SCSC

Scottish Clinical Simulation Centre

ACID: Anaesthetic Critical Incident Drills

Trainee Package

1-1 Key basic plan v.1

This Key Basic Plan will detect and identify almost all initial problems, allowing you to fix or temporise. There are specific drills for specific problems later on in the QRH. Using the same systematic approach:

- Increases the chance of identifying the problem.
- Reduces the risk of missing the problem.
- Limits fixing attention inappropriately.

START

1. **Adequate oxygen delivery (Note Box B)**
   - Pause surgery if possible.
   - Check fresh gas flow for circuit in use AND check measured F_iO_2.
   - Visual inspection of entire breathing system including valves and connections.
   - Rapidly confirm reservoir bag moving OR ventilator bellows moving.
2. **Airway (Box C)**
   - Check position of airway device and listen for noise (including larynx and stomach).
   - Check capnogram shape compatible with patent airway.
   - Confirm airway device is patent (consider passing suction catheter).
   - Consider whether you need to isolate equipment (Box D).
3. **Breathing**
   - Check chest symmetry, rate, breath sounds, SpO_2, measured VT_{exp}, $EtCO_2$.
   - Feel the airway pressure using reservoir bag and APL valve (Box E) <3 breaths.
4. **Circulation**
   - Check rate, rhythm, perfusion, re-check BP.
5. **Depth**
   - Ensure appropriate depth of anaesthesia, analgesia and neuromuscular blockade.
6. Consider surgical problem.
7. Call for help if problem not resolving quickly.

Box A: CRITICAL CHANGES

If problem worsens significantly or a new problem arises, call for **help** and go back to **START** of key basic plan.

Box B: ADEQUATE OXYGEN DELIVERY

Altering fresh gas flow may require change of vaporiser setting.

Box C: AIRWAY

Noise: Listen over the larynx with a stethoscope to get more information (e.g. leak / obstruction).

Tracheal tube: You can pass a suction catheter to check patency.

Box D: ISOLATE EQUIPMENT

Ventilate lungs using self-inflating bag connected **DIRECTLY** to tracheal tube connector.

DO NOT use the HME filter, angle piece or catheter mount.

- If increased pressure manually confirmed, re-connect machine.
- If increased pressure **NOT** manually confirmed, assume problem with machine/circuit/HME/filter/angle piece/catheter mount: check and replace as indicated.

Box E: BREATHING

Remember that airway 'feel' depends on your APL valve setting and fresh gas flow.

You can only "feel" a maximum of what the APL valve is set to.

Measured expired tidal volume gives additional information.

2-3_Increased airway pressure

You are 30 minutes into anaesthetic maintenance of a 35 year old female undergoing elective gynaecological exploratory laparoscopy under general anaesthetic. Her history includes cigarette smoking and she is otherwise fit and healthy. Since moving to the head down position, the peak airway pressure has gone up to 39cmH2O from 15cmH2O following induction. The uneventful induction was with Propofol 200mg, Rocuronium 30mg and Morphine 5mg. She has a size 8 ETT in situ, being ventilated with Oxygen, Air and Sevoflurane. You have 4 minutes to manage this problem.

2-3 Increased airway pressure v.1

Using these steps from start to end should identify any cause of increased airway pressure in theatre.
Avoid spending excessive time and attention on one aspect until you have run through the whole guideline.

START

1. **Adequate oxygen delivery**
   - Pause surgery if possible.
   - Consider surgery related cause.
   - Increase fresh gas flow AND give 100% oxygen AND check measured F_iO_2.
   - Visual inspection of entire breathing system including valves and connections.
   - Rapidly confirm reservoir bag moving OR ventilator bellows moving.
   - Confirm increased airway pressure by switching to hand ventilation (<3 breaths) (Box B).
2. **Airway**
   - Check position of airway device and listen for noise (including larynx and stomach).
   - Check capnogram shape compatible with patent airway.
   - Confirm airway device is patent (consider passing suction catheter).
   - Isolate patient from anaesthetic machine and breathing system (Box C).
   - If machine/breathing system problem excluded, consider whether airway device should be replaced or its type changed.
3. **Breathing**
   - Check chest symmetry, rate, breath sounds, SpO_2, measured VTexp, $ETCO_2$.
   - Feel the airway pressure using reservoir bag and APL valve (Box B).
   - Consider potential causes and actions (Box D).
4. **Circulation**
   - Check heart rate, rhythm, perfusion, recheck blood pressure.
   - If circulation unstable, consider if it is due to high airway pressure gas trapping.
5. **Depth:** Ensure adequate depth of anaesthesia and analgesia.
6. If not resolving, call for help AND check arterial blood gas, 12-lead ECG, chest X-ray.

Box A: CRITICAL CHANGES

If problem worsens significantly or a new problem arises, call for **help** and go back to **START** of **1-1 Key basic plan**

Box B: FEEL THE AIRWAY PRESSURE

Remember that airway "feel" depends on your APL valve setting.
You can only "feel" a maximum of what the APL valve is set to.
Measured expired tidal volume gives additional information.

