

NEW TECHNIQUES FOR LABOR ANALGESIA

Joy L. Hawkins, M.D.

Denver, CO

Lecture objectives: Discuss the benefits and risks of intravenous and neuraxial analgesia for labor including the current opioids and local anesthetics in use, and newer delivery systems.

In a recent survey²⁸, over 50% of women in the U.S. had a regional anesthetic during labor (Table 1). About 50% had parenteral medications, either alone or prior to receiving regional analgesia. Only about 10% of parturients had no analgesia, but these women might have incorporated “natural childbirth” techniques such as ambulation, warm water, breathing exercises, hypnosis, acupuncture, doula attendants¹, etc. Anesthesiologists are not usually involved with these patients, nor are we usually involved in the selection of single dose parenteral medications. However, anesthesiologists can add to the analgesic options available to the patient as discussed below.

Table 1. Types of Labor Analgesia Provided in the U.S. in 2001 (%)

	Stratum I (≥ 1500 births)	Stratum II (500-1499 births)	Stratum III (< 500 births)
None	6	10	12
Parenteral	34	42	37
Paracervical	2	3	3
Spinal	8	9	17
Epidural	61	42	35
Combined spinal-epidural	8	8	5

I. Intravenous patient-controlled analgesia for labor

Some patients are not candidates for regional analgesia for labor (coagulopathy, back instrumentation, etc.) or do not wish to have a regional anesthetic. Parenteral narcotics can be titrated via PCA to provide moderate analgesia and good patient satisfaction. Several studies have shown a 65% satisfaction score (“would use this method again”) with patient-controlled intravenous analgesia. The PCA doses may have to be adjusted up or down as labor progresses and depending on patient tolerance. Unfortunately, good analgesia during a contraction usually means maternal respiratory depression between contractions. It is also difficult to assess the fetus for potential depression. Studies using fentanyl PCA have not shown any increase in neonatal problems, while a large study using meperidine PCA had a 5% incidence of treatment with naloxone at delivery.

Some sample "formulas" for PCA use in labor:

- . Patient should receive metoclopramide 10 mg IV to potentiate analgesia.²
- . All patients should have respiratory rates and sedation scores monitored.
- . Pulse oximetry and supplemental oxygen should be used or at least available.

Fentanyl ^{3,4,5} :	1-2 mcg/kg loading dose IV Concentration of 25 mcg/cc Increment of 2 cc (50 mcg/bolus) Lockout of 10 minutes
Meperidine ⁶ :	50 mg loading dose IV (+ 25 mg promethazine?) Concentration of 10 mg/cc Increment of 1-1.5 cc Lockout of 10 minutes
Remifentanyl:	Increment of 0.25-0.5 mcg/kg Lockout of 2 minutes

II. Epidural patient-controlled analgesia for labor

Several studies have compared epidural PCA to continuous infusions or intermittent top-up doses for labor and found that parturients using PCEA will administer about 30% less bupivacaine as the other techniques to achieve the same pain control and height of block.^{7 8} As in other PCA techniques, the psychological benefit of “control” for the patient seems to “supplement” the effect of the medication, leading to a smaller dose requirement. Interestingly, policy change by the Association of Women’s Health, Obstetric, and Neonatal Nurses (AWHONN) regarding care of epidural catheters in the laboring patient (ie. L&D nurses cannot increase infusion rates or give bolus doses from the pump) has made the option of PCEA more popular, especially for anesthesia practices in hospitals without a residency training program. Time management studies have shown a 40% reduction in manpower requirements using PCEA versus continuous infusions with excellent patient satisfaction.

To set up the epidural PCA infusion:

First, bolus the epidural to achieve adequate analgesia in the usual manner
 Concentration: 0.125% bupivacaine with 2 mcg/cc fentanyl
 Bolus: 5 cc
 Lockout: 10 minutes
 Basal: 10 cc/hour
 Hourly limit: 20 cc

Any combination of basal rate and incremental dose that achieves a minimum of 12 cc/hr seems to be equally effective,⁹ but *much* higher volumes - up to 30 cc/hr - are often used. Laboring patients seem to benefit from larger bolus doses, up to 12 cc, although safety becomes an issue.

III. Intrathecal (spinal) analgesia or the "Walking Epidural"

Why bother with this technique of regional analgesia for labor? First, *immediate gratification*... The block is rapid in onset, gives complete analgesia, is *never* one-sided or spotty, and allows fairly controllable spread. Second, *safety*... The subarachnoid doses used are so small that the risks of local anesthetic toxicity or total spinal are negligible or absent. Third, *flexibility*... Patients in the latent phase of labor can be given intrathecal fentanyl or sufentanil and allowed to

ambulate, while multiparous parturients or patients > 8 cm can be a given single-shot spinal dose of a local anesthetic/narcotic combination for fast and complete pain relief during active labor and delivery.

