Nurse Anesthetists' Perceptions and Use of Ultrasound for Epidural and Spinal Needle Placement in Obese Parturients

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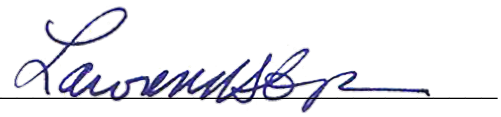
Signature  Date: 8/15/2020

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Abstract

Purpose: The use of ultrasound scout scans and real-time ultrasound scanning for epidural/spinal needle placement is possible, but not prevalent in obstetric anesthesia practice. Ultrasound use in the obese parturient with impalpable landmarks can facilitate epidural/spinal needle placement. It is estimated that 50% of parturients are obese and eight percent of those are considered morbidly obese as defined by a BMI $\geq$ 40 kg/m^2.[6]
A survey of Certified Registered Nurse Anesthetists (CRNAs) and Student Registered Nurse Anesthetists (SRNAs) was utilized to determine their knowledge of ultrasound for epidural/ spinal needle placement, the availability of ultrasound equipment, and barriers to ultrasound use in obstetric anesthesia practice. Previous studies have not included CRNAs.

Methods: An online survey was distributed to 1,882 practicing CRNAs and SRNAs to determine their knowledge, access, and perceptions of ultrasound used for epidural and spinal needle placement in parturients with a BMI $\geq$ 35 kg/m^2.

Results: Of the109 respondents, 85% were involved in obstetric anesthesia services, and 76% were regularly involved in the care of parturients with a BMI $\geq$ 35 kg/m^2. 57% of respondents had used ultrasound for a scout scan, and 29% used ultrasound in real-time needle placement. There was 100% agreement that ultrasound was helpful in needle placement when landmarks were indistinguishable. Barriers included a lack of knowledge, equipment, and privileges.

Conclusion: Ultrasound for epidural and spinal needle placement is known by CRNAs and SRNAs and is considered useful for needle placement in a parturient with a BMI $\geq$ 35 kg/m^2. The survey data showed that CRNAs who utilized ultrasound for epidural/spinal needle placement found it useful; however, they did not find it necessary in every case despite the parturients size.
Because of the low response rate, further research is necessary.

Data Sources: Cumulative Index to Nursing and Allied Health Literature (CINAHL), EBSCOhost, Google Scholar, Medscape, PubMed.

Keywords: Epidural and spinal needle placement, ultrasound scout scans, BMI, morbid obesity, obese parturients.

Introduction

The improvements in anesthesia medications, monitoring, and new types of equipment over the past ten years have yielded better anesthesia outcomes and improved patient safety.[1,2] One area of anesthesia practice that has benefited from improvements in equipment is airway intubation with video laryngoscopy rather than the time-honored Miller and Macintosh blades, which were introduced into anesthesia practice in the early1940s. The use of video laryngoscopy has decreased the number of difficult intubations that occur in practice.[3]

Ultrasound is becoming more available in anesthesia departments across the United States. It has the potential of improving the placement of epidural and spinal needles, mirroring the success of video laryngoscopy. Anesthesia practice has changed little in terms of the methods for placement of epidural and spinal needles for analgesia/anesthesia in obstetrics. Traditional palpation of landmarks is still the most common method used for needle placement.[4] Closed-claims data showed an increase in nerve injury from the use of central neuraxial analgesia/anesthesia in obstetrics from 2005 to 2015, which may be an indication of problems with the traditional palpation technique.[5]

Obesity is increasingly an issue in obstetrics. Eight percent of obstetric patients have a body mass index ≥ 40 kg/m^2.[7] Obesity contributes to complications during pregnancy, such as pregnancy-induced hypertension and gestational diabetes, among others. Obesity alone can increase the possibility of cesarean section delivery.[8] Frequently the initial meeting between Certified Registered Nurse Anesthetist (CRNA) and morbidly obese parturient is minutes before an urgent or emergent cesarean section delivery. An efficient procedure to determine the proper location for epidural or spinal needle placement is necessary to avoid the complications associated with neuraxial anesthesia in the morbidly obese parturient.[9]

The traditional palpation of landmarks for needle placement in epidurals/spinals may be technically challenging when the patient is obese. The distribution of adipose tissue interferes with the ability to palpate the spinal interspaces. The distance from skin to subarachnoid space may be further than anticipated. The three and a half-inch needles included in spinal kits may be too short, and unable to reach the subarachnoid space.[6] Patients with a body mass index of 35 kg/m^2or greater may benefit from the use of ultrasound scout scans to locate the correct interspace as well as determine the distance from skin to epidural or subarachnoid space.[7] However, to date, there have been no studies to ascertain the use of ultrasound in needle placement for epidurals/spinals in obstetric anesthesia practice by CRNAs.[7]

A Qualtrics survey was used to determine what CRNAs know about using ultrasound scout scans for needle epidural/spinal needle placement. The survey asked questions related to the usefulness of ultrasound in successful needle placement for epidurals/spinals in laboring or cesarean section delivery patients with a BMI ≥ 35 kg/m^2.

Research Questions

(1) Do nurse anesthetists have the knowledge and understanding of ultrasound and the skillset to use it for central neuraxial needle placement in the obstetric anesthesia practice setting?

(2) Is the use of ultrasound for central neuraxial anesthesia taught as a fundamental in nurse anesthesia education programs?

(3) What barriers to implementation in anesthesia practice do nurse anesthetists encounter when ultrasound use is considered for neuraxial needle placement?

Identifying gaps in knowledge and barriers to adoption are the first steps in improving clinical practice.[8] Perceptions of the utility of ultrasound with epidural/spinal needle placement were

determined in this study. As the availability of ultrasound equipment in anesthesia departments varies and, in some cases, may not be available, the survey was designed to identify these issues.

Literature Review

History of Regional Analgesia and Anesthesia.

Regional anesthesia was first developed in the late 1800s in Europe.[9] It was August Bier, a German physician, who performed the first intentional spinal in 1899. Moreover, in 1902 the first paper on the use of epidural injections was published by a French physician, Cathelin.[9] The technique was presented in papers and researched by several prominent physicians around the world.[11] While August Bier and his associate, Dr. Hildebrandt, may have been the first to use spinal anesthesia for surgical procedures, they did not suggest its regular use in surgical practice. The reasons for their lack of support may have been personal experience with nausea and vomiting and the severe headaches that followed their administration of spinal anesthesia to each other.[11]

In the early years of spinal anesthesia, the medication most often used was a 0.5% or 1.0% dilution of cocaine, the medication was diluted with tap water, as the idea of sterile or aseptic techniques had yet to be adopted.[11] It was not until the late 1960s that the medications, needles, and catheters necessary to provide epidural/spinal anesthesia were available and reliable enough to become a routine part of anesthesia practice.[10] Epidural analgesia/anesthesia took much longer to become a reality in anesthesia practice. Doctors Cathelin and Sicard first introduced the practice of epidural anesthesia as a single method for genitourinary and neurologic procedures.[10] These two physicians introduced this technique separately, and a German physician introduced the single-shot epidural in his obstetric practice for the management of labor pain.[11]

During the 1940s, the introduction of flexible needles and the use of silk ureteral catheters to deliver either continuous spinal or epidural analgesia/anesthesia helped to further spinal and epidural analgesia/anesthesia in practice.[11] Innovations necessary for epidural and spinal anesthesia to further succeed was the development of the local anesthetics.[12] In the early phases of epidural and spinal anesthesia, the only available medication was cocaine.[13] The innovations in both techniques, needles, catheters, and medications were fundamental to the advancement of epidural and spinal analgesia/anesthesia.[11]

Anesthesia and Obstetrics

The pain of childbirth has been dealt with in many ways throughout history.[14] The Egyptians treated the labor pain with turpentine and ground marble paste on the belly while the Chinese used alcohol and opium to ease the pain of laboring women.[14] In 1853 Dr. James Young Simpson became the first obstetrician to use chloroform as a labor analgesic, which was for the birth of Queen Victoria's ninth child, Beatrice.[14]

Analgesia use for in laboring patients in the 1800s was not accepted due to religious teachings, and a lack of knowledge by physicians.[15] In England and the southern United States during the early 1900s, chloroform found popularity because it had a quick onset of action and a pleasant smell which was not irritating to the lungs.[15] At the same time, in the northern United States, ether was the preferred drug used in surgery and labor.[15]

Ether had several disadvantages, flammability, pungency, irritation of the lungs, and slow onset of anesthetic action. Ultimately the use of ether overshadowed the use of chloroform because of a better safety profile than chloroform.

