Local Anesthetic Systemic Toxicity:

A Guideline to Proper Response

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Proficiency in the identification of symptoms pertaining to local anesthetic systemic toxicity (LAST) is key in preventing patient mortality. Local anesthetic toxicity can happen to any patient in any setting utilizing regional anesthetic techniques. Procedure settings that establish protocol, properly prepare, and establish continuing education regarding LAST have a greater chance of preventing and resuscitating patients receiving local anesthetics for acute pain management. *The American Society of Regional Anesthesia & Pain Medicine (ASRA)* has developed a set of guidelines to educate clinicians on identifying and treating local anesthetic toxicity. As stated, a proper preparedness plan is key in preventing these types of events from occurring.

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The ASRA strongly encourages facilities to develop a plan to manage these types of events when they occur. The organization advises facilities and anesthesia provider groups to make a "Local Anesthetic Toxicity Kit"— (ASRA, 2011) and encourages these instructions are clearly posted. The efficient and effective utilization of this treatment kit will help save lives when a toxicity event occurs.

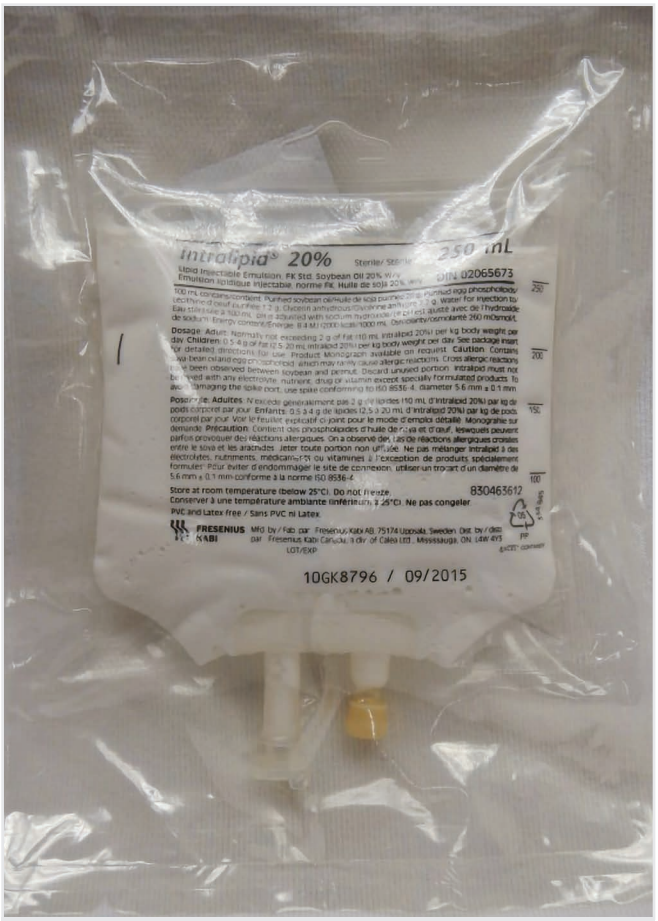
Based on the ASRA's Checklist, the ideal Local Anesthetic Toxicity Kit (AKA Lipid rescue kit) should include everything necessary to treat such events. This Lipid rescue kit's contents will be touched on in further detail later in this response. In the ideal world, it is encouraged to prevent local anesthetic toxicity events from occurring. So what steps can be put in place to assist clinicians in preventing such events from happening?

The primary way a provider can prevent the LAST event from occurring on the front end would be to "Be Sensible"— (ASRA, 2011). ARSA's states that to avoid toxicity, the ACT should utilize the lowest dose of local anesthetic necessary to achieve the desired depth and duration of nerve blockade (ASRA, 2011). Second, it is important for the team to be knowledgeable on the patient populations that are more susceptible to local anesthetic toxicity. These populations include but are not limited to: Those of advanced age, patients with severe cardiac dysfunction (especially those with a low ejection fraction), mitochondrial disorders, patients on sodium channel blockers, and any other patients that may have liver or kidney abnormalities (APSF, 2020). The most susceptible patients are those with extraordinarily low ejection fractions (EF), and those of small stature and/or low muscle mass (ASRA, 2011).