Box C: EXCLUDE ANAESTHETIC MACHINE/BREATHING SYSTEM PROBLEM

Ventilate lungs using self-inflating bag connected **DIRECTLY** to tracheal tube connector.
DO NOT use HME filter, angle piece or catheter mount.

- If increased pressure manually confirmed, re-connect machine
- If problem resolved, assume problem with machine, circuit, HME, filter, angle piece or catheter mount: check and replace.

BOX D: POTENTIAL CAUSES AND ACTIONS

- Inadequate neuromuscular blockade.
- If laparoscopic surgery, consider releasing pneumoperitoneum and levelling patient position.
- Consider potential causes:
  - Laryngospasm and stridor → **3-6**
  - Bronchospasm → **3-4**
  - Anaphylaxis → **3-1**
  - Circulatory embolus → **3-5**
  - Aspiration, pulmonary oedema; bronchial intubation; foreign body; pneumothorax.
- Consider potential actions: tracheal/bronchial suction; bronchodilator; PEEP; diuretic; bronchoscopy.

2-2_Hypoxia

You are 15 minutes in to anaesthetic maintenance of a fit and healthy 35 year old male undergoing elective repair of inguinal hernia under general anaesthetic. The SpO_2 has been gradually dropping since moving from the anaesthetic room in to theatre and is now 90%. The uneventful induction was with Propofol 200mg and Fentanyl 200mcg followed by an Ultrasound guided ilioinguinal field block with 10ml 0.25% levobupivacaine. He has a size 4 LMA in situ, breathing Oxygen, Air and Sevoflurane. You have 3 minutes to manage this problem.

2-2 Hypoxia / desaturation / cyanosis v.1

Using these steps from start to end should identify any cause of unexpected hypoxia in theatre.
Avoid spending excessive time and attention on one aspect until you have run through the whole drill.

START

❶ **Adequate oxygen delivery**

- Pause surgery if possible.
- Increase fresh gas flow AND give 100% oxygen AND check measured F_iO_2.
- Visual inspection of entire breathing system including valves and connections.
- Rapidly confirm reservoir bag moving OR ventilator bellows moving.
- If SpO_2 low, is it accurate? Consider whether poor perfusion could be the problem.

❷ **Airway**

- Check position of airway device and listen for noise (including over larynx and stomach).
- Check capnogram shape compatible with patent airway.
- Confirm airway device is patent (consider passing suction catheter).
- Isolate patient from anaesthetic machine and breathing system (Box B).
- Once machine/breathing system problem excluded, consider whether airway device should be replaced or its type changed.

❸ **Breathing**

- Check chest symmetry, rate, breath sounds, SpO_2, measured VTexp, $ETCO_2$.
- Feel the airway pressure using reservoir bag and APL valve (Box C) <3 breaths.
- Consider potential causes and actions (Box D).
- Consider muscle relaxation to optimise ventilation.

❹ **Circulation**

- Check heart rate, rhythm, perfusion, recheck blood pressure.
- If circulation unstable, consider if this is secondary to hypoxia.

❺ **Depth**

- Ensure adequate depth of anaesthesia and analgesia.

❻ If not resolving call for help AND check arterial blood gas, 12-lead ECG, chest X-ray.

Box A: CRITICAL CHANGES

If problem worsens significantly or a new problem arises, call for **help** and go to **START** of **GUIDELINE 1-1 Key basic plan**.

Box B: ISOLATE EQUIPMENT

Ventilate using self-inflating bag connected **DIRECTLY** to tracheal tube connector. **DO NOT** use HME filter, angle piece or catheter mount:

- If problem resolves: assume problem with machine, circuit, HME, filter, angle piece or catheter mount: check and replace.
- If increased pressure manually confirmed: re-connect machine.

Box C: AIRWAY PRESSURE

Remember that airway "feel" depends on your APL valve setting. You can only "feel" a maximum of what the APL valve is set to. Measured expired tidal volume gives additional information.

