Emergency guidelines - UK based

2. ALS Adult
3. ALS Children
4. Airway management ABCD (DAS)
5. Intubation checklist (NAP4)
6. Unanticipated difficult intubation (DAS)
7. Difficult intubation during RSI (DAS)
8. Failed intubation and difficult ventilation (DAS)
9. Trachy emergency – patent upper airway (NTSP)
10. Trachy emergency – laryngectomy (NTSP)
11. Trachy bleeding (local/ICMWK)
12. Sudden hypoxia on ICU (local/ICMWK)
13. Adult tachycardia (RCUK)
14. Adult bradycardia (RCUK)
15. Sudden hypotension (local/ICMWK)
16. Post-resuscitation (RCUK)
17. Anaphylaxis (RCUK)
18. Extravasation (Kansas univ)
19. LA toxicity (AAGBI)
21. Malignant hyperthermia (AAGBI)

Compiled by ICMWK March 2016
Unresponsive and not breathing normally

Call resuscitation team

CPR 30:2
Attach defibrillator/monitor
Minimise interruptions

Assess rhythm

Shockable (VF/Pulseless VT)

1 Shock
Minimise interruptions

Immediately resume CPR for 2 min
Minimise interruptions

Return of spontaneous circulation

Immediate post cardiac arrest treatment
- Use ABCDE approach
- Aim for SpO₂ of 94-98%
- Aim for normal PaCO₂
- 12-lead ECG
- Treat precipitating cause
- Targeted temperature management

Non-shockable (PEA/Asystole)

Immediately resume CPR for 2 min
Minimise interruptions

During CPR
- Ensure high quality chest compressions
- Minimise interruptions to compressions
- Give oxygen
- Use waveform capnography
- Continuous compressions when advanced airway in place
- Vascular access (intravenous or intraosseous)
- Give adrenaline every 3-5 min
- Give amiodarone after 3 shocks

Treat Reversible Causes
- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalaemia/metabolic
- Hypothermia
- Thrombosis - coronary or pulmonary
- Tension pneumothorax
- Tamponade – cardiac
- Toxins

Consider
- Ultrasound imaging
- Mechanical chest compressions to facilitate transfer/treatment
- Coronary angiography and percutaneous coronary intervention
- Extracorporeal CPR
Paediatric Advanced Life Support

Unresponsive Not breathing or only occasional gasps

Call resuscitation team (1 min CPR first, if alone)

CPR (5 initial breaths then 15:2)
Attach defibrillator/monitor
Minimise interruptions

Assess rhythm

Shockable (VF/Pulseless VT)

Return of spontaneous circulation

Non-shockable (PEA/Asystole)

1 Shock
4 J kg\(^{-1}\)

Immediately resume CPR for 2 min
Minimise interruptions

Immediate post cardiac arrest treatment
- Use ABCDE approach
- Controlled oxygenation and ventilation
- Investigations
- Treat precipitating cause
- Temperature control

Immediately resume CPR for 2 min
Minimise interruptions

During CPR
- Ensure high-quality CPR: rate, depth, recoil
- Plan actions before interrupting CPR
- Give oxygen
- Vascular access (intravenous, intraosseous)
- Give adrenaline every 3-5 min
- Consider advanced airway and capnography
- Continuous chest compressions when advanced airway in place
- Correct reversible causes
- Consider amiodarone after 3 and 5 shocks

Reversible Causes
- Hypoxia
- Hypovolaemia
- Hyper/hypokalaemia, metabolic
- Hypothermia
- Thrombosis (coronary or pulmonary)
- Tension pneumothorax
- Tamponade (cardiac)
- Toxic/therapeutic disturbances
Plan A: Initial tracheal intubation plan

Direct laryngoscopy succeed → Tracheal intubation

failed intubation

Plan B: Secondary tracheal intubation plan

ILMA™ or LMA™ succeed → Confirm - then fibreoptic tracheal intubation through ILMA™ or LMA™

failed oxygenation

failed intubation

Plan C: Maintenance of oxygenation, ventilation, postponement of surgery and awakening

Revert to face mask Oxygenate & ventilate succeed → Postpone surgery

Awaken patient

failed oxygenation

Plan D: Rescue techniques for "can't intubate, can't ventilate" situation

LMA™ improved oxygenation → Awaken patient

increasing hypoxaemia

or

Cannula cricothyroidotomy fail → Surgical cricothyroidotomy
**Example intubation checklist for ICU and emergency department**

### Emergency Induction Checklist

#### Prepare Patient
- Is preoxygenation optimal?
  - ETO₂ > 90%
  - Consider CPAP
- Is the patient’s position optimal?
  - Consider sitting up
- Can the patient's condition be optimised any further before intubation?
- How will anaesthesia be maintained after induction?

