Loss of Resistance with Nerve Stimulation Versus Loss of Resistance alone; Effect on Success of Thoracic Epidural Placement.

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1.1 Protocol

Objectives

The purpose of this randomized, observer-blinded, investigative trial is to determine if the use of electrical stimulation, compared to the traditional loss of resistance technique alone, improves the success rate of epidural catheter placement at an academic teaching institution. The primary outcome will be the success rate of placement of a thoracic epidural, which will be determined by the detection of a loss of sensation to cold (ice) in at least two contiguous dermatomal levels, 15 minutes after administration of a test dose of lidocaine through the epidural catheter. Secondary outcomes will include the time required to place the epidural catheter and the number of thoracic spine levels attempted.

Methods/Measurements:

Design:

This study will be a randomized, double-blinded (blinded to the patient and the observer), investigative trial that will take place after Institutional Review Board approval. Written informed consent will be obtained from all the study participants. It is expected that recruitment of patients for this study may take up to 24 months.

Selection Criteria:

Inclusion: Adults, between 18 and 90 years of age, undergoing intra-thoracic or intra-abdominal procedures that normally would receive thoracic epidurals for post-operative analgesia will be eligible.

Exclusion: Subjects with contraindications to regional anesthesia, such as a history of allergy to amide local anesthetics, presence of a progressive neurological deficit, a pre-existing coagulopathy or patients that are on anticoagulant medications that prohibit placement of an epidural, systemic infection or infection at the site of placement.

Setting**:**

All patients in the study will be undergoing elective surgery at Wake Forest University Baptist Medical Center. The interventions will be performed in the regional anesthesia area of the surgery center.

Interventions and Interactions:

Adults, between 18 and 90 years of age, undergoing intra-thoracic or intra-abdominal procedures and have consented to continuous thoracic epidural for post-operative analgesia will be recruited to participate. Eligible patients will be identified the day before surgery by review of the operative schedule, which is customary for patients who will receive regional anesthesia as part of their postoperative analgesic regimen. When appropriate, patients may be identified in the Surgical Navigation Center during their preoperative assessment visit. Upon arrival to the regional anesthesia area or in the Surgical Navigation Center, eligible patients will complete the study consent process. Additionally, baseline patient characteristics will be recorded including height, weight, BMI, sex, age, surgeon and operative side.

Before epidural placement each patient will be randomized through the use of sequentially numbered opaque envelopes to one of two treatment arms, traditional loss of resistance alone, or

loss of resistance followed by electrical stimulation of the tip of the catheter. As the patient will be sedated during epidural catheter placement, they will be blinded to their treatment arm. The investigator that determines if the epidural was successful placed will also be blinded to the patient's treatment arm.
Unless there is a contraindication, each patient will receive multimodal analgesia with 1000 mg of PO acetaminophen, 150 mg of PO pregabalin, and 400 mg of celecoxib prior to the block. Once randomization and blinding occur, standard ASA monitors and oxygen will be applied. All epidurals will be performed by a resident or a fellow trainee supervised by an attending anesthesiologist. A stimulating catheter will be placed for all epidurals so that the observer and patient will be blinded to the technique used for placement. Sedation for the epidural will be provided in the usual manner at the discretion of the anesthesiologist performing the neuraxial block.

All subjects will receive a thoracic epidural catheter placement at the level appropriate for their surgery and will be randomized to either have the epidural placed with a loss of resistance technique alone or loss of resistance technique with confirmation by nerve stimulation. In the traditional loss of resistance technique group, the epidural catheter will be placed after achieving loss of resistance to air. In the electrical stimulation group, following the location of the epidural space with a loss of resistance technique (using air), nerve stimulation will be utilized to elicit a myotomal contraction of the abdominal or thoracic wall. Nerve stimulation will be started at a pulse width of 0.3 ms and a frequency of 1 Hz and a current of 0.2mA. The current will be adjusted in increments of 0.2 mA until myotomal stimulation is detected or a max current of 5 mA is achieved. If no myotomal stimulation is detected then the stimulation will be attempted at a pulse width of 1 ms and a frequency of 1 Hz with a starting current of 0.2 mA and increasing increments of current of 0.2 mA until either myotomal stimulation is detected or a max current of 5 mA is achieved. Failure to stimulate after this setting will be determined to be a failure to confirm epidural placement with nerve stimulation. After placement of the catheter a standard test dose of 3+2 ml of 1.5% lidocaine with 1:200,000 epinephrine will be administered. 15 minutes after administration of the lidocaine test dose, a blinded member of the study team will assess for successful placement of the epidural catheter by checking for a loss of cold sensation to ice in two contiguous dermatomes around the level of epidural placement. If a loss of cold sensation is found, then the epidural placement will be classified as successful. If no loss of cold sensation is found, then the epidural placement will be classified as unsuccessful. If the patient does not have a successful epidural placement, then it will be at the discretion of the anesthesiologist whether to attempt replacement of the epidural or opt for alternate methods of post-operative analgesia.

