Guideline

Local Anaesthetic Systemic Toxicity

Document ID	CHQ-GDL-00731	**Version no.**	1.0	**Approval date**	05/11/2018
Executive sponsor	Executive Director Medical Services			**Effective date**	05/11/2018
Author/custodian	Director, Paediatric Emergency Department			**Review date**	05/11/2021
Supercedes	New				
Applicable to	Medical and Nursing staff working in Children's Health Queensland				
Authorisation	Executive Director Clinical Services (QCH)				

Purpose

The purpose of this guideline is to assist clinicians in understanding the circumstances, signs, symptoms, investigations and management of local anaesthetic systemic toxicity. Managing methaemoglobinaemia is also included in this guideline.

Scope

This guideline primarily applies to all staff involved in the care and management of children who have had local anaesthetics administered.

Guideline

Introduction

Local anaesthetic systemic toxicity can develop in a patient after local anaesthetic is administered via any route. It usually occurs from inadvertent intravascular administration.[1,2] Local anaesthetic systemic toxicity can be severe causing catastrophic effects for the central nervous system (CNS) and cardiovascular system (CVS), including cardiac arrest[3-5]. This guideline discusses signs and symptoms of local anaesthetic systemic toxicity, the investigations warranted, and its management principles. While this guideline exists primarily to direct the initial assessment and management of patients with suspected local anaesthetic systemic toxicity, it does not aim to replace phone consultation with a toxicologist.

Risk factors for local anaesthetic systemic toxicity

- Extremities of age (<4 months), liver dysfunction, renal dysfunction, cardiac conduction disease, ischaemic heart disease, highly vascular block site, pregnancy, carnitine deficiency and metabolic disturbance (e.g. acidosis)[4].

Signs and symptoms of local anaesthetic systemic toxicity

The symptoms that evolve and the speed in which they occur are variable, and are dependent on route of systemic absorption, local anaesthetic plasma concentration and the type of local anaesthetic used. There may be rapid onset of clinical manifestations.

Suspect local anaesthetic systemic toxicity if there is any physiological derangement after local anaesthetic administration.

Signs are often initially neurological (these can be subjective and difficult for infants/young children to report):

- Tinnitus, drowsiness, dizziness, anxiety, confusion, perioral numbness, blurred vision, dysarthria, limb twitching, tremor, and metallic taste.

More serve local anaesthetic systemic toxicity involves two main systems:

- CNS – manifesting as seizure activity, apnoea and coma.
- CVS – tachycardia and hypertension or bradycardia and hypotension. This can progress to ventricular dysrhythmias and asystole[6,7].

Management of local anaesthetic systemic toxicity

1. Stop local anaesthetic administration.
2. Call for help – resus team and toxicologist support (telephone Poisons Information Centre **131 126**).
3. Maintain airway and oxygenation:
    a. Avoid hypoxia, hypercarbia and acidosis (as they potentiate local anaesthetic systemic toxicity).
    b. Hyperventilate to pH 7.5.
4. Investigations:
    a. Blood gas – methaemoglobin concentration and electrolytes.
    b. ECGs – looking for Na+ channel blockade signs – prolonged PR, QRS and QT intervals, large terminal R wave in aVR.
5. Manage ventricular dysrhythmias and provide cardiovascular support as per standard advanced life support guidelines being mindful of the following:
    a. Adrenaline may potentiate dysrhythmias, consider lower dose adrenaline boluses (<1mcg/kg).
    b. Treat hypotension with 20 mL/kg fluid bolus +/- inotropes.
    c. Consider ECMO in consultation with Paediatric Intensive Care Unit (PICU)[3].
    d. Administer sodium bicarbonate 2 mEq/kg, repeated every 1 - 2 mins until a perfusing rhythm is seen[6].
6. Manage seizures with benzodiazepines (e.g. midazolam 0.05-0.2 mg/kg IV bolus)[3]:
    (a) Phenytoin is contraindicated.

7. The antidote intravenous (IV) lipid emulsion (clinoleic) can be considered for life-threatening cardiovascular toxicity which is not responding to resuscitative methods outlined above. Its efficacy is unproven[8-10]:

   (a) 1.5 mL/kg of 20% IV lipid emulsion over 1 minute followed immediately by infusion (0.25 mL/kg/min, 15mLkg/hr). A further two boluses (at 5 minute intervals) can be considered if no response[6, 11-12].

   Please note: IV lipid emulsion is stored in the green utility room in Lady Cilento Children's Hospital (LCCH) Emergency Department, in theatre, PICU and selected wards at LCCH.

Methaemoglobinaemia

Methaemoglobinaemia can also occur after local anaesthetic administration. It is not dose related. Neonates are more at risk. Methaemoglobinaemia is more common after benzocaine (often dental anaesthetics), lignocaine or prilocaine (EMLA) administration.

Clinical signs include blue discolouration of mucous membranes. Cellular hypoxia evolves. Do not rely on pulse oximetry.

If clinical signs appear, please collect a venous blood gas to check MetHb level.

Management

- Oxygen therapy.
- Methylene blue (1 mg/kg) in consultation with a toxicologist:
  - Often given if MetHb > 30% or if > 20% and symptomatic.
  - Contraindicated in G6PD deficiency, methaemoglobinaemia reductase deficiency, nitrite-induced methaemoglobinaemia, and hypersensitivity. Renal impairment needs dose adjustment[6].

Conclusion

Signs of local anaesthetic systemic toxicity are important to be aware of in areas where local anaesthetics are frequently used. Managing the clinical manifestations of local anaesthetic systemic toxicity can be complex. This guideline provides a framework for the treatment of local anaesthetic systemic toxicity, but it does not replace discussion with a clinical toxicologist.

Consultation

Key stakeholders who reviewed this version:

- SMO LCCH Emergency Department
- SMO PAH Emergency Department and Clinical Toxicology Unit
- SMO LCCH Anaesthetic Department

Guideline revision and approval history

Version No.	Modified by	Amendments authorised by	Approved by
1.0	Director, Paediatric Emergency Department	Divisional Director, Critical Care	Executive Director Medical Services

Keywords	local anaesthetic systemic toxicity, methaemoglobinaemia, lignocaine, benzocaine, clinoleic, intravenous lipid emulsion, 00731
Accreditation references	NSQHS Standards: 1, 4, 8

References and suggested reading

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