#### Prepare Equipment
- What monitoring is applied?
  - Capnography
  - SPO₂ probe
  - ECG
  - Blood pressure
- What equipment is checked and available?
  - Self-inflating bag
  - Working suction
  - Two tracheal tubes
  - Two laryngoscopes
  - Bougie
  - Supraglottic airway device
- Do you have all the drugs required?
  - Consider ketamine
  - Relaxant
  - Vasopressor

#### Prepare Team
- Allocate roles;
  - Team leader
  - First Intubator
  - Second Intubator
  - Cricoid Pressure
  - Intubator’s Assistant
  - Drugs
  - MILS (if indicated)
  - Rescue airway
- How do we contact further help if required?

#### Prepare for difficulty
- If the airway is difficult, could we wake the patient up?
- What is the plan for a difficult intubation?
  - Plan A: RSI
  - Plan B: e.g. BMV
  - Plan C: e.g. ProSeal LMA
  - Plan D: e.g. Front of neck
- Where is the relevant equipment, including alternative airway?
  - DO NOT START UNTIL AVAILABLE
- Are any specific complications anticipated?

---

This Checklist is not intended to be a comprehensive guide to preparation for induction.
Unanticipated difficult tracheal intubation
during routine induction of anaesthesia in an adult patient

Direct laryngoscopy  Any problems  Call for help

Plan A: Initial tracheal intubation plan

Direct laryngoscopy - check:
Neck flexion and head extension
Laryngoscope technique and vector
External laryngeal manipulation -
by laryngoscopist
Vocal cords open and immobile
If poor view: Introducer (bougie) -
seek clicks or hold-up
and/or Alternative laryngoscope

Tracheal intubation

Plan B: Secondary tracheal intubation plan

ILMA™ or LMA™
Not more than 2 insertions
Oxygenate and ventilate

failed intubation

ILMA™ or LMA™

Plan C: Maintenance of oxygenation, ventilation,
postponement of surgery and awakening

Revert to face mask
Oxygenate and ventilate
Reverse non-depolarising relaxant
1 or 2 person mask technique
(with oral ± nasal airway)

failed ventilation and oxygenation

Plan D: Rescue techniques for
“can’t intubate, can’t ventilate” situation

Difficult Airway Society Guidelines Flow-chart 2004 (use with DAS guidelines paper)
Unanticipated difficult tracheal intubation - during rapid sequence induction of anaesthesia in non-obstetric adult patient

Direct laryngoscopy  Any problems  Call for help

Plan A: Initial tracheal intubation plan

Pre-oxygenate
Cricoid force: 10N awake → 30N anaesthetised
Direct laryngoscopy - check:
  - Neck flexion and head extension
  - Laryngoscopy technique and vector
  - External laryngeal manipulation - by laryngoscopist
  - Vocal cords open and immobile
If poor view:
  - Reduce cricoid force
  - Introducer (bougie) - seek clicks or hold-up and/or Alternative laryngoscope

failed intubation

Plan B not appropriate for this scenario

Verify tracheal intubation
  (1) Visual, if possible
  (2) Capnograph
  (3) Oesophageal detector
"If in doubt, take it out"

Plan C: Maintenance of oxygenation, ventilation, postponement of surgery and awakening

Use face mask, oxygenate and ventilate
1 or 2 person mask technique (with oral ± nasal airway)
Consider reducing cricoid force if ventilation difficult

failed oxygenation
(e.g. SpO₂ < 90% with FiO₂ 1.0) via face mask

LMA™
Reduce cricoid force during insertion
Oxygenate and ventilate

failed ventilation and oxygenation

Plan D: Rescue techniques for "can't intubate, can't ventilate" situation

Postpone surgery and awaken patient if possible or continue anaesthesia with LMA™ or ProSeal LMA™ - if condition immediately life-threatening

Difficult Airway Society Guidelines Flow-chart 2004 (use with DAS guidelines paper)
Failed intubation, increasing hypoxaemia and difficult ventilation in the paralysed anaesthetised patient: Rescue techniques for the "can't intubate, can't ventilate" situation

failed intubation and difficult ventilation (other than laryngospasm)

Face mask
Oxygenate and Ventilate patient
Maximum head extension
Maximum jaw thrust
Assistance with mask seal
Oral ± 6mm nasal airway
Reduce cricoid force - if necessary

failed oxygenation with face mask (e.g. SpO₂ < 90% with FiO₂ 1.0)

call for help

LMA™ Oxygenate and ventilate patient
Maximum 2 attempts at insertion
Reduce any cricoid force during insertion

