Doctor of Nursing Practice at The University of Texas at El Paso

"I CAN SEE CLEARLY NOW WITH ULTRASOUND"
8TH ANNUAL DNP PROJECT SYMPOSIUM- MAY 13, 2020

COHORT VIII

Freddie J. Caldwell, MSN, APRN, CRNA
- Chairperson Elizabeth Portugal, DNP, APRN, CNM
UTEP | 500 W. UNIVERSITY AVE. EL PASO, TEXAS 79968

The University of Texas at El Paso

School of Nursing

Doctor of Nursing Practice Program

DNP Scholarly Project Report

I Can See Clearly Now with Ultrasound

Freddie Caldwell

DNP Project Chair: Dr. Elizabeth Portugal DNP, CNM, APRN

Date of Submission: 20 April 2020

Abstract

Pregnant women in active labor are presenting to Labor and Delivery units with increased risk factors for placement of labor epidurals for pain management. Anesthesia providers are challenged with providing a safer alternative to the traditional labor epidural placement process. Evidence shows that providers of anesthesia care can have safer outcomes for patients when they place lumbar epidurals with the use of pre-procedure ultrasound assistance. The population affected in this quality improvement (QI) project was pregnant women ages 22 to 35 years of age in active labor and admitted to William Beaumont Army Medical Center's (WBAMC) labor and delivery unit. These pregnant women were requesting a labor epidural for pain control and who were deemed to be difficult lumbar epidural placements. For the focus of my DNP project, these patients presented with a body mass index (BMI) of greater than 30 kg/m², scoliosis, anatomical abnormalities in the lumbar region, or patients who have had lumbar spine surgery that is from the L2 to L5 interspace. The evidence showed that the use of ultrasound for anatomical visualization has proven to be an asset for use in this client population. Ultrasound-guided neuraxial procedures are more commonplace with anesthesia providers in recent years (Sahin & Balaban, 2018). Ultrasound is also shown to increase the safety and efficacy of regional anesthesia in many anesthesia providers' current practices. Ultrasound is grossly underutilized at WBAMC when it comes to difficult placement of lumbar epidurals for patients in labor. This patient population can present with obesity or structural problems that can be better identified with the use of ultrasound guidance. My QI project will increase use of ultrasound technology for women with potentially difficult lumbar epidural placements in my workplace facility.

Introduction and Background

The purpose and intent of my project was to increase usage and awareness of pre-procedural ultrasound technology for obstetric laboring patients who are evaluated to be potentially difficult lumbar epidural placement among anesthesia providers at William Beaumont Army Medical Center. The specific population was pregnant women ages 22 to 35 years of age who were in active labor and admitted to William Beaumont Army Medical Center labor and delivery unit requesting a labor epidural for pain. I did not note the depth from skin to the epidural space. I also did not pay particular attention to alignment of the supraspinous processes, any instrumentation, and any anatomical abnormalities. The main focus of my project was to ascertain visualization of the supraspinous processes for trajectory to the epidural space. Sometimes we frantically look for our DNP project, and sometimes our DNP project finds us.

This proposal is significant because anesthesia providers at William Beaumont Army Medical Center WBAMC can have safer outcomes for patients when anesthesia providers place lumbar epidurals with the use of pre-procedural ultrasound guidance and assistance. After a literature review, the evidence shows that this technique is safer with better placement of the lumbar epidural and increased patient satisfaction. The population affected in my quality improvement (QI) project was pregnant women ages 22 to 35 years of age who are in active labor and admitted to William Beaumont Army Medical Center labor and delivery unit requesting a labor epidural for pain control and who were deemed to be difficult lumbar epidural placements. For the focus of my DNP project these patients are, a body mass index (BMI) of greater than 30 kg/m^2. Another group of patients who for the purpose of my project that I define as difficult are patients who present with scoliosis or anatomical abnormalities in the lumbar

region. Patients who have had lumbar spine surgery that is from the L2 to L5 interspace are of special interests for my project. Lastly, patients who take more than two attempts to place the lumbar epidural. I specifically chose patients between the ages of 22 and 35 because these are the patients who were represented in my reflective practice evaluation. Therefore, I wanted to stay consistent using the patient ages that I was seeing in my practice.

Understanding the obese patient is important in this setting. Obesity includes a many comorbidities including diabetes and hypertension, among others. This project focused on the effects of obesity on the placement of lumbar epidurals for the laboring mother. According to Kula, Riess, and Ellinas (2017), more than one-third of the United States population is considered obese, which is defined by the World Health Organization (WHO) as a BMI greater than 30 kg/m². In the United States, more than one-third of women are obese, and of that, more than half of all pregnant women are considered obese (Kula et al., 2017). So, this is a significant population to consider because of the roll obesity plays in difficult epidural placement. Butwick, Wong, and Guo (2018) found in their retrospective cohort study that the likelihood of receiving neuraxial analgesia is marginally increased for morbidly obese women compared to women with normal body mass index. Using United States national data, their cohort comprised of 17,220,680 deliveries, which accounts for 61.5% of 28 million births in the United States between 2009 and 2015 (Butwick et al., 2018). Anesthesia providers will encounter this population in the labor and delivery setting. The risk for lumbar epidural failure is 1.5 times higher for obese pregnant women as compared to non-obese pregnant women (Uyl, De Jonge, Uyl-de Groot, Van der Marel, & Duvekot, 2019). I did have a concern about the distribution of adipose tissue. Patients do present with different body habitus types such as the distribution of adipose tissue around the abdomen. Women have more subcutaneous white adipose tissue (SAT)

