COMMON CRISES IN PAEDIATRIC ANAESTHESIA

1. LARYNGOSPASM

Laryngospasm is a common complication during anaesthesia. It occurs mainly at induction and reversal of anaesthesia. It is also more common in infants than in the older child. Patients with URTI are more prone to laryngospasm.

From our departmental anaesthetic audit, at least 50% of laryngospasm episodes during anaesthesia were avoidable. These were due to stimulation of the patient and/or airway during periods of inadequate anaesthetic depth.

Management:
Prevention
Maintain adequate depth of anaesthesia, avoidpremature stimulation of the patient and/or airway.
Treatment:
100% O2, apply CPAP via mask and increase the depth of anaesthesia with an intravenous agent. Suction secretions if required.
If laryngospasm cannot be aborted by mask CPAP:
Suxamethonium 0.5mg/kg IV or 4mg/kg IM, in conjunction with atropine 0.02mg/kg IV or IM if bradycardic.
Always suspect aspiration pneumonitis if oxygen saturations remain poor after reversal of laryngospasm.

2. "TET" SPELLS

These are hypercyanotic attacks in cyanotic children, typically in Tetralogy of Fallot. The common precipitating factors are events resulting in an increase in oxygen demand such as crying, feeding, inadequate depth of anaesthesia and exercise. Other factors include dehydration, acidosis, decrease in systemic vascular resistance

(SVR) and excessive airway pressure. A child with Tetralogy of Fallots on Propranolol is likely to be prone to “Tet” spells.

Management:

- stop precipitating factors, increase depth of anaesthesia if depth not adequate
- maintain airway, give oxygen, hyperventilate if intubated
- bicarbonate to treat acidosis, if present
- ensure adequate volume status, give boluses of fluid up to 10ml/kg.
- Drugs:
  IV phenylephrine 1-2μg/kg to increase SVR
  IV propanolol 10-20μg/kg, test dose then 0.05-0.1mg/kg over 10 mins or IV Esmolol 500 μg/kg to relieve infundibular spasm
- Compression of bilateral femoral arteries. Compression of the aorta (if accessible) during surgery .
- Patient may need early, urgent correction of TOF if the Tet spells are frequent.

References:

1. Paediatric Cardiac Anaesthesia. Carol Lake, 4th Edition. Appleton and Lange, 2004, pp 348-349.
2. Twite MD, Ing RJ. Tetralogy of Fallot: Perioperative Anesthetic Management of Children and Adults. Semin Cardiothorac Vasc Anesth June 2012 16: 97-105.

3. POST-ADENO-TONSILLECTOMY BLEEDING

Incidence: about 0.1 to 2% of patients after tonsillectomy. 0.06-1% of them require anaesthesia for exploration in OT

Causes:
a. Early; within 6 hrs likely due to inadequate haemostasis
b. Late; days - weeks, likely due to infection
Problems

- Hypovolaemia due to haemorrhage
- Full stomach and risk of pulmonary aspiration
- Airway obstruction

Management
1. Pre-op assessment and management
a) Volume status: estimate the amount of blood loss and the degree of hypovolaemia, ensure good venous access, resuscitate if necessary.
b) Blood: GXM and ensure availability
c) Review previous anaesthetic chart for ease of intubation, size of ETT used, anaesthetic agents used, history of sleep apnea and post anaesthetic course.

2. Conduct of anaesthesia

(a) Preparation: skilled anaesthetic assistance, two large bore suction (Yankar) devices, ETT: previously used size and0.5 to 1 size smaller readily available.

(b) Technique: Rapid sequence induction vs. inhalational induction Dose and choice of induction agent depends on the preference/experience of anaesthetist in charge, airway assessment and volume status of the patient.

Following control of airway, empty the stomach using a large bore nasogastric tube.
Extubate awake in the lateral position.
Ensure adequate postoperative analgesia.

References:

1. Fields RG., Gencorelli FJ. and Litman RS. (2010), Anesthetic management of the pediatric bleeding tonsil. Pediatric Anesthesia, 20: 982–986.
2. Motoyama EK, Davis PJ. Smith's Anaesthesia for Infants and Children. 6th Edition, 1996, Mosby, St. Louis, p 658-9
3. Olutoye, O. A. and Watcha, M. F. (2012) Eyes, Ears, Nose, and Throat Surgery, in Gregory's Pediatric Anesthesia, Fifth Edition (eds G. A. Gregory and D. B. Andropoulos),

4. ACUTE EPIGLOTTITIS

Acute bacterial infection of the epiglottis in children 2-6 years of age. Pathogens may be Hemophilus Influenzae type B (75%) or B Hemolytic Streptococci. The child may present with acute stridor, sepsis and dehydration.

Management:
1. Preparation:
Avoid doing anything which may precipitate complete airway obstruction. Do not irritate the child by doing throat examination, IV cannulation, forcefully applying a face mask or monitoring, or separation from the parent.
Bring the child to OT to secure the airway, unless complete airway obstruction occurs in CE or ICU when immediate intubation is required.
Inform OT to prepare “E” tracheostomy set.
Prepare for difficult airway management with ENT surgeon present in OT.
Prepare ETT 1-2 sizes smaller than calculated size

2. Conduct of Anaesthesia:
Gaseous induction with mask CPAP in the presence of parent.
Establish IV access and apply monitors after induction.
Intubate patient orally under deep inhalational anaesthesia.
Change to nasal airway *only if* oral intubation was not too difficult
Do blood cultures and take bacterial swab from the epiglottis
Give antibiotics as requested by ICU paediatricians, usually Ceftriaxone or Cefotaxime

3. Post anaesthesia:
Sedation and spontaneous respiration with CPAP in ICU
Extubate when there is audible leak from ETT, usually within 36-72 hours.

