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Walden University

College of Nursing

This is to certify that the doctoral study by

Rachelle Dix

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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Walden University
2023

Abstract

Local Anesthetic Systemic Toxicity Education for Perianesthesia Nurses

by

Rachelle Dix

MS, Western Governors, 2019

BS, Western Governors, 2017

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

Walden University

August 2023

Abstract

Local anesthetic systemic toxicity (LAST) is a potentially life-threatening event following a local anesthetic bolus into the circulatory system. Because LAST is a low-volume, high-risk event, clinical exposure is lacking, creating a knowledge gap among perianesthesia nurses. A knowledge gap regarding LAST among perianesthesia nurses was identified at the project site, an ambulatory surgery center in south Mississippi. The practice-focused question was: Whether a web-based education intervention would increase perianesthesia nurses' knowledge about LAST. The doctoral project aimed to provide perianesthesia nurses with the clinical knowledge essential for early detection of LAST symptoms. A LAST education module was developed using the adult learning theory and the analysis, design, development, implementation, and evaluation model as frameworks. Thirty-one perianesthesia nurses participated in the LAST education module, completing a 10-question pretest to assess their LAST knowledge before the education intervention and provide demographic information of their years of nursing experience and years of perianesthesia nursing experience. A 10-question posttest was then administered after the education intervention. The results of the paired-samples *t* test yielded *p* values less than 0.001 and an increase in the mean scores from 58 to 90, indicating a statistically significant improvement in the nurses' knowledge scores. The findings imply that web-based LAST education can improve LAST knowledge in perianesthesia nurses. The findings of this project promote positive social change by preparing nurses to provide competent care to patients receiving local aesthetics, thus improving patient safety and contributing to community health.

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Dedication

I want to thank my family for all the sacrifices you have made during this journey. To my daughter, Morgan, you are the strongest woman I know- your unwavering encouragement to press on got me past many moments of self-doubt. To my son, you never failed to believe in me and unknowingly lifted my spirits when I needed it most. To my precious husband, Dr. Brian Dix, thank you for the endless hours of advice, anesthesia expertise, and proofreading. Thank you for believing in me and never ceasing to remind me of my capabilities. You helped me to persist during my greatest adversity!

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Section 1: Nature of the Project

Introduction

Local anesthetic systemic toxicity (LAST) is a a potentially life-threatening perianesthetic event following a local anesthetic bolus into the circulatory system, leading to cardiovascular and neurologic collapse (Ferguson et al., 2019). Local anesthetics are medications administered to individuals who require pain control. The use of local anesthetics in the perioperative setting is becoming more prominent for postoperative pain management and intraoperative surgical facilitation (Wadlund, 2017). Local anesthetics are used increasingly in the surgery setting, making it essential for multispecialty perianesthesia nurses to know LAST identification and treatment (Ferry & Cook, 2020). Adequate competency in clinical judgment is necessary for the early identification of LAST (Bevil et al., 2020). Perianesthesia nurses must be prepared to recognize and initiate rescue when LAST occurs. Researchers have highlighted a gap in perianesthesia nursing knowledge of the signs and symptoms and the correct course of treatment for the LAST event among perianesthesia nurses (Ferguson et al., 2019, p. 180). This lack of knowledge regarding LAST among perianesthesia nurses presents the opportunity for poor outcomes for patients receiving local anesthetics in the perioperative setting. Development of a LAST education intervention for perianesthesia nurses will increase perianesthesia nursing knowledge regarding LAST recognition and treatment. In Section 1, I present the problem statement, purpose, nature of the doctoral project, and significance of a LAST education intervention for perianesthesia nurses.

Problem Statement

A gap in knowledge regarding LAST among perianesthesia nurses presents the potential for poor outcomes for patients receiving local anesthetics in the perioperative setting. Catastrophic perianesthetic events infrequently occur, which presents a barrier to the preparedness of perioperative staff (Bevil et al., 2020). Ferguson et al. (2019) exposed a gap in knowledge of the signs and symptoms and the correct course of treatment for the LAST event among perianesthesia nurses. Nurses functioning in the perianesthesia setting assist anesthesiologists in administering local anesthetics, provide care during the perioperative and recovery phases, and must be aware of early signs and corrective treatment for LAST (Ferguson et al., 2019). Due to the increasing use of nerve block procedures and local anesthetic use, nurses must be prepared to recognize and initiate rescue when LAST occurs.

Local anesthetics are increasingly used throughout the perioperative stages, from intravenous insertion to postoperative pain control (Bevil et al., 2020). More than 20 years ago, the American Society of Regional Anesthesia and Pain Medicine (ASRA) recognized the increased risk for local anesthetic toxicity due to the increasing use of long-acting local anesthetics during a presentation of practice guidelines (Bevil et al., 2020). The ASRA recently updated local anesthetic practice advisories and insisted that LAST remains a serious adverse event despite advances in prevention (Neal et al., 2018). The ASRA continues to observe adverse events ranging from mild prefatory symptoms to cardiac arrest progressing to death from LAST (Neal et al., 2018). The current ASRA local anesthetic advisory guidelines called for LAST education and preparedness among

all professionals working with local anesthetics due to the general rarity of occurrence and continued occurrence of events despite proper technique (Neal et al., 2018). While it is recognized that LAST is severely underreported, the true frequency remains unknown due to misdiagnosis and publication bias from nonanesthesia providers (Neal et al., 2018).

Registered nurses are responsible for providing care through all stages of the perioperative process. The nursing staff spends the most time at the patient's bedside following regional anesthetic procedures (Bevil et al., 2020). While LAST remains a rare but clinically significant adverse event, the treatment and diagnosis of LAST are not typically included in the education curriculum for nurses (Bevil et al., 2020). The lack of clinical exposure to a LAST event may leave nurses unprepared to recognize and initiate rescue (Bevil et al., 2020). Because LAST requires rapid and early detection, perianesthesia nursing staff will most likely be the first to observe symptoms of LAST. This doctoral project provided insight into effective education methods through knowledge building for perianesthesia nurses regarding LAST by developing and offering a LAST educational intervention. The project supports clinical scholarship by integrating knowledge regarding a LAST educational intervention into perianesthesia nursing practice and potentially improving perioperative patient outcomes.

Purpose Statement

The gap in perianesthesia nursing practice that was addressed in this project was a knowledge deficit among perianesthesia nurses in recognizing risks associated with local anesthetic administration and signs and symptoms of LAST (see Wadlund, 2017). With

this doctor of nursing practice (DNP) project, I aimed to develop a educational intervention that prepared perianesthesia nurses to recognize complications associated with local anesthetics. Perianesthesia nurses need specific education regarding LAST recognition and treatment (Ferguson et al., 2019). Bowsher et al. (2018) indicated that there is an urgent need for mandatory LAST education in all practice settings utilizing local anesthetics. Nurses having a knowledge base that includes LAST symptom recognition and treatment may potentiate life-saving measures for the patient experiencing a LAST event in the perianesthesia setting (Ferguson et al., 2019).

Toxic levels of local anesthetic depress myocardial contractility and occur in as little as 56 seconds and up to 30 minutes following administration (Ferguson et al., 2019). Due to the infrequency of LAST occurrence, perianesthesia nurses are unfamiliar with recognizing early symptoms like a metallic taste or auditory changes (Ferguson et al., 2019). LAST symptoms rapidly progress to seizure, coma, and respiratory and cardiovascular depression (Ferguson et al., 2019). The ASRA emphasized the importance of a continued focus on knowledge improvement to promote the early recognition and awareness of LAST to improve prevention and treatment efforts (Neal et al., 2018). The practice-focused question for this project was: Will a web-based education intervention increase perianesthesia nurses' knowledge about LAST?

Ferguson et al. (2019) indicated that perianesthesia nurses do not possess the knowledge or confidence to manage a LAST event effectively. This project was an educational intervention designed to address the knowledge gap in perianesthesia nursing practice regarding LAST. The rapid and successful treatment of LAST demands early

detection that will likely be observed first by perianesthesia nursing staff (Bevil et al., 2020). The nursing care of patients at risk for experiencing LAST presents a potential challenge to patient safety (Ferry & Cook, 2020). The goal of this doctoral project was to equip perianesthesia nurses with the clinical knowledge vital to the early recognition of LAST symptoms.

