Advanced Life Support Course (ACRRM ALS)

PARTICIPANT MANUAL

“Any attempt at resuscitation is better than no attempt”
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Acknowledgement

Sections of this manual contain information derived from the ACRRM Rural Emergency Skills Training (REST) course manual and the Australian and New Zealand Resuscitation Council Guidelines and Flowcharts.

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Section 1 – Introduction

Background

ACRRM considers that all ACRRM Fellows should gain competency in Advanced Life Support skills that would strengthen their confidence and competence in dealing with emergency situations. As such, the College has introduced the mandatory category of Advanced Life Support into its Professional Development Program (PDP).

To be compliant in the Advanced Life Support category of the ACRRM PDP, participants must successfully complete one Advanced Life Support activity congruent with the Australian Resuscitation Council guidelines during the triennium.

According to the Australian Resuscitation Council guidelines, Advanced Life Support is basic life support (e.g. understanding of, and practical competence in, one person and two person expired air resuscitation and external cardiac compression) with the addition of invasive techniques such as:

- airway management techniques that include Geudel’s airway, bag and mask, oxygen therapy and either laryngeal mask or intubation;
- use of Automated External Defibrillators (AEDs) / biphasic defibrillators;
- identification and management of basic arrhythmias; and
- intravenous access and drug therapy.

The ACRRM Advanced Life Support course will incorporate the key aspects of Advanced Life Support skills as detailed above. The course content will be aimed toward general practitioners, especially those practising in rural and remote Australia.

Aims of the Course

The Advanced Life Support course to be developed by ACRRM for rural and remote general practitioners through the funding of this project aim to:

- Provide the rural and remote primary health care workforce and registrars with evidence based knowledge and skills to successfully provide Advanced Life Support to their patients, based on early detection, treatment and management of emergency medicine situations consistent with the ACRRM Professional Development Program requirements, ACRRM curriculum, and Australian Resuscitation Council guidelines;
- Provide the rural and remote primary healthcare workforce with an accessible learning environment;
- Provide the rural and remote primary health workforce with access to continually updated resource materials to enhance their learning and patient management;
- Provide an environment in which the rural and remote primary health care workforce can interact with their peers and establish productive professional networks;
- Increase access to Advanced Life Support education and training opportunities for rural and remote doctors; and
- Increase the number of rural and remote doctors participating in Advanced Life Support education.
Use of this Manual

This manual is designed to highlight key current ALS guidelines specified by the Australian and New Zealand Resuscitation Council Policy Statements.

The course is designed to include sound educational principles, incorporating principles of adult learning, with a particular focus on the modes of teaching and learning relevant to emergency medicine skills.

The ANZCOR Guidelines relevant to this course content are referred to later in the manual, and links to those are noted for your pre-reading/reference.

If however you require more detailed information, or wish to read more specific Australian and New Zealand Resuscitation Council Guidelines please click HERE for access to full GUIDELINE INDEX and references.

Accreditation of this Course and Maintenance of Standards

- The course is accredited for continuing professional development by ACRRM PDP and covers the mandatory requirement for FACRRM/ VR maintenance compliance. It is also an accredited QA&CPD course (including BLS mandatory requirement).
- The course is accredited for eligible participants practicing in ASGC-RA 2-5 to claim against all components of the Procedural Grant (Emergency Medicine; Anaesthetics; Obstetrics and Surgery).
- See HERE for more information regarding eligibility to apply/register/claim grant.

Satisfactory Completion of the Course

The six assessment components are:
- Pre MCQ
- Basic Life Support
- Basic Airway Management
- Defibrillation
- Advance Life support
- Post MCQ

Section 2 – Course Objectives

Course Objectives

The main learning objectives of the ACRRM Advanced Life Support (ALS) course are to:

- Augment the skills of the rural and remote primary health care workforce to improve early detection, treatment and management of medical emergencies in rural and remote communities;
- Increase the confidence of rural general practitioners in performing Advanced Life Support in emergency situations.
Section 3 – Pre-Hospital Care

Pre-hospital Care and community involvement

The rural practitioner has a very important role to play with regards to pre hospital care and community involvement. Communities look at the doctor and other health professionals for guidance and direction. There is more evidence to suggest that the earlier doctors perform CPR the better the outcome the patient will have. Practitioners should be teaching the community members that any attempt at resuscitation is better than none regardless of their training. The more health professionals teach this the better outcome patients will have.

Practitioners should actively encourage Basic Life Support (BLS) workshops in the community. It should not be forgotten that BLS can be taught to primary school children!

If BLS has commenced earlier it will then give doctors a better chance of resuscitating the critically ill patient.

Basic Life Support

- The Australian Resuscitation Council defines Basic Life Support as “the preservation of life by the establishment of and/or maintenance of airway, breathing and circulation and related emergency care without the use of equipment.”

- Emphasis is being placed on early CPR

- The educational premises is “simple is best”

- The principles of Basic Life Support are essential to the application of skills in Advanced Life Support and other interventions in Emergency Care.

- The principles of BLS are outlined in the flow chart on the following pages, (from ARC Guidelines).

- Specific techniques are required in children, dependent on the size of the child. These are outlined in the following pages.

