

Anaesthetic Emergency Algorithms

Contents	Page
SCARE COVERABCD A SWIFTCHECK	2
General principles	5
Laryngospasm	6
Airway Obstruction	7
Aspiration/Regurgitation	8
Difficult intubation	9
Hypoventilation	13
Bronchospasm	14
Pulmonary Oedema/ARDS	15
Pneumothorax	17
Desaturation	18
Bradycardia	20
Tachycardia	21
Hypotension	23
Hypertension	24
Myocardial Ischaemia	26
Cardiac Arrest	27
Drugs and IV access	29
Awareness	30
Air embolism	31
Anaphylaxis	32
Trauma	33
Water intoxication	37
Electrolyte Disturbances	38
Hyponatraemia	38
Hypernatraemia	39
Hypokalaemia	40
Hyperkalaemia	41
Hypocalcaemia	42
Hypercalcaemia	43
Metabolic disturbances	44
Hypoglycaemia	44
Hyperglycaemia	45
Metabolic Acidosis	46
Metabolic Alkalosis	47
Hypothyroidism	48
Hyperthyroidism	49
Phaeochromocytoma	50
Addisonian Crisis	51
Carcinoid Crisis	52
Sepsis	53
Neuraxial Anaesthesia	54
Nerve Blocks	55
Post-Crisis	56

SCARE
COVER ABCD A SWIFTCHECK

General

- Formulated by Australian Safety Foundation
- Facilitates rapid identification of crisis during anaesthesia.

Algorithm	Description
SCARE	S – scan C – check A – alert R – ready E – emergency
COVER ABCD A SWIFT CHECK (ventilated) AB COVER ABCD A SWIFT CHECK (spont breathing)	COVER – covers 95% C – circulation, capnograph, colour O – oxygen supply, oxygen analyser V – ventilation, vaporisers E – ETT, eliminate machine R – review monitors and equipment A – airway: laryngospasm, airway obstruction, aspiration, difficult intubation B – breathing: hypoventilation, bronchospasm, pulmonary oedema, pneumothorax, desaturation C – circulation: BP, HR, myocardial ischaemia, cardiac arrest D – drugs A SWIFTCHECK – second crisis applied with cause of crisis NOT revealed by COVER ABCD. A – awareness, air embolism, air in pleura, anaphylaxis (4%) S – surgeon, situation W – Wound, water intoxication I – infarct, insufflation F – fat syndrome, full bladder T – trauma, tourniquet down C – catheter, cannula, chest drain, cement H – hyper/hypothermia, hypoglycaemia E – embolus (fat, thrombus, amniotic fluid), endocrine (hyper/hypo thyroid, adrenal, pancreas, pituitary) C – check (right patient, operation, body part, side, notes) K – potassium, or other electrolyte K – keep patient asleep until new anaesthetic machine is found

C1 – circulation	Feel pulse If absent → CPR, cardiac arrest treatment, help 3%
C2 - colour	Observe cyanosis, desaturation Test pulse oximetry → O
O1 – oxygen	Check rotametre Change FiO ₂ 100% Turn off nitrous and air 2%
O2 – oxygen analyser	Check O ₂ analyser shows rising O ₂ concentration 0.2%
V1 – ventilation	Hand ventilate lungs → assess compliance of circuit, airway patency, chest compliance. Assess capnography 20%
V2 – vaporiser	Vaporiser settings, adequately filled, leaks, wrong agent 4%
E1 – ETT	ETT for kinks, leaks, patency, obstruction, endobronchial Recheck capnography. Consider readjusting, removing or replacing 14%
E2 - Equipment	Eliminate anaesthetic machine, breathing system and ventilator. Hand ventilate. Consider gas sampling problems 15%
R1 – review	Review monitors – on, power, calibration 4% Review other equipment – diathermy, humidifiers, blankets, endoscopes, probes, prostheses, retractors 2%
A – airway	Check patency Problems – laryngospasm 6%, obstruction 1%, aspiration 5%
B – breathing	Assess pattern, adequacy Problems – hypoventilation 2%, bronchospasm 2%, pulmonary oedema, collapse, pneumothorax 1%
C – circulation	Assess peripheral perfusion – pulse, BP, ECG Problems: VR obstruction, raised ITP (PEEP), tamponade Tachyarrhythmia 2%, bradyarrhythmias 5%, hyper(1%)/hypotension(5%), ischaemia 1%
D - drugs	Review intended and unintended drug and substance administration. Consider drug failing to reach patient 3%
A	Air embolus Air in lung (pneumothorax) Awareness Anaphylaxis 4%
S1 – surgeons	IVC compression, vagal stimulation, bleeding, direct myocardial stimulation
S2 – Sepsis	Hypotension, desaturation, acidosis
W1 - wound	Trauma, bleeding, tamponade, pneumothorax
W2 – water intoxication	Fluid overload Electrolyte disturbance
I1 – infarct	Myocardial conduction, ST disturbance, hypotension, poor contractility
I2 - insufflation	Vagal tone, recued venous return, gas embolism
F1 – fat syndrome	Desaturation + hypotension post induction
F2 – full bladder	Haemodynamic changes, sympathetic stimulation
T1 - trauma	Spinal injury, head injury, pneumothorax, tamponade, ruptured viscus, concealed haemorrhage
T2 – tourniquet down	LA toxicity, unseen bleeding
C	catheter, cannula, chest drain, cement
H	Hyper/hypothermia, hyper/hypoglycaemia
E1 - embolus	Thrombus, gas, AFE
E2 - endocrine	Thyroid, adrenal, pituitary, pancreas
C - check	Right patient, operation, side, site

K1 - potassium	Potassium and other electrolyte
K2	Keep asleep

General Principles

1. Communication:
 - a. Send for Help Early
 - b. Be constructive in leadership. Avoid insulting or provoking comments
 - c. Directions need to be addressed, heard and understood.
 - d. Regularly appraise the situation
2. Team Approach
 - a. Identify a team leader
 - b. Leader must delegate
3. Adopt a protocol and drill approach
 - a. Simultaneously treat (ABCs) and diagnose

Laryngospasm

DEFINITION

- Involuntary occlusion of glottis by contraction of laryngeal muscles closing the vocal cords

LOOK FOR

- Inspiratory stridor/airway obstruction
- Increased inspiratory efforts/tracheal tug
- Paradoxical chest/abdominal movements (negative pressure pulmonary oedema)
- Desaturation, bradycardia, central cyanosis

PRECIPITATING FACTORS

- Airway irritation and/or obstruction
- Blood/secretions in the airway
- Regurgitation and aspiration
- Excessive stimulation/"light" anaesthesia
- Failure of anaesthesia delivery system.

EMERGENCY MANAGEMENT

1. Cease stimulation/surgery, or suction excessive secretions
2. 100% Oxygen
3. Request immediate assistance
4. Break the laryngospasm:
 - a. Try gentle chin lift/jaw thrust
 - b. Try mask CPAP/IPPV
5. If this is unsuccessful, Deepen anaesthesia with an IV agent – propofol 30-50mg
6. Give suxamethonium unless contraindicated, Give atropine unless contraindicated
7. Intubate and ventilate

FURTHER CARE:

- Careful postoperative review of the patient to:
 - confirm a clear airway
 - exclude pulmonary aspiration
 - exclude post obstructive pulmonary oedema
 - explain what happened to the patient.
- There is a risk of awareness
 - go and see the patient in the ward
 - explain again, and reassure the patient.

Airway Obstruction

LOOK FOR

- Noisy, poor or absent ventilation
- Increased inspiratory efforts/tracheal tug
- Paradoxical chest/abdominal movements

EMERGENCY MANAGEMENT

1. Cease stimulation/surgery
2. 100% oxygen
3. Request immediate assistance
4. Try chin lift/jaw thrust
5. Consider allowing the patient to wake up,

OR

6. Ensure adequate depth of anaesthesia
7. Visualise and clear the pharynx/airway, consider laryngospasm, or regurgitation
8. Insert oral and/or nasal airways
9. Reposition head, apply chin lift/jaw thrust, Try "team" mask CPAP/IPPV

IF YOU CANNOT VENTILATE

10. Have someone feel the pulse and call out the SpO₂
11. Consider suxamethonium 1-2 mg/kg IV and atropine 0.012 mg/kg IV, make one attempt at intubation under direct vision

IF YOU CANNOT INTUBATE

12. Consider a laryngeal mask.
13. IF THIS FAILS, Do an immediate cricothyroidotomy, Ventilate with 100% oxygen

IF YOU CANNOT VENTILATE VIA AN ETT, consider:

- (1) Misplaced/kinked/blocked ETT
- (2) Bronchospasm
- (3) Pneumothorax
- (4) Consider possible obstruction distal to ETT:
- (5) Try pushing a small tube past it, or push the obstruction down one bronchus, and ventilate the other lung, with a clean tube

FURTHER CARE

1. Review the patient to:
 - a. confirm a clear airway
 - b. exclude pulmonary aspiration
 - c. exclude post obstructive pulmonary oedema
 - d. explain what happened
2. If there is a risk of awareness:
 - a. go and see the patient in the ward
 - b. explain again and reassure them
 - c. advise them to warn future anaesthesiologists.

Aspiration/Regurgitation

ASPIRATION - SYMPTOMS AND SIGNS

- Laryngospasm / airway obstruction
- Bronchospasm / rales / crepitations
- Hypoventilation / dyspnoea / apnoea
- Reduced compliance (ARDS)
- Desaturation / bradycardia / cardiac arrest.

EMERGENCY MANAGEMENT

1. Inform the surgeon
2. Head down, lateral position
3. Apply cricoid pressure (release cricoid pressure if active vomiting occurs – can cause oesophageal rupture)
4. Try to clear and suction the airway
5. Give 100% oxygen
6. Decide if intubation is required (trivial → wake up, hypoxic/significant → deepen and intubate)

IF INTUBATION IS NOT REQUIRED

7. Consider deepening anaesthesia
8. Try gentle mask CPAP/IPPV with cricoid pressure
9. Ventilate the lungs with cricoid pressure

IF INTUBATION IS REQUIRED / CANNOT VENTILATE

1. Give suxamethonium 2 mg/kg (100mg adult dosage) IV & atropine 0.6 mg IV
2. Intubate using cricoid pressure, optimise FiO₂ and ventilate
3. Suction ETT with 'Y' catheter (size = 2 x ETT size)
4. If airway obstruction clinically, bronchoscopy and lavage if necessary
5. Bronchodilators as necessary for bronchospasm
6. Insert NGT to drain stomach
7. Chest x-ray
8. Based on information decide:
 - a. Surgery to proceed or continue
 - b. Keep intubated vs. extubated:
 - i. If normal and saturation is adequate, extubate. If stable after two hours in recovery, send to ward and arrange for follow up
 - ii. If unstable or saturation is inadequate, maintain intubation, PEEP and IPPV; admit to a high dependency area
 - iii. High risk – pH < 7.35, volume > 25mLs

