Anaesthetic Crisis Handbook

For every problem:

• **Verbalise** the problem. Say out loud…. ‘We have a **problem**, I am **concerned**’

• Call for **HELP** early

• **Set oxygen to 100%** (except where stated otherwise)

• Identify a ‘**hands off**’ Team Coordinator

• **Delegate duties** to **specific** team members

• Use **closed loop**, quiet & efficient **communication**

• Use the **indexed pages & coloured boxes** in this manual to **assist you**


(Created by Adam Hollingworth with help from many people along the way)

Adapted from various sources including:

• Guidelines: ANZAAG, AAGBI, NZRC, Starship Protocols
• Hutt Valley & CCDHB: Clinical protocols
• ESA Emergency Quick Reference Guide
• CCDHB Crisis Checklists. Dr A McKenzie
• Emergencies in Anaesthesia. Oxford Handbook
• Wellington ICU Drug Manual. Dr A Psirides & Dr P Young
• Various published peer reviewed papers
Instructions for Use

- Use the **index** and **coloured tabs** to find quick reference pages to assist in a crisis.

- The **handbook is in 2 parts:**
  - The front book: How to treat known Emergencies
  - The back book: How to Diagnose Problems

- **Routine/obvious tasks** (eg call for help, turn oxygen to 100%) are assumed & thus **not** repeated on every sheet for clarity.

- For simplicity & to avoid calculation errors in an emergency, drug doses are given for a 70Kg adult. Paeds doses are clearly marked where appropriate.

- There is an adult & paediatric drug formulary at the back
  - Emergency/Doing tasks
  - Thinking tasks, diagnostic or further information
  - Doses, equipment or calculation information

- Cards are arranged into coloured boxes:

- Work through emergency/doing boxes in a linear fashion. Decision making steps are **highlighted** for clarity.

Using an aid such as this efficiently, in a crisis, is a **learned** skill. You must take time to become **familiar** with this manual and **practise** using it.

It is recommended that a ‘**reader**’, with no other tasks, **read these cards out loud** to the team leader during the crisis.
25d. High Airway Pressure
26d. Desaturation
27d. High EtCO₂
28d. Low EtCO₂
29d. Tachycardia
30d. Bradycardia
31d. Hypertension
32d. Hypotension
33d. Failure to wake
34r. TELEPHONE DIRECTORY
35r. ADULT DRUG FORMULARY
36r. PAEDS DRUG FORMULARY
25d. HIGH AIRWAY PRESSURE

- **Listen to** chest. Watch for bilateral chest rise & fall
- **Switch to** bag - manually ventilate to confirm high pressure
- **Examine** EtCO₂ waveform - ?bronchospasm ?kinked ETT
- **Exclude** light anaesthesia & inadequate muscle relaxation
- **Perform a** systematic visual check:
  - airway device (inside & outside mouth) ⇒ filter ⇒ circuit ⇒ valves ⇒ ventilator
- **Check airway** - the position & patency - suction full length of ETT
  (Consider performing bronchoscopic exam)
- **If suspect** autoPEEP watch for persistent expiratory flow at end expiration. Try disconnecting circuit.
- **If problem not identified** need to exclude circuit > filter > airway > patient source:
  - **Exclude circuit**: replace circuit with Ambu-bag (if required convert to TIVA)
  - **Exclude filter**: replace or remove
  - **Exclude airway**: replace ETT. If using LMA convert to ETT
  - Not resolved = **patient problem**

- Consider timing of event eg CVL insertion, position change, surgical event
- **Possible causes** (most common in bold):
  - **Circuit**:
    - ventilator settings
    - kinked tube
    - valve failures
    - obstructed filter
    - O₂ flush failure
  - **Airway**:
    - laryngospasm
    - tube position
    - tube size
    - blocked or kinked tube
  - **Patient**:
    - chest wall rigidity
    - bronchospasm
    - anaphylaxis
    - pneumothorax
    - pneumoperitoneum
    - tracheal problems/pathology:
      - FB
      - secretions
      - tumour
      - obesity
    - alveolar problems/pathology:
      - oedema
      - infections
      - ARDS
      - contusion
26d. DESATURATION