- Remember that cardiac arrest in children is usually the result of progressive hypoxia and metabolic derangement, rather than a primary cardiac event. Therefore oxygen delivery, rather than defibrillation, in conjunction with external cardiac compression, is the critical intervention in children.
Basic Life Support

Dangers?

Responsive?

Send for help

Open Airway

Normal Breathing?

Start CPR
30 compressions : 2 breaths

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

Continue CPR until responsiveness or normal breathing return
Advanced Life Support

- Cardio resuscitation (CPR) is the technique of chest compressions combined with rescue breathing.

CPR has fundamental components:

A.....**Airway** assessment and management

B.....**Breathing** assessment and management

C.....**Circulation** assessment and management

Advanced Life Support (ALS) is basic life support with the addition of invasive techniques.

See Following

ANZCOR ALS Guidelines : (Flowcharts and other)
Advanced Life Support for Adults

Start CPR
- 30 compressions: 2 breaths
- Minimise Interruptions

Attach
Defibrillator / Monitor

Assess Rhythm

Shockable

Shock

CPR for 2 minutes

Non Shockable

Return of Spontaneous Circulation?

CPR for 2 minutes

Post Resuscitation Care

During CPR
- Airway adjuncts (LMA / ETT)
- Oxygen
- Waveform capnography
- IV / IO access
- Plan actions before interrupting compressions (e.g. charge manual defibrillator)

Drugs
- **Shockable**
  - *Adrenaline 1 mg after 2nd shock (then every 2nd loop)*
  - *Amiodarone 300mg after 3 shocks*
- **Non Shockable**
  - *Adrenaline 1 mg immediately (then every 2nd loop)*

Consider and Correct
- Hypoxia
- Hypovolaemia
- Hyper / hypokalaemia / metabolic disorders
- Hypothermia / hyperthermia
- Tension pneumothorax
- Tamponade
- Toxins
- Thrombosis (pulmonary / coronary)

Post Resuscitation Care
- Re-evaluate ABCDE
- 12 lead ECG
- Treat precipitating causes
- Aim for: SpO2 94-98%, normocapnia and normoglycaemia
- Targeted temperature management
Advanced Life Support for Infants and Children

Start CPR
- 2 breaths : 15 Compressions
- Minimise Interruptions

Attach Defibrillator / Monitor

Assess Rhythm

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

Non Shockable
- Return of Spontaneous Circulation?
- CPR for 2 minutes

Post Resuscitation Care

During CPR
- Airway adjuncts (LMA / ETT)
- Oxygen
- Waveform capnography
- IV / IO access
- Plan actions before interrupting compressions (e.g. charge manual defibrillator to 4 J/kg)

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

Consider and Correct
- Hypoxia
- Hypovolaemia
- Hyper / hypokalaemia / metabolic disorders
- Hypothermia / hyperthermia
- Tension pneumothorax
- Tamponade
- Toxins
- Thrombosis (pulmonary / coronary)

Post Resuscitation Care
- Re-evaluate ABCDE
- 12 lead ECG
- Treat precipitating causes
- Re-evaluate oxygenation and ventilation
- Targeted Temperature Management

Newborn Life Support

At all stages ask: do you need help?

Term gestation? Breathing or crying? Good tone?
- YES Stay with Mother
- NO Maintain normal temperature, Ensure open airway, Stimulate

HR below 100? Gasping or apnoea?
- YES Positive pressure ventilation SpO₂ monitoring
- NO

HR below 100?
- YES Ensure open airway Reduce leaks Consider: Increase pressure & oxygen Intubation or laryngeal mask
- NO

HR below 60?
- YES Three chest compressions to each breath 100% oxygen Intubation or laryngeal mask Venous access
- NO

HR below 60?
- YES IV Adrenaline Consider volume expansion
- NO

Maintain normal temperature, Ongoing evaluation

Laboured breathing or persistent cyanosis?
- YES Ensure open airway SpO₂ monitoring Consider CPAP
- NO

Post-resuscitation care

Targeted pre-ductal SpO₂ after birth
- 1 min 60-70%
- 2 min 65-85%
- 3 min 70-90%
- 4 min 75-90%
- 5 min 80-90%
- 10 min 85-90%

IV Adrenaline 1:10,000 solution

<table>
<thead>
<tr>
<th>Gestation (weeks)</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>23-26</td>
<td>0.1 mL</td>
</tr>
<tr>
<td>27-37</td>
<td>0.25 mL</td>
</tr>
<tr>
<td>38-43</td>
<td>0.5 mL</td>
</tr>
</tbody>
</table>

10-30 mcg/kg (0.1-0.3 mL/kg)

January 2016
Foreign Body Airway Obstruction (Choking)

Assess

Ineffective Cough
- Severe airway obstruction
  - Unresponsive
    - Send for help
    - Start CPR
  - Responsive
    - Send for help
    - Give up to 5 back blows
    - *If not effective*
    - Give up to 5 chest thrusts

Effective Cough
- Mild airway obstruction
  - Encourage Coughing
    - Continue to check casualty until recovery or deterioration
    - Send for help

January 2016
Anaphylaxis

Emergency management for health professionals

Clinical features

Any acute onset of hypotension or bronchoconstriction or upper airway obstruction where anaphylaxis is considered possible, even if typical skin features are not present

OR

Any acute onset with typical skin features (urticarial rash or erythema and flushing, and/or angioedema)

PLUS

Involvement of respiratory and/or cardiovascular and/or persistent severe gastrointestinal symptoms

1 Immediate action

• Remove allergen (if still present)
• Call for assistance
• Lay patient flat. Do not allow them to stand or walk. If breathing is difficult allow them to sit.

