

Local Anesthetic Dosing Calculator

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Abstract

The Local Anesthetic Dosing Calculator is a clinical tool designed to determine the maximum safe dose of local anesthetics based on drug concentration and patient body weight. It assists healthcare providers during procedures requiring higher anesthetic doses, such as large laceration repairs and intradermal injections. By calculating individualized maximum dosages, the calculator supports safe administration practices and helps prevent toxicity and adverse events, including local anesthetic systemic toxicity (LAST). In addition, this tool outlines the characteristics of LAST, how to minimize LAST, and provides evidence-based management steps to guide providers in the event of this adverse reaction.

I. HOW TO USE

When to Use

Use the dosing calculator during procedures involving higher doses of local anesthetics (i.e. nerve blocks, regional anesthesia) to reduce risk of toxicity and adverse effects including local anesthetic systemic toxicity (LAST).

Table 1. Suggested local anesthetic dosing. (Adopted from [Long 2022](#))

Local Anesthetic	Plain maximum dose	With epinephrine maximum dose
Bupivacaine/Levobupivacaine	2 mg/kg	
Lidocaine	5 mg/kg	7 mg/kg
Mepivacaine	5 mg/kg	7 mg/kg
Prilocaine	6 mg/kg	
Ropivacaine	3 mg/kg	

Important: Use ideal or lean body weight for dosing calculation

Pearls / Pitfalls

- The anesthetic toxic dose is based on [ideal body weight](#).
- Local anesthetic systemic toxicity (LAST) is rare but potentially life-threatening. Symptoms can be divided into two main categories:

- Neurotoxicity: perioral numbness, metallic taste, mental status changes or anxiety, visual changes, muscle twitching, and ultimately, seizures, coma, and respiratory depression.
- Cardiovascular toxicity: tachycardia, hypertension, ventricular arrhythmias, and/or asystole.
- Patient risk factors for LAST include:
 - Extremes of age.
 - Decreased muscle mass.
 - Renal, hepatic, or cardiac disease.
 - Metabolic disturbances (acidosis, hypoxia, hypercarbia).
 - Pregnancy.
- Procedural risk factors for LAST include:
 - Injection into highly vascular areas (highest incidence in paravertebral injections, followed by upper and lower extremity peripheral nerve blocks).
 - Large laceration repairs and intradermal injections.
 - Multiple injections or continuous infusion.
- Ways to reduce the risk of LAST ([Bailey 2025](#), [On'Gele 2024](#)):
 - Calculate the patient's maximum dose.
 - Dilution of anesthetic with normal saline allows for larger volume blocks to be performed without risking toxic doses.

- Vasoconstrictors, such as epinephrine, can be added to decrease rate of absorption and therefore decrease toxic dose.
- Use ultrasound to confirm needle placement.
- Aspirate prior to injecting.
- Perform a slow injection and look for appropriate anesthetic spread when using ultrasound guidance.
- Monitor for development of symptoms.

Why Use

It is important to appropriately dose local anesthetics and reduce the risk of LAST by calculating the maximum dose in advance to reduce risk.

II. NEXT STEPS

Advice

- If the anesthetic dose is above the threshold for toxicity, consider lowering the dosage to the weight-determined range.
- Prepare for adverse events by having a nerve block checklist and having intralipid readily available and easy to access.

Management

LAST is an uncommon but potentially life-threatening complication of local anesthetic use that may be encountered in the ED, hospital, or surgical center. Patients at extremes of age or with organ dysfunction are at higher risk. Inadvertent intra-arterial or intravenous injection, as well as [repeated doses](#) and higher doses of [local anesthetics](#) are associated with greater risk of developing LAST. Using ultrasound guidance, aspirating prior to injection, and utilizing the minimal local anesthetic dose needed are techniques that can reduce the risk of LAST.

Diagnosing LAST

Local anesthetic toxicity results from sodium channel blockade, which affects the central nervous system and cardiac system. The CNS is more sensitive to the effects of local anesthetics than the cardiac system and will generally manifest signs/symptoms of toxicity first.