☐ Check FiO₂ & turn to 100% O₂
☐ Check patient colour, peripheral temperature & probe position
☐ Switch to bag to test circuit integrity & lung compliance
☐ Check the SpO₂ & EtCO₂ waveforms to aid systematic diagnosis:
  • If EtCO₂ waveform abnormal or absent:
    - Exclude: disconnected circuit, cardiac arrest, ↓cardiac output
    - Consider laryngospasm or bronchospasm (if LMA convert to ETT)
    - Check airway position & patency:
      • Visualise cords = r/o oesophageal ETT
      • Suction full length of ETT (consider performing bronchoscopic exam)
      • Look inside mouth for kinks/gastric contents
    - Check ventilator mode & setting
    - Ventilate via Ambu-bag to exclude ventilator/circuit/probe problem
  • If EtCO₂ waveform normal: (∴ intact circuit integrity):
    - Check fresh gas flow / FiO₂
    - Exclude endobronchial ETT
    - Inspect neck veins, chest rise & auscultate. Use ultrasound (if skilled)
    - Consider airway, lung/breathing, circulation causes (see yellow box)
☐ Work through diagnostic checklist below to exclude all other causes

• Consider timing of event eg position change, surgical event
• Possible causes (most common in bold):
  • Airway:
    - airway obstruction
    - laryngospasm
    - bronchospasm
    - endobronchial intubation
    - 1 lung ventilation
    - aspiration
  • Lungs/Breathing:
    - apnoea/hypoventilation
    - atelectasis
    - pneumothorax
    - sepsis/ARDS
    - pulmonary oedema
    - contusion
    - pneumonia
    - interstitial lung disease
  • Ventilator/Circuit/Probe:
    - probe displacement
    - inadequate reversal
    - mal: function/setting
    - auto-PEEP
    - low fresh gas flow
    - oxygen supply failure
    - circuit obstruction/disconnection
  • Circulation:
    - cardiac arrest
    - cardiac failure
    - anaphylaxis
    - embolism: pulmonary, air, CO₂, cement
    - hypothermia/poor periph circulation
    - methaemoglobinaemia e.g. prilocaine
**27d. HIGH EtCO₂**

- Quick check patient monitors: ?oxygenated & anaesthetised patient:
  - Anaesthetist’s A Airway, B SpO₂, C HR, MAP, D Depth of anaesthesia, E Temp

- This is generally not a crisis. Use the time to consider the causes

- **Frequency gamble:**
  - Check monitors & ventilator:
    - **EtCO₂ waveform**
    - **Fresh Gas Flow** - correct for circuit type, size of patient
    - **Ventilator** settings & mode - Resp rate, Tidal volume
  - Check **soda lime** ?exhausted
  - Review:
    - Anaesthetic **depth**
    - Recent **drug doses** for errors

- **Systematically** work through all causes (see below)

- Consider timing of event eg drug administration, surgical event

- **Possible causes** (most common in bold):

  - **↑Production**
    - Endogenous:
      - sepsis/↑temp
      - MH
      - thyroid storm
      - malignant neuroleptic syndrome
      - reperfusion
    - Exogenous:
      - CO₂ insufflation
      - bicarb administration

  - **↓Elimination**
    - Lungs:
      - hypoventilation
      - bronchospasm/asthma
      - COPD
    - Circuit/machine:
      - ↓Fresh Gas Flow/re-breathing
      - incorrect vent settings
      - soda lime exhaustion
      - airway obstruction
      - ↑dead space
      - valve malfunction
Quick check patient monitors: ?oxygenated & anaesthetised patient:
- Anaesthetist's A Airway EtCO₂, B SpO₂, C Vent Settings, D HR, E MAP, F Depth of anaesthesia, G Temp

If no EtCO₂ waveform diagnose immediately:
- Cardiac arrest - see tab 6e or tab 7e
- Incorrect ETT placement - if in doubt replace
- Severe bronchospasm - confirm airway & see tab 4e
- Check circuit & CO₂ sample line connections

If low EtCO₂ then first frequency gamble:
- Check sampling line - securely connected & patent
- Check MAP
- Examine patient:
  - Airway position & patency
  - Auscultate & ensure bilateral chest rise - (r/o laryngospasm/bronchospasm)
- Check ventilator:
  - Switched on & functioning
  - Correct settings: tidal volume, RR

If problem not identified work through causes systematically (see yellow box)

Consider timing of event e.g. post intubation, drug administration, surgical event

Possible causes (most common in bold):
- **NO EtCO₂!!:**
  - oesophageal intubation
  - no ventilation, no airway
  - cardiac arrest
  - circuit/sampling line disconnection
  - ventilator failure or not on
  - apnoea

- **Production:**
  - hypothermia
  - deep anaesthesia
  - ↓ thyroid

- **Sampling dilution:**
  - high FGF
  - sampler placed incorrectly
  - dilution of sampling gas with air
  - circuit disconnected