In the 1930s, the use of nitrous oxide for pain management of labor became popular. It was first used in an 80% concentration with oxygen, which caused nausea and hypoxia. A 50%

concentration with oxygen gained favor because fewer problems with nausea and hypoxia were noted during administration. The combination saw widespread utilization in obstetrics for pain management of labor due to its acceptance by physicians and popularity with parturients.[15] There was a turn in practice when in the 1940s, the use of twilight sleep was used for labor pain, which consisted of intravenous morphine and scopolamine.[15] The combination of morphine and scopolamine offered amnesia and pain relief and did not appear to impede the progress of labor.[15]

The use of medications either inhaled, ingested, or injected to decrease the pain of labor and childbirth concentrated on the maternal aspects and overlooked the effects on the emerging fetus.[16] Physicians had some idea that the fetus was affected by medications, but it wasn't until 1876 when Paul Zweifel, a Swiss obstetrician, was able to prove that chloroform was present in the umbilical cord blood and infant's urine.[16] Although it was known that chloroform crossed the placenta, change in obstetric analgesia practice was limited by the lack of suitable replacements for analgesia during labor.[16]

In 1902 an Austrian physician, Richard von Steinbuchel, introduced the idea of "twilight sleep." The use of ether and chloroform was met with resistance from obstetricians, and twilight sleep also was not readily accepted and despite Zweifel's discovery of placenta transfer of chloroform.[16]

Virginia Apgar, who was the director of the division of anesthesia at Columbia University hospital from 1938 to 1949, was the physician who led the way in evaluating newborns at the time of delivery. In her time, the late 1930s and early 1940s, newborns were often labeled as stillborn at the time of delivery, and no effort to resuscitate them was made.[16] She brought changes in neonate evaluation at delivery using five signs: heart rate, respiratory

effort, color, muscle tone, and reflexes. Based on her scoring system resuscitation of the infant would be started immediately after birth which in turn improved the neonatal outcomes and decreased the number of stillbirths.[16] Her scoring system was initially published in 1953 and is still used today in labor and delivery units and operating rooms across the world.[16]

In 1941 three physicians, Edwards, Hingson, and Southworth, working at the naval hospital in Staten Island, New York, introduced caudal anesthesia.[16] In 1942 Edwards and Hingson proved that an emergency cesarean section delivery could be accomplished using their caudal technique. The technique employed a flexible needle that was left in place so that it could be dosed with medication as needed.[16] The early phases of spinal/epidural analgesia and anesthesia proved that it was a viable method in obstetrics.[15]

Virginia Apgar, with her work on infant assessment at delivery, and resuscitation, proved that spinal anesthesia was preferable to general anesthesia for infants at birth.[18] The medications used for general anesthesia cross from maternal blood to the placental blood supply and exert effects on the fetus.[16] Dr. Apgar noticed that infants whose mother received general anesthesia for cesarean section delivery were apneic and hard to arouse at delivery. In contrast, the infants whose mother received spinal anesthesia were alert and had good ratings on her five-point assessment.[16] Using the Agar score Dr. Apgar and her colleagues, Dr. Holaday, a research anesthesiologist, and Dr. James, a pediatrician, found that low Agar scores correlated with neonates that were both acidotic and hypoxic.[17] Drs. James and Apgar, through continued research, proved that a standard neonate resuscitation technique in the 1940s using intragastric air to provide oxygen to a neonate was detrimental to a positive outcome. The two physicians worked to prove that endotracheal intubation was the method to use when dealing with an apneic

newborn.[17] The work of Dr. Apgar in obstetric anesthesia and neonate evaluation at birth has contributed significantly to the successful outcomes we see today.[17]

The use of epidural analgesia/anesthesia was becoming accepted into obstetric anesthesia practice in the mid-1970s as the techniques improved, and the development of new catheters progressed.[11] Development of new local anesthetics and better epidural catheters, along with the improvement of newborn outcomes, put central neuraxial analgesia/anesthesia as the preferred method of analgesia/anesthesia for obstetrics.[11]

Impact of Obesity on Obstetrics

Obesity in the United States has increased over the last twenty years.[18] In pregnant women, it is estimated that 50% are obese, and of that 50%, 8% are super obese.[19] The World Health Organization defines obesity as a body mass index ≥ 35 kg/m^2, and super obesity is considered ≥ 40 kg/m^2.[18]

Nurse anesthetists often encounter parturients in an urgent or emergent situation when there is little time to formulate an anesthesia care plan. Obese parturients will often have airway concerns, challenging intravenous access, or difficulty in placing an epidural/spinal, which can complicate the anesthesia care plan.

As national trends for bodyweight continue to increase CRNAs will see obstetric patients presenting for anesthesia care being more obese and oft-times super-obese.[20]

Central neuraxial analgesia/anesthesia is preferred for the obese and super-obese parturients because it avoids the need for airway instrumentation and the use of intravenous narcotics, which may cause maternal hypoventilation and sedative effects on the emerging fetus.[7] The difficulty in placing the epidural/spinal needle in the obese or super-obese can be the limiting factor in using neuraxial techniques in an urgent or emergent situation.[7] The early

introduction of the parturient to the anesthesia provider allows for appropriate planning and intervention to avoid the problems associated with securing the airway, ventilation,[24] and possible issues for spinal/epidural needle placement.[7] Planning and assessment are necessary for providing the obese and super-obese parturient safe and successful analgesia/anesthesia.[7]

Obesity, Obstetrics, and Central Neuraxial Analgesia/Anesthesia

The use of epidural and spinal analgesia/anesthesia for obstetrics is well-founded.[24] The teaching of needle placement for most nurse anesthetists has been to watch one placed by an experienced mentor and then to demonstrate the technique back when other opportunity arise in the clinical setting.[24] The use of simulation models has become more prevalent in education and practice and serves to lessen the likelihood of patient injury due to inexperience.[7]

The factors which contribute to the problematic needle placement for epidural or spinal are multifaceted.[7] Back flexion and spinal curvature have been noted to indicate difficult needle placement.[19] The distribution of adipose tissue and abdominal girth contributes to the problematic placement of epidural/spinal needle placement and is not solely based on the body mass index (BMI).[25] Parturients may also have underlying spine abnormalities such as scoliosis or previous spine surgery, which would make epidural or spinal needle placement difficult.[25] Palpation of landmarks in the obese can be difficult when the adipose tissue is distributed in the hips and back.[26] A better indicator of difficulty with needle placement is the measure of abdominal girth in conjunction with body mass index.[26]

The use of Tuffier's line, the imaginary line drawn from the top of both iliac crests across the back to the spine, is the primary way to estimate the lumbar 3 - 4 interspace.[26] However, because of anatomic variation, this method does not give the most accurate results. In women,

Tuffier's line most often corresponds to the lumbar five body and top of the superior endplate.[26] The use of bedside ultrasound improves the accuracy of finding the appropriate space.[27]

The parturient's help can be enlisted in finding the spinal column and midline when palpation of landmarks is difficult, especially in the obese and super obese population.[27] A study done by Marroquin and others showed that in 90% of the cases, parturients were able to help the anesthesiologists locate the midline.[28] Parturient identification of the spinal column midline was found to be a useful technique by 66% of the anesthesiologists participating in the study.[28] The significance is that self-identification will prove successful in more than half of the attempts.[28]

Ultrasound used for central neuraxial needle placement is not a new concept.[29] A group in Germany, and an independent group in Russia considered this technique in the late 1970s and early 1980s, proving that it could be done.[29] Limitations at that time were lack of access to ultrasound machines, cost of ultrasound machines, inability to interpret the images accurately, and poor image quality.[29] These limitations hindered the adoption of ultrasonography in obstetric anesthesia practice.[29] Twenty years later, in 2000, research on the use of ultrasound for central neuraxial analgesia/anesthesia indicated that it was feasible in obstetric anesthesia practice.[29] The machines were still large and cumbersome; however, with improvements in technology, the image quality was markedly improved.[30]

Technology continues to improve, and researchers are learning that ultrasound scout scans can easily identify the lumbar 3-4 interspace.[30] Ultrasound images allow for visualization of the spinous processes, ligamentum flavum, and even permit depth measurements to judge if standard needle length is adequate.[31] The use of ultrasound scout scans in the obese and super obese parturients increases the first pass success rate of needle placement.[31] The identification of

pertinent structures and the target area is beneficial in those patients that traditional palpation of landmarks is impossible.[31]