References:
1. 3. Olutoye, O. A. and Watcha, M. F. (2012) Eyes, Ears, Nose, and Throat Surgery, in Gregory's Pediatric Anesthesia, Fifth Edition (eds G. A. Gregory and D. B. Andropoulos),
2. Motoyama EK, Davis. PJ. Smith's Anaesthesia for Infants and Children. 6th Edition, 1996, Mosby, St. Louis, pp 667-9
3. Sumner E, Hatch DJ. Paediatric Anaesthesia. 2nd Edition, 1999, Edward Arnold Ltd, , pp. 497-8.

5. SUSPECTED ANAPHYLAXIS DURING ANAESTHESIA:

ANAPHYLAXIS IS A LIFE THREATENING CRISIS SITUATION

- Prompt diagnosis requires early recognition of signs & symptoms.
- Early treatment with adrenaline & fluid replacement is crucial

ANZAAG
Australian & New Zealand Anaesthetic Allergy Group

Anaphylaxis during Anaesthesia
Diagnostic Card

ANZCA
AUSTRALIAN AND NEW ZEALAND COLLEGE OF ANAESTHETISTS

Absence of tachycardia or cutaneous signs does not exclude anaphylaxis

Grade 1	Generalised mucocutaneous signs: Erythema, Urticaria+/- Angioedema
Grade 2	Moderately severe - Multi-organ manifestations including: Mucocutaneous signs Hypotension, Tachycardia Evidence of Bronchospasm, cough, difficult ventilation
Grade 3	Severe-Life Threatening and requiring immediate and specific treatment: Cardiovascular collapse Bradycardia or Tachycardia, Arrhythmias Bronchospasm Cutaneous signs may be absent, or present only after correction of hypotension
Grade 4	Cardiopulmonary Arrest

PRESENTING SIGNS AND SYMPTOMS	POSSIBLE CAUSES
Skin and Mucosa Hives, flushing, erythema, urticaria, Swelling head and neck or peripheries	Direct Histamine Release Venous Obstruction Head Down Position C1-esterase deficiency (Angioedema only) Mastocytosis Cold induced anaphylaxis
Airway Compromise Dyspnoea, wheeze, stridor, difficulty inflating lungs	Direct Histamine Release Acid aspiration Exacerbation of asthma Intubation; Oesophageal Intubation Foreign Body Difficult airway Visceral traction Mastocytosis Consider: Auto PEEP (disconnect from ventilator) Tension pneumothorax (decompress)
Hypotension	Direct Histamine Release Visceral Traction Vasodilation by drugs Central Neural Blockade Drug Overdose Vasovagal Hypovolemia Mastocytosis Cold induced anaphylaxis
Cardiac Arrest	Myocardial Ischaemia/Infarction Electrolyte Abnormality Sepsis Blood Loss Tension Pneumothorax Cardiac Tamponade Pulmonary Embolism Mastocytosis

ANZAAG-ANZCA Anaphylaxis Management Guidelines Version 1.1 June 2013

Immediate Investigations

Mast cell tryptase samples
Take two blood samples in plain tubes (brown top)
(i) immediately after the reaction has been treated (within 1 hour of the reaction), and;
(ii) about 6 hours or up to 24 h after the reaction
It is essential to *state the time on samples (and time from onset of reaction)* and record this in the notes.
Send sample to KKH lab (ext 1383) where serum (or plasma) will be stored until it can be sent to TTSH clinical immunology lab (63578464) for measurement of serum tryptase.

Later Investigations

Any patient who has a suspected anaphylactic reaction associated with anaesthesia should be investigated fully.
Refer the patient to an allergist.
Ensure detailed analysis and proper documentation of events surrounding the suspected anaphylactic reaction.

References:
1. Suspected anaphylactic reactions associated with anaesthesia, revised edition 2009. Association of Anaesthetists of Great Britain and Ireland.

6. LATEX ALLERGY

Latex Allergy Cart
Special anaesthetic set-up and care is required in the event that a patient with latex allergy presents for surgery.

Latex allergy Protocol
Check that all equipment & drug ampoules ~~required~~ do not ~~have~~ contain latex. Look for the no latex sign

- Infusion sets should have 3-way stopcocks

- Cover the OT table with non-latex materials before the patient to lies on it.
- REMOVE ALL LATEX MATERIALS AND USE ONLY LATEX-FREE GLOVES
- THROUGHOUT. Display a prominent sign “LATEX ALLERGY” at all entry points to the OT, recovery room and the patient’s bed/cot.

Contents of the Latex Allergy Cart

- Glass syringes / disposable latex free syringes
- IV tubings without rubber injection ports
- 3-way stopcock
- Non-latex breathing systems and Self – inflating resuscitation bags e.g. Laerdal® bags are silicone
- Laryngeal masks and PVC ETT
- Cotton gauze and non-latex tapes and bandages
- Non-latex gloves (neoprene / nitrile)

ANNEX 1

KK Women's and Children's Hospital
Major Operating Theatre/Day Surgery
Latex Allergy Protocol

Summary of Workflow

1. Establish Presence of Allergy to Latex
2. Inform relevant OT Personnel
3. List as First Case
4. Ensure OT is aired for at least 2 hours prior to arrival of patient with known Latex Allergy
5. Ensure OT is equipped with all latex-free items
6. Prominent display of signages
7. Standby Resuscitation drugs and equipment in OT and Recovery Room

1. Establish Presence of Allergy to Latex

Take history from patient/parent. Review old notes, looking for formal diagnosis by allergist. Review old anaesthetic records.

A. Spectrum of Latex Allergy
1. Type I Hypersensitivity
2. Type IV Hypersensitivity
3. Contact Dermatitis

B. Risk Factors
1. Multiple surgeries e.g. spina-bifida, urogenital malformations, anorectal alformations
2. Spinal cord injuries (intermittent self-catheterisation)
3. Healthcare workers
4. Allergy to tropical fruits e.g. bananas, kiwis

2. Inform Relevant OT Personnel

The following should be made aware of the patient with latex allergy.