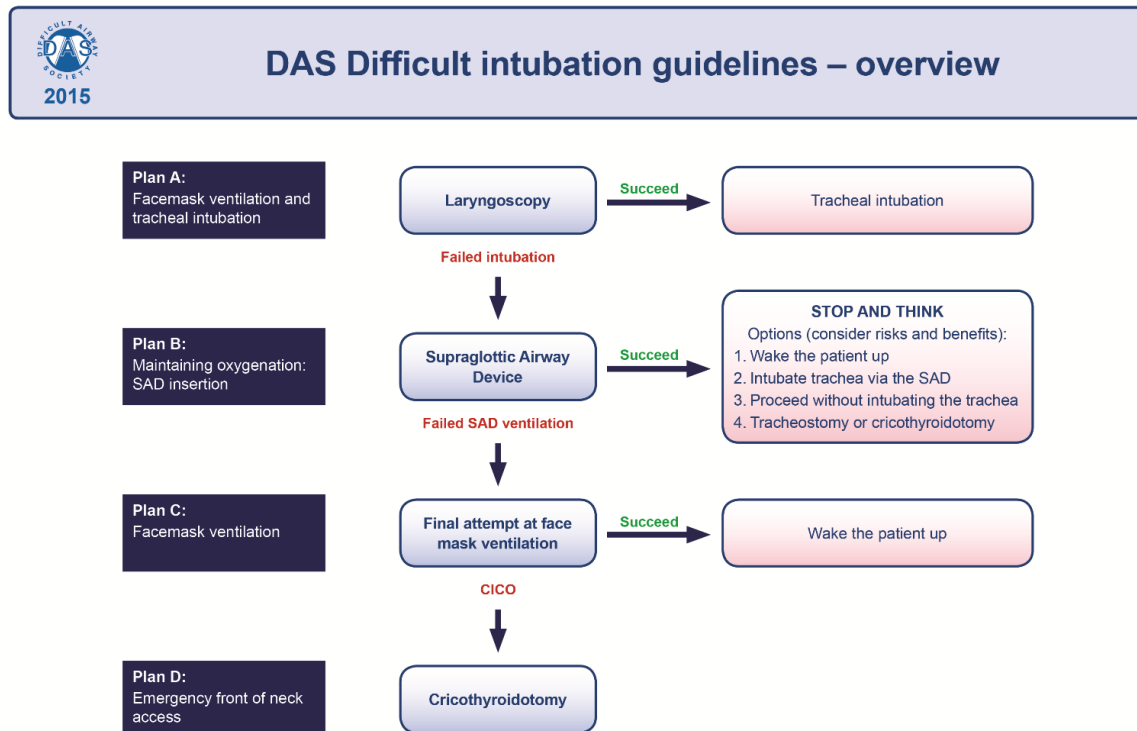
FURTHER CARE

- Consider other causes
- Repeat chest X-ray and blood gases
- Consider PEEP, bronchodilators, inotropes
- Culture sputum, antibiotics when indicated. Antibiotics should not be routinely started. Indications include large aspiration of faeculent material.
- Explain what happened to the patient/family
- Arrange follow up as necessary.

Difficult intubation

PATIENTS DO NOT DIE FROM FAILED INTUBATION - ONLY FAILED VENTILATION

Always have skilled assistance, preferably another anaesthetist, when difficulty is expected or the patient's cardio-respiratory reserve is low.



This flowchart forms part of the DAS Guidelines for unanticipated difficult intubation in adults 2015 and should be used in conjunction with the text.

LOOK FOR

- History of difficult intubation
- Anatomical hallmarks at pre-operative assessment
- Patho-physiological states involving head and neck region
- Syndromes known to be associated with difficult intubation

MANAGEMENT

1. Call for skilled assistance, and the difficult intubation trolley; notify the surgeon.
2. Maintain ventilation with oxygen at all times
3. Have someone feel the pulse and call out the SpO₂.

If you can ventilate by face mask, consider

1. waking the patient up (surgery not immediately urgent) OR
2. maintaining anaesthesia by:
 - a. facemask
 - b. laryngeal mask
 - c. intubation

If reintubation is attempted:

1. try basic manoeuvres first:
 - a. Optimise the head and neck position – align oral, pharyngeal and laryngeal axes
 - b. Try laryngeal manipulations such as "BURP"
 - c. Try a well-lubricated gum elastic bougie or stylet
 - d. Try different laryngoscope blades – McCoy (lever), Miller (straight blade, head turn left, right sided entry)
2. Most experienced anaesthetist to perform. Consider 2 person technique.
3. Consider: Airtraq, CMAC or other video laryngoscopes

If these fail:

4. Consider inserting an LMA
5. Consider other techniques:
 - a. Blind nasal
 - b. Retrograde
 - c. Lighted stylet

If an LMA is in place

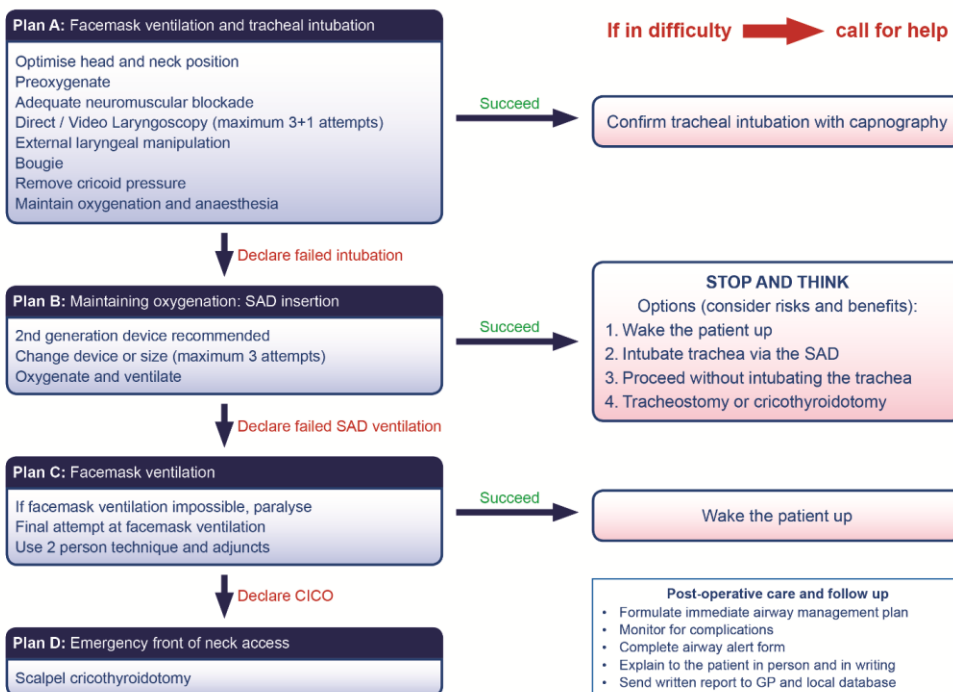
1. consider whether to proceed and whether steps should be taken to secure endotracheal intubation

FURTHER CARE

1. Exclude other complications
2. There is a risk of awareness:
 - a. Go and see the patient in the ward
 - b. Explain the full circumstances and reassure them
3. Advise them to warn future anaesthesiologists



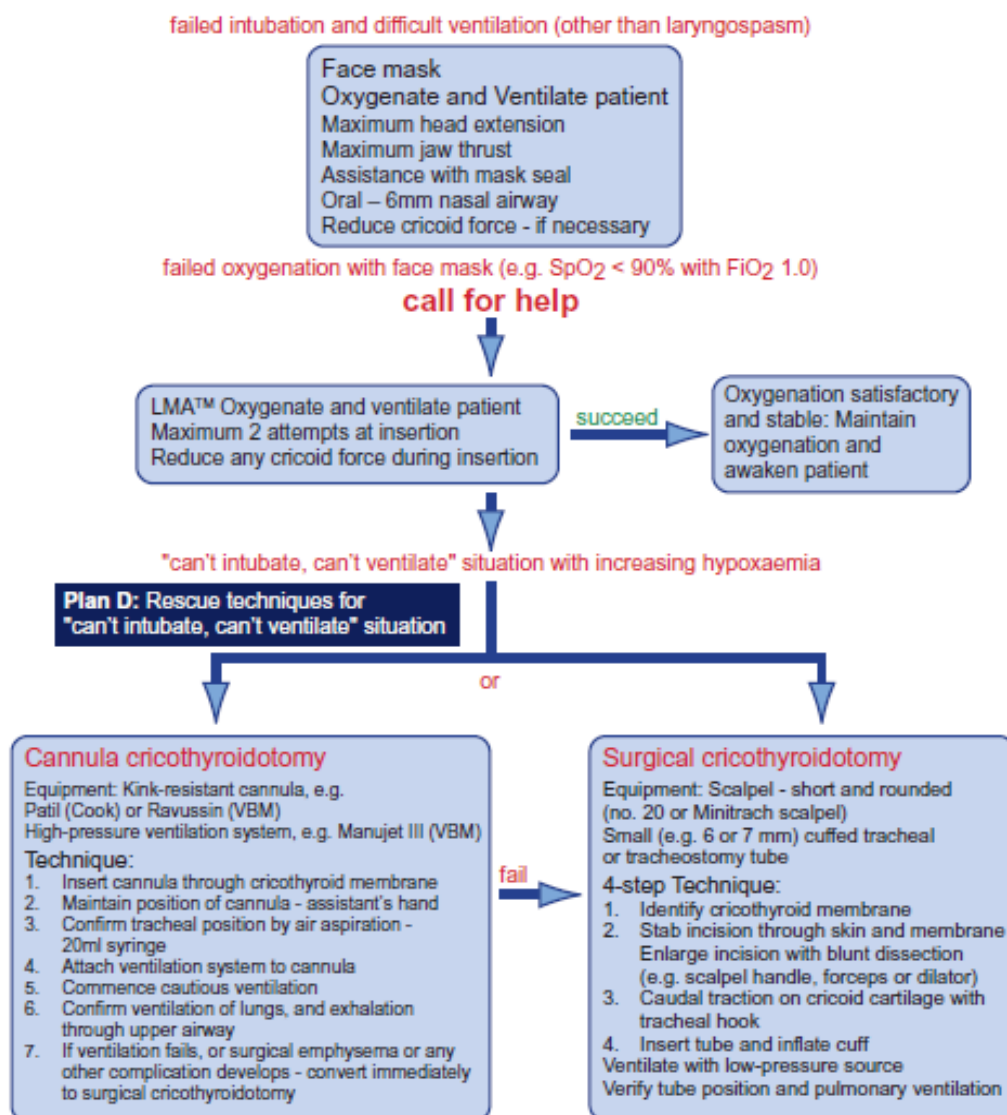
Management of unanticipated difficult tracheal intubation in adults



This flowchart forms part of the DAS Guidelines for unanticipated difficult intubation in adults 2015 and should be used in conjunction with the text.

MY PLAN

Can't intubate CAN ventilate	Can't intubate Can't Ventilate
1st Attempt – call for help 2nd attempt: - Optimise position - Manoeuvres: BURP, 2 person - Adjuncts: bougie, video laryngoscope 3rd attempt: another anaesthetist - Intubating LMA - Wake Up and plan for difficult intubation - Mask ventilate - Reverse relaxant	- Call for help - LMA – maximum 2 attempts - Surgical techniques: - Cannula cricothyroidotomy - Surgical cricothyroidotomy



Above images reproduced from - Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults. C. Frerk, V. S. Mitchell, A. F. McNarry, C. Mendonca, R. Bhagrath, A. Patel, E. P. O'Sullivan, N. M. Woodall and I. Ahmad, Difficult Airway Society intubation guidelines working group. British Journal of Anaesthesia, 115 (6): 827–848 (2015) doi:10.1093/bja/aeu371.