both in the abdominal and gluteofemoral area (Karastergiou, Smith, Greenberg, & Fried, 2012). The SAT is important because that is where 80% to 90% of total body fat is stored, according to Karastergiou et al. (2012). Eley et al. (2019) found that abdominal subcutaneous fat had less of an effect on BMI than the distance from skin to epidural space, which showed a 47% variance from skin to epidural space. I used this evidence to further assess potential difficulty in placing epidural in my obese patients. Being able to palpate supraspinous processes is one of the hallmarks in finding proper placement for potential interspaces for placement of a continuous lumbar epidural. The anesthesia provider usually does this by placing both hands on the ischial spines then bringing both thumbs to the midline and that should intersect the L4 – L5 interspace. Anesthesia providers may not be able to palpate the ischial spine or the supra spinous processes with the obese patient. Pre-procedure ultrasound can increase single needle insertion with no redirections achievable with 63.8% of the patients, particularly women with easily palpable spinous processes (Chin et al., 2018). Evidence shows that ultrasound offers a clear benefit when placing lumbar epidurals for obese patients in labor.

Another type of patient who presents to the labor and delivery unit requesting a lumbar epidural may have scoliosis. Ko and Leffert (2011) defined scoliosis as a lateral curvature of the spine that is present in approximately 2% of the general population and affects women two times more than men. Adolescent idiopathic scoliosis (AIS) is the most common form of scoliosis. AIS is present in 2% to 4% of children between 10 and 16 years of age, with many females presenting with a curvature of greater than 30 degrees (Tawfik, Atallah, Elkharboutly, Allakkany, & Abdelkhalek, 2017). Anesthesia providers are often not able to palpate the supraspinous processes with patients who present with scoliosis. If the patient is not obese, sometimes the supraspinous processes can be felt above the lateral curvature in the lumbar region

or below to lateral curvature. The physical assessment of finding an adequate lumbar in a space is still dependent upon palpating the anatomy. If the patient had corrective surgery, there may be an increase in number of attempts and increased failure rates. Bauchat, McCarthy, Koski, and Wong (2015) reported a success rate of only 50% to 66% of patients with surgical correction for scoliosis. They also reported that newer surgical techniques should provide better access to the epidural space. Majeed, Ahmed, Alkahtani, and Altahtam (2017) described in their case study that there was a benefit to using ultrasound in patients with abnormal spinal anatomy. The patient that they presented had scoliosis with Harrington rod surgical correction. The authors of this case study also stated that the use of this technique is unappreciated and is a skill that is now highly warranted for anesthesia providers (Majeed et al., 2017). Piosik, Helbo-Hansen, and Sphrehn, (2015) described in their case study a laboring patient presenting with thoracolumbar scoliosis. A well-functioning epidural catheter was easily inserted on the first attempt without any need for redirections of the epidural needle with use of ultrasound for needle insertion and trajectory. Visualization of the anatomy will increase accuracy and safety of the placement of the continuous lumbar epidural. The use of pre-procedure ultrasound has been shown to reduce the number of attempts in 84% of neuraxial procedures (McConachie & Sharma, 2016). Even if the patients have corrective surgery, they can still have lumbar epidural placement (Stitzel, 2019). Care needs to be given when obtaining an informed consent and a pre-anesthetic evaluation to discuss that there may be possibility of increased attempts and failure rate.

The final set of patients are those who are defined as taking two attempts or more to place their lumbar epidurals for relief of labor pains. Labor epidural failure rate is 9% to 12% and is multifactorial (Kingsley, McGlennan, Brown, & Abir, 2017). This subset of patients can be found in the non-obese patient. The patient may have small interspaces that may result in