Choice of drugs¹⁰ and clinical management (Table 2):

Early labor (<5 cm): Fentanyl 25 mcg or
Sufentanil 5-10 mcg
Consider ambulation
Dose epidural catheter when pain returns or immediately start a low-dose infusion at 12-15 cc/hr

Active labor (>5 cm): Fentanyl 25 mcg + 0.5-1 cc 0.25% bupivacaine (1.25-2.5 mg)¹¹
May use sufentanil 5-10 mcg alone if motivated to ambulate
Begin usual epidural infusion at 12-15 cc/hr

Second stage: Now need somatic anesthesia with local anesthetic properties
Narcotic + local anesthetic mix as above
Meperidine 20 mg "saddle block"
60-90 minutes duration→ may not need an epidural catheter

Table 2. Lipid-soluble Opioids for Labor Analgesia

Drug	Dose	Duration (min)	Comment
Fentanyl ¹²	15-30 mcg	30-120	Rapid onset, short duration
Sufentanil	5-10 mcg	60-180	More itching, provides slightly better analgesia than fentanyl
Meperidine	10-20 mg	60-180	Significant local anesthetic effect, vomiting common (20-30%)
Hydro-Morphone	40 mcg	60-180	Preliminary data only

Technique for combined spinal/epidural analgesia for labor:

- Identify the epidural space in the usual way.

- Insert a 120+ mm, 24-27 gauge pencil-point needle through the epidural needle until it passes into the subarachnoid space. Assure free-flow of CSF.
- Inject opioid +/- local anesthetic as a 1-3 cc volume.
- Remove the spinal needle.
- Insert epidural catheter into the epidural space and secure.
- Monitor blood pressure, sedation and fetal heart rate for 30 minutes.

In some cases it may be preferable to use a continuous spinal technique using the epidural catheter, for example after a "wet tap", in morbidly obese patients who have a very low incidence of PDPH, or in a patient with prior back surgery such as placement of Harrington rods.

In rare cases a single-shot combination of fentanyl 25 mcg + morphine 0.25 mg can be used to provide up to six hours of analgesia with minimal hemodynamic changes, although side effects may be prohibitive.^{13 14}

Managing complications:

- | | |
|--|--|
| . Itching | Nalbuphine 2.5-5 mg IV
Propofol 10-20 mg IV
Naloxone 40 mcg IV (last resort)
Naltrexone 25 mg PO (after delivery)
? diphenhydramine (too sedating) |
| . Nausea/Vomiting | Metoclopramide 10-20 mg IV
Nalbuphine 2.5-5 mg IV
Ondansetron 4 mg IV
Naloxone 40 mcg IV (last resort)
Naltrexone 25 mg PO (after delivery) |
| . Hypotension | Fluids / phenylephrine |
| . Respiratory depression ¹⁵ | Nalbuphine 20 mg IV
Naloxone 0.2-0.4 mg IV |

Most problems associated with the combined spinal-epidural technique are minor and easily managed (eg. itching).¹⁶ However, there are some common concerns about adding this to a labor analgesia regimen. Fortunately most have turned out to be *potential* rather than *actual* problems. For example:

1. Is there an increased risk of post-dural puncture headache?
No, in fact the risk is the same or less than when using a standard epidural technique because the rate of "wet tap" is less.¹⁷ However, you *must* use an atraumatic spinal needle.

2. Is fetal distress more common after intrathecal narcotics?
Probably not, but maybe. There have been case reports of acute fetal bradycardias (variable

decelerations), possibly associated with uterine hypertonicity. Recent studies indicate that non-reassuring fetal heart rate tracings are no more common after intrathecal sufentanil than after traditional epidurals¹⁸ and that emergency cesarean section does not occur more often.¹⁹ However, another group found a higher incidence of profound fetal bradycardia requiring emergency cesarean delivery after intrathecal sufentanil than after intravenous meperidine.²⁰ Because the etiology of the bradycardia is probably uterine hypertonicity, nitroglycerin or terbutaline is the logical treatment rather than phenylephrine or ephedrine. Most non-reassuring fetal heart tones resolve uneventfully.

3. What if there is no CSF return from the spinal needle?

This happens about 10% of the time. Either the spinal needle is too short, you are off the midline and bypassing the dural sac, or your epidural needle is not actually in the epidural space.

4. Will my epidural catheter migrate through the hole in the dura?

In several large series, this does not seem to happen.^{15,21} Also, cadaver studies have shown it is almost impossible to pass an epidural catheter through a single dural hole made by a 25g spinal needle.²² There are now special kits in which the epidural needle has a back hole for introducing the spinal needle via a different path than the epidural catheter. However, these are quite expensive in comparison to adding a single pencil-point spinal needle to your epidural tray, and have not been shown to have any advantage.