2 Give INTRAMUSCULAR ADRENALINE into mid-lateral thigh without delay

Adrenaline Dose Chart (1:1000 ampoules containing 1 mg adrenaline per 1 mL)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight (kg)</th>
<th>Adrenaline volume 1:1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1</td>
<td>5–10</td>
<td>0.05–0.1 mL</td>
</tr>
<tr>
<td>1–2</td>
<td>10</td>
<td>0.1 mL</td>
</tr>
<tr>
<td>2–3</td>
<td>15</td>
<td>0.15 mL</td>
</tr>
<tr>
<td>4–6</td>
<td>20</td>
<td>0.2 mL</td>
</tr>
<tr>
<td>7–10</td>
<td>30</td>
<td>0.3 mL</td>
</tr>
<tr>
<td>10–12</td>
<td>40</td>
<td>0.4 mL</td>
</tr>
<tr>
<td>&gt;12 and adult</td>
<td>&gt;50</td>
<td>0.5 mL</td>
</tr>
</tbody>
</table>

Repeat doses every 5 minutes as needed

If multiple doses required or a severe reaction, consider adrenaline infusion if skills and equipment available (see section 5)

Autoinjectors

An adrenaline autoinjector (EpiPen or Anapen) may be used instead of an adrenaline ampoule and syringe.

For children 10–20 kg (age 1–5 years) EpiPen Junior or Anapen Junior should be used.

Instructions are on device label

3 Call ambulance to transport patient if required

4 Supportive management

When skills and equipment available:

• Monitor pulse, blood pressure, respiratory rate, pulse oximetry
• Give high flow oxygen and airway support if needed
• Obtain intravenous access in adults and in hypotensive children
• If hypotensive, give intravenous normal saline (20 mL/kg rapidly) and consider additional wide bore intravenous access

For Additional measures see below

5 Additional measures

Adrenaline infusion

If inadequate response or deterioration, start an intravenous adrenaline infusion as follows:

Give only in liaison with an emergency medicine critical care specialist.

Mix 1 mL of 1:1000 adrenaline in 1000 mL of normal saline

Start infusion at 0.5 mL/hr (or 0.1 microgram/kilogram/minute)

Titrate rate according to response

Monitor continuously

CAUTION – intravenous boluses of adrenaline are not recommended due to the risk of cardiac arrhythmias

If adrenaline infusion is ineffective or unavailable, consider:

For upper airway obstruction

• Nebulised adrenaline (5 mL i.e. 5 ampoules of 1:1000)
• Consider intubation if skills and equipment are available

For persistent hypotension/shock

• Give normal saline (maximum 50 mL/kg in the first 30 min)
• In patients with cardiogenic shock (especially if using beta blockers) consider an intravenous glucagon bolus of 1–2 mg in adults (in children: 20–30 microgram/kg up to 1 mg). This may be repeated or followed by an infusion of 1–2 mg/hour in adults.
• In adults, selective vasoconstrictors metaraminol (2–10 mg) or vasopressin (10–40 units) only after advice from an emergency medicine critical care specialist

For persistent wheeze

• Bronchodilators. Salbutamol 8–12 puffs of 100 microgram using a spacer or 5 mg salbutamol by nebuliser
• Oral prednisolone 1 mg/kg (maximum 50 mg) or intravenous hydrocortisone 5 mg/kg (maximum 200 mg)

6 Observation

Prolonged and biphasic reactions may occur

Observe patient for at least 4 hours after last dose of adrenaline

Observe longer (overnight) if patient:

• had a severe reaction (hypotension or hypoxia) or
• required repeated doses of adrenaline or
• has a history of asthma or provoked anaphylaxis or
• has other concomitant illness or
• lives alone or is remote from medical care

7 Follow-up treatment

Antihistamines

Antihistamines have no role in treating respiratory or cardiovascular symptoms of anaphylaxis. Oral non-sedating antihistamines may be given to treat itch and urticaria. Inflammable syncope should not be used in anaphylaxis as it can worsen hypotension and cause muscle necrosis.

Corticosteroids

The role of corticosteroids is unknown. It is reasonable to prescribe a 2-day course of oral prednisolone (e.g. prednisolone 1 mg/kg, maximum 50 mg daily) to reduce the risk of symptom recurrence after a severe reaction or a reaction with marked or persistent wheeze.

Adrenaline autoinjector

Prescribe an autoinjector, pending specialist review. Train the patient in autoinjector use and give them an ASCIA Action Plan for Anaphylaxis (see Australian Society of Clinical Immunology and Allergy website www.allergy.org.au)

Allergy specialist referral

Refer patients with anaphylaxis for specialist review

Click HERE for ANZCOR Guidelines – See Section 9.2 - Guideline 9.2.7

First Aid Management of Anaphylaxis

Published as an insert to Australian Prescriber August 2011, Vol 34 No. 4, and available at www.australianprescriber.com with Vol. 34 No. 4, August 2011.

