounds and observation of bilateral chest rise and fall, $C0_2$ monitoring is likely the best way to detect oesophageal intubation and therefore should be available during endotracheal intubation. (Respiratory Care 1995; 40(12): 1321-1324). Although CO_2 may be present in the stomach this is quickly removed during ventilation of the stomach resulting in a flat capnogram as illustrated below.



www.capnography.com

Disposable, single-use, end tidal CO_2 detectors that change colour when exposed to 4% CO_2 are also available for use in some organisations where capnography is not readily available.

PROCEDURE

Zoll M series CCT

1) Attach the CO_2 sensor cable to the defibrillator/monitor.
2) Wait for the sensor to warm up – The message "**WARM UP**" is displayed on the screen as this occurs (<1min).
   a) The warm up message will disappear when it is ready for use.
3) A "**ZERO CO2 SENSOR**" message will be displayed when a capnostat sensor is attached for the first time but the zero value is retained for subsequent use.
   a) Place the sensor on the **"0" cell** on the sensor cable.
   b) The zero will automatically be performed and a "**ZEROING CO2 SENSOR**" message displayed.
4) The sensors calibration can be checked on a previously used sensor where zero is not required.
   a) Place the sensor adaptor onto the "**REF**" cell for 5sec and an $ETCO_2$ value of 38mmHg +/-2mmHg will be displayed.
5) Attach the airway adaptor sliding it into place until a click is heard.
6) **Airway adaptor zero** is only required when switching between different adaptor types.
   a) Press the "Param" soft key
   b) Select "EtCO2" menu
   c) Press "Enter"
   d) Press the "Zero" soft key
   e) Ensure that the adaptor is away from all CO_2 sources and select "Start" then "Enter".
   f) "ZEROING CO2 ADAPTER" is displayed & completes in approx 15secs.
7) Place airway adaptor at the proximal end of the airway circuit in a position that ensures that it will not fill with fluid or secretions.

NOTE: the airway adapter should be placed away from in-line suction catheters as these are too large to pass through the airway adaptor and attempts to pass the catheter may damage the sensor.

8) Confirm correct setup by observation of the $ETCO_2$ waveform on the display.

SECTION 5:

CIRCULATION

CIRCULATION

Venous access is the next priority, following defibrillation, intubation and ventilation, to allow the administration of drugs to support circulation and cardiac arrest management. During cardiac arrest with CPR in progress, the circulation time from central veins through the heart to the femoral artery is about 30 seconds, compared with 5 minutes or more when a peripheral vein is used. Ultimately, the route chosen for access will depend upon staff skills, access to the patient and available equipment.

CENTRAL IV ACCESS

Is the optimal route as it allows rapid delivery of drugs into the central circulation however central venous cannulation is associated with a variety of life-threatening complications, is a skilled technique and may not be achievable in most cardiac arrest situations.

PERIPHERAL IV ACCESS

Is therefore the choice for IV access as it is relatively fast to achieve cannulation of a large peripheral vein, and is a practiced skill for nursing staff. Lower limb veins should be avoided due to impairment of venous return. Where there are no accessible peripheral veins, the external jugular should be considered. Size 14G – 18G cannula are preferred to administer large volumes at fast rates.
IV cannulation competence is a requirement for ALS competence.

INTRAOSSEOUS (IO) ACCESS

In patients less than 6years old IO access may be used where IV access has been unsuccessful and is usually inserted into the anterior tibial bone marrow. IO use in older children and adults has been successful in the distal radius and ulnar and the proximal tibia.
In addition to the complications associated with IV access the IO route has the following additional associated complications:

- Sub-periosteal infusion
- Occlusion or needle clotting
- Osteomyelitis
- Fat emboli

SECTION: 6

DRUGS

DRUGS

The following routes for administation must be considered during cardiac arrest:

Intravenous (IV) drug administration during cardiac arrest MUST be followed immediately with:

- 20mL (minimum) normal saline flush and
- CPR for distribution of the drug.

Pulmonary drug administration via an endotracheal tube (ETT) or laryngeal mask airway (LMA) requires:

- Administration via a y-suction catheter placed beyond the tip of the ETT and
- Followed by 5 inflations to distribute the drug.