"can't intubate, can't ventilate" situation with increasing hypoxaemia

Plan D: Rescue techniques for "can't intubate, can't ventilate" situation

Cannula cricothyroidotomy
Equipment: Kink-resistant cannula, e.g. Patil (Cook) or Ravussin (VBM)
High-pressure ventilation system, e.g. Manujet III (VBM)
Technique:
1. Insert cannula through cricothyroid membrane
2. Maintain position of cannula - assistant's hand
3. Confirm tracheal position by air aspiration - 20ml syringe
4. Attach ventilation system to cannula
5. Commence cautious ventilation
6. Confirm ventilation of lungs, and exhalation through upper airway
7. If ventilation fails, or surgical emphysema or any other complication develops - convert immediately to surgical cricothyroidotomy

Surgical cricothyroidotomy
Equipment: Scalpel - short and rounded (no. 20 or Minitrach scalpel)
Small (e.g. 6 or 7 mm) cuffed tracheal or tracheostomy tube
4-step Technique:
1. Identify cricothyroid membrane
2. Stab incision through skin and membrane
   - Enlarge incision with blunt dissection (e.g. scalpel handle, forceps or dilator)
3. Caudal traction on cricoid cartilage with tracheal hook
4. Insert tube and inflate cuff
   - Ventilate with low-pressure source
   - Verify tube position and pulmonary ventilation

Notes:
1. These techniques can have serious complications - use only in life-threatening situations
2. Convert to definitive airway as soon as possible
3. Postoperative management - see other difficult airway guidelines and flow-charts
4. 4mm cannula with low-pressure ventilation may be successful in patient breathing spontaneously

Difficult Airway Society guidelines Flow-chart 2004 (use with DAS guidelines paper)
Emergency tracheostomy management - Patent upper airway

Call for airway expert help
Look, listen & feel at the mouth and tracheostomy
A Mapleson C system (e.g. ‘Waters circuit’) may help assessment if available
Use waveform capnography when available: exhaled carbon dioxide indicates a patent or partially patent airway

Is the patient breathing?

Yes

Apply high flow oxygen to BOTH the face and the tracheostomy

Assess tracheostomy patency

No

Call Resuscitation Team
CPR if no pulse / signs of life

The tracheostomy tube is patent
Perform tracheal suction
Consider partial obstruction
Ventilate (via tracheostomy) if not breathing
Continue ABCDE assessment

Can you pass a suction catheter?

Yes

Tracheostomy tube partially obstructed or displaced
Continue ABCDE assessment

No

Deflate the cuff (if present)
Look, listen & feel at the mouth and tracheostomy
Use waveform capnography or Mapleson C if available

Is the patient stable or improving?

Yes

No

REMOVE THE TRACHEOSTOMY TUBE
Look, listen & feel at the mouth and tracheostomy. Ensure oxygen re-applied to face and stoma
Use waveform capnography or Mapleson C if available

Call Resuscitation Team
CPR if no pulse / signs of life

Primary emergency oxygenation

Standard ORAL airway manoeuvres
Cover the stoma (swabs / hand). Use:
Bag-valve-mask
Oral or nasal airway adjuncts
Supraglottic airway device e.g. LMA

Tracheostomy STOMA ventilation
Paediatric face mask applied to stoma
LMA applied to stoma

Secondary emergency oxygenation

Attempt ORAL intubation
Prepare for difficult intubation
Uncut tube, advanced beyond stoma

Attempt intubation of STOMA
Small tracheostomy tube / 6.0 cuffed ETT
Consider Aintree catheter and fibreoptic ‘scope / Bougie / Airway exchange catheter

Emergency laryngectomy management

Call for airway expert help
Look, listen & feel at the mouth and laryngectomy stoma
A Mapleson C system (e.g. ‘Waters circuit’) may help assessment if available
Use waveform capnography whenever available: exhaled carbon dioxide indicates a patent or partially patent airway

Is the patient breathing?

Apply high flow oxygen to laryngectomy stoma
If any doubt whether patient has a laryngectomy, apply oxygen to face also*

Assess laryngectomy stoma patency

Most laryngectomy stomas will NOT have a tube in situ

Remove stoma cover (if present)
Remove inner tube (if present)
Some inner tubes need re-inserting to connect to breathing circuits
Do not remove a tracheoesophageal puncture (TEP) prosthesis

Can you pass a suction catheter?

Deflate the cuff (if present)
Look, listen & feel at the laryngectomy stoma or tube
Use waveform capnography or Mapleson C if available

Is the patient stable or improving?

