RUTGERS

School of Nursing

Nurse Anesthesia Program

Local anesthetic systemic toxicity (LAST) simulation training for healthcare providers in the labor and delivery department

Russell Lynn Memorial Student Lecture Series

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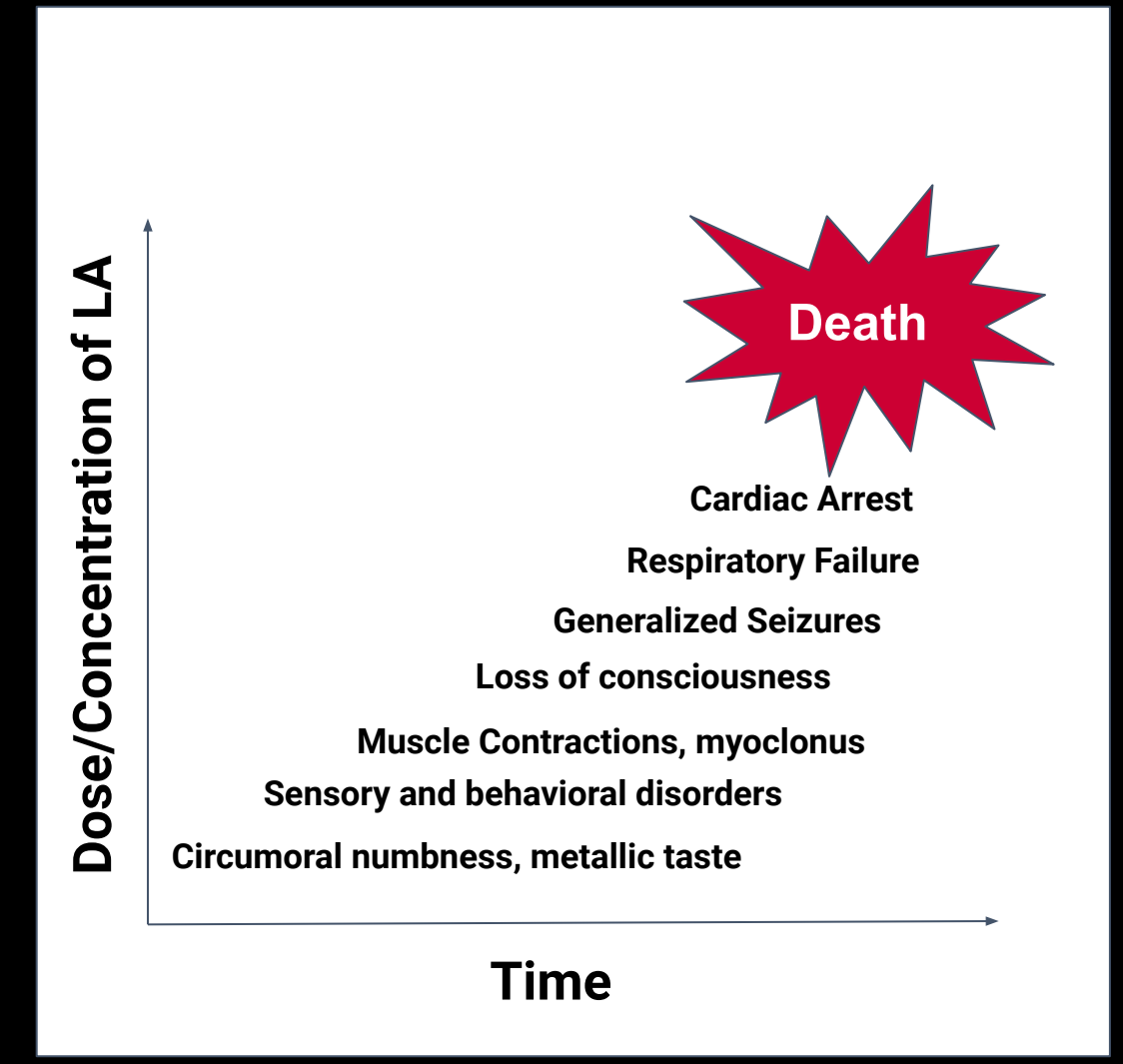
Background and Significance

