Local anaesthetic systemic toxicity: A critical consideration for OR nurses

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Introduction

Local anaesthetics (LAs) are medications administered by many types of healthcare workers, including anaesthesiologists, dentists, surgeons, emergency department physicians, and nurses. Local anaesthetic systemic toxicity (LAST) refers to a spectrum of clinical manifestations arising from excessive absorption of LAs. Although reported incidences of major LAST events is very low (0.04–1.8/1000 for nerve blocks), likely due to increased awareness and preventive protocols, their potential to cause life-threatening cardiovascular and neurological complications necessitates vigilance. Understanding the toxic thresholds of different LAs (Table 1) and recognizing early symptoms is crucial for timely intervention and effective management.

Table 1

Commonly Used LAs and Their Maximum Recommended Doses

Anaesthetic	Maximum dose (per lean body weight)
2% lidocaine without epinephrine	4.5 mg/kg
2% lidocaine with epinephrine	7 mg/kg
0.5% ropivacaine	3 mg/kg
0.5% Bupivacaine	2.5 mg/kg

Note. (Gadsden, 2013; Warren & Pak, n.d.).
LA = local anaesthetic.

It is important to recognize that LA doses are additive. For instance, administering 2.5 mg/kg of 2% plain lidocaine along with 1.5 mg/kg of ropivacaine can result in toxicity. The addition of epinephrine helps elevate the toxicity threshold by inducing vasoconstriction, thereby slowing systemic absorption. It also serves as an indicator of accidental intravascular injection, as it triggers tachycardia (15 mcg epinephrine results in an increase in heart rate [HR] >10 beats/min) and hypertension (a rise in blood pressure [BP] >15 mmHg).

Risk factors

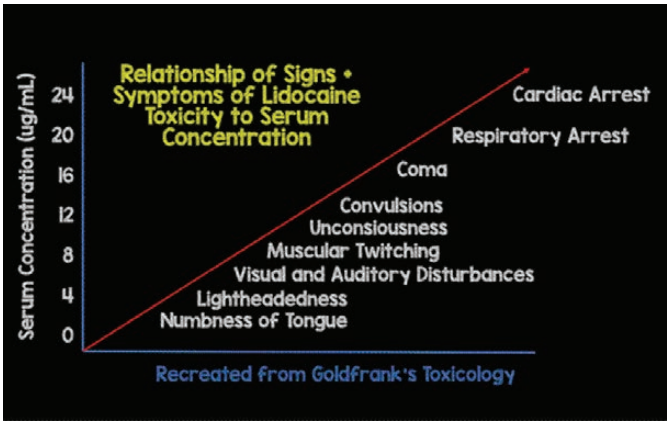
- Extremes of ages
- Underlying cardiac condition
- Hepatic disease
- Renal insufficiency
- Pregnancy
- Route of administration (Intravenous > Intercostal > Caudal > Epidural > Brachial plexus > Local)

Prevention

- Slow incremental injection
- Aspiration before injection
- Every dose is a test dose
- Monitoring in place for early detection

Figure 1

Signs and Symptoms



Note. (Warren & Pak, n.d.)

Management of LAST (Anesthesia Considerations, n.d.)

1. Stop injection/infusion.
2. Call for help!
   - get qualified assistance
   - get LAST kit
   - get checklist
3. Manage the airway
   - give 100% O_2, if necessary, control ventilation with facemask, supraglottic device or endotracheal tube [ETT]
   - prevent hypoxia and acidosis, as both aggravate LAST).
4. Suppress seizure: Benzodiazepines preferred, avoid/minimize propofol if hemodynamically unstable; succinylcholine will terminate tonic-clonic muscle activity, but not central nervous system (CNS) electrical activity.
5. Alert nearest facility having cardiopulmonary bypass.