Hypoventilation

LOOK FOR

- Desaturation
- Rising ETCO₂
- Change in heart rate

PRECIPITATING FACTORS

- Coughing/breath holding/light anaesthesia
- Airway obstruction
- Distended abdomen
- Lithotomy, Trendelenberg position
- CNS depression
- Loss of integrity of chest wall or diaphragm
- Muscle weakness
- Pre-existing conditions
- Drugs
 - Relaxants
 - "High spinal" blockade
- Equipment related problems

EMERGENCY MANAGEMENT

1. Complete COVER ABCD A SWIFT CHECK
2. A – AIRWAY control
3. B - VENTILATE THE LUNGS
4. Treat the underlying cause (above)

Bronchospasm

LOOK FOR

- Increasing circuit pressure
- Desaturation
- Wheeze (auscultate), hyperresonant lung fields
- Rising ETCO₂ and prolonged expiration, sloping expiratory phase
- Reduction in tidal volumes
- Pulsus paradoxus

THINK OF

1. Anaphylaxis/allergy to drugs/IV fluids/latex
2. Airway manipulation/irritation/secretions/regurgitation/foreign body
3. Oesophageal/endobronchial intubation
4. Pneumothorax
5. Pulmonary oedema
6. Inadequate anaesthetic depth or failure of anaesthetic delivery system

EMERGENCY MANAGEMENT

1. 100% Oxygen
2. Cease stimulation/surgery
3. Request immediate assistance, inform surgeon
4. Deepen anaesthesia with sevoflurane
5. If intubated exclude endobronchial or oesophageal position → eliminate circuit by feeling with bag.
If mask/LMA in use consider:
Laryngospasm / Airway Obstruction
Regurgitation / Vomit/Aspiration
6. Give inhaled salbutamol 6 puffs, inhaled ipratropium 250mcg 6 puffs
7. Give adrenaline IV 10mcg bolus
or salbutamol IV 50mcg bolus
8. If you cannot ventilate via an ETT consider:
Misplaced/kinked/blocked ETT, catheter mount, filter or circuit (See Check)
Pneumothorax
Aspiration
Consider possible obstruction distal to ETT → try pushing a small tube past it, or push the obstruction down one bronchus and ventilate the other lung.
9. Other treatments available:
 - a. Aminophylline 250mg IV slowly
 - b. Hydrocortisone 200mg IV
 - c. Magnesium IV 2g slow
 - d. Ketamine 1-2mg/kg IV

FURTHER CARE

- Bronchodilators as necessary
- Chest X-ray
- ABGs
- Ventilator settings: 100% FiO₂, long expiratory time, permissive hypercapnoea
- Admit to HDU/ICU if necessary

Pulmonary Oedema / ARDS

LOOK FOR

- Respiratory distress/tachypnoea
- Desaturation
- Increased inspiratory pressure
- Pink frothing sputum up ETT / LMA (diagnostic)
- Crepitations or bronchospasm
- ↑JVP, CVP, PCWP

PRECIPITATING FACTORS

1. Pathophysiology: ↑hydrostatic pressure, ↑ vascular permeability, ↓ plasma oncotic pressure, ↓ interstitial pressure, obstructed lymph drainage.
2. Fluid overload
3. Non cardiogenic:
 - a. Post airway obstruction – negative pressure
 - b. Anaphylaxis
 - c. Neurogenic – acute head injury
 - d. Sepsis
 - e. Pulmonary aspiration (chemical pneumonitis)
 - f. Multiple organ failure - ↑ capillary permeability
 - g. Rapid lung expansion following pneumothorax / pneumonectomy
4. Cardiogenic –
 - a. MI, myocardial disease
 - b. Mitral disease
 - c. Pulmonary HTN

EMERGENCY MANAGEMENT

1. Call for help, inform surgeon
2. ABC – 100% O₂
3. Head up tilt/sit up to offload pulmonary vasculature
4. If breathing spontaneously apply CPAP
5. Intubate if necessary:
 - a. IPPV and PEEP if intubated
6. Consider drug therapy:
 - a. Morphine IV 5mg
 - b. GTN SL 500mcg, or IV
 - c. Furosemide IV 40mg

FURTHER CARE

1. Chest x-ray – basal shadowing, upper lobe diversion, bat's wing, Kerley B lines, hilar haze, bronchial cuffing, pleural effusions, septal fluid lines.
2. Review perioperative fluid balance/renal function
3. Non-cardiogenic: consider following airway obstruction
 - a. Allergy/anaphylaxis
 - b. Aspiration
 - c. Sepsis
 - d. Multiple organ failure, eg major trauma, pancreatitis
 - e. Renal - renal function tests
4. Cardiogenic:

- a. ECG
 - b. Fractionated cardiac enzymes
 - c. Echocardiogram
5. Consider admission to high dependency area / ICU

Pneumothorax

LOOK FOR

- Difficulty with ventilation/respiratory distress
- Desaturation
- Hypotension
- Heart rate changes
- Unilateral chest expansion
- Expose, inspect, palpate
 - Auscultate, percuss
 - Abdominal distension
- Distended neck veins, raised CVP
- Tracheal deviation

PRECIPITATING FACTORS

- Any needle or instrumentation, even days previously
 - In or near the neck or chest wall
 - Down the trachea/bronchial tree
- External cardiac compression
- Fractured ribs, crush injury
- Blunt trauma/deceleration injury
- Problem with pleural drain already sited
- Airway overpressure, obstructed ETT
- Emphysema or bullous lung disease
- Vigorous coughing followed by hypoxaemia

EMERGENCY MANAGEMENT

1. Inform the surgeon
2. Turn off the nitrous oxide, 100% O₂
3. Inspect the abdomen, or the diaphragm from below if visible
4. Insert an IV cannula into the affected side – 2nd ICS MCL
5. Insert a pleural drain at the same site, continuously observe the bottle for bubbling and/or swinging
6. Be vigilant for further deterioration in the patient; it may be due to:
 - a. Increased or continuing air leak
 - b. Kinked/blocked/capped/clamped underwater seal drain
 - c. Contralateral pneumothorax
 - d. Misplaced pleural drain tip
 - e. Trauma caused by drain insertion
 - f. Misconnection of drain apparatus

FURTHER CARE

1. If the problem persists, consider cardiac tamponade
2. Consider pericardiocentesis and/or opening the chest.
3. Arrange a chest X-ray and look for:
 - a. -state of re-expansion of the lung
 - b. -mediastinal shift
 - c. -position of the tip of the drain
4. Explain the nature of the problem to the patient before discharge from the recovery ward.

Desaturation/Hypoxia

DIFFERENTIAL

1. Equipment:
 - a. FiO₂ analyser, Pulse Oximetry
 - b. Hypoxic gas mixture –
 - i. flow meter settings
 - ii. O₂ supply
 - iii. Second gas effect
2. Ventilation:
 - a. Equipment:
 - i. Inadequate MV
 - ii. Disconnection
 - iii. ETT – kinking, disconnection, misplacement
 - b. Hypoventilation – drugs, regional
 - c. ↑ AWR
 - i. Laryngospasm
 - ii. Tracheobronchial obstruction
 - iii. bronchospasm, anaphylaxis
 - d. ↓ FRC
 - i. Pneumothorax – esp in context of CVC insertion
 - ii. ↑ IAP, obesity
3. Shunt:
 - a. Atelectasis
 - b. Airway secretions
 - c. ↓ HPVC
 - d. Pulmonary oedema
 - e. Aspiration
 - f. Cardiac pathology
4. Poor O₂ Delivery:
 - a. Sepsis
 - b. Hypovolaemia
 - c. Embolus
 - d. Anaemia
5. ↑ O₂ demand:
 - a. Sepsis
 - b. MH

EMERGENCY MANAGEMENT – *oxygenation is the priority over diagnosis*

1. Check the pulse oximeter reading → assume correct until proven otherwise
2. Inform surgeon, call for help
3. Complete COVER ABCD-A SWIFT CHECK
 - a. Expose the chest, breathing circuit and airway connections
 - b. Give 100% FiO₂
4. Equipment:
 - a. quick scan of anaesthetic circuit from the wall O₂ outlet → patient
 - b. Confirm the FiO₂ is appropriate, if any doubt about supply, use O₂ from portable cylinder
 - c. Recheck Pulse oximetry
 - d. Check ECG, ET CO₂ for any abnormalities

5. Hand ventilate with 100% oxygen (use cylinder if wall connection in doubt), auscultate lungs to eliminate the ventilator
6. Secure the Airway (if not already done)
7. Examine the patient:
 - a. Airway – biting, obstruction, filter blockage, endobronchial intubation → change ETT if in doubt
 - b. Breathing – auscultation, subcutaneous emphysema, aspiration/secretions

REVIEW AND TREAT OTHER POSSIBLE CAUSES

1. Underlying cardiopulmonary problems
 - a. If bronchial secretions or plugs are suspected
 - Posture and suction ETT/bronchi
 - Give a "long slow blow" especially in children
 - If cardiovascularly stable consider PEEP/CPAP
 - b. If acute shunt is suspected
 - Ensure the patient is supine and level
 - If R→L shunt, ↑ SVR (↑VR, vasopressors) and ↓PVR (remove PEEP, ↓ITP)
 - c. If a pneumoperitoneum is present, deflate the abdomen
 - d. Consider gas embolism
2. Pulse oximeter malfunction
 - Consider: polycythaemia, methaemoglobinaemia, acute tricuspid incompetence, probe sited distal to an AV fistula.

FURTHER CARE

1. Reassess the situation
2. If persistent/unstable desaturation consider:
 - a. completing/abandoning surgery
 - b. chest X-ray, blood gases
 - c. Fiberoptic bronchoscopy
3. If stable and well saturated, wake the patient up and extubate
4. If unstable or desaturated, admit to ICU/HDU

Bradycardia

CAUSES

- Drugs
 - Inhalational agent overdose. Consider also suxamethonium, induction agents, neostigmine, and opioids.
 - Check drugs given by surgeon.
- Airway
 - Hypoventilation
 - Hypoxia
- Vagal Reflexes - Cease stimulation
- Regional Anaesthetic
 - Consider: Vasodilation, respiratory failure.
 - Ensure: Volume loading, vasopressors (early adrenaline), airway support, left lateral displacement during pregnancy.
- Surgical Factors
 - Consider: IVC compression, pneumoperitoneum, retractors position.
 - Ensure: Surgeon aware.
- Undetected Blood Loss
 - Improve IV access, fluid replacement, cross match.
- Cardiac Event
 - Consider: Tension pneumothorax, haemothorax, tamponade, embolism (gas, amniotic or thrombus), sepsis, myocardial depression (from drugs, ischaemia, electrolytes, trauma).
 - Underlying risk factors: 3° heart block, Mobitz type II heart block

EMERGENCY MANAGEMENT

1. Cease all vagal stimuli: Inform the surgeon, call for help if severe.
 - a. Peritoneal and abdominal distension
 - b. Visceral retraction
 - c. Airway stimulation
 - d. Extra-ocular muscle traction
2. Do not hesitate to treat as Cardiac Arrest – is there output?
3. Ensure adequacy of oxygenation and ventilation
4. If Adverse signs (SBP < 90mmHg, ventricular arrhythmias, heart failure, malignant heart block)
 - a. Reduce vapouriser
 - b. Crystalloid 500ml bolus and repeat if necessary
 - c. **Atropine** 0.6mg IV for an adult; 0.012mg/kg IV for child
 - d. Consider **adrenaline** slow IV bolus: 0.05 mg (adult); 0.001mg/kg (child) followed if necessary by an infusion of adrenaline: For adults, 1mg in 100ml burette starting at 60mls/hr (10 mcg/min); For children, 1 mg in 1000 ml, start at 0.1 mcg/kg/minute.
 - e. Alternative drugs: isoprenaline, dopamine, glucagon, glycopyrrolate.
5. Increase monitoring - ECG, arterial line, CVP, Swan Sheath
6. Consider external pacemaker (transvenous or transcutaneous) if unsatisfactory response.

