

Contents

Specific Problems.....2

Amniotic Fluid Embolism	2
Airway Fire	2
Non-Airway Patient Fire	3
Operating Room Fire	3
Autonomic Dysreflexia	4
Electrical Power Failure	4
Pipeline Oxygen Failure	5
High ICP	5
Intra-Arterial Injection	5
Extravasation of Anaesthetic Agent	6
Restraint	6

Symptoms8

Hypoxia	8
High Airway Pressure	8
Hyperthermia	8
Hypothermia	8
Loss of Consciousness	9
Post Op Agitation	9
Post Op Blindness	10
Long Case	10

Specific Problems

Amniotic Fluid Embolism

- = 4th commonest cause of direct maternal death 1:12:000
- 70% within labour, 11% post partum
- 50% mortality; only 15% survive without neuro impairment
- thought entry via small tears in lower uterine segment & endocervix
- likely due to anaphylactic response to fetal tissue
- sequelae:
 - ▶ phase 1: within 30mins: intense ↑pulmon vasoC ⇒ R heart failure, ↓O₂, ↑CO₂, ↓pH
 - ▶ phase 2: L heart failure ⇒ pulmon oedema
 - ▶ coagulopathy
 - ▶ 50% mortality in 1st hour
- RFs:
 - ▶ >35yr multip
 - ▶ obstructed labour esp with uterine stimulants
 - ▶ multiple pregnancy or short labours
- signs (often a diagnosis of exclusion):
 - ▶ sudden pHTN ⇒ heart failure ⇒ sudden collapse with ↓bp & fetal distress
 - ▶ APO (>90% of cases) & cyanosis (80%)
 - ▶ hypoxaemia
 - ▶ coagulopathy (80%)
 - ▶ seizures (50%)
 - ▶ cardiac arrest (>90%)

Diagnosis

- still no diagnostic marker for AFE - diagnosis of exclusion

Management

- purely supportive:
 - ▶ senior staff
 - ▶ early delivery of fetus vital for both parties survival
 - ▶ oxygenation - may require NIV (CPAP/PEEP)/intubation
 - ▶ aggressively support
 - coagulopathy - high risk of DIC. Involve haematologist
 - R heart strain
 - uterine tone - use routine meds
 - ▶ deliver baby as quickly as possible
 - ▶ possible but not evidence based:
 - steroids
 - plasma exchange/haemofiltration
 - bypass

Airway Fire

Prevention

- triangle of fire:
 - ▶ fuel = any material that burns
 - ▶ ignition = laser, diathermy (rarely)
 - ▶ oxidiser = O₂ or nitrous
- thus:
 - ▶ use as low FiO₂ as possible, avoid nitrous
 - ▶ saline in ETT cuff,
 - ▶ pack wet throat pack around ETT
 - ▶ add methylene blue to proximal cuff - obvious is laser penetrates it
 - ▶ laser ETT
- be aware of risk of fire

Diagnosis

- Diagnosis usually by surgeon or smoke from field when laser or diathermy

Immediate management:

- disconnect breathing circuit immediately, clamp end of ETT, flood with saline (field & down ETT)
- only re-ventilate when fire extinguished - monitor SpO₂
- supraglottic fire:
 - ▶ always remove ETT (if involved)
 - ▶ BMV if required
- infraglottic fire:
 - ▶ always remove ETT
 - ▶ BMV
- bronchoscopy to inspect airway (+/- ETT if in place)
- inspect ETT for missing fragments
- reestablish secure airway - likely ETT to remain for prolonged ventilation in ICU
- if reintubation impossible use all other options as CICO
- expedite end of operation

Subsequent management:

- ▶ dex 4-8mg qds - to limit burn oedema
- ▶ defer extubation
- ▶ watch for ALI/ARDS
- ▶ refer to burn centre early for Rx of scarring & stenosis

Non-Airway Patient Fire

- beware fire under drapes and neuraxial techniques
- recognition may be difficult