- Local anesthetic systemic toxicity (LAST) is caused by increased serum levels of local anesthetics.
- LAST is a low frequency, high mortality complication of regional anesthesia.
- Local anesthetics are administered in epidurals and spinal labor analgesia utilized in 74.4% of births at a local 291-bed community medical center (NJ Department of Health, 2021).
- Pregnant woman receiving epidurals and spinals are at higher risk of developing local anesthetic systemic toxicity due to a series of pregnancy-related physiological changes.
- Signs and symptoms of LAST are often nonspecific and can result in delayed recognition and progression of symptoms if staff and providers are not familiar with the presentation (Mock et al., 2021).

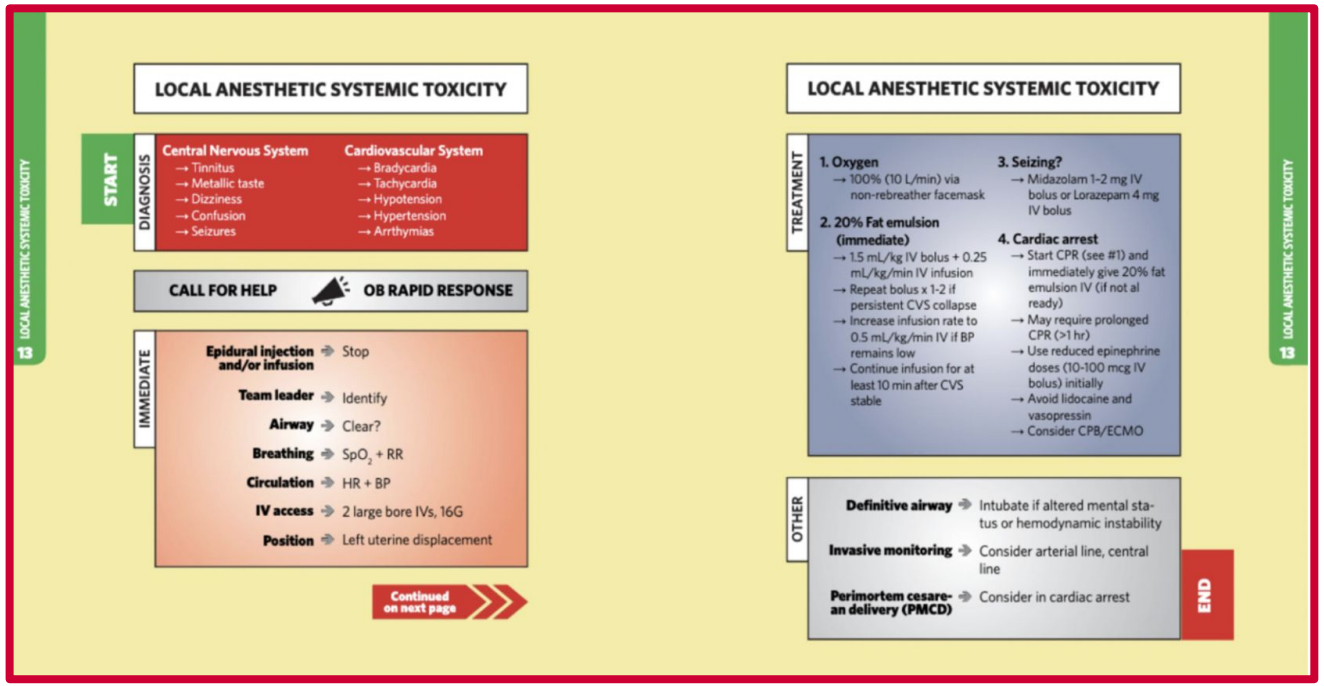
The Progression of LAST

Early symptom recognition is **KEY.**

Early intervention is the goal!