The time of attempted epidural placement will be limited to thirty minutes at which time the patient will receive alternate post-operative analgesia with intravenous or PO opioids as is our standard care in after failed epidural placements.

The products to be used are our standard institutional epidural kits from Arrow/Teleflex incorporated which contain a 17g Tuohy needle kit product number ASK-17019-WF1 as well as a stimulating peripheral nerve catheters(19 Ga. x 90 cm StimuCath® Continuous Nerve Block Catheter with SnapLock™ Adapter (Arrow by Teleflex Medical, Morrisville, NC), and

stimulation will be achieved using a B Braun Stimuplex HNS12 Nerve Stimulator product id 4892098.
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Outcomes Measures:
Subjects will be evaluated for the successful placement of a thoracic epidural as determined by a sensory blockade in at least two continuous dermatomal levels to ice consistent with epidural blockade. The primary outcome will be that the patient has loss of cold sensation in at least two contiguous dermatomal levels 15 minutes after administering the test dose of lidocaine. Secondary outcomes will include, but are not limited to, the time required for epidural catheter placement and the number of thoracic spine levels attempted before presumed epidural catheter placement. We will also record the level of myotomal stimulation, the current and pulse width required to stimulate the response, the level of expertise of the physician placing the epidural, and the SBP prior to and 15min after test dose

Analytical Plan:
Power / Sample Size:
On the basis of a previous publication [5,6], we expect a 23% failure rate for thoracic epidural blocks with conventional loss of resistance technique. We hypothesize that confirmatory nerve stimulation can decrease the failure rate to 3%, which is similar to the use of epidural waveform analysis[15]. Thus, a calculated sample size of 44 patients per group would be required for a statistical power of 0.80 and a type I error of 0.05. A total of 100 subjects will be enrolled to account for potential dropout.

Human Subjects Protection:

Subject Recruitment Methods:
Potential study participants will be identified based on the posting of their surgical procedure as undergoing open intra-thoracic or open intra-abdominal procedures. On the day of surgery, all patients undergoing these surgical procedures routinely come through the regional anesthesia area of surgical services to receive further anesthetic evaluation, education, and potential regional anesthesia procedures. Once they have been consented by the regional anesthesia team for an epidural catheter placement, all patients, regardless of gender, race or age, and who qualify for the study based on inclusion and exclusion criteria will be formally asked to participate in the study at this time. All patient information will be kept confidential both during recruitment and throughout the duration of the study.

Informed Consent:
Written informed consent will be obtained from each subject. It can be obtained by any physician listed as part of the study staff. If possible, patients scheduled for open intra-thoracic or open intra-abdominal procedures will be seen in the preoperative assessment clinic at North Carolina Baptist Hospital. Otherwise, as is typical for regional anesthesia techniques, the study team will meet the patient in the Regional Anesthesia and Acute Pain Management area. They will be

informed of the purpose of the study along with the risks, benefits, and alternatives. Questions will be answered and consent obtained. A copy of the signed informed consent will be placed in the patient's medical record. All subjects may decline participation in the study at any time. Informed consent and all necessary study data will be obtained prior to the administration of any sedative medication.

Confidentiality and Privacy

Confidentiality will be protected by collecting only information needed to assess study outcomes, minimizing to the fullest extent possible the collection of any information that could directly identify subjects, and maintaining all study information in a secure manner. To help ensure subject privacy and confidentiality, only a unique study identifier will appear on the data collection form. Any collected patient identifying information corresponding to the unique study identifier will be maintained on a linkage file, stored separately from the data. The linkage file will be kept secure with access limited to designated study personnel. Following data collection, subject identifying information will be destroyed at the earliest opportunity, consistent with data validation and study design, producing an anonymous analytical data set. Data access will be limited to study staff. Data and records will be kept locked and secured with any computer data password protected. No reference to any individual participant will appear in reports, presentations, or publications that may arise from the study.

Data and Safety Monitoring

The principal investigator will be responsible for the overall monitoring of the data and safety of study participants. The principal investigator will be assisted by other members of the study staff.

Reporting of Unanticipated Problems, Adverse Events or Deviations

Any unanticipated problems, serious and unexpected adverse events, deviations or protocol changes will be promptly reported by the principal investigator or designated member of the research team to the IRB and sponsor or appropriate government agency if appropriate.

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