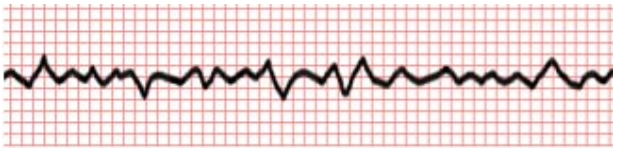
Advanced Life Support Resource Package

For Healthcare Professionals



To be revised August 2008 by the HNEAHS ALS Committee

Developed by HNEAHS ALS Committee 2007

HUNTER NEW ENGLAND
NSW HEALTH

Thank you to the Hunter New England Advanced Life Support Working Party

Editors

Karen Chronister (Acting Area Critical Care Coordinator-Southern Sector)
Jane OBrien (Area Critical Care Coordinator- Southern Sector)

Contributors

Branka Barac (Clinical Educator, University Department of Rural health)
Leanne Bradford (Nurse Unit Manage ICU, The Mater Hospital)
Karen Chronister (Acting Area Critical Care Coordinator- Southern Sector)
Maria Dolahenty (Clinical Nurse Specialist ICU, The Mater Hospital)
Jane Douglas (Registered Nurse ICU, The Mater Hospital)
Leanne Egan (Clinical Nurse Consultant (Metropolitan), Division of Emergency Medicine)
Marianne Gaul (Area Clinical Nurse Consultant, Rural Critical Care- Northern)
Alison Johnson (MET Coordinator, John Hunter Hospital)
Amanda Klabe (Clinical Nurse Specialist ICU, Armidale Hospital)
Melissa Lintott (MET Coordinator and Clinical Nurse Educator, The Mater Hospital)
Margo Nancarrow (Paediatric Nurse Educator Kaleidoscope, John Hunter Childrens Hospital)
Elizabeth Newham (Paediatric Nurse Educator Kaleidoscope, John Hunter Hospital)
Jane OBrien (Area Critical Care Coordinator- Southern Sector)
Martin Rowley (Intensive Care Specialist, John Hunter Hospital)
Serina Shaw (Clinical Nurse Educator, Emergency, Tamworth Hospital)
Fiona Smith (Clinical Nurse Educator ICU, John Hunter Hospital)
Christine Somerville (Clinical Nurse Educator, Manning Health Campus)
Liana Vandervelden (Clinical Nurse Specialist, HDU/CCU, The Maitland Hospital)
Phillip Way (Rural Critical Care CNC- Southern)
Joanne West (Acting MET Coordinator ICU, John Hunter Hospital)
Rhonda Winskill (Paediatric Rural Outreach CNC, HNE Health (Southern Sector), Northern Child Health Network)
Kane Wyborn (Clinical Nurse Consultant, Belmont Hospital)

Acknowledgements

For associated Learning Packages:

Peter Cocking (Clinical Nurse Consultant Wounds, IV, enteral and TPN)
Peter Hudson (Nurse Unit Manager, Emergency, Belmont Hospital)
Phillip Way (Rural Critical Care CNC-Southern)

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Introduction

The Advanced Life Support (ALS) package for Adults and Paediatrics has been developed in accordance with the Australian Resuscitation Council (ARC) guidelines and accredited by the Australian College of Critical Care Nurses (ACCCN). Being accredited by the ARC and ACCCN allows candidates to be placed on a national database and makes ALS certification transferable across the nation.

This will provide the theoretical component of the ALS program only. Opportunities to practice clinical skills and education days will also be available.

Reassessment of proficiency in ALS must be attended annually, by accredited assessors, to retain endorsement of ALS certification.

Definition of ALS

"Advanced Life Support is basic life support with the addition of invasive techniques eg defibrillation, advanced airway management, intravenous access and drug therapy." ARC Guidelines 11.1 February 2006

1. Lethal arrhythmia interpretation
2. Defibrillation
3. Advanced Airway Management
4. Pharmacological intervention

Aim

The aim of the ALS curriculum is to equip participants with the knowledge and practical skills necessary to perform ALS.

Objectives

The knowledge obtained from this curriculum will enable the participant to:

1. Differentiate between BLS and ALS
2. Demonstrate advanced airway management
3. Identify lethal arrhythmias and the patient management in each situation
4. Discuss ALS drugs
5. Perform defibrillation in a safe and competent manner
6. Demonstrate external pacing

Packages available

There are several self-directed learning packages available to enhance the participants understanding of ALS concepts. It would be expected that first time ALS participants complete at least the first 5 listed packages.

1. An introduction to respiratory physiology
2. Advanced Airway Management
3. Cardiac physiology
4. Basic rhythm interpretation
5. An introduction to vascular access
6. External pacing
7. Medical Officer educational components

Assessment

To be ALS certified the participant must pass both of the assessment criteria.

1. Written exam –80% pass mark
2. Clinical skills – competency based assessment

Assessors

All HNE assessors will fit specific criteria as per the HNE ALS curriculum guide. The ALS Program Coordinator for your hospital will be listed on the ALS website along with their contact details.

Outcome

As a participant you must comply with local hospital and HNE policies to find out your scope of practice regarding ALS in an emergency situation within your place of employment.

HNE ALS Webpage

The following information may be found at the HNE ALS webpage:

- BLS package
- ALS package
- Other complementary packages including respiratory physiology, advanced airway management, cardiac physiology, basic arrhythmia interpretation, vascular access, external pacing, medical officer educational components
- Names of assessors
- Dates, times and locations of ALS education days, clinical skills practice, fast track assessment, and train the trainer courses
- Links to relevant policies
- Practice exam questions

Appeals Process

If a participant does not meet the above assessment criteria they have the right to appeal to their assessor to resit the written exam or redo practical component.
If the Assessors actions are deemed to be inappropriate they can appeal to the ALS Program Coordinator. The Assessor or Program Coordinator must document all appeals or grievances. The participant should receive in writing the outcome of the appeal. The participant has the right to appeal twice.

If the participant appeals due to medical illness or compassionate reasons they must produce a medical certificate or similar evidence.

The participant is able to resit the exam up to three times and perform the practical assessment twice on the same day **if they so wish.** A reassessment must be made at a mutually agreed time.

The participant is able to request a different assessor for consequent assessments.

Note: As this is a self- directed learning package, it is expected that it is the responsibility of the participant to

- Complete learning packages (for beginners in ALS) or have prior learning
- Organise assessment by appropriate persons within your hospital
- Be aware of manual handling, OH&S and infection control protocols.

MODULE ONE
PRIORITIES OF CARE

Aim: The aim of this module is to provide an overview of the conditions that may pre-empt cardiac arrest. The participant should also learn techniques used to provide rapid patient assessment and intervention. The contents of this module are embedded into the relevant sections of the manual.

Utilising life-threatening scenarios, the participant should be able to:

1. Demonstrate a systematic method of patient assessment to identify appropriate priorities of care
2. Prioritise the care for life threatening conditions and cardiopulmonary arrest
3. Apply current algorithms for BLS and ALS as recommended by the Australian Resuscitation Council (ARC)
4. Apply standard precautions when delivering patient care.
5. Apply concepts learned in the care and management of patients with life threatening situations.

Priorities in an Emergency

It is well documented that there is an increased chance of survival in patients suffering from medical emergencies including sudden cardiac arrest if the time interval from the onset of symptoms to early defibrillation and advanced care (i.e. advanced life support) is short.

As illustrated in Policy Statement 2.1 below, the ARC promotes the rapid assessment of patients, early call for help and the commencement of basic life support prior to the commencement of ALS techniques.

In all emergency situations the rescuer must:

- Assess the situation quickly
- Ensure the safety of the rescuer, victim and bystanders
- Call for help – according to the organisations/area health service policy
- Commence appropriate treatment following the basic life support flowchart
- Where there is more than one victim, the care of the unconscious victim takes priority.

ARC Policy Guideline 2.1 Feb 2002

When calling for help, the **phone first** approach is recommended. This is because the vast majority of cardiac arrests are due to ventricular fibrillation (VF), which is treatable by defibrillation. When the time to defibrillation is short the patients' chance of a positive outcome improves significantly. (ARC Policy Statement 2.1 Feb 2002)

The 'Chain of survival' concept describes a sequence of events/interventions, which if performed rapidly could link the critically ill patient with survival. The interventions include early access, early CPR, early defibrillation, and early advanced care. Survival is unlikely where there is omission or delay in any of these essential components of the chain. Although the research is predominantly aimed at pre-hospital care of patients, the chain of survival concept is also integral to the care of critically ill patients within the hospital environment. (Cummins et al 1991 p1832, Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care: International Consensus on Science)

There are 4 crucial links in the chain of survival;

1. Early recognition and call for help

2. Early CPR
3. Early defibrillation
4. Early advanced life support and post-resuscitation care

ERC Guidelines 2005, Section 1 p S4

Early Recognition and Call for Help

This initial link of the chain relies on rapid assessment of patients and the ability to recognize the need to activate an emergency system in order to secure speedy access to advanced life support techniques. Depending on the facility this may be a Medical Emergency Team (MET) response or the traditional Cardiac Arrest call. According to the ERC, 'early involvement of the MET may reduce cardiac arrests, deaths and unanticipated admissions to ICU.'

Early CPR

The commencement of CPR immediately after the patients collapse can result in an improved outcome for the patient.

Early Defibrillation

The use of defibrillation to re-establish normal heart rhythm has been described as the most important link in the chain of survival. 'CPR plus defibrillation within 3-5minutes of collapse can produce survival rates as high as 49-75%.'

Early Advanced Life Support and Post-Resuscitation Care

CPR and defibrillation alone will often not be adequate to fully resuscitate a patient. Advanced Life Support techniques such as endotracheal intubation, ventilation and drug therapy will routinely be necessary throughout and after initial resuscitation.
(ERC Guidelines 2005, Section 1, Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care: International Consensus on Science, Cummins et al 1991 p1832)

Basic Life Support

As timely and effective application of BLS techniques is the fundamental basis of the concept of advanced life support, it is worthwhile revising Basic Life Support definition and flowchart.

DEFINITION

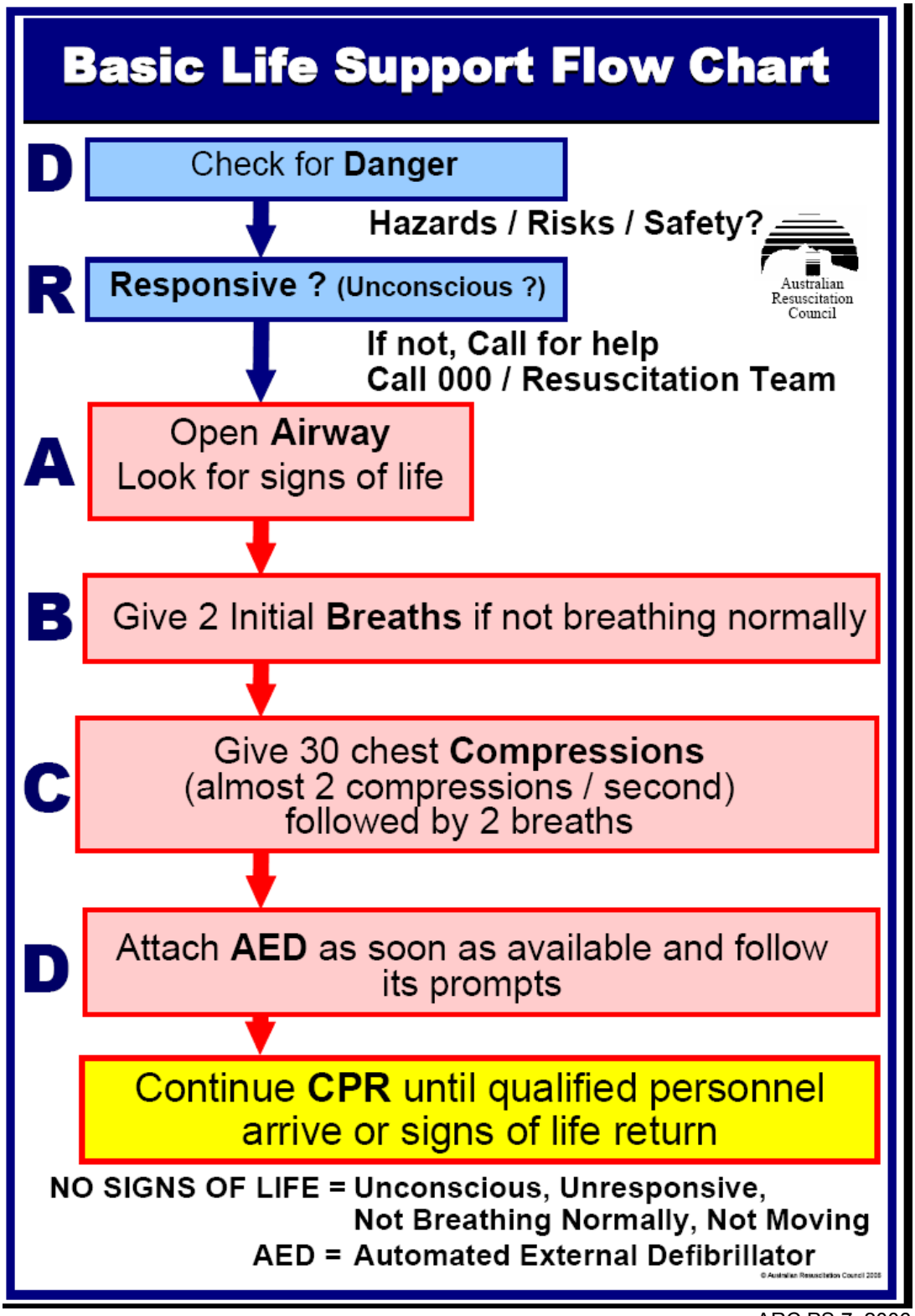
Basic Life Support (BLS) is the preservation of life by the initial establishment of and/or maintenance of airway, breathing, circulation and emergency care. Adjunctive equipment is not necessary. BLS is only a temporary measure to maintain normal ventilation and circulation. The purpose of BLS is to maintain myocardial and cerebral oxygenation until defibrillation; ALS personnel and equipment are available.

- Effective BLS may actually increase the likelihood of successful defibrillation
- Effective BLS buys time until reversible causes can be diagnosed and/or treated (ARC PS 11.1 2006, ARC Glossary 2006)

The BLS flowchart uses the **DRABCD** mnemonic to identify the sequence of interventions for initial resuscitation.

D Check for danger (hazards/risks/safety)
R Check for response (unresponsive/unconscious)
A Opening the airway (Look for sign of life, call 000/resuscitation team)
B Give rescue breathing (give 2 rescue breaths if not breathing normally)
C Give 30 chest compressions (almost 2 compressions/second) followed by 2 breaths
D Attach an AED/SAED (automatic external defibrillator) if available and follow the prompts

When providing 30 compressions (at approximately 100/minute) and giving 2 breaths (each given over 1 second per inspiration), this should result in the delivery of 5 cycles in approximately 2 minutes. (ARC PS 7, 2006)


Basic Life Support Flow Chart
D
Check for Danger
Hazards / Risks / Safety?
R
Responsive ? (Unconscious ?)
Australian Resuscitation Council
If not, Call for help
Call 000 / Resuscitation Team
A
Open Airway
Look for signs of life
B
Give 2 Initial Breaths if not breathing normally
C
Give 30 chest Compressions
(almost 2 compressions / second)
followed by 2 breaths
D
Attach AED as soon as available and follow its prompts
Continue CPR until qualified personnel arrive or signs of life return
NO SIGNS OF LIFE = Unconscious, Unresponsive, Not Breathing Normally, Not Moving
AED = Automated External Defibrillator

ARC PS 7, 2006

Adult Advanced Life Support

DEFINITION

Advanced Life Support (ALS) is basic life support with the addition of invasive techniques e.g. defibrillation, advanced airway management, intravenous access and drug therapy. (ARC PS 11.1, 2006)