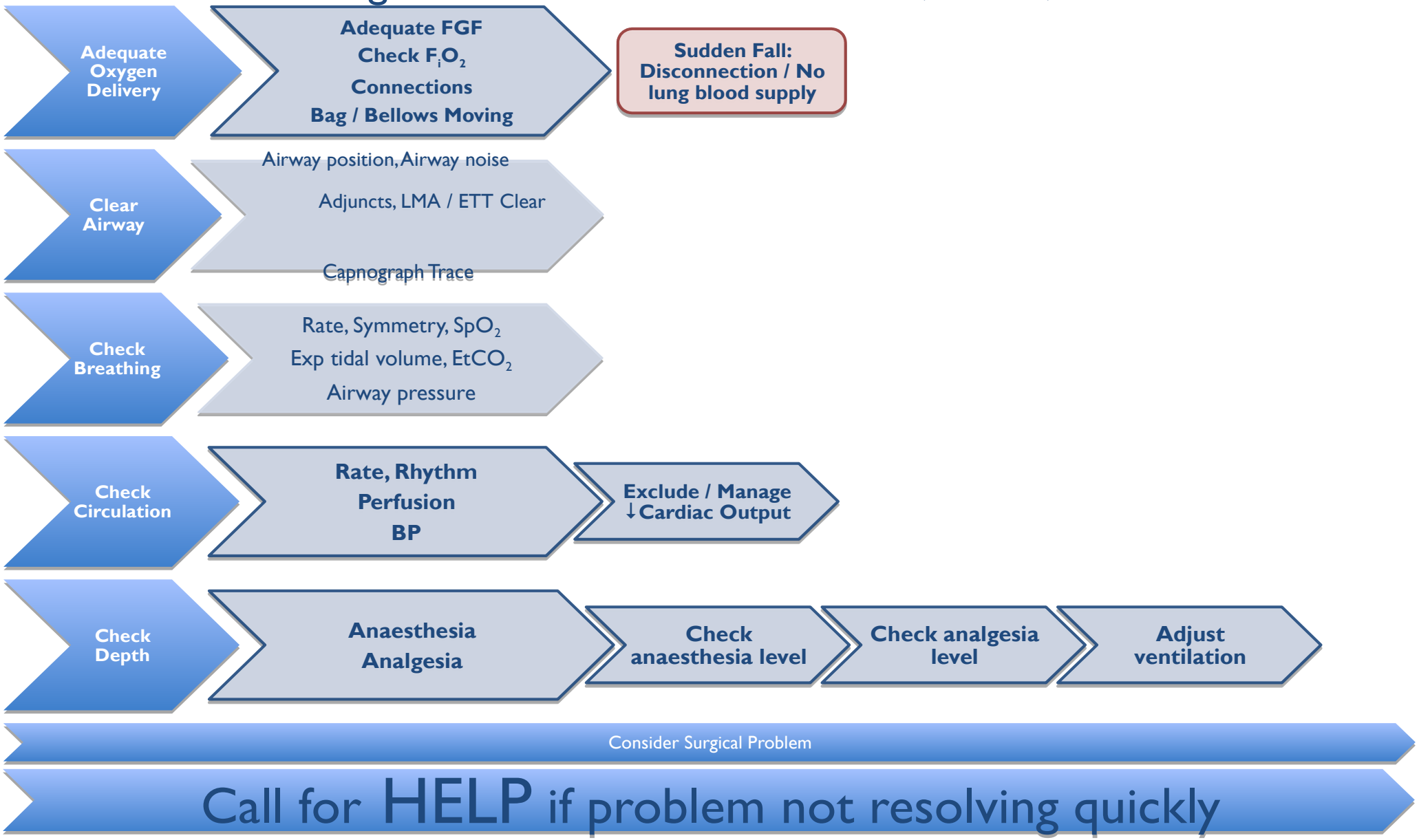
BOX D: POTENTIAL CAUSES AND ACTIONS

- Hypoxia with increased airway pressure → **2-3**
- Inadequate movement or expired volume: assist/increase ventilation.
- Asymmetrical chest expansion: exclude bronchial intubation/foreign body/pneumothorax.
- Consider potential actions: tracheal/bronchial suction; bronchodilator; PEEP; diuretic; bronchoscopy.
- Consider potential causes:
  - Laryngospasm and stridor → **3-6**
  - Bronchospasm → **3-4**
  - Anaphylaxis → **3-1**
  - Circulatory embolism → **3-5**
  - Cardiac ischaemia (or infarction) → **3-12**
  - Cardiac tamponade → **3-9**
  - Sepsis → **3-14**
  - Malignant hyperthermia crisis → **3-8**
  - Aspiration, pulmonary oedema, congenital heart disease

NQ_Fall in $EtCO_2$

You are 10 minutes in to anaesthetic maintenance of a 75 year old male undergoing urgent DHS for fractured hip sustained within the last 24 hours. He has hypertension and peripheral vascular disease and he is on Aspirin, Ramipril and Bendrofluazide. The uneventful induction was with Propofol 150mg, Fentanyl 100mcg and Vecuronium 6mg, followed by 5mg Morphine and fascia iliaca block with 30ml 0.25% Levobupivacaine. He has a size 8 ETT in situ, being ventilated with Oxygen, Air and Sevoflurane. His $EtCO_2$ was 5.8 following intubation and has gradually reduced to 3.1. You have 3 minutes to manage this problem.