Nature of the Doctoral Project

I identified a knowledge gap among perianesthesia nurses regarding LAST by collecting data from literature focused on nursing knowledge and the recognition of LAST symptoms. The databases of CINAHL Plus, MEDLINE, Ovid, ProQuest, and PubMed were searched using the Boolean operator "AND" to expand the search. The following search terms were used: *local anesthetic systemic toxicity, LAST awareness, education, awareness,* or *knowledge*. Inclusion criteria for the project included nurse, nurses, and nursing literature published within the past 5 years and limited to articles published in peer-reviewed, scholarly journals. The exclusion criteria were articles that did not include nursing and were not available in full-text English. My search yielded 15 available resources. I excluded three resources due to the topic being physician-focused education. Twelve remaining resources that included education regarding LAST in nursing and published within the last 5 years were used in the project. I reviewed the American Society of PeriAnesthesia Nurses (ASPAN) 2021–2022 Perianesthesia Nursing Standards and Interpretive Statements to research practice recommendations and guidelines. The search of the ASPAN (2020) standards search yielded a nonspecific

reference to a core competency schedule that includes LAST as a competency requirement.

Education interventions to improve nursing competencies are encouraged by the administration and the providers at the project site facility. Organization leadership at the project site verbalized support for the project's purpose and the approach used to address the nurses' lack of knowledge relating to LAST. Nurses were given invitations with QR code access to participate in the learning module via a learning management system (LMS) application. I used the LMS application, EdApp, to present the learning module. A pretest, completed electronically by participants via the LMS, was required before they could access the education intervention. All test score data were stored electronically within the LMS application, with access available to me exclusively. My access to the data stored within the LMS was via a username and password login. In addition to knowledge assessment, the pretest requested demographic information, including years of nursing experience and perianesthesia nursing experience. The LMS did not collect identifiable information to access the learning module. Upon completing the pretest, the participants were granted access to the LAST education module within the LMS, and upon completion of the education module, participants immediately completed the posttest electronically through the LMS. The LMS also stored the posttest score data electronically within the LMS. I then downloaded the de-identified results to my password-protected computer stored in a private, locked office and uploaded the data into Microsoft Excel. The data were analyzed using descriptive analysis with statistical package for the social sciences (SPSS) statistical software. I calculated the mean

difference between the pre- and posttest scores to determine if the nurses' knowledge increased after participating in the education module.

For this project, I developed a learning intervention from evidence-based literature to address the knowledge gap in perianesthesia nursing practice regarding LAST-prepared perianesthesia nurses' ability to recognize and initiate rescue during a LAST event. The learning intervention content as well as the pre- and posttests were reviewed by two organization anesthesiologists for validity prior to implementation. Neal et al. (2018) indicated that until alternative medications are introduced, the burden remains upon LAST researchers and anesthesia providers to increase LAST awareness through education interventions to improve early recognition and treatment of LAST. While the elimination of LAST is ideal, knowledge and preparation regarding LAST among health care professionals leads to a highly treatable complication should LAST present (Neal et al., 2018).

Significance

This DNP project will impact health care consumers, nurses, and providers. Forero et al. (2016) suggested that individuals with a significant risk for LAST include the older individuals, obstetric patients, patients with renal disease, patients with cardiovascular disease, and patients suffering from liver disease. Patients with comorbidities, including cardiac arrhythmias, congestive heart failure, and metabolic disorders, can mask early signs of developing LAST, contributing to a significant safety risk (Ferry & Cook, 2020). Educating perianesthesia nurses to practice caution and preparation when treating the at-risk patient population will promote healing and

improved quality of life for patients. Outcomes of patient populations with significant risk for LAST will improve by limiting the consequences of LAST by creating competent perianesthesia nurses. Considering the extensive use of local anesthetics across various clinical settings, it remains the responsibility of all providers utilizing local anesthetics to possess the knowledge to recognize and treat LAST should it present (Neal et al., 2018). Providers that remain vigilant regarding LAST offer opportunities to develop effective systems of prevention and treatment of LAST, thus influencing future practice guidelines regarding the use of local anesthetics in many practice settings (Neal et al., 2018).

The current project enhanced nursing practice by decreasing nurses' knowledge deficit regarding LAST and creating perianesthesia nurses who are confident and capable of recognizing and treating LAST. Perianesthesia nurses must possess an in-depth knowledge of LAST symptoms and treatment to minimize adverse outcomes. This project also contributes to potential yearly competency requirements for perianesthesia nursing. Educating perianesthesia nurses across diverse specialties about LAST is essential to improve patient outcomes due to the increasing use of local anesthetics in various treatment settings (Ferry & Cook, 2020).

The project may also influence provider competency learning interventions for providers utilizing local anesthetics. The outcomes of this project contribute to interprofessional team development, learning opportunities, and communication roles during anesthetic emergencies (see Bevil et al., 2020). The effort to impact the opioid epidemic includes increasing the use of local anesthetics (Ji et al., 2021). The increasing use of local anesthetics requires the foundational knowledge of LAST from health care

providers (Neal et al., 2018). The rising use of local anesthetics in the perioperative setting highlights the need for clinicians across all clinical settings to be competent and ready to address local anesthetic emergencies (El-Boghdadly et al., 2018).

This DNP project contributes to positive social change by improving patient safety, decreasing hospital admission/length of stay, and lowering health care costs (see Schneider & Howard, 2021). Health care consumers will benefit from the project because the knowledge gained by perianesthesia nurses prepares them to provide care to patients receiving local anesthetics with profound competence (see Schneider & Howard, 2021). The project contributes to improved patient outcomes, directly impacting health within the community. This project also promotes positive social change by improving perianesthesia nursing competence through increasing knowledge and awareness concerning LAST, positively impacting the opioid crisis within the community and promoting healthy communities (see Mazurenko et al., 2020).

Summary

Higher doses of local anesthetics and lengthy anesthetic techniques increase the risks of a patient developing LAST (El-Boghdadly et al., 2018). The prevalence of chronic diseases in communities also contributes to an increased risk of developing LAST (Forero et al., 2016). Multimodal pain management approaches include increasing local anesthetics to decrease the risk of opioid addiction (Mazurenko et al., 2020). The occurrence of LAST continues to remain low, but the outcome of a LAST event can be deadly. Proficient clinical knowledge and judgment are essential for the early recognition of LAST. A significant knowledge gap exists among nurses regarding LAST despite

ample research that discloses a need for improved competency. Education regarding LAST will increase perianesthesia nurses' knowledge and prepare them to initiate rapid, life-saving measures. Educating perianesthesia nurses about LAST promotes positive social change by reducing recovery times, decreasing hospital length of stay, lowering care costs, and improving patient safety. Rapid LAST management is key to patient survival, and knowledge of risk factors, treatment processes, and preventive measures is crucial for nurses caring for patients receiving local anesthetics. Equipping perianesthesia nurses with LAST knowledge is necessary to increase their competency in managing patients receiving local anesthetics, potentially improving patient safety.

Section 2: Background and Context

Introduction

The increasing use of local anesthetics for pain control in the perioperative setting calls for improved nursing knowledge and awareness related to local anesthetic safety (Wadlund, 2017). As local anesthetic use for pain control in the surgery setting continues to become common practice, it is essential for perianesthesia nurses to possess the knowledge to recognize LAST symptoms and be prepared to initiate rapid treatment (Ferry & Cook, 2020). A documented knowledge gap regarding LAST among perianesthesia nurses presents the potential for poor outcomes for patients receiving local anesthetics in the perioperative setting (Ferguson et al., 2019). The practice-focused question for this project was: Will a web-based education intervention increase perianesthesia nurses' knowledge about LAST? In this DNP project, I developed a learning intervention to prepare perianesthesia nurses to recognize complications associated with local anesthetics that give rise to LAST.

In Section 2, I present the concepts, models, and theories that guided the development of this DNP project, including the adult learning theory and analysis, design, development, implementation, and evaluation model (ADDIE). Section 2 also includes discussion about the project's relevance to nursing practice, the background and context of the problem, and the role of the DNP student. This discussion offers insights that informed the guiding characteristics and concepts behind this DNP project as well as established a profound urgency behind the need to educate perianesthesia nurses about LAST and the risks that precede a LAST episode.

Concepts, Models, and Theories

I used the adult learning theory and ADDIE model to inform the structure and organize the content of this doctoral project. The adult learning theory, developed by Malcolm Knowles in 1968, deconstructs andragogy, or the way adults learn into assumptions (An & Quail, 2018). The adult learning theory was chosen to help guide this doctoral project because the project is a learning intervention for perianesthesia nurses. I used the ADDIE Model to guide the instructional design of the project. The ADDIE model was developed in the 1970s and continues to be the most utilized instructional model due to its simplicity and effectiveness (Quigley, 2019). The ADDIE model was chosen to organize this doctoral project because of its streamlined approach using continuous feedback for improvements (see Quigley, 2019).