multiple attempts. Sometimes even with the non-obese patient there can be multiple attempts and redirections of the epidural needle. Pre-procedure ultrasound can increase single needle insertion with no redirections achievable, with 63.8% of the patients, particularly women, with easily palpable spinous processes (Chin et al., 2018). Aberrant anatomy can pose difficulty in placing the lumbar epidural and laboring patients. These are conditions that can misalign the spine. Degenerative joint disease, arthritis, or herniated discs can affect the patient's ability to get in a good anatomical position for placement of the labor epidural. In a normal scenario, the patient is instructed to push out the spine to open up the spaces between the supraspinous processes and give better access to the potential epidural space. In some morbidly obese patients, getting into that position can be difficult and sometimes unattainable. Different positioning techniques can also be employed by having the patient sit with her legs crossed in front. There is also a technique to use a sitting stool and place the feet flat on the stool to try to open up the spaces between the supraspinous processes. Patient fear can also inhibit the patient from getting in proper positioning for placement of the continuous lumbar epidural. This fear can often be eliminated by calmly discussing with the patient what to expect and give realistic descriptions of what the patient may feel. Some patients verbalize that they do not want to have a detailed description of the process. If that is the patient's wish, I explain that it is very important that they stay very still during the procedure. As providers, we may encounter many different personalities and patient types. My goal is to minimize the number of attempts to place the continuous lumbar epidural and to place an effective epidural. If there is a safe alternative to placing the epidural, I am willing to accommodate it for my patients' best outcomes.

Current practice at William Beaumont Army Medical Center labor and delivery unit is after a patient requests a labor epidural that requires two or more attempts using palpation and loss of

resistance technique, another anesthesia provider may be called to help attempt placement. At my facility, this requirement usually means that the next anesthesia provider uses the same technique and sometimes sees the same result. This process results in prolonged discomfort for the patient, multiple attempts, and potential for injury to the patient. The evidence shows that the use of ultrasound for anatomical visualization has proven to be an asset for use in this client population. Ultrasound-guided neuraxial procedures are more commonplace with anesthesia providers in recent years (Sahin & Balaban, 2018). Ultrasound is also shown to increase the safety and efficacy of regional anesthesia in many anesthesia providers' current practices. It is grossly underutilized in my facility for difficult placement of lumbar epidurals for patients in labor. This patient population can present with obesity or structural problems that can be better identified with the use of ultrasound assistance. After critically reviewing my 10-day reflective evaluation form, I saw that this was an opportunity for improvement in my practice and my facility. My project will increase use of ultrasound technology for patients admitted to William Beaumont Army Medical Center labor and delivery unit with potentially difficult lumbar epidural placements.

Historically, neuraxial analgesia is the gold standard method for pain relief during labor. There are two stages of labor that are of concern to the anesthesia provider and the patient regarding labor pain. The first stage of labor neural blockade is needed to cover T 10-L1 sensory level and during the second stage of labor T10-S4 sensory level (Butterworth, Wasnick, & Mackey, 2018). Currently, over half of the women in North America to are requesting continuous lumbar epidural for labor pain (Parajian, 2016). These women come in all types of shapes and sizes and comorbidities. In recent years there been more of an acceptance of the use of lumbar epidural management for labor pain (Parajian, 2016). Whether it was seen as a badge

of honor, just not readily available, offered, or considered a safe technique in the past, current thinking has changed regarding lumbar epidurals for labor. Seventy-one percent of pregnant women get epidurals or other spinal anesthesia according to a Stanford University study, indicating an increase of 10% from 2008 (White, 2018). With the use of ultrasound currently in practice for placement of regional anesthesia, current literature has shown that there is an increased efficacy and safety when incorporating ultrasound. Vallejo (2018) found that pre-procedure ultrasound imaging allows for greater accuracy and fewer needle passes by providing reliable and accurate anatomical information. The information that was shown in the meta-analysis review article was accurate interspace identification, establish midline, estimate depth to the epidural space, optimal interspace insertion area, and best angulation for the Touhy needle (Vellejo, 2018). Skill level of expertise of the anesthesia provider does factor into the successful use of ultrasound and placing continuous lumbar epidurals (Rossi, Varaday, Abir, & Brown, 2017). Ghosh, Madjdpour, and Chin (2016) suggested that practitioners should familiarize themselves with normal anatomy before attempting ultrasound assisted placement of continuous lumbar epidurals. That should be considered in any practice in any situation.

One technique that is currently used by many anesthesia providers is the combined spinal epidural technique (CSE). This technique utilizes the use of a Touhy needle that is popularly used for placing the epidural catheter. This technique is also reported to have a significantly faster onset than traditional dosing through a continuous lumbar epidural catheter and a 7% failure rate when compared to 12% rate with standard epidurals (Nanji & Carvalho, 2018). The placement of a spinal needle inside of the Touhy needle (needle and needle technique) and the return of a cerebral spinal fluid is also a marker that the Touhy needle is in the right space. Once the epidural space is established, the epidural catheter is advanced into the epidural space. Some

practitioners believe that this technique should not be used for obese patients because injecting local anesthetic into the cerebral spinal fluid may mask if the epidural catheter may not be placed accurately (Ootaki, 2017). Evidence shows that using a palpitation technique along with the use of ultrasound can improve safety of epidural techniques and accuracy of placement (Patel & Lie, 2015). As a result, the use of ultrasound can increase the safety for obese patients to have a combined spinal technique, which can have a quicker onset to comfort for the laboring patient. Husain, Fernando, and Segal (2019) reported that pre-procedural spinal ultrasound reduces the risk of failed epidural anesthesia and decreases the trauma from needle attempts and needle redirections. The inability to palpate the supraspinous processes can definitely be a deterrent for some practitioners to place lumbar epidurals. In fact, some anesthesiologists refused epidurals in a large number of scoliosis patients who underwent corrective surgery (Falick-Michaeli et al., 2016). Ultrasound can aid in visualization of the alignment of the supraspinous processes, insertion angle of the Touhy needle, and depth of the epidural space (McConachie & Sharma, 2016). Use of ultrasound for epidural procedure has been recommended by National Institute for Health and Clinical Excellence (NICE) since 2008 (Patel & Lie, 2015). Ultrasound is increasingly being viewed as an everyday tool in obstetrical anesthesia for administration of spinal and epidural anesthesia (Lee & Loughrey, 2017).