5. How do you test the epidural catheter once the intrathecal dose is working?

Always aspirate your catheter!²³ Whatever you use for the intravascular component of your test dose (epinephrine, fentanyl, air, etc.) can be the same. It is harder to test the intrathecal component, but a hyperbaric dose of local anesthetic *will* produce motor block. Or you can wait until the intrathecal dose wears off and test dose the catheter in the usual fashion. Or you can start a dilute epidural infusion. If the catheter migrates intravascular, the block will dissipate. If the catheter migrates intrathecal, the block will intensify and progress to motor block. Neither scenario is dangerous to the patient.

6. Will you pick up paresthesias when placing the catheter after the intrathecal dose?

Yes. In addition, patients commonly have a paresthesia with the catheter if they had one when the spinal needle was placed. Obviously, any paresthesia must resolve before drug is injected.

7. Why do I sometimes see breakthrough pain about 90 minutes after the intrathecal dose when my epidural infusion is already running? You're seeing a "window" between the intrathecal analgesia wearing off and the epidural infusion taking full effect. Try increasing the initial infusion rate to 15 cc/hr. You can decrease the rate after a few hours if the patient is comfortable. Or, just plan on stopping by after 90 minutes to check on the patient and add a small (5cc) top-up dose if needed. Or, use PCEA and the patient can top up themselves.

Setting Up a Protocol for Ambulation^{11,24}

Although there is no data showing any impact of ambulation on the outcome of labor^{25,26}, there is significant goodwill to be gained with patients, obstetricians, and midwives when you can provide effective analgesia and still allow the patient to be out of bed and ambulatory. Several centers have experience with thousands of patients in which ambulation has been safely allowed when following a set protocol. If you wish to set up such a protocol, include the following:

- There must be no obstetric contraindication to the patient ambulating or to intermittent fetal monitoring. Follow ACOG guidelines on intermittent fetal

monitoring.

- After the anesthetic is placed, monitor maternal and fetal vital signs for thirty minutes. If hypotension occurs, it is almost always in the first 30 minutes. There should be a reassuring fetal monitor strip. There have been reports of increased variable decelerations after intrathecal narcotics, perhaps due to an increase in uterine contractility.²⁷
- After 30 minutes, have the patient lift her leg off the bed to assess motor strength. If normal, have her sit on the side of the bed and reassess her blood pressure. If normal, have her stand at the side of the bed, recheck orthostatic vital signs and have her do a slight knee bend to be sure her motor function is completely intact. At this point she can sit in a chair, walk to the bathroom, or walk in the halls on L&D with someone in attendance.
- If you are not beginning the infusion immediately, the patient should be instructed to let the anesthetist know *as soon as* she feels return of contractions, so a top-up dose can be given before all analgesia is lost.

TABLE 4. PCIA Fentanyl Protocol at the University of Saskatchewan

-
1. Resuscitation equipment and drugs immediately available (maternal and neonatal)
 2. Pulse oximetry
 3. One-on-one nursing
 4. Ongoing parturient education regarding utilization of PCIA
 5. Assurances that support providers understand importance and implications of not assisting parturient with PCIA administration
 6. Anesthesiologist administered intravenous fentanyl loading dose 2–3 mcg/kg (150–200 mcg)
 7. Initial PCIA parameters: Bolus: 50 mcg (2 ml of 25 mcg/ml)
Lockout: 10 minutes
4-hour limit: NIL
No continuous (background) intravenous infusion of Fentanyl
 8. As requirements increase as labor progresses the following titration regime is followed:
 1. Ensure utilizing PCIA appropriately
 2. Ensure demands produce delivery (ie, PCIA button connected to the PCIA machine)
 3. Decrease Lockout: 10 minutes to 5 minutes (effectively doubles available dose)
 4. Reassess in 1–2 hours if requirements are not met
 5. Increased bolus: 50–75 mcg (most parturients are well controlled at this point)
 6. Reassess in 1–2 hours
 7. Rarely need to increase bolus: 75–100 mcg
- This regime usually produces VAS pain scores of 3–4/10 during contractions.
-