The adult learning theory focuses on five assumptions of adult learners, with the basis being the "why" there is a need to learn something (An & Quail, 2018). The adult learning theory also embraces the concept of self-driven, autonomous learning (An & Quail, 2018). Knowles's foundation for the adult learning theory was based on the learner's need to know why they need to learn something, which helps the educator assist the learner in recognizing the importance of the presented knowledge (McEwen & Wills, 2019). The five concepts of Knowles's adult learning theory are self-concept, experience, readiness to learn, orientation to learning, and motivation (Stoltz, 2021). The concept of self-concept implies that as individuals mature, they move from a state of dependence into self-direction (Pappas, 2013). Experience suggests that as people mature, they accumulate events that become learning resources (Pappas, 2013). The concept of

readiness to learn suggests that as maturity progresses, the individual becomes motivated to learn by required tasks or the demands of a social role (Pappas, 2013). Orientation to learning refers to the idea that as individuals mature, their perspective progresses from subject-centered learning to problem-centered learning with immediate knowledge application (Pappas, 2013). Knowles included the fifth concept of motivation in 1984 to indicate that as a person matures, the desire to learn comes from an internal stimulus (Pappas, 2013). The concept of motivation includes preferred, self-directed learning that is sought out by the learner (McEwen & Wills, 2019).

I chose Knowles's adult learning theory as part of the framework for this project because it has been successfully applied to many nursing education projects that encompass self-directed learning (see McEwen & Wills, 2019). Because most nurses work long, unpredictable hours, education must be accessible at their convenience, and the implications of intense work schedules and family responsibilities require access to self-directed learning. When applying Knowles's assumption of self-concept, perianesthesia nurses presented with evidence of a knowledge gap regarding local anesthetic safety will seek knowledge to promote the safety of their patients. The concept of experience supported the project's focus on accessing the perianesthesia nurses' prior experience with local anesthetics to build upon the nurses' knowledge of local anesthetic systemic toxicity. The readiness to learn concept guided this project by helping me develop the presentation of an education session regarding a real problem that may threaten patient safety in patients receiving local anesthetics. In the education intervention, nurses recognized a need to learn to confidently manage the care of a patient

receiving local anesthetics. Knowles's concept orientation to learning was supported in this project through the presentation of knowledge that was immediately applicable in the clinical setting. The concept of motivation to learn was supported in this project by ensuring that perianesthesia nurses understood the importance of recognizing symptoms of LAST. Recognition of LAST risks and symptoms encouraged nurse buy-in for accessing the education.

The ADDIE model is an instructional design tool that educators have used to guide the development of education programs for more than 40 years (Kurt, 2017). The ADDIE model was developed as an education instructional guide in the 1970s by Florida State University for the U.S. Army and eventually implemented in all branches of the U.S. Armed Forces (Kurt, 2017). The ADDIE model consists of five steps that must be completed in consecutive order with consistent focus and reflection to inform the following step (Quigley, 2019). The five steps, in consecutive order, are analysis, design, development, implementation, and evaluation (Quigley, 2019). The ADDIE model is an excellent tool for informing future education implementations through the insightful feedback the model offers (Quigley, 2019). Using the ADDIE model to guide education content and delivery through LMSs, educators can use consistent feedback analysis to continuously improve results in training and education (Quigley, 2019).

I used the ADDIE model to guide this education project through the model's five steps (Jeffery et al., 2015). Applying the ADDIE model, the analysis phase included establishing the current knowledge level of LAST among perianesthesia nursing staff in the practice setting through anonymous pretest questionnaires. The education module was

developed with organization anesthesiologists during the design phase. During the design phase, specific learning objectives were agreed upon with the organization's anesthesiologists. The education content and method of presentation were also reviewed with the organization's chief anesthesiologist during the development phase. The implementation phase included all the organization's perianesthesia nurses participating in the education module. The evaluation phase consisted of anonymous posttest questionnaires that assessed the effectiveness of the educational intervention. The posttest evaluation provided me with valuable insight into the knowledge gained from the education module and participant perceptions relating to educational intervention. The insights revealed during the evaluation phase will also contribute to improving future LAST education interventions.

Relevance to Nursing Practice

Importance of LAST Education for Nurses

While the clinical practice of administering local anesthetics continues to advance with techniques and dosage titrations, the fact remains that LAST continues to occur (Macfarlane et al., 2021). According to Macfarlane et al. (2021), LAST occurs at a rate of 1–2 per 1,000 nerve blocks. Because LAST is a rare occurrence, clinicians caring for these patients can undoubtedly miss the opportunity to recognize and treat it. Most cases of LAST are observed in the perianesthesia setting for preprocedural analgesia (Macfarlane et al., 2021). With the advancing practice of local anesthetic administration techniques, the onset of LAST is noted to be increasingly delayed, and this delayed onset of LAST leaves nonanesthesia providers, including perianesthesia nurses, unprepared to

recognize and initiate LAST rescue promptly (Macfarlane et al., 2021). The continued evolution of factors involving the use of local anesthetics presents a significant challenge to the diagnosis and treatment of LAST, making LAST education essential for nurses caring for patients after local anesthetic administration (Macfarlane et al., 2021).

Ferguson et al. (2019) observed that nurses working in units where local anesthetics are administered were lacking sufficient knowledge to recognize symptoms of LAST. The knowledge gap of nurses regarding LAST presents the opportunity for poor outcomes in patients receiving local anesthetics (Ferguson et al., 2019). The vast use of local anesthetics throughout the perioperative phases presents the potential for a rare but significant LAST event (Bevil et al., 2020). The diagnosis and treatment of LAST are not typically included in nursing curriculum (Bevil et al., 2020). The rare occurrence of LAST also presents a lack of clinical exposure, leaving perianesthesia nurses unfamiliar and unprepared to recognize the signs and symptoms (Bevil et al., 2020). Toxicity symptoms can occur in as little as 60 seconds following local anesthetic administration (Schneider & Howard, 2021). Nurses must remain watchful for subtle presenting signs and symptoms of toxicity (Schneider & Howard, 2021). Because nursing staff spends a significant amount of time at the bedside following local anesthetic administration, a logical recommendation is to include LAST education in nursing curriculum. Dedicated education regarding LAST is vital to close the knowledge gap in nursing practice (Ferguson et al., 2019). An additional recommendation to improve nursing practice is yearly competency education regarding LAST awareness for knowledge retention (Ferguson et al., 2019).

Previous strategies to address the knowledge gap of nurses regarding LAST include implementing recommended LAST checklists, using simulation education along with didactic LAST education. Wadlund (2017) created LAST continuing education for perioperative nurses to gain the knowledge needed to recognize the signs and symptoms of LAST and assist in initiating early treatment. The Association of PeriOperative Registered Nurses (AORN) recommended that nurses caring for patients receiving local anesthetics possess the knowledge of local anesthetic medication use, dosing, and contraindication to expedite early recognition of LAST (Wadlund, 2017). The ASRA developed an updated LAST checklist in 2020 from simulation feedback to be displayed in departments where local anesthetics are administered (Neal et al., 2020). Ferguson et al. (2019) performed an evidence-based didactic education intervention to address the LAST knowledge gap among nurses working in areas where local anesthetics were administered. The education intervention was found to improve LAST nursing knowledge, but the results left the researchers questioning the nurses' actual retention of knowledge obtained; therefore, Ferguson et al. suggested the addition of an electronic online LAST education module for annual competency and education review. Bevil et al. (2020) performed LAST education using high-fidelity simulation in conjunction with a didactic session for perioperative nurses and found significant knowledge acquisition and retention among participants. However, Bevil et al. noted a considerable challenge regarding removing nursing staff from work areas to participate in the education simulation, creating staffing strains.

Advancing Nursing Practice

The ubiquitous use of local anesthetics throughout the perioperative phases requires adequate nursing knowledge for improved patient safety (Wadlund, 2017). LAST continues to be a potentially severe adverse event in the presence of local anesthetic use (Neal et al., 2020). The literature has highlighted a knowledge gap among nurses in recognizing the signs, symptoms, and treatment of LAST (Ferguson et al., 2019). A significant challenge to presenting education to nurses continues to be staffing strains when removing nurses from the bedside to participate in training sessions (Bevil et al., 2020).

In this doctoral project, I aimed to advance nursing practice by educating perianesthesia nurses about LAST to improve patient safety. The use of a LMS to present LAST education minimized staffing concerns by offering the education at the nursing staff's convenience to avoid interruption of patient care. Falaki et al. (2022) noted that both didactic and LMS methods significantly improve nursing knowledge. Busy work schedules and complicated patient acuities prevent nurses from attending scheduled education sessions, and LMSs offer organized education content while facilitating learner engagement through a proposed virtual classroom at the learner's convenience (Falaki et al., 2022).