Continue ABCDE assessment

Laryngectomy stoma ventilation via either
Paediatric face mask applied to stoma
LMA applied to stoma

REMOVE THE TUBE FROM THE LARYNGECTOMY STOMA if present
Look, listen & feel at the laryngectomy stoma. Ensure oxygen is re-applied to stoma
Use waveform capnography or Mapleson C if available

Is the patient breathing?

Call Resuscitation Team CPR if no pulse / signs of life

Primary emergency oxygenation

No

Secondary emergency oxygenation

Attempt intubation of laryngectomy stoma
Small tracheostomy tube / 6.0 cuffed ETT
Consider Aintree catheter and fibreoptic ‘scope / Bougie / Airway exchange catheter

Yes

Continue ABCDE assessment

Laryngectomy patients have an end stoma and cannot be oxygenated via the mouth or nose
Applying oxygen to the face and stoma is the default emergency action for all patients with a tracheostomy

Tracheostomy bleeding

Lightly blood-stained secretions only?
- Early (days 1-3) – likely benign - observe
- Late (after day 3) – senior review

Significant frank blood?

Call for help
- ICU consultant and senior nursing staff
- ENT surgeon – on call consultant at John Radcliffe will coordinate. May also be one in clinic or theatre on site (put days here)
- General surgeon
- Senior anaesthetist

100% oxygen
- Or high flow via trachy mask

Inflate cuff
- Temporary over-inflation can be considered (usually at least 20 ml for Portex tubes)

Sit nearly fully upright
- 45 degrees if hypotensive

Suction via tracheostomy
- Large gauge catheter to retrieve clots

Attach water’s circuit or self-inflating bag, and end-tidal monitoring
- Consider assisting ventilation or take over

Finger pressure in sternal notch or at bleeding point if obvious
- If heavily sedated, consider packing pharynx

Suction pharynx
- Remove clots

Next measures
- Kaltostat or adrenaline-soaked ribbon gauze - tuck into trachy wound.
- Inject lidocaine + adrenaline 1:200,000 around trachy site.
- Sedation if coughing is excessive or struggling with ventilation (+/- muscle relaxant)
- Correct known coagulopathy or reverse anticoagulants where possible

Bleeding still through tracheostomy despite cuff inflation?

Profuse?
- Consider intubation via mouth and:
  - distal balloon placement
  - Intentional endobronchial intubation
  - double-lumen tube
  - bronchial blocker.
  Or consider palliation.

Not profuse but not settling?
- Adrenaline nebs
  IV +/- nebulized tranexamic acid.
  Consider plans as for profuse bleeding.

Haemostasis achieved?
- Bronchoscopy and upper airway scope
- CXR
- Physiotherapy
  Consider possibility that it was a ‘herald bleed’ (re TIF below)

Causes

Early
- Suction or movement of tracheostomy

Late
- Granulation tissue
- Stoma site infection
- Tracheo-innominate fistula

Also consider:
- Bleeding from non-trachy surgical site if present and nearby.
- Upper respiratory tract bleeding (eg epistaxis)
- Haemoptysis unrelated to tracheostomy
### Sudden hypoxia on the ICU – cause not clear

1. **Call for help**
2. **100% inspired oxygen**
3. **Check end tidal CO2 trace**
4. **Tracheal suction (in-line if present, or use suction catheters)**
5. **Assess chest movement and listen to chest**

<table>
<thead>
<tr>
<th>Findings</th>
<th>Diagnoses to consider</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstructed appearance (see-sawing), bilaterally quiet, ↓Expansion &amp; compliance</td>
<td>Consider tracheal or tube obstruction</td>
<td>Follow tracheal tube algorithm. Then consider these:</td>
</tr>
<tr>
<td>Endobronchial intubation Has ETT moved in further (usually not more than 24cm at teeth)?</td>
<td>• Consider withdrawing 1-2 cm • CXR +/- bronchoscopy</td>
<td></td>
</tr>
<tr>
<td>Pneumothorax or haemothorax Trauma, new line or drain, high ventilation pressure, in-situ chest drain fault.</td>
<td>• Needle decompression or drain (or resolve drain issue). • CXR/CT if stabilises</td>
<td></td>
</tr>
<tr>
<td>Pulmonary haemorrhage Bronchiectasis, abscess, TB, or tumour?</td>
<td>• Airway specialist and thoracic surgeon involvement. • CXR/CT</td>
<td></td>
</tr>
<tr>
<td>Collapse/atelectasis due to sputum, or aspiration</td>
<td>• Suction (+/- saline) • Recruitment breaths with ventilator or bag • Consider bronchoscopy</td>
<td></td>
</tr>
<tr>
<td>New widespread wheeze +/- reduced compliance</td>
<td>Bronchospasm COPD/asthma Anaphylaxis</td>
<td>• Suction • ECG/CXR +/- Echo/troponin • Consider • Bronchodilators/steroid • Furosemide/nitrate • Stop feeding, empty stomach • Bronchoscopy</td>
</tr>
<tr>
<td>Aspiration Feeding tube malposition Vomiting</td>
<td>Pulmonary oedema New ischaemia Recent fluid bolus</td>
<td>• Suction • ECG/CXR +/- Echo/troponin • Consider • Furosemide/nitrate • Stop feeding, empty stomach • Bronchoscopy</td>
</tr>
<tr>
<td>New widespread crackles +/- reduced compliance</td>
<td>Pulmonary oedema New ischaemia Recent fluid bolus</td>
<td>• Suction • ECG/CXR +/- Echo/troponin • Consider • Furosemide/nitrate • Stop feeding, empty stomach • Bronchoscopy</td>
</tr>
<tr>
<td>Aspiration Feeding tube malposition Vomiting</td>
<td>Normal breath sounds and compliance</td>
<td>Low cardiac output state MI PE Haemorrhage Tamponade</td>
</tr>
</tbody>
</table>
Adult Tachycardia (with pulse) Algorithm

