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ORIGINAL ARTICLE

# Differences between anticipated and perceived difficulty and insertion duration of labor epidural techniques among anesthesiologists, nurses and patients

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## ABSTRACT

**Background:** Difficulty with the labor epidural technique has been described using a variety of criteria, but remains inadequately defined. We sought to determine the reasons cited for difficulty with the insertion of labor epidural techniques among anesthesiologists, nurses, and patients. We hypothesized that the perception of procedural difficulty would correlate among participants and with the elapsed duration of the insertion attempt.

**Methods:** A total of 140 participant sets (i.e. anesthesiologist, nurse and patient) were asked to complete a questionnaire on procedural difficulty, immediately before (i.e. anticipated) and after (i.e. perceived) a standardized epidural technique. Procedural duration, using specified start and end times, was recorded in seconds by an independent co-investigator. Demographic data for all groups were recorded.

**Results:** Perceived difficulty with the epidural technique was similar among all groups (range 10–14%;  $P=0.29$ ) and correlated with anticipated difficulty (anesthesiologist  $P=0.0004$ ; nurse  $P=0.00001$ ; patients  $P=0.006$ ) and procedural duration (all groups  $P < 0.001$ ). The most common reasons cited for perceived difficulty were procedural duration (anesthesiologist  $P=0.58$ ), number of attempts (nurse  $P=0.02$ ), and pain experienced (patient  $P=0.035$ ).

**Conclusions:** Difficulty with the epidural technique is associated with anticipated difficulty and procedural duration. The reasons for perceived difficulty differ among anesthesiologists, nurses and obstetric patients, with patients most commonly citing pain experienced.

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**Keywords:** Epidural technique; Obstetric; Labor analgesia; Provider perceptions; Nurse perceptions; Patient perceptions; Procedural difficulty; Procedural duration

## Introduction

Despite a significant increase in use over the past three decades,<sup>1</sup> the epidural technique remains one of the most difficult manual skills to acquire and perform within the specialty of anesthesia.<sup>2</sup> Difficulty with the epidural technique has been associated with a number of patient factors, including obesity,<sup>3</sup> scoliosis,<sup>4</sup> spinal abnormalities,<sup>5</sup> previous back surgery,<sup>6</sup> or an inability to palpate bony landmarks.<sup>7–10</sup> During pregnancy, weight gain, tissue edema, and a limited ability to achieve and maintain optimal positioning may result in greater difficulty.<sup>7</sup>

Procedural difficulty with the epidural technique, however, has not been robustly defined. Although the

number of attempts is a commonly used measure, an “attempt” may represent the number of needle passes, skin withdrawals, vertebral levels used, or individuals using the epidural needle.<sup>3,5</sup> Moreover, because these elements are subject to interpretation, the recorded description may conflict with the physical examination of the patient and the recollection of patients, nurses, and anesthesiologists.

We sought to determine the frequency of anticipated and perceived difficulty with the epidural technique, the reasons for these assessments, and whether responses differed between anesthesiologists, nurses and patients. We hypothesized that perceived difficulty with the epidural technique would correlate with greater anticipated difficulty and longer procedural duration.

## Methods

After receiving human research committee/institutional review board approval for verbal informed consent of

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the anesthesiologist, nurse, and patient, we queried participants regarding procedural difficulty and duration immediately before (i.e. anticipated), and upon completion of (i.e. perceived), the epidural technique (Appendix A).

Patient characteristics including age, height, weight and parity were recorded. Anesthesiologists were randomly selected to perform the epidural techniques; no attempts were made to select more experienced anesthesiologists due to certain patient characteristics such as high body mass index (BMI). Before epidural placement, all subjects were asked to indicate anticipated procedural difficulty based on a 5-point Likert scale (very easy, easy, neither easy nor difficult, difficult, and very difficult) and to select and rank reasons for this assessment. For anesthesiologists and nurses this included past epidural experiences, patient factors, provider factors, or other; and for patients, personal experiences, friend/family experiences, health care source, or other. Anesthesiologists completed the assessment before palpation of the patient's back. Nurses completed the assessment after being made aware of the anesthesiologist performing the epidural technique, and their training level. Participants were also asked to report anticipated procedural duration and time to maternal comfort.