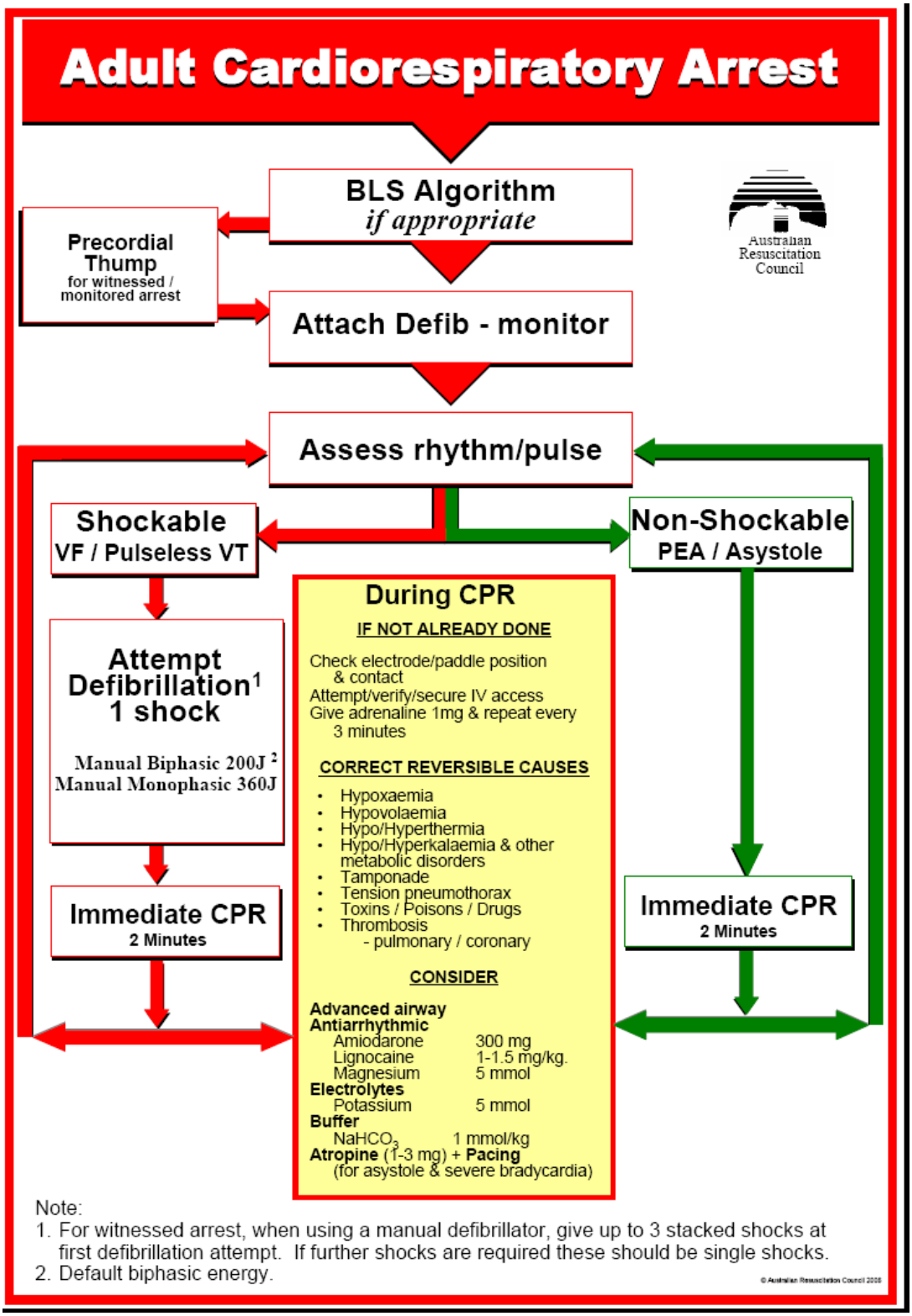
The ARC ALS flowchart illustrates the sequence of actions to be undertaken once equipment and drugs are available. The algorithm is based on the following considerations:

1. The pre-eminent importance of early defibrillation in achieving successful outcomes
2. Automated External Defibrillators (AEDs) can accurately diagnose cardiac rhythms and separate them into 2 groups
    a) Shockable - those responsive to defibrillation
    b) Non-shockable - those NOT responsive to defibrillation
3. There are interventions which are indicated in all causes of cardiac arrest
4. There is a group of potentially reversible conditions which if left untreated, may cause cardiac arrest or prevent resuscitation

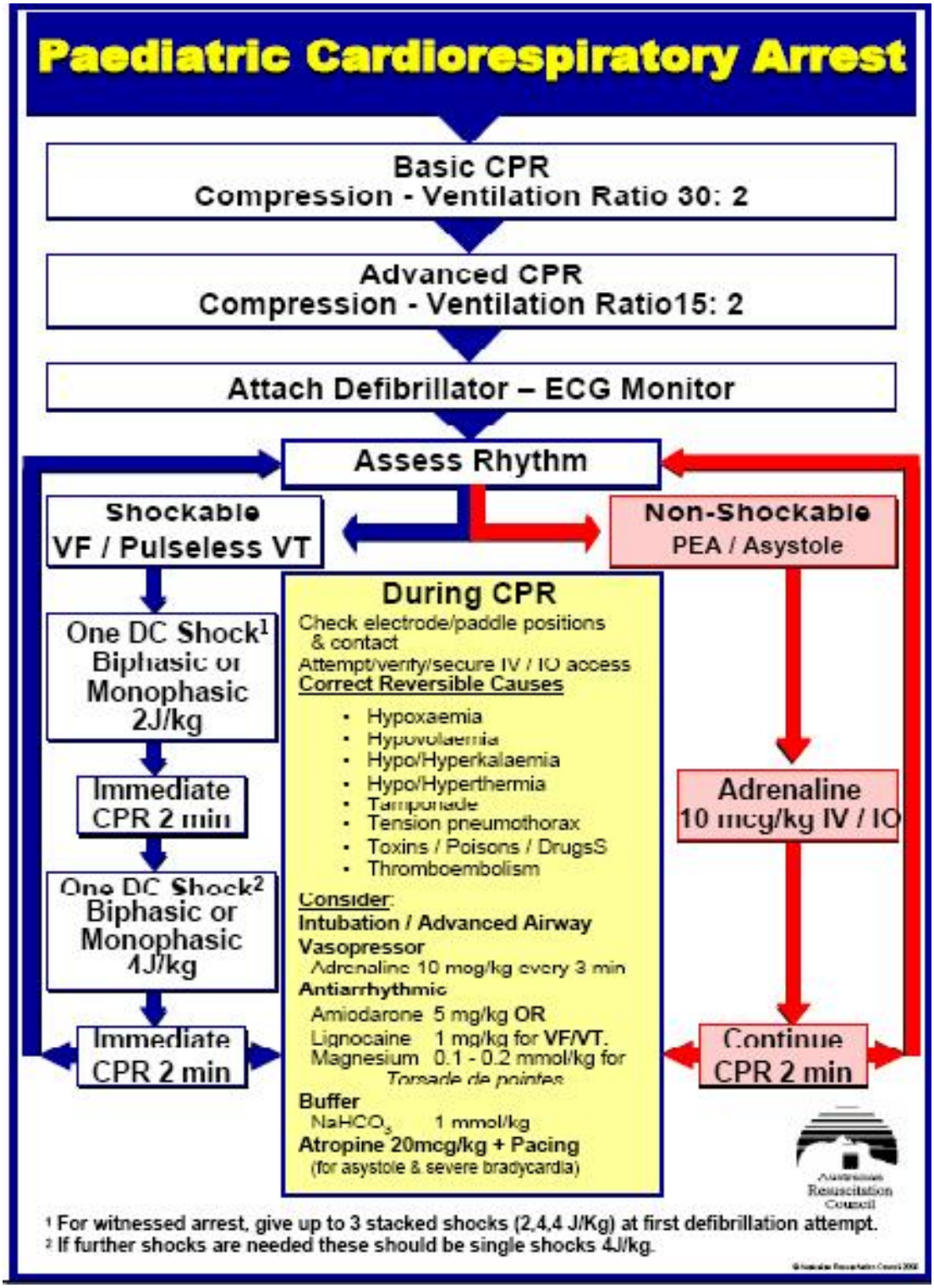
(ARC PS 11.2, 2006)

The ARC ALS algorithm has been designed as a simple visual aid, which details a pre-constructed action plan of interventions for the patient suffering from a suspected cardiac arrest. The simplicity of the algorithm is derived from separating cardiac rhythms associated with cardiac arrest into 2 distinct groups, either shockable or non-shockable. Once the patients' rhythm is identified it is as simple as following the appropriate side of the algorithm, left for shockable and right for non-shockable. The simpler the algorithm to remember the more likely it is that is will be used. (Varon et al, 2002, Kloeck et al 1997)

The Adult Advanced Life Support Algorithm



ARC PS 11.2, 2006


Paediatric Cardiorespiratory Arrest
Basic CPR
Compression - Ventilation Ratio 30: 2
Advanced CPR
Compression - Ventilation Ratio15: 2
Attach Defibrillator – ECG Monitor
Assess Rhythm
Shockable
VF / Pulseless VT
Non-Shockable
PEA / Asystole
One DC Shock[1]
Biphasic or
Monophasic
2J/kg
Immediate
CPR 2 min
One DC Shock[2]
Biphasic or
Monophasic
4J/kg
Immediate
CPR 2 min
During CPR
Check electrode/paddle positions
& contact
Attempt/verify/secure IV / IO access
Correct Reversible Causes
Hypoxaemia
Hypovolaemia
Hypo/Hyperkalaemia
Hypo/Hyperthermia
Tamponade
Tension pneumothorax
Toxins / Poisons / DrugsS
Thromboembolism
Consider:
Intubation / Advanced Airway
Vasopressor
Adrenaline 10 mcg/kg every 3 min
Antiarrhythmic
Amiodarone 5 mg/kg OR
Lignocaine 1 mg/kg for VF/VT.
Magnesium 0.1 - 0.2 mmol/kg for
Torsade de pointes
Buffer
NaHCO3 1 mmol/kg
Atropine 20mcg/kg + Pacing
(for asystole & severe bradycardia)
Adrenaline
10 mcg/kg IV / IO
Continue
CPR 2 min
Resuscitation
Council
[1] For witnessed arrest, give up to 3 stacked shocks (2,4,4 J/Kg) at first defibrillation attempt.
[2] If further shocks are needed these should be single shocks 4J/kg.

Basic Life Support

The first and most important step in the ALS algorithm is basic life support measures, which may include CPR. It is important to remember that once the MET/arrest team arrives to commence ALS techniques, basic life support measures must not stop. Prompt and effective BLS combined with early defibrillation are associated with improved survival after cardiac arrest. At this point resuscitation will appear more as a continuum rather than BLS and ALS.
(ARC PS 11.2, p1, 2006) (ERC Guidelines for Resuscitation 2005, Section 4, S42)

Precordial Thump

It is only administered in a monitored arrest where VT/VF is the rhythm and immediate defibrillation is unavailable. (ARC PS 11.2, p2, 2006). **Paediatrics:** may only be indicated for older children.

Attach Defibrillator/Monitor

If an AED/SAED is available attach the pads to the patient. If only a manual defibrillator is available attach the leads to the patient and turn on the defibrillator, the patients rhythm (lead ll) will be displayed on the defibrillators monitor. **Paediatrics:** In infants less than 1 year of age there is insufficient evidence to recommend for or against the use of AEDs/SAEDs.
(ARC PS 11.2, p2, 2006)

Assess Rhythm/Pulse

If an AED/SAED is utilized the machine will analyse the patients rhythm, if a manual defibrillator is used the operator must diagnose the rhythm.
(ARC PS 11.2, p2, 2006)

Shockable Rhythm – Pulseless VT/VF (Follow the left side of algorithm)

VF is the most common rhythm in adult cardiac arrest, which may have been preceded by a period of VT or SVT. Both pulseless VT and VF produce no cardiac output. As defibrillation is the treatment for both rhythms it should occur without delay either using an AED/SAED or manual defibrillator. Deliver 1 shock ONLY. Chest compressions should stop only long enough to deliver the shock and must continue immediately afterwards for 2 minutes regardless of the patients rhythm.
If the patient has suffered a witnessed monitored arrest where pulseless VT/VF is the rhythm, a stacked shock regime should be administered. In this case the paddles/pads should remain on the patients chest, the defibrillator recharged and the rhythm checked between shocks. If pulseless VT/VF persists rapidly repeat the shock. A maximum of 3 shocks can be delivered using this stacked regime. If further shocks are required they should be delivered as single shocks with 2 minutes of CPR afterwards. (ARC PS 11.2, p2, 2006, ERC Guidelines for Resuscitation 2005, Section 4, S45)

Non-Shockable Rhythms – Non VT/VF (follow the right side of the algorithm)

Defibrillation is not indicated in Pulseless Electrical Activity (PEA) (also known as Electromechanical Disassociation (EMD)) and asystole. Treatment for both rhythms is immediate CPR whilst reversible causes can be treated. The prognosis for patients suffering PEA or asystole is poor. CPR and ALS techniques (intubation/ventilation, IV access, drugs, pacing) are implemented while reversible cause is sought. (ARC PS 11.2, p3, 2006) (ERC Guidelines for Resuscitation 2005, Section 4, S48). **Paediatrics:** Asystole is the most common non-shockable rhythm.

Immediate CPR

While defibrillation is the treatment of choice for pulseless VT/VF, a period of effective CPR will increase oxygen stores in the myocardium potentially increasing the success of subsequent defibrillation and maintain cerebral viability. CPR must continue during ALS interventions and always for 2 minutes after unsuccessful defibrillation. Interruptions to CPR should be kept to a minimum; this includes time spent to reassess rhythm and pulse (ARC PS 11.2, p3, 2006) (ERC Guidelines for Resuscitation 2005, Section 4, S46)

During CPR

- Look for reversible causes
- Minimise interruptions to CPR and ALS interventions
- Attempts to secure the airway should not interrupt CPR for more than 20 seconds
- IV/ (I/O) intraosseous access should be obtained where possible
- Adrenaline should be administered every 3 minutes
- Other drugs and electrolytes should be administered as indicated

ARC PS 11.2, p3, 2006

Correct Reversible Causes

The 4 H's and 4 T's are a memory aid to the possible causes of cardiac arrest and barriers to resuscitation. These conditions should be sought and if found corrected.

- Hypoxaemia
- Hypovolaemia
- Hypo/Hyperthermia
- Hypo/Hyperkalemia and metabolic disorders
- Tamponade
- Tension Pneumothorax
- Toxins/poisons/drugs
- Thrombosis – pulmonary, coronary

ARC PS 11.2, p4, 2006, ERC Guidelines for Resuscitation 2005, Section 4, S49

Occupational Health and Safety and Advanced Life Support

'The maintenance of occupational health and safety standards depends on the actions of all individuals in a workplace. Duties of care for workers and third parties are shared by everyone whose actions could affect their health and safety.

- Employers must provide safe and healthy workplaces and safe systems of work;
- Employees must work in as safe a manner as possible
- Suppliers, designers and manufacturers must provide safe products and accurate information about the safe use of materials and equipment.'

National Occupational Health and Safety Commission, National OH&S Strategy 2002-2012

Resuscitation of those suffering life threatening emergencies is frequently complex and often appears chaotic. Many advanced life support techniques utilised are invasive and have the potential to cause harm to staff and patients. Examples of some potential hazards during advanced life support include:

- Needle stick injuries
- Back injuries
- Electrical injuries
- Cross infection (HIV, Hep B, TB, SARS)

Whilst performing any form of resuscitation the operator must always be vigilant in assessing risk. Always:

- Check that there is no hazard to you, the patient, your colleagues or relatives during resuscitation
- Maintain the use of personal protective equipment
- Adhere to your facilities/area occupational health and safety and Infection Control Policy.

Throughout this manual potential OH&S and Infection Control issues will be addressed within each module as they arise.

References

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MODULE TWO
CARDIOVASCULAR SYSTEM

The cardiovascular system is divided into five sections and reviews anatomy and physiology, electrophysiology, cardiac monitoring, arrhythmias and electrical therapy.

Section I: Anatomy and physiology of the cardiovascular system.

Refer to cardiac physiology package

Aim: This section reviews the anatomy and physiology of the cardiovascular system.

The participant should be able to:

1. Outline the major anatomical components of the cardiovascular system
2. Discuss the normal physiological function and control of the cardiovascular system
3. Outline the haemodynamics of the cardiovascular system
4. Outline the specific tissue types found in the cardiovascular system
5. Describe the role of the cardiovascular system in maintaining homeostasis
6. Apply concepts learned in the care and management of patients with life threatening situations.

Section II: Principles of electrophysiology. Refer to cardiac physiology package

Aim: The aim of this section is to develop an understanding of the principles of electrophysiology as a prerequisite to recognising potential life threatening arrhythmias.

The participant should be able to:

1. Distinguish between electrical pacemaker cells and mechanical contractile cells
2. Describe the key electrophysiological properties of myocardial cells
3. Outline factors which may alter the electrical conduction and subsequent myocardial contraction
4. Describe the electrical basis of cardiac function and outline the major components of the conduction system
5. Describe the action potential of a myocardial cell and discuss the interaction of pharmacology on this action potential
6. Apply concepts learned in the care and management of patients with life threatening situations.

Section III: Cardiac monitoring

Aim: The aim of this section is to develop the skills of cardiac monitoring and the management of common monitoring problems.

The participant should be able to:

1. Discuss the options available to the healthcare professional when establishing cardiac monitoring in the arrested patient
2. Discuss the problems associated with “paddle” monitoring and outline how these can be minimised
3. Describe the anatomical landmarks used for cardiac monitoring
4. Discuss the rationale for continuous cardiac monitoring in Lead II
5. Apply concepts learned in the care and management of patients with life threatening situations

Section IV: Rhythm interpretation. Refer to Rhythm Interpretation Package

Aim: The aim of this section is to assist the participant to develop skills in rhythm analysis and their cognition of lethal and non-lethal rhythms.

The participant should be able to:

1. Outline the common causes of arrhythmias
2. Describe the characteristics of arrhythmias originating from elsewhere in the myocardium
3. Outline the fundamental electrophysiological characteristics of lethal and non-lethal rhythms
4. Describe the appropriate management of the lethal rhythms
5. Apply concepts learned in the care and management of patients with life threatening situations

Section V: Defibrillation

Aim: the aim of this module is to provide the participant with an understanding of defibrillation, the safety factors associated with its use and its importance in the management of cardiac arrest.