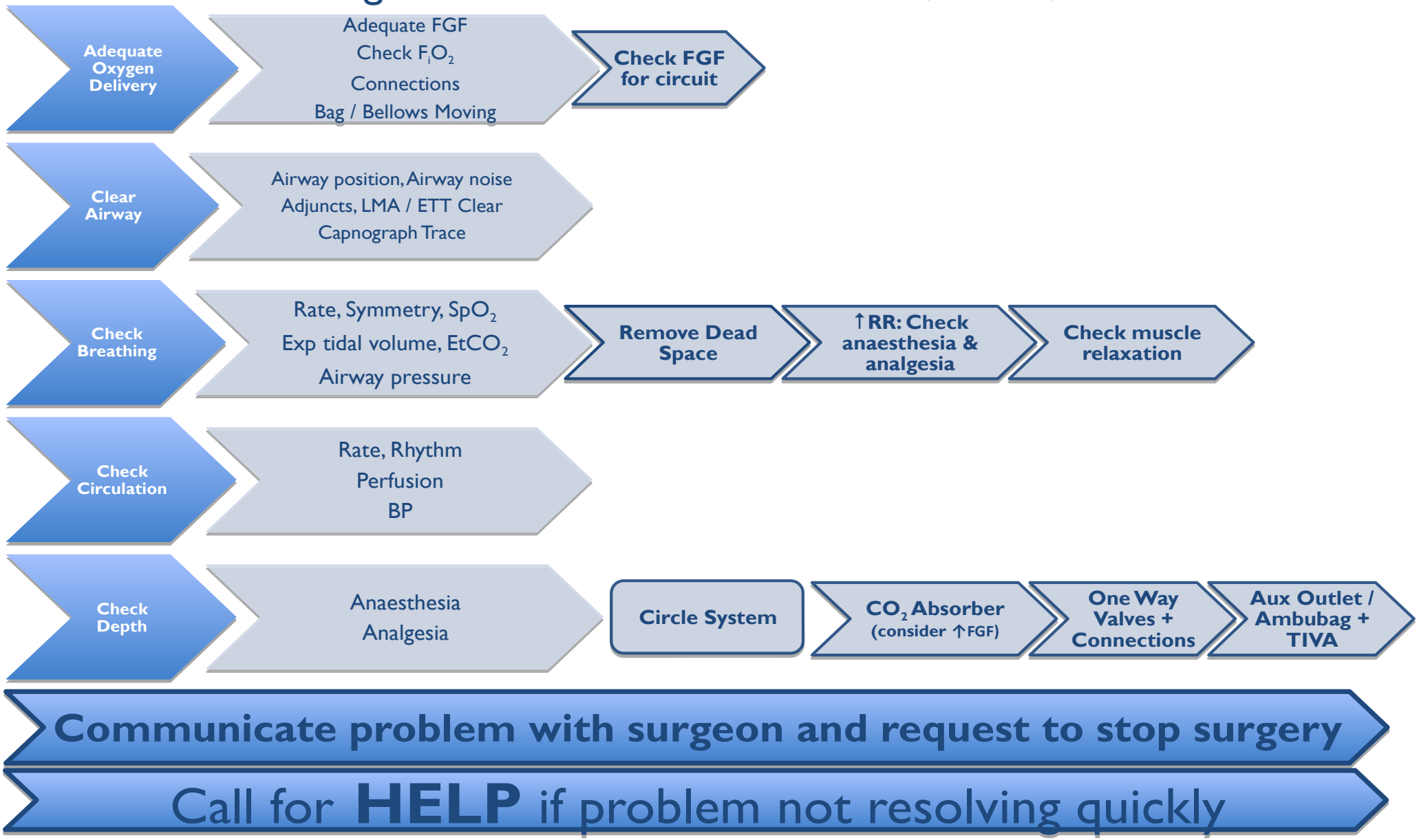
Management of Fall in $EtCO_2$ - Look, Listen, Feel:



NQ_Rise in $FiCO_2$

You are 10 minutes in to anaesthetic maintenance of an unfasted 25 year old male undergoing emergency reduction of ankle dislocation under general anaesthetic. He is otherwise fit and healthy. The uneventful rapid sequence induction was with Thiopentone 500mg and Suxamethonium 100mg, followed by Fentanyl 50mcg. He has a size 8 ETT in situ, being ventilated with Oxygen, Air and Sevoflurane via a Bain circuit in the anaesthetic room. There is now $FiCO_2$ appearing in the circuit. You have 3 minutes to manage this problem.

Management of Rise in $FiCO_2$ - Look, Listen, Feel:



2-6_Bradycardia

You are 20 minutes in to anaesthetic maintenance of a 29 year old female undergoing elective laparoscopy for investigation of pelvic pain. She has a history of SVT twice in the past 8 years but is on no medication. She is otherwise fit and healthy. The uneventful induction was with Propofol 180mg, Fentanyl 100mcg followed by Rocuronium 30mg. She has a size 8 ETT in situ, being ventilated with Oxygen, Air and Sevoflurane. She has a narrow complex bradycardia at a rate of 42 which developed from an initial heart rate of 70. You have 3 minutes to manage this problem.

2-6 Bradycardia v.1

Bradycardia in theatre should not be treated as an isolated variable: remember to tailor treatment to the patient and the situation.
Follow the full steps to exclude a serious underlying problem.

START

❶ **Immediate action**: Stop any stimulus, check pulse, rhythm and blood pressure:
- If no pulse OR not sinus bradycardia OR severe hypotension: use Box A.
- If pulse present AND sinus bradycardia: use Box B.

❷ **Adequate oxygen delivery**
- Check fresh gas flow for circuit in use AND check measured F_iO_2.
- Visual inspection of entire breathing system including valves and connections.
- Rapidly confirm reservoir bag moving OR ventilator bellows moving.

❸ **Airway**
- Check position of airway device and listen for noise (including larynx and stomach).
- Check capnogram shape compatible with patent airway.
- Confirm airway device is patent (consider passing suction catheter).