1. Anaesthesia Consultant-in-charge
2. Surgeon
3. OT Nursing Manager (Anaesthesia and Scrub)
   3.1 NM/NC will inform and instruct staff of the appropriate preparations necessary

3. List as First Case

Aerosolised latex particles may trigger allergic reaction in susceptible patients. Such particles released from a proceeding case will linger in the air and put the next patient at risk.

4. Ensure OT aired for at least 2 hours prior to arrival of patient

This reduces amount of aerosolised latex in the environment.

5. Ensure OT is latex-free

1. Ensure that all members of staff have changed into clean OT attire and washed their hands prior to entering the designated latex free operating room.
2. It is ideal for the staff to remain in the designated latex precaution theatre for the duration of the surgical procedure and sufficient staffs are available to collect and deliver any additional items or equipment to the theatre.
3. Restrict traffic flow in the designated theatre before and during the procedure.
4. Staff to check to ensure that consumables used are latex free by looking on the latex free logo packages.

A) Anaesthetic equipment (refer to Appendix 1 for details)
   i) Machine, circuit, monitors
   ii) Rescuscitation equipment
   iii) Drugs, fluids and giving sets
   iv) Syringes, extension tubings, gloves
   v) Others

B) Surgical equipment

C) Scrub nurse to check compatibility of
   i) Surgical instruments
   ii) Implants
   iii) Urinary catheter
   iv) Special equipment

D) Personnel to ensure no personal effects containing latex are brought or worn into OT, e.g.
   i) Bags, purses, wallets, mobile phone casings
   ii) Hair accessories
   iii) Shoes
   iv) Pens

6. Prominent display of signages

Signages of Latex Allergy should be displayed at all doors of the OR.

7. Resuscitation drugs and equipment

1. Latex-free resuscitation cart should be available at all times.
2. Emergency drugs on standby
   i) Adrenaline 1:10,000 and 1:100,000
   ii) Salbutamol MDI and spacer
   iii) Antihistamines eg Benadyl
   iv) Steroids e.g. Hydrocortisone
   v) Phenylephrine

8. Recovery Room

Patient should be segregated from other patients. Appropriate monitors and equipment should be latex-free as per point 5.
Handover to ward staff should be done regarding patient's allergic status before sending

the patient back to the ward.

Appendix
1. AU Latex-free Items

References
1. The Association of Anaesthetists of Great Britain and Ireland (2009) Suspected anaphylactic reactions associated with Anaesthesia. http://www.aagbi.org/publications/guidelines/docs/anaphylaxis_2009.pdf
2. DL. Hepner, MC Castells. Latex Allergy: An Update. Anesth Analg 2003;96:1219–29
3. NUH Latex Allergy Workflow

7. MALIGNANT HYPERTHERMIA (MH)

Cart (MH Cart) - An orange colored box containing the necessary drugs, equipment and treatment algorithm for the acute management of MH is available in the recovery area of major OT and day surgery OT. It should be brought into theatre for any suspect case. If the “box” is opened at any time, the seal will be broken and the last person using it should check the contents thoroughly before applying a new seal.

ALWAYS RETURN THE CART AFTER USE to the respective OT recovery areas.

Malignant Hyperthermia Crisis

AAGBI Safety Guideline

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

1 Recognition

- Unexplained increase in $ETCO_2$ **AND**
- Unexplained tachycardia **AND**
- Unexplained increase in oxygen requirement
- (Previous uneventful anaesthesia does **not** rule out MH)
- Temperature changes are a late sign

2 Immediate management

- **STOP** all trigger agents
- **CALL FOR HELP.** Allocate specific tasks (action plan in MH kit)
- Install clean breathing system and **HYPERVENTILATE** with **100% O_2 high flow**
- Maintain anaesthesia with intravenous agent
- **ABANDON/FINISH** surgery as soon as possible
- Muscle relaxation with non-depolarising neuromuscular blocking drug

3 Monitoring & treatment

- Give **Dantrolene**
- Initiate active **cooling** avoiding vasoconstriction
- **TREAT:**
  - **Hyperkalaemia:** calcium chloride, glucose/insulin, $NaHCO_3$
  - **Arrhythmias:** magnesium/amiodarone/metoprolol **AVOID** calcium channel blockers – interaction with dantrolene
  - **Metabolic acidosis:** hyperventilate, $NaHCO_3$
  - **Myoglobinaemia**: forced alkaline diuresis (mannitol/furosemide + $NaHCO_3$) may require renal replacement therapy later
  - **DIC:** FFP, cryoprecipitate, platelets
- Check plasma CK as soon as able
- *For Paediatric Doses see Section 6*

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

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

For Dantrolene Doses in Paediatric patients see Section 5

Continuous monitoring
Core & peripheral temperature
$ETCO_2$
SpO_2
ECG
Invasive blood pressure
CVP

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

4 Follow-up

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

The UK MH Investigation Unit, Academic Unit of Anaesthesia, Clinical Sciences Building, St James's University Hospital Trust, Leeds LS9 7TF. Direct line: 0113 206 5270. Fax: 0113 206 4140. Emergency Hotline: 07947 609601 (usually available outside office hours). Alternatively, contact Prof Hopkins or Dr Halsall through hospital switchboard: 0113 243 3144.

Your nearest MH Kit is stored .....

Malignant Hyperthermia Crisis

AAGBI Safety Guideline

5 Paediatric Adminstration of Dantrolene

- Mix 20mg (one vial) of Dantrolene with 60ml of sterile water to make a Dantrolene solution of 1mg in 3ml.
- Give an initial bolus of *7.5ml/kg* of the Dantrolene solution (=2.5mg/kg)
- Repeat further doses of *3 ml/kg* (=1mg/kg) up to a maximum of 30ml/kg in total of Dantrolene.
- For a 10kg infant :
  Give an initial bolus of 75mls (2.5mg/kg) of Dantrolene solution followed by 30ml (1mg/kg) boluses as required up to a maximum of 300mls (10mg/kg) of Dantrolene solution in total.
- Remember to include the Dantrolene solution administration in the overall fluid bolus totals i.e. 300mls of Dantrolene Solution in a 10kg child = 30ml/kg of fluid.

