Regional Anesthesia and Lipid Resuscitation for Local Anesthetic Systemic Toxicity

Local anesthetic systemic toxicity (LAST) incidence has increased as regional anesthesia has continued to expand and gain popularity.

Lipid rescue therapy (LRT) is effective in reversing LAST.

Because other safety steps may not prevent intravascular injection, **test dosing with an epinephrine-containing solution may have value**. Any significant changes in heart rate and blood pressure may alert the anesthesiologist to intravascular injection of both epinephrine and anesthetic.

Compared with non-ultrasound techniques, ultrasound guided RA has been associated with reduced rates of inadvertent vascular puncture and reduced LA requirements, resulting in reduction in the risk and severity of LAST.

As LAST is a rare but devastating complication of RA, the availability of lipid emulsion is a patient-safety issue. The *American College of Medical Toxicology (ACMT)* guidelines **recommend that 20 % lipid emulsion should be "immediately available in all areas where potentially toxic doses of local anesthetics are administered."**

Lipid resuscitation was successful in 11 of 12 events in the eight departments that store lipid emulsion. Although we did not assess the circumstances in which lipid emulsion was used, clinical and experimental reports have shown failure of lipid rescue in LAST management. Failures may be due to the physicochemical properties of local anesthetics, an inadequate dose of lipid emulsion and/or interaction between the lipid emulsion and local anesthetics. Optimal methods of administering lipid emulsion have not yet been determined.

There are many commercially available 20% intravenous lipid emulsion preparations. The most prevalent formulations have 100% long-chain fatty acids derived from soybean oil. The formulations with 100% long-chain fatty acids contain linoleic acid (53%), oleic acid (24%), palmitic acid (11%), alpha-linolenic acid (8%), and stearic acid (4%).

Others in the market contain 50% medium-chain fatty acids from coconut oil and 50% long-chain fatty acids from soybean oil. The formulations with 50% medium-chain triglycerides contain caprylic acid (28.5%), capric acid (20%), lauric acid (1%), and caproic acid (0.5%), and the long-chain fatty acids in the formulations contain linoleic acid (29.1%), oleic acid (11%), palmitic acid (7.4%), alpha-linolenic acid (4.5%), and stearic acid (2%).

American Society of Regional Anesthesia (ASRA) has published guidelines for LAST, including recommendations for ILE therapy.

- For patients *over 70 kilograms*, a **rapid 100 mL bolus of 20% lipid emulsion followed by another 200 to 250 mL infusion over 15 to 20 minutes is the recommended course.**
- For patients *below 70 kilograms*, a **rapid 1.5 mL/kg (of lean body weight) bolus of 20% lipid emulsion followed by a 0.25 mL/kg/minute infusion should start.**
- The same bolus dose is repeatable, along with *doubling the infusion rate if cardiovascular instability continues*. The recommended **dosing limit is approximately 12 mL/kg.**
- **Propofol**, which is reconstituted in 10% lipid emulsion***, is not an acceptable ILE therapy alternative*** *for LAST as a much larger volume of 10% lipid emulsion would be needed to match the effects of the more concentrated 20% emulsion*. Also, the cardio depressant effects of propofol would worsen hemodynamic instability.

The early and less frequent *adverse effects* of **intravenous lipid emulsions (ILE)** include:

- Allergic reaction
- Dyspnea
- Hyperlipidemia
- Hypercoagulability
- Irritation

The delayed and less frequent adverse effects of ILE include:

- Transient elevation of liver function test values
- Hepatomegaly
- Splenomegaly
- Thrombocytopenia

Since its initial proposal for bupivacaine toxicity, ILE therapy has become recognized as the **standard treatment for LAST and is recommended for local anesthetic-mediated cardiac arrest.**