My data supporting the existence of the problem is represented by a 22-year-old patient who presents to the William Beaumont Army Medical Center labor and delivery unit in active labor requesting anesthesia and analgesia intervention for pain control. My colleague who was assigned to the labor and delivery unit for that shift evaluated the patient. The patient was counseled that because of her scoliosis, there may be multiple attempts to try to place it continues lumbar epidural. She was also counseled that there might be a unilateral sensory block,

a higher potential for dural puncture, or unsuccessful placement of the epidural catheter. After discussion, an informed consent was obtained the patient agreed to proceed with placement of an epidural catheter for pain control. My colleague made three attempts using palpation of the anatomical structures and loss of resistance technique. Those three attempts were unsuccessful and on one of those attempts a patient complained of a transient paresthesia to one side that subsided spontaneously. At this point, my colleague called me to come over to the labor and delivery unit and attempt to place a continuous lumbar epidural. She gave me a bedside report of the patient's history and what she had done previously to place the epidural. I introduced myself to the patient and discussed with her what I was going to try to do to help alleviate her labor pain. I palpated the patient's supraspinous processes, paying attention to where my colleague had attempted previously. I also asked the patient to sit with her legs crossed and assessed the supraspinous processes before I used sterile technique to prepare the patient for continuous epidural placement. I attempted at L2 – L3 and was unsuccessful due to the inability of being able to have lost resistance technique with the 17-gauge Touhy needle. After my failed attempt, we discussed with the patient if she wanted us to abandon the technique or give one more attempt. The patient verbalized that she would like for us to try one more time, and my colleague attempted and was successful placement at L4 – L5 below the area affected by scoliosis. After testing the epidural for proper placement, local anesthetic was administered through the continuous lumbar epidural with good relief, and the patient had a spontaneous vaginal delivery without complications.

As I left the room, I evaluated what happened with that patient and reflected on what I could have done better to have a better outcome for the patient. It dawned on me right at that moment why did not I use ultrasound. I discussed with several of my colleagues about what

happened with this patient presenting in labor and delivery with scoliosis. I asked around in my department of 31 certified registered nurse anesthetist (CRNA's) and there was only one person who occasionally used the ultrasound after she could not place an epidural after two attempts. That person was deployed so I could not use her as a resource, but I began to do a literature review, and there were high levels of research evidence supporting the use of ultrasound assistance for the placement of continuous lumbar epidurals for labor.

My PICOT (Population, Intervention, Comparison, Outcomes, and Time) questions came directly from my evaluation of my reflective practice form. My goal was to adhere fervently to the ages and population that I saw when I did my practice reflection. My population was pregnant women between the ages of 20 to 35 years of age who are in active labor admitted to William Beaumont Medical Center labor delivery unit and requesting a lumbar labor epidural for pain control. My intervention question was: "Does ultrasound-assisted placement provide better/easier placement of epidural catheters?" The comparison that I wanted to evaluate was the practice that I use now of utilizing loss of resistance and landmark technique. The outcome I expected is that the patient would verbalize pain relief due to appropriate placement of the epidural catheter in the appropriate space in order to get a T8– T9 dermatome sensory block. The time of my project evaluation was from January 19, 2020 to February 19, 2020.

Literature Review

I used the following terms for my literature review: epidural, American Association of Nurse Anesthetist (AANA), American Association of Anesthesiologist (ASA), lumbar epidural, labor epidural, obesity, scoliosis, combined spinal epidural, failure rates with epidural, continuous lumbar epidural, ultrasound, current ultrasound techniques, ultrasound with labor epidural placement, current trends and labor anesthesia, neuraxial blocks, current anesthesia

techniques for labor epidurals, anesthesia, analgesia, epidural randomized controlled study, epidural observational study, epidural meta analysis/cohort study, pre-procedure ultrasound, epidural ultrasound assisted, epidural ultrasound-guided. I utilized the following databases for my literature review: PubMed, Google, Google Scholar, ResearchGate, EBSCOhost, UTEP library database, Medscape, National Center for Biotechnology Information (NCBI), Cochrane database, and Elsevier.