FURTHER CARE

1. Continue the adrenaline infusion, titrating against heart rate and blood pressure
2. Consider transvenous or transcutaneous pacing
3. Consider an urgent cardiology consult

Tachycardia

EMERGENCY MANAGEMENT

- a. Inform surgeon
- b. ABC – 100% oxygen, monitoring
- c. Assess severity:
 - a. If pulseless → Treat as Cardiac Arrest , pulseless VT
 - b. Arrange for defibrillator

DIAGNOSE RHYTHM – if unclear, organise a 12 lead ECG

Narrow Complex Tachycardia

1. Assess stability: ↓LOC, chest pain, hypotensive, high ventricular rate > 150, heart failure
 - a. Unstable:
 - i. cardioversion synchronised DC shock 1J/kg, attempt x 3
 - ii. if unsuccessful, amiodarone IV 5mg/kg (300mg) over 30min + 900mg/24 hours
 - b. Stable:
 - i. Vagal manoeuvres – carotid sinus massage, valsalva
 - ii. Adenosine IV 6/6/12mg rapid bolus
 - c. If irregular, likely AF RVR:
 - i. Control rate – IV esmolol 0.5mg/kg or digoxin IV 500mcg
2. Check and correct Electrolytes

Broad Complex Tachycardia

Differentials:

- Regular complex – pulsatile VT
 - Irregular complex:
 - AF with BBB
 - Pre-excited AF
 - Polymorphic VT - TdP
1. Assess stability: ↓LOC, chest pain, hypotensive, high ventricular rate > 150, heart failure
 - a. Unstable:
 - i. DC synchronised cardioversion: 100J → 200J → 200J, children 2J/kg → 4J/kg → 4J/kg.
 - ii. if unsuccessful, amiodarone IV 5mg/kg over 30min + 900mg/24 hours
 - b. Stable:
 - i. Amiodarone 300mg IV over 30 min + 900 mg over 24 hours
 - ii. Consider lignocaine IV 1mg/kg
 - iii. Beta-blocker if AF
 - iv. Magnesium 2g IV if TdP
 2. Check and correct Electrolytes

REVIEW AND TREAT PROBABLE CAUSES

- Hypovolaemia
 - Consider: Blood loss, dehydration, diuresis, sepsis
 - Ensure: Adequate IV access, fluid replacement cross match and check haematocrit.
- Drugs
 - Consider: Induction and inhalation agents, atropine, local anaesthetic toxicity, adrenaline, cocaine, vasopressors.
- Airway:
 - Hypoventilation

- Hypoxia (see Desaturation)
 - Anaphylaxis
- Reflex Stimulation
 - Consider: Laryngoscopy, CVC insertion, surgical manipulation.
 - Consider Awareness
- Cardiopulmonary Problems
 - Consider: Tension pneumothorax, haemothorax, tamponade, embolism (gas, amniotic or thrombus), sepsis , myocardial irritability (from drugs, ischaemia, electrolytes, trauma), pulmonary oedema.
 - Ensure: Review of appropriate pages in manual, including both cardiac arrest pages: (advanced life support, and basic life support during anaesthesia)

FURTHER CARE

1. Monitor: myocardial ischaemia, 12 Lead ECG, check – EUC
2. Cardiac referral

Hypotension

CAUSES

- Patient:
 - Hypovolaemic
 - Obstructive: venous return, right heart (pulmonary circulation, pneumothorax), embolus
 - Distributive: anaphylaxis, sepsis
 - Cardiogenic – primary pump failure, rhythm disturbance
- Anaesthetic:
 - Measurement error
 - Drugs – excessive anaesthesia, toxicity (eg. LA)
 - Regional – high block

EMERGENCY MANAGEMENT

1. Confirm the blood pressure change is real –
 - a. Palpate pulse whilst repeating NIBP
 - b. Check height of IABP transducer
2. Inform surgeon –
 - a. Surgical cause – caval compression, blood loss, pneumoperitoneum
3. Check ABC –
 - a. 100% O₂, reduce volatile
 - b. Check output - don't hesitate to treat as cardiac arrest
4. Optimise haemodynamic parameters –
 - a. Preload – check CVP, position head down, elevate legs, fluid challenge 10mls/kg
 - b. Contractility – consider ephedrine IV 6mg, reduce/cease anaesthetic agents
 - c. Afterload - vasopressor: metaraminol bolus IV 0.5mg
5. If severe give adrenaline: For an adult, 0.1 mg IV bolus very slowly. For a child 0.001 mg/kg IV very slowly; titrate to clinical response. Followed if necessary by an infusion of adrenaline: For adults, 1 mg in 100 ml burette starting at 60ml/hr. For children, 1 mg in 1000 ml (1 mcg/ml), starting at 0.1 mcg/kg/minute
6. Increase monitoring - ECG, arterial line, CVP, filling pressures.
7. Consider TOE

FURTHER CARE

1. Review and treat probable cause(s):
 - a. Check peripheral perfusion (warm vs. cold)
 - b. Check breath sounds (pneumothorax, bronchoconstriction)
 - c. Check urine output, bloods
 - d. Check cardiac failure – poor response to fluid challenge, ↑JVP, ↑PCWP, poor peripheral perfusion
2. See precipitating factors to below
 - a. Correct acidosis
 - b. Correct temperature
 - c. Correct electrolytes

Hypertension

LOOK FOR

- Anaesthetic
 - Measurement error
 - Drug errors
 - Awareness or light anaesthesia
 - Airway problems
 - Hypercarbia
 - Hypoxia
- Surgical factors
- Patient factors:
 - Pre-existing hypertension and withdrawal of medication
 - Uncommon/unusual conditions
 - Fluid overload
 - Pre-eclampsia
 - Raised intracranial pressure, Acute head injury
 - Hyperthyroidism
 - Pheochromocytoma/carcinoid, Conn's
 - Malignant hyperthermia

EMERGENCY MANAGEMENT

1. Inform surgeon – stop surgery until controlled, cease stimulation
2. Confirm the blood pressure change is real:
 - a. Palpate pulse with NIBP
 - b. Check transducer for IABP
3. Check ABC – 100% O₂, pulse oximetry, patient colour
4. Immediate reduction:
 - a. Cease vasopressor therapy
 - b. Deepen anaesthesia/assess depth –
 - i. check ET volatile, TIVA pump and line
 - ii. ↑FGF and volatile concentration
 - iii. Give propofol bolus
 - c. Supplement anaesthesia:
 - i. Opioids
 - ii. Increase neuraxial block
5. Recheck for drug errors and delivery of anaesthesia:
 - a. Dilution error
 - b. Surgical drugs – Moffet's solution (1mL 1:1000 adrenaline + 2mLs 10% cocaine + 4mLs NaHCO₃ + 13mLs NS), phenylephrine
6. More definitive BP control:
 - a. Consider an appropriate dose of opioid – alfentanil
 - b. Consider antihypertensive therapy:
BE CAUTIOUS USING HYPOTENSIVE AGENTS IF THE POSSIBILITY OF LIGHT ANAESTHESIA EXISTS
 - glyceryl trinitrate 50 mg in 100 ml 5% Dextrose and start at 1ml/hr for adults (0.1 ml/kg/hour for children).
 - If tachycardic - give esmolol or metoprolol IV bolus injections
 - Others:
 - Hydralazine IV 5mg bolus → 20mg

- Clonidine OV 0.5mg/kg bolus
- Phentolamine IV 1mg bolus
- SNP 50mg in 100mLs 5% Dextrose at 1-6mcg/kg/min.

FURTHER CARE

1. Aim is to prevent ICH or myocardial event
2. Review and treat probable cause(s):
 - a. Bloods – TFTs, 24 hour urine catecholamine
 - b. ECG – check for myocardial ischaemia
3. See precipitating factors
4. Consider invasive blood pressure monitoring
5. There is a risk of awareness

Myocardial Ischaemia

LOOK FOR

- ST changes - elevation or depression
- T wave flattening or inversion
- New LBBB
- Ventricular dysrhythmias

PRECIPITATING FACTORS

- Patient:
 - Pre-existing cardiovascular disease
- Anaesthetic:
 - Haemodynamic instability
 - Tachy- or bradycardia
 - Hyper- or hypotension
 - Desaturation
 - Pulmonary oedema
 - Awareness / light anaesthesia / intubation

EMERGENCY MANAGEMENT

1. Inform the surgeon - Defer, or rapidly complete surgery
2. ABCs - Ensure adequate oxygenation
3. Correct any haemodynamic derangement: hyper/hypotension, tachy/bradycardia
4. If ischaemia does not resolve rapidly:
 - a. commence GTN (50mg in 500ml 5% dextrose) Start at 0.1 ml/kg/hr
 - b. consider short acting beta-blocker
 - c. IV morphine if awake
5. Check monitor:
 - a. Consider 5-lead ECG monitoring
 - b. Monitor ECG continuously
6. Aim for haematocrit - 30%, Hb > 100g/L

FURTHER MANAGEMENT

1. Obtain a 12 lead unfiltered ECG as soon as possible to assist in the diagnosis.
2. Load with antiplatelet if not already on – aspirin 300mg, clopidogrel 300mg
3. Admit to HDU/ICU/CCU – refer to cardiology for definitive treatment
4. Consider invasive monitoring:
 - a. Blood pressure
 - b. Cardiac filling pressures
 - c. TOE
5. Further investigation - serial ECG/cardiac enzymes
6. Continue oxygen therapy for at least 2 days.