The participant should be able to:

1. Describe the physiological effects of defibrillation/synchronised cardioversion
2. Discuss indications for electrical therapy
3. Differentiate between monophasic and biphasic defibrillators
4. Explain the difference between automatic and semi-automatic external defibrillators
5. Describe the ARC policies in relation to electrical therapy
6. Describe the role of the clinician in electrical therapy
7. Discuss the safety issues in relations to electrical therapy
8. Discuss the indications for emergency cardiac pacing
9. Discuss the electrical therapy in relation to children
10. Apply concepts learned in the care and management of patents with life threatening situations

Cardiac Monitoring:

Section III

Cardiac monitoring in the arrested patient:

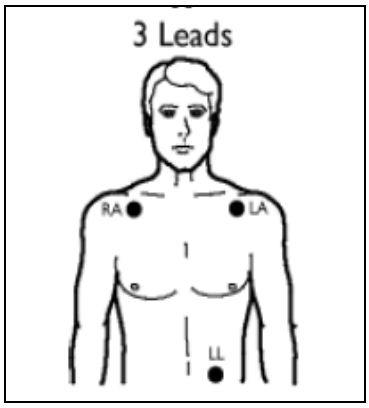
The early initiation of cardiac monitoring to allow for rhythm interpretation and treatment decisions is crucial in the advanced life support situation. The quickest way to do this is dependent on the equipment you have at hand and your experience with using it. Basically you have two options

Three lead monitoring.

This is the most traditional form of monitoring.

Position the 3 leads on your patient's chest as follows, taking care to avoid areas where muscle movement could interfere with transmission:

- **WHITE**
  - RA (right arm), just below the right clavicle
- **BLACK**
  - LA (left arm), just below the left clavicle
- **RED**
  - LL (left leg), on the lower chest, just above and left of the umbilicus.



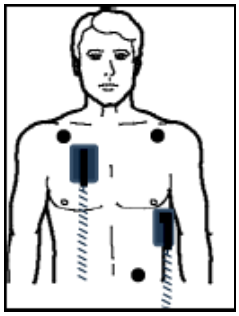
Three lead monitoring should always be used in the arrested patient as it will provide constant information in relation to rhythm and will facilitate decision-making. Lead II is the preferred monitoring lead as it lies in a direct plane with the normal electrical axis of the heart. As a result lead II will generally provide the PQRS complex, which has the largest amplitude - this facilitates rhythm analysis.
The use and institution of three lead monitoring also allows the clinicians the ability to switch between leads I, II and III, which can be useful and essential in the correct determination of asystole and for the differential diagnosis of other rhythms

Via the paddles/pads

To facilitate fast reaction in an emergency situation, you can “take a quick look” at the patient’s rhythm using the paddles/pads. This is particularly useful if you suspect that the patient will require immediate defibrillation.

To apply the paddles/pads to the patient:

1. Place the left (sternum) paddle/pad to the right of the patient’s sternum, just below the clavicle (see the following figure).
2. Ensure that the defibrillator is monitoring in ‘paddles’ not ‘ECG’
3. Place the right (apex) paddle/pad on the patient’s chest wall, mid-axillary at the 5^{th} or 6^{th} intercostal spaces.
4. Press the paddles/pads firmly against the patient’s skin to maximize electrode contact



BASIC RHYTHM INTERPRETATION: Section IV- refer to Basic Rhythm Interpretation hyperlink

Paediatric Considerations

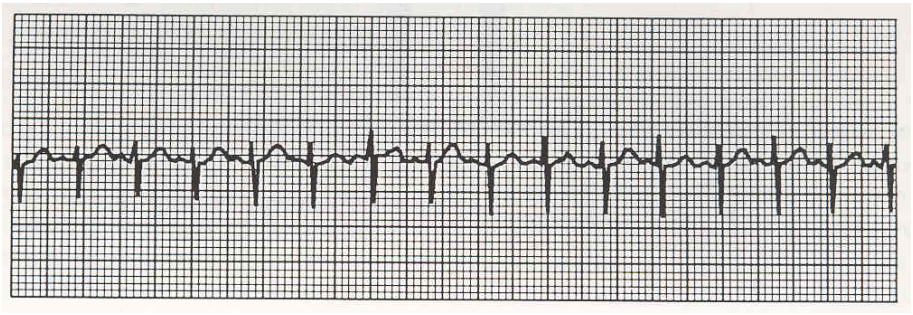
When considering arrhythmia assessment in infants and children the same simple criteria needs to be considered. Ask yourself:

1. Is the child clinically stable or shocked?
2. Is the rate to fast or too slow for this child?
3. Is the rhythm regular or irregular?
4. Are the QRS complexes narrow or broad?

Remember that any arrhythmia seen in the adult patient can also occur in the paediatric patient. However the most common arrhythmias seen in children are different from those seen in adults. In children the most common arrhythmias are: supraventricular tachycardia, bradycardia and sinus arrhythmia.

Sinus Tachycardia in the Paediatric Patient

Rate	Can be as high as 220 beats per minute in an infant
Rhythm	Regular
P Waves	Normal. Only one before each QRS
PR interval	Normal
QRS duration	Normal



Management

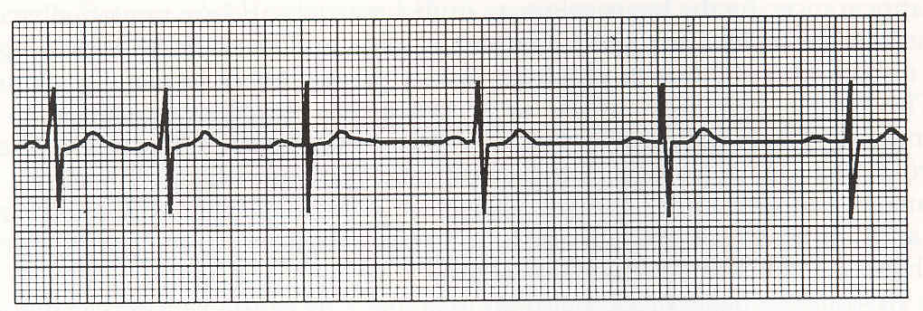
Reassess ABC
Consider causes: hypoxia, shock, (sinus tachycardia is a normal cardiac response to an increased in oxygen demand or a compromise in cardiac output and systemic perfusion.)

The management of sinus tachycardia is treatment of the underlying cause.

- **Deliver high flow oxygen and/or bag-mask ventilation**
- Volume expansion 20ml/kg of 0.9% normal saline IV/IO
- Reassess

Sinus Bradycardia in the Paediatric Patient

Rate	A sinus rate that is below normal for age, for example: below 100 beats per minute in newborns, 80 beat per minute in infants and 60 beats per minute in older children
Rhythm	Regular
P Waves	Normal. Only one before each QRS
PR interval	Normal
QRS duration	Normal



Management

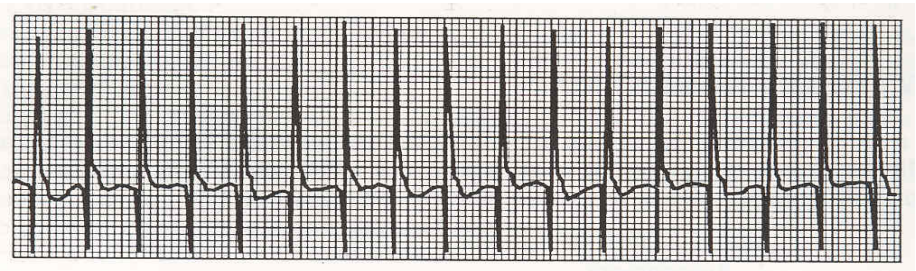
Reassess ABC

Consider causes: hypoxia, shock, raised ICP, vagal stimulation

- **Deliver high flow oxygen and/or bag-mask ventilation**
- Volume expansion 20ml/kg of 0.9% normal saline IV/IO
- If ineffective give Adrenaline10 micrograms/kg IV/IO
- For vagal stimulation, ensure adequate ventilation, give atropine 20microgams/kg IV/IO

Supraventricular Tachycardia in the Paediatric Patient

Rate	Over 220 beats per minute and often up to 300 beat per minute in an infant, usually less in children, approximately 180 beats per minute
Rhythm	Regular QRS
P Waves	Once the heart rate exceeds 200 beats per minute usually not distinguishable
PR interval	not measurable
QRS duration	Normal



Management

Reassess ABC

Not Shocked: Attempt vagal stimulation; in infants and young children elicit the 'diving reflex' (this can be achieved by applying to the face a plastic bag filled with iced water) or one-sided carotid sinus massage. In older children ask them to perform a Valsalva manoeuvre – ie; blowing hard through a narrow straw.

If these manoeuvres are unsuccessful give a bolus of Adenosine 50 micrograms/kg IV/IO as a starting dose. The dose of Adenosine can be increased to 100micrograms/kg after 2 minutes if success is not achieved.

If severe hypotension or pulselessness occurs, synchronized DC shock should be given: dose = 0.5-1.0J/kg.

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Defibrillation:

SECTION V

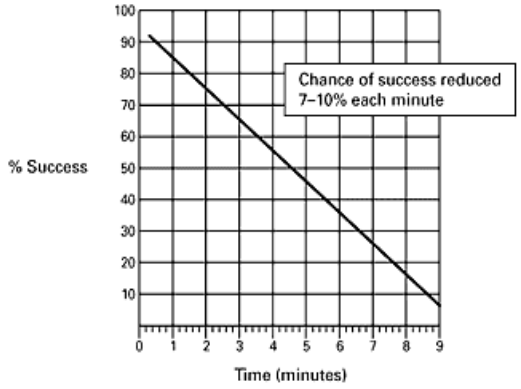
Introduction

Early defibrillation, within three (3) minutes of the arrest, provides the best possible chance of survival in adult patients with ventricular fibrillation (VF), the most common rhythm at the time of cardiac arrest, or pulseless ventricular tachycardia (VT).

This rapid depolarisation may enable the sinus node, the heart's intrinsic pacemaker, to take over and facilitate the resumption of organised electrical activity (ARC 2002:1; Cook 2003:44). During defibrillation the electric current discharges without regard to the cardiac cycle, i.e. at a random point in the cardiac cycle. The amount of electric current, which penetrates the chest wall, may vary depending on the type of defibrillator used. Both monophasic and biphasic defibrillators are available to perform defibrillation.

Timing of Defibrillation

The rapidity at which defibrillation is instituted is the ***major determinant of survival*** in the arrested person, secondary to ventricular fibrillation. For every minute defibrillation is delayed, in a person with VF or pulseless VT, the chance of survival is reduced by 7-10%.



The likelihood of defibrillation success decreases with time.

Indications for Defibrillation

Defibrillation shock is indicated for treating:

- Ventricular fibrillation.
- Pulseless ventricular tachycardia.

Note*:* If there is doubt about whether the rhythm is asystole or fine VF defibrillation ***is not recommended***, because it is unlikely to result in a perfusing rhythm, instead chest compressions and ventilation must be continued (Jevon, 2006:25).

Monophasic and Biphasic Defibrillators

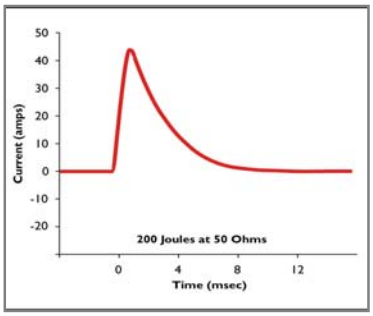
Defibrillators deliver electrical energy in waveforms to the heart. Waveforms describe the electrical pulse (the current delivery, time in seconds and the direction of current

flow) through a critical myocardial mass. Energy levels vary with the type of the defibrillator and waveform being used.
There are basically two types of defibrillators currently in use, which are categorised by waveform: **monophasic** and **biphasic.**

Monophasic Defibrillators

- Waveforms deliver the electrical current in one direction only i.e. a single pulse of electricity travels in one direction from one the defibrillation pad / paddle to the other.
- Monophasic defibrillators require high electrical energy and current, and therefore increase the risk of myocardial dysfunction post procedure as well as causing burns to the patient's external chest wall (ILCOR 2000:109).
- There are two main types of monophasic waveforms, with the monophasic damped sinusoidal (MDS) waveform being the most common, in which the current gradually returns to zero and the monophasic truncated exponential (MTE) where the current terminates before it reaches zero (ERC 2005a:S30).

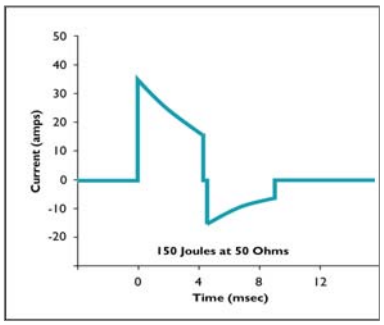
Monophasic damped sinusoidal (MDS)



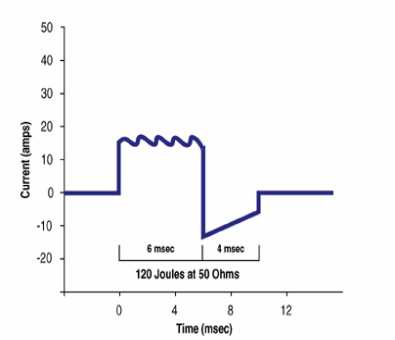
Biphasic Defibrillators

- Biphasic defibrillators use different waveform technology from the monophasic defibrillators, delivering lower energy shocks in comparison to the high-level energy shocks from monophasic defibrillators.
- Deliver current that flows in a positive direction for a specified duration, and then the current are reversed in a negative direction for the remaining milliseconds of electrical discharge (ERC 2005a:S30).
- There are two types of biphasic waveform: the first generation biphasic truncated exponential (BTE) and the rectilinear biphasic (RLB) which are specifically designed for external defibrillation.
- Biphasic defibrillators compensate for the wide variations in transthoracic impedance by electronically adjusting the waveform magnitude and duration (ERC 2005a:S30).

Biphasic Truncated Exponential



Rectilinear Biphasic



There are three key benefits from using biphasic defibrillators:

1. Less myocardial dysfunction following defibrillation.
2. Lower risk of skin burns (Amato-Vealey & Colonies 2005:6).
3. Less number of defibrillatory shocks required.

Biphasic waveform shocks are safe and effective for the termination of VF when compared with monophasic waveform shocks.
Either monophasic or biphasic waveforms can be used.

ARC 2006a: 11.5, 1

Automated External Defibrillators

Automated external defibrillators (AEDs) are portable, sophisticated, reliable and safe computerised devices that delivery defibrillatory shocks to patients in cardiac arrest. They use voice and / or visual prompts to guide the operator / rescuer to safely attempt defibrillation (RCUK 2005a: 23). They are suitable for use by both lay rescuers and healthcare professionals.

There are two types of AEDs: semi-automated (SAED) and fully automated (AED). The SAED are the most commonly used. AEDs deliver the shock, where indicated, without further assistance from the operator. In both types of automated external defibrillators (AEDs), the operator is required to identify that the victim is in cardiac arrest and then apply two adhesive electrodes, defibrillation pads, to the victim's chest.

AEDs can accurately diagnose cardiac rhythms and separate them into two groups:

1. 'Shockable' - those responsive to defibrillation.
2. 'Non-shockable' - those unresponsive to defibrillation.

The defibrillation pads have a dual function: recording an electrocardiogram (ECG) and delivering an electrical shock where indicated. Interpretation of the cardiac rhythm is done automatically using sophisticated electronic algorithm. If VF / VT is detected the defibrillator automatically charges to a predetermined energy level; and then advises the operator to deliver the shock through voice and/or written prompts. If a non-shockable rhythm is detected, such as asystole, the defibrillator will inform the operator

that no shock is advised and to commence CPR if no pulse is present (Liddle et al 2003:1216).

All AEDs analyse the victim's cardiac rhythm, determine the need for an electrical shock and deliver the shock where indicated. In the case of the SAED, the device advises the operator when to deliver the shock through voice and visual prompts. Some SAEDs have the capacity to allow the operator, usually a healthcare professional, to override the defibrillator and deliver the electrical shock manually, independently of any prompts from the defibrillator (RCUK 2005a: 23).

Semi-Automated External Defibrillators (SAEDs) are available in both monophasic and biphasic waveforms, although manufacturers are now only releasing SAEDs with biphasic waveforms.

Training in the use of the SAED is considered by many authorities to be an essential skill that should be taught in Basic Life Support (BLS) courses.

Defibrillation Precautions

- Be aware of electrical hazards in the presence of water, metal fixtures, oxygen and flammable substances (ARC 2006a, 11.5, 6) for the victim, rescuer and bystanders / team members.
- Warning of an impending electrical discharge is essential by clearly and loudly calling out the 'stand clear' command.
- **Avoid** charging paddles unless they are placed on the victim's chest.
- **Avoid** placing defibrillator pads/paddles over ECG electrodes (risk of burns or sparks); ECG leads (may melt); medication patches (may reduce effectiveness of shock), an implantable device eg. pacemaker (may damage implantable device); 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** having the victim in contact with metal fixtures eg. bed rails (risk of burns).
- **Avoid** delivering the shock with a gap between the paddle/pad and chest wall (spark hazard).
- **Avoid** defibrillating if victim, operator and/or close bystander are situated in an explosive / inflammable (eg. petrol) environment.
- **Avoid** allowing oxygen from a resuscitator to flow onto the victim's chest during delivery of the shock (risk of fire) (ARC 2006a, 11.5, 6).

Note: Body jewellery that cannot be removed from the front of the chest will need to be left in place (and may cause minor skin burns) (Liddle et al 2003:1218).

Recommended Energy Levels FOR DEFIBRILLATION

Whether using a manual external defibrillator (MED) or a semi-automated external defibrillator SAED) the following energy levels are recommended:

MONOPHASIC Energy level for ***adults*** should be set at maximum (usually 360 joules) for all shocks.

BIPHASIC Energy level for ***adults*** should be set at 200 joules for all shocks unless there is relevant clinical data for the specific defibrillator that suggests that an alternative energy level provides adequate shock success (eg. > 90%) (ARC 2006a, 11.5, 4).

