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# Advances in Labor Analgesia

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Labor results in severe pain for most women. The ideal labor analgesia technique should dramatically reduce the pain of labor while allowing the parturient to participate actively in the birthing experience. In addition, it should have minimal effect on the fetus and the progress of labor. New techniques of labor analgesia approach this goal. This lecture will review these new methods of pain relief for the parturient and will highlight their benefits and risks. The discussion will include spinal opioids and combined spinal-epidural analgesia (CSE), patient-controlled epidural analgesia, and continuous spinal analgesia.

## Regional Analgesia for Labor

Of all the possible methods of pain relief that can be used in labor, neuraxial blockade (epidural, spinal, combined spinal-epidural, continuous spinal) provides the most effective and least depressant analgesia. Epidural analgesia via a catheter technique provides excellent pain relief and the ability to extend the duration of the block to match the duration of labor, but it is not "instant" in onset and may be associated with motor block. Single-shot spinal analgesia using a lipid soluble opioid is rapid and simple, but is associated with a limited duration of action. The combination of epidural and spinal anesthesia into one technique, termed "Combined Spinal-Epidural" (CSE), provides the advantages of a spinal technique (speed of onset, lack of motor block) with the additional flexibility of renewal via an epidural catheter. All three of these regional techniques have advantages and disadvantages, and decisions regarding which technique to use should be individualized to best fit the needs of the individual parturient.

## Combined Spinal-Epidural Analgesia

The first reports of CSE described placing an epidural catheter at one interspace and subsequently initiating a spinal anesthetic at a second interspace (1). CSE provides the fast onset and optimal operative conditions associated with a single-shot spinal technique,

but also offers the flexibility of an epidural catheter for extending the duration of the block. The disadvantage of this technique as it was originally described was that it necessitated two separate anesthetics at two different interspaces and utilized a "traumatic" spinal needle. The evolution of CSE has been in the direction of a needle-through-needle technique. A recent review article describes the evolution of this technique from its introduction to its present use (2).

Continuous spinal-epidural analgesia can be safely used to provide analgesia in parturients who are to receive an epidural for labor. There are, however, specific patients who will greatly benefit from this technique. These include patients in early or late labor. Patients in early labor can be made comfortable with spinal opioids such as sufentanil or fentanyl, the effects of which will last for approximately 2–3 h, during which time the patient will not have a motor block and will be able to ambulate. The major advantage of CSE for patients in late labor is the almost immediate pain relief. Because CSE allows for ambulation of the parturient, it has been called the "walking epidural" (3).

Continuous spinal-epidural analgesia for labor is usually achieved using a short-acting lipid soluble narcotic such as fentanyl or sufentanil. Although morphine has been described as an intrathecal opioid for labor, it has several disadvantages including slow onset, incomplete analgesia, prolonged nausea and pruritus, and delayed respiratory depression. Although pruritus is also associated with lipid-soluble opioids, it is usually mild and short-lived and does not generally need to be treated. A review of the complications associated with CSE concluded that CSE is as safe a technique as conventional epidural technique and is associated with greater patient satisfaction (4).

The following opioids are most often used to produce analgesia in the laboring patient:

- Sufentanil, 2.5–10  $\mu\text{g}$ .
- Fentanyl, 10–25  $\mu\text{g}$ .

Lipid-soluble opioids, even administered via the subarachnoid route, might not always provide adequate analgesia if given to the parturient who is in advanced labor. In cases where the second stage of

labor is imminent, the subarachnoid administration of a combination of local anesthetic plus opioid should be considered. The combination of sufentanil 2.5–5  $\mu\text{g}$  plus bupivacaine 2.5 mg provides rapid analgesia without motor block, alleviates the pain of the second stage of labor, and lasts longer than sufentanil alone (5).

### *Possible Complications and Side Effects of Intrathecal Opioids for Labor*

Continuous spinal-epidural analgesia has been reported to be as safe as conventional epidural techniques. Side effects and complications, however, can occur and include the following:

- Pruritus.
- Nausea/Vomiting.
- Hypotension.
- Urinary retention.
- Uterine hyperstimulation and fetal bradycardia.
- Maternal respiratory depression.

### *Uterine Hyperstimulation/Fetal Bradycardia*

It has been suggested that spinal opioids, perhaps because of their associated decrease in maternal catecholamines, might precipitate uterine hypertonicity and fetal bradycardia (6). Several recent reports have evaluated the incidence of fetal bradycardia and emergency Cesarean section after CSE and have not found an increase in these complications (7,8).