REFERENCES

1. Zhang J, Bernasko JW, Leybovich E, Fahs M, Hatch MC. Continuous labour support from labour attendant for primiparous women: a meta analysis. *Obstet Gynecol* 1996; 88: 739.
2. Vella L, Francis D, Houlton P, Reynolds F: Comparison of the antiemetics metoclopramide and promethazine in labour. *BMJ* 1985;290:1173.
3. Douglas MJ: Alternatives to epidural analgesia during labour. *Can J Anaesth* 1991;38:421.
4. Campbell DC: Parenteral opioids for labor analgesia. *Clin Obstet Gynecol* 2003;46:616.
5. Rosaeg OP, Kitts JB, Koren G, Byford LJ: Maternal and fetal effects of intravenous patient-controlled fentanyl analgesia during labour in a thrombocytopenic parturient. *Can J Anaesth* 1992;39:277.
6. Sharma SK, Sidawi JE, Ramin SM, et al: Cesarean delivery: a randomized trial of epidural versus patient-controlled meperidine analgesia during labor. *Anesthesiology* 1997;87:487.
7. D'Angelo R: New techniques for labor analgesia: PCEA and CSE. *Clin Obstet Gynecol* 2003;46:623.
8. Liu SS, Allen HW, Olsson GL. Patient-controlled epidural analgesia with bupivacaine and fentanyl on hospital wards. *Anesthesiology* 1998;88:688.
9. Gambling DR, Huber CJ, Berkowitz J et al: Patient-controlled epidural analgesia in labour: varying bolus dose and lockout interval. *Can J Anaesth* 1993;40:211.
10. Honet JE, Arkoosh VA, Norris MC, Huffnagle HJ, Silverman NS, Leighton BL: Comparison among intrathecal fentanyl, meperidine, and sufentanil for labor analgesia. *Anesth Analg* 1992;75:734.
11. Collis RE, Baxandall ML, Srikantharajah ID, Edge G, Kadim MY, Morgan BM: Combined spinal epidural (CSE) analgesia: technique, management, and outcome of 300 mothers. *Int J Obstet Anesth* 1994;3:75.
12. Palmer CM, Cork RC, Hays R, VanMaren G, Alves D: The dose-response relation of intrathecal fentanyl for labor analgesia. *Anesthesiology* 1998;88:355.
13. Leighton BL, DeSimone CA, Norris MC, Ben-David B: Intrathecal narcotics for labor revisited: the combination of fentanyl and morphine intrathecally provides rapid onset of profound, prolonged analgesia. *Anesth Analg* 1989;69:122.

-
14. Caldwell LE, Rosen MA, Shnider SM. Subarachnoid morphine and fentanyl for labor analgesia. *Reg Anesth* 1994; 19: 2-8.
 15. Ferouz F, Norris M, Leighton BL: Risk of respiratory arrest after intrathecal sufentanil. *Anesth Analg* 1997;85:1088.
 16. Albright GA, Forster RM. The safety and efficacy of combined spinal and epidural analgesia/anesthesia (6002 blocks) in a community hospital. *Reg Anesth Pain Med* 1999; 24: 117-25.
 17. Norris MC, Grieco WM, Borkowski M, Leighton BL, Arkoosh VA, Huffnagle HJ, Huffnagle S: Complications of labor analgesia: epidural versus combined spinal epidural techniques. *Anesth Analg* 1994;79:529.
 18. Nielsen PE, Erickson JK, Abouleish EI, et al. Fetal heart rate changes after intrathecal sufentanil or epidural bupivacaine for labor analgesia: Incidence and clinical significance. *Anesth Analg* 1996; 83: 742.
 19. Albright GA, Forster RM. Does combined spinal-epidural analgesia with subarachnoid sufentanil increase the incidence of emergency cesarean delivery? *Reg Anesth* 1997;22: 400.
 20. Gambling DR, Sharma SK, Ramin SM, et al. A randomized study of combined spinal-epidural analgesia versus intravenous meperidine during labor. *Anesthesiology* 1998;89:1336.
 21. Eldor J, Stacey R: Combined spinal-extradural analgesia in the delivery room (letter). *Br J Anaesth* 1994 ;73:426
 22. Holmstrom B, Rawal N, Axelsson K, et al. Risk of catheter migration during combined spinal-epidural block: percutaneous epiduroscopy study. *Anesth Analg* 1995; 80:747.
 23. Norris MC, Fogel ST, Dalman H, et al. Labor epidural analgesia without an intravascular "test dose". *Anesthesiology* 1998;88:1495.
 24. Breen TW, Shapiro T, Glass B, Foster-Payne D, Oriol NE: Epidural anesthesia for labor in an ambulatory patient. *Anesth Analg* 1993;77:919.
 25. Nageotte MP, Larson D, Rumney PJ, Sidhu M, Hollenback K: Epidural analgesia compared with combined spinal-epidural analgesia during labor in nulliparous women. *NEJM* 1997; 337:1715.
 26. Bloom SL, McIntire DD, Kelly MA, et al: Lack of effect of walking on labor and delivery. *NEJM* 1998;339:76.
 27. Clarke VT, Smiley RM, Finster M: Uterine hyperactivity after intrathecal injection of

fentanyl for analgesia during labor: a cause of fetal bradycardia? (letter) *Anesthesiology* 1994; 81:1083.

28. Bucklin BA, Hawkins JL, Anderson JR. Obstetric anesthesia work force survey, 2001. *Anesthesiology* 2003;99:A1182.