COMMON CRISES IN PAEDIATRIC ANAESTHESIA

1. LARYNGOSPASM

Laryngospasm is the sustained closure of the vocal cords resulting in the partial or complete loss of the patient's airway. 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.

Factors predisposing to larygngospasm include: insufficient depth of anaesthesia, airway hyperreactivity, airway irritation from secretions, blood, or malpositioned airway devices.

Management:

Prevention

Maintain adequate depth of anaesthesia, avoid premature stimulation of the patient and/or airway. During emergence, patients should be extubated either in a deep plane of anaesthesia or fully awake but not in-between.

Treatment:

Prompt recognition and early correction is essential to re-establish ventilation and oxygenation as soon as possible

1. **100% O_2, apply CPAP** via mask and increase the depth of anaesthesia with an intravenous agent (e.g. propofol). Suction secretions if required.

2. 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.

Reference:

1. Gavel G and Walker RWM. Laryngospasm in anaesthesia Contin Educ Anaesth Crit Care Pain first published online August 26, 2013 doi:10.1093/bjaceaccp/mkt031

2. HYPERCYANOTIC/ "TET" SPELLS

Most frequently occurs in young infants with Tetralogy of Fallot but may occur with other congenital heart defects that have pulmonary or subpulmonary stenosis and a VSD, at any age. "Tet" spells may be best thought of as an imbalance between pulmonary and systemic
vascular resistance favouring decreased pulmonary flow and increased right-to-left shunting. Hypoxemia, metabolic acidosis, hyperpnea, increased systemic venous return, catecholamines,
and pulmonary vasoconstriction are thought to be involved.

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.

Management:

- Stop precipitating factors, increase depth of anaesthesia
- Maintain airway, 100% 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.
- Refer to Cardiology. Patient may need early, urgent correction of TOF if the 'Tet' spells are frequent.

References:

2. Paediatric Cardiac Anaesthesia. Carol Lake, 4th Edition. Appleton and Lange, 2004, pp 348-349.
3. 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 of packed red cells.

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 and 0.5 to 1 size smaller readily available. Surgeon in OT.

(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. 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:

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 and scrubbed up in OT.

Prepare ETT 1-2 sizes smaller than calculated size

Conduct of Anaesthesia:

Gas induction with mask CPAP in the presence of parent.

Establish i.v. access and apply monitors after induction.

Intubate patient orally under deep inhalational anaesthesia.

Do blood cultures and take bacterial swab from the epiglottis

Give antibiotics as requested by ICU paediatricians, usually Ceftriaxone.

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. 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. In: Motoyama EK, Davis PJ, editors. Smith's Anaesthesia for Infants and Children. 7th ed. Philadelphia: Mosby Elsevier; 2006.
3. Sumner E, Hatch DJ. Paediatric Anaesthesia. 2nd Edition, 1999, Edward Arnold Ltd.

5. SUSPECTED ANAPHYLAXIS DURING ANAESTHESIA:

ANAPHYLAXIS IS A LIFE THREATENING CRISIS

- Prompt diagnosis requires early recognition of signs & symptoms.
- Early treatment with adrenaline & fluid replacement is crucial
- Severe anaphylaxis can lead to cardiovascular collapse and death

Immediate management

- ABC approach (Airway, Breathing, and Circulation)
- Remove all potential causative agents and maintain anaesthesia, if necessary, with an inhalational agent.
- **CALL FOR HELP** and crash cart, note the time.
- Maintain the airway and administer oxygen 100%. Intubate and ventilate with oxygen if necessary.
- Elevate the patient's legs if there is hypotension.
- If appropriate, start cardiopulmonary resuscitation immediately according to Advanced Life Support

- **Adrenaline i.v.**
  1 to 10 µg/kg (0.01 to 0.1 ml/kg of 1:10 000 solution ie.100 µg/ml), titrate to BP
- Several doses may be required if there is severe hypotension or bronchospasm. Consider starting an intravenous infusion of adrenaline.
- Give saline 0.9% or lactated Ringer's solution 20 ml/kg at a high rate (large volumes may be required).