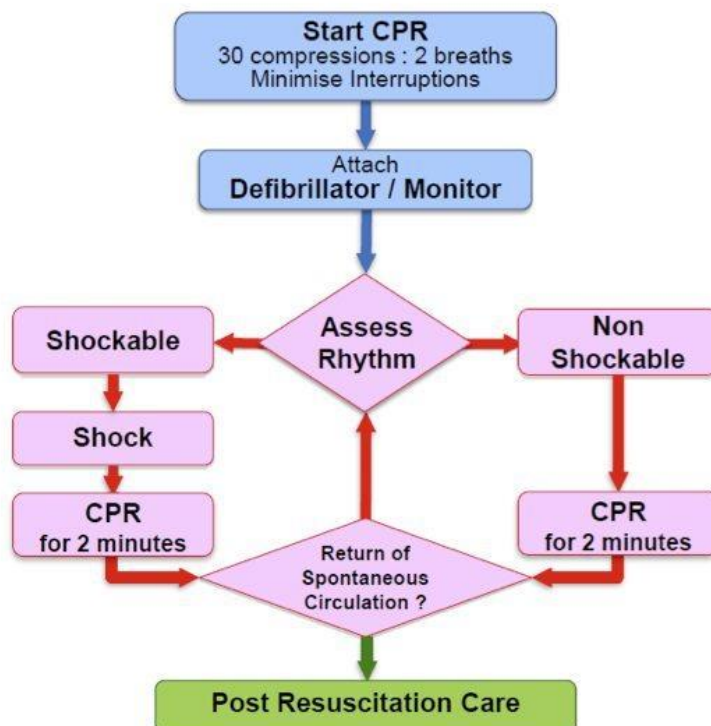
Cardiac Arrest

PRECIPITATING FACTORS

- Patient: Pre-existing disease states
 - Cardiac
 - Respiratory
 - Renal
- Surgical: surgical manoeuvres
- Anaesthetic:
 - Error or fault in anaesthetic technique
 - Inadequate ventilation
 - Essential monitoring not in use
 - Drug problems
 - Overdose (e.g. opioids)
 - Induction/reversal drugs
 - Anaphylaxis
 - Wrong route



Advanced Life Support for Adults



During CPR

Airway adjuncts (LMA / ETT)
Oxygen
Waveform capnography
IV / IO access
Plan actions before interrupting compressions
(e.g. charge manual defibrillator)
Drugs
Shockable
* Adrenaline 1 mg after 2nd shock
(then every 2nd cycle)
* Amiodarone 300 mg after 3rd shock
Non Shockable
* Adrenaline 1 mg immediately
(then every 2nd cycle)

Consider and Correct

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

Post Resuscitation Care

Re-evaluate ABCDE
12 lead ECG
Treat precipitating causes
Re-evaluate oxygenation and ventilation
Temperature control (cool)

December 2010

EMERGENCY MANAGEMENT

1. Call for help, Inform the surgeon:
 - a. Stop surgery/blood loss
 - b. Resuscitation team
2. Place patient supine and expose the chest
 - a. Praecordial thump (in witnessed or monitored adult arrest only)/external cardiac compression
 - b. Start Chest Compression (30:2) – minimise interruptions
 - c. During CRP:
 - i. Airway Adjuncts
 - ii. Breathing – 100% O₂
 - iii. IV/IO access
 - iv. Defibrillator preparation prior to interrupting compressions
3. Attach monitor/defibrillation:
 - a. Shockable: DC cardioversion 100J (2J/kg) → 200J (4J/kg) → 200J (4J/kg)
 - b. Non-shockable: continue CPR, adrenaline 1mg (10mcg/kg) immediately
4. Drugs:
 - a. Adrenaline 1mg (10mcg/kg) after 2nd shock, then every 2nd round
 - b. Amiodarone 300mg (5mg/kg) after 3rd shock

FURTHER CARE

1. Correct reversible Causes:
 - a. 4Hs: Hypovolaemia, hypoxia, hypo/hyperthermia, hypo/hyperkalaemia
 - b. 4Ts: Tension pneumothorax, tamponade, toxins/drugs, thrombus
2. Re-evaluate ABCDE
3. 12 lead ECG
4. Temperature control (consider cooling)
5. Arrange admission to ICU
6. Accurately document events as soon as possible

Drugs and IV Access

EMERGENCY CHECK

1. Review all ampoules/syringes/bags/burettes/diluents/ cassettes
2. Review all drug and cannulae labels
3. Systematically review all vascular access equipment, working from fluid source, via the cannula/skin interface to the tip of the cannula
4. Check that vehicles/dilutions/rates/routes are correct
5. Correlate doses with effects
6. If you have any doubts about the contents of a syringe or infusion discard and prepare a new solution.
7. Check: Right patient, drug, dose, dilution, route, rate, time.
8. Communicate the above with team

ALWAYS CONSIDER

1. Drug administration problems may be interrelated with vascular access problems
2. Wrong patient
3. Wrong drug
 - a. Ampoule or syringe swap
 - b. Known allergy
4. Right drug
 - a. Wrong dose/rate
 - b. Wrong diluent/dilution
 - c. Wrong time
 - d. Wrong route/site
5. Failure of intended delivery
 - a. Malpositioned cannula tip
 - b. Bag/syringe/burette empty
 - c. Cannula disconnected/blocked/kinked
 - d. Line disconnected/blocked/kinked
 - e. Back flow (up a "Y piece")
6. Unintended delivery
 - a. Drug flushed from dead space of IV line or cannula
 - b. Drip/pump delivering drug inadvertently
 - c. "Flushing" syringe containing drug
 - d. Someone else giving the drug
 - e. Check for any unrecognised cannulae in situ

BEWARE

- Any syringe containing relaxant
- Haematoma/extravasation
- Inadvertent intra-arterial placement
- Pneumothorax, haemothorax, hydrothorax
- Nerve damage
- Dysrhythmias (cannula tip in heart)
- Cannula dead space

Awareness

LOOK FOR

1. There may be no obvious signs
2. Hypertension
3. Tachycardia
4. Reflex activity:
 - a. Withdrawal/movement
 - b. Coughing/straining
 - c. Pupillary dilation
 - d. Sweating/tears

HIGH RISK SITUATIONS

1. Patient factors:
 - a. History of drug/alcohol abuse
 - b. Highly anxious patient
 - c. Previous awareness
2. Surgical Factors:
 - a. Cardiac bypass
 - b. Emergency Caesarian
 - c. Trauma
3. Equipment problems:
 - a. Vaporiser leaking/empty/mal-positioned
 - b. Incorrectly calibrated vaporiser
 - c. Nitrous oxide run out
 - d. Failure of drug delivery with TIVA
4. Drug errors:
 - a. Syringe swap causing paralysis before induction
 - b. Syringe swap causing non delivery of opioid/sedative
5. Anaesthetic technique:
 - a. Deliberate light anaesthesia during crisis management or caesarean section
 - b. Opioid based anaesthesia
 - c. Regional/local anaesthetic techniques
 - d. Anaesthesia with paralysis
6. Other problems (airway):
 - a. Laryngospasm/airway obstruction
 - b. Difficult/prolonged intubation
 - c. Delayed extubation

EMERGENCY MANAGEMENT

1. Stop painful surgical or other stimuli
2. Verbally reassure the patient
3. Rapidly deepen anaesthesia
4. Consider amnestic drugs: eg. midazolam 3mg IV bolus

FURTHER CARE

1. Interview the patient post operatively as soon as possible, and again several days later
 - a. Reassure the patient
 - b. Explain what has happened
 - c. Be honest and sympathetic
 - d. Arrange for follow up

Air Embolism

LOOK FOR

- Breathing:
 - A sudden fall in ETCO_2 , $\uparrow \text{ETN}_2$
 - Desaturation and/or central cyanosis
 - A sudden change in spontaneous breathing pattern
 - Coughing
- Circulation
 - Air in surgical field or vascular line
 - Hypotension
 - A change in the heart rate
 - A change in the ECG configuration – peaked p waves, RV strain, $\text{S}_1\text{Q}_{\text{III}}\text{T}_{\text{III}}$
 - Raised CVP or distended neck veins
 - A cardiac murmur (course millwheel) or mottled skin

EMERGENCY MANAGEMENT

1. Inform the surgeon
 - a. Prevent further entrainment/infusion of gas
 - b. Flood the field with fluid, cover entry point
 - c. Cease gas insufflation
 - d. Neurosurgery – jugular compression
2. ABC:
 - a. 100% O_2
 - b. Turn of N_2O
3. Minimise the effects of embolus
 - a. Aspirate central venous line if already in situ – optimal 2cm below junction of RA/SVC
 - b. Consider valsalva or PEEP 5cmH₂O → reduces gradient
 - c. Position:
 - i. Level of surgery below heart
 - ii. If possible, position L tilt and head down
 - d. Do not hesitate to treat as a cardiac arrest
4. If hypotensive:
 - a. Volume expansion with crystalloid 10 ml/kg
 - b. Consider adrenaline initial bolus 0.1 mg IV (adults); in children 2.0 mcg/kg IV.
Repeat if necessary or follow with an infusion 1mg in 100ml burette, start at 60mls/hr (adults).
5. Rescue Methods:
 - a. CP Bypass
 - b. Hyperbaric oxygen

FURTHER CARE

1. Careful postoperative review of the patient to:
 - a. Confirm nature/source of embolism
 - b. Stabilise long bone fractures
2. Consider admission to ICU
3. If there is confirmed cerebral gas embolism
4. Early hyperbaric oxygen therapy (within at least the first 4-6 hours and sooner if possible)

Anaphylaxis

LOOK FOR

1. Cardiovascular changes 88%
 - a. Hypotension, circulatory collapse
 - b. Tachy/bradycardia
2. Respiratory changes 36%
 - a. Bronchospasm
 - b. Pulmonary oedema
3. Erythema/Skin Rash/Pruritus
4. Oedema of the face and lips
5. Nausea and vomiting in awake patients

LOOK FOR

1. Allergic reaction to drugs, colloids, blood products, latex
 - a. Muscle relaxants, IV antibiotics and NSAIDs the most causative

EMERGENCY MANAGEMENT

1. Inform the surgeon, Request immediate assistance
2. Cease all drugs/plasma expanders/blood products
3. ABC – 100% O₂, consider intubation if not already done
4. Adrenaline treatment
 - a. Mild-moderate:
Adults 10-100mcg IV bolus, 250-500mcg IM bolus
Children 1-10mcg/kg IV bolus, 10mcg/kg IM bolus
 - b. Severe:
Adults 5mcg/kg IV bolus, 0.25mcg/kg/min infusion
Children 10mcg/kg IV bolus
 - c. Cardiac arrest: ALS protocol
 - d. Titrate carefully against heart rate, blood pressure and clinical response of the allergy
5. Optimise venous return
 - a. Immediate and aggressive volume expansion – no evidence for colloids vs. crystalloids
 - b. Position – head down with legs elevated
6. Other drugs:
 - a. Metaraminol
 - b. Vasopressin 10-40IU IV
 - c. H₁ blockers – promethazine 0.5-1mg/kg IV
 - d. H₂ blockers – ranitidine 1mg/kg IV
 - e. Steroids – hydrocortisone 2-6mg/kg IV

FURTHER CARE

1. The patient may relapse
 - a. Biphasic response in 20% cases
 - b. Continue the adrenaline infusion for days, if necessary
2. Admit to HDU/ICU
3. Take bloods for testing as soon as possible
 - a. Serum tryptase immediately + 1-6 hours post-reaction
4. Counsel the patient/relatives – provide documentation and letter
5. Arrange for allergy testing 4-6 weeks

NOTES

TRAUMA

LOOK FOR

Any unexplained change in the patient's condition

RISK FACTORS

1. After high velocity motor vehicle accidents
2. With any neck/head/chest/abdominal injury, no matter how trivial the external signs
3. With multiple injuries
4. Patients with pre-existing systemic disease
5. Elderly patients

PRECIPITATING FACTORS

1. Breathing:
 - a. Pneumo-/ haemothorax
 - b. Pulmonary contusion
 - c. Ruptured larynx / bronchus
2. Circulation:
 - a. Ongoing haemorrhage (overt or occult)
 - b. Intracranial hypoperfusion from any cause
 - c. Cardiac tamponade
 - d. Myocardial contusion

Rapidly evolving clinical problems

Especially before systematic assessment

Hyperkalaemia from suxamethonium

EMERGENCY MANAGEMENT

1. Check if the Early Management of Severe Trauma (EMST) protocol is complete. If not, systematically go through it
2. Treat all cervical spines as unstable until cleared
3. Inform the surgeon about your concerns
4. If there is cardiovascular instability, consider:
 - a. Haemorrhage. Much of the blood volume may disappear:
 - into a pelvis,
 - into the retroperitoneal space,
 - into extensive soft tissue damage
 - b. Myocardial contusion
 - c. Haemo/pneumothorax
5. If you suspect an intracranial problem:
 - a. Assess for focal signs
 - b. Inform a neurosurgeon immediately
6. Get a CT scan as soon as practicable
7. Check arterial line, measure filling pressures
8. Secondary survey. Be prepared to completely expose and examine the patient, top to toe and including the back.
9. Check haemoglobin, electrolytes and clotting regularly.