Endorsed by the Australasian Society of Clinical Immunology and Allergy, the Royal Australian College of Physicians, the Royal Australian College of General Practitioners, the Australasian College for Emergency Medicine, the Royal Australian and New Zealand College of Radiologists, the Internal Medicine Society of Australia and New Zealand, and the Australian Dental Association.
The Canadian C-Spine Rule
For alert (GCS=15) and stable trauma patients where cervical spine injury is a concern

1. Any High-Risk Factor Which Mandates Radiography?
   - Age $\geq 65$ years
   - Dangerous mechanism*
   - Paresthesias in extremities
   - No
   - Yes

2. Any Low-Risk Factor Which Allows Safe Assessment of Range of Motion?
   - Simple rearend MVC **
   - Sitting position in ED
   - Ambulatory at any time
   - Delayed onset of neck pain ***
   - Absence of midline c-spine tenderness
   - No
   - Unable
   - Yes

3. Able to Actively Rotate Neck?
   - $45^\circ$ left and right
   - Able
   - No Radiography
   - Unable

* Dangerous Mechanism:
  - fall from elevation $\geq 3$ feet / 5 stairs
  - axial load to head, e.g. diving
  - MVC high speed (>$100$km/hr), rollover, ejection
  - motorized recreational vehicles
  - bicycle collision

** Simple Rearend MVC Excludes:
  - pushed into oncoming traffic
  - hit by bus / large truck
  - rollover
  - hit by high speed vehicle

*** Delayed:
  - i.e. not immediate onset of neck pain
Lecture Summary 1: *Introduction to ALS*

- **How is this different to other courses?**
  - Small group learning
  - Not as structured and more interactive
  - Directed at the rural practitioner

- **What should we expect you to get out of this course?**
  - Know Basic Life Support (ALS) / Advanced Life support (ALS)
  - Test your knowledge - participate in interactive scenarios

- **Main focus is MORE Emphasis on:**

**Summary of main changes in BLS**

- **Priorities in an Emergency**
  - Focus changed to cover a range of emergency situations not just cardiac arrest and includes collapsed and injured victims.
  - **Unconsciousness**
    - Focus now on the breathing unconscious
  - **Breathing**
    - Focus on unresponsive and not breathing normally as the indicators for resuscitation.
  - **Compressions**
    - Focus on unresponsive and not breathing normally as the indicators for resuscitation.
    - If unwilling / unable to perform rescue breathing, then perform compression only CPR
    - Change rescuers every 2 minutes to decrease rescuer fatigue and maintain depth and rate of compressions.
    - Use of prompt devices in clinical use as a part of an overall strategy to improve quality of CPR.
AED Use In BLS

- This is a new guideline recognising the role of AEDs as part of BLS in both out of hospital and in hospital environments.
- Clear recommendations that training in AED use should be part of BLS education.

CPR

- Increase emphasis on bystander CPR as life-saving intervention.
- Compression: rescue breathing ratio remains at 30:2
- Steps in resuscitation are now DRS ABCD
- check for Danger
- check for Response
- ‘S’ has been added for Send for help
- ‘A’ directs rescuers to open the Airway
- ‘B’ directs rescuers to check Breathing but no need to deliver two rescue breaths
- ‘C’ directs rescuers to perform 30 Compressions to victims who are unresponsive and not breathing normally, followed by 2 breaths
- ‘D’ directs rescuers to attach an AED as soon as it is available
- If unwilling / unable to perform rescue breathing, then perform compression only CPR.

Summary of main changes in ALS:

- Again more emphasis on CPR
- Less emphasis on drugs
- Atropine is NOT recommended in for routine use for cardiac arrest due to asystole or PEA
- Precordial thump is NOT recommended for VF but may be considered for pulseless monitored VT if defibrillator is not available
- More emphasis on IO administration of drug if unable to get IV
- De-emphasis on the role of early tracheal intubation and more emphasis on other techniques such as BMV and LM
- Capnography to confirm and continuously monitor ET placement and quality of CPR.
- Increased role of US to detect reversible causes
- More emphasis on post resuscitation care
- Avoiding hyperoxaemia after ROSC…titrate SpO2 94-98%
- Glucose control if patients BSL >10
- Early coronary PCI in patients with sustained ROSC
- More emphasis on identifying cause and Mx them accordingly
- Routine use of therapeutic hypothermia for comatose out-of-hospital arrest due to VF
Lecture Summary 2: Airway Management

Preoxygenation
Usual approaches to preoxygenation:
- 100% O2 with tidal breaths for 3 to 5 minutes or
- 8 deep breaths over 60 seconds
*The critically ill patient has little reserve to tolerate interruption of oxygen delivery*
- Pre-oxygenation efforts (basic airway manoeuvres, assisted patient breaths with BVM and tight seal for 4 minutes) appear to be marginally effective in regard to providing a reasonable safeguard against hypoxemia during laryngoscopy and endotracheal intubation.

