International Journal of Obstetric Anesthesia (2016) **26**, 4–7
0959-289X/$ - see front matter
http://dx.doi.org/10.1016/j.ijoa.2016.01.004

ORIGINAL ARTICLE

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Catheter failure rates and time course with epidural versus combined spinal-epidural analgesia in labor

J. Groden, A. Gonzalez-Fiol, J. Aaronson, A. Sachs, R. Smiley
Department of Anesthesiology, Columbia University College of Physicians and Surgeons, New York, NY, USA

ABSTRACT

Background: The combined spinal-epidural technique for labor analgesia has several advantages over the traditional epidural technique, including faster onset, greater maternal satisfaction, and decreased need for physician boluses. Proponents of the epidural technique criticize the combined spinal-epidural technique, arguing that the epidural catheter remains untested and thus may not be reliable if needed for surgical intervention. We compared failure rates and time of failure between techniques in our tertiary-care academic practice.

Methods: Data regarding failed catheters were collected from October 2012 to September 2014 as part of our Quality Assurance program. Failed catheters were defined as any catheter replaced after it was considered to be properly placed and then determined to be intravascular, one sided or resulting in poor maternal analgesia or anesthesia.

Results: A total of 5487 analgesics were performed (3980 combined spinal-epidural; 1507 epidural). Eighty-five combined spinal-epidural catheters (2.1%) and 59 epidural catheters (3.9%) were replaced during labor ($P<0.001$). Mean time to replacement was 512 ± 422 min and 354 ± 300 min for the combined spinal-epidural ($n=80$) and epidural ($n=57$) groups, respectively ($P=0.02$). Median time to replacement was 398 [IQR 131–578] min and 281 [IQR 186–767] min for combined spinal-epidural and epidural groups, respectively ($P<0.0001$).

Conclusion: We were able to demonstrate that catheters placed using a combined spinal-epidural technique were less likely to fail during labor and that the time to detection of a failed catheter was significantly longer in the combined spinal-epidural group. Our findings validate the combined spinal-epidural technique as reliable for labor analgesia and tend to refute the theory of the untested catheter.

Keywords: Labor analgesia; Epidural; Combined spinal-epidural; Failed analgesia

Introduction

The combined spinal-epidural (CSE) technique for labor analgesia has several advantages over the traditional epidural technique. These include faster onset, better first-stage analgesia, greater maternal satisfaction, decreased motor weakness and decreased need for physician boluses.[1–5] Previous studies have found that catheters placed with a CSE technique are at least as reliable as those placed by an epidural technique for both labor analgesia and surgical anesthesia.[1,2,6–9] Despite this, many proponents of traditional epidural analgesia criticize the CSE technique using the argument of the untested catheter, which suggests that catheters placed using a CSE technique are less reliable than those placed in the traditional manner. The argument is that with the CSE technique, direct assessment of epidural catheter function is delayed secondary to intrathecal drug administration at the time of catheter placement.[2,9] Therefore, the technique should not be chosen for patients with a high chance of needing the catheter for surgical anesthesia or for whom the failure of surgical anesthesia is of higher risk. Alternatively, detection of cerebrospinal fluid (CSF) via the spinal needle during a CSE technique can confirm correct placement of the epidural needle, especially in the setting of a questionable loss of resistance, perhaps even more reliably than the achievement of labor analgesia.[2] We have compared failure rates and time of failure between catheters placed via the CSE and traditional epidural techniques in our tertiary-care academic practice.

Accepted January 2016
Correspondence to: Jonathan Groden MD, Department of Anesthesiology, Columbia University College of Physicians and Surgeons, 630 West 168th Street, PH-5, New York, NY 10032, USA.
E-mail address: jgroden@gmail.com

Methods

After Institutional Review Board approval, an analysis was conducted on data collected from October, 2012 through September, 2014 as part of our Quality Assurance (QA) program. The QA program requires a member of the anesthesia team to complete a form following every obstetric anesthetic or analgesic to identify key components of the anesthetic as well as any complications. Specific complications included on the form are dural puncture, epidural catheter replacement during labor and failed neuraxial anesthesia at cesarean delivery (CD). Failed catheters were defined as any catheter that was replaced after it was initially thought to be properly placed, and determined to be intravascular, one-sided or resulting in poor maternal analgesia. Those patients with failed catheters were identified using the QA database and their anesthetic records were reviewed to determine age, body-mass index (BMI), gravity, parity, depth to epidural space, original catheter depth at skin, number of physician boluses until removal, time between catheter placement and identification of the failed catheter, time between catheter placement and delivery and mode of delivery. Physician boluses were recorded whenever patients reported inadequate analgesia despite the availability and use of patient-administered epidural doses.