IF THE SITUATION IS STILL UNRESOLVED

Re-check for:

1. Airway injury

2. Cervical spine injury
3. Pulmonary contusion
4. Bronchopleural fistula
5. Unexplained blood loss/anaemia
6. Cardiac tamponade
7. Hyperkalaemia after suxamethonium
8. Undiagnosed intracranial collection
9. Hypothermia

FURTHER CARE

1. Maintain vigilance
2. Continuously reassess the situation
3. Consider admission to ICU / HDU post operatively.

ACUTE TRAUMA SUB-ALGORITHM (*EMST protocol)

As many incidents in trauma patients involve "corner cutting", such as failure to check due to perceived urgency, it is essential the recheck everything carefully. The best way to do this is to start again with COVER ABCD. If not successful consider possible missed diagnoses - follow the EMST system - repeat the primary survey, review results to date and look for missed injuries.

A airway injury

Look For	failure to secure airway failure to ventilate with tube in airway
Manage	failed intubation drill consider surgical cricothyrotomy early with facial injury

A cervical spine injury

Look For	priapism, areflexia, trauma above clavicles history of neck pain or tenderness
Manage	immobilise neck, review cervical spine X-ray (radiologist if possible), further films as required

B tension pneumothorax

Look For	distended neck veins, decreased air entry on ipsilateral side, hyperresonance on ipsilateral side, mediastinal shift away
Manage	immediate needle thoracotomy, formal UWSD insertion
Algorithm	pneumothorax algorithm

Massive haemothorax

Look For	distended or flat neck veins, decreased air entry on ipsilateral side dullness to percussion on ipsilateral side, mediastinal shift away
Manage	volume load ++, formal UWSD insertion, beware of increased bleeding on UWSD insertion, consider early involvement of thoracic surgeon
Algorithm	hypotension (hypovolaemia) / pneumothorax algorithms

Pulmonary contusion

Look For	desaturation in presence of chest injury
Manage	desaturation algorithm

Bronchopulmonary fistula

Look For	continuous air leak via UWSD
Manage	consider UWSD piercing lung, consider inserting additional large UWSD, consider isolating lung with ETT down other bronchus or double-lumen tube
Algorithm	desaturation algorithm

C unexplained blood loss/Hypovolaemia

Look For	sites of concealed bleeding: chest/abdomen/pelvis, sites of visible bleeding
Manage	consider chest X-ray, consider pelvis X-ray, consider diagnostic peritoneal lavage or if severe, urgent laparotomy view operative site, examine known wounds if MAST suit in use: • ensure correct inflation • consider removal using standard method
Algorithm	hypotension algorithm

Cardiac tamponade

Look For	distended neck veins, decreased heart sounds unexplained hypotension, equalisation of cardiac pressures
Manage	consider pericardial tap/may need open drainage TOE

Myocardial contusion

Look For	unexplained dysrhythmias, ST.T wave changes on ECG hypotension with adequate filling
Manage	
Algorithm	dysrhythmia (bradycardia & tachycardia) / hypotension algorithms

Hyperkalaemia after suxamethonium

Look For	patient after head injury, spinal injury or burns, widened QRS, cardiac arrest
Manage	consider taking blood for K estimation, CPR as required, give glucose and insulin, consider giving calcium, consider giving NaHCO ₃ , do not discontinue CPR continue for at least 30 minutes
Algorithm	cardiac arrest / hyperkalaemia algorithms

D undiagnosed intracranial collection

Look For	dilating pupil under GA, unexplained bradycardia and hypertension in presence of known or suspected head injury, raised ICP if monitored, failure to waken
Manage	urgent CT scan if available, urgent neurological consultation

E hypothermia

Look For	temperature fall during long cases
Manage	cover as much of patient as possible, active warming and heating methods, warm theatre

WATER INTOXICATION

LOOK FOR

1. In the awake patient - CNS symptoms and signs
 - Drowsiness and confusion
 - Nausea and vomiting
 - Coma
 - Convulsions
2. In the anaesthetised patient - CVS signs
 - Circulatory overload
 - ECG changes
 - Delayed emergence from anaesthesia

PRECIPITATING FACTORS

1. High risk procedures:
 1. closed cavity irrigation/prolonged operating time
2. Anaesthesia:
 2. administering large volumes of hypotonic fluids.

EMERGENCY MANAGEMENT

1. Inform surgeon, call for help
 3. Cease irrigation/surgery
2. ABC - Increase FIO₂
3. URGENT, Na⁺, K⁺, Osmolarity (blood)
Consider electrolyte abnormalities
4. If symptomatic:
 - a. 0.9% saline and frusemide 25mg IV
 - b. mannitol 0.25 gm/kg IV may be considered if the patient is not hypervolaemic
5. If severe CNS depression/convulsions:
 - a. hypertonic saline –
 - i. 1.2-2.4mls/kg/hour of 3% saline
 - ii. Aim ↑Na 1mmol/L/hour, < 12mmol/L/day
 - b. anticonvulsants

FURTHER CARE

1. Continue ECG /SpO₂ monitoring
2. Attention to fluid balance
3. Monitor electrolytes, osmolality, blood gases
4. Mild symptoms - fluid restriction may suffice
5. Consider central venous line or pulmonary artery catheter
6. Consider HDU/ICU admission

Electrolyte Disturbances

HYPONATRAEMIA

LOOK FOR

- Confusion, convulsions, coma
- GI – N+V

PRECIPITATING FACTORS

- ↑volume: Excessive IV with 5% dextrose, water toxicity, cardiac and renal failure
- Euvolaemic: SIADH hypothyroidism
- ↓volume: Diuretics, vomiting, ileus, diarrhoea

EMERGENCY MANAGEMENT

1. Exclude factitious cause: hyperglycaemia, mannitol, ethanol, methanol, ethylene glycol
2. Treat underlying cause
 - a. Correct hypovolaemia with colloid or N Saline
 - b. Correct hypervolaemia (CCF, water overload) with diuretic and fluid restriction, posture, oxygen
 - c. SIADH – fluid restriction, demeclocycline 300-600mg PO daily
3. Symptomatic hyponatraemia - fitting or coma: aim is slow correction of Na⁺ over 24-36 hours with 0.9% Saline
 - a. Hypertonic saline rarely to correct if Na⁺ <120mmol/L and patient symptomatic. 1-3mls/kg/hour of 3% Saline
 - b. Frequent monitoring of electrolytes – over-rapid correction can cause cerebral pontine myelinolysis, subdural hematoma, and cardiac failure.

HYPERNATRAEMIA**LOOK FOR**

- Pyrexia, confusion, coma, thirst
- Dehydration, hypovolaemia, tachycardia, hypotension

PRECIPITATING FACTORS

1. Excess fluid loss - Burns, pyrexia, polyuric renal failure, vomiting, diarrhoea
2. Endocrine – diabetes insipidus, Hypoadrenalism, thyrotoxicosis
3. Iatrogenic - Overuse of intravenous sodium bicarbonate, mannitol, diuretics

EMERGENCY MANAGEMENT

1. Treat underlying cause, according to fluid status:
 - a. Hypovolaemia ($\downarrow\downarrow$ water, $\downarrow$ Na)
 - i. IV normal saline until volume corrected, followed by N/2
 - ii. 1 L water deficit will increase serum Na by 4mmol/L above 145mmol/L
 - b. Euvolaemia ($\downarrow$ water, normal Na)
 - i. Correct deficit with 5% dextrose or 4% dextrose saline
 - ii. Give PO water if possible
 - c. Hypervolaemia ($\uparrow$ water, $\uparrow\uparrow$ Na)
 - i. Frusemide IV 20mg
2. Slow correction of Na over 24 hours – over-rapid correction can result in cerebral oedema
3. Other:
 - Adjust fluid regime for insensible losses
 - Frequent monitoring of urine output and electrolytes
 - Consider thromboprophylaxis

HYPOKALAEMIA

LOOK FOR

- Mild < 3.5mmol/L, moderate < 3mmol/L, severe < 2.5mmol/L
- Tachyarrhythmias: AF, SVT, VT, Torsade
- ECG changes: prolonged PR, flat T waves, T wave inversion, U waves
- Ileus, constipation
- Muscle weakness, ventilatory failure, prolongation of NDNMBDs
- Metabolic alkalosis (↑bicarbonate suggests chronicity), impaired renal concentrating ability
- ↑ digoxin toxicity

PRECIPITATING FACTORS

1. ↑ Loss: Diuretics, RTA, vomiting, ileus, diarrhoea, polyuric states
2. ↓ intake: Hypovolaemia, dehydration
3. Redistribution: Steroids, bronchodilators, catecholamines, TPN, insulin

EMERGENCY MANAGEMENT

1. Treat underlying cause
2. If hypovolaemic, give IV colloid 10ml/kg
3. Give IV KCl if symptomatic (max rate 40 mmol/hr).
 - a. 40mmol KCl in 100mL Saline → central line with infusion device, continuous ECG monitoring.
4. Consider MgSO₄ 5-10mmol IV. Concurrent ↓Mg common.
5. Measure electrolytes and blood gases hourly until K > 4mmol/L

PERIOPERATIVE CONSIDERATIONS

1. Classically, postponement if K < 3mmol/L
2. Main risk is that of arrhythmias

HYPERKALAEMIA

LOOK FOR

- Mild > 5.5mmol/L, Moderate > 6mmol/L, Severe > 6.5mmol/L
- Bradycardia, "sine wave", QRS asystole
- ECG changes, peaked T waves, prolonged PR interval, wide QRS, deep S waves
- Sinus arrest, VEBs, AV block, VT, VF
- Hypotension, muscle weakness

PRECIPITATING FACTORS

1. ↓loss: renal failure (acute/chronic), K sparing diuretics,
2. ↑input: iatrogenic, blood transfusion
3. Cell lysis: burns, crush injury, spinal injury, haemolysis
4. Redistribution: acidosis,
5. Suxamethonium

