PART B
STUDY DESCRIPTION

TITLE OF PROTOCOL	Assessment of the use of ultrasound for epidural catheter placement and comparison with palpation technique		
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B1. PURPOSE OF PROTOCOL

The purpose of this investigation is to evaluate the use of ultrasound for the placement of epidural catheters in obstetric anesthesia. We plan to answer two questions in this investigation:

1) How does the traditional technique based on palpation compare to one using ultrasound to place an epidural catheter?
2) Does ultrasound reduce one potential risk in epidural placement?

B2. SIGNIFICANCE AND BACKGROUND FOR THE STUDY

Spinal and epidural procedures (neuraxial) are performed in obstetric anesthesia to provide labor pain control and anesthesia for cesarean delivery. Traditionally, neuraxial procedures are performed using a 'blind' technique. The clinician used palpation (feel with your fingers) to identify the boney landmarks in the patient. Based on the boney landmarks, the clinician will then insert a needle to attempt to enter the space about 4 centimeters below the skin and between the bones of the spine. The success rate of this technique in trained hands is very high (~99%). However, it may take considerable procedure time to achieve success based on the patient or other factors.

Over the last few years ultrasound imaging has become heavily relied upon for many procedures in medicine. For example, ultrasound imaging has proven to be superior for central line catheter placement compared to a blind technique. Ultrasound imaging has also revolutionized the use of regional anesthesia (nerve blocks of the arms and legs). Unlike these two examples, ultrasound imaging for neuraxial procedures has not yet been shown to provide clear benefit. Some of this difference may be attributed to the inability to perform real-time imaging for needle placement. Instead, clinicians are mostly limited to identifying the 'ideal' needle entry site and angle, and the estimated depth of needle insertion.[1]

Despite this limitation, ultrasound assistance has been associated with a reduction failed epidural catheterization among untrained clinicians, and in a reduction in traumatic attempts.[2] The importance of these findings remains debated in the literature.[3] Furthermore, the increased time that might be required to perform ultrasound imaging (reducing the impact of any procedural difference in time) has been minimally accounted for in the literature.

One clinically important aspect of the procedure which might be improved with ultrasound imaging is to reduce the potential risk of spinal cord injury. In theory, the spinal cord ends in most patients sufficiently above the site of needle insertion so that injury would be impossible. Unfortunately, studies have demonstrated that even experienced clinicians are frequently higher in the spinal column than they intend. Thus, while extremely rare, the incidence of spinal cord trauma is not zero.

If it could be demonstrated that ultrasound imaging results in greater accuracy of the needle insertion site, then this would lead to a potential for a safer procedure.

B3. DESCRIPTION OF RESEARCH PROTOCOL

A. Study Design – Overview, Methods, Procedures

This study contains two phases:

1) A prospective, randomized, blinded comparison of ultrasound imaging versus palpation for epidural catheter insertion in laboring women.
2) A prospective, single cohort, blinded trial to assess whether ultrasound imaging provides a reliable placement below the L3 vertebra.

The initial phase of the investigation will be a randomized comparison of ultrasound versus palpation. Patients will be enrolled in early labor and will be randomized to have their epidural placed with either technique. The technique will be chosen by computer-generated randomization list maintained in opaque sequentially numbered envelopes. Description of the placement technique is below. The primary outcome will be the number of epidural catheters inserted above the intended insertion site. We will also assess the total time required for epidural catheter placement, number of attempts for successful insertion, effectiveness of the epidural catheter for labor pain control.

Following completion of enrollment of the first phase, the second phase of the investigation will enroll patients only into the single-cohort ultrasound arm. The study will use the same methodology as the initial phase, but without randomization due to a single cohort. The primary outcome will be the absolute number of epidural catheters inserted above the L3 vertebral body. We will also assess the effectiveness of the ultrasound markings for guiding placement.

Procedure placement technique

After written, informed consent, and standard patient preparation, the epidural catheter will be placed with the patient in the sitting position by a junior resident. In the ultrasound arm, the patient will be first imaged using an appropriate probe, and the identified ultrasound landmarks marked on the skin. The skin will be prepped in the usual fashion, and the needle will be inserted at the identified site and direction determined by ultrasound. In the palpation arm, the skin will be prepped and the needle will be inserted using palpation-identified landmarks to guide the needle. All catheters will be intended to be placed at the L4-L5 interspace as the primary attempt. The L3-L4 interspace will be used as a secondary attempt.

Assessment of final position

After insertion of the epidural catheter and administration of the pain relief medication, patients in both groups will be examined by a blinded observer using ultrasound to determine the catheter insertion site and the likely insertion interspace.

If, however, we discover that the use of ultrasound for placement of the epidural catheter may present greater risk than previously anticipated to the pregnant woman or fetus, then we will stop the study after phase 1 and not proceed with phase 2.