Local Background and Context

The project site was an outpatient surgery center located in the southeastern United States. The facility is a multispecialty surgery center providing surgical and procedural services to all demographic groups of all ages. A knowledge deficit among

perianesthesia nurses in recognizing risks associated with local anesthetic administration and signs and symptoms of LAST has been well documented (Wadlund, 2017). Addressing this knowledge deficit is important because perianesthesia nurses assist anesthesia providers with nerve block procedures frequently and are most often the care provider at the bedside, monitoring patients following the procedures (Bevil et al., 2020). Bowsher et al. (2018) indicated that there is an urgent need for mandatory LAST education in all practice settings utilizing local anesthetics. Perianesthesia nurses function in the vital role of observing patients for risks and signs and symptoms associated with LAST following nerve block procedures (Hunter et al., 2019). The risks associated with local anesthetics can be prevented with knowledgeable perianesthesia nursing staff (Hunter et al., 2019). The project site perianesthesia nurses needed specific education regarding LAST recognition and treatment. The relevance of the knowledge gap regarding LAST is that perianesthesia nurses must be competent in early recognition and treatment of LAST because the onset of LAST may occur anywhere from seconds up to 30 minutes following the injection of local anesthetic (see Ferguson et al., 2019). The practice-focused question that guided this project was: Will a web-based education intervention increase perianesthesia nurses' knowledge about LAST?

The project site organization was recently ranked as the best hospital in the region and one of the top hospitals in the state. The organization embraces safety as one of the seven pillars of excellence as part of their vision statement. The ASRA issued recommendations for practice patterns and system improvements to mitigate the risks of LAST and enhance patient safety, including posting the current ASRA LAST checklist in

highly visible areas where local anesthetics are used, educating clinicians about LAST, and the immediate availability of lipid emulsion therapy (Neal et al., 2018). None of the ASRA recommendations were actively present at the project site.

Role of the DNP Student

The DNP-prepared nurse plays a valuable role in influencing the future of nursing practice. As health complexities evolve, so does the nursing knowledge vital to nursing practice (Zaccagnini & White, 2017). The DNP-prepared nurse is adept at translating evidence-based research to advance nursing practice (Trautman et al., 2018). As a registered nurse with extensive perianesthesia experience and ambulatory perianesthesia certification, I noticed a decline in nursing knowledge regarding low-incidence, high-risk perioperative emergencies during a round of yearly staff competency evaluations. Concurrently, I observed that anesthesia providers were increasingly turning to nerve blocks for pain control postoperatively at my organization. I am not an employee at the project site; however, I did conduct my practicum hours at the project site with the anesthesia providers. During my practicum at the project site, I conducted a learning needs assessment among the perianesthesia nurses regarding local anesthetic safety and observed numerous procedures involving local anesthetics, concluding that there was a significant knowledge gap regarding LAST among perianesthesia nurses. Through conducting a literature review on the topic, I found that a knowledge gap regarding LAST among nurses continues to be well documented, indicating a need for continued research for effective education efforts.

As the DNP student in this doctoral project, my role was to develop a LAST education module that effectively increased perianesthesia nurses' knowledge to recognize LAST and initiate LAST rescue. I was the project team leader responsible for developing, presenting, collecting, and analyzing data regarding the LAST education module. The organization has two anesthesiologists who were resources for my questions and module content approval. I coordinated meetings with the anesthesiologists for advice and guidance on LAST module content development and met with them to review the content of the LAST education module for advising, approval, and finalization of the LAST education module. The LAST education module was offered over a period of 1 week. During the week of the LAST education module presentation, the anesthesiologists were made available for the nurses' questions and discussions. Following the doctoral project data analysis, I presented the project results to the organization's anesthesiologists.

Summary

The practice problem was a knowledge gap regarding LAST among perianesthesia nurses. A literature review revealed a need for LAST education for nurses who practice where local anesthetics are utilized. The knowledge gap regarding LAST left nurses unprepared to recognize and treat LAST, which presented an opportunity for poor patient outcomes in patients receiving local anesthetics. I conducted this doctoral project to offer LAST education via a LMS to perianesthesia nurses to close the knowledge gap regarding LAST, maximize the convenience of access to LAST education, and minimize the interruption of patient care for nurses to access education. In

the following section, I will discuss the sources of evidence, data collection methods, and evidence analysis.

Section 3: Collection and Analysis of Evidence

Introduction

LAST is a life-threatening perianesthetic event following an unintentional bolus of local anesthetic into the circulatory system (Ferguson et al., 2019). Local anesthetics are increasingly used in the perioperative setting for postoperative pain management and intraoperative surgical facilitation (Wadlund, 2017). The prolific use of local anesthetics in all clinical settings generates a demand for LAST education for nurses who care for patients after local anesthetic administration (Macfarlane et al., 2021). The low incidence of LAST confers a lack of clinical exposure, leaving perianesthesia nurses unprepared to recognize the signs and symptoms of LAST (Bevil et al., 2020). The DNP role unequivocally embraces the process of research while implementing best practice evidence into practice to improve outcomes (Zaccagnini & White, 2017). I conducted this doctoral project to develop a LAST education module via a LMS to improve perianesthesia nurses' knowledge to recognize the signs and symptoms of LAST and understand LAST rescue. In Section 3, I discuss the sources of evidence and analysis procedures used to develop the LAST education project.

Practice-Focused Question

The gap in perianesthesia nursing practice was a knowledge deficit in recognizing risks associated with local anesthetic administration and signs and symptoms of LAST (see Wadlund, 2017). A gap in knowledge regarding LAST among perianesthesia nurses presents the potential for poor outcomes for patients receiving local anesthetics in the perioperative setting. The increasing use of local anesthetic requires nurses to recognize

and initiate rescue when LAST occurs (Bevil et al., 2020). The practice-focused question that guided this project was: Will a web-based education intervention increase perianesthesia nurses' knowledge about LAST?

Sources of Evidence

I collected the evidence for this education project from the CINAHL Plus, MEDLINE, Ovid, ProQuest, and PubMed databases. The search terms used for gathering evidence related to the project included *local anesthetic systemic toxicity, LAST awareness, education, awareness,* or *knowledge*. The Boolean operator "AND" was used to expand the search. The inclusion criteria for the search included the nursing field as the primary focus. Literature published within the past 5 years was prioritized, and searches were limited to peer-reviewed, scholarly journals. I excluded articles that did not include nursing and articles unavailable in full-text English. I also searched the ASPAN 2021–2022 Perianesthesia Nursing Standards and Interpretive Statements for practice recommendations and guidelines for local anesthetics and LAST competency.

The aim of this DNP project was to develop a learning intervention that provided perianesthesia nurses with the necessary knowledge to recognize the symptoms associated with local anesthetic toxicity. Perianesthesia nurses must receive specific education about LAST. Bowsher et al. (2018) insisted that LAST education be mandatory in all practice settings utilizing local anesthetics. I used evidence from AORN's "Guideline for Care of the Patient Receiving Local Anesthetics" and the ASPAN 2021–2022 Perianesthesia Nursing Standards, Practice Recommendations, and Interpretive Statements for LAST core competencies for all phases of perianesthesia care to develop

the LAST education module (see Appendix A). The education module and the pre- and posttest were developed using evidence-based literature regarding LAST education for nurses. Project site organization anesthesiologists reviewed and approved the content of the education module and test validity.

Local anesthetics are used in everyday practice across all health care specialties (Bowsher et al., 2018). While most nurses are familiar with the uses of local anesthetics, most lack awareness of local anesthetic guidelines and the recognition of LAST (Bowsher et al., 2018). Ferguson et al. (2019) indicated that there was a knowledge deficit among perianesthesia nurses regarding LAST awareness. Because LAST remains a rare, catastrophic, perianesthetic event, the opportunity for LAST knowledge acquisition remains minimal due to a lack of clinical exposure (Bevil et al., 2020). The nursing staff are most often with patients after the administration of local anesthetic; however, education regarding LAST recognition and treatment continues to be left out of the nursing education and standard competency evaluations (Bevil et al., 2020). In their guidelines for local anesthetics, the AORNs' suggested that the nurse providing care for local anesthetic patients should recognize signs of toxicity and familiarize themselves with treatment protocols for LAST (Schneider & Howard, 2021). Education interventions in nursing specialties about the signs, symptoms, timely treatment, and best practices relating to LAST contribute to improved patient outcomes (Ferry & Cook, 2020).