At all times throughout the study period, the obstetric anesthesia service was staffed by at least one attending subspecialist obstetric anesthesiologist and by at least two anesthesia residents or a resident and an obstetric anesthesia fellow. The choice of technique, CSE or epidural, was based on attending preference and generally not on patient-related factors. The CSE and epidural procedures were typically performed via a loss of resistance to saline technique, using a 17-gauge Tuohy needle and a 19-gauge flexible, closed-tip multiport epidural catheter. Analgesia via the epidural technique was generally initiated with 0.125% isobaric bupivacaine 4–6 mL, 1.5% lidocaine with 1:200 000 epinephrine 5 mL and fentanyl 50–100 μg. Combined spinal-epidural analgesia was initiated with 0.25% isobaric bupivacaine 1.0 mL and fentanyl 10–15 μg via a 27-gauge Whitacre spinal needle placed via the 17-gauge Tuohy needle. With both techniques, catheters were routinely secured at the skin at a distance 5 cm greater than the loss of resistance. All patients received patient-controlled epidural analgesia (PCEA) with 0.0625% bupivacaine and fentanyl 2 μg/mL (infusion 12 mL/h, demand dose 5 mL, lockout time 6 min, hourly limit 32 mL). For this study, catheters were considered failures if they were replaced during labor or at the time of CD or if general anesthesia (GA) was required for CD. Patients who required supplemental intravenous analgesics at the time of CD or those who required GA after delivery of the baby were not considered to have a failed catheter.

Statistical analysis

The rate (proportion) of failure between techniques were compared by Fisher's Exact test, Kaplan-Meier survival curves were created and Cox proportional hazards analysis was performed to determine if a difference existed between the times to recognize failed catheters between CSE and epidural groups. Demographic variables were compared by appropriate parametric (t) or non-parametric (Mann-Whitney U) tests. Data are presented as numbers (percentages), mean ± standard deviation (SD) or median [interquartile range (IQR)]. A P value <0.05 was considered significant.

Results

A total of 5487 labor analgesics were performed during the study period (3980 CSE, 1507 epidural). Eighty-five CSE (2.1%) and 59 epidural catheters (3.9%) were replaced during labor ($P<0.001$) (Table 1). Of these patients, the only difference between the groups was the time from initial neuraxial placement to delivery, which was significantly longer in the CSE group. Data regarding time to replacement were available for 80 CSE and 57 epidural catheters. Mean time to replacement was 512 ± 422 min and 354 ± 300 min for the CSE and epidural groups, respectively ($P=0.02$). Median time to replacement was 398 min [IQR 131–578] and 281 min [IQR 186–767] for CSE and epidural groups, respectively (Figs. 1 and 2, $P<0.0001$). A total of 943 catheters placed during labor were used for CD (633 CSE, 310 epidural). Forty-seven CSE (7.4%) and 23 epidural catheters (7.4%) failed to provide adequate surgical anesthesia for CD and required either replacement or conversion to GA ($P=1.0$).

Discussion

Our findings corroborate results of previous studies reporting lower CSE failure rates during labor.[2,3,5–8] One usual and obvious (and likely correct) explanation for this observation is that the presence of CSF in the spinal needle provides confirmation of proper epidural needle placement.[2] In our practice, nearly all catheters are inserted by anesthesia residents under the supervision of attending obstetric anesthesiologists. As a result, the presence of CSF, as an objective endpoint, can help the supervising anesthesiologist differentiate between true and false loss of resistance, especially when supervising junior residents with less experience in neuraxial anesthesia.

Our findings also indicate that catheters in the epidural group failed significantly earlier than those placed by a CSE technique. While it is not clear why the epidural catheters failed earlier, the time to failure for most CSE catheters was well beyond that of the 1–2 h window in which a catheter placed by CSE technique could