Procedural duration was defined as the elapsed time from the initial insertion of the needle for local anesthetic infiltration until the removal of the epidural needle from the skin insertion site with the epidural catheter successfully placed. As per our standard clinical approach, an attending anesthesiologist was present for all epidural placements; if the attending anesthesiologist had to assist or complete an epidural placement, the cumulative elapsed time was calculated from initial needle insertion by the resident or fellow. An independent co-investigator recorded actual elapsed times for procedural duration in seconds (Clock Application, Apple iOS 6, iPhone5, Cupertino, CA, USA). All subjects were asked to refrain from looking at their watches or other timing devices until the post-placement questionnaire was completed.

A standardized epidural technique was used with patients in the sitting position. The epidural space was identified using a 17-gauge Tuohy-Weiss needle through a midline, loss of resistance to saline approach. A 19-gauge epidural catheter with a single orifice (Arrow FlexTip Plus®, Arrow International, Reading, PA, USA) was placed 5 cm into the epidural space. Within 5 min of securing the epidural catheter, all patients received a standard test dose with 3 mL of 1.5% lidocaine with 1:200000 epinephrine and, if no symptoms of intravascular or intrathecal placement were experienced, 15 mL of 0.125% bupivacaine with fentanyl 2 µg/mL was administered in divided doses.

Upon completion of the epidural technique, all subjects were asked to indicate if they perceived procedural difficulty and the reasons for this ranking. Anesthesiolo-

gists were asked to grade the quality of the anatomic landmarks (Grade 1=spinal processes visible, 2=spinous processes not visible but easily palpable, 3=spinous processes not visible or easily palpable, but interspace palpable, and grade 4=spinous processes and interspaces not visible or easily palpable), and to indicate (yes/no) whether midline deviation of the spinous processes was present, if the patient was able to curve her back towards the provider, and if the nurse was helpful (e.g. positioning, comforting the patient, etc.). Anesthesiologists were also asked to indicate their training level, and if a resident, to indicate how many months of obstetric anesthesia experience they possessed (inclusive of the current month). Nurses were requested to record their years of experience on the obstetric suite. All participants were asked to indicate perceived procedural duration.

### Statistical analysis

Although intended to be a descriptive study indicating the factors associated with anticipated and procedural difficulty, we conducted a power analysis to determine the relationship between perceived procedural difficulty and actual duration. Using  $50 \pm 10$  s and  $120 \pm 40$  s for normal and difficult epidural technique attempt, respectively, from our prior study that employed the same endpoints for procedural duration,<sup>8</sup> an effect size of  $-0.77$  was calculated. Using an alpha level of 0.05 and desired statistical power level of 0.8, for a two-tailed hypothesis, we anticipated a minimum sample size of 52 sets. We initially studied 60 sets, to account for possible dropouts. However, at a planned interim analysis of 25 sets, data indicated greater variation in elapsed time when a difficult epidural attempt was encountered. We subsequently completed an estimated logistic curve with the collected data, which indicated a need for 120 sets.

Data are reported as mean  $\pm$  standard deviation (SD) for continuous variables and as frequency (percentage) for categorical variables. Analysis of variance (ANOVA) and Pearson chi-square test were used to compare the primary and secondary outcomes of interest among the three respondents' groups. Additional stratified analyses were performed to assess the perception of procedural difficulty and procedure duration time according to each respondent type. Some response categories were grouped (e.g. very difficult and difficult; very easy and easy) for analysis. All reported *P* values are two-sided, and a *P* value  $<0.05$  was considered to indicate statistical significance. Analyses were conducted with SAS software, V9.3 (SAS Institute, Cary, NC, USA).

### Results

A total of 140 sets (composed of an anesthesiologist, nurse and patient) of participants enrolled in our study between July 2011 and December 2012. The epidural technique was performed by a resident [Clinical

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