Those drugs able to be administered via this route are limited to the following:

- Adrenaline
- Atropine
- Lignocaine
- Naloxone
- Salbutamol

	ADULT	PAEDIATRIC
Dose	IV dose increased x2	IV dose increased x10
Volume for Dilution	10mL N/S or WFI	0.7mL Neonate 1-2mL Infant 2-5mL Small child 5-10mL Large child

ADRENALINE		
DESCRIPTION	Naturally occurring catecholamine with alpha and beta effects Produces positive inotropic and chronotropic effects It is administered in a cardiac arrest to cause peripheral vasoconstriction via its alpha-adrenergic action that conserves the circulating volume to the myocardium and brain It may facilitate defibrillation by improving myocardial blood flow during CPR	
INDICATIONS	Asystole Bronchospasm PEA Anaphylaxis Pulseless VT/VF not responding to initial defibrillation	
DOSE	***ADULT***	***CHILD***
	1mg	0.01mg/kg initial dose 0.1mg/kg subsequent doses
ADMINISTRATION	IV bolus Repeat every 3-5mins	IV or intraosseous bolus Repeat every 3-5mins
ADVERSE EFFECTS	Tachycardia Tachyarrhythmias Severe hypertension Hyperglycaemia Tissue necrosis with extravasation	
NOTES	Higher doses of adrenaline have not been shown to improve long term outcome	

ADENOSINE		
DESCRIPTION	Inhibition of sinus and AV node conduction To interrupt re-entry circuits involving AV node	
INDICATIONS	First-line drug for narrow complex paroxysmal SVT SVT is the most common tachyarrhthmia seen in children Adenosine is the recommended drug in the uncompromised child	
DOSE	***ADULT***	***CHILD***
	6mg	0.1 – 0.2mg/kg
ADMINISTRATION	Rapid IV bolus If no effect within 1-2mins 12mg rapid IV bolus	IV or intraosseous bolus to a maximum of 12mg
CONTRAINDICATIONS		
ADVERSE EFFECTS	Headache Chest pain Flushing Feeling of "impending doom" Excessive inhibition of AV node Usually resolve rapidly as adenosine ½ life extremely short	
NOTES	May precipitate bronchoconstriction in asthmatics. Initial dose of 3mg used for patients on beta-blockers or calcium antagonists	

AMIODRONE		
DESCRIPTION	Class III Antiarrhythmic Blocks potassium channels prolonging entire action potential Decreases sinus automaticity - slows AV conduction Increases refractory period of His-Purkinje system Has effects on sodium, potassium and calcium channels as well as alpha and beta adrenergic blocking properties	
INDICATIONS	Failure of defibrillation and adrenaline to revert VF/pulseless VT Prophylaxis of recurrent VF/VT Conscious VT, AF, Atrial flutter, SVT	
DOSE	***ADULT***	***CHILD***
	5mg/kg	5mg/kg
ADMINISTRATION	300mg in 20mL5%Glucose IV bolus over 2mins **Conscious VT, AF, SVT:** 5mg/kg in 100mL 5% Glucose over 20-30 minutes	IV bolus over 2 minutes
CONTRAINDICATIONS	Thyroid dysfunction Sinus bradycardia Sinoatrial heart block	
ADVERSE EFFECTS	Transient hypotension Bradycardia Heart block	
NOTES	ARC recommendations it is at the discretion of the Medical officer / accredited RN as to the choice of antiarrythmic administered of Lignocaine or Amiodarone	

ATROPINE		
DESCRIPTION	Anticholinergic, muscarinic receptor blocker Parasympathetic antagonist that blocks the action of the Vagal nerve on the heart Reduces the refractory period of the SA and AV node thus increases the rate of discharge and enhances conduction	
INDICATIONS	Severe bradycardia Asystole	
DOSE	***ADULT***	***CHILD***
	1mg in asystole 0.5mg increments in bradycardia	0.02mg/kg
ADMINISTRATION	IV bolus Repeated to a maximum of 3mg	IV or intraosseous bolus
CONTRAINDICATIONS	Glaucoma	
ADVERSE EFFECTS	Anticholinergic effects Dries secretions Urinary retention Dilated pupils Hyperthemia (in large doses) Delerium Excitement Tachycardia	
NOTES	Avoid large doses in coronary patient as excessive tachycardia can occur, aggravating myocardial ischaemia and/or precipitating ventricular arrhythmias	