Recommended Defibrillation Shock Protocol

The Australian Resuscitation Council (ARC) recommends that a ***single shock*** (360 joules monophasic; or 200 joules biphasic) strategy is used in patients / victims in an ***unwitnessed*** cardiac arrest requiring defibrillation for VF or pulseless VT. When using this strategy, CPR should be resumed immediately following defibrillation the single shock delivery and CPR interruptions minimised (ARC 2006a, 11.5, 4-5).

A 3 stacked-shock delivery is recommended in cases where the occurrence of the cardiac arrest (VF or pulseless VT) is ***witnessed*** by the rescuer, and a defibrillator is ***immediately*** available. Up to 3 shocks (360 joules monophasic; or 200 joules biphasic) may be delivered during the first defibrillation attempt (ARC 2006a, 11.5, 5). In general stacked shocks can only be administered using a manual external defibrillator (MED) as most AEDs will be programmed to deliver a single shock (ARC 2006c, 11.2, 2).

Interruptions to CPR should be minimised and resumed after the third shock is indicated. If further shocks are indicated a ***single*** shock strategy is recommended (ARC 2006a, 11.5, 5).

Defibrillation Pads (Electrodes) versus Paddles

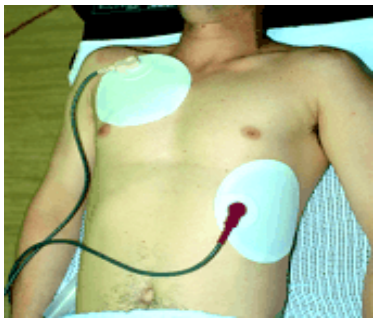
Self-adhesive defibrillation pads are safe and effective; and are an acceptable alternative to standard defibrillation paddles (ARC 2006a: 11.5, 3). They enable the operator to perform 'hands-free' defibrillation i.e. the operator is a safe distance rather than leaning over the patient as occurs with paddles. Manual external defibrillators may use either paddles or self-adhesive pads, whilst most SAEDs now only use self-adhesive pads (ERC 2005a: 3).

If paddles are used, the application of firm pressure and conductive gel pads are recommended for maximum electrical contact. Whether pads or paddles are used, care should be taken to follow the manufacturer's instructions; and are not in electrical contact with each other (ARC 2006a: 11.5, 3).

Recommended Pad or Paddle Placement

- One pad / paddle is placed in the right parasternal area over the second intercostal space.
- The other pad / paddle is placed on the midaxillary line over the sixth left intercostal space (ARC 2006a: 11.5, 2).

Note: The pad / paddle should be clear of any breast tissue. It is important that this electrode is placed sufficiently laterally (RCUK 2005b: 7).

Position of Pads / Electrodes 

Confirmation of Shock Delivery

Following delivery of the shock, the rescuer should check for:

- A motor response in the victim indicating delivery of the electrical charge (if there is no motor response consider: synchronised cardioversion mode inadvertently selected, flat defibrillator battery, lead fracture, electrical charge dumped.
- Evidence of shock delivery on the electrocardiogram (ECG) (ARC 2006a, 11.5, 7).

Failure of Defibrillation Attempts to Successfully Convert Rhythm

If initial defibrillation is unsuccessful:

- Recommence CPR with oxygen.
- Check paddle or pad position.
- Check for adequate skin contact (clipping excessive body hair under defibrillation pad / paddle may be required).
- Consider changing the defibrillation pads.
- Consider anterior-posterior pad/paddle placement, so that the maximum amount of current transverses the myocardium (ARC 2006a, 11.5, 7)

Special Considerations in Paediatric Patients

Correct Pad or Paddle Usage

Correct pad / paddle selection:
Infants: pad / paddles of 4.5 cm diameter are suitable
Small children: pad / paddles of 8.0 cm diameter are suitable

Most defibrillators are supplied with adult defibrillator pad / paddles, which are 13cm in diameter. Smaller pad / paddles are necessary for infants and small children to prevent physical contact between pad/paddles on the chest and to optimise full skin contact.

Correct Pad or Paddle Placement

There are two choices for pad / paddle placement:

1. Standard anterolateral placement (as in adults) ***or***
2. Anteroposterior placement.

The anteroposterior placement is needed if the pads / paddles available are too large and there is risk of charge arcing between the pads / paddles. In this case one pad / paddle is placed on the upper back, below the left scapula and the other is located on the chest to the left of the sternum.

Correct Pad / Paddle Contact

Conductive gel and / or appropriate sized pads should be confined to the area underneath the paddles and not permitted to touch each other to avoid bridging and ineffective delivery.

Correct Paediatric Energy Selection

The ideal energy dose for safe and effective paediatric defibrillation is unknown.
DC shock is the same with both monophasic and biphasic defibrillators in infants and children.

Rhythm	**Energy dose 1st shock**	**Energy dose subsequent shocks**
Ventricular Tachycardia (VT)	Unsynchronised 2 Joules/kg	Unsynchronised 4 Joules/kg
Pulseless VT	Unsynchronised 2 Joules/kg	Unsynchronised 4 Joules/kg
Supraventricular Tachycardia (SVT)	Synchronised 0.5- 1.0 Joules/kg	

Semi-Automated External Defibrillation - Paediatric Patients

A semi-automated external defibrillator (SAED) may be used for children provided it is able to differentiate shockable from non-shockable rapid paediatric rhythms (ARC 2006:12.6, 6)

In infants less than one (1) year of age there is insufficient evidence to recommend for or against the use of AEDs.

For children 1-8 years of age an AED capable of delivering a reduced dose (50-75 Joules) is satisfactory. In children greater than eight (8) years of age a standard AED may be used.

Precordial Thump and Fist Pacing (Adult)

Introduction

A precordial thump is a ***single sharp blow*** delivered by a rescuer's fist to the mid-sternum of the victim's chest (ARC 2006b: 11.3, 1).

The precordial thump is thought to produce an electrical depolarization of 2 to 5 joules. This small electrical shock may disrupt a re-entrant pathway arrhythmia if delivered at the right moment. The precordial thump should be delivered as soon as possible after the witnessed cardiac arrest.

The precordial thump technique should be taught as part of an Advanced Life Support (ALS) course in conjunction with recognition of life-threatening arrhythmias and appropriate steps to be initiated if the precordial thump fails and is considered a component of defibrillation (ARC 2006b: 11.3, 1)

Potential Indications

A precordial thump may be administered ***within the first 15 seconds*** of a monitored arrest, where the rhythm is ventricular fibrillation (VF) or ventricular tachycardia (VT), and a defibrillator is ***not immediately*** available (ARC 2006b: 11.3, 1; ARC 2006c: 11.2, 2).

Contraindications

1. Recent sternotomy for coronary artery grafts or valve replacement, or recent chest trauma.
2. The presence of a pulse (ARC 2006b: 11.3, 1).

Precautions

The force of the blow should not break ribs. The idea is to produce an electrical impulse causing depolarization of the myocardium, not to mechanically compress the chest or heart.

Procedure for Precordial Thump

1. Confirm pulselessness in the victim.
2. Expose the chest to visualise the centre of the chest
3. The rescuer's clenched fist is held approximately 25-30cm (10-12 inches) above the sternum of the victim.
4. The fist is then brought down sharply so that the inside (medial, ulna) side of the fist makes contact with the chest, followed immediately by retraction of the fist, which creates an impulse-like stimulus (ERC 2005:S33).
5. Review the victim's cardiac rhythm and provide appropriated interventions.

Fist Pacing

The administration of serial rhythmic blows to the chest has been proposed as a technique to provide mechanical pacing until an electrical pacemaker is available. Fist pacing may be considered in haemodynamically unstable bradyarrhythmias until an electrical pacemaker (transcutaneous or transvenous) is available (ARC 2006b: 11.3, 2).

Synchronised elective cardioversion

Electrical synchronised cardioversion is performed to restore normal heart rhythm in conscious patients with abnormal heart rhythms such as atrial or ventricular tachyarrhythmia's, particularly when drug therapy has been ineffective. The procedure is usually performed electively i.e. the patient is admitted to an area, which has full resuscitation, and monitoring equipment, patient consent is obtained; and sedation or anaesthesia is administered to the patient prior to the procedure.

In contrast to defibrillation, the electrical charge used in ***synchronised*** elective cardioversion is discharged after the R wave when the myocardial cells are completely refractory, in order to minimise the risk of ventricular fibrillation (Riley, 1997:27). To use synchronised cardioversion the defibrillator unit is set to the synchronised mode. Both monophasic and biphasic defibrillators are capable of performing synchronised cardioversion.
(ERC, 2005b:S69)
Initially, lower joules are selected and increased in increments if this energy level fails to revert the arrhythmia:

External Cardiac Pacing

External or non-invasive transcutaneous cardiac pacing may be considered in patients with ***symptomatic (haemodynamically unstable) bradycardia***, which is refractory to pharmacological therapies, namely atropine sulphate. External cardiac pacing is considered to be a holding manoeuvre, buying time for spontaneous recovery of the heart's conduction system or until a more definitive treatment is available such as transvenous pacing (Jevon 2002:43). Many defibrillator units have the facility to carry out pacemaker function, including SAEDs.

External cardiac pacemakers generate electrical stimuli that pace the heart through external electrodes/pads that adhere to the chest wall i.e. the heart is paced by an electrical unit rather than by the patient's own heart pacemakers. This is referred to as capture. To achieve capture, the pacer rate must be set higher than the patient's intrinsic rate and the pacer output high enough to cause the heart to contract.

Capture consists of two components:

1. **electrical capture**: sufficient electrical current is delivered to stimulate the heart (usually between 50 to 100 milliamperes [mA]) and is seen on the cardiac monitor as a wide QRS following a spike.
2. **mechanical capture**: the patient's blood is perfusing at approximately the same rate as the displayed pacer rate, and can be confirmed by feeling for the right arm or right femoral artery (it should never be taken on the left side of the body as pacing causes muscular contractions that can be mistaken for a pulse). Most units allow heart rate selection in a range from 30 to 180 beats per minute.

Electrode / Pad Application

External cardiac pacing is a painful intervention for the patient, and the patient will require intravenous analgesia and sedation prior to the procedure. An anterior pad is placed to the left of the sternum and centred as close as possible to the point of maximal cardiac impulse and a posterior pad is placed just below the left scapula. Patients with excessive body hair require clipping to ensure good skin contact. The patient must have dots as well as external pads insitu and must monitor via the defibrillator.

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MODULE THREE

RESPIRATORY SYSTEM

The respiratory system is divided into three sections and reviews anatomy and physiology, advanced airway management including oxygen therapy and mechanical airways, and finally endotracheal intubation.

Section I Anatomy and Physiology of the Respiratory System

Refer to respiratory physiology package

Aim: This section aims to provide an overview of the relevant anatomy and physiology of the respiratory system.

The participant should be able to:

1. Outline the major anatomical components of the respiratory system
2. Discuss the normal physiological function of the respiratory system
3. State the functions of the respiratory system
4. Outline the blood supply of the respiratory system
5. Outline the specific tissue types found in the respiratory system
6. Describe the role of the respiratory system in maintaining homeostasis
7. Apply concepts learned in the care and management of patents with life threatening situations

Section II Maintenance of airway and breathing

Aim: The aim of this section is to examine the physical and mechanical methods of maintaining an airway and effective breathing.

The participant should be able to:

1. Discuss the role of oxygen in the resuscitation setting
2. Discuss manual airway techniques available and the indications for the use of each
3. Discuss the indications and problems associated with oropharyngeal airways
4. Discuss the indications for laryngeal airway
5. Apply concepts learned in the care and management of patients with life threatening situations

Section III Endotracheal Intubation

Refer to Intubation package

Aim: The aim of this section is to examine the advanced airway management technique of endotracheal intubation.

The participant should be able to:

1. List the indications for endotracheal intubation
2. List the complications associated with endotracheal intubation and how these can be minimised
3. Describe the procedure of cricoid pressure and list the indications for its use
4. Discuss alternative methods to traditional intubation
5. Apply concepts learned in the care and management of patients with life threatening situations

Paediatric Specific Information –

ADJUNCT TO SECTION I

Respiratory anatomy and physiology

It is important to consider that infants and children are not just little adults and have anatomical and developmental differences in all systems including the respiratory system. This is often referred to as “Big head, little body syndrome”.
Key anatomical and physiological differences include:

- At birth only half the adult number of alveoli are present, an adult number is nearly reached by 3 years of age.
- Chest wall is rounded, soft and compliant up to the preschool age and thus due to mechanics of breathing the lungs work closer to their residual volume.
- Almost exclusively the diaphragm in infants and preschool children carries out the mechanical work of breathing.
- Up until 6 months they are predominantly nasal breathers.
- There is a large cranial vault but underdeveloped cranial sinuses.
- Tracheal diameter will triple between birth and adolescence.
- Humidification of inspired air is less effective in an infant and preschool child due to the trachea being proportionally much shorter than an adult.
- The trachea bifurcates at the level of the 4^{th} thoracic vertebra (an adult it is 2 vertebra lower).
- The anterior pharyngeal wall is in close apposition to the posterior- pharyngeal wall, combined with hypertrophy of tonsillar and adenoid tissue and a small larynx increases the risk of airway obstruction and makes intubation difficult.
- The respiratory rate is higher than adults to compensate for limited alveolar surface and the increased anatomical dead space.
- Active secretory glands and rich vascularity creates airway oedema more quickly than an adult.
- Skin surface is 3 times that of an adult in infants, in combination with increased respiratory rate leads to increased insensible losses compared with an adult.
- Undeveloped left ventricular muscle, an immature autonomic nervous system and a natural arrhythmic pattern means that blood pressure is lower and poor lung perfusion is likely during cardiopulmonary arrest.
- Children will predominantly suffer respiratory distress and generally oxygen should not be spared.

Paediatric Patients: Special Considerations

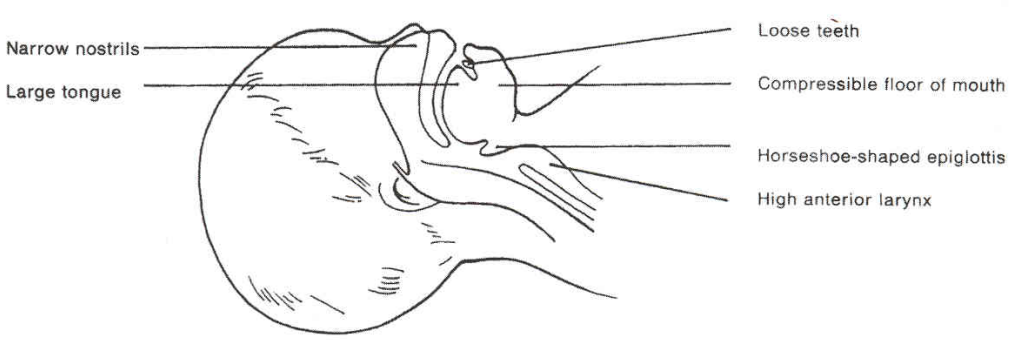
Children have unique anatomical and physiological differences. Remember:

- size and relative body proportion change with age
- care regimes and management is related to age and weight
- children have unique psychological needs

As the child grows and their weight increases the shape and proportion of various organs change.

Note: By approximately 8 years of age children’s airway anatomy and physiology approximates that of adults.

Airway Differences:



Summary of significant upper airway anatomy for a child.

- Head is large and the neck is short, tending to cause neck flexion
- Infants less than 6 months old are obligate nasal breathers
- Diaphragmatic breathers- anything that impedes diaphragmatic contraction can lead to respiratory distress
- Intercostal muscles not fully developed these muscles function to stabilize not lift the chest wall
- Large tongue/small mouth
- Shorter and softer trachea, overextension or flexion may cause tracheal compression
- Narrower airways which are easily obstructed by secretions
- Epiglottis is horseshoe shaped and projects posteriorly at 45˚
- Larynx high and anterior
- Cricoid ring is the narrowest point of the airway
- Easily fatigued
- Ribs horizontally in orientation – this reduces the efficiency of ventilation during periods of respiratory distress up to approximately the preschool age
- Cartilaginous compliant chest wall – compromising the child's ability to maintain functional residual capacity or increase their tidal volume when experiencing respiratory distress
- Chest wall very thin – transmit sounds more readily

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Adult Airway Management:

SECTION II

Assessment for airway patency by the rescuer should include the following:

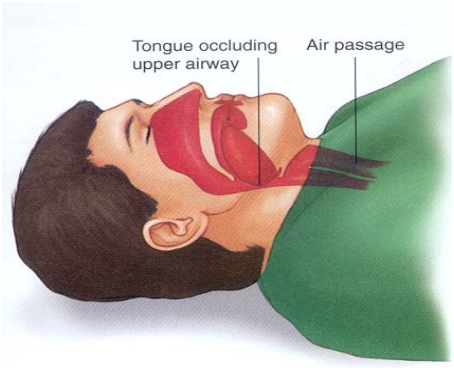
- Determining the patient's level of consciousness (LOC).
- Looking for any trauma to the face and / or neck.
- Assessing for presence of airway foreign body.
- Determining the presence of respiratory effort (rise and fall of chest wall).
- Assessing adequacy of ventilation i.e. skin colour, noisy breathing, degree of air entry, use of accessory muscles.

Airway management is required to provide a patent airway when the victim:

- Is unconscious.
- Has an obstructed airway.
- Requires rescue breathing (ARC 2006: 4, 2)

Causes of Upper Airway Obstruction

- The tongue falling back (and occluding the airway) in a comatose victim, especially in the supine position.



Foreign body:

- Fluids: saliva, vomitus, blood
- Solids: food, false teeth, other foreign matter.