Anesthesia education programs are gradually adding ultrasonography for epidural/spinal needle placement to their simulation and hands-on patient care training.[31] Current nurse anesthesia and physician anesthesia residency programs are incorporating simulation training and the use of ultrasound for a variety of anesthesia procedures to improve patient safety.[32] The anesthesia learner is given the theory and principles behind the use of ultrasound and then simulated hands-on learning to visualize the sonoanatomy associated with the spinal column.[5] The next step in the learning process is handling the ultrasound probe and visualizing the appropriate anatomy on live models while practicing needle placement on inanimate models.[33] In a comparison study, those learners who had the simulation training before patient contact were more often successful on the first attempt.[32] The first pass success rate in another study conducted in 2017 after using ultrasound scout scans was 67%.[25] The number of attempts were fewer in the ultrasound group as opposed to the palpation of landmarks group.[25]

To date, American CRNAs have not been queried to ascertain the awareness of ultrasound use for pre-puncture scans or the availability of ultrasound machines. In the United Kingdom, a survey was done in 2013 to determine how ultrasound was used in anesthesia, including the skillset of anesthesiologists and how anesthesiologists utilized ultrasound.[34] In that survey, it was discovered that because of the expense of ultrasound machines, often, they were shared by several different departments and therefore were rarely available for anesthesia use when needed.[34] A Canadian survey of anesthesiologists in both academic centers and community hospitals conducted in 2011 showed that the use of ultrasound was increasing for central venous access; however, it was not being used in novel ways such as central neuraxial needle

placement.[35] In the Canadian study as in the United Kingdom survey, it was noted that lack of resources to obtain an ultrasound machine played a role in the lack of use in practice.[34,35,36]

Theoretical Model

Knowledge Translation Theory, Definitions, Beginnings, and Key Theorists

Knowledge translation theory has been used since 1910 to bring research into clinical application.[37] In 1986, French sociologists, Michel Callon and Bruno Latour developed the knowledge translation theory for looking at a process.[37] Callon, identified four steps in the translation process.[38] The four steps include: problematization, interessement, enrolment, and translation.[38] The first step in the process is the identification of the problem, which was termed problematization.[38] The problem is identified, and the researcher tries to convince the audience that there is a need for change in processes.[38]

The second step in the process, known as Interessement, is strengthening the link between the research question and its usefulness to the target audience.[38] The third step of the process, enrolment, involves the enlistment of the audience in taking part in finding a solution to the problem posed in the research question.[38] The fourth step, translation, is where the problem identified in the research question(s) and solutions come together resulting in solutions.[38]

Bruno Latour, considered the power and the transfer of power related to translation theory.[38] Latour's model followed Callon's knowledge translation theory but does not have an endpoint and convergence, however, it was a continuous transformation resulting in a string of translations as its final step in the process.[38]

The model of knowledge translation theory was further refined by Estabrooks and colleagues in 2006.[38] Using knowledge translation theory and the innovation diffusion theory, which is not synonymous with knowledge translation theory but attempts to explain the sharing

of ideas in research.[38] The diffusion of innovation is comprised of four components for the spread of new ideas.[39] The four components are innovation, communication channels, time, and finally, a social system.[39] Five stages complement the four components: awareness, persuasion, decision, implementation, and adoption. Individuals progress through these five stages before the innovation is adopted into practice.[39] The two theories share many similarities, complement one another, and are easily adapted to the healthcare setting.[39] Estabrooks and colleagues took eighteen of the theories from different disciplines and brought forth a theory definitions guide and made them more useful to apply.[39] The models of particular interest in the healthcare setting and clinical practice were under the category labeled Utilization Models in Nursing.[39] The two that were of most interest were Stetler's Theory of Research Utilization in Practice and the Iowa Model of Research use in Practice.[39]

Application to the Research Survey

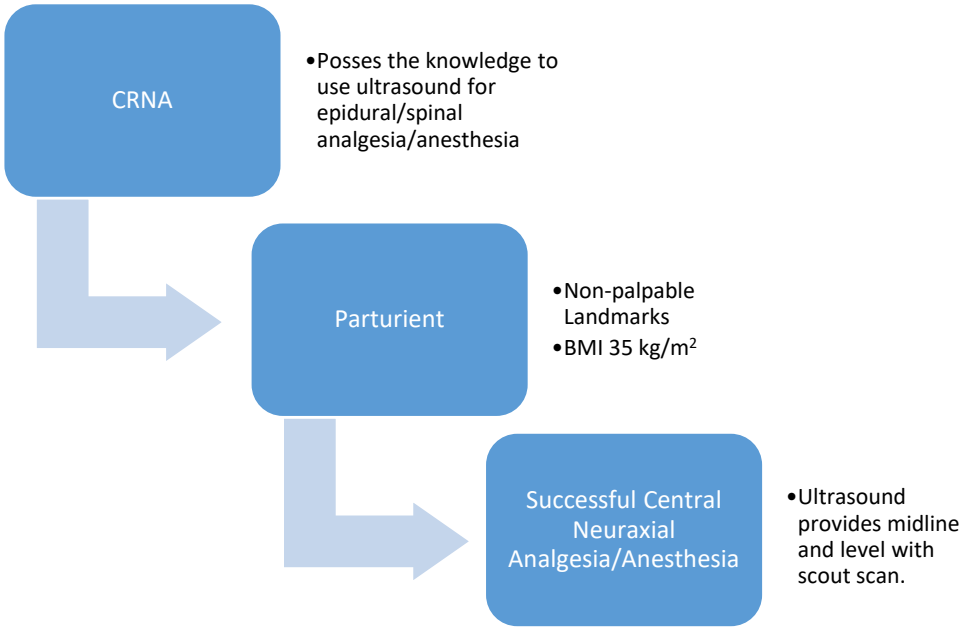
The use of the problem-solving model encompasses the existence of a problem with the need for pulling knowledge to provide solutions to the problem or offer alternative ways to deal with the problem.[39] The other variation of knowledge translation theory, which is appropriate for the survey, is known as the Iowa Model of Research Use in Practice.[39] This form of knowledge translation theory is a revision of Stetler's Theory of Research Utilization in Practice.[39] The Iowa Model of Research Use in Practice poses that a "trigger" is the impetus for knowledge gathering and that the clinician pulls the acquired knowledge into practice to solve the problem that is not solved by the traditional knowledge already in practice.[39] These theories have been used in physician residency programs to improve the learning experiences of residents and better facilitate the learning of the subject matter.[39] The application of knowledge translation theory and more accurately the problem-solving version and the Iowa Model of Research Use in Practice,

for the study of ultrasound scout scans for epidural/spinal needle placement in parturients with a body mass index ≥ 35 kg/m^2 may offer a solution to the problem of difficult needle placement and multiple attempts by CRNAs when utilizing the palpation of landmarks technique for obese parturients.[39]

Conceptual Model Used in Research

The conceptual model below shows the objectives of the survey as aligned with the theory. The first objective is looking at the population of nurse anesthetists (CRNAs) and determining the knowledge and skillset with ultrasound and ultrasound used for central neuraxial analgesia/anesthesia. The second objective is to identify the population of parturients with non-palpable landmarks and a body mass index ≥ 35 kg/m^2. The final objective is to look at successful central neuraxial needle placement with the use of an ultrasound scout scan to identify both the midline and the lumbar three, four levels of the spine. These three objectives make up the core components of the survey (Figure 1).

Figure 1. Conceptual Model.



Methods and Materials

Study Design

A quantitative survey was used to examine the current knowledge base, access to ultrasound and the barriers to access or utilization of ultrasound scout scans for central neuraxial analgesia/anesthesia in parturients with a body mass index (BMI) ≥ 35 kg/m^2. The quantitative survey used for this study was chosen because of the characteristics of quantitative survey research.[40] More specifically, quantitative research deals with the discovery of a problem using numbers and is considered more scientific because of its accuracy.[41] As quantitative research looks to measure numerical data,[41] which is appropriate for addressing the research questions guiding this study: Do nurse anesthetists (CRNAs) know how to utilize ultrasound for central neuraxial analgesia/anesthesia? Do nurse anesthetists (CRNAs) have access to ultrasound equipment for central neuraxial analgesia/anesthesia? What barriers do they encounter that stop/limit them from using ultrasound technology in their daily practice?

Survey questions were put together using the Qualtrics Survey platform. The final survey contained thirty questions with twenty-nine multiple-choice questions and one short answer question.