NRBM at 15 L/min gives 60 – 70% O2 at best


Hypoxemic patients - NIV
- Preoxygenation using non-invasive ventilation (NIV) with pressure support is more effective at reducing desaturation than the nonrebreather bag valve mask


Obese patients – head-up position
- The effectiveness of preoxygenation is enhanced in the head-up position as compared to supine position in the obese patient (but not in parturient women).
- NIV improves preoxygenation in the hypoxemic critically-ill patient but not in the obese patient

Solis A, Baillard C, Effectiveness of preoxygenation using the head-up position and noninvasive ventilation to reduce hypoxaemia during intubation, Ann Fr Anesth Reanim. 2008:490-4
Apnoeic oxygenation/aventilatory mass flow:

- O2 continues to be absorbed from the alveoli during apnoea during classic RSI (average 250 mls/min).
- If the airway is open and full of O2, there will be a mass flow of O2 into the alveoli to replace the O2 absorbed.
- CO2 is 25 times more soluble than O2, stays in blood. Only 10 ml/min into the alveoli.
- If doing RSI with apnoea, maintain open airway and give O2.
- An approach to improve O2 concentration is to use high flow nasal oxygen (15 L/min) under the mask and to continue this during intubation attempts.
- Apnoeic oxygenation will maintain sats for at least 100 minutes despite CO2 build up in blood.

Rudlof B et all, Aventilatory mass flow during apnea: Investigations on quantification, Anaesthetist 2010, May 9 (Epub)
Levitan R, NO DESAT!, Emergency Physicians Monthly, 9 December 2010

Aspiration risk

- Is best reduced by adequate sedation, careful suction and gentle low pressure ventilation.
- Ventilation after induction confirms that ventilation can be maintained.
- If intubation is difficult and maintains oxygenation prior to intubation.
- Richard Levitan "The AirwayCam Guide to Intubation and Practical Emergency Airway Management"
- Try to decompress the stomach with gastric tube before induction?
- There is no evidence to support cricoid pressure or “rapid sequence induction / intubation”.
- May have place with high aspiration/low desaturation risk.
- Avoid if low aspiration/high desaturation risk


Multiple attempts at intubation greatly increase adverse events:

<table>
<thead>
<tr>
<th>Event</th>
<th>&lt;2 attempts (%)</th>
<th>&gt;2 attempts (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoxia (sats &lt;90 or &gt;5% fall)</td>
<td>10.5%</td>
<td>70%</td>
</tr>
<tr>
<td>Severe Hypoxia (sats &lt;70)</td>
<td>1.9%</td>
<td>28%</td>
</tr>
<tr>
<td>Oesophageal intubation</td>
<td>4.8%</td>
<td>51.4%</td>
</tr>
<tr>
<td>Regurgitation</td>
<td>1.9%</td>
<td>22%</td>
</tr>
<tr>
<td>Aspiration</td>
<td>0.8%</td>
<td>13%</td>
</tr>
<tr>
<td>Bradycardia</td>
<td>1.6%</td>
<td>18.5%</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>0.7%</td>
<td>11%</td>
</tr>
</tbody>
</table>


- Sternal notch in horizontal line with the external ear canal improves direct laryngoscopic view and maximizes airway diameter (to optimize pre-oxygenation and mask ventilation) in all age groups.
- Obese patients may need to be “ramped” with blankets and pillows while children may need padding under their torso.

Collins Jeremy S. et al, Laryngoscopy and Morbid Obesity: a Comparison of the “Sniff” and “Ramped” Positions, Obesity Surgery, 14, 2004 Ps 1171 – 1175
Ear to sternal notch (Levitan)

13-3b Lateral radiographs showing the effect of head movement on the location of the tracheal tube tip relative to the epiglottis and larynx. The second point of tube deflection is directing the tube anteriorly into the larynx. Note that upper airway volume dimension is much greater in the neck flexed position (right) compared to full atlanto-occipital extension (left) or neutral (middle). This is a major reason patients lean forward when in respiratory distress.

Bimanual laryngoscopy:
Laryngeal manipulation (thyroid, not cricoid cartilage) to improve glottis view, especially epiglottis only (grade 3) views

Bimanual laryngeal manipulation

7-10a Cross-sectional cadaver demonstration of epiglottis hanging down, blocking line of sight to larynx.

7-10b Driving the tip of the curved blade into the vallecula causes the epiglottis to lift upward. ELM helps drive tip of curved blade fully into vallecula and it also drives larynx posteriorly into operator’s line of sight (large arrow). (Images modified from Gorback MS. Emergency airway management. BC Decker, Philadelphia 1990. Used with permission.)

End tidal CO2 is the most reliable method for confirming tracheal placement of ETT and should be used in every case?

Colorimetric, inline, sidestream

Typical capnograph trace during CPR with the tracheal tube correctly placed (NAP4 report 2011)
7.0 women, 8.0 men usually OK
Carina at level of sternal angle, want tip of ETT mid trachea (about clavicles on Xray), 20-21 cms
women; 22-23 cms men ensures not in R main bronchus with margin for movement

(Sitzwohl C., et al. Endobronchial intubation detected by insertion depth of endotracheal tube, bilateral auscultation, or observation of chest movements: randomised trial, BMJ. 2010 Nov 9;341:c5943. doi: 10.1136/bmj.c5943)

Cuff pressure 20 to 30 cms H2O. Air in cuff with cuff pressure monitoring if aerial retrieval.