Swelling of nasal passages, oral cavity, pharynx or larynx from:

- Allergic reaction
- Burns
- Trauma
- Infection
- Tumour
- Laryngeal spasm

Diagnosis of Upper Airway Obstruction

Inadequate movement of air from nose and / or mouth.
Presence / absence of noises:

- Absence of noises with complete airway obstruction
- Snoring, gurgling or inspiratory stridor with partial upper airway obstruction
- See-saw chest movement, rib retractions

Airway Devices

Airway devices that may be used to achieve airway patency include:

- Oropharyngeal airway
- Nasopharyngeal airway
- Laryngeal Mask Airway (LMA)
- Endotracheal tube

Emergency Airway procedures.

- Cricothyroidotomy. This involves cutting the cricothyroid membrane with a scalpel, and inserting an endotracheal tube. Equipment required is minimal (a scalpel blade on a handle, and an endotracheal tube) Airway access can be gained in less than a minute. The procedure usually requires specific training, at least in a simulation laboratory.
- Cricothyroid puncture and jet ventilation. This may be of benefit in children where a cricothyroidotomy is difficult due to size. A large bore (14 gauge) IV cannula is inserted through the cricothyroid membrane, and a size 2.5 portex connector can be attached to the other end, then the patient may be gently bagged, whilst other measures are prepared.

Difficult intubation

This is a complex anaesthetic issue. Some guidelines include:

- It may be possible to predict a difficult intubation. Aspects include a history of difficult intubation, a stiff or immovable neck, inability to widely open the mouth on request, and a poor jaw – neck angle.
- Can the patient be bag and mask ventilated? If so this may be the option of choice until the patient wakes up and regains his own airway.
- If no ventilation is possible, despite use of airway devices (see above), then emergency airway procedures (see above) should be instituted.
- Senior anaesthetic assistance should be urgently summoned where possible. The use of the intubating bronchoscope, is very skilled, and not an ALS procedure.

Pharyngeal Suctioning

Pharyngeal suction may be necessary prior to the insertion of an oropharyngeal airway to remove foreign material / vomitus from the mouth to reduce the risk of aspiration into the respiratory system. A disposable rigid suction (sometimes referred to as a Yankeur sucker) or a flexible suction catheter may be used. Protective Personal Equipment (PPE) must be worn during the procedure.

The patient may require pre-oxygenation if time permits prior to suctioning. The general rule of thumb is that pharyngeal suctioning should not be performed for more than 20 seconds to avoid hypoxia. The rule of thumb for pharyngeal suction is ‘only suck what you can see’.

Rigid & Flexible Suction Devices

Airway devices should only be inserted by operators adequately trained and competent in their use

Airway Adjuncts for Adults

Oropharyngeal Airway

- May be used to maintain airway patency, by keeping the tongue free of posterior pharyngeal wall
- Facilitates other techniques such as mouth-to mask and bag-valve-mask (BVM) ventilation

Oropharyngeal Airways

Insertion of the oropharyngeal airway may:

- Cause airway obstruction if wrongly sized / inserted
- Stimulate gag reflex if the victim is not unconscious
- Be occluded with foreign matter
- Damage teeth and / or lips; or may be misplaced if placed under the tongue (Harrison, 1999:51)

Contra-indications for use of the oropharyngeal airway:

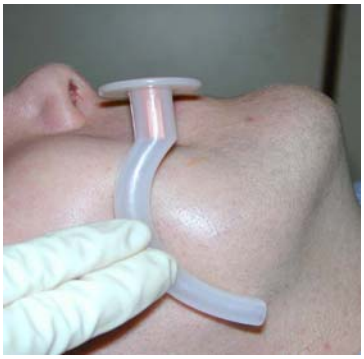
- Lack of knowledge/skill to insert OPA correctly
- Patient with a clenched jaw
- Patient with an active cough/gag reflex (ARC 1999:52)

Correct sizing of the oropharyngeal airway is essential. If it is too small or too large it may occlude the airway

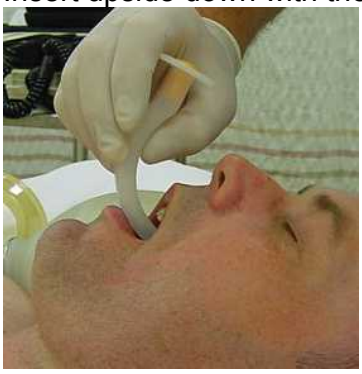
Insertion of Oropharyngeal Airway

- Check the victim's level of consciousness
- Ensure the oropharynx is free of secretions / foreign bodies - pharyngeal suctioning may be required
- Correct sizing of the airway device is essential. (The ACCCN recommends using the distance between middle of the victim's mouth to the angle of the jaw as the correct length with the phalange in at the mouth)

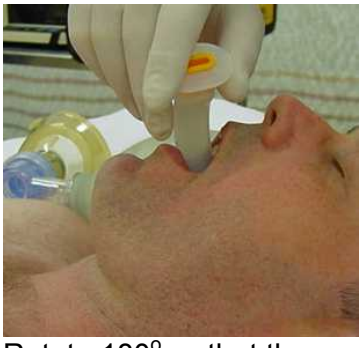
Sizing Technique for Oropharyngeal Airway



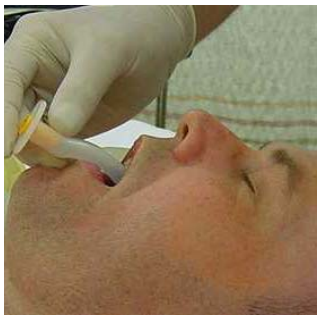
Insert upside down with the tip against the hard palate

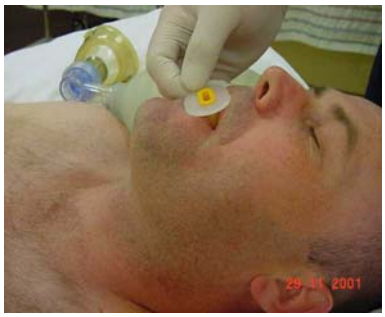


Insert further into the mouth until the soft palate is reached



Rotate 180^{o} so that the curvature of the airway device matches that of the tongue

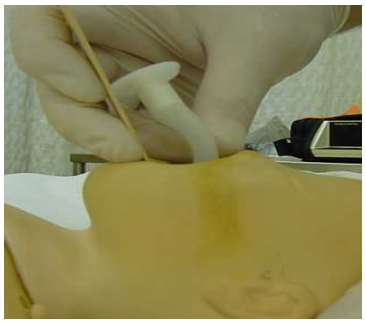




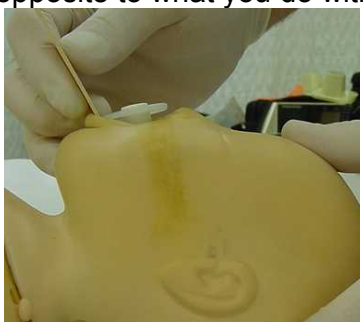
Advance the tip of the oropharyngeal airway to the back of the mouth to stabilise the position in the posterior portion of the pharynx
If the gag reflex is present remove the airway device.
Check for unimpeded air entry.

Insertion of guedels in paediatric patients

After selecting an appropriate sized guedels airway, open the airway using chin lift manoeuvre.



Use a tongue depressor or a laryngoscope blade to aid insertion of the airway-the right way up. NB This is the opposite to what you do with adults and older children.



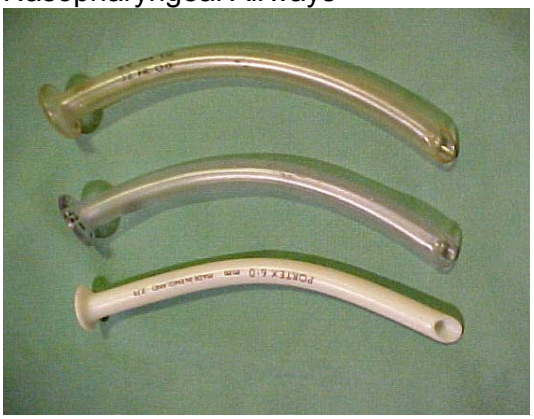
Nasopharyngeal Airway

May be used to maintain airway patency.
Indications:

- The victim cannot tolerate an oral airway but;
- A gag reflex is present
- If the oropharyngeal airway OPA is difficult / dangerous to insert i.e. oral trauma /clenched jaw / seizures (ARC 1999:109).

Once insitu the nasopharyngeal airway may be better tolerated by the patient than the oropharyngeal airway

Nasopharyngeal Airways



Contra-indications for use of the nasopharyngeal airway:

- Lack of knowledge/skills to correctly insert device
- Obstruction of both nasal passages
- Nasal fracture/s
- Known bleeding disorder / previous history of severe epistaxis
- Resistance to passage of device during insertion
- A victim with head injury and probable fracture of cribiform plate/base of skull (ARC 1999:109).

Insertion of the Nasopharyngeal Airway

- Select the correct size airway adjunct by measuring from the earlobe (tragus) to the tip of the nose (suggested sizes: large adult - 8.5; small adult - 7.5; adolescent - 6.5).
- Lubricate the airway adjunct with a water-soluble lubricant.
- Insert the airway device in the largest nostril.
- If obstruction is encountered select the other nostril, or if this fails use a smaller nasopharyngeal airway.
- Check for unimpeded air entry.
- A disposable, flexible suction catheter may be used to remove secretions from the nasopharyngeal airway once insitu.
- Document the procedure in relevant medical record/s.

Laryngeal Mask Airway (LMA)

The Laryngeal Mask Airway (LMA) was developed in the 1980's to fill a niche between facemasks and endotracheal tubes in anaesthesia. A similar niche exists in cardiac arrest / resuscitation situations (ARC 2006: 11.7, 4).

The LMA insertion is an advanced life support procedure. Doctors and registered nurses who are trained in its use may insert an LMA, to secure the airway in patients who are profoundly unconscious and require an artificial airway, with regurgitation being significantly lower than with the use of oropharyngeal or nasopharyngeal airway devices.

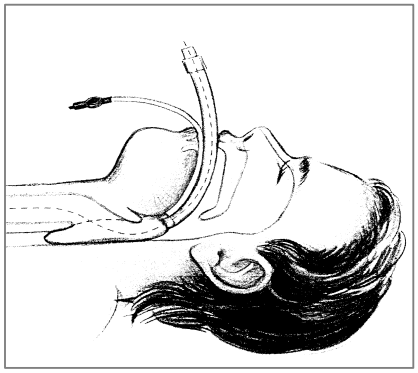
LMAs are available both as disposable and reusable advanced airway adjuncts.

Numerous studies have clearly demonstrated success rates from 64% to 100% LMA insertion by nurses, respiratory therapists and emergency services (EMS) personnel (AHA 2000:119; York Clark 2004:25). Training can be easily performed using manikins only (ARC 2006: 11.7, 4)

Description

- The Laryngeal Mask Airway (LMA) is an advanced airway adjunct when endotracheal intubation is not possible (ASNSW 2005; York Clark 2004:24).
- The LMA is composed of a tube with a cuffed mask-like projection at distal end, which is introduced blindly through the mouth into the hypopharynx (AHA 2000 Part 6:119) (Figure 1).
- When the cuff is inflated it seals the hypopharynx around the laryngeal opening.
- Only health professionals trained in LMA insertion are to carry out procedure.

Figure 1



The LMA consists of three parts (Figure 2):

1. Airway tube

2. Mask (which is designed to conform to contours of hypopharynx with its lumen facing the laryngeal opening)

3. Mask inflation line (also referred to as the inflation system).

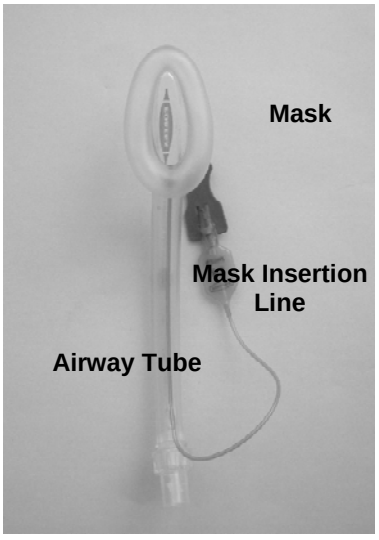


Figure 2

Indications for use

In resuscitation situations when:

- The patient is profoundly unconscious and has absent glossopharyngeal reflexes **and**
- Airway patency cannot be maintained with airway opening techniques and oro/ nasopharyngeal airway **or**
- Endotracheal intubation cannot be achieved or has failed due to lack of expertise or equipment (Baskett & Brain 1994:3; York Clark 2004:25).
- The LMA may be used as an alternative to the facemask in bag-valve-mask (BVM) ventilation for temporary control of an airway obstruction (York Clark 2004:25).

Contraindications for use

The LMA is contra-indicated for use if the patient has one or more of the following:

- Has not fasted or possibly non-fasted with retained gastric contents
- Has a significant hiatus hernia
- Has morbid obesity
- Is pregnant and greater than 14 weeks gestation
- Has multiple or massive injuries
- Has acute abdominal or thoracic injury
- Was on opiate medication prior to fasting
- Is profoundly unconscious but resists LMA insertion (Baskett & Brain 994:3; Wilson 1996:48)
- Has decreased pulmonary compliance, because low-pressure seal formed around larynx may not allow for adequate ventilation (York Clark 2004:25).

Advantages of LMA

- The LMA is safe, easy and quick to insert (Eastwick-Field 1996:177).
- The LMA is more secure and reliable than facemask with bag-valve ventilation (AHA 2000:119).
- The clinician does not require direct vision of the trachea and a laryngoscope is not needed (Eastwick-Field 1996:175).
- The LMA has advantages over endotracheal intubation when access to the patient is limited, for example, possible unstable neck injury or appropriate position for endotracheal intubation is impossible (AHA 2000:119).
- The LMA assists in the delivery of high flow oxygen (ASNSW 2005).

Limitations of LMA

- Untrained staff.
- Air leak around the cuff during positive pressure ventilation.
- Pulmonary aspiration of regurgitated gastric contents (AHA 2000:119), however the incidence of aspiration is reported to be low (Jevon 2002:45), usually occurring during mouth-to-mask ventilation prior to LMA insertion.
- Should only be used in patients with an empty stomach.

Insertion of LMA

- The LMA is placed blindly into the pharynx, and advanced until resistance is felt as the distal portion of tube locates in hypopharynx (Figure 3).

- The cuff is then inflated leaving the distal opening of the tube just above the glottis providing a clear airway (AHA 2000:119).
- Insertion attempts of the LMA should be limited to 20 seconds maximum.

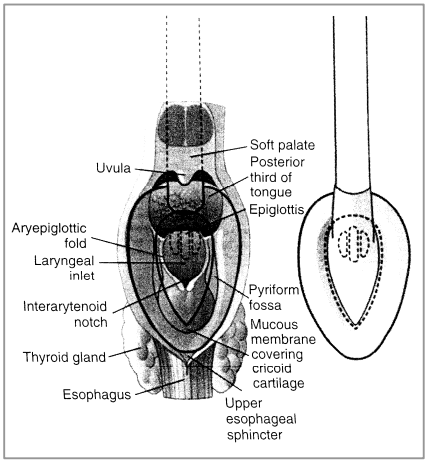


Figure 3

Causes of incorrect LMA position

- Insertion of LMA back to front
- Incorrect size
- Not inserted deep enough
- The LMA has folded over

Note: Immediate action required if any of the above causes of incorrect LMA position is removal and reinsertion.

Precautions during LMA insertion

- Mal-positioning of the LMA may increase the risk of aspiration and regurgitation.
- Coughing.
- Laryngeal spasm if secretions irritate the vocal cords.
- Poor distribution of first-line drugs via this route i.e. less than1/3rd of the drug will reach the pulmonary circulation (Danks & Danks 2004:34).

Adverse effects from LMA

- Oropharyngeal trauma.
- Sore throat.
- Dysphonia.
- Aspiration and regurgitation.
- Excessive salivation.
- Hypoglossal nerve injury, tongue numbness, vocal cord paralysis, from poor technique/ excessive cuff pressure (Joanna Briggs Institute 2003:n.p.).

Equipment required

- Personal Protective Equipment (PPE).
- LMA (correct size).
- Water-soluble lubricant.
- 20-50 ml syringe.
- Suction device and suction tubing.
- Disposable rigid sucker.

- Oxygen source.
- Oxygen tubing.
- Bag-valve-mask (BVM) device (York Clark 2004:25) and stethoscope
- White 1/2" tape to secure LMA

LMA insertion technique

1. PREPARING EQUIPMENT

- Select LMA size based on the patient's weight in kilograms.
- Open sterile packaging but do not remove the LMA.
- Attach a 20ml syringe to the inflation valve on Mask Insertion Line.
- Check cuff integrity with the recommended amount of air to ensure pressure is maintained.
- Deflate the inflation valve and allow the cuff to return to atmospheric pressure i.e. remains partially inflated (Figure 4).
- Coat the **posterior** surface of the LMA **only** with water-soluble lubricant (not the anterior surface as it may cause blockage to the orifice or may be inhaled into the airway) (York Clark 2004:27).