- **Elimination:**
  - hyperventilation

- **Transport of CO₂ in blood:**
  - severe hypotension
  - anaphylaxis
  - cardiac arrest
  - embolism - air or pulmonary
  - tamponade/tension pneumothorax

- **CO₂ diffusion in lung:**
  - low tidal volumes/dead space
  - laryngospasm
  - severe bronchospasm
  - ETT obstruction
  - endobronchial intubation
### 29d. TACHYCARDIA

- **Check patient monitors:** is the patient oxygenated & anaesthetised?:
  - **Anaesthetist’s A** Airway, ECO₂, **B** SpO₂, **C** Vent Settings, **D** HR, **E** MAP, **F** Depth of anaesthesia, **G** Temp

- **If there is diagnostic uncertainty & MAP <65 with HR >150** then give **synchronised DC shock** (see yellow box for joules)

- **Differentiate** sinus tachycardia & complex tachy-arrhythmia:
  - current surgical/pain stimulation
  - sinus rhythm?
  - QRS regularity?
  - QRS width?

- **If sinus tachycardia** consider causes (see yellow box below)

- **If complex tachy-arrhythmia** treat based on **MAP**:
  - MAP <65mmHg = **synchronised DC shock** (see yellow box for joules)
  - MAP >65mmHg = manage by regularity & QRS width:
    - **Regular:**
      - **Narrow:** [SVT] vagal manoeuvres, adenosine, ß blocker
      - **Wide:**
        - [VT] amiodarone
        - [SVT with aberrancy] see narrow
        - [WPW] amiodarone
    - **Irregular:**
      - **Narrow:** [AF] ß blocker or amiodarone
      - **Wide:**
        - [torsades] magnesium
        - [AF with pre-excitation] amiodarone
        - [AF with aberrancy] see narrow

- **Send urgent ABG. Ensure high normal K⁺ & Mg²⁺**

- Consider timing of event eg drug administration, surgical event etc.

- **Possible causes** of sinus tachycardia (most common in bold):
  - **Primary causes:**
    - IHD
    - cardiomyopathy
    - sick sinus syndrome
    - accessory conduction pathways
    - myocarditis
    - pericarditis
    - valvular disease
    - congenital heart disease
  - **Secondary causes:**
    - hypovolaemia
    - anaesthesia depth
    - drugs - incl drug error
    - pain
    - electrolyte abnormalities
    - cardiac tamponade
    - sepsis
    - thyroid storm
    - MH

- **Synchronised shock guides:**
  - **AF/monomorphic VT:** 100J ⇒ 150J ⇒ 200J (巯 0.5J/kg ⇒ 1J/kg ⇒ 2J/kg)
  - **SVT or flutter:** 50J ⇒ 100J ⇒ 200J (巯 0.5J/kg ⇒ 1J/kg ⇒ 2J/kg)
  - polymorphic VT or unstable: 200J (巯 4J/kg)

- **Adenosine:** 6mg, then 12mg, then 12mg then consider other causes (巯 = 0.1mg/kg>0.2mg/kg,0.3mg/kg)
- **ß blocker:** Esmolol 10mg titrated. Metoprolol 2.5mg boluses titrated (max 15mg)
- **Amiodarone:** 300mg slow IV push (巯 = 5mg/kg)
- **Magnesium:** [torsades] 10mmol (5ml of 49.3%) over 2mins (巯 = 0.1ml/kg). (Give slower for other causes)
30d. BRADYCARDIA

Quick check patient monitors: is the patient oxygenated & anaesthetised?:

- Anaesthetist’s A Airway, B SpO₂, C Vent Settings, D MAP, E Temperature

If MAP >65mmHg you have time (see causes listed in yellow box below):

- Frequency gamble common causes
- Systematically work through all causes

If MAP <65mmHg +/- with evidence of ↓ perfusion then consider:

- **Atropine 600mcg** (⇒ 20mcg/kg) or **glycopyrrolate 200mcg** (⇒ 10mcg/kg)
- **Ephedrine 9mg** bolus titrated (⇒ 0.1 mg/kg)
- **Adrenaline** infusion (⇒ see green box)
- **Isoprenaline bolus**, followed by infusion (⇒ see green box)

If drug toxicity or overdose:

- βblocker = as above + **high dose insulin** infusion, **Na bicarb** (if propanolol OD)
- Ca channel = as βblocker + **10mls 10% Ca chloride** slow push (can repeat)

If severe refractory bradycardia try external temporary pacing:

- attach defib & ECG leads
- set to PACER mode
- select rate 60/min
- ↑mA of output until capture (normally 65-100mA required)
- set final mA 10mA above capture
- confirm pulse

