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Epidural Analgesia and the Incidence of Cesarean Section

Time for Another Close Look

The relationship between epidural analgesia and the incidence of cesarean section remains controversial. Three years ago, Dewan and Cohen1 reviewed this subject for Anesthesiology. Their editorial accompanied reports of two prospective, randomized studies that showed that early administration of epidural analgesia (i.e., cervical dilation of 3–5 cm) did not increase the incidence of cesarean section in nulliparous women, when compared with early administration of nalbuphine followed by late administration of epidural analgesia.2,3 In contrast, Thorp et al.4 earlier observed that epidural analgesia resulted in an increased incidence of cesarean section in nulliparous women. They concluded that this effect may be limited by delaying administration of epidural analgesia until cervical dilation of at least 5 cm.

Subsequently, two prospective, randomized trials were performed at the University of Texas South-
is unclear that there was an increased incidence of cesarean section in the women randomized to an offer of epidural analgesia.

Readers should consider carefully the implications of excluding one third of the patients in each group. In the epidural group, the authors excluded those women at lowest risk for cesarean section (i.e., those who labored rapidly and did not request analgesia, or those who requested analgesia but delivered before analgesia could be provided). Conversely, in the meperidine group, the authors excluded the women at highest risk for cesarean section (i.e., those with a longer labor and more severe pain, which may have signaled an increased risk of dystocia).

In this issue of Anesthesiology, Sharma et al. report this group's second randomized trial of epidural versus intravenous meperidine analgesia during labor. The authors randomized 715 women of mixed parity in spontaneous labor at full term to receive either epidural analgesia or patient-controlled intravenous analgesia (PCA) with meperidine. (The authors chose PCA so that fewer patients in the meperidine group would “cross over” to the epidural group.) Enrollment and randomization occurred when the patients were admitted from the triage area to the nurse-midwifery service at Parkland Hospital. Subsequently, an anesthesiologist offered epidural analgesia to those women randomized to the epidural group, but not to those women randomized to the PCA group. Epidural analgesia was initiated with small boluses of 0.25% bupivacaine and was maintained with a continuous epidural infusion of 0.125% bupivacaine with 2 µg/ml fentanyl. The PCA was initiated with 50 mg meperidine and 25 mg promethazine and was maintained by patient-controlled boluses of 10–15 mg meperidine every 10 min. Among the 358 women who were randomized to an offer of epidural analgesia, 243 actually received epidural analgesia. Of the remaining 115 women, 78 labored rapidly and never requested or received epidural analgesia, and the remaining 37 refused epidural analgesia. Among the 357 women who were randomized to an offer of PCA, 259 women completed the study as allocated. Of the remaining 98 women, 73 women labored rapidly and did not receive any analgesia, 20 women refused PCA, and 5 women who received meperidine PCA “crossed over” to epidural analgesia because of inadequate pain relief.

Using an intention to treat analysis, the authors observed no difference between the two groups in the incidence of cesarean section (i.e., 4% in the epidural group and 5% in the PCA group). When the authors evaluated outcome among the nulliparous women, they again noted no difference between the two groups in the incidence of cesarean section (i.e., 5% in the epidural group and 6% in the PCA group). Women in the epidural group had lower pain scores during both the first and the second stage of labor, and women in the PCA group had higher sedation scores. (Women in the PCA group were “visibly sedated but... invariably arousable.”) There was no difference between the two groups in neonatal outcome, except that more babies in the PCA group received naloxone to reverse respiratory depression at birth.

The authors also noted no difference between the two groups in the incidence of cesarean section when they evaluated outcome for protocol-compliant patients (i.e., 5% in the epidural analgesia group and 6% in the PCA group). Among the protocol-compliant patients, the authors observed a longer first stage of labor and an increased incidence of oxytocin augmentation in the epidural group. The authors did not report the duration of the first stage of labor or the incidence of oxytocin augmentation as part of their intention-to-treat analysis.

Altogether, 213 (30%) of the 715 patients did not comply with their group assignment. This resulted in part from the fact that enrollment and randomization occurred at the time of admission to the labor and delivery unit rather than at the time that patients first requested analgesia. The 30% rate of protocol noncompliance illustrates the enormous difficulties in performing randomized trials of epidural analgesia in laboring women. Nonetheless, it remains unclear why 57 (8%) women refused the allocated method of analgesia despite their earlier consent.