LAST Treatment Interventions



- ❑ Airway management, circulatory support, and reduction of systemic side effects
- ❑ Lipid emulsion therapy
  - ❑ Bolus of 1.5 ml/kg of 20% lipid emulsion over 1 minute
  - ❑ Infusion of 0.25 ml/kg/min until 10 minutes after hemodynamic stability is achieved
  - ❑ Additional bolus and increasing the rate to 0.5 ml/kg/min if patient remains unstable
  - ❑ Maximum recommended dose for initial administration: 10 ml/kg for 30 minutes
- ❑ Modified ACLS guidelines
- ❑ ECMO

The Problem

- Limited clinical experience with identification of LAST signs and symptoms can lead to delayed treatment and catastrophic consequences for patients.
- The medical center's labor and delivery and anesthesia departments leadership have recognized a need for interdisciplinary simulation training focusing on LAST and progression to cardiac arrest due to the department's busy nature and higher volume of new hires.
- Currently, there are no simulation competencies in place regarding LAST progressing to cardiac arrest at this facility.

Implications

- **Impact on Healthcare Quality and Safety:**
  - If LAST does occur, inexperienced staff in a fast-paced environment may not identify symptoms and initiate treatment as quickly as staff with simulation training regarding LAST and cardiac arrest, as it is a low frequency, high mortality event.
  - Lack of knowledge, lack of continuity of care, and lack of standardized procedures and policies contributed to **more than 50%** of preventable maternal deaths (NJ Department of Health, 2022).
  - The cost of maternal morbidity in the US rivals chronic conditions like diabetes.
    - According to the Commonwealth Fund (2021), the costliest maternal health outcomes include: lost productivity (**$6.6 billion)**, cesarean section delivery (**$895 million**), and increased hospital stay shortly before or following childbirth (**$350 million**).

Literature Review

Low-frequency, high-risk event simulation training

- Continuing education and training for LAST reinforces skills and knowledge sets that can lead to early recognition and treatment (Bevil et al., 2020; Mock et al., 2021; Nedialkov et al., 2018).
- Simulation training does not always require expensive equipment and state-of-the-art facilities, but in-situ simulations help providers become more comfortable with quickly locating resources and initiating interventions due to their familiarity with their surroundings (Meeker et al., 2018; Mogler et al., 2020; Owe et al., 2017).
- Simulation is a useful tool for education and skill maintenance even when equipment and resources are limited; simplified tools can be utilized and transferred easily into practice if the practiced scenario becomes an actual patient emergency (McIntosh et al., 2017; Mogler et al., 2020).

Literature Review

Treatment for LAST

- The prompt recognition and response in treating LAST are of utmost importance; local anesthetics are often injected into highly vascular and well-perfused tissues to ensure rapid absorption, leading to a precipitous escalation in symptoms (Mock et al., 2021; Nedialkov et al., 2018)

- In the parturient population, local anesthetics are regularly utilized for epidural and spinal analgesia, putting them at greater risk for LAST due to frequent exposure (Bevil et al., 2020; Mock et al., 2021).

- When discussing the treatment of LAST, the side effects of lipid emulsion must also be evaluated; patients must be monitored for allergic reactions, hyperthermia, hypercoagulability, and bronchospasm after lipid emulsion infusions (Mock et al., 2021; Nedialkov et al., 2018).

Simulation differences

- The literature search yielded varying results comparing high-fidelity vs low-fidelity simulation and its impact on provider practice.

- Meeker et al. (2018) concluded that high-fidelity patient simulation was associated with improved teamwork and communication, while other studies found that simulation training, regardless of the level of resources utilized, is essential in continuing education and improving communication (Evain et al., 2019; Mogler et al., 2020).

PURPOSE STATEMENT

- This DNP project aims to utilize simulation training to provide labor and delivery RNs, anesthesia providers, and OB-GYN residents the necessary skills and knowledge set to quickly identify local anesthetic systemic toxicity (LAST) and implement prompt treatment and/or ACLS protocol if the patient progresses to cardiac arrest.