6 Paediatric Administration of Supportive Therapy

ARRHYTHMIAS:

- Magnesium: 0.2 mmol/kg (50mg/kg). Give slowly by IV injection not >10mg/kg/min
- Amiodarone: 5mg/kg over 20 minutes then 300micrograms/kg/hr. Max 1.2g in 24 hours
- Esmolol: *Loading dose of 500mcg/kg over 1 min then an infusion of 50mcg/kg/min over 4 mins Re-load with 500mcg/kg if inadequate response and increase infusion by 50mcg/kg/min Repeat until effective or a maximum infusion of 200mcg/kg/min is reached.*
- AVOID calcium channel blockers they interact with Dantrolene

HYPERKALAEMIA: ***Calcium Gluconate 10%:*** 0.5ml/kg to a maximum of 20mls
10% Dextrose (5mls/kg) + Insulin (0.1 Units/Kg) over 20 minutes.
Monitor Blood Sugar.

ACIDOSIS: Correct with *SODIUM BICARBONATE* 0.5-1.0 mmol/kg
(0.5-1.0 ml of 8.4% NaHCO3/ kg).

URINE OUTPUT: Need to maintain urine output at least 2 ml/kg/hr *If required use: MANNITOL* 0.5 - 1.0 g/kg *(2.5 – 5 ml/kg of 20% solution)* and/or *FRUSEMIDE* 1 mg/kg IV

DIC:

FFP	10ml/kg
Cryoprecipitate	5ml/kg body weight up to 30kg 5 units at a time are issued to children >30kg
Platelets	<30kg 10ml/kg >30kg one pool of donors

Drug doses references from the BNF for children. The drugs advised are for the initial management of MH. For ongoing and definitive treatment please contact your regional Paediatric Intensive Care Unit.

E) INVESTIGATIONS

- ABGs
- U/E/S (K)
- FBC (Hct, platelets)
- Coagulation
- CK

F) STABILISE AND SEND TO ICU

POST-CRISIS PROBLEMS

A **A**lkalinize urine & diurese, monitor for **ARF**

B **B**eware hypothermic, hyperkalemic, hypokalemic, hypervolemic overshoot - serial monitoring of filling pressures, fluid balance, electrolytes, Temp, K, Ca, coagulation profile and Haematocrit may require correction.

C **C**reatine Kinase (**C**K) levels track severity of *rhabdomyolysis*: if present, beware of renal failure, which may follow marked rhabdomyolysis. Monitor **CNS** function.

D **DIC** with *coagulopathy, thrombocytopenia, hemolysis, and abnormal bleeding*

E **E**levated liver functions are often observed 12-36 hours post-MH crisis.

Post-Acute Phase

A **A**wareness of recrudescence signs. **B** **B**iopsy: Send the patient to a biopsy center for evaluation.

C Counsel the patient and family regarding MH and further precautions

D **D**antrolene 1 mg/kg IV q 4-6h and continued for 24-48h after an episode of Malignant Hyperthermia. **D**ocumentation.

ANAESTHESIA FOR MH-SUSCEPTIBLE PATIENT

A **A**naesthesia machine preparation: change circuits, disable or remove vaporizers, flush machine at a rate of 10 L/min for 20 minutesContinue to use high gas flow rates to prevent rebound phenomena.
Anesthesia: Use local or regional anesthesia but general anesthesia with non-triggering agents is acceptable. Safe drugs include: barbiturates, benzodiazepines, opioids, nondepolarizing neuromuscular blockers and their reversal drugs, and nitrous oxide.
B **B**ody temperature monitoring.
C **Ca**pnography: **C**lose monitoring for early signs of MH.
D **D**antrolene available.
Discharge, if no problems, after 2.5 hours.

References :

1. MHAUS (Malignant Hyperthermia Association of the United States) : website www.mhaus.org. 24h Hotline : 0011 315 464 7079Malignant Hyperthermia Crisis. AAGBI Safety Guideline 2011.

8. LOCAL ANAESTHETIC TOXICITY

AAGBI Safety Guideline

Management of Severe Local Anaesthetic Toxicity

1 Recognition

Signs of severe toxicity:

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

2 Immediate management

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

3 Treatment

IN CIRCULATORY ARREST

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

GIVE INTRAVENOUS LIPID EMULSION
(following the regimen overleaf)

- Continue CPR throughout treatment with lipid emulsion
- Recovery from LA-induced cardiac arrest may take >1 h
- Propofol is not a suitable substitute for lipid emulsion
- Lidocaine should not be used as an anti-arrhythmic therapy

WITHOUT CIRCULATORY ARREST
Use conventional therapies to treat:

- hypotension,
- bradycardia,
- tachyarrhythmia

CONSIDER INTRAVENOUS LIPID EMULSION
(following the regimen overleaf)

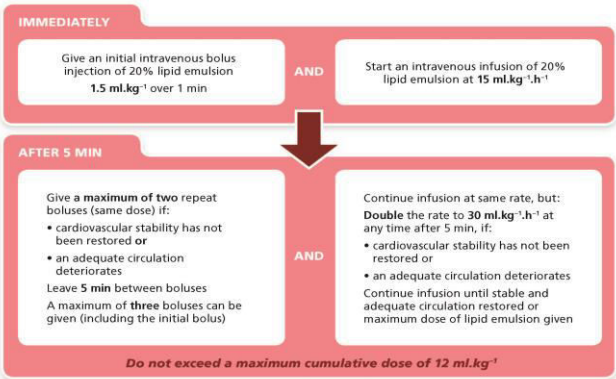
- Propofol is not a suitable substitute for lipid emulsion
- Lidocaine should not be used as an anti-arrhythmic therapy

4 Follow-up

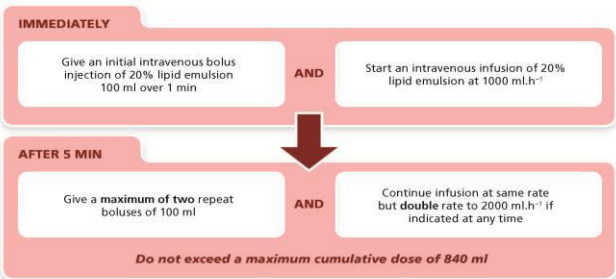
- Arrange safe transfer to a clinical area with appropriate equipment and suitable staff until sustained recovery is achieved
- Exclude pancreatitis by regular clinical review, including daily amylase or lipase assays for two days
- Report cases as follows:
  - in the United Kingdom to the National Patient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

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

Your nearest bag of Lipid Emulsion is kept.....