Secondary management

- Hydrocortisone i.v. 2-4 mg/kg (max 200mg)

- If the blood pressure does not recover despite an adrenaline infusion, consider:
  - IV phenylephrine 10 µg/kg
  - IV noradrenaline (0.3 x body weight into 50ml N/S
  - IV vasopressin (bolus 0.03 units/kg then 2 units/h)

- Treat persistent bronchospasm with an i.v. infusion of salbutamol. If a suitable breathing system connector is available, a metered-dose inhaler may be appropriate. Consider giving
- IV Aminophylline 10 mg/kg over 1 hour (max 500 mg) or
- IV Magnesium sulphate 50% (500 mg/mL): 50 mg/kg to max 2 g over 20 minutes

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.
2. Australian and New Zealand Anaesthetic Allergy Group Anaphylaxis Management Guidelines. Last modified on: 21 April 2016 http://anzaag.com/Mgmt%20Resources.aspx

6. LATEX ALLERGY

Latex Allergy Cart**:**
Special anaesthetic equipment and care is required when a patient with suspected or known latex allergy presents for surgery.

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

- Infusion sets should have 3-way stopcocks
- Cover the OT table with non-latex materials 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)

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 Major OT Paeds recovery area, and day surgery OT outside OT2. It should be brought into theatre for any suspected 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 areas.

1.RECOGNITION
Signs of MH
Unexplained tachycardia AND
Unexplained increase in oxygen requirement (Previous uneventful anaesthesia does not rule out MH)

- Increased $ETCO_2$
- Trunk or limb rigidity
  Masseter spasm or trismus
- Unstable/ rising blood pressure
- Respiratory and metabolic acidosis
  Temperature changes are a late sign

2. IMMEDIATE MANAGEMENT
CALL FOR HELP, GET DANTROLENE, MH Kit.
Allocate specific tasks

- Notify surgeon
- Stop all trigger agents (volatiles)
  VentilateNotify surgeon

- Install clean breathing system and HYPERVENTILATE with 100% O_2 10L/min
  Maintain anaesthesia with intravenous agent
  ABANDON/FINISH surgery as soon as possible
  Muscle relaxation with non-depolarising neuromuscular blocking drug

3. TREATMENT AND MONITORITNG

(A) **Dantrolene** 2.5mg/kg IV rapidly
Repeat bolus 1mg/kg until signs and symptoms of MH subside and titrate to HR, muscle rigidity and temperature (up to 10mg/kg)

(B) **Cool** the patient if T > 39 □C cold IV saline, ice saline lavage, surface cold packs. Stop when T < 38 □C and falling

(C) **Treat:**

- Hyperkalaemia: NaHCO3, hyperventilation, calcium chloride, glucose/insulin.
  Glucose/insulin:
  10U soluble insulin / 50ml 50% dextrose (adult),
  0.15U soluble insulin/kg / 10ml 50% dextrose/kg (child)
  Calcium chloride 10mg/kg for life threatening arrhythmias
- Arrhythmias: magnesium/amiodarone/metoprolol AVOID calcium channel blockers - interaction with dantrolene (hyperkalaemia, cardiac arrest)
- Metabolic acidosis: hyperventilate, $NaHCO3^-$
- Myoglobinaemia: forced alkaline diuresis (mannitol/furosemide + $NaHCO3^-$); may require renal replacement therapy later
- DIC: FFP, cryoprecipitiate, platelets
- Check plasma CK as soon as possible

(D) Monitor

Core & peripheral temperature

$ETCO_2$, SpO_2, ECG

Invasive blood pressure, CVP

Continue monitoring in ICU, repeat dantrolene as necessary

(E) Investigate

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

(F) Stabilize and send to ICU.