1. Balki M. Locating the epidural space in obstetric patients-ultrasound a useful tool: continuing professional development. Can J Anaesth (2010 Dec) 57(12):1111-26
2. Shaikh F, Brzezinski J, Alexander S, Arzola C, Carvalho JC, Beyene J, Sung L. Ultrasound

imaging for lumbar punctures and epidural catheterisations: systematic review and meta-analysis. BMJ (2013) 346:f1720.
3. Gambling DR. Lumbar ultrasound: useful gadget or time-consuming gimmick? Int J Obstet Anesth (2011 Oct) 20(4):318-20

B. Statistical Considerations

a. ***Sample Size Justification:***

Sample size was calculated using a power of 0.9 and alpha of 0.05.

For the first phase, the expected rate of success in the palpation group of 50% compared to a success rate of 80% in the ultrasound group would require 51 patients per group.

For the second phase, the sample size was calculated as a performance goal study. With a null hypothesis of 99% success rate and performance goal of 94.55% (defined by the 95% confidence interval around 99%), assuming a 98% success rate in the study group, 141 patients would be required.

Based on previous experience, the sample sizes will be increased by 20% to account for dropouts due to technical issues or other considerations. Thus, we will enroll a total of 210 for this study.

b. ***Data Analysis:***

Data will be analyzed using IBM SPSS for Windows. The primary outcome of the first phase will be compared using Fisher's exact test. The primary outcome of the second phase will be assessed as a performance goal: the confidence interval of the true study value will be compared to the lower limit of the null hypothesis performance goal. Secondary outcomes will comparing using Fisher's exact test, t-test, as appropriate. Logistic regression will be used to identify factors associated with failure. These factors will include patient height, weight, BMI, depth of the epidural space and presence of scoliosis or lordosis.

C. Subject Selection

This study will be conducted on healthy, ASA I or II patients who have been admitted for labor and delivery. All patients will have already consented for neuraxial anesthesia prior to enrollment.

Inclusion criteria:

- Healthy ASA I or II parturient
- Will be receiving neuraxial placement for labor, having been consented for the procedure
- Patients eligible for randomization will be those requiring epidural pain relief when investigators are available to consent patient and conduct study procedures

Exclusion criteria:

- ASA III or IV
- Unable to participate in the study due to severe pain
- Contraindications to neuraxial analgesia
- Previous spinal surgery in the lumbar or sacral area (L1 through Sacrum)
- BMI greater than 37
- Height less than 60 inches
- Significant scoliosis

B4. POSSIBLE BENEFITS

There are no benefits to the patient for participating in this study. The information gained may improve the care of future patients.

B5. POSSIBLE RISKS AND ANALYSIS OF RISK/BENEFIT RATIO

Prior to enrollment, the patient wil have already consented for neuraxial anesthesia, and the risks/benefits/alternate procedures of that were discussed. These procedures and medications are standard of care and will be administered whether the patient is in the study or not.
The risks of this study are minimal.

- The performance of an ultrasound for assessment of the lumbar spine is non-invasive and does not carry any specifically identified risk.
- The expected time for the ultrasound imaging is very short (less than 5 minutes)
- The second, blinded ultrasound assessment will be made after the patient has received their pain relief medications.

If, however, we discover that the use of ultrasound for placement of the epidural catheter may present greater risk than previously anticipated to the pregnant woman or fetus, then we will stop the study after phase 1 and not proceed with phase 2.

B6. RECRUITMENT AND CONSENT PROCEDURES

Recruitment

Subjects will be recruited from the patients admitted to the Labor and Delivery unit at BIDMC. All subjects will be in labor and will be expected to receive a neuraxial analgesic for labor pain. Subjects will be approached for enrollment after being consented for neuraxial analgesia.

Consent

Patients will be consented by one of the investigators in the study, whose name appears on the consent form. All subjects will be consented in their labor room, a private location. Written informed consent will be obtained and a copy provided to the patient and in the chart.

B7. STUDY LOCATION

Privacy

All potential subjects will be approached in their labor room. These rooms are single patient rooms and are used for all other private discussions during medical and obstetric care. The study will be conducted in the labor room, which is the standard location for neuraxial analgesia procedures. Only the minimum required information will collected.

Physical Setting

The study will be conducted in a labor room, a single-patient location that is considered private. This location is currently used placement of neuraxial analgesia procedures.

B8. DATA SECURITY

The data will be recorded on paper and these records will be maintained in a secured location in a private, locked office. The date will be transferred to electronic form and maintained in a REDCap file.

B9 Multi-Site Studies

Is the BIDMC the coordinating site? ☐ Yes ☐ No
Is the BIDMC PI the lead investigator of the multi-site study? ☐ Yes ☐ No ☒ N/A

B10 Dissemination of Research Results

The information regarding each patient's involvement will be available to the patient at the conclusion of their participation. If a subject expresses interest in the results of the study, we will record their contact information and send them the results when available.