### *Post-Dural Puncture Headache*

Because the CSE technique includes dural puncture, there has been concern regarding the potential for postdural puncture headache. The use of small-bore "atraumatic" spinal needles will reduce the incidence of postdural puncture headache in patients receiving CSE to approximately 1% or less. In addition, it has been suggested that the incidence of unintentional dural puncture is less in CSE patients than in patients receiving conventional epidurals (4). One possible explanation for this finding is that, as part of the CSE technique, the spinal needle may be used for verification of correct placement of the epidural needle when there is inconclusive loss of resistance.

### *Subarachnoid Migration of the Epidural Catheter*

This complication has been studied extensively and does not appear to be a risk of the CSE technique. Holmstrom et al. (9), in a cadaver study, found that it is almost impossible to pass an epidural catheter through a single dural hole made by a 25-gauge spinal needle. Special epidural needles with a separate port for the spinal needle are now available and should prevent the unintentional subarachnoid threading of

the epidural catheter. Regardless of the needle used, all epidural doses should be incremental.

### *Respiratory Depression*

Sufentanil- and fentanyl-induced central respiratory depression has been reported (10). Although respiratory depression might result from potentiation of the respiratory depressant effect of a parenterally administered opioid, respiratory depression after spinal opioids might also occur in patients who have not had parenteral opioids (11). This respiratory depression occurs acutely and, therefore, any patient receiving CSE must be appropriately monitored for signs of respiratory depression for at least 20 min after administration of the subarachnoid opioid.

### *Basic CSE Technique*

The basic CSE technique is as follows:

- The epidural space is identified in the usual fashion. The loss of resistance to saline technique, however, may cause confusion because of misinterpretation of the saline for CSF.
- Once the epidural space is reached, a long "atraumatic" spinal needle is advanced through the epidural needle until CSF is obtained. Although many combinations of epidural and spinal needles are now available, the spinal needle must protrude past the end of the epidural needle at least 12 mm (but optimally 14–18 mm).
- A syringe is attached to the spinal needle and the subarachnoid drug is administered.
- The spinal needle is removed, an epidural catheter is inserted into the epidural space and secured. An epidural infusion of dilute local anesthetic (e.g., bupivacaine 0.0625%) plus opioid (e.g., fentanyl 2–3  $\mu\text{g}/\text{mL}$ ) is subsequently initiated.

## **Other Advances in Labor Analgesia**

### *Continuous Infusion of Dilute Local Anesthetic Plus Opioid*

A major advance in epidural analgesia has been the routine use of a continuous infusion of dilute local anesthetics plus lipid soluble opioids. Infusions have provided better pain relief while producing less motor block. Maternal and neonatal drug concentrations have been tested and continuous infusions have been demonstrated to be safe for both mother and neonate (12). A common infusion for labor analgesia is 0.0625% bupivacaine with 2  $\mu\text{g}/\text{mL}$  fentanyl, with or without epinephrine, infusing at 10–12 mL/h.

### *Patient-Controlled Epidural Analgesia*

Patient-controlled epidural analgesia may provide several advantages, including the ability to minimize

drug dosage, the flexibility and benefits of self-administration, and reduced demand on professional time (13). It has been suggested that this technique may be of great benefit because self-control and maintenance of self-esteem may be vital to a positive experience in childbirth. It has been suggested that patient-controlled epidural analgesia during labor is now a useful alternative that is safe when small doses of dilute bupivacaine are administered with each bolus, reasonable hourly limits are prescribed, and periodic assessments by anesthesiologists are made (14). Controversy still exists regarding the use of a continuous basal infusion in addition to patient-controlled boluses. Although basal infusion plus patient demand may be associated with larger doses than if the basal infusion is withheld, the addition of a basal infusion provides for a more even block and may therefore produce greater patient satisfaction.

### *Continuous Spinal Analgesia With Microcatheters*

Because of an association with cauda equina syndrome, spinal microcatheters have been restricted by the FDA. An ongoing multi-institutional study that is being undertaken with FDA approval is evaluating the safety and efficacy of delivering sufentanil and/or bupivacaine into the intrathecal space via a 28-gauge catheter. It appears from preliminary results that continuous spinal analgesia for labor using a 28-gauge microcatheter is safe and may offer several advantages (15).

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