**Does the endotracheal tube cuff seal the airway?**

“It is clear that high-volume, low-pressure (HVLP) endotracheal tube cuffs do not reliably prevent subglottic fluid from passing to the tracheobronchial tree”

“This leakage occurs down longitudinal channels caused by folds in the cuff wall material. These folds always occur in an HVLP cuff inflated within a trachea because the diameter of the cuff must be greater than that of the trachea for the intracuff pressure to be equal to the tracheal wall pressure”

(Blunt Mark c et al, Gel lubrication of the tracheal tube cuff reduces pulmonary aspiration, Anesthesiology 95;(2), Aug 2001, 377-381)

“The incidence of dye tracking past the large-volume cuffs studies was 100%.”


**Paediatric tubes**

<table>
<thead>
<tr>
<th>Uncuffed ETT</th>
<th>Age/4 +4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuffed ETT</td>
<td>Age/4 +3</td>
</tr>
</tbody>
</table>

(other papers have suggested Age/3 +3)

Length Age/2 +12 after 1 year of age
Newborn 3.0 9.5 cms
6 months 3.5 11.5 cms
12 months 4.0 12 cms

ARC Guideline 12.6 “Techniques in Paediatric Advanced Life Support”

**The LMA**

Is an alternative to intubation for maintaining ventilation

Reduces aspiration by:
- preventing prolonged forceful BVM ventilation and multiple attempts at intubation
- protecting the airway from contamination from above eg. blood
- When properly placed, by physically occluding the upper oesophageal sphincter

Matico Adrian A. et al, Positive Pressure Ventilation with the Laryngeal Mask Airway in the Operating Room and Prehospital: A Practical Review, J Trauma, 2006;60:1371-1376
The principle causes of difficulty inserting the LMA are:
- impaction at the back of the mouth
- folding over of the distal cuff
- distal cuff impacting the glottic inlet

Use of a bougie or nasogastric tube passed into the oesophagus to assist placement of the proseal LMA improves first pass placement to close to 100%

The LMA and inexperienced users
- LMA may be better than bag mask in non expert hands.
- Stimulation related to insertion is about the same as for oro-pharyngeal airway

The most important thing for safe use of the LMA is adequate sedation
Benumof JL, Laryngeal Mask Airway and the ASA Difficult Airway Algorithm, Anesthesiology V84, No3 Mar 1996
- Intracuff pressure limitation should be a standard of practice to reduce mucosal pressure.
- The target intracuff pressure should be the minimum required to form an effective seal, or
- This is easier to gauge with a manometer. Manufacturers recommend 60cms H2O

Matioc AA & Arndt G; (Brimacombe J, reply), Correspondence: The Laryngeal Tube and Pharyngeal Mucosal Pressure, Canadian Journal of Anesthesia, Vol 50, No 5, May 2003

LMA size
3 children >30 kg and small adults
4 for most females and small males
5 for larger males

Gender more reliable than weight?

Biggest LMA you can get in with lowest cuff volume

Paediatric LMA

Sizes
2.5 20-30 kg
2 10-20 kg
1.5 5-10 kg
1 Neonates (<5 kgs)

ARC Guideline 12.6 “Techniques in Paediatric Advanced Life Support”
LMAs are as effective as ETT for neonatal resuscitation when bag/mask fails
Cochrane

*The two steps of the Chandy maneuver are performed sequentially.*
(A) Optimal ventilation is established by slightly rotating the device in the sagittal plane, using the metal handle, until the least resistance to bag ventilation is achieved. This helps to align the internal aperture of the device with the glottic opening.

(B) Just before blind intubation, the LMA-Fastrach™ is slightly lifted (but not tilted) away from the posterior pharyngeal wall using the metal handle. This prevents the endotracheal tube (ETT) from colliding with the arytenoids and facilitates the smooth passage of the ETT into the trachea.”

Ferson DZ, Rosenblatt WH, Johansen MJ, Osborn I, Ovassapian A. Use of the intubating LMA-Fastrach in 254 patients with difficult-to-manage airways. Anesthesiology. 2001;95:1175-81

The Frova intubating bougie

Will assist epiglottis only view (grade 3 laryngeal view)

Has a “rapifit adapter” which allows connection to the ventilation bag

Some people use it for all intubations
• The bevel of the ETT faces left.

• The tip of the tube tends to catch on the right aryepiglottic fold and rotation anti-clockwise can resolve it. It may be necessary to pull the tube back a little to disimpact it first.

• The effectiveness of oxygen insufflation into the trachea has been documented since 1956. Normal O2 consumption 250mls/min

• There is no agreement on flow rates - 4 to 10 litres/min have been shown to be effective.

Okazaki J., Usefulness of Continuous Oxygen Insufflation into Trachea for Management of Upper Airway Obstruction during Anesthesia. Anesthesiology 2000;93:62-8

• Similarly, there is no agreement on jet insufflation – traditionally 1 sec on, 4 sec off / ENK 4 on, 6 off

• Case reviews of needle cricothyrotomy used for failure to intubate/failure to ventilate confirm its effectiveness and relative safety.