❹ **Breathing**
- Check chest symmetry, rate, breath sounds, SpO_2, measured VTexp, $ETCO_2$.
- Feel the airway pressure using reservoir bag and APL valve <3 breaths.

❺ **Circulation**
- Check rate, rhythm, perfusion, recheck blood pressure.

❻ **Depth**
- Consider current depth of anaesthesia AND adequacy of analgesia.

❼ Consider underlying problem (Box C).

❽ Call for help if problem not resolving quickly.

❾ Consider transcutaneous pacing (Box D).

Box A: CRITICAL BRADYCARDIA

Give atropine 20 $\mu g.kg^{-1}$ (adult 0.5-1 mg) with fluid flush.
If no pulse: (or heart rate <60 bpm infant or neonate):
- Delegate (minimum) 1 person to chest compressions
- **→ 2-1 Cardiac arrest**

Box B: DRUGS FOR BRADYCARDIA

- Glycopyrrolate 5 $\mu g.kg^{-1}$ (adult 200-400 µg)
- Ephedrine 100 $\mu g.kg^{-1}$ (adult 3-12 mg)
- Atropine 10 $\mu g.kg^{-1}$ (adult 300-600 µg)
- Isoprenaline 0.5 $\mu g.kg.min^{-1}$ (adult 5 $\mu g.min^{-1}$)
- Adrenaline 1 $\mu g.kg^{-1}$ (adult 10-100 µg) in emergency only

Box C: POTENTIAL UNDERLYING PROBLEMS

- Consider whether you could have made a drug error.
- Consider known drug causes (eg. remifentanil, digoxin etc).
- Surgical stimulation with inadequate depth.
- Also consider: high intrathoracic pressure; pneumoperitoneum; local anaesthetic toxicity **(→ 3-10)**; beta-blocker; digoxin; calcium channel blocker; myocardial infarction, hyperkalaemia, hypothermia, raised intra-cranial pressure.

Box D: TRANSCUTANEOUS PACING

- Attach pads and ECG leads from pacing defibrillator.
- Set to PACING MODE.
- Set PACER RATE.
- Increase PACER OUTPUT from 60 mA until capture (spikes align QRS).
- Confirm capture: electrical AND mechanical (femoral pulse).
- Set PACER OUTPUT 10 mA above capture.

2-1_Cardiac arrest

You are 30 minutes in to anaesthetic maintenance of an elderly female undergoing emergency DHS for fractured hip under general anaesthetic. The uneventful induction was with Propofol 100mg and Fentanyl 100mcg followed by Vecuronium 4mg and fascia iliaca block with 30ml 0.25% Levobupivacaine. She has a size 8 ETT in situ, being ventilated with Oxygen, Air and Sevoflurane. She has developed ventricular fibrillation. You have 3 minutes to manage this problem.

2-1 Cardiac arrest v.1

The probable cause is one or more of: something related to surgery or anaesthesia; the patient's underlying medical condition; the reason for surgery; equipment failure. The first priority is to start chest compressions, then get help, then find and treat the cause using the guideline.

START

1 IMMEDIATE ACTION

- **Declare "cardiac arrest"** to the theatre team AND note time.
- Delegate one person (minimum) to chest compressions 100 min^{-1}, depth 5 cm.
- Call for help: nearby theatres / emergency bell / senior on-call / dial emergency number.
- Call for cardiac arrest trolley.
- As soon as possible, delegate task of evaluating potential causes (Box A).

2 Adequate oxygen delivery

- Increase fresh gas flow, give 100% oxygen AND check measured F_iO_2.
- Turn off anaesthetic (inhalational or intravenous).
- Check breathing system valves working and system connections intact.
- Rapidly confirm ventilator bellows moving or provide manual ventilation.

3 Airway

- Check position of airway device and listen for noise (including larynx and stomach).
- Confirm airway device is patent (consider passing suction catheter).
- **If expired CO_2 is absent, presume oesophageal intubation until absolutely excluded.**

4 Breathing

- Check chest symmetry, rate, breath sounds, SpO_2, measured expired volume, $ETCO_2$.
- Evaluate the airway pressure using reservoir bag and APL valve.

5 Circulation

- Check rate and adequacy of chest compressions (visual and $ETCO_2$).
- Encourage rotation of personnel performing compressions.
- If i.v. access fails or impossible use intraosseous (IO) route.
- Check ECG rhythm for no more than 5 seconds.
- Follow Resuscitation Council (UK) and ERC Guidelines.
- See Boxes B and C for reminders about drugs and defibrillation.