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



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

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

1. FOLLOW-UP

Arrange safe transfer to a clinical area with appropriate equipment and suitable staff until sustained recovery is achieved.

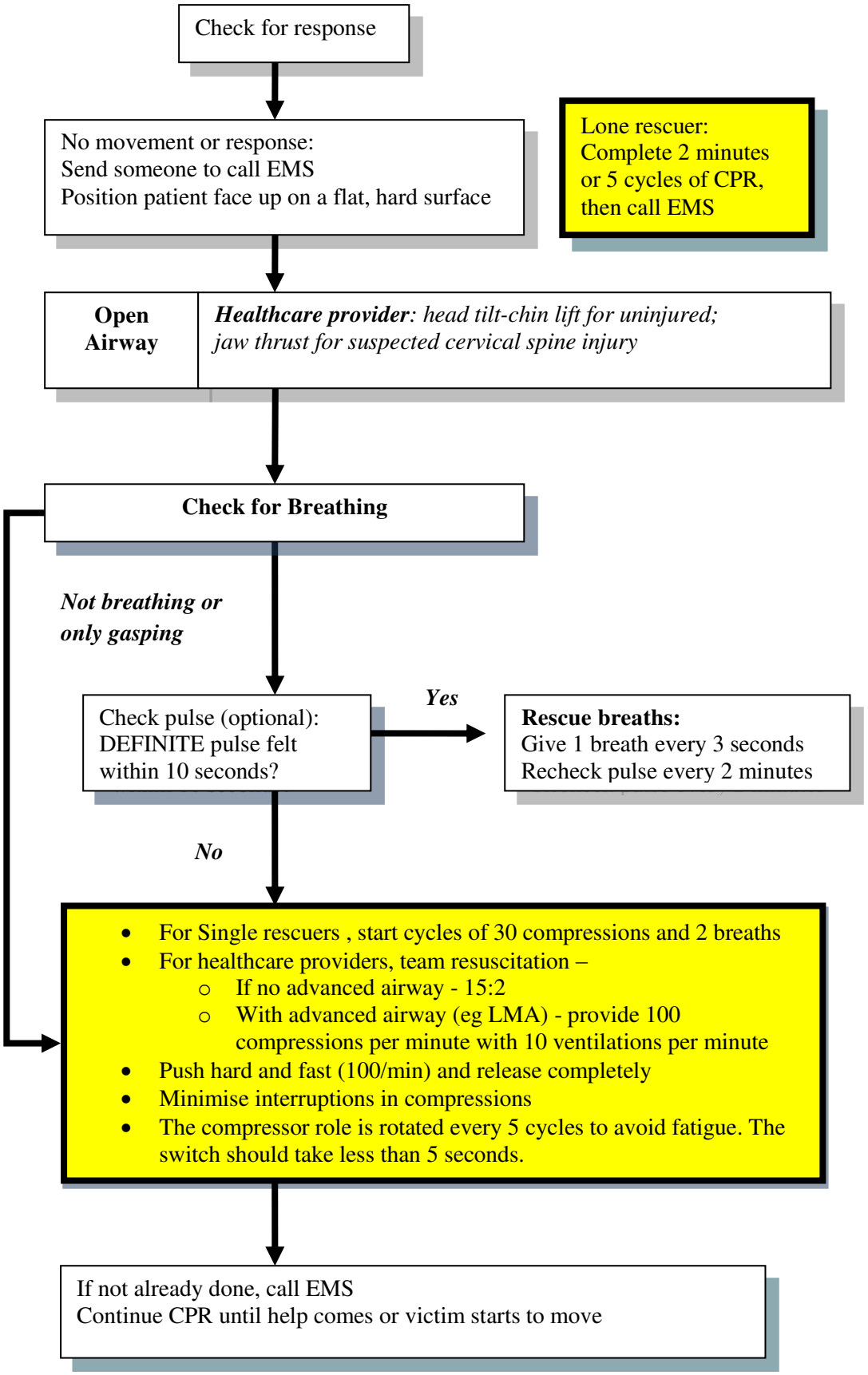
Exclude pancreatitis by regular clinical review, including daily amylase or lipase assays for two days.

References:

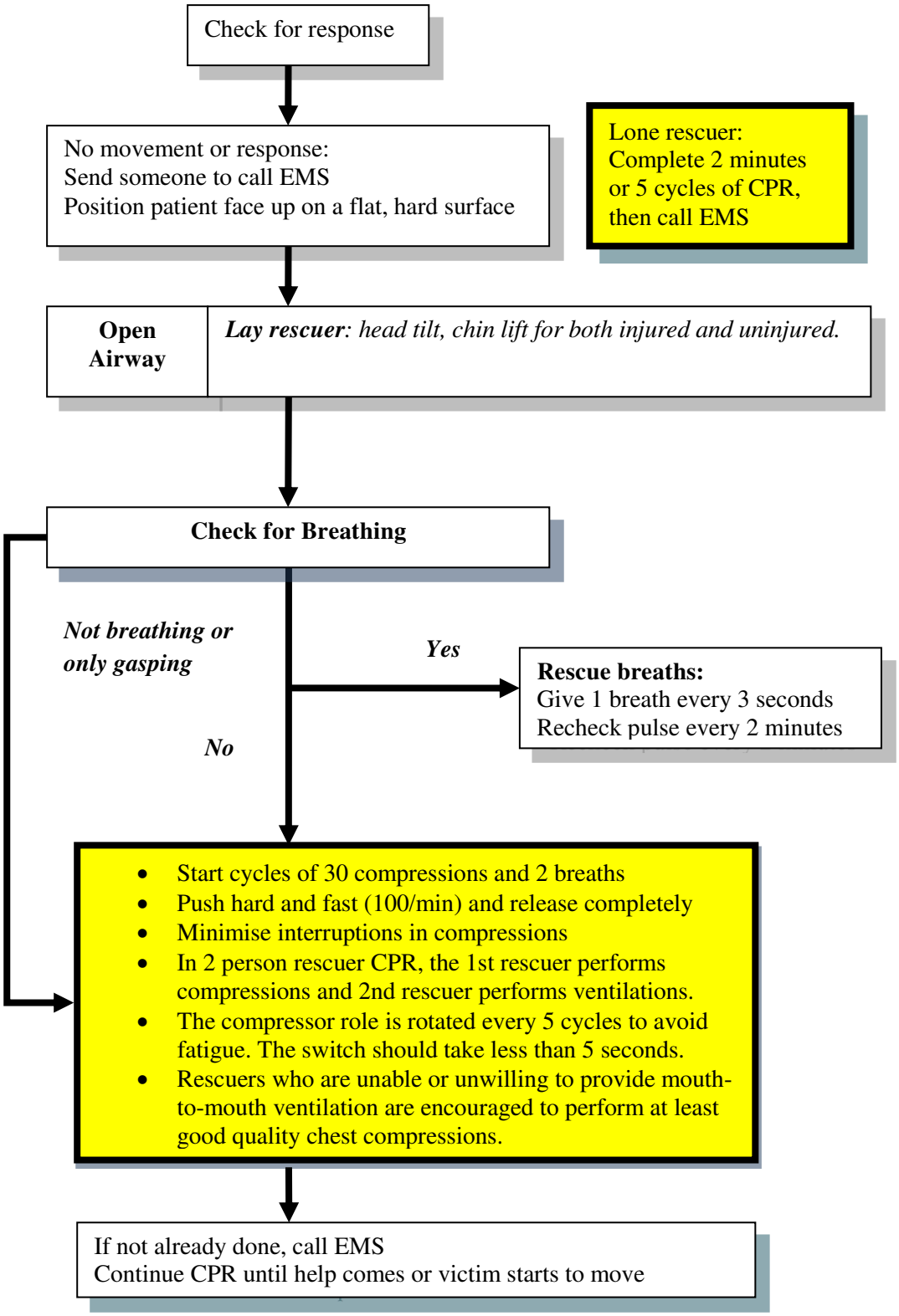
1. AAGBI Safety Guideline: Management of Severe Local Anaesthetic Toxicity 2010.
2. Neal et al. ASRA Practice Advisory on Local Anesthetic Systemic Toxicity Regional Anesthesia and Pain Medicine & Volume 35, Number 2, March-April 2010

Source: Singapore Resuscitation Council 2016

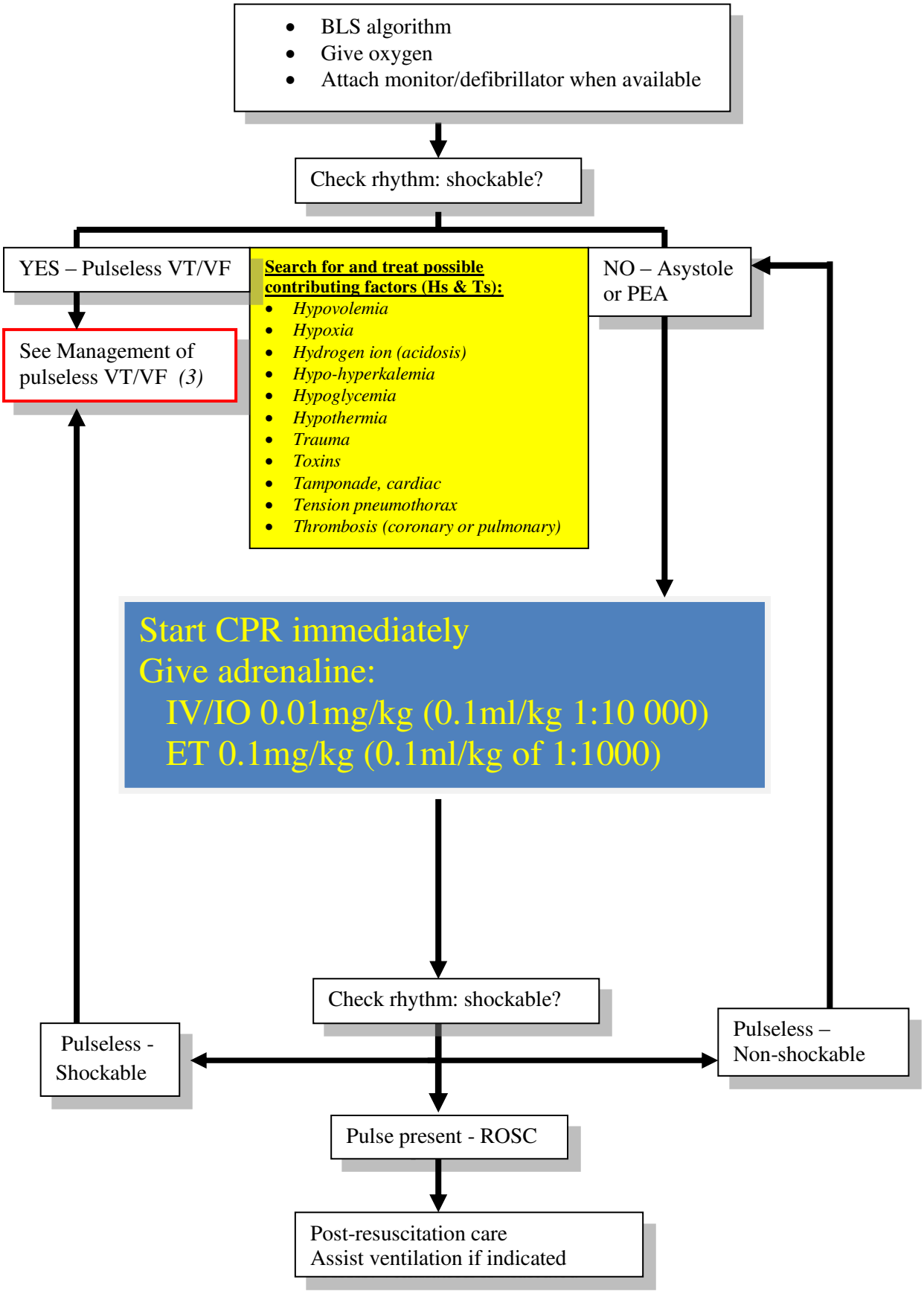
1a. PAEDIATRIC RESUSCITATION (HEALTHCARE PROVIDER)