• In a review by Patel, 20 of 23 patients were subsequently Intubated.

Patel R G, Percutaneous Transtracheal Jet Ventilation: a safe, quick, and temporary way to provide oxygenation and ventilation when conventional methods are unsuccessful. Chest 1999;116;1689-1694

ENK percutaneous needle cricothyroidotomy set

Percutaneous cricothyrotomy eg. Melker :
Is a rapid alternative to surgical cricothyrotomy.

Ensure adequate skin incision as skin will not dilate if too small

Soft end of wire first

Lubricate dilator

Use rotation while firm grip holding dilator into tube
Relative Contraindications
- Distorted Anatomy: trauma to larynx, obesity, scarring (surgery or radiotherapy)
- Subcutaneous abscess
- Coagulopathies
- Children < 10 years

Surgical Cricothyrotomy eg. with MelkeR

- Use blunt tip dilator
- Scalpel, tracheal hook and tracheal dilator in kit
- Bleeding is related to the length of the incision but must be big enough to accommodate tube
- Vertical incision is easier to extend if in wrong place or transected trachea
- Can use scalpel, bougie and size 6.0 ETT if nothing else is available
A. M. B. Heard, R. J. Green and P. Eakins, The formulation and introduction of a 'can’t intubate, can’t ventilate' algorithm into clinical
Lecture Summary 3 : Defibrillation

Take Home Message

- Best results come from recognising and treating shockable rhythms early
- When you get home – get to know your defibrillator
Why early Defibrillation?

- If IVF is not treated within 2 – 5 minutes, a likely result of defibrillation is asystole or Pulseless Electrical Activity (PEA)
- Emphasis on EARLY BLS and EARLY DEFIBRILLATION for best results

When to Defibrillate

- NO SIGNS OF LIFE?
- Start compressions/breaths at 30:2
- Assess rhythm – if shockable …… SHOCK
- Compressions for 2 min and assess rhythm – if shockable . . . REPEAT SHOCK
- Compressions for 2 min and assess rhythm – if shockable . . . .GIVE ADRENALINE
  AND REPEAT SHOCK
- Compressions for 2 min and assess rhythm – if shockable . . GIVE AMIODARONE
  AND REPEAT SHOCK
- Give compressions for 2 min

History

- 1775 Danish Physician Peter Abilgaard observed that “electricity” could kill a bird by stopping its heart
- 1899 Jean-Louis Prévost and Frederic Batelli, two physiologists from Universiity of Geneva, Switzerland showed a dog’s heart could be stopped and “brought back to life” by an electrical charge
Internal Defibrillation

- 1947 The first successful use of (internal) defibrillation on a human by US cardiac surgeon Claude Beck on a 14 year old patient.
- 1956 Kouwenhoven and Zoll develop first external defibrillator
- 1966 First “portable” defibrillators in ambulances (Northern Ireland)
- 1980s First automated external defibrillators (AEDs)

Aim of Defibrillation

- Use just enough energy to temporarily depolarize the entire myocardium, interrupting re-entry and permitting the sinus pacemaker to resume control – without damaging the myocardium

Biphasic Waveforms

- Defibrillation shock is delivered to the heart via two vectors
- Now standard for all modern external defibrillators.
- Less energy is required than old monophasic defibs ...hence most current defibrillators have a recommended setting of 150 - 200J
Defibrillation Pads

- Better contact than paddles
- Easily applied
- Positioned along electrical axis of heart

Defibrillation Risks

- Pacemakers
- GTN patches
- Short circuits (ECG leads)
- Moisture
- Contact with patient at time of defibrillation

When else might you need to defibrillate a patient?

- Broad complex arrhythmias
  - Compromised VT
- Narrow complex arrhythmias
  - Compromised AF/Atrial flutter/SVT
- In Non-compromised arrhythmias – seek advice first
The “Sync” button

- A shock on ventricular repolarisation (T wave) may precipitate VF
- Use synchronisation for cardioversion i.e. when recognisable QRS complexes e.g. AF, Atrial flutter, SVT
- May not work if very irregular rhythm

The Pacemaker Function

- Generally for slow rhythms with poor perfusion e.g. complete heart block
- Delivers an adjustable small, regular shock
- Usually preset to a rate of 70 bpm. Start at energy output of 30 mA and increase to obtain “capture”
- May require pads AND ECG leads (check your machine)
Automatic defibrillators (AED)

- Simple! Cheap!
- Minimal training
- Biphasic and pre-set to 150J for all shocks
- Many manual defibs incorporate an AED function

The Future

- Implantable internal defibrillators – expensive. Usually combined with pacemaker. Use lot lower energy levels
- External defibrillators with impedance compensation for optimal energy level

Take Home Message

- Best results come from recognising and treating shockable rhythms early
- When you get home – get to know your defibrillator
Lecture Summary 4: Resuscitation Drugs

MORE Emphasis on

Chain of survival

LESS Emphasis on DRUG THERAPY
### Administration

- IV site preferred
- Lower limb discouraged due to impairment of venous return during resuscitation.
- Should be followed by 20-30ml of IV fluid and external cardiac compression
- If CVC is present should be used
- IO should be used if IV cannot be established.