The results of the present study will be welcome news for anesthesiologists who provide care for obstetric patients. However, it would be naive, and indeed a mistake, to assume that this study settles the issue in favor of epidural analgesia. Years ago, Roy Pitkin, then chair of the Department of Obstetrics and Gynecology at the University of Iowa and now Editor-in-Chief of Obstetrics and Gynecology, advised me that the concluding paragraph of most clinical manuscripts should begin as follows: "Under the conditions of the present study, we conclude..."
What were the conditions of the study by Sharma et al.?*

**Patient Population**

Most of the patients were poor and either Hispanic (70%) or black (22%). Other investigators have documented a decreased rate of cesarean delivery among indigent women.8

**Obstetric Management**

Patients were not admitted to the labor and delivery unit until labor was well established. (The median cervical dilation on admission was 4 cm in both groups.) Labor was managed by on-site nurse midwives. Fetal assessment was provided by periodic fetal heart auscultation, and continuous electronic fetal heart rate monitoring was reserved for women with meconium-stained amniotic fluid, fetal heart rate decelerations, or inadequate progress of labor. An intrauterine pressure catheter was used to confirm adequate uterine activity. Strikingly, only 20 (5%) of the 580 nulliparous women in the two groups underwent cesarean section. A cesarean section rate of 5% in nulliparous women should give pause to all of us who provide care to obstetric patients.

**Anesthetic Management**

The authors' technique of epidural analgesia (i.e., 0.25% bupivacaine followed by 0.125% bupivacaine with 2 μg/ml fentanyl) probably represents a "middle-of-the-road approach" in contemporary practice. Some anesthesiologists now provide epidural analgesia with a more dilute solution of bupivacaine (a few patients actually walk), but other anesthesiologists continue to use a more concentrated solution. In the present study, the anesthesiologists titrated the epidural infusion to maintain a T-10 sensory level. (This implies that the anesthesiologist checked the sensory level at regular intervals—an attention to detail that is overlooked by a disappointingly large number of practitioners.) In contrast, the authors' meperidine PCA regimen differs strikingly from the way that intravenous opioid analgesia is provided in most obstetric units in the United States. Obstetricians often administer homeopathic doses of opioid, which result in modest sedation but little analgesia in laboring women. In the present study, 61 (21%) women in the PCA group received more than 200 mg meperidine.

Altogether, many anesthesiologists may find it difficult to extrapolate the conditions of the present study to their own practice. Nonetheless, it is hard to reconcile the present study with claims that "epidural analgesia has made a significant contribution to the cesarean section epidemic in the United States."9

What is the current state of affairs regarding this contentious issue? The following summary includes some of my personal opinions on this subject.

1. Most studies suggest that laboring women who request and actually receive epidural analgesia are more likely to undergo cesarean section than those who do not. This does not establish a cause-and-effect relationship. The presence of severe pain during early labor may signal an increased risk for prolonged labor and operative delivery.10

2. Several retrospective, population-based studies suggest that the introduction of an epidural analgesia service, or the increased use of epidural analgesia, does not increase the cesarean section rate.11-13

3. Epidural analgesia during labor is not a generic procedure. Many practitioners believe, as do I, that the epidural administration of a dilute solution of local anesthetic (e.g., 0.0625 - 0.125% bupivacaine) is less likely to increase the cesarean section rate than administration of a more concentrated solution (e.g., 0.25 - 0.5% bupivacaine). Some retrospective studies support this hypothesis, but it remains unproven by prospective, randomized trials.14-15

4. Among women in spontaneous labor, it seems reasonable to delay administration of epidural analgesia until labor is well established. However, it is unnecessary to await an arbitrary cervical dilation of 5 cm.

5. In some patients, use of epidural analgesia may increase the likelihood of vaginal delivery. For example, the availability of epidural analgesia may encourage women with a history of previous cesarean section to attempt vaginal birth after cesarean. Similarly, some obstetricians allow a trial of labor in

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women with a breech presentation only if the patient receives epidural analgesia.  