1b. PAEDIATRIC RESUSCITATION (LAY RESCUER)



2. ALGORITHM FOR PULSELESS ARREST (NON-SHOCKABLE)



3. ALGORITHM FOR PULSELESS ARREST - SHOCKABLE

- BLS algorithm
- Give oxygen (via BVM)
- Attach monitor/defibrillator when available

Check rhythm: shockable?

→ NOT SHOCKABLE - Asystole or PEA → See Management of Asystole or PEA *(A3)*

YES / SHOCKABLE - Pulseless VT/VF

1st shock 4J/kg Resume CPR immediately. *Can use AED if > 1 year old*

CPR *

2nd shock 4J/kg Resume CPR immediately.

CPR

IV/IO adrenaline 0.01mg/kg; max 1mg q3-5 mins or every other shock

3rd shock 4J/kg Resume CPR immediately.

CPR *

IV/IO amiodarone 5mg/kg
OR
IV/IO lignocaine 1mg/kg; max 100mg initial bolus followed by infusion 20-50 microgram/kg/min.

4th shock 4J/kg Resume CPR immediately.

CPR

Give adrenaline 0.01mg/kg; max 1mg q3-5 mins or every other shock

5th shock 4J/kg Resume CPR immediately.

CPR *

IV/IO amiodarone 5mg/kg; max. 3 doses
OR
IV/IO lignocaine if not given earlier 1mg/kg; max 100mg initial bolus followed by infusion 20-50 microgram/kg/min.

6th shock 4J/kg Resume CPR immediately.

Perform 2 mins of CPR then check for pulse and rhythm – shockable?

Give adrenaline every other shock (every 3-5 mins)

Consider other antiarrhythmics:
-IV/IO lignocaine *1mg/kg (max. 100mg) initial bolus followed by infusion 20-50microgram/kg/min. Repeat bolus can be given after 15 minutes after initiating infusion if delayed > 15 minutes*
-IV/IO amiodarone *5mg/kg, up to 3 times*
-IV/IO magnesium sulphate *50mg/kg (max2g) for Torsades de Pointes*

Consider increasing energy dose *of shocks to* ***max 10J/kg*** *for refractory VF*

* ***CPR2 mins then check pulse and rhythm – shockable?***

- *Minimise time between chest compressions and shock delivery.*
- *Check rhythm and shock immediately after chest compressions, rather than after rescue breaths, if possible.*
- *Minimise time between shock delivery and resumption of chest compressions.*

During CPR

- Monitor CPR quality
- Check frequently for reversible causes – Hs,Ts **
- Advanced airway placement and confirmation

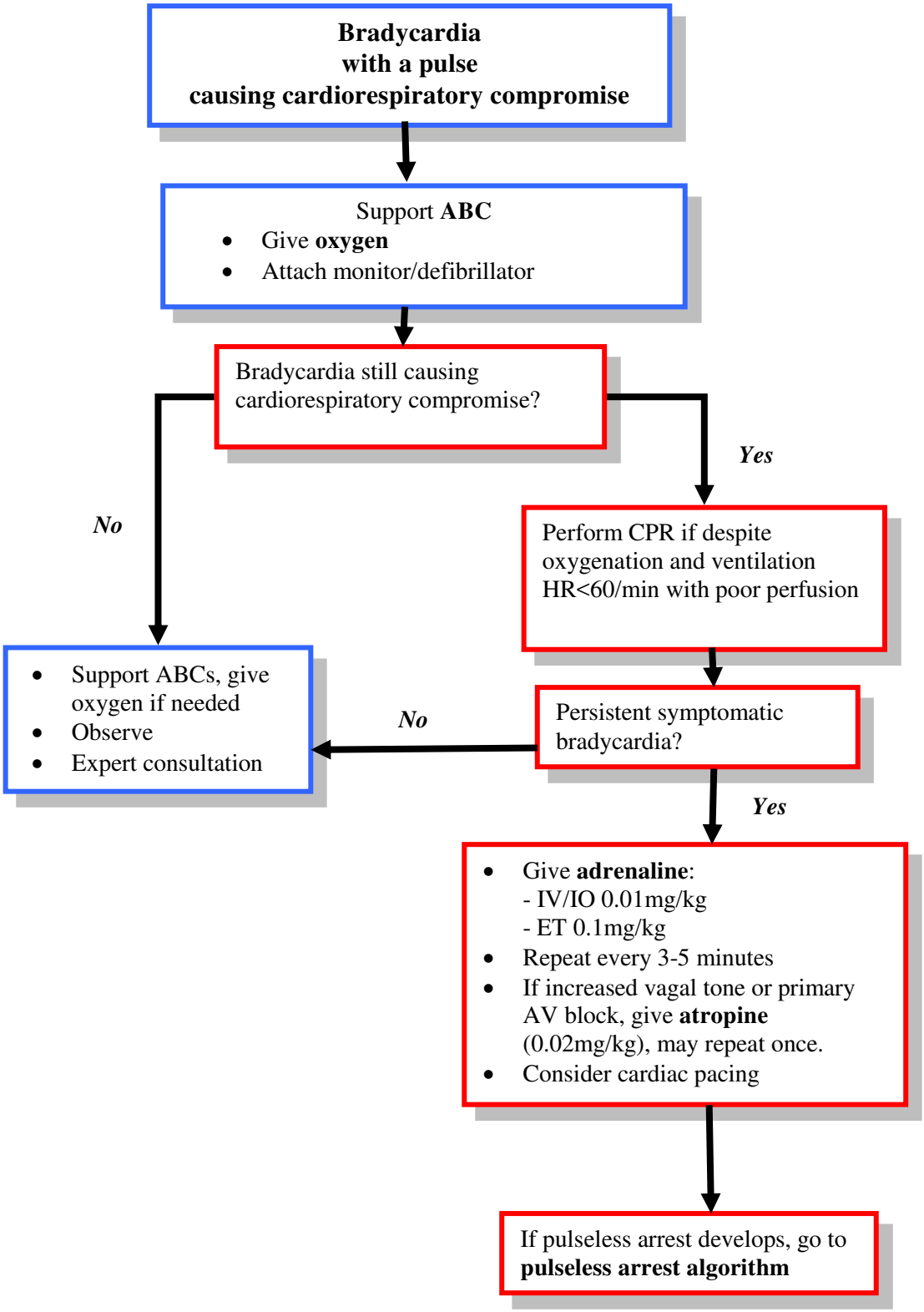
→ Pulse present / return of spontaneous circulation