Setting

Qualtrics survey platform was utilized because of its online presence and ease of distribution. The ability to collect data without collecting identifying information about the respondents ensured the anonymity for those answering the survey.

The American Association of Nurse Anesthetists (AANA) Research and Quality Division was utilized to distribute the survey. The AANA is the professional organization for nurse anesthetists; membership is not mandatory. There are approximately 54,000 members,

which is 90% of the total number of nurse anesthetists in the United States.[42] The AANA Research application process was followed, and the required documentation was submitted for approval. The AANA Research Division sent an e-mailed cover letter to 1,882 CRNAs and SRNAs with a link to the survey. The use of the AANA Research Division was chosen because of their access to e-mail lists of CRNAs/SRNAs.

Ethics

Qualtrics was the platform used for this survey. The ability to send an anonymous link ensured that no digital information was collected that could be used to identify the respondent. The AANA Research Division does not allow the researcher to have the e-mail addresses but instead sends an e-mail with a cover letter with a link to the survey.

Qualtrics is a FedRamp authorized entity, and FedRamp is the gold standard for data security of the US government.[43] Once downloaded, data were stored on a password protected computer only accessible to the researcher.

The proposed study was determined to be exempt from IRB oversight by the University of Michigan-Flint IRB. The proposed study was allowed to be disseminated without changes in form or content. (See Appendix B)

Population/Participants

The target audience for the survey was CRNAs and SRNAs who perform central neuraxial analgesia/anesthesia on laboring women with a body mass index (BMI) ≥ 35 kg/m^2. The AANA Research Division sent out 1,882 e-mails on March 18, 2020, containing the link to the survey. A reminder e-mail was sent to 1,878 of the original recipients on April 8, 2020. Qualtrics has a sample size calculator that can be used to estimate the number of returned responses that are needed for statistical significance. Considering that 1,882 survey links were

sent out, a response rate of 320 is needed to give a confidence level of 95% and a margin of error of 5%.[44] The 1,882 e-mails and 1,878 reminders yielded 109 responses for a response rate of 6%. The 109 responses give a 9% margin of error.

Instrumentation

The survey instrument was developed based on three articles that surveyed anesthesiologists in the United Kingdom and Canada.[35,36] These studies looked at the availability and barriers to practice for ultrasound in a variety of anesthesia applications, not necessarily central neuraxial analgesia/anesthesia.[36] Questions were designed to identify the types of practice settings for the nurse anesthetists, the number of years in anesthesia practice, the knowledge of the use of ultrasound in practice, and the use of ultrasound for central neuraxial analgesia/anesthesia. Questions addressed the barriers to the use of ultrasound in their specific practice settings, including knowledge and credentialing, accessibility, or financial barriers due to the cost of ultrasound equipment and training (Table 1).

Table 1. Research Questions and Corresponding Survey Question Numbers.

Research Questions	Corresponding Survey Question Numbers*
1. Demographic questions.	3, 4, 5, 6
2. Do CRNAs have the knowledge, understanding, and skillset to use ultrasound in OB Practice for central neuraxial analgesia/anesthesia?	7, 8, 10, 11, 12, 13, 14, 15, 16, 23, 24, 25, 26, 28, 29, 30
3. Is the use of ultrasound for central neuraxial analgesia/anesthesia taught as a fundamental in nurse anesthesia programs?	17, 18, 19
4. What barriers to implementation in anesthesia practice do CRNAs encounter when ultrasound use is considered for central neuraxial analgesia/anesthesia?	9, 21, 22, 23, 30

*Corresponding Questions may be found in Appendix A

Dissemination

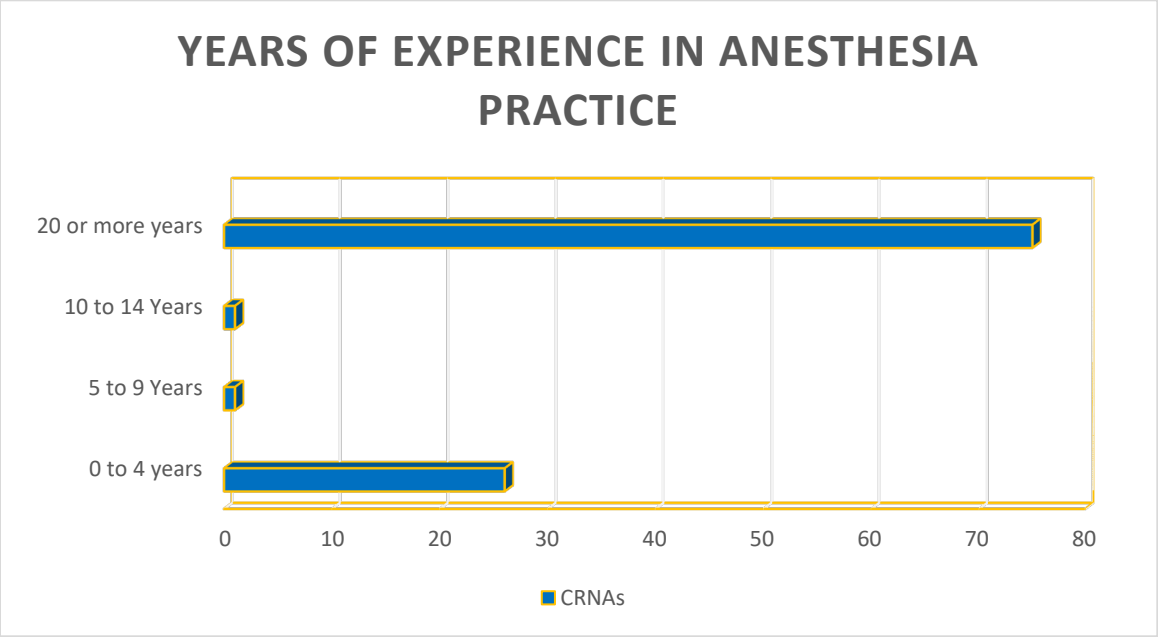
A virtual poster presentation with an oral component will be given at the Iowa Association of Nurse Anesthetists (IANA) Fall Meeting on October 9-11, 2020. IANA's membership is listed at 451 members. The CRNA attendees are primarily solo practitioners and provide anesthesia services in eighty-eight of Iowa's ninety-nine county Critical Access Hospital System.

Results

Demographics of the Survey Respondents

The survey was available from March 25, 2020, to May 4, 2020, to respondents. One hundred nine surveys were returned. (See Appendix A for Survey).

Figure 2. Years of Anesthesia Experience



The largest group of respondents (73%) had 20 years or more experience, and the second largest group (25%) had zero to four years (Figure 2).

The primary practice type for the respondents was in an anesthesia care team model (37%), and the second most represented practice type was the CRNA only practice (22%).

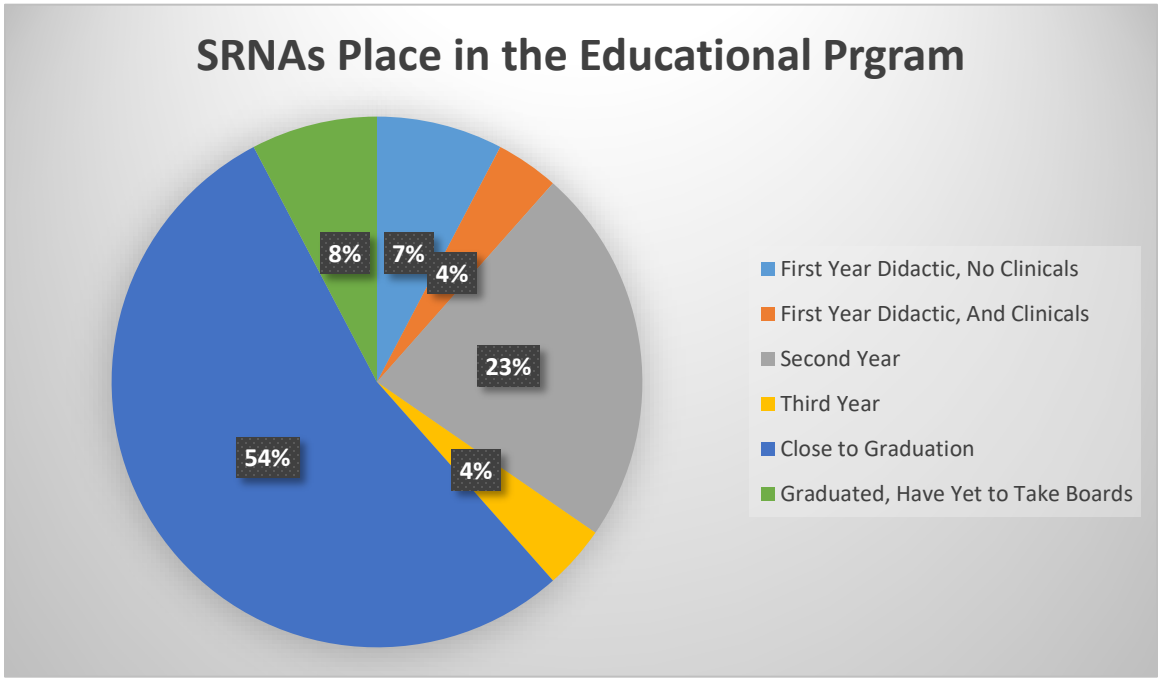
The majority of respondents (Table 2) worked in either an academic medical center (14%) or a large urban hospital (14%). About one in four worked in a community setting (26%), and the remainder (46% of the 109 respondents) were distributed between rural hospitals, government facilities, Indian Health Services, the critical access hospital system, and accredited anesthesia education programs.