Another way to prevent a LAST event is through pharmacological markers, such as using 1:200,000 (5mcg/

"Small patient size is a risk factor for LAST. The role of skeletal muscle as a large reservoir compartment for local anesthetic may explain this phenomenon, and was confirmed in rat models"

~ Weinberg, APSF, 2020 ~



mL) (Neal et al, 2011) concentration of epinephrine mixed into the local anesthetic. The use of epinephrine can be used to disseminate whether or not the care team is injecting the anesthetic intravascularly, limiting the risk of a potential LAST event. Another way to prevent such injections would be to ensure that the provider/assistant (Cer.A.T.T.) is consistently aspirating (looking for blood return) before each incremental injection of local anesthetic. It is important to note incremental injection, patience during neuraxial and peripheral nerve blockade is essential to keeping the patient safe and promoting a successful block.

Finally, vigilance in monitoring the patient's hemodynamic state and clinical presentation during and after the procedure is essential in detecting and responding to LAST events. The utilization of the *American Society of Anesthesiologists (ASA)* standard monitors must be considered and most certainly utilized before the administration of any local anesthetics. Patient monitoring should begin prior to the block procedure and continued for at least 30-minutes post-injection (Neal et al, 2011). Signs and symptoms of Local Anesthetic Toxicity do not always readily present themselves after a patient has been

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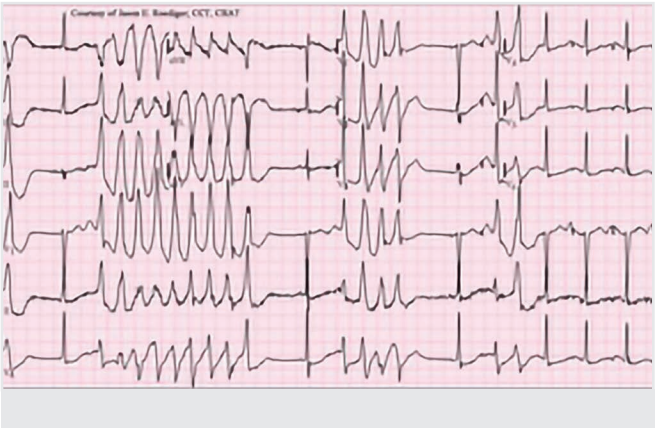
injected with a local anesthetic. The signs and symptoms will vary depending on the volume the patient was exposed to during the procedure. Central nervous system symptoms occur in three stages depending on the severity of exposure: *Excitation, Depression, and Non-specific.*



Stage three: Non-specific is the most advanced stage symptoms of exposure; this is presented as metallic taste, circumoral (surrounding the mouth) numbness, diplopia (double vision), tinnitus (ringing of the ears), and dizziness (Neal et al., 2011).

Severe exposure to Local Anesthetic Systemic Toxicity will eventually cause cardiovascular symptoms. Initially, symptoms will present in a hyper-dynamic fashion in the form of hypertension, tachycardia, and ventricular arrhythmias, such as ventricular tachycardia, torsades de pointes, and ventricular fibrillation. After this initial excitation presentation, the patient will generally present with progressive and worsening hypotension, the development of an Atrioventricular heart block, and, if left untreated, asystole (Neal et al., 2011). The rapid excitation and precipitous cardiovascular decline are why lipid rescue protocols are important to a facility in preventing and treating the LAST event.