EMERGENCY MANAGEMENT

1. Exclude artefact: (drip arm tourniquet, haemolysis)
2. Determined by ECG changes / haemodynamics
3. Give, in the following order, as necessary:
 - a. CaCl_2 10ml of 10% IV stat, or Ca Gluconate 10mLs 10% IV stat (if ECG signs present)
 - b. Glucose 25mLs 50% IV + 10 units novorapid
 - c. Continuous nebulised salbutamol – 5mg stat
 - d. Frusemide 10-20mg IV stat
 - e. Resonium 30g PO/PR q6h
 - f. NaHCO_3 50ml IV stat if co-existing metabolic acidosis
 - g. Consider dialysis in anuretic patients or if persistent

PERIOPERATIVE MANAGEMENT

1. High risk of malignant arrhythmias, postpone unless urgent
2. Avoid suxamethonium
3. Avoid acidosis

HYPOCALCAEMIA

LOOK FOR

- Normal Calcium levels:
 - 2.1-2.6mmol/L
- Paraesthesia, Tetany, laryngospasm, Chvosteks and Trousseau signs
- Confusion, convulsion
- ↓ cardiac output, hypotension
- ECG: prolonged QTc interval

PRECIPITATING FACTORS

1. Endocrine: Parathyroidectomy, hypoparathyroidism, ↓ Vitamin D
2. ↓ intake: malnutrition
3. Early rhabdomyolysis
4. Iatrogenic: Massive blood transfusion

EMERGENCY MANAGEMENT

1. Treat only if symptomatic
2. Measure ionised Ca^{2+}
 - a. If $\text{Ca} < 2.0\text{mmol/L}$ → CaCl_2 10ml 10% IV push
 - b. If $\text{Ca} > 2.0\text{mmol/L}$ → PO calcium
3. PO Cholecalciferol
4. Check acid base and electrolytes

HYPERCALCAEMIA

LOOK FOR

- Muscle weakness
- Drowsiness, coma
- Abdominal pain, bone pain
- Polyuria, polydipsia and dehydration
- Pathological stones – renal, biliary
- ECG – short QT, prolonged PR and QRS, T wave inversion and flattening, AV block

PRECIPITATING FACTORS

1. Malignancy – multiple myeloma, paraneoplastic, bone metastasis
2. Hyperparathyroidism
3. Endocrine – acromegaly, pheochromocytoma
4. Renal failure

EMERGENCY MANAGEMENT

1. Usually none, treat underlying cause
2. Rehydration to normovolaemia
3. Diuretics once normovolaemia assured:
 - a. 1000mLs normal saline + IV 20mg frusemide + 20mmol KCl
 - b. Monitor – electrolytes hourly, urine output, urine sodium
4. Malignancy setting –
 - a. mithramycin 25mcg/kg over 3 hours
 - b. calcitonin 3-4u/kg IV
5. Hyperparathyroidism – pamidronate 60mg in 500mLs over 4 hours
6. Dialysis if unresponsive to above measures

METABOLIC DISTURBANCES

HYPOGLYCAEMIA

LOOK FOR

- BSL < 4mmol/L
- Sweating, tachycardia
- Confusion, aggression
- Reduced level of consciousness

PRECIPITATING FACTORS

1. Diabetics (both insulin and non insulin dependent)
2. Septic patients
3. Iatrogenic:
 - a. insulin infusions
 - b. TPN, especially where TPN is ceased
4. Alcoholic patients
5. Fasting, dehydration, pre or post ileus/vomiting

EMERGENCY MANAGEMENT

1. Measure blood sugar with finger prick
2. Give 50ml 50% dextrose IV bolus injection
 - a. Continue to give IV dextrose until BSL > 7mmol/L
3. Cease insulin infusions if applicable
4. Measure electrolytes (especially K⁺)
5. Consider glucagon 1mg IV

HYPERGLYCAEMIA

LOOK FOR

- BSL > 10mmol/L
- Tachypnoea, air hunger
- Confusion, aggression, reduced consciousness
- Dehydration, hypotension, inappropriate polyuria

PRECIPITATING FACTORS

1. Diabetics (both insulin and non insulin dependent)
2. Septic patients, elderly patients, patients on TPN
3. Fasting, dehydration, pre or postop ileus/vomiting

EMERGENCY MANAGEMENT

1. Assess volume and restore euvolaemia:
 - a. 0.9% Saline: 15-20 ml/kg over first hour, reassess, 10 ml/kg/hr thereafter
 - b. Avoid Hartman's as lactate is converted to glucose when fasted
2. Biochemistry and blood gases
3. If ketoacidosis: (pH < 7.1, BSL > 20mmol/L):
 - a. Call for help
 - b. Insulin infusion: 50u actrapid / 50ml saline
 - i. Bolus 10units
 - ii. Start 5 u/hour infusion
4. Measure BSL, biochemistry and blood gases hourly
 - a. Aim to ↓ glucose <5mmol/hour
 - b. If K <5mmol/L, give KCl replacement (20mmol/L IV fluid)
 - c. Reduce insulin infusion, change to 5% dextrose when BSL < 15mmol/L
5. No routine indication for sodium bicarbonate
6. NG tube if vomiting, Urinary catheter in all patients, consider CVC, arterial line
7. Treat any sepsis, infection
8. Change to SC insulin when ketones <1, and eating

METABOLIC ACIDOSIS

LOOK FOR

- Tachypnoea, air hunger
- Shock, hypotension, oliguria

PRECIPITATING FACTORS

1. Anion Gap
 - a. Ketones
 - b. Uraemia – renal failure
 - c. Toxins: Salicylate, methylene glycol, alcohol
 - d. Lactic acidosis (shock, trauma, adrenaline/salbutamol)
2. Non Anion Gap: bicarbonate loss
 - a. GI loss – fistula (ureterosigmoidostomy, small bowel, pancreatic) , diarrhoea
 - b. Renal loss – RTA, acetazolamide
 - c. Saline infusion
 - d. Endocrine – Addison's, Hyperparathyroid

EMERGENCY MANAGEMENT

1. Treat underlying cause
2. Ensure adequate ventilation with respiratory compensation
3. Support the circulation with: volume, inotropes
4. Measure biochemistry: calculate anion and osmolal gap
5. IV NaHCO₃ only indicated in bicarbonate losing states with normal anion gap, eg renal tubular acidosis

METABOLIC ALKALOSIS

LOOK FOR

- Tachy-arrhythmias: AF, SVT or VT
- ECG changes:: prolonged PR interval, flat T waves, U waves
- Ileus, constipation, muscle weakness, ventilatory failure
- Dehydration, hypovolaemia

PRECIPITATING FACTORS

1. $\downarrow H^+$:
 - a. Vomiting, pyloric stenosis
 - b. Congenital chloride diarrhoea
 - c. Diuretics
 - d. Intracellular shift - $\downarrow K$
 - e. Post-hypercapnoeic acidosis
2. $\uparrow Cl^-$:
 - a. Iatrogenic bicarbonate, antacids, TPN, massive blood transfusion
 - b. Conn's syndrome, $\uparrow$ aldosterone
3. Drugs

EMERGENCY MANAGEMENT

1. Treat underlying cause
2. If hypovolaemic, give colloid 10 ml/kg and reassess
3. Measure electrolytes and blood gases hourly
4. Drug therapy:
 - a. Consider $MgSO_4$ 0.1 - 0.2 mmol/kg IV
 - b. Consider IV KCl, phosphate
 - c. Consider IV or oral acetazolamide in euvolaemic patients

HYPOTHYROIDISM

LOOK FOR

- Intolerance to cold
- Hypothermia, hypoglycaemia, hypotension
- Dry skin ("crazy pavement") changes (chronic)
- confusion, coma, delayed awakening
- bradycardia, ↓blood volumes, cardiac output, pericardial effusions

PARTICIPATING FACTORS

1. Elderly patients
2. Previous thyroidectomy, fasting
3. Sepsis, infections

EMERGENCY MANAGEMENT

1. Maintain normotension and euvolaemia with fluid, inotropes if required
2. Normothermia: Actively warm if required
3. ECG monitoring, consider arterial line
4. Monitor BSL, electrolytes
5. Drug therapy: consult endocrinologist
 - a. IV T₃ (Liothyronine) 5-20 mcg slowly, then 8-12 hourly
6. Check baseline thyroid function tests
7. Admit to HDU/ICU postoperatively

NOTE

- Whenever possible, establish a euthyroid state prior to anaesthesia and surgery. Consult endocrinologist
- Start 100-200mcg daily and continue for several weeks before checking biochemical TFTs

HYPERTHYROIDISM

LOOK FOR

- Bedside signs may include fine tremor, exophthalmos, goitre, sweating
- Triggers
 - Thyroid surgery
 - Withdrawal of anti-thyroid medication
 - Sepsis
- Pyrexia
- CVS: tachycardia, AF, SVT, pulmonary oedema, CCF
- Hypercarbia, metabolic acidosis, electrolytes - ↓K, ↓Na, ↓Mg, ↑Ca
- Delirium, seizures, coma
- Dehydration, hypovolaemia, hypotension

EMERGENCY MANAGEMENT

1. Consider malignant hyperthermia
2. Consider intubation and controlled ventilation with adequate sedation and analgesia if not already done
3. Aggressive fluid rehydration with added glucose
4. Cool patient actively - cooled blankets, ice-packs, cold saline
5. Monitor:
 - a. Bloods - thyroid function test, frequent monitoring of electrolytes and glucose
 - b. Urinary catheter, consider CVC, arterial line
6. Drug therapy:
 - a. Paracetamol
 - b. α-blockade (phentolamine IV 1-2mg bolus)
 - c. β blockade (esmolol 0.5mg/kg bolus) aiming for HR <90
 - d. Carbimazole (60-120mg) or propylthiouracil (1g) PO/NG (effects start 1 hour)
 - e. Potassium Iodide 500mg PO/NG (must be given AFTER PTU), or Lugol's iodine 5 drops NG tube
 - f. Steroids hydrocortisone 100mg IV q6h for adrenal insufficiency, ↓T₄→T₃ conversion
7. Rescue measures:
 - a. Reserpine
 - b. Dialysis, plasmapheresis
 - c. Dantrolene
8. Admit to HDU/ICU postoperatively

NOTES

- Patient should be euthyroid for elective surgery. Control usually requires 6-8 weeks of PO propylthiouracil or Carbimazole.