During the literature review, key concepts and synthesis of evidence identified that obesity, scoliosis aberrant anatomy to include surgical repair, or idiopathic origin of the spine can cause difficulty in placing epidurals. Because these conditions exist does not exclude the patient from receiving a continuous lumbar epidural for analgesia during labor. Special care and planning need to be involved along with discussing with the patient about the risks and benefits of having a continuous lumbar epidural placed. One potential solution is to have good interdisciplinary communication that can optimize a patient's outcome regarding placement of a continuous lumbar epidural. The obstetrical care provider starts with the initial assessment of the patient. If the patient chooses to incorporate potential usage of a continuous lumbar epidural and a problem is identified, early intervention from a multidisciplinary standpoint will increase the best outcome for these patients (Pauza, Porter-O'Grady, Baker, & Malloch, 2014). Another possible solution for this problem is to familiarize anesthesia staff with the utilization and support research on the effectiveness of using ultrasound assistance for placement of continuous lumbar epidurals. The use of ultrasound is greatly underutilized in my work setting for placement of continuous lumbar epidurals. It is used routinely for placement of regional anesthesia. Several ultrasound machines are readily available throughout the anesthesia department, and one could easily be transported to the labor and delivery unit for exclusive use of there. Evidence shows

that utilization of pre-procedure ultrasound can increase safety and the success rate and placement of continuous lumbar epidurals in these potentially difficult patients.

This problem is important because multiple attempts in placing continuous lumbar epidurals can expose patients to injury, infections, and additional procedures and treatments to rectify sequela that go along with multiple attempts and injury. These treatments include but are not limited to postdural puncture blood patch, potential for surgery, antibiotic therapy, and decreased patient experience and satisfaction. Ultrasound assistance after identification of patients who present with obesity, scoliosis, aberrant anatomy, or corrective spinal surgery has been shown in the literature and practice to increase continuous lumbar epidural efficacy and safety. In conclusion, a concise summary of the literature review and evidence show that pre-procedure ultrasound assistance will yield safer patient outcomes and fewer attempts and increase patient experience. Based on these findings I feel that it is a great rationale for conducting my DNP project.

Project Design

I chose to use the Ferlie and Shortell framework model for translational research into practice (White et al., 2016). I selected this framework because it fits the personnel and my work environment (Nilsen, 2015). The model focuses on the importance of context and change and describes four levels of change. I want to discuss the use of pre-procedural ultrasound with the individual healthcare practitioner (I know that ultrasound is being underutilized in the labor delivery unit at my facility). The four levels of changes are:

1. The individual patient will benefit from utilization of ultrasound assisted lumbar epidural placement.
2. The healthcare team will be supportive because this measure can increase our efficacy and

also patient safety.

3. The overall organization (William Beaumont Army Medical Center Department of Anesthesia Services) will have buy-in if I present this in a palatable way that this can be a quality improvement for patients.

4. Because my department is very supportive of the staff (CRNAs) obtaining our DNP, the cultural environment of our department (organization) will be amenable to change. I will use current best practices, literature, and highest levels of research evidence for support of my framework for change.

Quality Improvement Framework:

I chose the Plan-Do- Study-Act (PDSA) quality improvement (QI) framework. This model focuses on three questions to set the aim or organizational goal, establish measures, and select changes. It incorporates Plan-Do- Study-Act (PDSA) cycles to test changes on a small scale.

Plan: My plan is to have increased usage of ultrasound technology in the placement of difficult epidurals (two attempts or more with an epidural needle), obesity (BMI) of greater than 30 kg/m^2, or structural abnormalities.

Do: I had no multiple attempts and only one redirection of the needle with use of pre-procedural ultrasound.

Study: I learned that the use of ultrasound as a tool for visualization, spinal alignment, and Touhy needle angulation was a definite benefit for the placement of continuous lumbar epidurals. I feel that my goal was met.

Act: The changes that I would hope to see is that anesthesia providers in my department at my institution will use ultrasound assistance in patients evaluated to be difficult epidural

placement in patients laboring at William Beaumont Army Medical Center. I can always re-evaluate and adapt this process. My conclusion is that after identification of patients who are evaluated to be difficult continuous lumbar epidural placements that ultrasound be used in the placement of the catheters.

My project setting was at William Beaumont Army Medical Center labor and delivery unit. Patients were admitted by the obstetrical care providers and evaluated to be in active labor. I perform a pre-anesthetic evaluation once the obstetrical care providers contacted me. Resources I needed were readily available in the William Beaumont Army Medical Center operating room holding area. The ultrasound machine that I used was a SonoSite X-Porte, a C60xp ultrasound transducer, sterile skin marker, and a sterile transducer kit.

Population

My population was pregnant women ages 22 to 35 years of age who were in active labor and admitted to William Beaumont Army Medical Center labor and delivery unit requesting a labor epidural for pain.

