Pain management during labor

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F1000 Medicine Reports 2009, **1**:5 (doi: 10.3410/MI-5)

The electronic version of this article is the complete one and can be found at: <http://F1000.com/Reports/Medicine/content/1/5>

Abstract

Recent studies investigating the management of analgesia in childbirth have demonstrated that pain relief can be started early in labor with no negative consequences. Also of particular importance are studies showing that automated delivery of large boluses of diluted local anesthetic with opioids might be more effective than continuous background infusion of these drugs in patient-controlled epidural analgesia.

Introduction and context

Providing effective and safe analgesia during labor remains an ongoing challenge, as demonstrated by recent studies that looked into the optimal dose of local anesthetic to be given, either into the epidural or the intrathecal space, as well as the modality of its administration and the rediscovered continuous intrathecal administration of drugs. The more technically savvy researchers have undertaken sophisticated studies describing new ways of providing epidural analgesia by automated delivery of boluses rather than by continuous background infusion during patient-controlled epidural analgesia (PCEA). Others have opted to test the use of ultrasound to guide their way into the neuraxial spaces. These are exciting times indeed in the field of obstetric anesthesia.

The goal of this brief review is to guide providers of obstetric anesthesia towards an understanding of how these new findings can improve their clinical practice. Research has provided new insights into the mechanisms and management of analgesia in labor and has shed more light on the timing of epidural labor analgesia, the choice of local anesthetics, the pharmacogenetics of opioids, and the use of spinal microcatheters, ultrasound technology, and programmed boluses with PCEA.

Recent advances

Timing of epidural labor analgesia

One of the most important recent advances directly influencing clinical practice has been the unequivocal demonstration that provision of neuraxial analgesia early in labor has distinct advantages for maternal analgesia and satisfaction, with no negative impact on mode of delivery; that is, the Cesarean section rate was not influenced by early combined spinal-epidural (CSE) [1] or epidural [2] analgesia. These findings create a real paradigm shift for care providers and allow women to benefit from early neuraxial analgesia. The idea that there is 'no need to wait for a cervical dilatation of at least 4 cm' has finally made it through and has received full media coverage [3].

Choice of local anesthetic

The choice of which drug or combination of drugs, via what route, and in what manner remains a concern for the clinician. In choosing the dose and volume of local anesthetic for epidural labor analgesia, larger volumes of more dilute solutions of bupivacaine have been recommended [4]; bupivacaine 0.125% when compared to bupivacaine 0.25% produced equivalent analgesia with a 25% reduction in dose (that is, only 50% increase in volume).

Both recent and past studies have looked at the motor-blocking effects of local anesthetics and their impact on mode of delivery. Low concentrations of epidural bupivacaine (0.0625%) for maintenance of labor analgesia provide effective and cost-efficient analgesia (relative to ropivacaine and levobupivacaine) with minor and inconsequential degrees of motor blockade [5]. Similarly, for intrathecal analgesia in labor there seems to be no benefit in substituting racemic bupivacaine with ropivacaine or levobupivacaine in combination with sufentanil [6].

Therefore, in the era of combined CSE and low-dose PCEA infusions, bupivacaine undoubtedly remains the choice for initiation of analgesia intrathecally or in dilute epidural solutions, as well as for maintenance of labor analgesia.

Pharmacogenetics

Pharmacogenetics, or the study of how genes impact on the response to drugs, offers the potential to tailor medications to each individual's genetic profile. Many anesthesiologists wonder about the relevance of genetic research to modern anesthesiology, and often ask: 'What impact does this have on my everyday care of patients? I usually titrate all drugs to effect anyway.'

Some insight has been given into the genetic component of the analgesic response to intrathecal opioids given in labor. While the way to routine genetic testing to guide analgesic therapy is still a long one, a true pharmacogenetic effect of the μ -opioid receptor gene has been demonstrated that explains differences in analgesic requirements observed routinely in obstetric anesthesia practice. A significant increase in sensitivity to the analgesic effect of intrathecal fentanyl in laboring women carrying a common variant of the μ -opioid receptor gene was shown [7]. This demonstration of a 1.5- to 2-fold difference in analgesic requirement according to genotype is clinically relevant, because provision of optimal labor analgesia remains a challenge, with a need to reduce doses and minimize opioid-related side effects.