- Post-resuscitation care

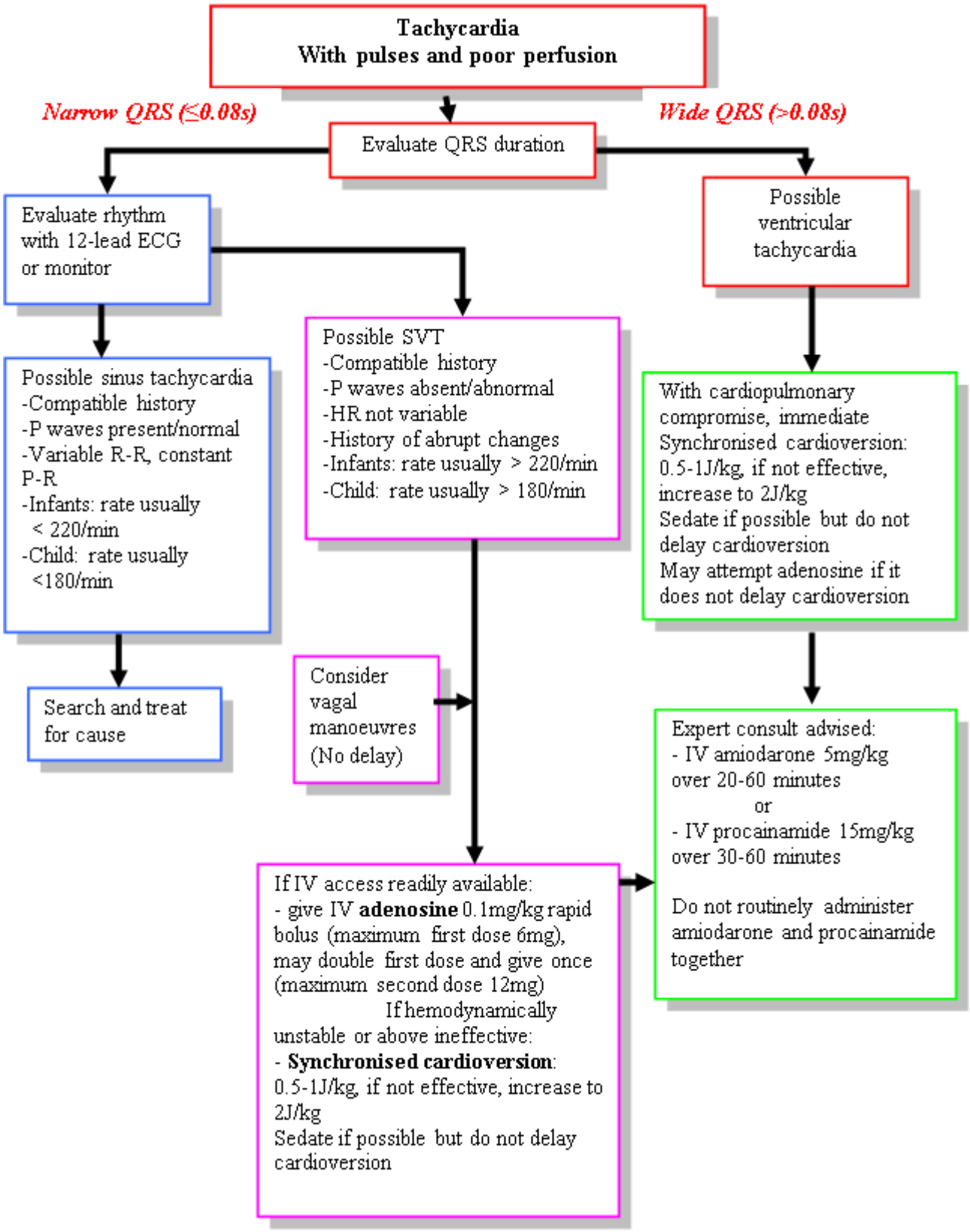
** : **Search for and treat possible contributing factors (Hs & Ts):**

- *Hypovolemia*
- *Hypoxia*
- *Hydrogen ion (acidosis)*
- *Hypo-hyperkalemia*
- *Hypoglycemia*
- *Hypothermia*
- *Trauma*
- *Toxins*
- *Tamponade, cardiac*
- *Tension pneumothorax*
- *Thrombosis (coronary or pulmonary)*

4. ALGORITHM FOR BRADYCARDIA



5. ALGORITHM FOR TACHYCARDIA



6. ALGORITHM FOR NEWBORN RESUSCITATION