If PEA at any point start CPR - see tab 7e

Consider timing of event eg drug administration, surgical event

Possible causes (most common in **bold**:)

<table>
<thead>
<tr>
<th>Primary causes</th>
<th>Secondary causes</th>
<th>Anaesthetic causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>IHD</td>
<td>electrolyte abnormality</td>
<td>hypoxia</td>
</tr>
<tr>
<td>AV block</td>
<td>drugs eg error, overdose,</td>
<td>volatile</td>
</tr>
<tr>
<td>pacemaker malfunction</td>
<td>anti-arrhythmics</td>
<td>suxamethonium</td>
</tr>
<tr>
<td>cardiomyopathy</td>
<td>↓thyroid</td>
<td>opioids</td>
</tr>
<tr>
<td>sick sinus syndrome</td>
<td>↓temperature</td>
<td>anticholinesterases</td>
</tr>
<tr>
<td>myocarditis</td>
<td>vagal stimulation</td>
<td>vasopressors</td>
</tr>
<tr>
<td>pericarditis</td>
<td>↑ICP</td>
<td>auto-PEEP</td>
</tr>
<tr>
<td>valvular heart disease</td>
<td>cardiac tamponade</td>
<td>MH</td>
</tr>
<tr>
<td>pulmonary HTN</td>
<td>tension pneumothorax</td>
<td>high/total spinal</td>
</tr>
<tr>
<td>athlete</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For paediatric normal heart rates see tab 9e

Isoprenaline: bolus: dilute 200mcg amp into 20mls then give 1ml boluses titrated (⇒ use infusion -see tab 36r). Infusion: dilute 1mg (5vials) into 50mls. Infuse at 0-60mls/hr

Adrenaline: 5mg in 50mls saline. Infuse at 0-20ml/hr (⇒ see tab 36r)

Na bicarb 8.4% (β blocker OD): 50ml slow push. Can rpt every 2mins (target pH 7.45-7.55)

**High dose insulin** [β blocker/CCB OD]: **Bolus= 50ml of 50% dextrose & 70u actrapid.** Infusion= 100u actrapid in 50mls saline, run at 35ml/hr and 10% dex run at 250mls/hr (Monitor BSSL & K every 30mins)
31d. HYPERTENSION

- Quick check patient monitors: is the patient oxygenated & anaesthetised?:
  - Anaesthetist’s A Airway, B ETCO₂, C SpO₂, D Vent Settings, E MAP, F Depth of anaesthesia, G Temp

- Check accuracy of reading: check equipment (including transducer height)

- Frequency gamble on common causes:
  - Check for painful surgical activity - give analgesia
  - Check recent drug infusions & recent doses for drug error (incl LA with adrenaline)
  - Check tourniquet time
  - Consider bladder volume/fluids infused

- Systematically work through possible causes (see yellow box)

- Once all reversible causes have been addressed then consider IV antihypertensive agents (as green box below) to SBP target of ~160mmHg

- Consider timing of event eg drug administration, surgical event

- Possible causes (most common in bold):
  - Anaesthesia:
    - too light
    - pain
    - hypoxia
    - hypercapnia
    - MH
    - drugs - consider error
    - IV line - non-patent/tissued
    - A line transducer height
  - Patient related:
    - essential HTN
    - rebound HTN - B blocker stopped
    - full bladder
    - pre-eclampsia
    - renal disease
    - phaeochromocytoma (always give α blocker before β blocker)
    - thyroid storm
    - ↑ICP

- Surgery:
  - tourniquet
  - aortic clamping
  - carotid endarectomy
  - baroreceptor stimulation
  - pneumoperitoneum

- β Blocker = esmolol: 10mg boluses titrated; metoprolol: 2.5mg boluses titrated (max 15mg)
- a Blocker = labetalol (also β blocker): 5mg boluses titrated (max 100mg). phentolamine: 5-10mg IV rpt’ed every 5-15mins
- a Agonists = clonidine: 30mcg boluses titrated (max 150mcg)
- vasodilators = GTN: S/L spray or IV infusion: 50mg in 50ml saline at 3ml/hr and titrate; magnesium: slow bolus 5mls of 49.3%, repeat if required
32d. HYPOTENSION

☐ Check patient monitors: is the patient oxygenated & anaesthetised?:
  - Anaesthetist’s A Airway EtCO₂, B SpO₂, Vent Settings, C HR, D MAP, E Depth of anaesthesia

☐ Check accuracy of reading: check equipment (including transducer height)