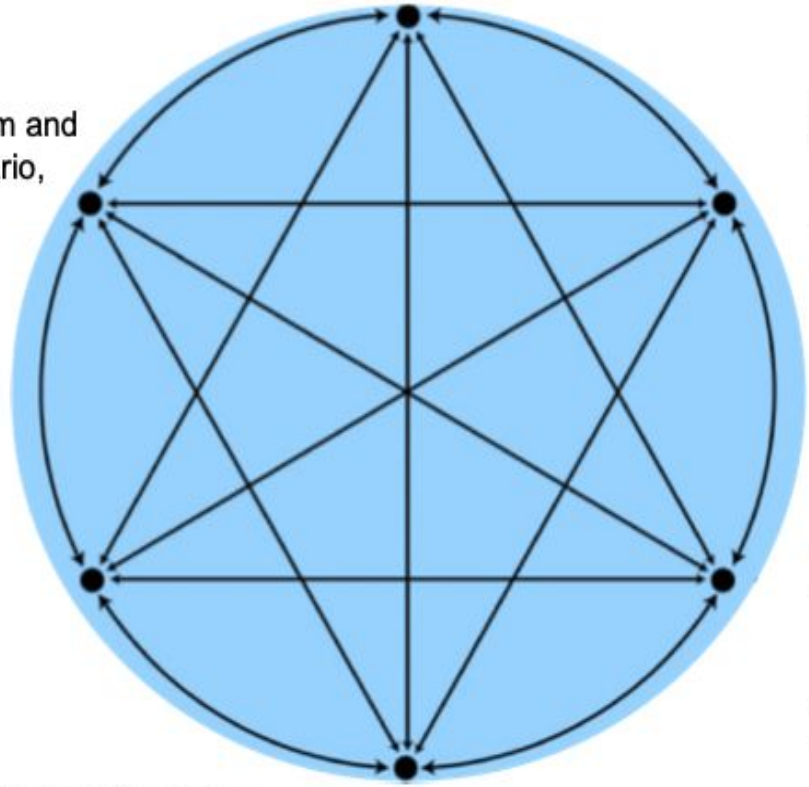
Goals and Objectives

- ❑ To reduce overall time of scenario completion between the initial simulation and second simulation occurring 6-8 weeks later.
- ❑ Observe improvement in teamwork and communication among labor and delivery staff with the Association of periOperative Registered Nurses (AORN) tool by measuring the time from role establishment to treatment initiation.
- ❑ To implement the Stanford Obstetric Anesthetic Emergency Manual as part of the education for LAST management and verifying knowledge with the AORN competency treatment checklist.
- ❑ Evaluate labor and delivery staff's ability to implement necessary interventions in the LAST scenario by utilizing the AORN competency treatment checklist.

Practice Change Framework

- Kern's Six Step Approach to Curriculum Development

1. Problem Identification:
- LAST is low frequency, high morbidity and mortality event which leads to less experience and provider comfort with prompt identification and intervention.
- No multidisciplinary simulation-based training currently in practice.



2. Targeted needs assessment:
- Busy L&D Department with high use of local anesthetics in regional anesthesia
- L&D RNs, anesthesia providers, and OBGYN resident physicians.

3. Goals and objectives
- Utilize simulation training to provide labor and delivery RNs, anesthesia providers, and OB-GYN residents with the necessary skills and knowledge sets to quickly identify local anesthetic systemic toxicity (LAST) and implement prompt treatment and/or ACLS protocol if the patient progresses to cardiac arrest.

4. Educational strategies
- Educational debrief following simulation with LAST education PowerPoint and Stanford Manual for OB Emergencies.

5. Implementation
- Obtain leadership support from L&D, anesthesia, and OBGYN resident education.
- Direct observation during LAST scenario simulation via AORN competency checklist.
- LAST education presentation between implementation days.

6. Evaluation and feedback
-Debrief with each simulation room and as a large group to discuss scenario, what went well and improvement suggestions.

Intervention

- Implement a simulation scenario to evaluate teamwork and treatment of LAST as symptoms progress to cardiac arrest.
- Evaluate participants ability to identify and initiate treatment of LAST using the Association of periOperative Registered Nurses (AORN) competency checklist.
- Provide education and resources to staff after the initial simulation.
- A second simulation will be conducted 6 weeks later and will utilize the same AORN checklist to evaluate team communication and the amount of time taken to identify LAST and initiate treatment.

Setting

- Fast-paced labor and delivery department in a 291-bed community, academic medical center.
- Simulation will be implemented in available patient rooms on the labor and delivery unit.

Population

- The study incorporates all staff working in the labor and delivery department, including registered nurses, OBGYN physician residents, and anesthesia providers who will be actively involved in the simulation and education component.
- The number of participants will be dependent upon participants' availability to attend the simulation workshop.