### ET
- Diluted with water
- only adrenaline and atropine

### Intracardiac
- **NOT** recommended
- **Oxygen**
  - Remember BMV without O2 attached is 21%
  - If available...always supplement

- **Vasopressors**
  - Adrenaline or vasopressin
  - No evidence to show increased rate of survival to hospital discharge
  - Evidence that vasopressors help improve time to spontaneous circulation

- **Other Drugs**
  - No evidence to show increased rate of survival to hospital discharge

- **Adrenaline**
  - Naturally occurring catecholamine with alpha and beta effects
  - Administered in cardiac arrest to cause peripheral vasoconstriction via alpha-adrenergic effect directing cardiac output to heart and brain
  - Only evidence is improved time to spontaneous circulation BUT no difference in survival

- **Dose and Indications**
  - 1mg (1ml of 1:1000 or 10ml in 1:10000)
  - VF or pulseless VT post initial counter shocks have failed (after 2nd shock then after every second cycle)
  - *note each cycle comprises of 5 sets of 30 compressions : 2 breaths = 2min*
  - Asystole and EMD in the initial cycle then every second cycle
  - If pulse returns BUT BP low consider infusion @ 1-20mcg/min
- **Amiodarone**
  - Antiarrhythmic drug with complex pharmacokinetics and pharmacodynamics
  - Improvement in defibrillation response for VF or haemodynamic unstable VT
  - Better evidence than lignocaine for refractory or recurrent VT/VF BUT no difference in survival to hospital discharge

- **Dose and Indications**
  - Bolus of 300mg
  - Then infusion 15/kg over 24hrs
  - VF/pulseless VT between the 3rd and fourth shock when refractory to defib shock and adrenaline (= b/n 6-8 min)

- **Calcium**
  - Important for normal cardiac and nerve activity
  - It transiently increases myocardial excitability and contractibility and peripheral resistance
  - *NOT routinely recommended for in/out hospital arrest*

- **Dose and Indications**
  - 5-10ml of 10% calcium chloride (10ml of 10%=6.8mmol Ca ions = 360mg elemented Ca)
  - Or calcium gluconate (10ml of 10%=2.2 mmols of Ca ions)
  - Hyperkalaemia
  - Hypocalcaemia
  - OD of calcium-channel blocking drugs
• **Lignocaine**
  - Sodium channel blocker
  - Only used in situations where amiodarone cannot be used.

• **Dose and Indications**
  - Bolus of 1mg/kg
  - Additional bolus of 0.5mg/kg should be considered.
  - VT/pulless VT when amiodarone cannot be used.
  - Profololaxis in the setting of recurrent VF of VT

• **Magnesium**
  - Electrolyte essential for membrane stability
  - *NOT routinely recommended for in/out hospital arrest*

• **Dose and Indications**
  - 5 mmol slow IV push
  - Torsades de pointes
  - Cardiac arrest associated with digoxin toxicity
  - VF/pulseless VT (if refractory defib shocks and adrenaline)
  - Documented hypokalemia
  - Documented hypomagnessemia
**Potassium**
- Electrolyte essential for membrane stability
- Low potassium in conjunction with digoxin therapy and hypomagnasemia may lead to life threatening arrhythmias

**Dose and Indications**
- 5mmol
- Persistent VF due to documented low potassium

**Sodium Bicarbonate**
- Alkalising agent
- *NOT recommended for routine treatment of in/out hospital arrest*

**Dose and Indications**
- 1mmol/kg over 2-3 min
- Hyperkalaemia
- Documented metabolic acidosis
- OD with TCA
- Protracted arrest >15min

**Fluids**
- No published data
- *NOT routinely recommended for in/out hospital arrest*
- Only give if suspected hypovolemic arrest at a volume of 20ml/kg

**Thrombolytics**
- *NOT routinely recommended for in/out hospital arrest*
- Should only be considered if PE is proven or suspected as the cause of arrest….prolonged CPR (60-90) min should be considered if it is given
Section 6 – Airway Management

- See SECTION 4 – Guideline 4: AIRWAY at ANZCOR Guidelines
- See further relevant information in the lecture summary

Section 7 – Defibrillation

- See SECTION 7 – Guideline 7: DEFIBRILLATION at ANZCOR Guidelines
- See further relevant information in the lecture summary

Section 8 – Medications in Adult ALS

- See SECTION 11 – GUIDELINE 11.5: MEDICATIONS IN ADULT ALS at ANZCOR Guidelines
- See further relevant information in the lecture summary

Section 9 – Pre-Course MCQ

- You may find it useful to read through the ANZCOR Guidelines indicated above prior to completing your Pre-ALS MCQ.
- Further useful relevant information is provided in the lecture summaries provided.
- Please complete the Pre-ALS Course MCQ and submit a week prior to the Workshop.
- This test is not pass/fail and is anonymous.
- Completion of this MCQ will give you indication of your pre-course knowledge and an analysis is used to inform trainers of any particular area that may need particular attention.
- Click HERE to go to the Pre-Course MCQ, complete and submit.