6 Systematically evaluate potential underlying problems and act accordingly (Box A).

7 If there is return of spontaneous circulation, re-establish anaesthesia.

Box A: POTENTIAL CAUSES

4 H's, 4 T's:

Hypoxia **(→ 2-2)**
Hypovolaemia
Hypo/hyperkalaemia
Hypothermia

Tamponade **(→ 3-9)**
Thrombosis **(→3-5)**
Toxins
Tension pneumothorax

Specific peri-operative problems:

Vagal tone
Drug error
Local anaesthetic toxicity **(→ 3-10)**
Acidosis
Anaphylaxis **(→ 3-1)**
Embolism, gas/fat/amniotic **(→ 3-5)**
Massive blood loss **(→ 3-2)**

Box B: DRUGS FOR PERI-OPERATIVE CARDIAC ARREST

Fluid bolus 20 $ml.kg^{-1}$ (adult 500 ml).
Adrenaline 10 $\mu g.kg^{-1}$ (adult 1000 µg – may be given in increments).
Atropine 10 $\mu g.kg^{-1}$ (adult 0.5-1 mg) if vagal tone likely cause.
Amiodarone 5 $mg.kg^{-1}$ (adult 300 mg) after 3rd shock.
Magnesium 50 $mg.kg^{-1}$ (adult 2 g) for polymorphic VT/hypomagnesaemia.
Calcium chloride 10% 0.2 $ml.kg^{-1}$ (adult 10 ml) for magnesium overdose, hypocalcaemia or hyperkalaemia.
Thrombolysis for suspected massive pulmonary embolus.

BOX C: DEFIBRILLATION

Continue compressions while charging: Biphasic 4 $J.kg^{-1}$ (adult 150-200 J)
DO NOT check pulse after defibrillation.
Use 3 stacked shocks in cardiac catheterisation lab.

BOX D: DON'T FORGET!

- **Use waveform capnography. No expired CO_2 = lungs not being ventilated (assume and exclude oesophageal intubation). Very rarely, absent/minimal expired CO_2 = CPR not occurring OR pulmonary circulation disconnected from systemic (e.g. in major trauma).** Sudden increase in $ETCO_2$ usually signals return of spontaneous circulation.
- Optimise position for chest compressions (use overhead for bariatric patients).
- Uterine displacement in pregnant patients.
- Ventilator can free up hands but remember to set to volume control. Minimise intrathoracic pressure: avoid excessive tidal volume and hyperventilation.

2-4_Hypotension

You are 20 minutes in to anaesthetic maintenance of an elderly female undergoing elective umbilical hernia repair. She is usually hypertensive on a beta-blocker and diuretic. She has been fasting all day and is last on your list. The uneventful induction was with Propofol 150mg and Fentanyl 100mcg followed by Vecuronium 4mg and Morphine 5mg. She has a size 8 ETT in situ, being ventilated with Oxygen, Air and Sevoflurane. Her BP was 120/80 following induction but is now 70/30. You have 3 minutes to manage this problem.

2-4 Hypotension v.1

Hypotension is commonly due to unnecessarily deep anaesthesia, the autonomic effects of neuraxial block, hypovolaemia or combined causes.
You should rapidly exclude a problem in adequate oxygen delivery, airway and breathing first.

START

1 Adequate oxygen delivery

- Pause surgery if possible.
- Increase fresh gas flow AND give 100% oxygen AND check measured F_iO_2.
- Visual inspection of entire breathing system including valves and connections.
- Rapidly confirm reservoir bag moving OR ventilator bellows moving.

2 Airway

- Check position of airway device and listen for noise (including larynx and stomach).
- Check capnogram shape compatible with patent airway.
- Check airway AND airway device are patent (consider passing suction catheter).

3 Breathing

- Check chest symmetry, rate, breath sounds, SpO_2, measured VTexp, $ETCO_2$.
- Feel the airway pressure using reservoir bag and APL valve <3 breaths.
- Exclude high intrathoracic pressure as a cause.

4 Circulation

- Check heart rate, rhythm, perfusion, recheck blood pressure.
- If heart rate <60 bpm consider giving anticholinergic drug (Box B).
- Consider giving vasopressor (Box C) and positioning (e.g. move head down).
- Consider fluid boluses (250 ml adult, 10 $ml.kg^{-1}$ paediatric).
- If heart rate >100 bpm sinus rhythm, treat as hypovolaemia: give i.v fluid bolus.
- If heart rate >100 bpm and non-sinus → **2-7 Tachycardia.**

5 Depth

- Ensure correct depth of anaesthesia AND analgesia (consider risk of awareness).

6 Exclude potential surgical causes (Box D) – discuss with surgical team.

7 Consider causes in Box E and call for help if problem not resolving quickly.

Box A: CRITICAL CHANGES

If problem worsens significantly or a new problem arises, call for **help** and go back to **START** of **1-1 Key basic plan**.

Box B: ANTICHOLINERGIC DRUGS

- Glycopyrrolate 5 $\mu g.kg^{-1}$ (adult 200-400 µg)
- Atropine 5 $\mu g.kg^{-1}$ (adult 300-600 µg)

Box C: VASOPRESSOR DRUGS

- Ephedrine 100 $\mu g.kg^{-1}$ (adult 3-12 mg)
- Phenylephrine 5 $\mu g.kg^{-1}$ (adult 100 µg)
- Metaraminol 5 $\mu g.kg^{-1}$ (adult 500 µg)
- Adrenaline 1 $\mu g.kg^{-1}$ (adult 10-100 µg) in emergency only

Box D: SURGICAL CAUSES

- Decreased venous return (e.g. vena cava compression / pneumoperitoneum)
- Blood loss (unrecognised / undeclared / occult)
- Vagal reaction to surgical stimulation
- Embolism (gas / fat / blood / cement reaction)

Box E: DON'T FORGET!