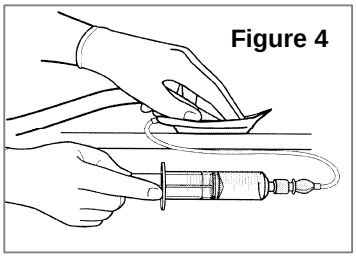


Figure 4

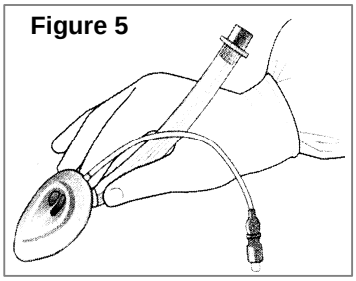
2. PREPARING THE PATIENT

- The clinician should position him / her self behind the patient and place the patient in supine the position.
- Suction the airway if indicated.
- Pre-oxygenate the patient using a bag-valve-mask (BVM) device with a flow rate > 10 LPM prior to LMA insertion if time permits (ideally for 3-4 minutes) (York Clark 2004:26; Danks & Danks 2004:34).
- With the patient in the supine position, extend the head and flex the neck prior to insertion, unless spinal injury is suspected when minimal extension and flexion should occur (ASNSW 2005; York Clark 2004:26).
- Do **not** apply cricoid pressure during LMA insertion as the procedure and the LMA is above the larynx.

3. INSERTION TECHNIQUE

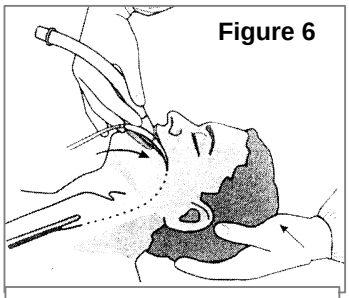
- Don PPE prior to the procedure.
- With the dominant hand, the operator holds the LMA like a pen - grasping the LMA by positioning the index finger in the crease between the airway tube and the laryngeal mask facing towards the tongue (Figure 5).

Figure 5



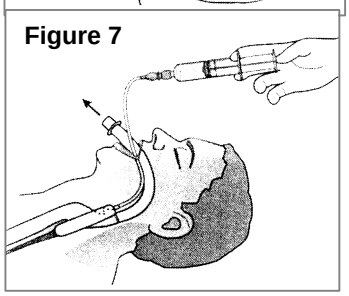
- With the non-dominant hand slightly extend the patient's head backwards (Figure 6).

Figure 6



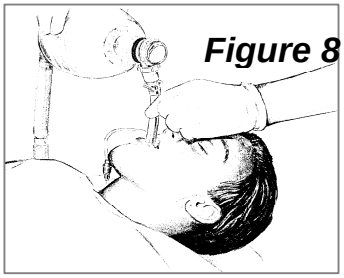
- Insert the LMA with cuff tip gliding over the tongue and against the posterior pharyngeal wall.
- Using the index finger push the LMA applying slight backward pressure (towards the ears) and follow the anatomical curve.
- Advance the LMA until resistance is felt at the back of the pharynx and then insert with a single firm downward motion until the LMA stops (ASNSW 2005; York Clark 2004:27-28).
- Maintain firm pressure until the cuff has almost disappeared and forward movement has stopped (ASNSW 2005).
- Inflate the cuff with the correct amount of air - during inflation release the LMA to ensure placement is maintained as the cuff expands (ASNSW 2005; York Clark 2004:27-28) (Figure 7).

Figure 7



- Attach to the BVM device and confirm chest expansion and bilateral breath sounds (Figure 8).
- Insert a bite block or oropharyngeal airway if needed to prevent the patient biting the airway tube and secure the tube with a tie or bandage to the lower jaw (ASNSW 2005; York Clark 2004:2-28).
- Assess correct LMA placement i.e.
    - Slight outward movement of the airway tube with cuff inflation
    - Slight visible bulging at the cricoid region
    - No visible cuff in the oral cavity
    - Ease of ventilation, equal bilateral breath sounds, and rise and fall of the chest wall
    - Pulse oximetry readings indicate adequate ventilation.

Figure 8



Unsuccessful LMA insertion

- If after 30 seconds the LMA has not been successfully inserted remove it and oxygenate the patient using the BVM device or a mask with a one-way valve prior to attempting reinsertion of the LMA (Hand and Banks 2004:46).

Post LMA insertion

- Reassess the patient for chest expansion and bilateral breath sounds.
- Observe for gastric distension as this increases the risk of aspiration.
- Continue BVM ventilation until the procedure is ceased.
- Provide concise documentation of the procedure in the patient's relevant medical records.

Removal of LMA

- Is undertaken in an area that has immediate access to resuscitation equipment (in event that the LMA is removed before effective airway reflexes have returned)
- The patient should regain full consciousness **before** the LMA is removed i.e. the patient is able to open their mouth on command (Joanna Briggs Institute 2003:n.p.).
- Wean the patient off assisted ventilation.
- Provide continuous cardiac and pulse oximetry monitoring.
- Observe the patient for swallowing.
- Remove or/cut the tape securing the airway tube.
- Remove the bite block.
- Suction oral cavity before removing the LMA, as required, aspiration of saliva/secretions may occur.
- Do **not** deflate the cuff when removing the LMA, as the cuffed mask will scoop up pooled secretions above the mask during the extubation process.
- Remove the LMA gently and slowly **only** when the patient can open their mouth on command (if the LMA is removed before return of effective swallowing and cough reflexes secretions in the upper pharynx may enter into the larynx provoking coughing or laryngeal spasm).
- Verify the patient's airway patency and assess for adequate ventilation.
- Provide assisted ventilation where indicated.
- Re-insert the LMA as required.
- Document the procedure in the patient's relevant medical record/s.

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Paediatric Specific Information:

ADJUNCT TO SECTION II AND III

Tubes for Paediatrics

Unlike the adult in whom the airway is narrowest at the glottis (space between the vocal cords), the airway of the infant/child is narrowest at the level of the cricoid cartilage. Therefore an endotracheal tube that passes easily through an infant/childs cords may be too large at the cricoid ring. Uncuffed tubes are routinely used in paediatrics to avoid tracheal stenosis.

- Cuffed endotracheal tubes may be preferable when lung compliance is poor, high airway resistance is present or a large glottic leak occurs. If the size is correct it is safe for children provided cuff pressure is maintained below 20cm H_2O
- Choice of tube size is more accurately measured by using resuscitation (Broselow tape) tapes however the following may be helpful.
- Newborns: Uncuffed 3mm diameter
- Infant to 6 months: Uncuffed 3.5mm diameter
- 7months- 1 year: Uncuffed 4mm diameter

For children over 1 year uncuffed tubes:

$$\text{Size (mm)} = \text{Age}\ \frac{\textbf{(yrs)}}{\textbf{4}} + \textbf{4}$$

For children over 1 year **cuffed** tubes

$$\text{Size (mm)} = \text{Age}\ \frac{\textbf{(yrs)}}{\textbf{4}} + \textbf{3}$$

- Approximate depth of insertion measured from centre of the lips for:
- Newborn: 9.5 cm
- 6 month: 11.5 cm
- 1 year old: 12 cm

For children over 1 year:

$$\text{Depth (cm)} = \text{Age}\ \frac{\textbf{(yrs)}}{\textbf{2}} + \textbf{12 cm}$$

- LARYNGEAL MASKS- if endotracheal intubation is difficult they can enable higher tidal volumes to be delivered than bag-valve-mask ventilation and regurgitation risks can be reduced. Training in their use is critical and complications are higher in children compared with adults.

The appropriate size is related to body weight
<5 kg: Size 1
5-10 kg: Size 1.5
10-20 kg: Size 2
20-30 kg: Size 2.5
30-50 kg: Size 3
50-70 kg: Size 4
70-100 kg: Size 5
>100 kg: Size 6

Weight estimation in children
Formula: 1-10 years
(Age+4) x 2

Preparation of Intubation Drugs for paediatrics

Midazolam

- 15mg ampoule
- **Add N/S and make up to 15mls in a 20ml syringe.**
- **i.e.1mg/ml**

Thiopentone

- 500mg ampoule
- **Dilute to 20mls with H_2O ampoules**
- **i.e. 25mg/ml**
- dose 5mg/kg

Vecuronium

- 10mg ampoule
- **Dilute to 10mls with H_20 ampoule**
- **i.e. 1mg/ml**
- dose 0.1mg/kg

Suxamethonium

- 100mg ampoule
- **Dilute to 10mls with H_20 ampoule**
- dose 1-2mg/kg

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Cricoid Pressure:

Adjunct to section III

Aspiration of gastric contents into the lung/s is common during resuscitation and may result in significant, adverse patient outcomes (ARC 2006: 11.4:1).

Cricoid pressure (also referred to as the Selleck's manoeuvre) may be performed by a trained assistant during endotracheal intubation to compress the upper oesophagus and thereby decrease the likelihood of passive regurgitation in the unconscious patient (ARC 2006: 11.4:1). Cricoid pressure may also assist the person intubating to visualise the vocal cords.

Indications for Cricoid Pressure

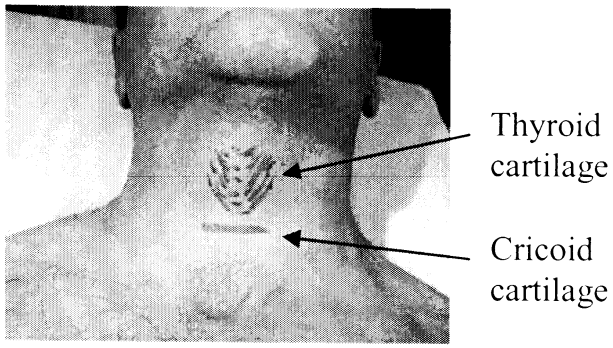
The application of pressure by a *trained* assistant on the cricoid cartilage of the unconscious patient may prevent:

1. Regurgitation of gastric contents into the pharynx until the airway below the larynx can be protected by an endotracheal tube (ETT) with an inflated cuff
2. Gastric inflation during manual ventilation i.e. using a bag-valve-mask device (ARC 2006: 11.4:1).

Cricoid pressure should be maintained *until* the person intubating indicates that it is safe to release, unless active vomiting occurs

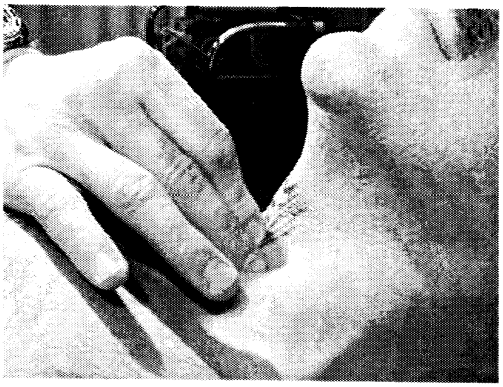
Technique Guidelines

- Cricoid pressure should not be applied if there is swelling of the front of the neck from recent trauma or if the anatomy is difficult to define.
- Cricoid pressure should not be performed, *at any time*, if there are active vomiting attempts by the patient.
- The trained assistant should be able to accurately locate the cricoid cartilage; apply pressure using the thumb, index and middle fingers; recognise the importance of maintaining pressure until the airway is secure; and function without impeding the work of others.
- The pressure required to ensure oesophageal closure has been compared with the pressure against the bridge of the nose that causes discomfort or the pressure against the cricoid that prevents swallowing (ARC 2006: 11.4:1-2).
- The correct position for Cricoid pressure is just below the prominent thyroid cartilage (Adam's apple)



(ARC 2006: 11.4:2)

Upon advice from the person intubating, the trained assistant applies direct Cricoid pressure with their thumb and middle finger on either side of the Cricoid cartilage, with the fingers together and the index finger above, in the space between the Cricoid and thyroid cartilages.



(ARC 2006: 11.4:2)

Cricoid pressure is applied directly backwards and maintained until advised to release (ARC 2006: 11.4:2).

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MODULE FOUR
RESUSCITATION DRUGS

Aim: The aim of this module is to examine methods of establishing vascular access and to promote further understanding of the pharmacological agents used in the management of ALS. This includes the actions, indications, dosage and administration of such agents.

The participant should be able to:

1. Outline the principles of venous and intraosseous cannulation
2. Outline the major sites for venous and intraosseous cannulation
3. Describe the types of cannulae used
4. Outline the principles of endotracheal drug administration
5. Identify complications associated with vascular and intraosseous access
6. Describe the indications, actions, routes of administration, precautions and the clinically recommended forms of those medications commonly used in ALS
7. Apply concepts learned in the care and management of patients with life threatening situations

Pharmacological Intervention

"No medication has been shown to improve long term survival in humans after cardiac arrest. Priorities are defibrillation, oxygenation and ventilation together with external cardiac compression"
(ARC guidelines policy statement 11.6, Feb 2006).

Administration of drugs

During resuscitation it is advantageous to use the largest and most accessible vein, which will not incur interruption during the period of resuscitation

Drug administration can be achieved via the following routes:
Peripheral cannula: Intravenous drug administration is preferable and IV access is quickly and most easily achieved via a large bore peripheral cannula inserted into a large peripheral vein (e.g. cubital fossa). (ARC Guideline 11.6 Feb 2006). Avoid lower limb veins due to impairment of blood flow below the diaphragm. Paediatric veins can be located in the dorsum of the hand, wrist, forearm, cubital fossa, and long saphenous vein in the leg (ARC Guideline 12.6 pg3-4, Feb 2006).
Intravenous drug administration in cardiac arrest must be followed by a fluid flush of at least 20- 30mls in adults or appropriately small boluses for children, followed by external cardiac compressions,

External jugular. If no visible peripheral vein cannulation is achievable, the Medical Officer should consider the external jugular for cannulation.

If **Central Venous Line** (CVL/PICC) available, utilize it, as it provides more rapid drug delivery (however, CPR should not be interrupted to insert one)

Surgical Cutdown onto the long saphenous, saphenofemoral junction or basilic vein' (ARC Guideline 12.6 pg4, Feb 2006) may be attempted by a medical officer trained in this technique. Refer to Medical Adjunct section of this ALS package.

Intraosseous Needle. Valuable time should not be wasted (no more than 90 seconds) with repeated unsuccessful attempts at peripheral cannulation in the paediatric patient (ARC Guideline 12.2 pg2, Feb 2006).
Intraosseous Access (IOA)

- This is a rapid, safe and reliable route for administration of drugs, crystalloids, colloids and blood.
- A rigid needle (intraosseous) is inserted into the anterior medial aspect of the proximal or distal tibial bone marrow, providing access to the non-collapsible marrow venous plexus. The bone marrow has a rich blood supply.
- IOA can be achieved in 30-60 seconds.
- Onset of action/drug levels following IOA administration is comparable to IV administration.
- The intraosseous route is not recommended for longer than a 24hour period.

Please see appendix I of module 4 for further information on Intraosseous access

Intracardiac injection should not be attempted. Intracardiac injection could result in multiple serious complications (aortic perforation, tamponade).

ETT - An alternate route only if intravenous or intraosseous access is unavailable
Only the following drugs can be administered via ETT:

- Adrenaline
- Lignocaine
- Atropine
- Naloxone

Method of drug administration via ETT

- Suction the airway
- Insert a clean catheter (eg suction catheter) into the endotracheal tube (ETT), beyond the tip of the ETT; instil medication via side port on catheter.
- **Adults**: Administer five times the intravenous dose, diluted to 10ml in water for injection. Water for injection achieves better drug absorption.
- **Paediatrics**: Drug doses and dilutions are weight dependant; refer to specific drug information.
- Follow by at least two vigorous ventilations to disperse the drug
- Protect eye and mucous membranes when administering drugs via the ETT

ETT dilution volumes
Adult: make up to 10mls with water for injection
Paediatrics:
Less than 1 year old – make up to 0.7ml with water for injection
1 → 5yr old – make up to 1-2mls with water for injection
5 → 8yr old – make up to 2-5mls with water for injection

Advanced Life Support Drugs

Adrenaline

Actions

- Adrenaline is a sympathomimetic agent (mimics the sympathetic nervous system). It stimulates both alpha and beta receptors of the sympathetic nervous system. In cardiac arrest, via its alpha adrenergic action, it produces vasoconstriction and directs available cardiac output to the myocardium and brain. (Australian Resuscitation Council Guideline 11.6, 12.4 February 2006).
- Beta 1 adrenergic stimulation produces an increase in force of myocardial contraction and heart rate and Beta 2 adrenergic stimulation produces bronchodilatation and vasodilatation.

Indications

- Adrenaline is used in resuscitation for asystole, electromechanical dissociation (EMD) and ventricular fibrillation that has not responded to initial defibrillation attempts. Adrenaline is also used for bronchospasm, anaphylaxis and hypersensitivity reactions.

Dosage

- **Adult** – IV 1mg, or via ETT 5 times the IV dose
- **Paediatric** - IV/intraosseous10mcg/kg (0.1ml/kg of 1:10000) or via ETT 100mcg/kg (0.1ml/kg of 1:1000 solution)

This should be repeated every 3-5 mins during CPR

Adverse Effects (post arrest)

- Tachyarrhythmia's, severe hypertension after resuscitation, tissue necrosis if *extravasation* occurs, inactivated by Sodium bicarbonate.

Amiodarone

Actions

- A class III antiarrhythmic that produces an antifibrillatory action by prolonging the refractory period, resulting in slowing the rate of ventricular tachydysrhythmias (large difference in the action of oral versus intravenous amiodarone)
- Complex drug that has effects on Na^+, K^+ and Ca^{++} channels as well as alpha- and beta-adrenergic blocking properties

Indications

- Failure of DC shocks and adrenaline to revert VF/Pulseless VT

Dosage

- **Adult** - Initial bolus 300mgs IV. A further dose of 150mgs could be considered followed by an infusion
- **Paediatric** - IV/intraosseous 5mg/kg, which may be repeated

Adverse Effects (post arrest)

Hypotension, bradycardia and heart block that may be related to the rapidity of the infusion.