Process

The first step in the process of developing the idea for my DNP project was to perform a reflective practice evaluation. From my 10-day reflective practice I identified patients that I took care of for a potential quality improvement project. After that information was collected, I evaluated and categorized the patients according to their presentation and diagnoses. I chose three PICOT questions that were areas of concern or areas for improvement in my practice. I picked a PICOT question; “Use of ultrasound and the placement of continuous lumbar epidurals in patients who are obese, anatomical abnormalities or deemed it difficult placements”. I discussed the topic with my chair, and we agreed that it would be an important topic to pursue

for a DNP project. I completed the ethical and human subject training required by the University of Texas at El Paso. I filed the proper paperwork with both William Beaumont Army Medical Center and University of Texas at El Paso Institutional Review Boards (IRBs). Both institutions determined that my DNP project "is not research." I obtained a worksite approval letter for my immediate supervisor at William Beaumont Army Medical Center and Army Medical Command to conduct my DNP project. Use of ultrasound is already commonplace for placement and assistance of regional anesthesia, so no new practices were being developed by my DNP project.

The (CRNA) covering the labor and delivery unit at William Beaumont Army Medical Center contacted me. At this point, the patient had already been evaluated to meet criteria for epidural placement. A pre-anesthetic evaluation was performed, along with a detailed discussion of risks and benefits and a signed consent for the procedure is obtained. I performed a chart review to ensure that all consent and documentation were completed. I introduced myself to the patient if I did not previously meet the patient or was assigned to the labor and delivery unit and did the pre-anesthetic evaluation myself. I explained the procedure and the use of the ultrasound as a visualization tool, and all 10 patients agreed to proceed. Then, the SonoSite X-Porte ultrasound machine was turned on and the depth set at18.3 cm with the musculoskeletal setting (MSK). The patient was placed in the sitting position, a procedural timeout was done, and then the back was thoroughly prepped and draped using sterile technique. I palpated the ischial spines and felt for the supraspinatus processes, which should approximate the L4-L5 interspace. Sterile transducer gel was liberally placed at that point. The sterile prepped C60xp transducer was placed longitudinally to identify alignment of the supraspinous processes. Once I found a suitable interspace, I used the inferior point of the supraspinous process. I made a horizontal line with the sterile marker and a small dot at the bottom of the ultrasound transducer. I intersected

two lines and that was where I placed the local anesthetic of choice. I then use a17-gauge Touhy needle with the visualized trajectory and loss of resistance technique. Once I was in the epidural space, I could choose to do a combined spinal technique described above or placement of the epidural catheter through the Touhy needle. Once the catheter was in place, I performed a test dose per our institution's guidelines. I taped and secured a sterile occlusive dressing over the epidural and began the infusion of local anesthetic of choice.

The data collected in my project showed that out of my 10 patients, only once did the 17-gauge Touhy needle need to be redirected. The BMI of all 10 patients ranged from 30.3-45 kg/m². There were no patients who had a past medical history of scoliosis, any previous spinal surgeries, or any aberrant anatomy to add to my data. There were also no patients who presented with two attempts or more for placement of a continuous lumbar epidural. All continuous lumbar epidural placements were performed by me.

Findings and Outcomes

The results of my project showed that out of 10 patients, only once did the 17-gauge Touhy needle need to be redirected. There was no report from any other patients of a unilateral block. There was no evidence of a postdural puncture or report of a postdural puncture headache. There also was no patient complaint of paresthesias during the procedure. All 10 patients verbalized satisfaction and adequate pain control from the continuous lumbar epidural. Nine patients had spontaneous vaginal deliveries, and one patient had a cesarean section with good analgesic results from the epidural I placed as reported to me by the CRNA in the cesarean section. The BMI of all 10 patients ranged from 30.3-45 kg/m². One patient with a BMI of 33 kg/m needed to have a redirect of the 17-gauge to a needle. It was necessary to tilt the probe laterally when I was lining up my sterile skin markings, and I

believed that contributed to the need for needle redirection. There were no patients presenting with scoliosis, previous spinal surgery, misaligned spinous processes, or two or more Touhy needle attempts. I felt that there was an added level of safety with ultrasound-assisted visualization of the supraspinous processes and trajectory of the 17-gauge Touhy needle. I believe that the outcome of my project shows that use of pre-procedure ultrasound in placement of continuous lumbar epidurals and obese patients is a valuable tool as supported by the literary evidence.

Evaluation

Based on the evidence of my project and my review of the literature, the use of preprocedure ultrasound assistance should be considered for obese patients for assistance and placement of continuous lumbar epidurals. Unfortunately, I did not get to use ultrasound for placement on two of the other types of patients who I described in my discussion of the importance of this project. Those other two types of patients are patients who present with scoliosis and/or corrective surgery and patients who took more than two attempts in placing a continuous lumbar epidural for relief of labor pains. That fact surely is a limitation of my project report. During the time of the start and finish dates of my project, there were no reports from my colleagues of a patient who took two attempts or more to place her continuous lumbar epidurals. The evidence shows and my practice supports that pre-procedure ultrasound assistance has a place in assisting in the placement of continuous lumbar epidurals.