Evidence Generated for the Doctoral Project

Participants

Local anesthetics are being utilized more than ever in the clinical setting, making it critical that all perianesthesia nurses know LAST identification and treatment (Ferry & Cook, 2020). LAST competency is essential for the early identification of LAST (Bevil et al., 2020). All perianesthesia registered nurses at the project site organization were expected to participate in this education project. The perianesthesia nursing staff includes nurses from all degree levels, males, and females from novice- to expert-level nurses working in preoperative staging, post anesthesia care unit and operating/procedure rooms. The organizational leadership agreed with the need to educate the perianesthesia nurses about the LAST complication. Organizational leadership announced the LAST education project to the perianesthesia nurses during a facility staff meeting, and an invitation flyer was posted in the employees' breakroom and at all the organization's timeclock locations. The perianesthesia nurses in the organization were given invitations with QR code access to participate in the learning module via a LMS application. Participation in the learning module was voluntary and able to be completed while on duty.

Procedures

I adapted the content for the learning module and pre-/posttest from the AORN-approved LAST continuing education and StatPearls continuing education regarding local anesthetic toxicity (see Appendix B). The pretest consisted of questions regarding local anesthetics' pathophysiology, signs and symptom of LAST, and nursing management of the patient experiencing LAST. The pretest was administered to

participants to assess their LAST awareness and treatment knowledge levels within the LMS application before they were granted access to the learning module. Nurses accessed the pretest via a QR code on the invitation. The participants completed the learning module via personal devices or an electronic device that I had available in a central location within the project site. The learning module was not accessible via the organization's computers. The pre- and posttest took approximately 10–15 minutes to complete. The facility director did "walking rounds" throughout the week to encourage nurses to complete the learning module. All test result data were stored electronically in the LMS application to which I had exclusive access. In addition to knowledge assessment, the pretest collected demographic information from the participants, including their years of nursing experience and years of perianesthesia nursing experience. The LMS was hosted on Amazon Web Services and followed best practices for secure procurement and operation while adding an extra layer of security with single sign-on (EdApp, 2022). The administrator portal of the LMS provided completion rates with analytics and allowed me to easily view and export engagement and performance insights into reports (see EdApp, 2022). Metrics and data were obtained through the LMS reporting site and easily exported to Excel (see EdApp, 2022). I had access to the administrator portal through a secure username and password. The data were kept within the LMS until all data were procured, and I then exported the data into Microsoft Excel on my personal computer. My computer remained password protected and kept in a locked office within my home.

Upon completion of the pretest, participants were granted access to the LAST educational module within the LMS. Participants were asked to complete the educational modules during a specific week. The organizational leadership agreed that the nursing staff would be able to complete the learning module during the week allotted. Upon completion of the learning module, the participants acquired the knowledge to understand the pathophysiology of local anesthetics and the risk factors that predispose patients to LAST, recognize the signs and symptoms associated with LAST, and manage the care of patients with LAST.

After completion of the educational module, participants immediately completed a posttest. The posttest was delivered electronically within the LMS education module and took 10–15 minutes to complete. The posttest result data were stored electronically within the LMS. The results were downloaded to a computer and then uploaded to Excel in a de-identified fashion. I analyzed the data using descriptive analysis with the SPSS software. The mean difference was calculated between the pre- and posttest data to determine whether nurses' knowledge improved after attending the educational module. I arranged the data presentation to display the lowest score, highest score, and differences between the pre- and posttest scores.

Protections

I obtained approval from Walden University's Institutional Review Board to conduct this staff education project (Approval Number 05-16-23-1031033). Permission to conduct the project was obtained from the project site organization's leadership. The organization's director encouraged all facility perianesthesia nurses to participate in the

education module. Arming perianesthesia nurses with LAST knowledge is necessary to improve their ability to manage patients receiving local anesthetics to improve patient safety (Ferguson et al., 2019). Participants in the educational module remained anonymous because the LMS did not collect identifiable information from them. Access to the LMS was enabled via a QR code, so no identifiable information was needed. On the introductory page of the LMS, participants were informed that they were confirming their consent to participate in the educational module by completing a pretest. The institution's name did not appear in written reports on the data collected from this project. My access to the data stored within the LMS was via a username and password login. The collected data were stored on my private office personal computer, and any physical data printouts were stored in a locked file.

Analysis and Synthesis

There are 25 full-time perianesthesia nurses employed at the project site organization, and all were invited to participate in the project. Additionally, all part-time perianesthesia nurses available during the week of project implementation were invited to participate. I stored the pre- and posttest results electronically in the LMS. Data were only analyzed from participants who completed both the pre- and posttest. I performed data analysis with descriptive statistics using SPSS to determine whether nurses` knowledge improved after participating in the educational module. The data were presented from the lowest score to the highest score and to show differences between the pre- to posttest scores.

Summary

In Section 3, I reviewed the practice-focused question and presented the sources of evidence used to develop the learning intervention that provides knowledge to perianesthesia nurses to recognize the symptoms associated with local anesthetic toxicity. The project conducted to generate evidence regarding the education of perianesthesia nurses about LAST via LMS was discussed.

In Section 4, I will discuss the findings and implications of the project. My proposed recommendations will be provided as solutions to the practice gap addressed by the project. In the following section, I will also address the strengths and limitations of the project.

Section 4: Findings and Recommendations

Introduction

A knowledge gap regarding LAST among perianesthesia nurses presents the potential for poor outcomes for patients receiving local anesthetics in the perioperative setting. Low-volume, high-risk perianesthetic events, such as LAST, present a barrier to the preparedness of perianesthesia nursing staff (Bevil et al., 2020). Nurses in the perianesthesia setting assist anesthesiologists in administering local anesthetics, providing care during the perioperative and recovery phases, and must be aware of early signs and corrective treatment for LAST (Ferguson et al., 2019). Due to the increasing local anesthetic use in the perioperative setting, perianesthesia nurses must be prepared to recognize and initiate rescue when LAST occurs. The practice-focused question that guided this project was: Will a web-based education intervention increase perianesthesia nurses' knowledge about LAST? The purpose of this doctoral project was to develop a staff education intervention to equip perianesthesia nurses with the clinical knowledge vital to the early recognition of LAST symptoms.

The project included an elearning staff education module (see Appendix A) about LAST recognition, current treatment, and pre-/posttest evaluations (see Appendix B). Participants completed a pretest evaluation of LAST knowledge prior to accessing the LAST education module. Following completion of the learning module, participants completed a posttest to evaluate their current LAST knowledge. Participants completed the pretest, learning module, and posttest electronically via a LMS platform. I compared

the participants' pre- and posttest scores to determine the effectiveness of the learning module.

Participation in the project was voluntary. All perianesthesia nurses in the project site organization were invited to participate in the project. I identified myself as a DNP student at Walden University, explained the project and informed consent process for participation, and provided Walden University's contact information to all participants in person. The participants were also given QR code invitations to participate and informed that the project would be live for 1 week. I was present in the organization during the week of the project implementation to answer questions and receive feedback. A total of 38 nurses were invited to participate: 25 of full-time staff and 13 part-time staff. Thirty-one nurses completed the pretest, education module, and posttest. In Section 4, I discuss the findings and implications of this doctoral project, make recommendations, and describe the project's strengths and limitations.

Findings and Implications

Results

The LMS utilized to conduct pre- and posttests was able to capture the participants' paired scores anonymously. A 10-question pretest was required to be completed before the participant was granted access to the education module. At the end of the pretest, the participants were asked to enter the number of years they had worked as a registered nurse and the number of years functioning in a perianesthesia nurse role. After completing the education module, the same questions from the pretest were presented in the posttest. The posttest provided the correct answers with rationales upon

completion. I used paired-sample *t* tests to analyze pre- and posttest scores. Table 1 indicates that 6.5% of participants were registered nurses who had less than 1 year of experience, 16.1% were nurses for 5–10 years, and 51.6% were nurses for more than 10 years.

Table 1

Registered Nurse/Perianesthesia Years' of Experience

Parameter	*n* (%)
RN years	
Less than 1 year	2 (6.5)
5 to 10 years	5 (16.1)
Greater than 10 years	24 (77.4)
Perianesthesia years	
Less than 1 year	10 (32.3)
5 to 10 years	5 (16.1)
Greater than 10 years	16 (51.6)

Note. $N = 31$.

By employing a pre- and posttest analysis, I was able to determine whether implementing the LAST education intervention enhanced the knowledge scores among the perianesthesia nurse participants. The pretest mean determined using paired samples statistics was 58.06 and the posttest mean was 90 (see Table 2).