Table 2. Primary Work Setting

Work Setting	Number of CRNAs	Percentage of Survey Respondents
Academic Medical Center	15	14%
Large Urban Hospital	15	14%
Community Hospital	27	26%
Critical Access Hospital	8	8%
Government or Armed Services Hospital	4	4%
Indian Health Services	1	1%
Ambulatory Surgery Center	11	11%
Rural Hospital	12	12%
Accredited Anesthesia Educational Program	11	10%
Free-Standing Birthing Center	0	0
Total	*104*	*100%*

Source: Research Survey

Figure 3. SRNAs Place in the Educational Program.



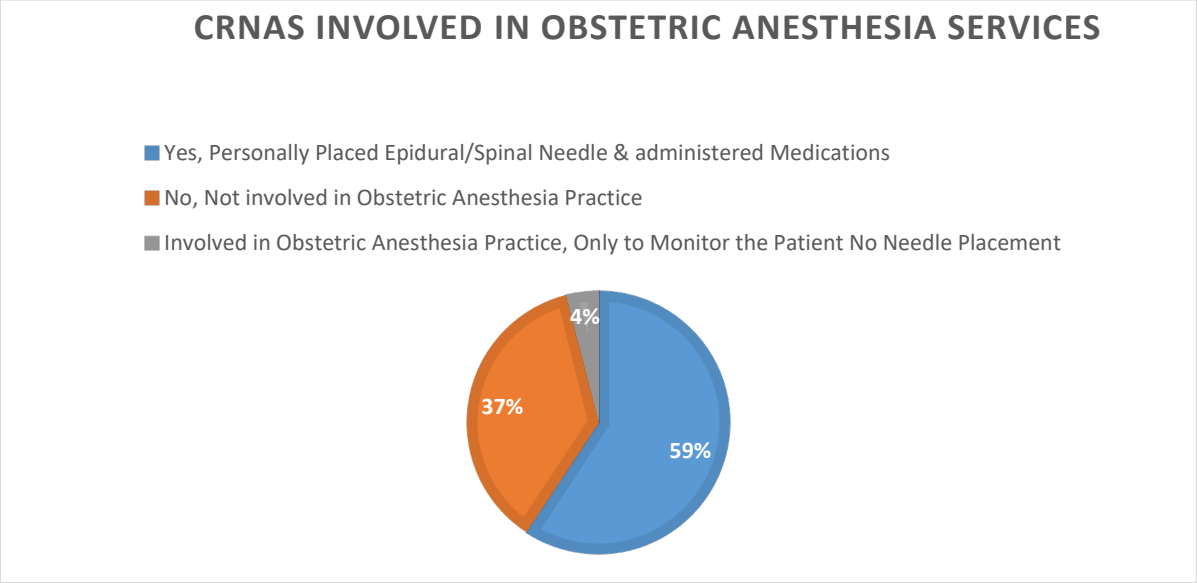
It should be noted that SRNAs were included in this survey to determine if ultrasound for central neuraxial analgesia/anesthesia was starting to be taught in the initial anesthesia education process. It was mentioned several times that a classmate's doctoral project first introduced some students to the concept. Another avenue where SRNAs learned about the technique of ultrasound for central neuraxial analgesia/anesthesia was a didactic lecture during their education. A program director was also noted to have taught students about the use of ultrasound for epidural/spinal needle placement. Although it is not a comprehensive representation of anesthesia students in the United States, it does show the respondents' place in their educational program (Figure 3).

CRNA Knowledge, Understanding, and Skillset to use Ultrasound in OB Anesthesia Practice.

In order to determine if CRNAs have the knowledge, understanding, and skillset for ultrasound use with central neuraxial analgesia/anesthesia in obstetric anesthesia practice, it first had to be determined whether the CRNAs participating in the survey were involved in obstetric anesthesia practice. It was also essential to know whether the respondents did epidural/spinal analgesia and anesthesia.

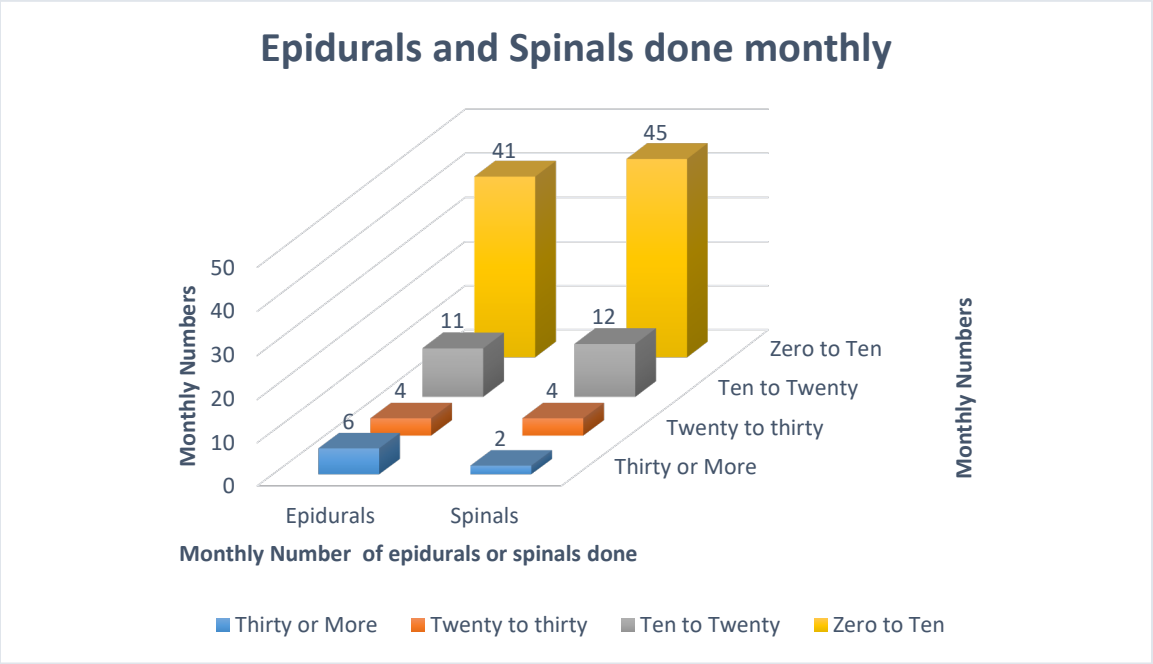
85% of respondents did administer both epidural and spinal analgesia/anesthesia. About 5% did not do epidural analgesia/anesthesia but did regularly administer spinal analgesia/anesthesia. 9% did not administer regional anesthesia in their practice. 63% of the respondents personally provided obstetric anesthesia services in their practice while 37% did not provide obstetric anesthesia services in their practice setting. There were 4% that did monitor the patient after the initiation of epidural/spinal analgesia/anesthesia; however, these individuals did not personally place the epidural/spinal needle (Figure 4).

Figure 4. CRNAs Involved in Obstetric Anesthesia Services.



When asked how many epidurals were done monthly, 84% did between ten and twenty. 6% did twenty to thirty epidurals a month, and one in ten respondents (10%) did more than thirty a month. A similar question about spinal analgesia/anesthesia was asked, and the results were similar to the epidural results. 76% of respondents regularly cared for patients with a BMI ≥ 35 kg/m^2, and 24% did infrequently; however, no one chose the option of never (Figure 5).