Conclusions

The use of pre-procedure ultrasound-assisted continuous lumbar epidural catheter placement was a successful tool in placing epidurals in obese patients the BMI of greater than 30

kg/m² as supported by the literary evidence. There were no findings of postdural punctures, inadvertent postdural punctures, paresthesias, or complications from the epidural placements. All 10 patients verbalized adequate comfort with the placement of the continuous lumbar epidurals. Limitations of my project were that there were no patients who were admitted to the labor and delivery unit that had scoliosis, aberrant spinal anatomy, previous back surgery, or more than two attempts at placement of a continuous lumbar epidural.

Discussion

Implications for practice are after an extensive review of the research literature the evidence showed pre-procedure ultrasound assistance will be a quality improvement change. Utilization of pre-procedure ultrasound assistance in placing continuous lumbar epidurals in obese laboring patients helped in assessing alignment of the supraspinous processes, trajectory of the Touhy needle through visualization of the epidural space, and identifying pertinent anatomy. What this means for other practitioners is that if a patient presents to the William Beaumont Army Medical Center labor and delivery unit and is evaluated to be a potentially difficult continuous lumbar epidural placement, pre-procedure ultrasound assistance has been shown to be a quality of care improvement in the safety and efficacy of placement of the continuous lumbar epidural. Utilization of pre-procedure ultrasound for identification of anatomical structures for regional anesthesia has been in place for years and has now gained popularity for usage in the obstetrical environment. Utilization of ultrasound is not a new practice, and the systems impact of my DNP project is that we can provide safer placement of continuous lumbar epidurals that has been shown by evidence in the literature and implementation into my practice. Anesthesia providers at my facility use ultrasound for placement of regional anesthesia and are very familiar with the use of ultrasound equipment. Therefore, familiarization with spinal anatomy for

placement of continuous lumbar epidurals should not be a hindrance after reviewing normal anatomy. A definite limitation to my project was that there were no patients who presented with scoliosis, previous back surgery, aberrant anatomy, or needing two or more attempts in placing a continuous lumbar epidural. Despite that fact there is plenty of evidence to show that utilization of ultrasound assistance, it is advantageous in that population. For sustainability, I can periodically do a departmental in-service to discuss the impact of utilization of pre-procedure ultrasound usage in patients who are evaluating to be potentially difficult continuous lumbar epidural placements.

References

Bauchat, J. R., McCarthy, R. J., Koski, T. R., & Wong, C. A. (2015). Labor analgesia consumption and time to neuraxial catheter placement in women with a history of surgical correction for scoliosis. *Anesthesia & Analgesia*, *121*(4), 981-987. doi:10.1213/ane.0000000000000690

Butterworth, J. F., Wasnick, J. D., & Mackey, D. C. (2018). Obstetric Anesthesia. M*organ and Mikhail's Clinical Anesthesiology* (6th ed., pp. 861-897). New York, NY: McGraw-Hill Education / Medical.

Butwick, A. J., Wong, C. A., & Guo, N. (2018, September). Maternal body mass index and use of labor neuraxial analgesia: A population-based retrospective cohort study. *Anesthesiology, 9*(129), 448-458. Retrieved from https://doi.org/10.1097/ALN.0000000000002322

Chin, A., Crooke, B., Heywood, L., Brijball, R., Pelecanos, A. M., & Abeypala, W. (2018). A randomised controlled trial comparing needle movements during combined spinal-epidural anaesthesia with and without ultrasound assistance. *Anaesthesia*, *73*(4), 466-473. doi:10.1111/anae.14206

Eley, V., Chin, A., Sekar, R., Donovan, T., Krepska, A., Lawrence, M., … Marquart, L. (2019). Increasing body mass index and abdominal subcutaneous fat thickness are associated with increased skin-to-epidural space distance in pregnant women. *International Journal of Obstetric Anesthesia*, *38*, 59-65. doi:10.1016/j.ijoa.2018.10.005

Falick-Michaeli, T., Schroeder, J. E., Barzilay, Y., Luria, M., Itshayek, E., & Kaplan, L. (2016). Adolescent idiopathic scoliosis and pregnancy: An unsolved paradigm. *Global Spine Journal*, *6*(6), 626-626. doi:10.1055/s-0036-1586242

Ghosh, S., Madjdpour, C., & Chin, K. (2016). Ultrasound-guided lumbar central neuraxial block. *BJA Education*, *16*(7), 213-220. doi:10.1093/bjaed/mkv048

Husain, T., Fernando, R., & Segal, S. (2019). *Obstetric anesthesiology: A case-based approach*. Cambridge, MA: Cambridge University Press.