The following drugs may also be considered:

Magnesium Sulphate

Actions

- Essential electrolyte for membrane stability, nerve conduction and muscle contraction
- Hypomagnesaemia causes myocardial hyper excitability particularly in the presence of hypokalemia and digoxin therapy

Indication

- **Torsades de pointes (first line drug)**
- Digoxin toxicity
- Ventricular arrhythmias
- Hypokalemia
- Hypomagnesia

Administration

- **Adult** - 5 mmol bolus IV, may be repeated once
- **Paediatric** - IV/Intraosseous 0.1 – 0.2mmol/kg followed by an infusion of 0.3mmol/kg over 4 hours

Adverse Reactions (post arrest)

- Excessive use may lead to muscle weakness, paralysis and respiratory failure

Lignocaine

Actions

- Lignocaine is a class 1 anti-arrhythmic agent (membrane stabilising) with a rapid action and a short half-life.
- It reduces the difference in excitability between ischaemic and normal myocardial tissue.
- It decreases the duration of the action potential by blocking the sodium channel and shortening the refractory period.
- Lignocaine depresses the automaticity of ventricular cells but has limited effect on the speed of conduction, contractility or cardiac output

Indications

- Antiarrhythmic for VF/VT that has not responded to DC shocks, adrenaline or amiodarone.
- Ventricular tachycardia not associated with loss of consciousness.

Administration

- **Adult** - Initial bolus 1mg/kg IV, additional bolus of 0.5mg/kg may be considered after 5 minutes (Boluses only, are used during a cardiac arrest).
- ETT 5 times dose
- **Paediatric** - IV/intraosseous 1mg/kg or ETT 2mg/kg

Adverse effects (post arrest)

- Nausea and vomiting
- Neurological effects - confusion, drowsiness, slurred speech, muscle twitching and seizures
- Cardiac effects – hypotension, bradycardia, heart block and asystole

Atropine

Actions

- Increases heart rate by blocking vagal stimulation resulting in increase sinus and AV node discharge and enhances conduction

Indications

- Asystole.
- Symptomatic bradycardias associated with haemodynamic compromise (Hypotension, decreased level of consciousness)

Administration

- **Adult** – Initial bolus 1mg IV then 0.5mg increments to total maximum 3mg or ETT 5 times the IV dose
- **Paediatrics** - IV/intraosseous 20mcg/kg or ETT 30mcg/kg

Adverse effects (post arrest)

Atropine may cause tachyarrhythmias, hypertension, increased myocardial oxygen consumption, hyperthermia and excitement or delirium

Paediatrics Note: Bradycardia caused by hypoxaemia should be treated with ventilation and oxygen. Severe bradycardia and or bradycardia with hypotension should be treated with oxygen and adrenaline.

Potassium Chloride

Actions

- Essential electrolyte for cell membrane stability
- Maintenance of intracellular acid-base balance and isotonicity, transmission of nerve impulses, contraction of muscle and maintenance of renal function.

Indications

- Hypokalemia

Administration

- **Adult** - Bolus 5mmol slow IV
- **Paediatric** - IV/intraosseous 0.03 - 0.07mmol/kg by slow injection.

Adverse Effects (post arrest)

- Tachycardia
- Cardiac depression, arrhythmias and heart block
- Extravasation may lead to tissue necrosis

Vasopressin

Actions

- Commonly referred to as an antidiuretic hormone. In high doses vasopressin acts as a non-adrenergic peripheral vasoconstrictor and therefore is an effective vasopressor.

Indications

- Vasopressin is an alternative vasopressor to adrenaline, but at this stage there is insufficient clinical data to support its routine use.

Administration

- **Adult** - bolus of 40 units IV (20 pressor units/ml)
- **Paediatric** – approximately 0.5-0.8U/kg IV/IO

Adverse Reactions (post arrest)

- Tremor, diaphoresis, vertigo, headaches, abdominal cramps, nausea and vomiting
- Urticaria, bronchial constriction or in severe cases anaphylaxis

Adenosine

Actions

- Given by rapid intravenous injection depresses conduction through the AV node can interrupt the re-entry circuits involving the AV node and restore normal sinus rhythm, in patients with paroxysmal supraventricular tachycardia

Indications

- Rapid conversion to normal sinus rhythm of paroxysmal supraventricular tachycardia.

Administration

- **Adult** - Initial dose 3mg rapid intravenous bolus
- Second Dose, if SVT not eliminated in 1-2 minutes, give 6mg rapid bolus

- Third dose, if SVT does not resolve in 1-2 minutes, give 12 mg rapid bolus
- **Paediatric** –
- Initial Dose 0.1mg/kg (do not exceed 6mg) IV/Intraosseous
- Second Dose, if SVT not eliminated in 1-2 minutes, 0.2mg/kg (do not exceed 12mg)

- Half life of adenosine is less than 10 seconds

Adverse Reactions (post arrest)

- Cardiovascular: facial flush, headache, sweating, palpitations, chest pain, hypotension, transient asystole
- Respiratory: dyspnoea, chest pressure, hyperventilation,
- Central nervous system: light-headedness, dizziness, tingling in arms, numbness, apprehension, blurred vision, burning sensation.
- Gastrointestinal: nausea, metallic taste and tightness in throat.

Paediatric note: SVT may cause life-threatening Hypotension in paediatrics if haemodynamically stable vagal stimulation interventions should be attempted

Calcium Gluconate

Actions

- An electrolyte essential for normal muscle and nerve activity
- Calcium ions increase the force of myocardial contraction, excitability and may increase or decrease peripheral vascular resistance

Indications

- Used in the treatment of arrhythmias/hypotension associated with hypocalcaemia/hyperkalemia or overdose of calcium channel blocking drugs (eg. Verapamil)

Administration

- **Adult** - Bolus10ml of 10% Calcium Gluconate IV

- **Paediatric** - IV/Intraosseous 0.7ml/kg of 10% calcium gluconate (20mg/kg)

Adverse Effects (post arrest)

- Possible increase of myocardial and cerebral injury by mediating cell death

Glucose

Actions

- Increase blood glucose concentration

Indications

- Severe hypoglycaemia

Administration

- **Adult** - 20-50ml slow IV (3ml/min)
- **Paediatric** -1ml/kg of 50% Dextrose slow IV/IO (Intraosseous) or 5ml/kg of 10% Dextrose slow IV/IO
- Ensure BSL is rechecked after administration

Adverse Reactions (post arrest)

- Tissue extravasation, phlebitis, venous thrombosis
- Generalised flush
- Change in fluid status due to hypertonicity of glucose
- Large doses can promote a histamine release leading to anaphylaxis

Sodium Bicarbonate NaHCO3

Early effective BLS measures and adequate ventilation negate the need for NaHCO3

Actions

- Alkalising solution used to reverse metabolic acidosis associated with tissue hypoxia in cardiac arrest
- NaHCO3 increases plasma bicarbonate, buffers excess hydrogen ion concentration and raises blood pH

Indications

- **Protracted cardiac arrest i.e. >15minutes**
- Metabolic acidosis
- Hyperkalemia
- Overdose with tricyclic antidepressant

Administration

- **Adult** - Initial bolus 1mmol/kg IV then as guided by blood gases
- **Paediatric** - IV/intraosseous 1mmol/kg

Adverse Effects (post arrest)

- Alkalosis, hypernatremia and hyper osmolality

Fluid Therapy

In paediatric patients when hypovolaemia is suspected, intravenous isotonic crystalloid (e.g. 0.9% Sodium Chloride (Normal Saline) or Hartmann's solution) is given. An initial IV/IO bolus of **20mls/kg** of Sodium Chloride is given and additional boluses are titrated according to the clinical response.

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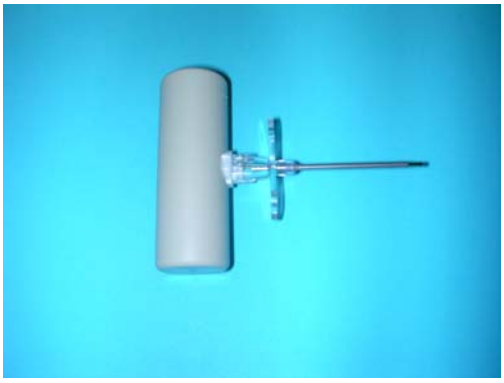
***APPENDIX 1*: Intraosseous (IO) Needle Insertion and Infusion for Children**

The Australian Resuscitation Council Guidelines states "valuable time should not be wasted (more than 90 seconds) with repeated unsuccessful attempts at cannulation because alternative access to the circulation is possible via the bone marrow intraosseous route".

- This is a rapid, safe and reliable route for administration of drugs, crystalloids, colloids and blood.
- A rigid needle (intraosseous) is inserted into the anterior medial aspect of the proximal or distal tibial bone marrow, providing access to the non-collapsible marrow venous plexus. The bone marrow has a rich blood supply.
- IOA can be achieved in 30-60 seconds.
- Onset of action/drug levels following IOA administration is comparable to IV administration.
- The intraosseous route is not recommended for longer than a 24hour period.



Picture A: Intraosseous needle

Insertion technique:

An intraosseous needle can be inserted by a Medical Officer or an accredited Registered Nurse.

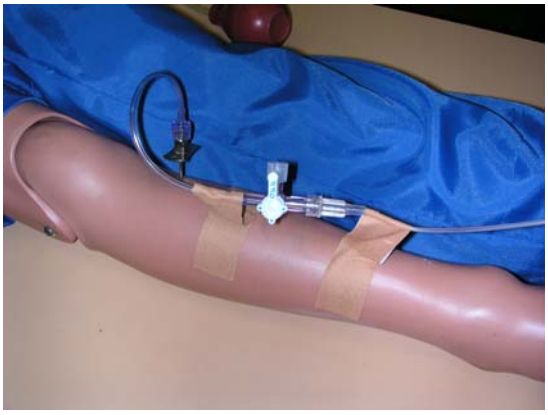
The proximal tibia is the ideal insertion site.

- Palpate tibial tuberosity
- Insert intraosseous needle 2-3cm below this point, perpendicular to the leg, with slight angle toward the foot to avoid epiphyseal plate.
- A boring action is used until a decrease in resistance or 'pop' is felt, indicating entry to the marrow.
- The needle should then stand on it's own and should not be inserted any further to avoid the needle penetrating through the other side of the bone. The distance of insertion is rarely greater than 1cm.
- Aspirate bone marrow to confirm placement, (aspirate can be sent for analysis of blood chemistry, culture, blood gases, haemoglobin and cross-matching.)

- Flush IO needle with Normal Saline and connect to extension tubing, three-way tape and IV line.
- Anchor the IV line on the leg as shown in the picture below

Drug and fluid doses and rates are the same as for conventional vascular routes. All fluids and drugs must be administered with the aid of pressure or injected from a syringe.

Alternative IO needle insertion sites are the distal tibia, distal femur and iliac crests.



Picture B: Suggested strapping technique for securing an IO needle. NOTE: There is no dressing around the IO site to enable regular observation and inspection.

Contraindications include:

- Fracture of the bone or where previous attempts at intraosseous insertions have taken place, into the same bone.

Complications:

- Penetrating through the other side of the bone
- Needle clotting if delay in flushing
- Osteomyelitis
- Local cellulites or abscess

References:

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MODULE FIVE
SPECIAL RESUSCITATION SITUATIONS

Aim: The aim of this module is to explore situations not initially involving the heart that may cause cardiac arrest.

The participant should be able to:

1. Describe the management of the pregnant cardiac arrest victim
2. Define ischaemic and haemorrhagic stroke
3. Describe the emergency management of stroke
4. Describe the management of traumatic cardiac arrest
5. Describe the management of the victim of electrocution
6. Define drowning, near drowning, immersion syndrome and secondary drowning
7. Describe ALS measures specific to the near drowning victim
8. Describe ALS measures in managing the hypothermic patient
9. Apply concepts learned in the care and management of patients with life threatening situations

Pregnancy

The mortality rate associated with pregnancy in developing countries is estimated at 1:30,000 deliveries. Significant physiological changes occur in body during pregnancy, for example cardiac output, blood volume, minute ventilation and oxygen consumption is increased. The gravid uterus may compress the iliac and abdominal vessels when the mother is in supine position causing reduced cardiac output and hypotension.

Causes of cardiac arrest

- Pre-existing cardiac disease
- Thromboembolism
- Suicide
- Hypertensive disorders of pregnancy
- Sepsis
- Ectopic pregnancy
- Haemorrhage
- Amniotic fluid embolism

(Soar J, Deakin C D, Nolan J P, Abbas G, Alfonzo A, Handley A, Lockey D Perkins G D, Thies K, 2005:S159-S160)

Modifications to BLS

After 20 weeks gestation uterine pressure against inferior vena cava and aorta may impede venous return and cardiac output. Uterine obstruction of venous return can cause pre-arrest hypotension or shock and precipitate cardiac arrest.

The pregnant woman needs to be positioned on her back with shoulders flat and sufficient padding under the right buttock to provide pelvic tilt to the left. (Australian Resuscitation Council Guideline 7 February 2006).

Hand position higher than normal may be required for chest compressions. Defibrillation energy is standard recommended dose. Application of adhesive defibrillator pads is preferable to use of paddles due to left lateral tilt and large breasts.

Modifications to ALS

In pregnancy there is an increased risk of aspiration due to gastro-oesophageal sphincter insufficiency. Early endotracheal intubation with cricoid pressure may decrease the risk of aspiration. A smaller endotracheal tube of 0.5-1mm internal diameter may be used because of maternal airway narrowing and swelling.

Specific causes of cardiac arrest in pregnancy include:

Haemorrhage

Life-threatening haemorrhage may occur in the antenatal or postnatal period. This can be due to ectopic pregnancy, placental abruption, placenta praevia and uterine rupture.

Treatment

- Fluid resuscitation and transfusion
- Correction of coagulopathy
- Oxytocin and prostaglandins
- Uterine compression sutures
- Radiological embolisation
- Hysterectomy
- Aortic cross-clamping

Soar et al 2005:S160

Stroke

Stroke is a sudden neurological illness caused by thrombus occlusion or a neurological bleed. Stroke may be defined as acute focal neurological deficit (Riley 2003:495).

Stroke may present as:

Cerebral infarction

Cerebral Thrombosis:
Atherosclerosis and narrowing of blood vessels can form a thrombus.
Cerebral Embolism:
Occurs as a result of thrombus or plaque from elsewhere in body approximately 30% of emboli may arise from thrombus in left atrium of ventricles of the heart (Riley 2003:495).

Spontaneous Intracranial haemorrhage

Intracerebral haemorrhage:
Occurs in age range of 40 – 70 years and incidence is approximately 9 in 100 000 commonly due to hypertension. Usually due to ruptured blood vessel (Riley 2003:497-498).

Subarachnoid haemorrhage (SAH):
Bleed occurs in subarachnoid space and into the brain parenchyma. Incidence is about 6 in 100 000 and patients are younger. Mortality is approximately 50%. SAH is caused by ruptured aneurysms in 85%
(Riley 2003:499).

Signs and symptoms

One third of the patients are aware of symptoms of the stroke and rescue bystanders may have limited knowledge. The clinical signs and symptoms of cerebral infarction and haemorrhagic type stroke may overlap.

- Altered level of consciousness (LOC)
- Intense or unusually severe headache with neurological deficit
- Aphasia
- Facial weakness or paralysis
- Incoordination, weakness, paralysis or sensory loss in one or more limbs
- Ataxia
- Visual loss or problems
- Vertigo, blurred vision

- Nausea & vomiting
- Photophobia or phonophobia
- Abnormal ventilation
- (ACCCN notes p75)

Treatment of Stroke

Involves basic resuscitation including airway, breathing and circulatory support.

Airway and Breathing

- Endotracheal intubation (ETT) if Glasgow Coma Score is 8 or below and absent gag reflex. ETT is vital to protect the airway and prevent aspiration.
- Adequate supplemental O_2 and ventilation support
- Monitoring of arterial blood gases and prevention of hypercarbia

(Riley 2003:496).

Circulation

- Monitor BP closely
- Assess clinical & neurological function prior to treating hypertension (cerebral perfusion may be dependant on BP)
- Maintain cardiac output & treat underlying cardiac problems eg heart failure, MI and arrhythmia

(Riley 2003:496).

Metabolic

- Blood glucose level (BGL) monitoring levels should be normal. Both hypo and hyperglycaemia can be detrimental after stroke.
- Nutritional & enteral support (long term)

(Riley 2003:496).

Anticoagulant

- Anticoagulation (in high risk) of cerebral infarction, prosthetic heart valves and atrial fibrillation with thrombus, CT scan must be available prior to therapy

(Riley 2003:496).

Thrombolysis

- T-PA intravenous in acute ischaemic stroke < 3hrs post event

(Aiyagari, Powers and Diringer 2005:988).

Other

Management of increased intracranial pressure

- Fluid restriction
- Elevate head of the bed
- ETT & ventilation (PCO_2 35-36mmHg)
- Hyper osmolar IV fluids with mannitol to improve cerebral perfusion
- Pain relief, agitation and fever control
- Anticonvulsant medication

- Surgical intervention with raised ICP, haemorrhage and cerebral oedema (ACCCN 76).

Trauma

Trauma is defined as injury that is caused by sudden physical force eg motor vehicle accident, physical assault, drowning and fire (ACCN 76).
Cardiac arrest from trauma injury has a high mortality with a survival of 2.2% commonly associated neurological disability (Soar et al 2005:S156).