☐ Assess severity: visualise patient, check ECG & EtCO₂/SpO₂ waveform:
  - **No cardiac output or critical MAP**: start CPR - see tab 6e or tab 7e
  - **MAP <65mmHg & concern** then consider:
    - Leg elevation
    - Rapid infusion of fluid +/- ready to transfuse blood (see tab 12e)
    - IV vasopressors or inotropes

☐ Consider reversible causes:
  - Frequency gamble on common causes
  - Systematically consider each cause in turn

☐ Consider:
  - ECHO (if skilled) to help differentiate causes
  - Other invasive monitoring to assist with diagnosis e.g. PPV SVV from arterial line, cardiac index monitoring

- Consider timing of event e.g. drug administration, surgical event, scope surgery (always suspect concealed haemorrhage)
- **Possible causes** (most common in bold):
  - **↓Preload**:
    - blood loss/hypovolaemia
    - ↑intrathoracic pressure
    - ↓VR - eg IVC compression, pt position, pneumoperitoneum
    - tamponade/tension pneumothorax
    - embolism
  - **↓Contractility**:
    - drugs incl. volatiles
    - IHD
    - cardiomyopathy
    - myocarditis
    - arrhythmia
    - valvular heart disease
  - **↓Afterload**:
    - drugs eg vasodilators incl anaesthetic agents, opioids, antiHTN drugs
    - neuraxial techniques
    - sepsis
    - tourniquet or clamp release
    - anaphylaxis
    - addisons crisis
    - ↓thyroid
  - **Equipment/human**:
    - artefact or failure
    - Invasive: wrong transducer height
    - NIBP: wrong cuff size
    - drug error

- ECHO: Consider LVEDV, LV function, gross valvular abnormality
- PPV SVV: >12% (only if: intubated, paralysed, Vt >8ml/kg, in sinus rhythm, norm abdo pressure) suggests hypovolaemia
- Normal CI = >2.6 L/min/m²

- **Pressors**: metaraminol 0.5mg (0.1mcg/kg), phenylepherine 100mcg, ephedrine 9mg (0.25mcg/kg), adrenaline 10-50mcg
- noradrenaline/adrenaline infusion: 5mg in 50mls. infuse 0-20ml/hr
33d. FAILURE TO WAKE

☐ This is generally not a crisis. Use the time to consider the causes

☐ Airway: ensure patent unobstructed airway

☐ Breathing:
  ▶ Ensure established respiratory pattern
  ▶ Check SpO₂
  ▶ Check EtCO₂ trace and value

☐ Cardiovascular: Ensure normal HR, MAP and ECG

☐ Drugs: Review all drugs given during anaesthetic:
  ▶ Check muscle relaxation with nerve stimulator. Give reversal agent (see green box)
  ▶ Consider timing and infusions of all agents
  ▶ Consider drug errors
  ▶ Consider drug interactions
  ▶ Consider patient factors e.g. renal/hepatic failure, elderly

☐ Others:
  ▶ Neurological:
    - check pupils
    - apply BIS for signs of seizure (frontal lobe seizure only)
    - consider need for CT
  ▶ Metabolic: send an ABG - check PaO₂, PaCO₂, Na, glucose
  ▶ Temperature: ensure >30°

☐ Systematically work through all causes (see below)

- Possible causes (most common in bold):
  
  **Drugs:**
  - analgesic agents e.g. opioids, α₂ agonists
  - anaesthetic agents e.g. volatile, propofol
  - muscle relaxants e.g. suxamethonium apnoea, inadequate reversal
  - sedative agents e.g. benzodiazepines, anticholinergics, antihistamines, antidopaminergics
  - magnesia toxicity

  **Metabolic:**
  - ↑↓ blood sugar
  - ↑↓ sodium
  - ↑ urea

  **Hypothermia**

Respiratory Failure:
  - hypoxia or hypercapnia:
    - ↓ central drive e.g. stroke, COPD
    - lung disease e.g. PE, ARDS
    - muscle power e.g. obesity

Neurological:
  - stroke - infarct, bleed or embolism
  - seizure (Non-convulsive status epilepticus or post-ictal)
  - local anaesthetic toxicity

Other - Uncommon:
  - central anticholinergic syndrome
  - dissociative coma
  - thyroid failure
  - toxicity of other CNS drugs

- [rocuronium/vecuronium relaxant]: Sugammadex dose on TBW: PTC>2 = 4mg/kg (70kg=280mg); >T₂ = 2mg/kg (70kg=140mg)
- [all non-depolarising relaxants]: Neostigmine 2.5mg (≥ 50mcg/kg) & glycopyrrolate 500mcg (≥ 10mcg/kg). Rpt at 15min
- [suxamethonium apnoea]: No reversal option → continue anaesthesia/refer to ICU
EMERGENCY OUT OF THEATRE
- MET Team ..............................................................