- Consider whether you could have made a drug error.
- Pneumothorax and/or high intrathoracic pressure can cause hypotension.
- Also consider:
  - Cardiac ischaemia → **3-12**
  - Anaphylaxis → **3-1**
  - Cardiac tamponade → **3-9**
  - Local anaesthetic toxicity → **3-10**
  - Sepsis → **3-14**
  - Cardiac valvular problem
  - Endocrine cause (eg steroid dependency)

2-5_Hypertension

You are 10 minutes in to anaesthetic maintenance of a 28 year old fit and healthy male undergoing elective nasal septoplasty. The uneventful induction was with Propofol 200mg and Fentanyl 50mcg followed by Vecuronium 4mg. He has a size 8 ETT in situ, being ventilated with Oxygen, Air and Sevoflurane. His BP was 120/80 following induction but is now 160/90. You have 3 minutes to manage this problem.

2-5 Hypertension v.1

Hypertension is most commonly due to inappropriate depth of anaesthesia or inadequate analgesia.
You should rapidly exclude a problem in adequate oxygen delivery, airway and breathing first.

START

❶ **Immediate actions**

- Recheck blood pressure AND increase anaesthesia AND reduce stimulus.

❷ **Adequate oxygen delivery**

- Check fresh gas flow for circuit in use AND check measured F_iO_2.
- Visual inspection of entire breathing system including valves and connections.
- Rapidly confirm reservoir bag moving OR ventilator bellows moving.

❸ **Airway**

- Check position of airway device and listen for noise (including larynx and stomach).
- Check capnogram shape compatible with patent airway.
- Confirm airway device is patent (consider passing suction catheter).

❹ **Breathing** - exclude **hypoxia** and **hypercarbia** as causes:

- Check chest symmetry, rate, breath sounds, SpO_2, measured VT_{exp}, $ETCO_2$.
- Feel the airway pressure using reservoir bag and APL valve <3 breaths.

❺ **Circulation**

- Check rate, rhythm, perfusion; increase frequency of BP check.
- Check cuff size and location, consider intra-arterial monitoring.

❻ **Depth**

- Ensure adequate depth of anaesthesia and analgesia.

❼ Consider underlying problem (Box B).

❽ Call for help and consider temporising drug (Box C) if problem not resolving.

Box A: CRITICAL CHANGES

If problem worsens significantly or a new problem arises, call for **help** and go back to **START** of **1-1 Key Basic Plan.**

BOX B: POTENTIAL UNDERLYING PROBLEMS

- Inadequate anaesthesia / analgesia (alfentanil can be diagnostic – see Box C for dose)
- Inadequate neuromuscular blockade
- Consider whether you could have made a drug error
- Omission of usual antihypertensives
- Distended bladder
- Vasopressor administered by surgeon
- Surgical tourniquet
- Excess fluid (over-administration / overload / TURP syndrome)
- Medical causes: drug interaction, renal failure, raised intracranial pressure, seizure, thyrotoxicosis, phaeochromocytoma

BOX C: TEMPORISING DRUGS FOR HYPERTENSION

- Alfentanil 10 $\mu g.kg^{-1}$ (adult 0.5-1 mg)
- Propofol 1 $mg.kg^{-1}$ (adult 50-100 mg)
- Labetolol 0.5 $mg.kg^{-1}$ (adult 25-50mg). Repeat when necessary.
- Esmolol 0.5 $mg.kg^{-1}$ (adult 25-50mg) Follow with infusion.
- Hydralazine 0.1 $mg.kg^{-1}$ (adult 5-10mg)
- Glyceryl trinitrate 0.5-5 $\mu g.kg.min^{-1}$ infusion (adult 2-20 $ml.hr^{-1}$ of 1 $mg.ml^{-1}$ solution)

2-7_Tachycardia

You are 20 minutes in to anaesthetic maintenance of a 21 year old fit and healthy male undergoing emergency laparoscopy for presumed appendicitis. He is usually fit and healthy. The uneventful rapid sequence induction was with Thiopentone 450mg, Fentanyl 100mcg and Suxamethonium 100mg, followed by Vecuronium 4mg and Morphine 10mg. He has a size 8 ETT in situ, being ventilated with Oxygen, Air and Sevoflurane. His heart rate pre-induction was 90 but it has gradually risen to 126. You have 3 minutes to manage this problem.

2-7 Tachycardia v.1

Tachycardia in theatre is often due to inadequate depth of anaesthesia / analgesia or alternatively a reflex to hypotension.
Tachycardia should not be treated as an isolated variable: remember to tailor treatment to the patient and the situation.
Follow the full steps to exclude a serious underlying problem.

START

❶ **Immediate action**: Stop any stimulus, Check pulse, rhythm and blood pressure:
- If no pulse or impending arrest: use Box A.
- If narrow complex AND not hypotensive first increase depth of anaesthesia/analgesia.

❷ **Adequate oxygen delivery**
- Check fresh gas flow for circuit in use AND check measured F_iO_2.
- Visual inspection of entire breathing system including valves and connections.
- Rapidly confirm reservoir bag moving OR ventilator bellows moving.