PHAECHROMOCYTOMA

LOOK FOR

- Paroxysmal hypertension, postural hypotension
- Tachycardia, AF, SVT, VT, cardiac dysfunction
- Peripheral ischaemia
- Hypercarbia, metabolic acidosis, hyperglycaemia (α_2 ↓ insulin release)

PRECIPITATING FACTORS

1. Confirmed diagnosis
2. Retroperitoneal or abdominal vascular procedures

EMERGENCY MANAGEMENT

1. Monitoring:
 - a. Central venous and arterial lines, large bore IV access
 - b. Regular BSL, electrolytes, blood (avoid anaemia)
2. Optimise environment:
 - a. Control the timing of surgical manipulations of the tumour
 - b. Adequate anaesthesia and analgesia especially during intubation, pneumoperitoneum
 - c. Avoid histamine-releasing drugs
 - d. Avoid droperidol (α_2 blocking effects), ketamine, halothane/desflurane
3. Drug therapy:
 - a. Phentolamine 5-10mg IV or by infusion as required
 - b. Nitroprusside (50 mg/250ml) titrate to 0.5mg/kg/24hrs
 - c. Consider MgSO_4 4g (80 mg/kg) bolus prn
 - d. Do NOT give β blockers until vasodilatation achieved
4. Upon tumour removal:
 - a. may require noradrenaline or adrenaline infusion
5. HDU post-op with anticipation of:
 - a. Hypoglycaemia
 - b. Hypotension
 - c. Hypertension – 50% (consider residual tumour, renal ischaemia)

ADDISONIAN CRISIS**LOOK FOR**

- Causes of adrenal disease:
 - Primary: autoimmune, infection (TB), septicaemia, haemorrhage, surgery.
 - Secondary: hypopituitarism, pituitary apoplexy
 - Cessation of chronic steroid therapy
- Weakness, fatigue
- Skin pigmentation
- Postural hypotension, bradycardia – resembles hypovolaemic shock
- Hypoglycaemia, ↓ Na⁺, ↑ K⁺, ↑ Ca²⁺
- Unresponsive to catecholamines

EMERGENCY MANAGEMENT

1. 100% O₂, ventilatory support
2. IV fluids to restore blood volume – use normal saline + glucose
3. Monitoring:
 - a. CVC, arterial line
 - b. Bloods - Baseline serum cortisol, ACTH
 - c. Frequent monitoring of electrolytes, glucose
4. Drug therapy
 - a. Hydrocortisone 100 mg (2 mg/kg) IV, then 100mg 6 hourly
5. Adrenaline infusion to maintain haemodynamics – may resistant in the absence of steroid replacement
6. Treat underlying cause
7. HDU post operatively

CARCINOID CRISIS**LOOK FOR**

- Flushing, especially head and neck
- Bronchospasm
- Sweating
- Hyper/hypotension
- Electrolyte disturbances

EMERGENCY MANAGEMENT

Ketanserin (a selective serotonin receptor antagonist with weak adrenergic receptor blocking properties)

Aprotinin

H1 and H2 receptor blockers

Somatostatin or octreotide

Avoid catecholamines

(? steroids)

SEPSIS

DEFINITIONS

- SIRS: 2 of the following
 - Temp > 38, <36
 - HR > 90
 - RR > 20, or PaCO₂ < 32mmHg
 - WCC > 12 or < 4
- Sepsis: SIRS resulting from infection
- Severe Sepsis: sepsis with hypoperfusion and organ dysfunction.
- Septic shock: sepsis with *hypotension* (SBP < 90mmHg, or >40mmHg from baseline) and perfusion abnormalities, or requirement of vasoactive drugs despite adequate fluid resuscitation.

LOOK FOR

- CNS: Confusion
- CVS: Hypotension and/or tachycardia
- Resp: Unexplained desaturation, Hypercarbia, tachypnoea
- Spiking fever and rigors, or hypothermia
- Investigations:
 - Unexplained metabolic acidosis (lactice)
 - Oliguria, elevated creatinine
 - Thrombocytopaenia
 - Evidence of disseminated intravascular coagulation (DIC)
- Postoperative respiratory failure
- Failure to reverse

EMERGENCY MANAGEMENT

1. Call for help
2. 100% oxygen with PEEP, Vigorous fluid resuscitation
3. Bolus of crystalloid 10 ml/kg IV for cardiovascular instability
4. Monitoring:
 - a. Arterial line and CVC – aim MAP >70mmHg, CVP 8-12mmHg; IDC UO>0.5mL/kg/hour
 - b. Consider non-invasive cardiac output monitoring, mixed venous sats (aim > 70%)
5. Consider an adrenalin infusion in adults and in children
 - a. 2mg in 100ml burette (20 mcg/ml), start at 0.15 mcg/kg/min
 - b. Titrate to achieve a mean blood pressure >70mmHg

FURTHER MANAGEMENT (3)

1. Take samples for microscopy and culture of:
 - a. Blood, urine
 - b. Any other fluids (eg bile, pus, ascites, CSF)
2. Record any prior antibiotics
3. Give appropriate empirical antibiotics
4. Check haematology, coagulation status, biochemistry, blood gases – normalise Hb, glucose, temperature, electrolytes.
5. Send to ICU

PERIOPERATIVE MANAGEMENT

1. Do not induce anaesthesia until adequate resuscitation has occurred (unless urgent)
2. Induce anaesthesia with recued doses or induction agents (Ketamine), considering RSI

3. Consider risks vs. benefits of neuraxial blockade

NEURAXIAL ANAESTHESIA

EMERGENCY MANAGEMENT

1. Question the patient, reassure and sedate if appropriate. Always check block adequacy prior to surgery.
2. Inform the surgeon as to the nature of the problem
3. Complete AB COVER CD - A SWIFT CHECK
4. If hypotensive or bradycardic do not hesitate to treat as Cardiac Arrest
5. Review and treat probable causes:
 - a. Inadequate fluid loading, blood loss
 - b. High block (aspirate CSF from epidural)
 - c. Drug errors: wrong drug, concentration, volume, site, route, rate
6. For suspected local anaesthetic toxicity
 - a. Give IV phenytoin 15 mg/kg over 30 minutes for CNS irritability
 - b. Control seizures with 1 - 2 mg/kg of IV thiopentone, but beware of cardiovascular compromise
 - c. For cardiovascular collapse, treat as Cardiac Arrest
 - i. Intralipid 20% 1.5mL/kg IV bolus then 15mLs/kg/hour
7. Assess the block
 - a. If inadequate consider
 - i. general anaesthesia,
 - ii. OR local infiltration
 - iii. OR further local anaesthetic down the epidural catheter
 - b. If excessive – ascending sensory loss, respiratory muscle weakness, ↓LOC, fixed dilated pupils
 - i. administer oxygen and assist ventilation if required
 - ii. consider RSI (with small amounts of induction agent)
 - iii. support circulation with fluids, metaraminol +/- adrenaline
8. Consider needle/catheter problem
 - a. Wrong site: intravascular, intrathecal, intrapleural placement/injection
 - b. Trauma: haematoma, nerve damage, pneumothorax, pain
 - c. Beware of tourniquet failure with Bier's blocks

FURTHER CARE

1. Confirm and correct cause
2. Review patient to determine delayed events
3. Counsel the patient, arrange follow up

NERVE BLOCKS

PROBLEMS

1. Arrhythmias
2. Signs of intravascular injection of local anaesthetic
3. Equipment malfunction with the use of tourniquets
4. Pneumothorax with blocks near the thoracic cage
5. With patient and operative site identification

EMERGENCY MANAGEMENT

1. Reassure the patient and sedate if appropriate
2. Inform the surgeon
3. Stop the procedure, especially for vagal responses
4. For tourniquet failure, reinflate and prepare to treat for intravascular injection of LA
5. If intravascular injection is suspected
 - a. Stop injection of local anaesthetic
 - b. Administer 100% oxygen
 - c. Prepare to support airway, breathing and circulation
 - d. Prepare anticonvulsant, (thiopentone/midazolam/propofol) and give if fitting does not resolve within 15 seconds
6. Do not hesitate to treat as cardiac arrest
 - a. If bradycardic consider atropine 0.6mg
 - b. If arrest or malignant arrhythmias, give intralipid 20% 1.5mls/kg bolus, then 15mLs/hour infusion
7. If intra-arterial injection of adrenaline containing LA is suspected, observe closely for local ischaemia.
 - a. Consider a vasodilator.
8. For block failure, convert to a general anaesthetic or use supplementary local infiltration (beware of overdosage).

FURTHER CARE

1. Confirm and correct cause
2. Review patient in the ward to assess delayed events
3. Counsel the patient and explain what happened

POST-CRISIS

IF THE PATIENT SURVIVES

1. Talk to the patient at the earliest opportunity
 - a. Explain what has happened
 - b. Keep it simple and stick to the facts
 - c. Avoid guesswork
 - d. Do not admit liability but do apologise for the mishap
2. For incidents with risk of psychiatric trauma/awareness/disability/pain, involve a psychiatrist/psychologist
3. If it was a minor mishap (eg. superficial corneal or dental damage), arrange for the problem to be corrected as soon as possible, at no expense to the patient.

IF THE PATIENT DIES

1. Contact a senior colleague who will:
 - a. Advise you to stop working that day/night
 - b. Help you with the tasks ahead
 - c. Liaise with medical/hospital administration
 - d. Arrange cover of your duties
2. Make a factual account as soon as possible referring to the medical record
 - a. Do not alter or erase any part of the anaesthetic record
 - b. You may annotate the medical record with a separately timed, dated and signed postscript
3. Leave ETT, IV lines, catheters etc. in situ. If there is any doubt at all about what happened, isolate the theatre/equipment/drugs for future examination by an appropriate person, who can document the checks performed.
4. Contact the family personally as soon as possible
 - a. Arrange an interview in a suitable room
 - b. DO NOT let others (eg. surgeon) conduct the interview alone
 - c. Give the bad news first; show empathy
 - d. Explain the facts as known at the time
 - e. Do not offer opinions lightly
 - f. Make yourself available to the family (eg. contact numbers)
5. Debrief the staff involved
 - a. Seek a good friend/family member for support
 - b. Contact the Head of Department
 - c. Contact the relevant medical defence organisation

AFTER THE CRISIS - THE POST-MISHAP PROTOCOL

1. Contact a mentor/senior colleague: To come and assist in the protocol.
2. The patient: Should be informed as soon as possible if he or she has survived and is conscious. The Coroner's office is responsible for the body of a dead patient; the surviving patient usually needs intensive care and the anaesthetist must be seen to be there and to be part of the team.
3. The relatives: Need to be informed promptly and accurately of what has occurred.
THE SURGEON MUST NEVER CONDUCT THE INTERVIEW ALONE.
The interview should be unhurried, run as a team effort and may be divided into two parts:
 - first the bad news,
 - and then after a pause, the facts as known.
 - Start with the need for the operation, what the plan was for the anaesthetic and build the basic medical history of the patient.
 - If an opinion is to be offered, make it clear that it is an informed guess, not fact; the autopsy may prove you wrong.
 - Ongoing support and communication channels of a surviving patient and of their friends and relatives should be established.
4. The next patient: Deserves a fresh team and equipment. The unthinkable sequel to an unexpected death is that the next patient also dies because of an undetected equipment fault or overstressed personnel.
5. The equipment and drugs used: If implicated, must be isolated for examination.
6. The medical staff involved: Need a debriefing session to state what they think occurred, to ventilate their feelings and to learn from the mishap. Critical Incident Stress Debriefing (CISD) may be appropriate after two or three days.
7. The nursing and paramedical staff: Should attend an end-of-shift defusing session, to allow immediate reactions to be revealed, and a factual and concise "take away" statement to be given out, in order that the hospital staff have information that is appropriate and accurate. The situation may also require a formal CISD. Special consideration should be given to any anaesthesia nurse(s) involved.
8. Administrative details: Check the medical record for accuracy and completeness, prepare formal statements, hospital or departmental incident reports, AIMS and TGA reports. The ICU record should be examined frequently. Never alter or destroy record, but you may annotate with a separate, timed, dated and signed postscript.
9. The anaesthetist, as well as the anaesthetist's family, should be supported and assisted in the immediate post-catastrophe period.
10. The courts: Copy, review and understand all relevant records. Notify medical defence and hospital administration. Prepare a personal statement of events for medical defence, even if no court action follows.