ANAESTHETICS & THEATRES
- Duty Anaesthetist .....................................................
- Duty Technician ......................................................
- Theatre Coordinator ...............................................  
- PACU Coordinator ...................................................
- Perfusionist ..............................................................

OBSTETRICS
- Obstetric Doctor .....................................................
- Delivery Technician ................................................
- Charge Midwife ......................................................
- Paed/NICU Doctor ...................................................  

LABORATORY/X-RAY
- Blood bank ............................................................
- Blood tests ............................................................
- X-Ray Technician ...................................................
- Duty Radiologist .......................................................

REFERRALS
- ICU Doctor ............................................................
- ICU Coordinator .....................................................
- Haematology Doctor ................................................
- Surgical Doctor ......................................................
- Paediatric Doctor ....................................................
- Cardiology Doctor ..................................................
<table>
<thead>
<tr>
<th>Drug</th>
<th>Bolus</th>
<th>Infusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenosine</td>
<td>6mg, then 12mg, then 12mg.</td>
<td></td>
</tr>
<tr>
<td>Adrenaline (1:1,000 = 1mg/ml) (1:10,000 = 100mg/ml)</td>
<td>[Arrest] 10ml of 1:10,000 (1mg); [Other] 0.1ml - 1ml of 1:10,000 (10-100mcg). Titrate</td>
<td>5mg in 50mls saline. Infuse 0-20ml/hr</td>
</tr>
<tr>
<td>Alteplase</td>
<td>-</td>
<td>[PE in cardiac arrest] 100mg in 20mls saline. Infuse at 80mls/hr</td>
</tr>
<tr>
<td>Aminophylline</td>
<td>400mg over 15mins</td>
<td>50mg in 50mls at 35ml/hr</td>
</tr>
<tr>
<td>Amiodarone</td>
<td>300mg slow push</td>
<td>900mg in 500ml D5W over 24hours</td>
</tr>
<tr>
<td>Ca²⁺ Chloride (10%)</td>
<td>10mls slow push</td>
<td></td>
</tr>
<tr>
<td>Clonidine</td>
<td>30mcg. Titrate (max 150mcg)</td>
<td></td>
</tr>
<tr>
<td>Dobutamine</td>
<td>-</td>
<td>250mg in 50ml saline. Infuse 0-10ml/hr</td>
</tr>
<tr>
<td>Esmolol</td>
<td>10mg. Titrate</td>
<td></td>
</tr>
<tr>
<td>GTN</td>
<td>[tococytic] 100-250mcg</td>
<td>[ischaemia] 50mg in 50ml saline. Infuse 3-12ml/hr. Titrate to MAP/ECG</td>
</tr>
<tr>
<td>Hydrocortisone</td>
<td>200mg</td>
<td></td>
</tr>
<tr>
<td>Insulin (actrapid)</td>
<td>[8blocker or CCB OD] 50ml of 50% dextrose &amp; 70u actrapid (1u/kg). Give as bolus.</td>
<td>[1K⁺] 10units in 250ml 10% dextrose. Infuse quickly</td>
</tr>
<tr>
<td>Intralipid (20%)</td>
<td>100ml bolus (1.5ml/kg). Rpt ev 5min, max x2</td>
<td></td>
</tr>
<tr>
<td>Isoprenaline</td>
<td>200mcg into 20mls saline. Give 1ml boluses titrated</td>
<td></td>
</tr>
<tr>
<td>Ketamine</td>
<td>[induction] 70-140mg (1-2mg/kg); [bronchospasm] 35-70mg (0.5-1mg/kg)</td>
<td></td>
</tr>
<tr>
<td>Labetalol</td>
<td>5mg slow push. Titrate (max 100mg)</td>
<td></td>
</tr>
<tr>
<td>Lignocaine (1%)</td>
<td>[Arrhythmia] 7mls (0.1ml/kg). Can rpt ev 10mins (max 0.3ml/kg)</td>
<td></td>
</tr>
<tr>
<td>Magnesium (49.3%)</td>
<td>[bronchospasm] 5mls over 20min [torsades] 5ml slow push [eclampsia] 8mls in 100ml saline. Infuse @ 324ml/hr</td>
<td>[eclampsia]: Maintenance = 16mls in 100ml saline. Infuse 14.5ml/hr for 8hrs</td>
</tr>
<tr>
<td>Metaraminol</td>
<td>0.5-1mg. Titrate</td>
<td></td>
</tr>
<tr>
<td>Metoprolol</td>
<td>1-2.5mg. Titrate (max 15mg)</td>
<td></td>
</tr>
<tr>
<td>Midazolam</td>
<td>[seizures] 1-7mg. Titrate</td>
<td></td>
</tr>
<tr>
<td>Milirinone</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Naloxone</td>
<td>[emergency] 400mcg [titration] 40mcg (max 800mcg)</td>
<td>Infusion with hourly rate = 2/3 of bolus dose required for initial clinical effect</td>
</tr>
<tr>
<td>Noradrenaline</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Oxytocin</td>
<td>[elective] 3units slow bolus (do not rpt)</td>
<td></td>
</tr>
<tr>
<td>Phenetholamine</td>
<td>5-10mg. Repeat every 5-15 mins as req’ed</td>
<td></td>
</tr>
<tr>
<td>Phenylephrine</td>
<td>100mcg bolus. Titrate</td>
<td></td>
</tr>
<tr>
<td>Salbutamol</td>
<td>250mcg slow push (Inhaled: 12 puffs via circuit)</td>
<td></td>
</tr>
<tr>
<td>Sodium Bicarb (8.4%)</td>
<td>25-50ml slow push. Can rpt every 2mins (target pH 7.40-7.50)</td>
<td></td>
</tr>
<tr>
<td>Sugammadex</td>
<td>[emergency post intubation] = 16mg/kg; [PTC&gt;2] 4mg/kg; [&gt;T₁] 2mg/kg</td>
<td></td>
</tr>
<tr>
<td>Suxamethonium</td>
<td>[laryngospasm] 35mg (0.5mg/kg)</td>
<td></td>
</tr>
<tr>
<td>Tranexamic Acid</td>
<td>1g over 10mins (15mg/kg)</td>
<td></td>
</tr>
<tr>
<td>Vasopressin</td>
<td>1 unit slow push</td>
<td></td>
</tr>
</tbody>
</table>