Prevention:

- ▶ avoid alcohol based skin preps
- ▶ allow adequate time for drying
- ▶ maintenance & checks on electrical equipment

Immediate management:

- ▶ remove all drapes & flammable material from patient
- ▶ extinguish fire:
 - flood with saline or use CO₂ canister (safe in wounds) (black stripe on cylinder)
 - do not use liquid on electrical equipment

Operating Room Fire

- where is fire:
 - ▶ intermittent noise = adjacent area ∴ make provisional preparations to evacuate but remain still
 - ▶ continuous noise = fire in your area ⇒ start preparing to evacuate
- establish person in charge of fire - usually nursing staff fire marshal
- all staff perform rapid visual check of area

Immediate Management

- Action based on size of fire:
 - ▶ small fire - extinguish with extinguishers
 - ▶ large ⇒
 - stop all work
 - call fire department
 - evacuate non essential persons to designated safe area
 - evacuate patients if does not compromise safety of staff
 - collect self inflating bags, o₂ supply, drugs to reverse patient
 - on way out: close theatre doors and turn off gas supply to room
 - only fire dept re-open door
 - staff should not risk life to stay with patient
 - follow evac route - do not use lift. use mattresses to drag patients down stairs
 - should have pre-designated evac area eg carpark outside ICU

- consider ventilated patient has better chance of survival from toxic fumes if left connected to ventilator in place

Autonomic Dysreflexia

- classically post spinal cord injury in reflex phase with massive SNS surge \Rightarrow malignant HTN
- prevention: use neuraxial anaesthesia spinal > epidural

Immediate Management:

- ▶ ABC 100% O₂
- ▶ position head up
- ▶ identify cause and try to treat/stop
- ▶ rapid onset & short acting pharmacological agents:
 - deepen anaesthetic
 - ensure adequate pain control
 - nifedipine 10mg sublingually
 - GTN -
 - IV = 100mcg bolus & rpt
 - IV infusion 0.5-10mg/hr
 - SL spray 400mcg
 - phentolamine 2-10mg IV PRN
- ▶ continue to titrate management until control

Electrical Power Failure

Systems

- hospitals should have 2 levels of redundancy:
 - ▶ onsite emergency generator -
 - = red power socket
 - normally diesel powered.
 - Activated by automatic sensors detecting \downarrow voltage from municipal supply for 2 mins
 - \hookrightarrow \therefore will see a delay before power re-established so only use on equipment with either battery backup or ok for short disruption
 - ▶ uninterruptible power supply -
 - = blue socket
 - battery backup which can provide instant continuous power
 - \therefore use on any essential equipment without internal battery backup
 - NB fault between battery bank and socket will still \Rightarrow power outage
- Anaesthetic machine:
 - ▶ depends on make what happens if power lost
 - may work completely
 - may only see functioning ventilator, gas supply & vapour for limited time only
 - may stop working completely

Immediate Management

- ▶ activate internal hospital disaster plan
- ▶ DA and nurse in charge to liaise with hosp control centre
- ▶ use flashlights, laryngoscope or mobile phone lights (do not use naked flame)
- ▶ minimise load on UPS - only essential equipment without internal battery into blue socket
- ▶ check for airflow at common gas outlet port - r/o ventilator failure
- ▶ convert to spont ventilation technique (vaporisers are unreliable without power & \downarrow s load on UPS)
- ▶ hand crank bypass or ECMO
- ▶ use BMV
- ▶ clinical assessment for hypoxia, perfusion. Use portable monitors asap
- ▶ switch to battery powered TIVA
- ▶ expedite end of surgery

Pipeline Oxygen Failure

Presentation

- should have visual & audible alarm of failure
- may see vent stop, O2 flush button failure
- should check for leaks, machine failure, obstruction in supply hose