Resuscitation of trauma patient is time critical the term “golden hour” emphasizes a need for rapid assessment and management. Resuscitation of trauma requires a coordinated, methodical and structured approach (McMahon and Browne 2003:12)

Australian hospitals follow the guidelines for Management of Severe Trauma (EMST).

Primary Survey

Rapid evaluation, to assess and treat life-threatening injuries.

A B C D E

Airway

- Cervical spine immobilisation / control if not in place, until C spine injuries have been excluded.
- Assess airway voice and patency
- Definitive airway management (ETT) for upper airway injury or coma (GCS<9).
- Surgical airway if unable to maintain adequate airway

Breathing

- Listen for breathing sounds & assess respiratory rate depth & effort
- Check trachea position, absence of breath sounds and tracheal deviation with hypotension is indicative of tension pneumothorax this requires immediate treatment of needle thoracostomy (Browne et al 2003:15).
- Provide supplemental O_2 (maintain SpO_2 >95%)
- Ventilate with 100% O_2 prior to ETT

Circulation

- Assess pulse, pulse pressure and heart rate
- ECG leads, pulse oximetry and blood pressure cuff
- Assess for blood loss (haemodynamic instability is affected to: chest abdomen, pelvis and extremity haemorrhage)
- IV Fluid resuscitation isotonic saline followed by colloid

“Find the injury before it finds you via circulatory collapse” (Browne et al 2003:16).

Disability

- Rapid neurological assessment (GCS eye opening, best verbal response & best motor response total score from 3-15)
- Assess pupil responses

Exposure

- Remove / cut clothing and assess & evaluate the whole body for injury
- Log roll & examine the back

After Primary Survey

Application of indwelling urinary catheter and gastric tube is done (ensure there are no contraindications).
Initial radiographs to be done include: lateral C spine, chest and pelvis (ACCCN 77).

Secondary Survey

- Commenced after the patient is resuscitated.
- Thorough head to toe examination to detect other injuries.
- Head and skull: inspect ears & nose for CSF discharge and examine skull
- Maxillofacial: jaw & face tested for abnormal mobility, suspect C-spine injury with significant facial injury.
- Neck and spine: patient is log rolled spine is inspected & palpated
- Chest is assessed for fractured ribs & any injuries to lungs, heart or great vessels.
- Abdomen: assess for potential injury to spleen, liver, mesenteries and kidneys. Retroperitoneal bleed may occur.
- Perineal: inspect perineal bruising may indicate urethral or prostate damage (IDC are contraindicated).
- Musculoskeletal: inspection & palpation of limbs, assessment of neurovascular function, check for lacerations, haematomas. Splint fractures reduce pain & orthopaedic review.
- Neurological examination spinal cord activity, reflexes (ACCCN78).
- Determine further radiographs & imaging
- Announce care plan
- Prepare for definitive care (OR, ICU, ward)

(Browne et al 2003:23).

Definitive Care

- OR, intensive care or acute care admission
- Handover from emergency

(Browne et al 2003:23).

Electrocution

Resistance

Tissues in the body are of different resistance to electrical current for example bone has highest resistance followed by fat, tendon, skin, muscle, blood vessels & nerves. Resistance of skin varies in relation to moisture. The resistance of wet & soaked skin is low which increases current flow and may induce

ventricular fibrillation. Moisture has been identified as being important factor in electrocutions
(Fatovich 2005:775).

Current

Hand-to-hand transthoracic current is more likely to be fatal than hand-to-foot or foot-to-foot pathway. Current follows path of least resistance.
Contact with alternating (AC) current may cause tetanic contraction and prevent release from electricity, resulting in myocardial or respiratory failure & death.

Respiratory failure / arrest may be caused by paralysis of CNS or it may precipitate VF (causing R on T phenomenon) as the current traverses the myocardium (Soar et al 2005:S162).

Clinical Effects

- Burns: Electrothermal burns from contact point to ground, varying degrees of burns central charred black with oedema appearance
- Cardiac: VF, delayed arrhythmia, sinus tachycardia, AMI
- Nervous System: respiratory arrest, seizures amnesia, coma, dysphasia, peripheral nerve injury)
- Renal: acute renal failure due to myoglobinuria

(Fatovich 2005:775).

Lightning Strike

Lightning strike passes over the surface of body & is called “external flashover”.

Deep burns may be a result at point of contact mostly on head neck and shoulders. Body injury can result indirectly through ground current “splashing” from objects & trees that are hit by lightning. Blunt injuries can be caused by explosive force. Pattern of severity varies among the affected (Soar et al 2005:S162).

Clinical Effects

- Cardiac arrest VF
- Chest pain & muscle aches
- Neurological deficits
- Contusions
- Tympanic membrane rupture
- Keraunoparalysis (limb paralysis is common)
- Mottled limb impalpable pulses
- Cutaneous burns “feathery”
- Cataracts
- Myoglobinuria
- Deafness
- Vestibular dysfunction
- Retinal detachment & optic nerve damage

(Fatovich 2005:777-778).

Rescue

Ensure safety make sure power is switched off prior to approaching casualty.

High voltage electricity can arc and be conducted through ground up to several metres. Check is it safe to approach & handle casualty after lightning strike it may be wise to move to a safer area.

Resuscitation Management

Do not delay basic and advanced life support (Soar et al 2005:S163).

- Airway management ETT
- C spine immobilisation
- Ventilatory support for muscular paralysis
- VF arrest requires defibrillation, (standard ALS protocol for asystole)
- Remove smouldering clothing to avoid thermal injury
- IV fluid resuscitation
- Surgical treatment with severe thermal injuries
- Perform thorough secondary survey
- Assess for compartment syndrome
- Monitor in hospital

(Soar et al 2005:S163).

Drowning

ILCOR defines drowning as a process resulting in primary respiratory impairment due to submersion / immersion in a liquid medium (Soar et al 2005:S141-142).

Pathophysiology

Hypoxaemia results as a consequence of drowning. Central nervous system damage and raised ICP, acidosis and damage to GIT may occur with hypoxaemia.
Pulmonary oedema can manifest in about 75% of drowning. This can cause > peripheral airway resistance, atelectasis, perfusion mismatching, pulmonary vasoconstriction > hypoxaemia and lung damage (ACCCN 79-80).
Salt versus fresh water: small differences in electrolytes are rare and of any clinical relevance (Soar et al 2005:S144).

Other associated injuries

- Spinal cord injury from diving
- Air embolism from scuba diving
- Hypothermia

Management of Drowning –

Basic Life Support and Aquatic Rescue

Ensure personal safety minimise danger to all, attempt to save without entering water use of aid eg stick rope or clothing. Use buoyant rescue aid or flotation device. Remove victim from the water by the safest possible means. Cervical spinal immobilisation is not indicated unless signs are apparent of spinal injury. If there is history of diving, trauma, alcohol intoxication or use of water slide, spinal precautions are taken. Whenever possible remove victim from water in a

horizontal position to minimise cardiovascular collapse & hypotension (Soar et al 2005:S142).

Advanced Life Support

Airway and Breathing
Initial assessment high flow O_2 to spontaneously breathing victim. Pulse oximetry ABG's. Early ETT if reduced consciousness to protect airway. Treat hypoxaemia.

Circulation and Defibrillation
Severe hypothermia (core body temperature ≤30°C) limit defibrillation to 3 shocks & withhold IV drugs until temperature increases. Correct hypovolaemia give IV fluids (avoid excessive amount). Haemodynamic monitoring (Soar et al 2005:S143).

Other Care
Protective ventilation: increase survival & reduce ARDS and Prophylactic antibiotics: prevent pneumonia. Hypothermia treatment:small studies have shown survival from passive warming (no evidence of benefit from induced hypothermia) and use of pragmatic approach. Rewarm until core temperature is 32°C-34°C & avoid hyperthermia (Soar et al 2005:S144).

Hypothermia

Is defined when body core temperature is below 35°C. Mortality rate from accidental hypothermia varies according to severity; it averages 21% when temperature decreases to between 28 and 32°C (Hussein 2003:772).

Hypothermia may be a result of: cold environment, immersion in cold water, impaired thermoregulation, injury or collapsed patient. People with alcohol or drug problems & mentally ill are at risk of hypothermia. In some situations hypothermia may be a protective measure to brain after cardiac arrest. Life saving resuscitation should not be withheld on clinical presentation (Soar et al 2005:S144). Do not confirm death until victim has been rewarmed or attempts have failed.

Resuscitation Management

Immediate BLS and ALS

- Use warm humidified O_2.
- ETT if indicated. Caution: handle patient gently as may precipitate arrhythmias
- Palpate major artery for 1 minute, look at ECG use Doppler if available if pulseless start ECC.
- Refer to ALS algorithm
- Confirm hypothermia with low reading thermometer
- Withhold drugs until temperature is >30°C (efficacy of drugs in hypothermia is limited)
- When temperature reaches 30°C intervals between drug doses should doubled (when temperature is normal use standard drug protocol)
- Rule out primary causes (4 H's & 4 T's)

- If VF give shock (if VF/VT persists after 3 shocks delay further defibrillation until core temperature is >30°C)
- Bradycardia may be present (cardiac pacing not indicated unless persists after warming)

Rewarming

- Remove from cold & prevent heat loss (cover with blankets)
- Rapid transfer to hospital
- Passive warming mild hypothermia & conscious victim (blankets & warm room)
- Active warming for severe hypothermia or cardiac arrest (warm IV fluid, gastric, peritoneal or pleural lavage and extracorporeal bypass)
- Large volume of warm IV fluids (due to vascular space expansion with vasodilation)
- Haemodynamic monitoring

(Soar et al 2005:S146).

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MODULE SIX
LEGAL AND ETHICAL ISSUES

Aim: The aim of this module is to explore the legal and ethical issues associated with resuscitation.

The participant should be able to:

1. Define legal and ethical terminology
2. Discuss legal and ethical principles related to ALS
3. Discuss guidelines for not initiating CPR
4. Discuss guidelines for ceasing CPR
5. Apply concepts learned in the care and management of patients with life threatening situations

Legal and Ethical Issues

Decisions to attempt or withhold resuscitation, need to be made with an adequate understanding of the legal and ethical principles involved. Health care providers must utilize a collaborative approach, involving both patient and where possible, family to discuss end of life issues. These matters are often influenced by many factors, including personal, cultural, religious, legal and even economical resources(1) Discussing and documenting these decisions in advance, allow for a planned response in the event of rapid deterioration of the patient. An understanding of the legal and ethical principles, allow health care providers to make rapid decisions when no such advance discussions have occurred.

Biomedical Ethics

There are four main ethical principles, which guide our practice, and provide a framework for reasoning, when determining an optimal course of action(5). Autonomy, Beneficence & Non-maleficence, and Justice.(2)

Autonomy

Autonomy refers to the patient's authority and right to make decisions on their own behalf. Health care providers facilitate this by providing all the relevant information to allow the patient to come to an informed decision. Patients need to be competent to understand not only their condition, but also the consequences of their decisions regarding health care. They also ought to be under no undue pressure or influence from members of the health care team or relatives. The NSW DOH guidelines for end of life care and decision-making states that patients have a right "to be informed of their condition and treatment options" and a right to "receive or refuse life-prolonging treatment." These guidelines also state that "Caregivers have an ethical and legal obligation to acknowledge and honour those stated choices and preferences."(3)

Beneficence

This is the responsibility of the health care worker to provide care that benefits the patient and aims for the wellbeing of the patient.

Non-maleficence

This is the responsibility of the health care worker to do no harm to the patient. This may involve not attempting resuscitation when it is futile, or against the patient's stated wishes.(1)

Justice

The principle of justice is the responsibility of the health care worker to treat all patients equally and with no discrimination.(3) Patients with the same medical needs are not to be treated differently. The ability of the patient to pay for treatment, or the patient's own contribution to the illness, ought not to determine or limit their treatment.(2)

A Patients Wishes

To avoid confusion about a person's wishes in regard to end of life issues and CPR, it is possible to prepare legally administered **living wills** and **advance directives**. These documents allow the person to express their wishes while competent. They may also elect a **surrogate decision maker** in the event that they cannot make health care decisions on their own behalf.

Advance Directives may be done through a solicitor, or simply by writing out a document and signing it with a witness. Within NSW this written document does not have to be in any particular form or structure, and does not have to be submitted to any authority for validation(4). It must however be specific. For practical reasons a copy of these documented wishes ought to be distributed to those most likely to be responsible in an emergency, or should one become incompetent to advise of decisions with regard to end of life issues. Any medical team caring for the person, and a close relative ought to have a copy.

Although Advance Care Directives are usually written and signed, a patient may elect to verbally advise of their wishes. These wishes ought to be clearly documented in the patient's medical history and communicated to the senior medical officer responsible for care.

CPR

The initial response to any cardiac arrest ought to be immediate CPR. Only when there is prior knowledge of a "No CPR" order, is resuscitation withheld. There are however, some clinical situations that are not so "black and White", and judgment on the appropriateness of CPR will inevitably have to be determined.

Some indications, which may influence the decision to withhold CPR, include:

- When the illness is in a terminal stage
- Multi organ failure with no reversible cause
- A neonate born with anencephaly or other fatal malformations
- A person who has been discovered and it is evident that a prolonged period of time has elapsed since arrest (eg: rigor mortis, dependent lividity).

In cases such as these (this small list is only a few examples), CPR would be of no benefit to the patient (6). Health care professionals are not required to provide treatment that would be considered futile.
"No CPR" orders must be specific in their description. Does the patient want defibrillation, but not intubation? The patient must be fully educated as to the consequences of these decisions.

NOTE: A "No CPR" order is not an indication to withdraw other treatment such as nutrition, pain relief, or antibiotics. Correction of electrolyte imbalances and other reversible issues should be attended. If the patient, or their surrogate decision-maker refuses certain treatment, for example, the use of inotropes, this should be specifically documented in the medical notes.

The people involved in the decision-making process need to understand the consequences of withholding this treatment.

Hospitals ought to have a policy to govern how often “No CPR” orders are reviewed and re-documented. Fluctuations in a patient’s condition may also determine that a review is needed(3). In Hunter New England Health Area, the orders need to be reviewed with changes in the patients clinical condition, or if the patient should change their mind. These orders will obviously be reviewed more frequently in acute care than in palliative or residential care. In some acute care areas “No CPR “ orders are reviewed weekly.

When To Stop CPR

Many issues influence the decision to stop CPR and pronounce death. The medical officer or team leader makes this decision, after considering:

- Medical history
- Diagnosis & prognosis
- Time elapsed between arrest and commencement of CPR
- No obvious reversible cause, and no severe hypothermia
- Length of time of resuscitation efforts
- Sustained asystole
- Confirmation of ‘no CPR’ order

The Presence of Family During Resuscitation

Health Care workers have a wide range of opinions concerning the presence of relatives during resuscitation. Many different experiences and cultural backgrounds may influence thoughts on this situation.
Many studies have documented the benefits of family presence. In a study involving 400 parents, most wanted the option to decide if they would stay with their child during resuscitation (7).

There are some documented arguments against the presence of relatives: (8)…

- Patient’s right to confidentiality
- Relative’s impact on the Resus team (influencing to prolong a futile resus attempt, or to prematurely stop resus)
- Hysterical relatives intervening and hindering resuscitation.
- Increasing the potential for litigation if an error is witnessed, increasing the stress on the medical team.
- Emotional trauma to the relative watching invasive procedures.

Although every resuscitation attempt ought to be approached individually, it would appear that of the studies conducted, most concluded the benefits to the relatives far exceeded the problems listed above.

Benefits included: (1)…

- Acceptance of the reality of the death
- A feeling that the relative was there to support their loved one during their final moments.

- Being able to talk to, and perhaps touch their loved one while they still warm. Some people believe a dying relative might still be able to hear them and gain comfort as a relative says goodbye.(8)
- The assurance that every effort was made to resuscitate.
- One study documented that 76% of relatives felt the grieving process had been easier. (8)

How Can We Help Those Who Wish to Be Present?

Relatives ought to be able to decide on their presence without judgment or influence from staff. Once the decision to stay with the patient has been made, it is essential that a staff member be appointed to stay with the relatives throughout. Explanation of procedures and comfort is essential. This also allows the team to focus on the patient, knowing that the relative is being cared for. The person accompanying the relative, needs to understand the resuscitation process, in order to answer questions and offer explanation. This job usually falls to a nurse, although in some countries, children's hospitals have social workers or counsellors that respond with the emergency team and are designated to this role.

Coroner's Cases

If it is suspected that a death would be examinable by the coroner, the hospital and medical practitioner must report the death to the police or coroner. The following is from a Department of Health Policy Directive titled, "Coroner's Cases and Amendments to Coroner's Act 1980".(9)

Within the HNEHS there is a "Checklist for Clinical Staff to Identify Deaths Reportable to The Coroner" – (form Discharge HSMR4F)

Guidelines for Staff regarding Coroner's Cases

- A death Certificate is not issued
- The body is not washed or prepared in any way. Nothing is removed. Body fluids (eg:NG aspirate) is collected and kept.(See page 5 of DOH Policy)
- MO reports death to police or coroner
- MO completes form A and if death is anaesthetic related, completes form B
- Body remains in the ward until police, with a family member present, have identified the body.
- Police will take the original medical records. A copy therefore is needed of all the record.

Documentation during ALS

Basic and Advanced Life Support needs to be documented clearly. All interventions and medications ought to be documented as they happen. It is helpful to have one person responsible for scribing during resuscitation. Medications need to be checked and documented legally. All forms must have clear patient identification with MRN. **The current form in use within the HNEHS is "CPR Record" HSMR 15RA**. The person documenting, and the Team Leader must sign the form.

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