35r. ADULT DRUG FORMULARY
<table>
<thead>
<tr>
<th>Drug</th>
<th>Bolus</th>
<th>Infusion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adenosine</strong></td>
<td>0.1mg/kg, then 0.2mg/kg, then 0.3mg/kg</td>
<td>-</td>
</tr>
<tr>
<td><strong>Adrenaline</strong> (1:1,000 = 1mg/ml) (1:10,000 = 100mcg/ml)</td>
<td>[Arrest IV] 0.1ml/kg 1:10,000 (10mcg/kg) [Arrest ETT] 0.1ml/kg of 1:1,000 (100mcg/kg) [Other] 0.01-0.05ml/kg 1:10,000 (1-5mcg/kg) [IM dose] 0.01ml/kg of 1:1,000 (10mcg/kg)</td>
<td>[↓bp] 0.15mg/kg (max 5mg) in 50mls saline. Infuse 0.5-10ml/hr</td>
</tr>
<tr>
<td><strong>Aminophylline</strong></td>
<td>10mg/kg over 1hr diluted to 1mg/ml (max 500mg)</td>
<td>1-9yrs: 55mg/kg into 50mls 5%dex. infuse 1ml/hr 10-15yrs &amp; &lt;35kg: 35mg into 50mls 5%dex. infuse 1ml/hr 10-15yrs &amp; &gt;35kg: neat drug. infuse 0.028mg/kg/hr</td>
</tr>
<tr>
<td><strong>Amiodarone</strong></td>
<td>5mg/kg slow push (max 300mg)</td>
<td>-</td>
</tr>
<tr>
<td><strong>Atropine</strong></td>
<td>20mcg/kg</td>
<td>-</td>
</tr>
<tr>
<td><strong>Ca²⁺ Chloride</strong> (10%)</td>
<td>0.05 - 0.2ml/kg (max 10mls) slow push</td>
<td>-</td>
</tr>
<tr>
<td><strong>Dobutamine</strong></td>
<td>-</td>
<td>15mg/kg in 50ml saline. infuse 0.5-4ml/hr</td>
</tr>
<tr>
<td><strong>Ephedrine</strong></td>
<td>0.25mg/kg (max 9mg/dose)</td>
<td>-</td>
</tr>
<tr>
<td><strong>Esmolol</strong></td>
<td>500mcg/kg slow push. Titrate</td>
<td>-</td>
</tr>
<tr>
<td><strong>Glycopyrrolate</strong></td>
<td>10mcg/kg</td>
<td>-</td>
</tr>
<tr>
<td><strong>Hydrocortisone</strong> [asthma]</td>
<td>4mg/kg</td>
<td>-</td>
</tr>
<tr>
<td><strong>Insulin (actrapid)</strong></td>
<td>[1K] Periv IV: 0.1unit/kg in 5ml/kg 10% dex [1K] CVL: 0.1u/kg in 2ml/kg 50% dex</td>
<td>-</td>
</tr>
<tr>
<td><strong>Intralipid (20%)</strong></td>
<td>1.5ml/kg bolus. Rpt ev 5min, max x2</td>
<td>15ml/kg/hr. Can double rate @5min (max total dose=12ml/kg)</td>
</tr>
<tr>
<td><strong>Isoprenaline</strong></td>
<td>-</td>
<td>300mcg/kg in 50mls saline. Infuse at 1ml/hr (0.1mcg/kg/min) and titrate up (max 10ml/hr)</td>
</tr>
<tr>
<td><strong>Ketamine</strong></td>
<td>[bronchospasm &amp; anaesthetised] 0.5-1mg/kg</td>
<td>-</td>
</tr>
<tr>
<td><strong>Labetalol</strong></td>
<td>0.25-0.5mg/kg slow push. rpt ev. 10min as req’ed (max 0.3mg/kg)</td>
<td>50mcg/kg &amp; saline to make 50ml. Infuse 0.3-1ml/hr(0-3mg/kg/hr)</td>