POST-CRISIS PROBLEMS

A **A**lkalinize urine & maintain diuresis, 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.

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 .....

This guideline is not a standard of medical care. The ultimate judgement with regard to a particular clinical procedure or treatment plan must be made by the clinician in the light of the clinical data presented and the diagnostic and treatment options available.

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%* $NaHCO_3$*/ 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.

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. http://www.mhaus.org 24h Hotline : 800-644-9737
2. Malignant Hyperthermia Crisis. AAGBI Safety Guideline 2011.

8. 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 sometime after an initial injection

2. IMMEDIATE MANAGEMENT

- Stop injecting the LA.
- Call for help
  Maintain and/or secure airway.
- 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 (1st choice) or thiopental in small incremental doses. AVOID Propofol in presence of haemodynamic instability
- Assess cardiovascular status throughout
- Consider drawing blood for analysis, but do not delay definitive treatment

TREATMENT

In the presence of Circulatory Arrest,

- Start CPR. Manage arrhythmias using ACLS protocol, (arrhythmias may be very refractory to treatment)
  For ventricular arrhythmias, amiodarone is preferred; avoid tAVOID vasopressin, beta blockers, Ca channel blockers lignocaine or procainamide.
- Consider the use of cardiopulmonary bypass if available

Lipofundin N 20%. (Kept in OT pharmacy store)

Give an initial intravenous bolus injection of Lipofundin 20% **1.5ml/kg** over 1 min AND start an infusion at 15ml/kg/hour.

After 5 minutes, if cardiovascular stability has not been restored:

Consider **a maximum of two** repeat boluses (1.5ml/kg)
A maximum of **three** boluses can be given (including the initial bolus) Leave 5 minutes between each bolus.

- **Double** the rate to **30 ml/kg/h** and continue infusion until stable and adequate circulation restored or **maximum dose of 12ml/kg of lipid emulsion** given
- 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
- Lignocaine should not be used as an anti-arrhythmic therapy

3. 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

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)

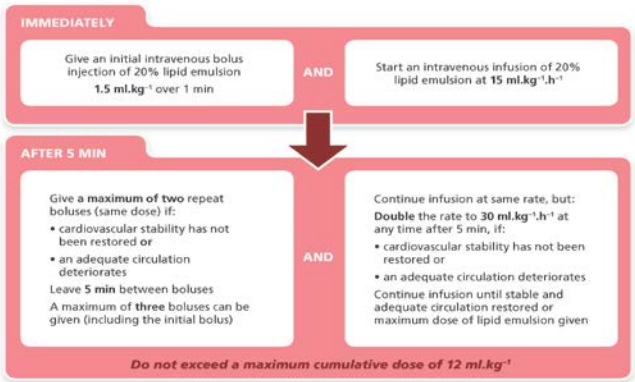
- Propofol is not a suitable substitute for lipid emulsion
- Lidocaine should not be used as an anti-arrhythmic therapy

4 Follow-up

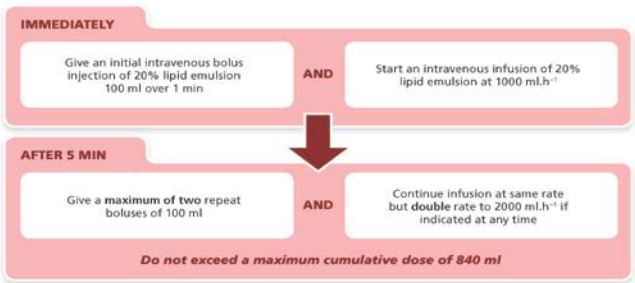
- Arrange safe transfer to a clinical area with appropriate equipment and suitable staff until sustained recovery is achieved
- Exclude pancreatitis by regular clinical review, including daily amylase or lipase assays for two days
- Report cases as follows:
  - in the United Kingdom to the National Patient 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:
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This Safety Guideline is endorsed by the Australian and New Zealand College of Anaesthetists (ANZCA).