The presenting symptoms of LAST include perioral numbness, metallic taste, mental status changes or anxiety, visual changes, muscle twitching, and ultimately, seizures, coma, and respiratory depression. Cardiovascular effects include tachycardia, hypertension, ventricular arrhythmias and/or asystole.

Management of LAST: (see guidelines: [American Society of Regional Anesthesia and Pain Medicine Local Anesthetic Systemic Toxicity checklist: 2020 version](#))

Management of LAST requires immediate recognition and a coordinated response, starting with stopping the local anesthetic administration and calling for expert help while initiating a dedicated LAST protocol. Prioritize airway management, airway support with 100% oxygen or noninvasive ventilation, and support circulation according to advanced cardiac life support (ACLS) guidelines. Crucially, avoid calcium channel blockers, beta-blockers, and lidocaine, as they can worsen cardiovascular depression and toxicity; use epinephrine in smaller doses (< 1 mcg/kg) for LAST-induced shock. Seizures should be promptly controlled with benzodiazepines (e.g., midazolam, lorazepam), avoiding propofol which can exacerbate cardiovascular depression. For cardiovascular compromise, including hypotension and life-threatening arrhythmias, 20% lipid emulsion therapy is critical: administer an initial bolus (e.g., 1.5 mL/kg over 1 minute) followed by a continuous infusion (e.g., 0.25 mL/kg/min). Repeat boluses can be given after 5 minutes for 2 or more times for persistent hemodynamic instability. Vigorous resuscitation should continue until stability is achieved, followed by close monitoring in an intensive care setting.

Critical Actions

Multiple variables may influence a patient's risk of developing LAST. This weight-based calculator should be used to generate a rough estimate for toxic doses.

III. EVIDENCE

FORMULA

Max allowable subQ dose based on ideal body weight, mg = max allowable subQ dose for a drug, mg/kg × weight, kg

Max allowable subQ dose based on ideal body weight, mL = max allowable subQ dose for a drug, mg/kg × (weight, kg / 10) × (1 / concentration, %)

Table 1. Suggested local anesthetic dosing. (Adopted from [Long 2022](#))

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Evidence Appraisal

There are no randomized clinical trials involving LAST. Much of the existing evidence is based on case reports, expert opinion, and retrospective anesthesia databases.

Original/Primary & Validation

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Citation	Long B, Chavez S, Gottlieb M, Montrieff T, Brady WJ. Local anesthetic systemic toxicity: A narrative review for emergency clinicians. <i>Am J Emerg Med</i> . 2022 Sep;59:42-48. doi: 10.1016/j.ajem.2022.06.017
Type of study	Narrative Review
Number of patients	n/a
Inclusion criteria	n/a
Exclusion criteria	n/a
Study endpoints and findings	n/a
Strengths	Up-to-date and evidence based diagnosis and management of LAST, toxic anesthetic doses
Criticisms	No randomized clinical trials

Citation	Schwartz DR, Kaufman B. Local Anesthetics. In: Hoffman RS, Howland M, Lewin NA, Nelson LS, Goldfrank LR. eds. <i>Goldfrank's Toxicologic Emergencies</i> , 10e. McGraw-Hill Education; 2015. Accessed November 19, 2025. https://accesspharmacy.mhmedical.com/content.aspx?bookid=1163&sectionid=65097021
Type of study	Narrative Chapter Review
Number of patients	n/a
Inclusion criteria	n/a
Exclusion criteria	n/a
Study endpoints and findings	n/a
Strengths	Well written textbook chapter. Reviewed literature over many decades with 124 references.
Criticisms	No randomized clinical trials

Clinical Practice Guidelines

- AAGBI Safety Guideline. Management of Severe Local Anaesthetic Toxicity. <https://anaesthesiologists.org/Home/Resources-publications/Guidelines/Archived-guidelines/Management-of-severe-local-anaesthetic-toxicity>
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SUPPLEMENTARY MATERIALS

Local Anesthetic Dosing Figure

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