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## Implementation of Crisis Checklist for Local Anesthetic Systemic Toxicity (LAST) in the Parturient Patient

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## **Executive Summary**

### **Introduction to the Problem**

Anesthesia providers are responsible for the administration of regional anesthesia in the form of central neuraxial blocks, such as spinals and epidurals, peripheral nerve blocks, and local injection. Local anesthetic systemic toxicity (LAST) is a life-threatening emergency that can occur from the injection of local anesthetic into the systemic circulation (El-Boghdadly, Chin, & Chin, 2016). A majority of regional anesthesia is given during labor and delivery, and it is imperative that the entire healthcare team can recognize the early signs and symptoms of LAST and provide the necessary treatment. The implementation of a standardized checklist *The Stanford Anesthesia Cognitive Aid Group for LAST* with education and training in the use of the checklist can provide better patient outcomes and increase patient safety.

### **Literature Review**

Local anesthetic systemic toxicity (LAST) is a rare and uncommon, life-threatening event that can occur when a local anesthetic is administered (El-Boghdadly, Chin, & Chin, 2016). It is imperative to recognize the early signs and symptoms of LAST and provide the recommended treatment. Currently, the treatment of choice is oxygenation and ventilation and intravenous lipid emulsion therapy (El-Boghdadly, Chin, & Chin, 2016). It is essential for all staff members involved in the care of the parturient patient to have a working knowledge on recognizing the early signs and providing rapid treatment to decrease patient morbidity and mortality (Ferguson, Coogle, Leppert, & Odom-Maryon).

Local anesthetics comprise the preferred method of anesthesia in obstetrics and include epidurals, subarachnoid, pudendal nerve blocks, and subcutaneous infiltration. Local anesthetic

systemic toxicity imposes a significant risk in the maternity setting due to the frequency of usage of local anesthetics (Bowsher, Deepak, & Edwards, 2018). Pregnancy increases sensitivity to local anesthetics which in turn increases the risk for LAST. These patients have decreased protein binding which increases the availability of free drug amount, increased risk of arrhythmias due to hormonal effects on cardiomyocytes, and increased neuronal sensitivity reducing the threshold to local anesthetics. Engorgement of epidural veins of the parturient patient poses an increased risk of accidental intravascular injection of local anesthetic (Dun-Chi, Sivanesan, Horlocker, & Missair, 2017).

Toxicity occurs when there is an elevated local anesthetic plasma concentration which can occur from an inadvertent intraarterial injection, intravenous injection, or systemic absorption. The onset of symptoms usually occurs within minutes of injection but can be delayed up to 60 minutes following injection (El-Boghdadly, Chin, & Chin, 2016). The early signs include circumoral numbness, tinnitus, metallic taste, and confusion followed by seizures, respiratory distress, and cardiac collapse (Fencel, 2015). The anesthesia provider needs to be aware of maximum dosing of all local anesthetics and be vigilant of the drug and amount that is being used on the surgical field. Safety during the perioperative administration of local anesthetics can be improved by providers having knowledge of its mechanism of action, signs and symptoms of LAST, and rapid treatment of the condition (Dickerson & Apfelbaum, 2014).

The initiation of intravenous lipid emulsion therapy is arguably one of the most critical factors in the treatment of LAST. Currently, Intralipid 20%, which is a soy-based intravenous lipid emulsion of long-chain triglycerides, is the lipid of choice for the treatment of LAST. The most widely accepted theory for the mechanism of action of lipid emulsion is the “lipid sink” theory. The lipids create a separate compartment that binds and inactivates the lipophilic local

anesthetic molecules and pulls them into the “sink” (Manavi, 2010). Dr. Weinberg supported this theory by using radiolabeled bupivacaine on isolated rat hearts showing that an infusion of lipid emulsion increases the rate of bupivacaine elimination from cardiac tissue (Manavi, 2010).

Local anesthetic toxicity is a rare complication from local anesthetics, and many clinicians have not had the experience of recognizing and treating LAST. The use of a checklist has proven to increase compliance with guidelines, improve patient outcomes, and decrease adverse events. The American Society of Regional Anesthesia and Pain Medicine developed a checklist for the treatment of LAST (Wiggins, 2018). Debriefing, following education and checklist training, is structured feedback and allows discussion of understanding and improvements that can be made. Research has shown that feedback improves performance and is critical to effective learning. A systematic review of high-fidelity simulation literature reported that 51 studies show educational feedback during debriefing as the most crucial feature (Wiggins, 2018).

## **Project Methods**

The *Stanford Anesthesia Cognitive Aid Group* checklist for LAST was implemented in the labor and delivery unit for utilization in a crisis situation. The checklist provides a standardized care pathway in an emergent situation for patients who develop LAST. The checklist was made available for all labor and delivery staff to assist with better management of the patient during a stressful situation. A copy of the *Stanford Anesthesia Cognitive Aid Group* tool for LAST was placed on each anesthesia neuraxial cart. An informative session was provided for all obstetrics staff (nursing, anesthesia) as the initial form of implementation. Prior to education, the staff completed a short pretest. A copy of the standardized checklist was

distributed to each person and they were thoroughly educated on how to implement the checklist efficiently. A PowerPoint presentation discussed the checklist, how to recognize the early signs and symptoms of LAST, and what to do when LAST is suspected. The staff was made aware of the locations of Intralipids. The education finished with the completion of a posttest, which contained the same questions as the pretest to compare for evaluation of the education. A survey was distributed in the stapled packet with the pretest and posttest and was completed after the posttest.