Pharmacological treatment of LAST events should occur is a procedural fashion as provided by the *American Society of Regional Anesthesia & Pain Medicine*. The first step of this process is to get help. A provider's initial focus should be airway management, in which the patient should be ventilated with 100% oxygen. The next step is seizure suppression, which is managed through the use of benzodiazepines. Next, a facility capable of cardiopulmonary bypass (CPB), or extracorporeal membrane oxygenation (ECMO) services should be notified in the event the LAST event progresses (Weinberg, 2010). The subsequent step in this process is to address the cardiac arrhythmias. This should be done by initiating BLS/ACLS procedures (Neal et al., 2011). Medications that should be readily available to the care team are vasopressin, calcium channel blockers, and beta-blockers. It is also important to note that any further administration of local anesthetics should be avoided; in this case, the avoidance of 2% lidocaine is typically used in ACLS algorithms (note: medications and dosages may have to be modified). It is also recommended that epinephrine be limited to less than 1 mcg/kg for treating hypotension (Neal et al, 2020).

When there are signs of cardiovascular collapse, propofol should be avoided. Propofol is a cardiovascular depressant; its composition of lipids is known to be too low to provide any benefit to local anesthetic toxicity. The use of propofol is discouraged, especially when there is a risk of cardiovascular collapse (Neal et al., 2011).

Lipid emulsion therapy should initially be administered as a bolus. This dose should equate to 1.5 mL/kg over one minute.

Lipid emulsion therapy should initially be administered as a bolus. This dose should equate to 1.5 mL/kg over one minute. This infusion should be continued after the initial bolus over 10 minutes after cardiovascular stability has been obtained. The lipid infusion should be infused at a rate of 0.25 mL/kg/min. This rate should be increased to 0.5 mL/kg/min if symptoms of cardiovascular collapse persist (ie. hypotension). The recommended upper limit of a lipid emulsion infusion is approximately 10 mL/kg for 30-minutes.

After a local anesthetic toxicity event, it is advised to continue ASA monitors for more than 12 hours. This is mainly because symptoms of cardiovascular depression can persist or reoccur long after treatment (Weinberg, 2010). This event should be reported for statistical data purposes to the necessary websites provided in this paper's sources.

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With proper facility protocols in place, Local Anesthetic Systemic Toxicity events can be avoided, and patient lives can be saved. The prevention of a negative LAST event can be avoided, in most cases, if the Provider and technologists are prepared for the event beforehand, sensible in their blockade administration and vigilant in their monitoring (Neal et al., 2012).

References

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Continuing Education Quiz

To test your knowledge on this issue's article, provide correct answers to the following questions on the form below. Follow the instructions carefully.

1. What organization recommends medical centers assemble a LAST toolkit?
a. ASATT
b. ASRA
c. AAAA
d. AANA

2. What is the front-end way the ACT can prevent a LAST event?
a. "Be sensible"
b. "Act quickly"
c. Initiate a code-blue
d. "Act irrationally"

3. Patients with mitochondrial disorders are more susceptible to the LAST event?
a. True
b. False

4. What patients are the MOST susceptible to developing LAST?
a. Mitochondrial disorders
b. Advanced age
c. Patients on sodium channel blockers
d. Patients with severely low ejection fractions

5. What is the recommended concentration of epinephrine as a marker to prevent a potential LAST event?
a. 1:100,000
b. 1:10,000
c. 1:200,000
d. 1:20,000

6. How long should patient monitoring occur after local anesthetic injection?
a. 15-minutes
b. 30-minutes
c. 60-minutes
d. 90-minutes

7. All are non-specific signs of LAST except?
a. Metallic taste
b. Circumoral numbness
c. Lower limb edema
d. Diplopia

8. What drug class is used to suppress seizures during a LAST event?
a. Lipid emulsion
b. Benzodiazepines
c. Opiates
d. NMBA

9. What drug should be avoided during signs of cardiovascular collapse?
a. Etomidate
b. Phenylephrine
c. Propofol
d. Robinul

10. What is the initial dose of lipid emulsion during a LAST event?
a. 1.5mL/kg over 1-minute
b. 1.5mL/kg over 5-minutes
c. 0.25mL/kg over 1-minute
d. 0.25mL/kg over 5-minutes

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