Karastergiou, K., Smith, S. R., Greenberg, A. S., & Fried, S. K. (2012). Sex differences in human adipose tissues – The biology of pear shape. *Biology of Sex Differences*, *3*(1), 13. doi:10.1186/2042-6410-3-13

Kingsley, C., McGlennan, A., Brown, J., & Abir, G. (2017, November 14). *The Labour epidural: Troubleshooting*. Retrieved from https://www.wfsahq.org/components/com

Ko, J., & Leffert, L. (2011). Clinical implications of neuraxial anesthesia in the parturient with scoliosis. *Obstetric Anesthesia Digest*, *31*(1), 53-54. doi:10.1097/01.aoa.0000393190.66961.ef

Kula, A. O., Riess, M. L., & Ellinas, E. H. (2017). Increasing body mass index predicts increasing difficulty, failure rate, and time to discovery of failure of epidural anesthesia in laboring patients. *Journal of Clinical Anesthesia*, *37*, 154-158. doi:10.1016/j.jclinane.2016.11.010

Lee, A., & Loughrey, J. P. (2017). The role of ultrasonography in obstetric anesthesia. *Best Practice & Research Clinical Anaesthesiology*, *31*(1), 81-90. doi:10.1016/j.bpa.2016.12.001

Majeed, A., Ahmed, I., Alkahtani, G., & Altahtam, N. (2017). Ultrasound-guided continuous spinal anesthesia for cesarean section in a parturient with scoliosis corrected with Harrington's rod surgery. *Saudi Journal of Anaesthesia*, *11*(4), 479. doi:10.4103/sja.sja_112_17

McConachie, I., & Sharma, M. (2016). Neuraxial blocks in parturients with scoliosis and after spinal surgery. *Journal of Obstetric Anaesthesia and Critical Care*, *6*(2), 70. doi:10.4103/2249-4472.191594

Nanji, J. A., & Carvalho, B. (2018). Modern techniques to optimize neuraxial labor analgesia. *Anesthesia and Pain Medicine*, *13*(3), 233-240. doi:10.17085/apm.2018.13.3.233

Nilsen, P. (2015). Making sense of implementation theories, models, and frameworks. *Implementation Science*, *10*(1). doi:10.1186/s13012-015-0242-0

Ootaki, C. (2017). Maternal morbid obesity and anesthesia management. *Hypertension Research in Pregnancy*, *5*(2), 41-45. doi:10.14390/jsshp.hrp2017-009

Parajian, T., Angle, P., Kurtz Landy, C. M., & Djordjevic, J. (2016). A snapshot of women's attitudes and preferences toward labor epidural analgesia and cesarean delivery. *International Journal of Anesthesiology & Research*, *4*(2) 200-207. doi:10.19070/2332-2780-1600047

Patel, S., & Lie, J. (2015). Ultrasound for obstetric neuraxial anesthetic procedures: Practical and useful? *Journal of Obstetric Anaesthesia and Critical Care*, *5*(2), 49. doi:10.4103/2249-4472.165130

Pauza, C., Porter-O'Grady, T., Baker, D., & Malloch, K. (2014). *Quantum leadership*. Burlington, MA: Jones & Bartlett Publishers.

Piosik, Z., Helbo-Hansen, S., & Sphrehn, M. (2015). Ultrasound-guided performance of labour epidural analgesia in a patient with thoracolumbar scoliosis. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/25612990

Rossi, I., Varaday, S., Abir, G., & Brown, J. (2017). Neuraxial anesthesia for scoliosis and previous spinal surgery in pregnancy. *Anesthesia Tutorial of the Week*, 1-5.

Sahin, T., & Balaban, O. (2018). Lumbar ultrasonography for obstetric neuraxial blocks: Sonoanatomy and literature review. *Turkish Journal of Anesthesia and Reanimation*, *46*(4), 257-267. doi:10.5152/tjar.2018.90277

Stitzel, C. (2019, June 19). Scoliosis and pregnancy: What you need to know. Retrieved from https://www.treatingscoliosis.com/blog/scoliosis-and-pregnancy-what-you-need-to-know/#can_you_have_an_epidural_if_you_have_scoliosis

Tawfik, M. M., Atallah, M. M., Elkharboutly, W. S., Allakkany, N. S., & Abdelkhalek, M. (2017). Does preprocedural ultrasound increase the first-pass success rate of epidural catheterization before cesarean delivery? A randomized controlled trial. *Anesthesia & Analgesia*, *124*(3), 851-856. doi:10.1213/ane.0000000000001325

Uyl, N., De Jonge, E., Uyl-de Groot, C., Van der Marel, C., & Duvekot, J. (2019). Difficult epidural placement in obese and non-obese pregnant women: a systematic review and meta-analysis. *International Journal of Obstetric Anesthesia*, *40*, 52-61. doi:10.1016/j.ijoa.2019.05.011

Vallejo, M. (2018). Pre-procedure neuraxial ultrasound in obstetric anesthesia. *Journal of Anesthesia and Perioperative Medicine*, *5*(2), 85-91. doi:10.24015/japm.2017.0050

White, K. M., Dudley-Brown, S., & Terhaar, M. F. (2016). *Translation of evidence into nursing and health care practice* (2nd ed.). New York, NY: Springer.

White, T. (2018, June 27). Epidurals increase in popularity, Stanford study finds. Retrieved from https://scopeblog.stanford.edu/2018/06/26/epidurals-increase-in-popularity-stanford-study-finds/