</tr>
<tr>
<td><strong>Magnesium</strong></td>
<td>0.1ml/kg over 20mins</td>
<td>-</td>
</tr>
<tr>
<td><strong>Metaraminol</strong></td>
<td>10mcg/kg</td>
<td>-</td>
</tr>
<tr>
<td><strong>Metoprolol</strong></td>
<td>0.1mg over 5mins</td>
<td>-</td>
</tr>
<tr>
<td><strong>Midazolam</strong></td>
<td>[emergency] IV: 0.1mg/kg; IM 0.2mg/kg; buccal 0.5mg. Can repeat dose @ 5mins</td>
<td>-</td>
</tr>
<tr>
<td><strong>Naloxone</strong></td>
<td>[titrate] 2mcg/kg (400mcg in 20mls give 0.1ml/kg)</td>
<td>300mcg/kg to 30ml 5% dex &amp; run at 0-1ml/hr (10mcg/kg/hr)</td>
</tr>
<tr>
<td><strong>Noradrenaline</strong></td>
<td>-</td>
<td>0.15mg/kg (max 5mg) in 50mls saline. Infuse 0.5-10ml/hr</td>
</tr>
<tr>
<td><strong>Phenylepherine</strong></td>
<td>2-10mcg/kg. Titrate</td>
<td>10mg in 100mls saline. Infuse 0-20mls/hr (1-5mcg/kg/min)</td>
</tr>
<tr>
<td><strong>Salbutamol</strong></td>
<td>Inhaled: &lt;5yr=6puffs; &gt;5yrs 12puffs via circuit IV: &lt;2yr=5mcg/kg slow; &lt;18yr=10mcg/kg (max 250)</td>
<td>Make neat salbutamol up to 50mls Infuse at 5-10mcg/kg/min for 1hr. Then 1-2mcg/kg/min</td>
</tr>
<tr>
<td><strong>Sodium Bicarb (8.4%)</strong></td>
<td>1ml/kg over 5min. Can repeat every 2mins (target pH 7.45-7.55)</td>
<td>-</td>
</tr>
<tr>
<td><strong>Sugammadex</strong></td>
<td>[emergency post intubation] = 16mg/kg; [PTC&gt;2] 4mg/kg; [T3]= 2mg/kg</td>
<td>-</td>
</tr>
<tr>
<td><strong>Suxamethonium</strong> [intubation] IV: 2mg/kg; IM 4mg/kg [laryngospasm] 0.5mg/kg</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Tranexamic Acid</strong></td>
<td>15mg/kg diluted in 20-50mls saline over 10mins</td>
<td>2mg/kg/hr in 500ml saline over 8hrs</td>
</tr>
<tr>
<td><strong>Vasopressin</strong></td>
<td>1unit/kg in 50mls saline. Infuse 1-3mls/hr</td>
<td>-</td>
</tr>
</tbody>
</table>
Anaesthetic Crisis Handbook

By Adam Hollingworth
adamhollingworth@gmail.com

For Nichola. Thank you for your never-ending support and patience.

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Disclaimer: Every effort has been taken to prevent errors/omissions/mistakes. However, this cannot be guaranteed. Graded assertiveness to query team leader decisions/management steps which are contrary to this manual are encouraged. However, clinical experience & acumen are vital in complex situations such as crises and may be more appropriate than this manual in certain situations.