Figure 5. Comparison of Epidural and Spinals done Monthly by Respondents.



When queried, if regional anesthesia had to be abandoned because of body habitus and BMI of greater than 35 kg/m^2, 40% said, yes, while 60% did not abandon. BMI and body habitus played no factor in deciding whether to do epidural/spinal needle placement for 85% of participants. 81% responded that there was not a BMI number or body type that would deter them from attempting a neuraxial block. The remaining 19% had a BMI number in mind that would be their upper limit for attempting a block.

When respondents were asked if ultrasound education and hands-on training for peripheral nerve blocks were obtained during their initial anesthesia education, 80% said no. When asked if ultrasound venous access education and hands-on practice was received during their initial anesthesia training, 73% answered no. About one in five (19%) of the survey respondents replied that they had learned ultrasound for peripheral nerve blocks in their anesthesia program, and 15% learned about ultrasound use for vascular access in their initial anesthesia school education.

60% of CRNAs learned to use ultrasound for peripheral nerve blocks and intravenous access sometime after graduation from their accredited anesthesia education program. In comparison, 28% have not learned to use ultrasound for either application. The question of how often ultrasound is used in their anesthesia practice for any anesthesia application, 43% indicated occasional use, and 29% claimed use several times a week. 22% answered ultrasound was not used at all in their practice. Daily use of ultrasound was reported by 6% of CRNAs.

The last few questions of the survey dealt with the specific use of ultrasound for needle placement for epidurals and spinals. When asked if the technique or use of ultrasound to facilitate epidural or spinal needle placement was known, 90% of respondents replied yes. Only 10% had not heard of ultrasound for needle placement. 88% of respondents have not used ultrasound for needle placement, while 12% utilized ultrasound to facilitate placement of the epidural/spinal needle.

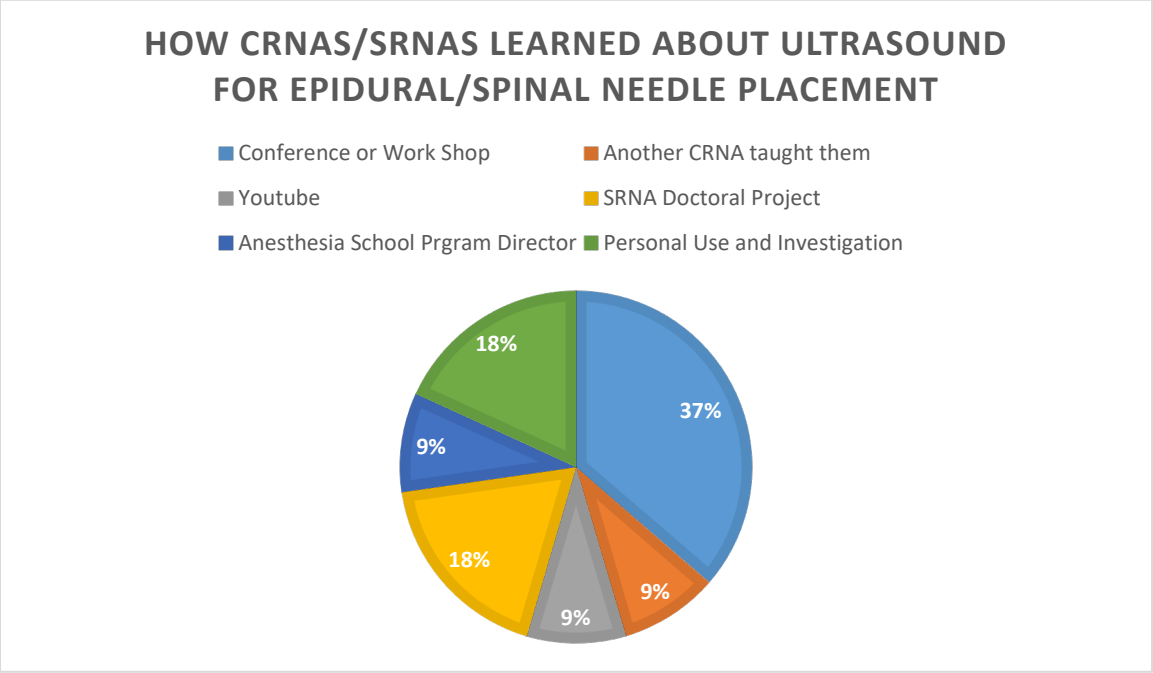
When asked how ultrasound was used to facilitate epidural and spinal needle placement, 57% responded that they utilized a scout scan to identify the midline and correct interspace. 29% used a combination of scout scans and real-time ultrasound to observe the needle's progression. 14% used a real-time ultrasound scan to watch the needle progression into the target space. There was complete agreement (100%) that a scout scan was useful in needle placement, and for those

that used the real-time ultrasound scan, three-quarters of the respondents (75%) found the technique useful for needle placement. When asked how useful they felt ultrasound would be for needle placement in obstetric patients with a BMI ≥ 35 kg/m^2, 24 respondents out of 61 that chose to answer the question (39%) responded that it would be moderately useful, 31% indicated it would be advantageous for needle placement. 16% found it neither helpful nor useless, and 3% found it useless. 11% responded that it might be slightly useful to patients with a BMI ≥ 35 kg/m^2.

When asked for a statement that best reflected their opinion of the technique, 66% said that they did not use ultrasound for this application in anesthesia practice. 15% responded that the time needed for needle placement using ultrasound was dependent on the patient's body habitus. 6% responded that the use of ultrasound would decrease the time for needle placement. 5% answered it would increase the time for needle placement. 8% choose the response: familiarity of the technique, time for needle placement would lead to a decrease in time and an increase in the success of needle placement.

The final question of the survey (short answer form) was how they learned of ultrasound use for epidural/spinal needle placement. The answers varied, but the most common were learned from a State meeting or workshop, the AANA annual conference, Dr. Charles Reese's workshops, YouTube videos, and also the program director of an anesthesia school. Some respondents also indicated that they learned of the technique from a classmate's doctoral project or their work in pain management or personal investigation and use. Other CRNAs taught the technique in their practice (Figure 6).

Figure 6. How Ultrasound for Epidural / Spinal Needle Placement was learned.



Discussion

The three research questions posed for this study were:

(1.) Do nurse anesthetists have the knowledge and understanding of ultrasound and the skillset to use it for central neuraxial needle placement in the obstetric anesthesia practice setting?

(2.) Is the use of ultrasound for central neuraxial needle placement taught as a fundamental in nurse anesthesia education programs?

(3.) What are the barriers to implementation in anesthesia practice do nurse anesthetists encounter when ultrasound use is considered for neuraxial needle placement?

The survey provided the data needed to answer the research questions addressing knowledge, utilization, and barriers to practice regarding ultrasound use for epidural and spinal needle placement in patients with a BMI of 35 kg/m^2 in the obstetric setting. The research examining ultrasound use for epidural/spinal needle placement has demonstrated that it is a

viable technique in obstetric anesthesia practice, and an ultrasound scout scan can determine the location of midline and correct level for epidural/spinal needle placement. [1,30,31]

The use of ultrasound for needle placement for epidurals/spinals was a familiar subject to the survey respondents, with most reporting that it was a useful technique. Very few, if any, of the respondents were using ultrasound for needle placement. The barriers to practice ranged from prohibition by anesthesiologists or hospital bylaws to not being familiar with ultrasound use for any anesthesia application. 73% of respondents had twenty or more years of experience. The number of years in practice would explain why many did not use ultrasound in their daily practice. The expense of equipment and the sharing of ultrasound equipment with other departments were common barriers to use. The expense of ultrasound equipment, sharing with other departments and equipment being unavailable was like the United Kingdom survey of the anesthesiologists.[33]

It was interesting to note that two of the respondents, one with forty plus years and another with an undetermined amount of time in anesthesia practice, indicated that ultrasound was unnecessary for anesthesia practice. The one with forty plus years in practice commented that a good understanding of anatomy and physiology was all that was necessary for successful needle placement for epidurals/spinals, and intravenous access. The respondent indicated body habitus/BMI did not contribute to difficulty of needle placement for vascular access or epidural/spinal procedures. The other respondent had never had difficulty in placing an epidural/spinal needle in any patient, so commented the use of ultrasound was unnecessary. While this was not the consensus of respondents, these outliers are noted as perceptions of why one might not accept the idea of using ultrasound scout scans for epidural or spinal needle placement.