CALCIUM		
DESCRIPTION	Electrolyte essential for normal muscle and nerve activity It transiently increases myocardial excitability and contractility and peripheral resistance Seldom indicated in the management of cardiac arrest	
INDICATIONS	Hyperkalaemia Hypocalcaemia Overdose of calcium – channel blocking drugs	
DOSE	***ADULT***	***CHILD***
	5-10mL of 10% Calcium Chloride or Calcium Gluconate	0.2ml/kg of 10% Calcium Chloride or 0.7ml/kg of Calcium Gluconate.
ADMINISTRATION	IV bolus	IV or intraosseous bolus
CONTRAINDICATIONS	N/A	
ADVERSE EFFECTS	Possible increased myocardial and cerebral injury by mediating cell death Tissue necrosis with extravasation	
NOTES	Incompatible with a range of drugs and may precipitate in IV lines	

LIGNOCAINE		
DESCRIPTION	Antiarrhythmic Sodium channel blocker; leads to a reduction in Action Potential production resulting in slowed cardiac conduction. Also produces local anaesthetic effect	
INDICATIONS	Failure of defibrillation and adrenaline to revert pulseless VT/VF Sometimes used as prophylaxis in the setting of recurrent VF/VT	
DOSE	***ADULT***	***CHILD***
	1mg/kg 0.5 mg/kg may be considered as an additional bolus	1mg/kg
ADMINISTRATION	IV bolus at rate of 25-50mcg/min	IV or intraosseous bolus
CONTRAINDICATIONS		
ADVERSE EFFECTS	Hypotension Bradycardia heart block seizures asystole slurred speech altered consciousness muscle twitching	
NOTES	ARC recommendations it is at the discretion of the Medical officer / accredited RN as to the choice of antiarrythmic administered of Lignocaine or Amiodarone	

MAGNESIUM		
DESCRIPTION	Major intracellular cation Causes smooth muscle stabilisation through inhibition of calcium channels	
INDICATIONS	Failure of defibrillation and adrenaline to revert pulseless VT/VF Torsades de Pointes Cardiac Arrest associated with digoxin toxicity, documented hypokalemia / hypomagnesaemia	
DOSE	***ADULT***	***CHILD***
	5mmol may be repeated **once**	0.05 – 0.1mmol/kg
ADMINISTRATION	IV bolus Followed by 20mmol infusion over 4 hrs	IV or intraosseous bolus Followed by 0.3mmol/kg infusion over 4 hours
CONTRAINDICATIONS	AV blocks Magnesium toxicity	
ADVERSE EFFECTS	Muscle weakness Respiratory depression /failure	
NOTES	Administer calcium gluconate 1 gram to reverse hypermagnesaemia	

POTASSIUM		
DESCRIPTION	Electrolyte essential for membrane stability.	
INDICATIONS	Persistent VF due to documented or suspected hypokalemia Hypomagnesemia Cardiac arrest associated with Digoxin toxicity	
DOSE	***ADULT***	***CHILD***
	5mmol	0.03 – 0.07mmol/kg
ADMINISTRATION	Slow IV bolus	Slow IV or intraosseous bolus
CONTRAINDICATIONS	N/A	
ADVERSE EFFECTS	Hyperkalaemia Bradycardia Hypotension Tissue necrosis with extravasation	
NOTES	N/A	

SODIUM BICARBONATE 8.4%		
DESCRIPTION	An alkalising solution which combines with hydrogen ions to form carbonic acid (a weak acid) to reverse acidosis	
INDICATIONS	Hyperkalaemia Documented metabolic acidosis (pH<7.1 or BE >-10mmol/L) Overdose of tricyclic antidepressants, salicylates, phenobarb	
DOSE	***ADULT***	***CHILD***
	1mmol/kg	1mmol/kg
ADMINISTRATION	IV bolus over 2-3 mins then as guided by arterial blood gases (usually for pH < 7.1)	IV or intraosseous bolus over 2-3 minutes then as guided by arterial blood gases (usually for pH < 7.1)
CONTRAINDICATIONS		
ADVERSE EFFECTS	Hypernatraemia and hyperosmolality Hypokalemia Paridoxical cerebral acidosis Depressed cardiac contractility Metabolic alkalosis Shifts Oxygen/ Haemoglobin curve to the left	
NOTES	Incompatible with **ALL** other drugs – requires a dedicated line In the prolonged arrest, sodium bicarbonate may be indicated after confirmation of severe acidosis (via ABG) however it is **no longer routine therapy**	

SECTION: 7

REVERSIBLE CAUSES

REVERSIBLE CAUSES

There are 8 reversible causes of cardiac arrest, known as the "4Hs and 4Ts". The following provides an overview of their diagnosis and management in ALS.

HYPOXIA

Description: Lack of oxygen to the brain and vital organs.