Table 2

Local Anesthetic Systemic Toxicity Knowledge Scores

		M	*N*	*SD*	*SEM*
Pair 1	Pretest	58.06	31	15.148	2.721
	Posttest	90.00	31	8.165	1.466

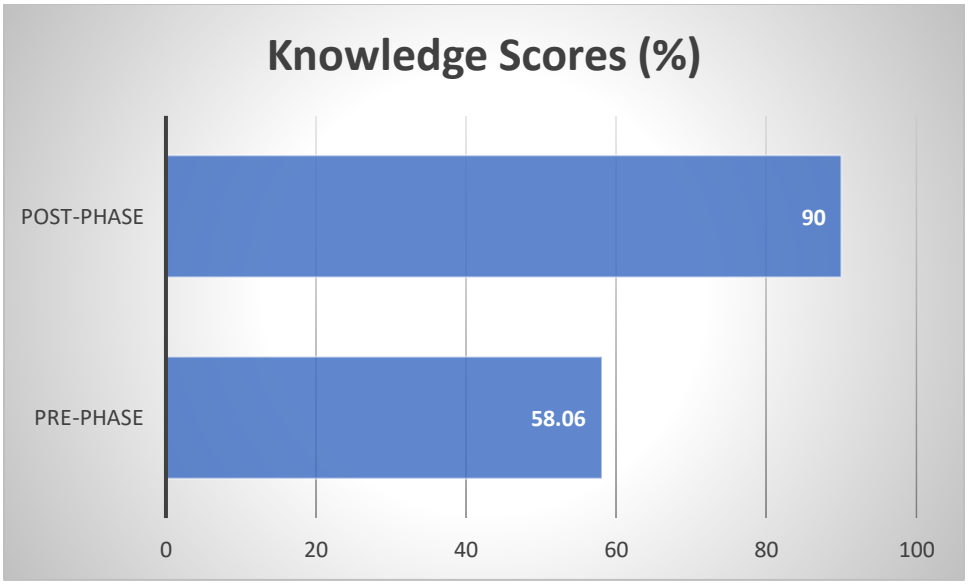
A paired-samples test indicated a favorable outcome $t(30) = -13.51$, $p < 0.001$. Since $p < .05$, it can be concluded that the pre- and posttest scores are statistically

significantly different. The mean difference between the pre- and posttest scores was -31.94, with a standard error of 2.4. The mean difference calculation means, on average, the posttest scores were approximately 31.94 points higher than the pretest scores among the participants. The standard error of 2.4 indicates that the mean difference of -31.94 is subject to some variability, with individual differences in the range of approximately ±2.4, indicating a variable score range of 29.54 and 34.34. Therefore, there is a statistically significant improvement between the pre- and posttest phase with respect to knowledge scores and a mean difference of 31.9 in favor of the posttest phase.

Figure 1 depicts an increase in knowledge scores, with the mean score for the posttest phase at 90 and the mean pretest phase knowledge scores at 58.06.

Figure 1

Local Anesthetic Systemic Toxicity Knowledge Scores



Limitations

As indicated in Table 1, 51.6% of the perianesthesia nurse participants had more than 10 years of nursing experience. There were occasional questions among the more experienced nurse participants about how to use the QR code and navigate the LMS platform. Some participants verbalized slight apprehension with the use of elearning technology, so the use of LMS technology may have prevented more nurses from participating. The learning intervention was implemented at one ambulatory surgery center setting; therefore, it cannot be concluded that perianesthesia nurses have the same knowledge level in all perianesthesia clinical settings.

Implications

The results from this project indicate that education is needed among perianesthesia nurses regarding LAST. It was enlightening to discover how many perianesthesia nurses with more than 10 years of perianesthesia experience had never heard of LAST. As part of this education project, LAST rescue was discussed. LAST rescue includes administering lipid emulsion therapy (Neal et al., 2018); however, this facility did not have lipid emulsion readily available onsite and would need to retrieve it from the main campus several blocks away. I provided the organization leadership and anesthesiologists with the ASRA's current LAST checklist and LAST rescue kit component suggestion (see Neal et al., 2020). The facility now has a LAST rescue kit in a centrally located Pyxis, and LAST checklists are posted in every perianesthesia nursing station (see Neal et al., 2020).

Dedicated education regarding LAST to perianesthesia nurses is essential to increase nursing knowledge and improve clinical practice (Bevil et al., 2020). This project will potentially improve patient outcomes by creating a safe and knowledgeable perianesthesia nursing team. This education project improved the participants' knowledge of LAST, showing that even the most experienced nurses in the group needed education about LAST.

This project promotes positive social change by improving perianesthesia nursing knowledge and awareness about LAST and highlighting the importance of continued learning in nursing practice. Nurses must always ensure patient safety (Ferguson et al., 2019). Early, rapid intervention during a LAST event is vital to patient survival (Ferguson et al., 2019). Addressing the knowledge gap regarding LAST requires dedicated education for nurses with routine competency evaluation to improve patient outcomes (Bevil et al., 2020). Further developments in knowledge regarding LAST may lead to improvements in resuscitation efforts, thus improving patient outcomes (Neal et al., 2018). Improving LAST knowledge among nurses promotes positive social change by preparing nurses to provide competent care to patients receiving local aesthetics, thus improving patient safety and contributing to community health.

Recommendations

LAST education for nurses is vital for patient safety in clinical settings where local anesthetics are administered (Neal et al., 2018). Because LAST remains a low-volume, high-risk event, clinical exposure is lacking, leaving perianesthesia nurses unprepared to recognize and initiate rescue (Ferguson et al., 2019). A proposed solution

that I discussed with facility leadership is to include LAST education in yearly competency education for perianesthesia and perioperative departments (see Bevil et al., 2020). The project site organization leadership agreed that LAST education is necessary for patient safety and requested my participation in creating a LAST education poster for the following skills fair. I agreed to assist with this project.

I also recommended that the current ASRA checklist be posted in highly visible locations throughout the facility, which was immediately implemented at the close of this project (see Neal et al., 2020).

Strengths and Limitations of the Project

A significant strength of this project was the interprofessional collaboration and knowledge sharing between providers triggered by the project. The anesthesia providers and surgeons began conversing with the perianesthesia nurses about their experiences with LAST and sharing knowledge. Some providers were unaware of the current ASRA's suggestions for a LAST rescue kit. Another strength of the project was that it stimulated an eagerness to learn among the perianesthesia nurses. The nurses became intrigued to learn about the advanced cardiovascular life support modifications required during LAST. Many of the participants verbalized that they appreciated how succinctly the education was presented without requiring an excessive amount of time necessary to complete the module.

Another suggestion for addressing the issue of low-volume, high-risk events is to retest nursing knowledge 3–6 months after the educational intervention to assess knowledge retention. Because LAST occurs infrequently, future LAST education

interventions should explore knowledge retention (Ferguson et al., 2019). Further insight into low-volume, high-risk event knowledge retention could contribute to annual competency education suggestions for specific clinical settings.

Summary

In this DNP project, I developed a learning intervention that provides perianesthesia nurses with knowledge to recognize the symptoms associated with LAST. In Section 4, I discussed the findings and implications as well as proposed recommendations based on the data analyzed for this project. Section 4 also included a summary of the strengths and limitations as well as suggestions for future projects using similar methods. In Section 5, I will discuss the dissemination plan and present an analysis of self through the scholarly journey of this project.

Section 5: Dissemination Plan

The goal of the project was to increase perianesthesia nursing knowledge regarding LAST. I disseminated a staff education module via an LMS to perianesthesia nurses at an outpatient surgery center. The results of the project were presented to the organization's anesthesiologists and leadership. The results will also be disseminated to the Research Oversight Committee of the project site at a future date. The main campus organization leadership has expressed a significant interest in having the education module presented at the primary campus skills fair, to which I have agreed. Moving forward, I also proposed that the LAST education be included as part of yearly competency requirements for perianesthesia and perioperative nurses.

Nurses in clinical settings where local anesthetics are used must know how to recognize and manage a LAST event. This project focused solely on educating perianesthesia nurses due to the frequency of local anesthetic use in the surgical setting; however, this education intervention is applicable across many clinical settings. Dissemination of this education module at an ASPAN conference could resonate with many nurses functioning in preanesthesia and postanesthesia care roles.

Analysis of Self

Practitioner

As a practitioner in the perianesthesia clinical setting, I strive to provide the most competent care possible to my patients. As a perianesthesia nurse, I pursued and achieved perianesthesia nursing certification to improve my competence in practice. In preparing for certification, I started recognizing the many knowledge gaps in nursing practice. As a

practitioner and DNP student, I began to understand the scientific underpinnings for practice, including translating knowledge to benefit the practice environment (see American Association of Colleges of Nursing, 2006). There will always be moments when I may encounter something unfamiliar and seek advice from a colleague. I have always enjoyed being a preceptor in my clinical setting, and I chose to pursue a DNP to become a nurse educator, a stellar nursing mentor, and inspire future nurses to always aspire to learn. Advancing nursing practice requires that the practitioner engages in leadership for evidence-based practice, possessing competence in the discipline and knowledge application for translating research into practice (AACN, 2006). The DNP journey has taught me the importance of lifelong learning in nursing.