Study Strengths

The primary strength of this study is that it is the first to determine CRNAs/ SRNAs awareness, understanding, and skill regarding ultrasound for epidural and spinal needle placement in parturients with a BMI ≥ 35 kg/m^2. The previous studies concentrated on anesthesiologists and anesthesiology residents.[33,34,35] Before this study, it was unknown whether CRNAs in practice had an understanding of ultrasound and skillset to use it in their anesthesia practice. It was also unknown if CRNAs knew that ultrasound could be used to facilitate epidural and spinal needle placement.

The data obtained from this study can guide future education for students and provide a framework for continuing education of practicing CRNAs.

Limitations of the Study

The primary limitation of the study is the small sample size from which the results were drawn. Of the 1,882 e-mails sent out, 109 responses were obtained for a 6% response rate. The survey was set up so that respondents could skip questions, and therefore not every question was answered by the full cohort of 109 respondents. There may also be bias because of self-selection. The group that chose to answer the survey may not be representative of nurse anesthesia practice in the United States regarding ultrasound use in nurse anesthesia practice, specifically in the use of ultrasound for epidural/spinal needle placement. Thus, further qualitative research is needed to understand the barriers presented herein.

Conclusion

The use of ultrasound during epidural/spinal needle placement is not common anesthesia practice. In the early 1970s, Grau and colleagues proved that it was possible to use ultrasound for epidural and spinal needle placement.[29] Because of expensive equipment and poor image quality, the technique was not further developed for obstetric or regional anesthesia practice.

As technology improved, and acquisition costs of ultrasound machines decreased use is more prevalent in anesthesia practice. The use of ultrasound for peripheral nerve blocks and vascular access is more familiar to CRNAs.[30] The palpation of landmarks for needle placement has been the primary technique since August Bier first experimented with spinal anesthesia, and Hingson and Edwards proved that caudal anesthesia could be used for cesarean section delivery.[15] Palpation has been the mainstay in anesthesia practice for epidural and spinal needle placement.

Data from the present study revealed that 73% of the CRNAs had twenty or more years of experience and thusly ultrasound was not a part of anesthesia practice when the participants started their careers in nurse anesthesia. The use of workshops and continuing education courses are the primary source for the acquisition of ultrasound knowledge and skills for this group of practitioners. Student respondents were learning the technique of ultrasound scout scans in their anesthesia programs in a variety of ways, either from student doctoral projects, lectures, or at their clinical sites.

Data showed that all the respondents were familiar with the use of ultrasound either as a scout scan or in real-time for epidural or spinal needle placement. Seventy Nine percent of the respondents who answered the question stated ultrasound could be useful in parturients with a BMI $\geq$ 35 kg/m^2. However, because of the lack of equipment or access to ultrasound

equipment, they are unable to use it for needle placement. Other CRNAs are prohibited by hospital bylaws or privileges from using ultrasound. Still, other CRNAs do not have the knowledge or skillset to use ultrasound for scout scans for epidural or spinal needle placement.

In the current Council on Accreditation of Nurse Anesthesia Educational Programs Standards of Accreditation of Nurse Anesthesia Programs Practice Doctorate, there is nothing said about ultrasound use for epidural and spinal needle placement.[47] In the appendix of the document, ultrasound is listed under the heading "Other" and recommends that a student have ten ultrasound-guided techniques.[47] There is no specification as to the breakdown of ultrasound-guided vascular access or ultrasound regional anesthesia. There are no specific numbers for each. A recommendation of increasing the requirement for ultrasound-guided techniques to include scout scans and real-time epidural/spinal needle placement both in the simulation setting and in the clinical setting is strongly supported by this study.

Appendix A

Ultrasound use for Epidural/Spinal Analgesia/Anesthesia in Patients with a High BMI

Start of Block: University of Michigan- Flint Doctor of Nurse Anesthesia Practice Program

Q1 Implied Consent: As a graduate student at the University of Michigan-Flint Doctor of Nurse Anesthesia Practice Program, I invite you to participate in a research project by taking a few minutes to complete the following survey. The project is designed to assess the knowledge and use of ultrasound for epidural and spinal needle placement in pregnant women with a body mass index of $\geq$ 35 kg/m2. Additionally, the project will identify the barriers that most Certified Registered Nurse Anesthetists are confronted with when attempting to bring the technique of ultrasound scout scans to their obstetric anesthesia practice. Your participation will provide valuable information. All responses are anonymous to protect contributor's privacy; you are not required to answer every question. Answering one or more survey questions implies consent to participate in this project. The IRB Project Coordinator can be reached at the University of Michigan-Flint Office of Research at 810-762-3383 or by e-mail at research@umflint.edu. For specific questions about the survey/project, please contact primary researcher William Loebig MS, CRNA at (563) 568-9330 or wloebig@umflint.edu. Thank you for your anticipated participation.

Q2 After reading the above-implied consent are you willing to participate in this survey?

- ○ Yes, please begin the survey. (1)
- ○ No, I do not wish to participate in this survey. (2)

End of Block: University of Michigan- Flint Doctor of Nurse Anesthesia Practice Program

Start of Block: Practice Setting

Q3 Which option best describes you primary practice setting.

- ○ Anesthesia Care Team Medically Directed (Anesthesiologist directing up to 4 CRNA rooms). (4)
- ○ Anesthesia Care Team Non-Medically Supervised (Anesthesiologist responsible for more than 4 CRNA rooms). (5)
- ○ CRNAs and anesthesiologists doing their own cases. (6)
- ○ CRNA only practice. (7)
- ○ SRNA currently in school. (8)

,Q4 Which best describes your primary work environment?

- ○ Academic Medical Center. (1)
- ○ Large Urban Hospital (2)
- ○ Community Hospital. (3)
- ○ Critical Access Hospital. (4)
- ○ Government Facility (VA Hospital, Armed Services Hospital). (5)
- ○ Indian Health Service. (6)
- ○ Free Standing Birthing Center. (7)
- ○ Ambulatory Surgery Center. (8)
- ○ Rural Hospital. (9)
- ○ An Accredited Anesthesia Educational Program. (11)

Q5 How many years have you been a practicing CRNA?

- ○ 0-4 years. (1)
- ○ 5-9 years. (2)
- ○ 10-14 years. (3)
- ○ 15-19 years (4)
- ○ 20 years or more. (5)

Q6 If you are a student in anesthesia school, what year are you in your educational program?

- ○ First year have not started Clinicals yet. (1)
- ○ First year in the clinical portion of the program. (2)
- ○ The second year of school. (3)
- ○ Third-year of school. (4)
- ○ Close to graduation from the program. (5)
- ○ Graduated from the program starting my first job in anesthesia. However, have not taken the certification exam. (6)

Q7 Do you independently perform epidural blocks?

- ○ Yes, I place the epidural needle/catheter and administer the medications. (1)
- ○ No, I do not place the epidural needle/catheter. (2)

Q8 Do you independently perform spinal blocks?

- ○ Yes, I place the spinal needle and administer the medications. (1)
- ○ No, I do not place the spinal needle. (2)

Q9 Do you Have access to ultrasound equipment in your anesthesia department?

- ○ Yes. (1)
- ○ No (2)
- ○ We share ultrasound equipment with other departments, but it is easily accessible when we need it. (3)
- ○ We share ultrasound equipment with other departments and it is not available when we need it. (4)

End of Block: Practice Setting

Start of Block: Neuraxial Anesthesia for obstetric patients greater than or equal to 35kg/m2

Q10 Do you personally render obstetric anesthesia services?

- ○ Yes (1)
- ○ No (2)
- ○ The anesthesiologist does analgesia/anesthesia and nurse anesthetist monitors the patient. (3)

Q11 How frequently do you provide anesthesia for obstetric patients with a BMI of 35 kg/m2 or greater?

- ○ Regularly. (1)
- ○ Infrequently. (2)
- ○ Never. (3)

Q12 What is your experience with epidural/spinal analgesia/anesthesia?

- ○ I do not administer epidural analgesia/anesthesia but do administer spinal analgesia/anesthesia. (1)
- ○ I do not administer spinal analgesia/anesthesia but do administer epidural analgesia/anesthesia. (2)
- ○ I administer both epidural and spinal analgesia/anesthesia. (3)
- ○ I administer neither epidural nor spinal analgesia/anesthesia. (4)

Q13 How many obstetric epidurals do you place on average during a month in your practice setting?

- ○ 0 to 10 (1)
- ○ 10 to 20 (2)
- ○ 20 to 30 (3)
- ○ 30 or more (4)

Q14 How many obstetric spinals (Intrathecal narcotics/ or spinal anesthetics) do you place on an average during a month in your practice setting?