If confirmed in other clinical settings and with other opioids, use of μ -opioid receptor genotyping may improve the provision of analgesia in the not-too-distant future.

Spinal microcatheters

Unfortunately, because spinal microcatheters (27–29 gauge) were associated with a cluster of cauda equina syndrome in the United States in the early 1990s they were banned by the US Food and Drug Administration

(FDA). Several years later, the FDA authorized a large multicenter study with the challenging goal of investigating the safety of continuous intrathecal labor analgesia with microcatheters. The recently published results of this trial were able to refute the purported association of this technique with neurologic injury [8]. However, larger studies to evaluate the safety of continuous spinal analgesia are still required before this technique can be routinely utilized for the provision of labor analgesia. The use of microcatheters has potential clinical implications, as it enables easily titratable use of intrathecal analgesia in women with complex cardiac or pulmonary diseases, or in women with previous spinal surgery (laminectomy, fusion, Harrington rods) that might have altered the integrity of the epidural space.

Regardless of whether microcatheters will find a real place in the armamentarium of obstetric anesthesiologists, the main limitation on their widespread use is that the European firm that produced the microcatheters for the US trial has no plans to market them in the United States. Meanwhile, a pediatric epidural kit available in the United States that contains a 22-gauge epidural/spinal needle with a 24-gauge epidural/spinal catheter could be used to perform continuous intrathecal analgesia and anesthesia in these special obstetric patients.

Ultrasound technology

The rationale for using ultrasound to improve the efficiency and safety of spinal and epidural analgesia/anesthesia in obstetrics has been assessed. One investigator [9] enthusiastically reported on the benefits of pre-procedural ultrasonographic assessment of the lumbar spine, which appears to provide valuable information for the placement of spinals and epidurals and should help manage high-risk women with challenging lumbar spine anatomy. This enthusiasm might be dampened by limitations such as the need for an assistant when real-time ultrasound is sought or in the presence of morbid obesity [10].

Programmed boluses with PCEA

Satisfaction with their treatment has been shown to improve when women are offered the option to manage their pain with a 'push button' and keep control of their pain management [patient-controlled epidural analgesia (PCEA)]. However, there is no consensus on an optimal 'program' for PCEA. In my opinion, one of the most significant advances over recent years relates to the idea that large boluses of diluted epidural solutions (local anesthetic with opioids) rather than continuous infusion of the same amounts of these drugs might provide better spread of the infusate and therefore better sensory

blockade. Several investigators have independently designed sophisticated studies using prototype pumps to allow the automated delivery of 'mandated' boluses of epidural solutions (local anesthetic with opioid, 5 ml every 30 minutes) along with boluses self-administered by the mother as wished [11–13]. This elegant drug-delivery combination appears to achieve better analgesia throughout labor, with lower amounts of local anesthetics being used overall and improved patient satisfaction.

'High-tech' algorithm-based computer-integrated PCEA may one day provide the ultimate tailored labor analgesia for those already convinced that CSE with PCEA is the way to go [14]. It remains to be determined how such prototypes will be applied in clinical practice, bearing in mind factors such as reliability and cost of the equipment versus the benefit in terms of a potential reduction in anesthesia workload once the program is running.

Implications for clinical practice

The most important contribution of recent obstetric anesthesia research to clinical practice has been the demonstration that early neuraxial labor analgesia does not impact negatively on mode of delivery and obviously improves maternal satisfaction. Modern clinical practice should no longer make women requesting early labor analgesia wait until a certain degree of cervical dilatation; obstetrical anesthesiologists should be prepared to educate women and general providers not aware of these recent advances, and should obviously be ready to provide early labor analgesia.

Other immediate applications relate to the choice of rather larger doses of more dilute solutions of bupivacaine for initiation and maintenance of labor analgesia using low-dose PCEA. The next generation of pumps might allow automated delivery of 'mandatory' boluses rather than background infusions to ensure a better spread of the infusate, and perhaps utilize algorithm-based computer-integrated PCEA programs.

Finally, for the more technically challenging cases, the use of ultrasound guidance and continuous intrathecal analgesia via microcatheter offer the potential to overcome difficulties in neuraxial analgesia/anesthesia placement.

Abbreviations

CSE, combined spinal-epidural; PCEA, patient-controlled epidural analgesia.

Competing interests

The author declares that she has no competing interests.

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