Immediate Management

- turn on O2 reserve cylinder fully
- check pressure gauge on reserve cylinder
- switch to manual ventilation \Rightarrow if vent uses O2 as driving gas it will save gas
- convert circuit to closed circle to conserve gas (close APL valve)
- check for disconnections
- convert to TIVA

Subsequent Management

- disconnect pipeline supply:
 - if failure at source then risk of contaminant
 - reestablishment of pipeline supply will override cylinder supply as higher pressure
- expedite end of surgery
- declare an emergency to hospital disaster team
 - ?other areas affected
 - stop all surgery
- liaise with medical engineering \Rightarrow when will O2 supply be turned back on
- if cylinder runs out \Rightarrow use RA +/- via a BMV
 - ↳ risk of hypoxia

Paeds

- T piece in paed's
 - cannot deliver IPPV without gas supply
 - is wasteful - should convert to circle system

High ICP

- approach to management:
 - optimise blood flow into & out of brain:
 - exclude venous obstruction
 - check ventilation
 - defend CPP
 - ↓brain metabolic rate:
 - drugs = opioids, benzo's, propofol, barbituaes
 - moderate hypothermia
 - avoid: ↑BSL, fever, seizure
 - osmotherapies:
 - manitol 0.25-0.5g/kg
 - hypertonic saline 0.25ml/kg 23.4% \Rightarrow aim Na 155
 - surgery \Rightarrow EVD/drain

Intra-Arterial Injection

- where is cannula:
 - pulse near
 - blood bright red
 - ultrasound
 - pulsatile flow
 - transduce cannula
- fentanyl: no issues
- propofol:
 - severe distal hyperaemia which can last hrs to 1 week
 - full recovery is the norm

- thiopentone:
 - ▶ severe pain & blanching
 - ▶ profound constriction by local NA release
 - ▶ may crystallise & embolise to distal vessels

Treatment

- Stop injection
- leave cannula in-situ
- inject:
 - ▶ 100mg lignocaine, 40mg papaverine in 10- 20ml Norm saline
- prevent vasospasm:
 - ▶ nimodipine
 - ▶ targeted urokinase
 - ▶ O₂
 - ▶ GTN
 - ▶ sympathetic block
- give systemic analgesia
- prevent thrombosis ⇒ heparin +/- warfarin thereafter
- liaise with vascular surgeon

Extravasation of Anaesthetic Agent

- wide range of symptoms from local ischaemia/necrosis to compartment syndrome/amputation

Treatment

- no proven definitive Rx
- leave cannula in situ
- options:
 - ▶ hyaluronidase - 2 options (max dose 1500units):
 - subcut 15units/ml saline at 5-10 sites along leading edge of extravasation has been used successfully
 - through cannula
 - ▶ Steroids - via cannula
 - ▶ Phentolamine 5-10mg in 10ml saline given subcut into area
 - ▶ regional stellate ganglion block:
 - neck fully extended
 - Feel for C7 transverse process above sternoclavicular joint
 - retract carotid out of the way
 - aim to hit transverse process with needle and inject
 - ▶ topical cooling and warming

Restraint

- = primarily used for safety
- = physical vs. chemical
- Prerequisite/indication:
 - ▶ restraint should occur in a safe and respectful and least restrictive but effective manner.
 - ▶ Restraint should be applied only to enhance or maintain the safety of consumers, service providers, or others.
- Service provider training and competency is critical, both to the appropriate and safe use of restraint, and to minimising the use of restraint.
- Legal/ethical considerations:
 - ▶ = acting for the consumer's good (beneficence),
 - ▶ avoiding harm to all (non-maleficence)
 - ▶ respecting the dignity + human rights.
 - ▶ NEVER use restraint/seclusion for punitive reasons.

- The Standard = at all times promote the interests, safety, and well-being of all.
- Any unauthorised restriction on a consumer's freedom of movement could be seen as unlawful.
- Organisations should have policies to guide implementation and seek legal advice PRN.