- ○ 0 to 10 (1)
- ○ 10 to 20 (2)
- ○ 20 to 30 (3)
- ○ 30 or more (4)

Q15 Have you ever had to abandon a regional anesthesia technique because patient body habitus (BMI > 35) rendered the procedure technically difficult?

- ○ Yes (1)
- ○ No (2)

Q16 Is there a BMI or patient body habitus that would preclude you from attempting neuraxial block?

- ○ Yes, BMI of 35 to 40. (1)
- ○ Yes, BMI of 40 to 50. (2)
- ○ Yes, BMI of 50 to 55. (3)
- ○ Yes, BMI of 55 or greater. (4)
- ○ No, BMI is not a factor. (5)

End of Block: Neuraxial Anesthesia for obstetric patients greater than or equal to 35kg/m2

Start of Block: Ultrasound Knowledge and Use in Anesthesia Practice

Q17 Were you trained in your initial anesthesia education to use ultrasound for placement of neuraxial nerve blocks?

- Yes, my anesthesia program provided ultrasound education and hands-on experience. (1)
- No, my anesthesia program did not provide ultrasound education or hands-on experience. (2)

Q18 Were you trained in your initial anesthesia education to use ultrasound for obtaining intravenous access?

- Yes, my anesthesia program provided ultrasound education and hands-on experience in obtaining venous access using ultrasound. (1)
- No, my anesthesia program did not provide ultrasound education or hands-on experience for obtaining venous access. (2)
- My anesthesia program provided the educational information, but I did not receive hands-on experience for obtaining venous access. (3)
- My anesthesia program provided hands-on experience for obtaining venous access, but did not provide the educational information. (4)

Q19 Did you learn to use ultrasound for neuraxial nerve block / intravenous access sometime after graduation from anesthesia school? (Check all answers that apply.)

- [ ] Yes, I learned to use ultrasound for IV access after graduation from anesthesia school. (1)
- [ ] No, I have not learned to use ultrasound for IV access. (2)
- [ ] Yes, I learned ultrasound guided nerve block after graduation from anesthesia school. (3)
- [ ] No, I have not learned to use ultrasound for peripheral nerve blocks. (4)

Q20 If your ultrasound experience was not obtained during your initial nurse anesthesia education, where did you learn to utilize ultrasound for your practice?

- ○ On the job training. (1)
- ○ Ultrasound equipment company representative. (2)
- ○ AANA ultrasound workshop. (3)
- ○ Other seminar/workshop. (4)

Q21 How frequently do you use ultrasound for any anesthesia application in your current anesthesia practice?

- ○ Daily. (1)
- ○ Several times a week. (2)
- ○ Occasionally. (3)
- ○ I do not use ultrasound in my anesthesia practice. (4)

Q22 Have you heard of using ultrasound to facilitate epidural or spinal analgesia/anesthesia administration?

- ○ Yes. (1)
- ○ No. (2)

Q23 Have you ever used ultrasound to assist in placement of epidural or spinal analgesia/anesthesia?

- ○ Yes. (1)
- ○ No. (2)

Q24 If you have used ultrasound to assist with an epidural or spinal placement, how was it used? (Check all that apply)

- ☐ A scout scan to locate the Interspace and mid-line. (1)
- ☐ Real-time ultrasound to watch the needle's progression. (2)
- ☐ A combination of both a scout scan and real-time scan. (3)

Q25 If you used the scout scan technique, did you find it useful?

- ○ Yes, I found the scout scan technique useful. (1)
- ○ No, I did not find the scout scan technique useful. (2)

Q26 If you used the real-time ultrasound scan technique, did you find it useful?

- ○ Yes, I found watching needle progression in real-time useful. (1)
- ○ No, I did not find the real-time needle progression technique useful. (2)

End of Block: Ultrasound Knowledge and Use in Anesthesia Practice

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Start of Block: Barriers to implementation in Anesthesia Practice.

Q27 What is the main barrier to using ultrasound for epidural/spinal analgesia/anesthesia in your practice?
(Check all that apply.)

- [ ] Lack of knowledge of ultrasound use. (1)
- [ ] Lack of funding for ultrasound equipment (2)
- [ ] Medical staff bylaws prohibit the use of ultrasound by nurse anesthetists (3)
- [ ] Lack of privileges to use ultrasound at the practice setting. (4)
- [ ] There are no barriers to the use of ultrasound in my practice setting. (5)
- [ ] Other (Write your response in the text box). (6)

_____

Q28 How useful do you foresee the use of ultrasound to be in placing epidurals/spinals for obstetric patients with a BMI (Body Mass Index) of $\geq$ 35 kg/m2?

- ○ Extremely useful (1)
- ○ Moderately useful (2)
- ○ Slightly useful (3)
- ○ Neither useful nor useless (4)
- ○ Useless. (5)

Q29 Choose the statement(s) that most accurately reflect your opinion regarding the use of ultrasound technology for epidural/spinal anesthesia in your practice with obstetric patients with a BMI of ≥ 35 kg/m2 (select all that apply)

- ○ Decreases time needed to place the needle and initiate analgesia/anesthesia. (1)
- ○ Increases time needed for needle placement and initiation of analgesia/anesthesia. (2)
- ○ Does not impact the time needed for needle placement and initiation of analgesia/anesthesia. (3)
- ○ Time required to use ultrasound for this purpose varies by patient. It depends on the patient body habitus. (4)
- ○ Use of ultrasound for this purpose has increased the success of spinal/epidural needle placement and decreased the time needed for the initiation of the block as my familiarity and experience with the technique has increased. (5)
- ○ I do not use ultrasound for this application. (6)

Q30 If you use ultrasound for epidural/spinal anesthesia in your practice, how did you first discover the technique? Describe your discovery of the technique (**short answer form**).

_____

End of Block: Barriers to implementation in Anesthesia Practice.

Appendix B

Health Sciences and Behavioral Sciences Institutional Review Board (IRB-HSBS) • 2800 Plymouth Rd., Building 520, Room 1170, Ann Arbor, MI 48109-2800 • phone (734) 936-0933 • fax (734) 998-9171 • irbhsbs@umich.edu

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To: William Loebig

From:

Thad Polk

Cc:

Lawrence Stump
William Loebig

Subject: Notice of Exemption for [HUM00150654]

SUBMISSION INFORMATION:
Title: Survey Of CRNAs Knowledge of Use of Ultrasound for Epidural and Spinal Needle Placement.
Full Study Title (if applicable): Survey of CRNAs Knowledge and Barriers to Practice of Ultrasound Scout Scans for Epidural and Spinal Needle Placement in Obstetric Patients with a BMI of 35 kg/m2 or higher.
Study eResearch ID: HUM00150654
Date of this Notification from IRB: 10/30/2019
Date of IRB Exempt Determination: 10/30/2019
UM Federalwide Assurance: FWA00004969 (For the current FWA expiration date, please visit the UM HRPP Webpage)
OHRP IRB Registration Number(s): IRB00000248

IRB EXEMPTION STATUS:
The IRB HSBS has reviewed the study referenced above and determined that, as currently described, it is exempt from ongoing IRB review, per the following federal exemption category:

EXEMPTION 2(i) and/or 2(ii) at 45 CFR 46.104(d):

Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) **if at least one of the following criteria is met**:

(i) The information obtained is recorded by the investigator in such a manner that **the identity of the human subjects cannot readily be ascertained**, directly or through identifiers linked to the subjects;

(ii) Any disclosure of the **human subjects' responses** outside the research **would not reasonably place the subjects at risk** of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation

Note that the study is considered exempt as long as any changes to the use of human subjects (including their data) remain within the scope of the exemption category above. Any proposed changes that may exceed the scope of this category, or the approval conditions of any other non-IRB reviewing committees, must be submitted as an amendment through eResearch.

Although an exemption determination eliminates the need for ongoing IRB review and approval, you still have an obligation to understand and abide by generally accepted principles of responsible and ethical conduct of research. Examples of these principles can be found in the Belmont Report as well as in guidance from professional societies and scientific organizations.

SUBMITTING AMENDMENTS VIA eRESEARCH:
You can access the online forms for amendments in the eResearch workspace for this exempt study, referenced above.

ACCESSING EXEMPT STUDIES IN eRESEARCH:
Click the "Exempt and Not Regulated" tab in your eResearch home workspace to access this exempt study.

Thad Polk
Chair, IRB HSBS

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