Scholar

As a DNP student scholar, I began researching the knowledge gap regarding LAST, specifically in the perianesthesia clinical setting. As I learned more about LAST through literature reviews, I became curious as to why nurses were required to complete drills and competency evaluations regarding malignant hyperthermia but not LAST. I discovered that many of my colleagues did not know about LAST. As a scholar and DNP student, I learned to apply knowledge gained from research to solve a problem in nursing practice (see AACN, 2006). I am proud of the exponential growth that I have accomplished as a scholar during this doctoral project. I have developed research skills essential for integrating knowledge from diverse sources and applying the knowledge gained to address a specific problem in perianesthesia nursing practice. The knowledge I have gained as a scholar will prove invaluable as an educator in my future endeavors. As

a scholar, I embrace that lifelong learning is essential to advance the future of nursing practice.

Project Manager

The experience I have gained as a project manager for this education project has proved invaluable to my role in nursing. I have learned to consider not only the objectives of the material presented but also the needs of learners. I found the role of project manager extraordinarily challenging and frustrating at times. I must admit that I sometimes found it disappointing to recognize that not all nurses value learning and its importance in clinical practice. In using the adult learning theory to guide the development of the project, I learned the importance of identifying the generation of the learner while understanding behaviors that influence learning (see Jeffery et al., 2015). While I do not desire to pursue a leadership role in nursing, I realize that as an educator, I will use leadership skills in the educator role. As the project manager, I learned to communicate, collaborate, and guide interprofessional engagement for this project to be implemented successfully (see Jeffery et al., 2015).

My long-term goal as a DNP is to become a nurse educator. The skills I have learned as a practitioner, scholar, and project manager will continue to guide my focus on educating future nurses on low-volume, high-risk events in clinical practice. The attributes that I have gained through the development of this doctoral project support DNP Essential III: Clinical Scholarship by generating evidence through practice to guide practice improvements (see AACN, 2006). I want to contribute to educating future nurses

and motivating them to function in this profession with profound competence and pride while stressing the professional responsibility of lifelong learning.

Summary

LAST can occur in any clinical setting utilizing local anesthetics. Because LAST is a low-volume, high-risk event, many nurses lack the knowledge to recognize or initiate rescue during a LAST event (Bevil et al., 2020). With this doctoral project, I aimed to increase perianesthesia nurses' knowledge regarding LAST by developing a web-based LAST education intervention that was presented to perianesthesia nurses at an ambulatory surgery center. Analysis of the data from the education intervention indicated that perianesthesia nursing knowledge significantly increased following participation in the LAST education module. In addition to educating perianesthesia nurses about LAST, the project site organization is now better equipped to provide care for a patient experiencing LAST with a LAST rescue kit in the Pyxis and LAST checklists posted in each department. Staff education projects, such as this one, are essential to improve clinical competency in low-volume, high-risk events.

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Appendix A: LAST Education Module

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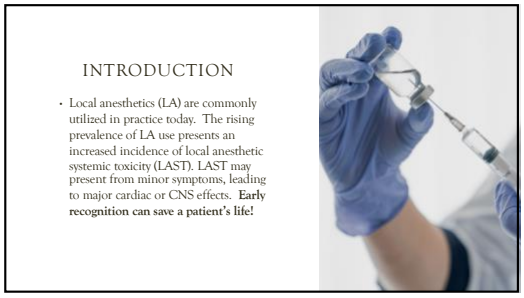

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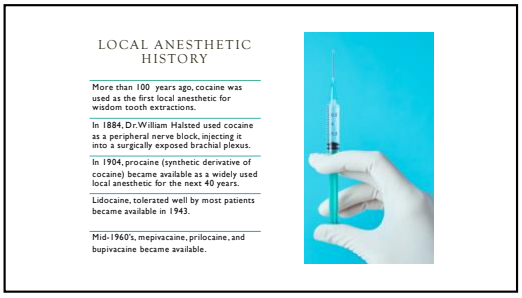

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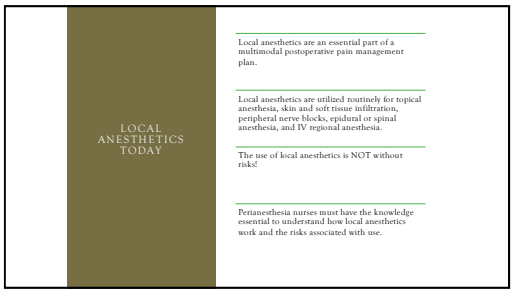
LOCAL ANESTHETICS TODAY
Local anesthetics are an essential part of a multimodal postoperative pain management plan.
Local anesthetics are utilized routinely for topical anesthesia, skin and soft tissue infiltration, peripheral nerve blocks, epidural or spinal anesthesia, and IV regional anesthesia.
The use of local anesthetics is NOT without risks!
Perianesthesia nurses must have the knowledge essential to understand how local anesthetics work and the risks associated with use.

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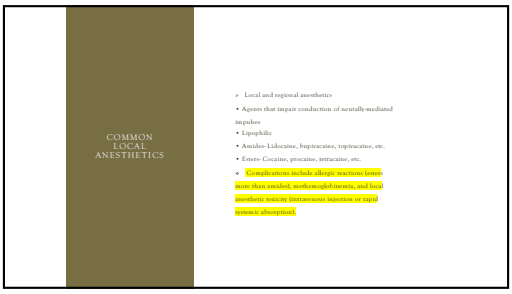
COMMON LOCAL ANESTHETICS
Local and regional anesthetics
Agents that impair conduction of neurally-mediated impulses
Lipophilic
Amides- Lidocaine, bupivacaine, ropivacaine, etc.
Esters- Cocaine, procaine, tetracaine, etc.
Complications include allergic reactions (esters more than amides), methemoglobinemia, and local anesthetic toxicity (intravascular injection or rapid systemic absorption)

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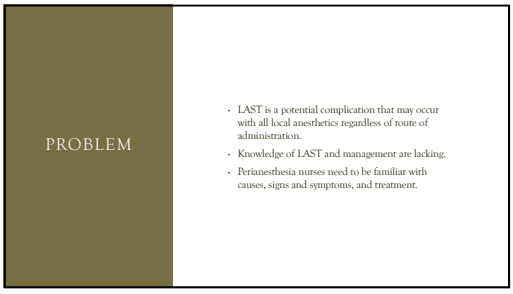
PROBLEM
LAST is a potential complication that may occur with all local anesthetics regardless of route of administration.
Knowledge of LAST and management are lacking.
Perianesthesia nurses need to be familiar with causes, signs and symptoms, and treatment.

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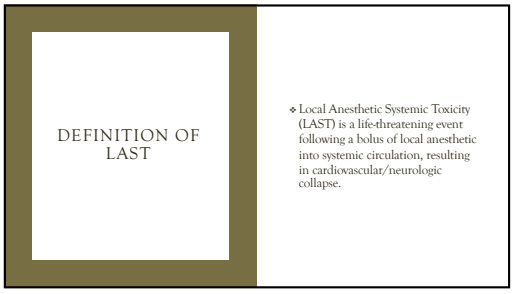
DEFINITION OF LAST
Local Anesthetic Systemic Toxicity (LAST) is a life-threatening event following a bolus of local anesthetic into systemic circulation, resulting in cardiovascular/neurologic collapse.

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PHARMACODYNAMICS

- Local anesthetics prevent the surgical stimuli from reaching the CNS by binding to receptor sites on the sodium channels in the nerve cell membrane and creating a reversible block of the transmission of nerve impulses.
- Local anesthetics bind with circulating plasma proteins. The degree to which the local anesthetic binds with proteins in the sodium channel predicts the duration of the nerve block.

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COMMON LOCAL ANESTHETIC ADDITIVES:

Medication may be added to local anesthetics to enhance how it works.

- **Epinephrine-** causes vasoconstriction, slowing systemic absorption of the local anesthetic and reducing bleeding. Decreases entry of the local anesthetic into plasma, which allows for safe administration of higher doses of the chosen local anesthetic. Epinephrine additive also increases the duration of the nerve block.
- **Sodium bicarbonate-** speeds the onset of nerve block by increasing the pH and tertiary state. Does not affect the duration of the block.