Local Anesthetic Systemic Toxicity (LAST)

AORN

Perioperative Simulation Scenarios

Sequence of Events

Skills Assessment - LOCAL ANESTHETIC SYSTEMIC TOXICITY (LAST)

Continue with the simulation until the following actions/treatments are completed.
Treatment action time points are referenced from time of crisis announcement

Action/Treatment Checklist	Time	Skill met	Skill not met
Crisis is announced	00:00		
Call for help is made			
Crisis leader is identified			
Patient is ventilated with 100% oxygen			
IV access is verified			
Benzodiazepines are administered for seizure suppression			
ACLS algorithm for VF/VT is initiated			
20% lipid emulsion* bolus (1.5 mL/kg) is administered over 1 minute			
Lipid emulsion infusion (0.25 mL/kg/minute to 0.5 mL/kg/minute) is continued			
20% lipid emulsion bolus is repeated as needed x 2			
20% lipid emulsion infusion is continued for 10 minutes after cardiac stabilization			

* Upper limit for 20% lipid emulsion: 10 mL/kg over the first 30 minutes

What is 20% Lipid Emulsion?

Intravenous 20% lipid emulsion, sometimes labeled as “fat emulsion” or “intralipid,” is administered to reverse the toxic effects of a local anesthetic overdose. Though the mechanism of action is not entirely understood, the theory is that the lipophilic toxins bind to the lipid emulsion, resulting in a decrease of unbound circulating toxin, thereby decreasing the level of cardiotoxicity. The lipid emulsion is a white, opaque solution available in 250 mL, 500 mL, or 1000 mL bags or bottles for IV injection. IV tubing and 60 mL syringes with large bore needles are also needed to draw up and deliver the bolus doses of medication. A 70-kg (154-lb) patient would need 105 mL for the initial dose (1.5 mL/kg).

Data Collection Tool

- The data was collected via direct observation with the addition of a competency tool provided by the Association of periOperative Nurses (AORN) for both the cold simulation and follow-up simulation.
- The competency tool was utilized in the cold simulation and will be used in the follow-up simulation to compare data and determine the efficacy of the simulation.
- The follow-up simulation will occur six weeks later to limit recall bias and determine if the knowledge supplied was retained by providers.

Implementation Stages

- **Stage 1** (September 20, 2023): LAST simulation without providing education and current treatment protocol. Evaluation of each team's ability to quickly identify LAST, initiate treatment, and provide ACLS will be documented via the AORN checklist.
- **Stage 2** (September 20, 2023): At the end of the simulation, there was be a debrief to discuss what the team did well and what they can improve upon.
  - Education was provided regarding what LAST is, the signs and symptoms, lipid emulsion therapy, and modified ACLS for the pregnant patient.
  - The Stanford Obstetric Anesthetic Emergency Manual was incorporated into the education and will be used as a guide to establish the most recent and best practice.
- **Stage 3** (November 1, 2023): LAST simulation will be repeated, and teams will be evaluated again utilizing the same AORN checklist.
- **Stage 4** (Dec. 2023): Results will be reviewed and presented.

Simulation Day 1

- 48 Participants comprised of anesthesia, nursing, and OBGYN providers
- 4 simulation rooms which were run simultaneously, with 2 champions facilitating each scenario
- Positive feedback from all involved departments, including leadership
- Improvements for future implementation date: ensure all champions attend virtual information session prior to running simulation
  - Goal: one DNP project partner running a room and one floating to assist in facilitating additional rooms

Initial Project Insights

- Establishing goals and objectives that are specific to the unit and disciplines involved is necessary to gain support from leadership.
- The interdisciplinary involvement provided different perspectives in each scenario and added to the in-situ simulation experience.
- Project champions representative of the different disciplines are crucial for simulation execution success.
- Debriefing immediately after each scenario in smaller groups helped address immediate questions about LAST and ACLS role establishment.
- A larger group discussion encouraged learning and camaraderie amongst nursing, anesthesia, and the OBGYN department.

Questions?

QR Code - Stanford Obstetric Anesthetic Emergency Manual

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