Symptoms

Hypoxia

- I need to ensure oxygen is getting from the reticulated supply to the vital organs. I would.....
- Rapid visual check from wall \Rightarrow circuit \Rightarrow airway \Rightarrow lungs \Rightarrow circulation
- differentials:
 - ▶ hypoxic hypoxia:
 - low FiO₂
 - hypoventilation
 - VQ mismatch
 - shunt
 - diffusion limitation
 - ▶ Anaemic hypoxia
 - ▶ Circulatory hypoxia
 - ▶ Histotoxic hypoxia

High Airway Pressure

- I would examine the chest looking for signs of bronchospasm, pneumothorax or any other gross pathology

Hyperthermia

Differential

- infection
- metabolic
- pyrogens/transfusion
- ICH
- exogenous
- other: MH, serotonin syndrome, NMS, thyroid storm

Hypothermia

Differential

Anaesthesia:

- ▶ behavioural
- ▶ \downarrow autonomical control \Rightarrow \uparrow IT range
- ▶ vasodilation \Rightarrow movement of heat to periphery
- ▶ heat loss: radiation, convection, conduction, evaporation
- ▶ cold fluids
- ▶ \downarrow metabolism

Patient:

- ▶ hypothyroid
- ▶ \downarrow BMI
- ▶ elderly
- ▶ autonomic neuropathy

Surgical:

- ▶ long procedures
- ▶ large surface area
- ▶ cold washes/TURP
- ▶ CPB

Treatment

Preop:

- ▶ active warming
- ▶ passive warming with clothes/blankets

Intraop:

- ▶ active:
 - Bair hugger/electric mat
 - radiant warmer
 - bypass circuit + heat exchange
- ▶ passive:
 - foil
 - fluid warmer
 - warm OT
 - HME/CO₂ absorber
 - ↓exposure
 - an. technique

Loss of Consciousness

Patient

- CNS:
 - ▶ seizure
 - ▶ stroke
 - ▶ ↑ICP
- Resp:
 - ▶ ↑CO₂
 - ▶ ↓O₂
 - ▶ acidosis
- CVS:
 - ▶ ↓CO/perfusion
 - ▶ arrhythmia
 - ▶ heart failure
- metabolic:
 - ▶ BSL
 - ▶ electrolytes
 - ▶ ↓temp
- Rare:
 - ▶ anaphylaxis
 - ▶ FES/cement
 - ▶ serotonin syndrome, NMS
 - ▶ drug withdrawal

Anaesthesia

- meds
- high spinal

Surgical

- TURP
- carcinoid
- neurosurg

Post Op Agitation

- drug related:
 - ▶ opioids/sedatives
 - ▶ central anticholinergic syndrome
- pain
- full bladder
- CNS:
 - ▶ post ictal
 - ▶ stroke

- ▶ trauma
- ▶ bleeding
- ▶ drug withdrawal
- Resp:
 - ▶ \uparrow CO₂, \downarrow O₂
 - ▶ acidosis
- CVS:
 - ▶ fat embolism
 - ▶ \downarrow bp, arrhythmia
- metabolism:
 - ▶ \uparrow / \downarrow Na
 - ▶ \downarrow BSL

Post Op Blindness

Differential

- ION
- retinal vein or arterial occlusion
- cortical stroke
- direct trauma to eye

- other ocular complications:
 - ▶ glaucoma
 - ▶ corneal abrasions
 - ▶ chemical injuries
 - ▶ laser injuries
 - ▶ retinal haemorrhage
 - ▶ TURP

Long Case

- airway - ETT
- monitoring:
 - ▶ invasive bp +/- CVL
 - ▶ temp
 - ▶ IDUC
- Equipment:
 - ▶ special mattress padding
 - ▶ warming devices eg fluid warmer
- Position/padding:
 - ▶ pressure sores - occipital, scapula, sacral
 - ▶ nerve damage
 - ▶ DVT
- eye mouth cares
- staff - fatigue & breaks