The stakeholders include Nurse Anesthetists, anesthesiologist, obstetrics nurses, patients, and family members. The medical professionals are the decision makers during a crisis situation, including the administration of the medications (intralipids) and the obstetrics patients and families are the beneficiaries of the project from the increase in knowledge of staff during a crisis situation. Additional stakeholders involved in the project include Mary Zerlan, DNP, CRNA, APN, serving as project leader from Southern Illinois University Edwardsville. Michelle Ertel, DNAP, CRNA, serving as a faculty member from Southern Illinois University Edwardsville and the anesthesia liaison at the implementing hospital. Dr. Freeman, MD, serving as the anesthesia medical director at implementing hospital.

## **Evaluation**

There was a total of 28 participants that included 14 CRNA's, 10 nurses, and four anesthesiologists. The pretest had a total of five questions, and 28 participants for a total number of 140 questions, and the posttest contained the same five questions. The pretest taken before the education had a total of 128 correct answers, and after the education, the posttest had 136 correct answers. After the education of LAST and the implementation of the checklist, almost all of the

participants provided positive feedback, and found the educational presentation beneficial to their current job role (N=27). There was one labor and delivery nurse that did not find the presentation beneficial to her current job role, does not feel confident in recognizing the signs and symptoms of LAST, and does not feel comfortable following the provided checklist. There were three questions missed on the pretest, and two missed on the posttest. All information was provided in the PowerPoint presentation to answer the questions. After the education, the investigator was present for any questions, comments, or concerns, and there were none presented. The education consisted of recognizing the signs and symptoms of LAST and how to implement the checklist. A majority of the participants felt confident in recognizing the signs and symptoms of a patient experiencing LAST (N=27). Education was provided on how to implement the checklist efficiently if needed in a crisis. Post education, participants felt comfortable using the checklist if needed for a patient experiencing LAST (N=27). The steps of the checklist were reviewed during the education and any questions answered. The *Stanford Cognitive Aid Group* checklist will be attached to each neuraxial cart and in the PACU if needed in a crisis situation.

This project assessed the impact of education on LAST and the implementation of a checklist. The results showed that staff had a solid, basic knowledge of local anesthetic systemic toxicity, but it improved after the education. The survey showed that staff would be comfortable implementing the checklist, if needed and that the education improved their knowledge of LAST. Local Anesthetic Systemic Toxicity is a rare yet fatal complication from regional anesthesia. Education of the staff will hopefully improve patient outcomes by the early recognition of signs and symptoms of LAST and implementing the checklist. It would be beneficial for yearly education to reinforce the knowledge due to the rare occurrence of LAST.

## **Limitations**

This project has several limitations. Time constraints were probably the most significant limitation. The implementation was initiated at anesthesia staff meeting and the Labor and Delivery department meeting. The twenty minutes included the PowerPoint presentation along with the pretest and posttest along with a question and answer session. Not every anesthesia provider and Labor and Delivery nurse attended the meeting. Those that were not present will be made aware of the checklist by the department team leaders and educators. The pretest and the posttest had the same questions in order to evaluate the effectiveness of the education. It was used to evaluate knowledge gained from the presentation and implementation of the checklist.

## **Impact to Practice**

Anesthesia providers are responsible for the administration of regional anesthesia in the form of spinals and epidurals, peripheral nerve blocks, and local injection. A majority of regional anesthesia is given during labor and delivery in the form of spinals and epidurals. Understanding the treatment for LAST is imperative for healthcare providers on Obstetric Units. It is estimated that LAST occurs in up to 1 per 500 peripheral nerve blocks and 4 per 10,000 epidural procedures (Dun-Chi Lin, Sivanesan, Hollocker, & Missair, 2017). The labor and delivery nurses are at the bedside of the patients that have received regional anesthesia. Local Anesthetic Systemic Toxicity can occur from 30 seconds up to days after administration of regional anesthesia. Nurses must be aware of the early signs and symptoms of LAST to prevent a fatal situation potentially. They alert the code team, anesthesia and have the lipid emulsion at bedside to assist with rapid implementation of the checklist. The rapid administration of lipid emulsion has proven to improve patient outcomes during a LAST crisis situation drastically.

The implementation of the checklist improves practitioner practice by enhancing the safety of the mother and fetus. The knowledge gained by the staff is empowering patients who benefit in the long-term.

## **Conclusion**

This project assessed the impact of education on LAST and the implementation of a checklist. The results showed that staff had a solid, basic knowledge of local anesthetic systemic toxicity but it improved after the education. The survey showed that staff would be comfortable implementing the checklist if needed and that the education improved knowledge of LAST. Local Anesthetic Systemic Toxicity is a rare yet fatal complication from regional anesthesia. The education of the staff will hopefully improve patient outcomes by the early recognition of signs and symptoms of LAST and implementing the checklist. It would be beneficial for yearly education to reinforce the knowledge due to the rare occurrence of LAST.

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