Assess using the ABCDE approach
- Monitor SpO₂ and give oxygen if hypoxic
- Monitor ECG and BP, and record 12-lead ECG
- Obtain IV access
- Identify and treat reversible causes (e.g. electrolyte abnormalities)

Adverse features?
- Shock
- Syncope
- Myocardial ischaemia
- Heart failure

Is QRS narrow (< 0.12 s)?

Yes - Unstable

Synchronised DC Shock*
Up to 3 attempts

Seek expert help

- Amiodarone 300 mg IV over 10-20 min
- Repeat shock
- Then give amiodarone 900 mg over 24 h

Broad QRS
Is QRS regular?

Irregular

Seek expert help

Regular

Narrow QRS
Is rhythm regular?

Irregular

Probable AF:
- Control rate with beta-blocker or diltiazem
- If in heart failure consider digoxin or amiodarone
- Assess thromboembolic risk and consider anticoagulation

Regular

Vagal manoeuvres
- Adenosine 6 mg rapid IV bolus
  if no effect give 12 mg
  if no effect give further 12 mg
- Monitor/record ECG continuously

Sinus rhythm achieved?

Yes

Probable re-entry paroxysmal SVT:
- Record 12-lead ECG in sinus rhythm
- If SVT recurs treat again and consider anti-arrhythmic prophylaxis

No

Possible atrial flutter:
- Control rate (e.g. with beta-blocker)

Broad

Irregular

Regular

Possibilities include:
- AF with bundle branch block treat as for narrow complex
- Pre-excited AF consider amiodarone

If VT (or uncertain rhythm):
- Amiodarone 300 mg IV over 20-60 min then 900 mg over 24 h

If known to be SVT with bundle branch block:
- Treat as for regular narrow-complex tachycardia

*Conscious patients require sedation or general anaesthesia for cardioversion
Adult Bradycardia Algorithm

Assess using the ABCDE approach
- Monitor SpO₂ and give oxygen if hypoxic
- Monitor ECG and BP, and record 12-lead ECG
- Obtain IV access
- Identify and treat reversible causes (e.g. electrolyte abnormalities)

Adverse features?
- Shock
- Syncope
- Myocardial ischaemia
- Heart failure

Yes

Atropine 500 mcg IV

Satisfactory response?

No

Consider interim measures:
- Atropine 500 mcg IV repeat to maximum of 3 mg OR
- Transcutaneous pacing OR
- Isoprenaline 5 mcg min⁻¹ IV
- Adrenaline 2-10 mcg min⁻¹ IV
- Alternative drugs

Seek expert help
Arrange transvenous pacing

No

Yes

Risk of asystole?
- Recent asystole
- Mobitz II AV block
- Complete heart block with broad QRS
- Ventricular pause > 3 s

Yes

Continue observation

No

Alternatives include:
- Aminophylline
- Dopamine
- Glucagon (if bradycardia is caused by beta-blocker or calcium channel blocker)
- Glycopyrrolate (may be used instead of atropine)
### Sudden hypotension on ICU — cause not clear