6. The use of epidural analgesia during labor likely decreases the requirement for administration of general anesthesia, with its attendant risks of failed intubation and aspiration, in parturients who require emergency cesarean section. In some cases, failure to administer epidural analgesia during labor may increase maternal risk during a subsequent emergency cesarean section.

7. Pain relief per se is a worthy goal. In their earlier study, Ramin et al.6 acknowledged, "Pain relief during labor is of paramount importance, and in most circumstances the... increased risk of cesarean delivery associated with epidural analgesia is a secondary consideration." In 1992, the American Society of Anesthesiologists and the American College of Obstetricians and Gynecologists issued a joint statement that included the following observation: "There is no other circumstance where it is considered acceptable for a person to experience severe pain, amenable to safe intervention, while under a physician's care."7 All women should have access to effective pain relief during labor.

8. Some third-party payers and managed health plans now limit access to, or deny reimbursement for, epidural analgesia during labor. Restricted access to epidural analgesia will result in unnecessary pain and dissatisfaction for obstetric patients, and is unlikely to affect the cesarean section rate significantly. Johnson and Rosenfeld16 observed an abrupt decrease in the use of epidural analgesia in their hospital as a result of TennCare, a state-funded health insurance plan for Medicaid and uninsured patients in Tennessee. However, that did not result in a decreased incidence of cesarean section in their patients.

9. Even if it were shown that the contemporary use of epidural analgesia results in a small increase in the cesarean section rate, it is unclear how many women—who now choose epidural analgesia—would voluntarily opt for nothing or intravenous opioid analgesia, which is less effective and provides marked sedation.

10. Maternal administration of high doses of opioids may result in substantial neonatal effects (e.g., respiratory depression, prolonged neurobehavioral changes). These effects have been largely ignored in this debate.

11. Maternal–fetal factors and obstetric management, not epidural analgesia, are the most important determinants of the cesarean section rate.

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Scuds, SCADS, and Other Air-borne Hazards

By the turn of the millennium, more than 1,000,000 predominantly aged patients will require cardiac surgery annually throughout the world. The cost of this health care likely will exceed 25 billion dollars, with a substantial portion of the overall expense attributable to management of the perioperative morbidity associated with cardiac procedures. For example, serious adverse central nervous system (CNS) events occur in approximately 6% of patients undergoing coronary artery bypass graft surgery, in addition, less apparent cognitive dysfunction occurs in 20–79%, persisting for 2 or more months in 15–57%.

A recent study reports that adverse CNS events after coronary revascularization greatly increase the duration of hospitalization and therefore health care costs. Type I (focal injury, stupor, coma) and type II (deterioration in intellectual function, memory deficit, seizure) adverse events not only double the average length of hospital stay, but also the amount of time spent in intensive care. This report confirms a previous finding that suggests patients with either type I or type II adverse CNS events require a longer hospitalization than those who suffer a postoperative myocardial infarction, left ventricular failure, or renal dysfunction after coronary revascularization. Thus, postoperative CNS morbidity arguably represents the most economically and emotionally costly consequence of cardiac surgery.

The pathophysiology of perioperative adverse CNS events is complex and incompletely understood, but probably includes phenomena that can precipitate focal or global cerebral injury. Focal injury is likely the end-result of marked and persistent hypoperfusion or flow obstruction produced by macroemboli (> 200 micron) consisting of atheromatous material, large air bubbles, or intracardiac thrombi. Subtle nonfocal neurologic symptoms may be the result of microembolism of air, fat, or blood element aggregate. During cardiopulmonary bypass (CPB), air entrained during manipulation of the heart and great vessels, gaseous emboli produced in the extracorporeal circuit, and air bubbles produced by cavitation phenomena in either the patient or bypass circuit circulate to the brain. Cerebral micrographs obtained from animal and human autopsy specimens demonstrate the diffuse presence of small capillary and arteriolar dilations (SCADs) after CPB, probably representing lodging of gas bubbles or fat particles (fig. 1).

Several studies suggest that the magnitude of postoperative cognitive dysfunction may be predicted by the volume of the embolic load, as detected by isonation of...