Diagnosis: Cyanosis, SpO_2 < 75%, PaO_2 < 70-80mmHg

Treatment: Important to exclude mechanical cause such as obstruction.
Administration of high flow, high concentration oxygen.

HYPOVOLAEMIA

Description: Lack of circulating blood or plasma volume.

Diagnosis: Obvious blood loss, history of ↑HR with associated ↓BP.

Treatment: Administration of IV fluids / blood products and control of bleeding – direct pressure on external bleeding source and emergency surgery for internal bleeding.

HYPER/HYPO – METABOLIC CONDITIONS

Description: Abnormally high or low level of electrolytes such as potassium and calcium.

Diagnosis: Confirmation on blood chemistry or arterial blood gas analysis.

Treatment: Administration of crystalloid IV fluids and electrolyte replacement (eg administration of 5mml K^+ by RN) or correction (eg administration of dextrose and insulin by MO).

HYPOTHERMIA

Description: Low core body temperature.

Diagnosis: Core temperature <35^oC

Treatment: Rewarm using administration of warmed IV fluids, heated ventilation circuit, irrigation/lavage of internal cavities (eg bladder via IDC, gastric via NGT).
Provide only CPR until temperature reaches 30^oC as defibrillation is ineffective below this hence the phrase “you’re not dead until you’re warm and dead”. http://en.wikipedia.org/wiki/Cardiac_arrest

TENSION PNEUMOTHORAX

Description: Air trapped and accumulating in the pleural cavity compressing the lung, heart and large vessels.

Diagnosis: Tracheal deviation away from the affected side, tympany on percussion of affected side, absent breath sounds on affected side, confirmation on CXR.

Treatment: Insertion of large bore needle into 2nd intercostal space, midclavicular line on the affected side by RN or MO. Immediate preparation for insertion of intercostal catheter by MO and underwater sealed drain is required.

TAMPONADE (CARDIAC)

Description: Blood/fluid trapped and accumulating in the pericardium compressing the heart.

Diagnosis: Becks triad: muffled heart sounds, elevated CVP with neck vein distension and hypotension.

Treatment: Pericardiocentesis performed by skilled MO.

TOXINS

Description: Substances ingested, injected or inhaled accidentally or as self-harm. May be caused through interactions of polypharmacy.

Diagnosis: History of ingestion / injection / inhalation. Confirmation via blood serology.

Treatment: Antidote or reversal agent of identified toxin/medication. Supportive management until toxin and definitive treatment identified.

THROMBOEMBOLISM

Description: Blood clot in coronary / pulmonary vasculature (MI / PE).

Diagnosis: History of deep vein thrombosis (DVT), cardiovascular disease and previous MI.

Treatment: MO to consider thrombolytic or surgical intervention if available.

SECTION: 8

POST RESUSCITATION CARE

POST RESUSCITATION CARE

The return of spontaneous circulation (ROSC) doesn't only indicate the success of resuscitation efforts but more likely marks the start of a long and difficult post-resuscitation phase.

In addition to the return of pulse and respiratory effort the following signs may also be noted as ROSC:

- Improvement in skin colour
- Attempts at swallowing by the patient
- Voluntary movement of limbs
- Return of consciousness

Following early and effective resuscitation from a primary cardiac arrest, the patient may recover almost immediately. Frequently however, resuscitation is prolonged and the patient remains in a state of reduced consciousness. These patients often require mechanical ventilation, invasive haemodynamic monitoring and drug therapy to support circulation.

Aims of therapy after initial resuscitation are to:

- Determine and treat the cause of the cardiac arrest
- Continue respiratory support
- Maintain cerebral perfusion
- Treat and prevent cardiac arrhythmias
- Prevent secondary damage

ASSESSMENT AFTER RESUSCITATION

History: Determine and treat the cause of the cardiac arrest. (4H's & 4T's)

- Past medical history
- Current drug therapy
- Relevant events preceding the cardiac arrest

Investigations after the arrest:

- Chest x-ray
- 12 lead ECG
- arterial blood gases
- blood chemistry
- blood glucose
- cardiac enzymes

DOCUMENTATION

Documentation of the resuscitation, as with any in-hospital event, remains the responsibility of those involved. The members of the ALS team should make an entry into the patients record that accurately reflects their involvement ie the interventions that they initiated and the patient response to those interventions.

The decision for cessation of resuscitation efforts must be made by a Medical Officer however this should occur involving discussion with the members of the resuscitation team.

Time of death is documented by the Medical Officer on the death certificate or in the patients notes should a death certificate not be able to be completed in the case of a coroners.

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ASSESSMENTS