#### Call for help!

<table>
<thead>
<tr>
<th>Ensure hypotension is not due to respiratory compromise</th>
<th>Obvious pneumothorax?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tilt bed or raise legs</th>
<th>□</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request fluid bolus</td>
<td>□</td>
</tr>
<tr>
<td>□ Hartmann’s and plan to run 500ml stat</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Request bolus dose vasopressor</th>
<th>□</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Metaraminol 0.5mg/ml 0.5mg (1ml) at a time</td>
<td></td>
</tr>
<tr>
<td>□ Adrenaline 10 mcg/ml (1ml from a minijet into 10ml saline) 10 mcg (1ml) at a time</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Is this the true BP and what is the rhythm?</th>
<th>□</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Feel for pulse. Look at the end-tidal CO₂ trace. Quickly check arterial line waveform and transducer position. If there is a waveform, assume it’s correct. Re-zero if necessary.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Look for blood</th>
<th>□</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Check for blood in the bed, bowel, stomach, new tense abdomen, or leak from haemofilter circuit</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Check infusions</th>
<th>□</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Check for kinked line, displaced CVC, syringe driver failure?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Check skin</th>
<th>□</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Look for new rash and swelling</td>
<td></td>
</tr>
</tbody>
</table>

| ECG | □ |

<table>
<thead>
<tr>
<th>Request or do ultrasound FICE +/- FAST</th>
<th>□</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Decide whether this is hypovolaemic, distributive, cardiogenic (including arrhythmia) or obstructive shock.</td>
<td></td>
</tr>
</tbody>
</table>

| Request CXR | □ |

<table>
<thead>
<tr>
<th>Cardiac output monitoring</th>
<th>□</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ ODM if asleep and no central access, otherwise LIDCO, or echo.</td>
<td></td>
</tr>
</tbody>
</table>

### Consider:

- Overt or concealed haemorrhage
- MI
- Arrhythmia – rule out VT, if new AF consider cardioversion.
- PE
- Concealed haemorrhage – retroperitoneal, small bowel, thorax
- Tamponade (recent central venous access, pacing wire etc.)
- Drug reaction – anaphylaxis or inadvertent bolus (including epidural)
- Intracranial haemorrhage
- New sepsis – take cultures and get antibiotic advice

### Further treatment:

- Consider increasing dose of adrenaline or noradrenaline
  
  **NOT** dobutamine/dopamine/milrinone or vasopression

- Treat specific problem
  
  _order_ blood, plan for DCCV, CT; _call_ surgeon, endoscopist, cardiologist
Post-resuscitation Care

(ROSC and comatose)

**Immediate treatment**

- **Airway and Breathing**
  - Maintain SpO₂ 94 – 98%
  - Advanced airway
  - Waveform capnography
  - Ventilate lungs to normocapnia

- **Circulation**
  - 12-lead ECG
  - Obtain reliable intravenous access
  - Aim for SBP > 100 mmHg
  - Fluid (crystalloid) – restore normovolaemia
  - Intra-arterial blood pressure monitoring
  - Consider vasopressor/inotrope to maintain SBP

- **Control temperature**
  - Constant temperature 32°C – 36°C
  - Sedation; control shivering

**Likely cardiac cause?**

- Yes
  - ST elevation on 12 lead ECG?
    - No
      - Consider Coronary angiography ± PCI
    - Yes
      - Coronary angiography ± PCI

- No
  - Consider CT brain and/or CTPA
  - Cause for cardiac arrest identified?
    - No
      - Treat non-cardiac cause of cardiac arrest
    - Yes
      - Admit to Intensive Care Unit

**ICU management**

- Temperature control: constant temperature 32°C – 36°C for ≥ 24 h; prevent fever for at least 72 h
- Maintain normoxia and normocapnia; protective ventilation
- Optimise haemodynamics (MAP, lactate, ScvO₂, CO/CI, urine output)
- Echocardiography
- Maintain normoglycaemia
- Diagnose/treat seizures (EEG, sedation, anticonvulsants)
- Delay prognostication for at least 72 h

**Secondary prevention**

- e.g. ICD, screen for inherited disorders, risk factor management

**Follow-up and rehabilitation**
When skills and equipment available:
- Establish airway
- High flow oxygen
- IV fluid challenge
- Chlorphenamine
- Hydrocortisone

Monitor:
- Pulse oximetry
- ECG
- Blood pressure

Adrenaline

1 Life-threatening problems:
Airway: swelling, hoarseness, stridor
Breathing: rapid breathing, wheeze, fatigue, cyanosis, SpO₂ < 92%, confusion
Circulation: pale, clammy, low blood pressure, faintness, drowsy/coma

2 Adrenaline (give IM unless experienced with IV adrenaline)
IM doses of 1:1000 adrenaline (repeat after 5 min if no better)
- Adult: 500 micrograms IM (0.5 mL)
- Child more than 12 years: 500 micrograms IM (0.5 mL)
- Child 6 -12 years: 300 micrograms IM (0.3 mL)
- Child less than 6 years: 150 micrograms IM (0.15 mL)