❸ **Airway**
- Check position of airway device and listen for noise (including larynx and stomach).
- Check capnogram shape compatible with patent airway.
- Confirm airway device is patent (consider passing suction catheter).

❹ **Breathing**
- Check chest symmetry, rate, breath sounds, SpO_2, measured VTexp, $ETCO_2$.
- Feel the airway pressure using reservoir bag and APL valve <3 breaths.

❺ **Circulation**
- Check rate, rhythm, perfusion, recheck blood pressure, obtain 12-lead ECG if possible.

❻ Consider underlying problems (Box B).

❼ Consider rate control (Box C).

❽ **Call for help;** consider electrical cardioversion (Box D) if problem not resolving quickly.

❾ **Depth:** Consider current depth of anaesthesia AND adequacy of analgesia.

Box A: CRITICAL TACHYCARDIA

If no pulse, delegate one person (minimum) to chest compressions and **→ 2-1 Cardiac arrest.**
If hypotension worsening or impending arrest, consider electrical cardioversion (Box D).

Box B: POTENTIAL UNDERLYING PROBLEMS

- Stimulation with inadequate depth.
- Consider drug error.
- Also consider: central line/wire; hypovolaemia; primary cardiac arrhythmia; myocardial infarction; electrolyte disturbance; local anaesthetic toxicity **(→ 3-10)**; sepsis **(→ 3-14)**; circulatory embolus, gas/fat/amniotic **(→ 3-5)**; anaphylaxis **(→ 3-1)**; malignant hyperthermia crisis **(→ 3-8)**

Box C: DRUGS FOR TACHYCARDIA

- Fluid bolus 10 $ml.kg^{-1}$ (adult 250 ml)
- Magnesium 50 $mg.kg^{-1}$ (adult 2 g) over >10 min, max conc. 200 $mg.ml^{-1}$
- Amiodarone 5 $mg.kg^{-1}$ (adult 300 mg) over >3 min, NOT in polymorphic VT
- Labetalol 0.5 $mg.kg^{-1}$ (adult 25-50 mg), repeat when necessary
- Esmolol 0.5 $mg.kg^{-1}$ (adult 25-50 mg)
- Adenosine 0.1 to 0.5 $mg.kg^{-1}$ (Adult 3 to 18 mg) – for SVT

Box D: ELECTRICAL CARDIOVERSION

- Attach pads and ECG from defibrillator.
- Ensure adequate depth / sedation / analgesia for cardioversion.
- Engage synchronisation and check for sync spikes on R-waves.
- Start with 1 Jkg^{-1} (adult 50-100 J) biphasic.
- Remember to hold shock button until sync shock delivered.

NQ_Convulsions

You are 10 minutes in to anaesthetic maintenance of a 54 year old female undergoing elective hysteroscopy for postmenopausal bleeding. She has a history of epilepsy and is on 300mg Carbamazepine twice daily and has self-terminating seizures about once every two months. She is otherwise fit and healthy. The uneventful induction was with Propofol 180mg and Fentanyl 50mcg. She has a size 4 LMA in situ, spontaneously breathing Oxygen, Air and Sevoflurane. She has just begun to have a generalized seizure. You have 3 minutes to manage this problem.

Management of Convulsions - Look, Listen, Feel:

Adequate Oxygen Delivery

Adequate FGF
Check F_iO_2
Connections
Bag / Bellows Moving

FiO_2 1.0

Prevent injury

Notify Surgeon

Clear Airway

Airway position, Airway noise
Adjuncts, LMA / ETT Clear
Capnograph Trace

May need to stop seizure to manage airway

Check Breathing

Rate, Symmetry, **SpO_2**
Exp tidal volume, $EtCO_2$
Airway pressure

Assist Breathing

Check Circulation

Rate, Rhythm
Perfusion
BP

Check Depth

Anaesthesia
Analgesia

Check BM

Stop Seizure:
Induction Agent
Benzodiazapine
$MgSO_4$ (Eclampsia)
Dextrose (Hypo)

Look for treatable cause:
Hypoxaemia, LA Toxicity, Drugs (NB social history), Sepsis, Pyrexia, Intrinsic CNS, Metabolic

Consider Surgical Problem

Call for HELP if problem not resolving quickly

ACID Teaching Package Evaluation: Trainee

How many months of anaesthesia training have you had?

0-3 3-6 6-12 >12

The ACID package has increased my confidence in dealing with critical incidents

1 2 3 4 5

(strongly disagree) (strongly agree)

I found the format of the key basic plan useful

1 2 3 4 5

(strongly disagree) (strongly agree)

I am comfortable having DOPS assessments carried out as part of the ACID package

Yes No

It would be useful to practise these drills as a table top exercise with other trainees

1 2 3 4 5

(strongly disagree) (strongly agree)

The one thing I liked most about the ACID package was:

The one thing I want to be changed with the ACID package is:

Please return to the trainer for your session

Certificate of attendance

Anaesthetic Critical Incident Drills (ACID) Training

This is to certify that

Dr. _____

Attended ACID training

On ___/___/_____

Trainer (s)

_____ _____ _____

A simulation based package supported by scschf.org

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