6. Manage arrhythmias and provide cardiovascular support
   - If pulseless, start cardiopulmonary resuscitation (CPR)
   - Administer amiodarone as first line antiarrhythmic (usual doses per advanced cardiac life support [ACLS]), avoid lidocaine, other sodium channel blockers, vasopressin, calcium channel blocker, and beta blockers.
   - Reduce bolus dose of epinephrine to ≤ 1 mcg/kg to avoid arrhythmogenic effects.
7. Lipid emulsion therapy:
   - Precise volumes and rates of lipid emulsion are not crucial. Rapidly administer 20% lipid emulsion at first signs of LAST, 1.5 ml/kg (70 kg = 105 ml) over 1 minute, then infusion at 0.25 ml/kg/min.
   - Repeat bolus once or twice and double infusion rate for persistent cardiovascular collapse
   - Continue infusion for at least 10 minutes after hemodynamic stability is achieved
   - Maximum dose ~ 10 ml/kg
   - Propofol is not a substitute for 20 % lipid emulsion.
8. Failure to respond to lipid emulsion and vasopressor requires prompt institution of extracorporeal membrane oxygenation (ECMO).
9. Transfer patient to monitored setting.

Author notes

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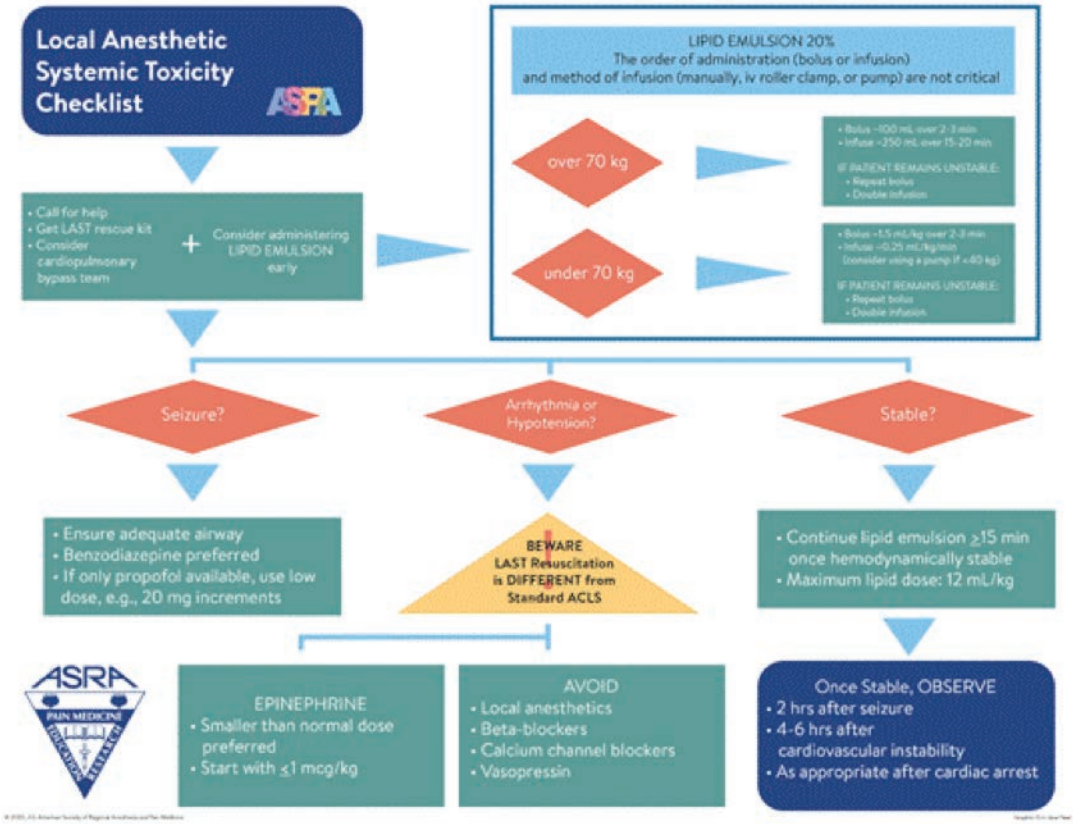
Figure 2

American Society of Regional Anesthesia and Pain Medicine: A Local Anesthesia Society Checklist



Note. (Neal et al., 2021; Braehler, 2020). Copyright © 2020 by the American Society of Regional Anesthesia and Pain Medicine.