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

3 IV fluid challenge:
Adult - 500 – 1000 mL
Child - crystalloid 20 mL/kg
Stop IV colloid if this might be the cause of anaphylaxis

4 Chlorphenamine
(IM or slow IV)
Adult or child more than 12 years: 10 mg
Child 6 - 12 years: 5 mg
Child 6 months to 6 years: 2.5 mg
Child less than 6 months: 250 micrograms/kg

5 Hydrocortisone
(IM or slow IV)
Adult or child more than 12 years: 200 mg
Child 6 - 12 years: 100 mg
Child 6 months to 6 years: 50 mg
Child less than 6 months: 25 mg
PEDIATRIC PATIENTS

December 2009

Adapted from: Saint Francis Hospital Department of Pharmacy Services Protocol

Prepare by diluting 5 mg phentolamine in 10 mL of 0.9% sodium chloride. Inject subcutaneously into the extravasation area within 12 hours of extravasation. Blanching should reverse immediately; additional

Mix each 500mg vial with 50mL of diluent (provided by manufacturer); mixed solution should be further diluted in 1000mL NS and begin administration within 4 hours. Infuse over 1 to 2 hours in a large

Hyaluronidase


Phentolamine (Regitine)

Phentolamine (Regitine)

Other agents that have been reported to cause irritation, phlebitis, or necrosis with extravasation include but may not be limited to:

Physician's order should be obtained to initiate warm or cold therapy when suspect extravasation is greater than 24 hours old

Drug name, dose, volume, and concentration

Amount of extravasated drug

Total amount of drug infused

Note: refer to administration and the sequence of administration

Method of IV administration (e.g., push, drip)

Location of venous access

Type of venous access device (e.g., central, peripheral)

Needle size and type

Extravasation site, size, and color description (may delineate area on patient's skin with felt-tip marker)

Patient complaints or statements at the time of vesicant or extravasation

Extravasation site, size, and color description (may delineate area on patient's skin with felt-tip marker)

Patient complaints or statements at the time of vesicant or extravasation

Apply warm packs for 15-20 minutes at least four times a day

Apply cool compresses for 15-20 minutes at least four times a day

Note on Oxaliplatin: The package insert states that there “is no proven successful management of extravasation” after it occurs, although sympathetic block and heparinization are commonly employed during chemotherapy. This is based on results in animals with other known anterior imprints. A case study report entitled “Extravasation of i.v. oxaliplatin” (can be found in J. Am. Health-Syst. Pharm. 1996; 53:1233-1234).
# AAGBI Safety Guideline
## Management of Severe Local Anaesthetic Toxicity

### 1 Recognition

**Signs of severe toxicity:**
- Sudden alteration in mental status, severe agitation or loss of consciousness, with or without tonic-clonic convulsions
- Cardiovascular collapse: sinus bradycardia, conduction blocks, asystole and ventricular tachyarrhythmias may all occur
- Local anaesthetic (LA) toxicity may occur some time after an initial injection

### 2 Immediate management

- Stop injecting the LA
- Call for help
- Maintain the airway and, if necessary, secure it with a tracheal tube
- Give 100% oxygen and ensure adequate lung ventilation (hyperventilation may help by increasing plasma pH in the presence of metabolic acidosis)
- Confirm or establish intravenous access
- Control seizures: give a benzodiazepine, thiopental or propofol in small incremental doses
- Assess cardiovascular status throughout
- Consider drawing blood for analysis, but do not delay definitive treatment to do this

### 3 Treatment

**IN CIRCULATORY ARREST**
- Start cardiopulmonary resuscitation (CPR) using standard protocols
- Manage arrhythmias using the same protocols, recognising that arrhythmias may be very refractory to treatment
- Consider the use of cardiopulmonary bypass if available

**GIVE INTRAVENOUS LIPID EMULSION**
(following the regimen overleaf)
- Continue CPR throughout treatment with lipid emulsion
- Recovery from LA-induced cardiac arrest may take >1 h
- Propofol is not a suitable substitute for lipid emulsion
- Lidocaine should not be used as an anti-arrhythmic therapy

**WITHOUT CIRCULATORY ARREST**
Use conventional therapies to treat:
- hypotension,
- bradycardia,
- tachyarrhythmia

**CONSIDER INTRAVENOUS LIPID EMULSION**
(following the regimen overleaf)
- Propofol is not a suitable substitute for lipid emulsion
- Lidocaine should not be used as an anti-arrhythmic therapy

### 4 Follow-up

- Arrange safe transfer to a clinical area with appropriate equipment and suitable staff until sustained recovery is achieved
- Exclude pancreatitis by regular clinical review, including daily amylase or lipase assays for two days
- Report cases as follows:
  - in the United Kingdom to the National Patient Safety Agency (via www.npsa.nhs.uk)
  - in the Republic of Ireland to the Irish Medicines Board (via www.imb.ie)

If Lipid has been given, please also report its use to the international registry at www.lipidregistry.org. Details may also be posted at www.lipidrescue.org

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Your nearest bag of Lipid Emulsion is kept

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This guideline is not a standard of medical care. The ultimate judgement with regard to a particular clinical procedure or treatment plan must be made by the clinician in the light of the clinical data presented and the diagnostic and treatment options available.