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FACTORS CONTRIBUTING TO LAST

- Site of injection
- Injection technique
- Type of anesthetic and dose
- Patient characteristics

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SITE OF INJECTION

- Site determines rate of absorption

Lowest to highest:

- Subcutaneous
- Brachial plexus
- Epidural
- Caudal
- Intercostal

More vascular = higher absorption

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INJECTION TECHNIQUE

Size of needle used to inject determines how rapid the anesthetic is injected.

An 18g needle will inject at a more rapid pace than a 25g needle.

Frequent aspiration will warn of inadvertent IV access, decreasing the risk for LAST.

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TYPE OF ANESTHETIC AND DOSE

Drug	Onset	Maximum Dose (with Epinephrine)	Duration (with Epinephrine)
Lidocaine	Rapid	4.5 mg/kg (7 mg/kg)	120 min (240 min)
Mepivacaine	Rapid	5 mg/kg (7 mg/kg)	180 min (360 min)
Bupivacaine	Slow	2.5 mg/kg (3 mg/kg)	4 hours (8 h)
Ropivacaine	Medium	2-3 mg/kg	3 hours (6 h)
Levobupivacaine	Medium	2.0 mg/kg or 400mg in 24 hrs	4-6 hours (8-12 h)
Procaine	Slow	8 mg/kg (10 mg/kg)	45 min (90 min)
Chloroprocaine	Rapid	10 mg/kg (15 mg/kg)	30 min (90 min)
Etidocaine	Rapid	2.5 mg/kg (4 mg/kg)	4 hours (8 h)
Prilocaine	Medium	5 mg/kg (7.5 mg/kg)	90 min (360 min)
Tetracaine	Slow	1.5 mg/kg (2.5 mg/kg)	3 hours (10 h)

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PATIENT CHARACTERISTICS

- **Comorbidities**- hepatic dysfunction, cardiac diseases, pregnancy, and metabolic syndromes
- **Physiologic limitations**- elderly are at higher risk of LAST due to decreased systemic blood flow and liver function, leading to decreased local anesthetic clearance.

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PREVENTION

1. Use the lowest dose of local anesthetic possible to achieve the desired result.
2. Use a slow, careful injection technique and frequent to determine whether there is blood return into the syringe.
3. When possible, maintain verbal contact with the patient to identify any concerning signs or symptoms.

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RECOGNIZE SIGNS & SYMPTOMS

- **Initial signs and symptoms present as agitation, confusion, dizziness, drowsiness, dysphoria, auditory changes, tinnitus, perioral numbness, metallic taste, and dysarthria.**

❖ **Progression of symptoms:**

- **CNS Excitement**- Tinnitus, Blurred Vision, Dizziness, Agitation, Metallic taste, Nystagmus, Seizures
- **CNS Depression**- Drowsiness, Coma
- **Cardiac Toxicity**- HTN, Tachycardia, Arrhythmia
- **Cardiac Depression**- Bradycardia, Conduction Blocks, Asystole

Resuscitation from asystole is difficult!

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POINTS TO CONSIDER:

- Lidocaine hydrochloride is an antiarrhythmic drug capable of toxic reaction on the CNS.
- Early CNS symptoms include perioral numbness and tongue paresthesia.
- Lidocaine efficacy decreases in the presence of inflammation.
- Considering an intravascular injection of LA- seizure may be the initial presentation.
- LAST most commonly occurs in brachial plexus blocks.

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EARLY RECOGNITION IS KEY!

- The ability to recognize LAST is crucial.
- While caring for any patient receiving local anesthesia, the team should constantly assess this for altered mental status, agitation, loss of consciousness, seizures, and cardiac collapse.
- Constant assessment is vital because early recognition and intervention can be lifesaving
- Successful resuscitation using a 20% lipid emulsion (Intralipid) combined with modified ACLS protocol has been thoroughly researched as an effective rescue measure.

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LAST RESCUE

1. Prompt, effective airway management
2. Benzodiazepines to treat seizures
3. Effective CPR
4. ACLS Protocol with modifications

***Avoid lidocaine, vasopressin, Ca Channel Blockers, Beta Blockers ***

Amiodarone is preferred in the event of ventricular arrhythmias.

5. Lipid Emulsion

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LAST RESCUE: LIPID EMULSION

- 20% Intralipid
- 1.5 mL/kg as an initial bolus followed by
- 0.25 mL/kg/min for 30-60 minutes
- Bolus could be repeated 1-2 times at 5-minute intervals for persistent asystole
- Infusion rate could be increased if blood pressure declines

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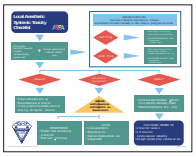
CAN YOU SPOT IT?

22

AMERICAN SOCIETY OF REGIONAL ANESTHESIA AND PAIN MEDICINE: UPDATED (2020) LAST CHECKLIST



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Appendix B: Pretest and Posttest

1. Which statement is false regarding local anesthetics?

    a. Local anesthetics are class I antiarrhythmic drugs.

    b. Local anesthetics can be administered around peripheral nerves and in the neuraxial space to anesthetize larger nerves or dermatomal distributions.

    c. Local anesthetics block calcium channels.

    d. Local anesthetics are not effective in sites of inflammation.

2. A 25-year-old woman presents to the emergency department with multiple lacerations to her upper extremities and face incurred in a motor vehicle collision. She has a past medical history of hypothyroidism and takes levothyroxine. On exam, she is well-appearing and in moderate distress. There are three 6 cm lacerations on both her thighs and two 4 cm lacerations on her face. The patient tolerates the laceration repairs with 2% lidocaine without epinephrine to both her thighs. The facial laceration repairs are done with 2% lidocaine with epinephrine because the facial lacerations bleed when wound compression is stopped. During the second facial laceration repair, the patient develops a ringing sensation in her right ear. Which of the following complications has most likely occurred?

    a. Accidental intravenous injection for the second facial laceration repair

    b. Accidental arterial injection for the second facial laceration repair

    c. Allergic reaction to the epinephrine

    d. Local anesthetic systemic toxicity

3. A 35-year-old male underwent a supraclavicular blockade with bupivacaine. Five minutes after the procedure, he reports some dizziness and appears agitated. What is the next best step in management?

    a. Immediate administration of buccal midazolam
    b. Place an order for lipid emulsion therapy
    c. Immediate ventilation and oxygenation
    b. watch and wait

4. What are the most common initial cardiovascular sign(s) of local anesthetic systemic toxicity?

    a. Hypotension and bradycardia
    b. Bradyarrhythmia
    c. Hypertension and dyspnea
    d. Ventricular fibrillation

5. Which one of the following adjustments to the Advanced Cardiac Life Support guidelines are recommended in cases of local anesthetic-induced cardiac arrest?

    a. Larger doses of epinephrine greater than 2g/kg are preferred
    b. Vasopressin should be avoided
    c. Procainamide is the preferred pharmacotherapy in the event of a ventricular arrhythmia

d. Propofol should be added as it can increase cardiac output

6. A 41-year-old woman undergoes an infraclavicular blockade with bupivacaine. Ten minutes later, she starts convulsing, and the bedsheet is soaked with urine. The patient is resuscitated and stabilized. She has no recollection of the incident and denies any history of seizures. What is the most likely etiology of this patient's presentation?

   a. Overdose of bupivacaine
   b. Intramuscular injection of bupivacaine
   c. Intravascular injection of bupivacaine
   d. Subcutaneous injection of bupivacaine

7. A 47-year-old woman with chronic back pain presents to the emergency department approximately six hours after seeing her pain management specialist. She feels lightheaded. She has facial tingling, blurry vision, and a ringing in her ears. She is concerned that she is having an adverse reaction to her nerve block. With regards to toxic exposure to the likely pharmacological agent, what is the most common initial presenting symptom?

   a. Tinnitus
   b. Visual disturbances
   c. Perioral numbness
   d. Areflexia

8. Complications of local anesthetics include:

    a. Allergic reactions

    b. Local Anesthetic Systemic Toxicity

    c. Methemoglobinemia

    d. All the above

9. A 25-year-old woman is being prepared for an open reduction internal fixation of a right radial fracture. A supraclavicular nerve block is performed with lidocaine by the anesthetist. Shortly afterward, she complains of anxiety and tinnitus and is noted to have a heart rate of 113/min. She soon sustains a generalized tonic-clonic seizure and ventricular tachycardia and rapidly becomes unresponsive. What is the most likely mechanism of the patient's condition?

    a. Increased drug metabolite leading to neurotoxicity

    b. Blocking sodium channels and slowing conduction

    c. Increasing conduction through the Purkinje fibers

    d. Direct myocardial injury

10. LAST is a potential complication that:

    a. May occur with all local anesthetics regardless of route of administration.

    b. May be attributed to preservatives in local anesthetics.

    c. Will cause arterial blood will appear "chocolate-colored" or brownish red

    All the above