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An approximate dose regimen for a 70-kg patient would be as follows:

**IMMEDIATELY**

- Give an initial intravenous bolus injection of 20% lipid emulsion 100 ml over 1 min
- Start an intravenous infusion of 20% lipid emulsion at 1000 ml.h⁻¹

**AFTER 5 MIN**

- Give a maximum of two repeat boluses of 100 ml
- Continue infusion at same rate but double rate to 2000 ml.h⁻¹ if indicated at any time

*Do not exceed a maximum cumulative dose of 840 ml*

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This AAGBI Safety Guideline was produced by a Working Party that comprised:
Grant Cave, Will Harrop-Griffiths (Chair), Martyn Harvey, Tim Meek, John Picard, Tim Short and Guy Weinberg.

This Safety Guideline is endorsed by the Australian and New Zealand College of Anaesthetists (ANZCA).

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Successful management of malignant hyperthermia depends upon early diagnosis and treatment; onset can be within minutes of induction or may be insidious. The standard operating procedure below is intended to ease the burden of managing this rare but life threatening emergency.

1 **Recognition**
- Unexplained increase in ETCO2 AND
- Unexplained tachycardia AND
- Unexplained increase in oxygen requirement
  (Previous uneventful anaesthesia does not rule out MH)
- Temperature changes are a late sign

2 **Immediate management**
- **STOP** all trigger agents
- **CALL FOR HELP.** Allocate specific tasks (action plan in MH kit)
- Install clean breathing system and **HYPERVENTILATE** with 100% O2 high flow
- Maintain anaesthesia with intravenous agent
- **ABANDON/FINISH** surgery as soon as possible
- Muscle relaxation with non-depolarising neuromuscular blocking drug

3 **Monitoring & treatment**
- Give **dantrolene**
- Initiate active **cooling** avoiding vasoconstriction

**TREAT:**
- **Hyperkalaemia:** calcium chloride, glucose/insulin, NaHCO₃⁻
- **Arrhythmias:** magnesium/amiodarone/metoprolol
  **AVOID** calcium channel blockers - interaction with dantrolene
- **Metabolic acidosis:** hyperventilate, NaHCO₃⁻
- **Myoglobinemia:** forced alkaline diuresis (mannitol/furosemide + NaHCO₃⁻); may require renal replacement therapy later
- **DIC:** FFP, cryoprecipitate, platelets
- Check plasma CK as soon as able

**DANTROLENE**
2.5mg/kg immediate iv bolus. Repeat 1mg/kg boluses as required to max 10mg/kg

**For a 70kg adult**
- **Initial bolus:** 9 vials dantrolene 20mg (each vial mixed with 60ml sterile water)
- Further boluses of 4 vials dantrolene 20mg repeated up to 7 times.

**Continuous monitoring**
Core & peripheral temperature
ETCO₂
SpO₂
ECG
Invasive blood pressure
CVP

**Repeated bloods**
ABG
U&Es (potassium)
FBC (haematocrit/platelets)
Coagulation

4 **Follow-up**
- Continue monitoring on ICU, repeat dantrolene as necessary
- Monitor for acute kidney injury and compartment syndrome
- Repeat CK
- Consider alternative diagnoses (sepsis, phaeochromocytoma, thyroid storm, myopathy)
- Counsel patient & family members
- Refer to MH unit (see contact details below)

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The UK MH Investigation Unit, Academic Unit of Anaesthesia, Clinical Sciences Building, Leeds Teaching Hospitals NHS Trust, Leeds LS9 7TF. Direct line: 0113 206 5270. Fax: 0113 206 4140. Emergency Hotline: 07947 609601 (usually available outside office hours). Alternatively, contact Prof P Hopkins, Dr E Watkins or Dr P Gupta through hospital switchboard: 0113 243 3144.

Your nearest MH kit is stored

This guideline is not a standard of medical care. The ultimate judgement with regard to a particular clinical procedure or treatment plan must be made by the clinician in the light of the clinical data presented and the diagnostic and treatment options available.

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