

Intrathecal Analgesia for Labor

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Intrathecal analgesia is a highly effective technique for pain relief in the first stage of labor. It is a technically simple procedure that can be easily learned by family physicians currently performing diagnostic lumbar puncture. Its effectiveness, simplicity, and low incidence of serious complications make it especially applicable to the practices of physicians delivering babies in areas where

continuous epidural anesthesia is not available. This article describes the procedure of intrathecal analgesia, and discusses advantages, complications, side effects, and applications.

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The goals of obstetrical management are twofold: to ensure the best possible medical outcomes for mother and infant, and to optimize the birth experience for the mother and family. Pain management is often a critical component in meeting these goals. Providing adequate pain relief can be problematic, especially in areas where choices are dictated by personnel or facility limitations.¹ Injection of small doses of opiates into the dural space (intrathecal analgesia) can provide effective pain relief for first stage labor.^{2,4} Because this procedure has a low incidence of serious side effects and is an easy technique to learn, it is being used by physicians in a wide variety of practice situations, particularly in areas where limited nursing or physician services make continuous epidural anesthesia impractical (Table 1).

The injection of opioids is accomplished in a procedure similar to spinal anesthesia. In contrast to spinal or epidural anesthesia, local anesthetics are not injected. This allows for profound analgesia (not anesthesia) for first stage labor without clinically significant motor or autonomic blockade.⁵ The narcotics diffuse freely through the cerebrospinal fluid and exert their action on receptors in the dorsal horn of the spinal cord. Several pathways and transmitters have been proposed to explain their exact mechanism of action.⁵

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TECHNIQUE

Table 2 outlines the procedure for intrathecal injection, and Table 3 is a list of items of equipment that may be unfamiliar to physicians not currently performing spinal anesthesia. Narrow gauge bullet-tip or pencil-point anesthesia needles (24 to 27 gauge) reduce the incidence of spinal headache after a dural puncture. A larger gauge introducer (usually 18 or 19 gauge) passed through the skin and into the supraspinous ligament helps guide the anesthesia needle, and eases passage of the needle through the tougher structures of the skin and ligament (Figure). A filter-tip needle, used for drawing up medications, avoids aspirating glass fragments from the vials along with medication.

The choice of narcotics depends on the desired effect and duration of action (Table 4).^{4,6} A wide range of dosages has been studied, and no consensus has been reached as to the optimal medication or dosage. In general, the lipid-soluble medications have a faster onset of action and shorter duration of action, and may have a lower side-effect profile. Considerable patient variability is noted, so medication choice should be based on practitioner preference and experience, not on patient variables such as weight or perceived pain. In our institution, we have chosen to use a combination of fentanyl (25 µg) and preservative-free morphine (0.2 mg). This provides a rapid onset of pain relief from the lipid-soluble fentanyl (onset 5 to 10 minutes)^{2,4} and a long duration of action from the relatively lipid-insoluble morphine (lasting from 6 to 10 hours).^{4,5,7}

TABLE 1

Advantages and Disadvantages of Intrathecal Analgesia in Labor**Advantages**

Effective pain relief in the first stage of labor
 Low incidence of serious complications
 Procedure similar to diagnostic lumbar puncture
 No increase in assisted deliveries
 No adverse fetal effects
 Useful in personnel shortage areas where epidural anesthesia is not available

Disadvantages

Limited duration of pain relief
 High incidence of side effects
 Risk of respiratory depression
 Patient must be monitored for 24 hours after injection
 No perineal or birth canal analgesia

ADVANTAGES

Intrathecal analgesia is effective, easy to perform, and avoids some side effects associated with other methods of obstetrical pain management, such as parenteral narcotics and epidural anesthesia.

The lack of local anesthetics in the injection accounts for many of these advantages. Because there is no motor blockade, intrathecal analgesia does not interfere with the mechanisms of labor or delivery.⁴ At usual doses, the duration of the first and second stage of labor is unaltered, although

there may be some prolongation of the first stage with high doses of morphine (>2 mg).⁸ Intrathecal analgesia is not associated with malrotation of the head during descent or with poor maternal expulsive effort, and there is no increase in cesarean section delivery.^{2,8} The incidence of maternal hypotension (0% to 15%)^{2,6,9} is lower with intrathecal narcotics than with spinal or epidural anesthesia because of the lack of autonomic blockade.⁵ The risk of respiratory paralysis and cardiovascular collapse from an inadvertent high spinal block is nonexistent.⁵ An unexpected intravascular injection

TABLE 2

Procedure for Intrathecal Analgesia

1. Evaluate patient and fetus. Check for contraindications, and obtain informed consent.
2. Position patient in lateral decubitus or sitting position. Locate L4-5 or L3-4 spinal interspace.
3. Sterile preparation, draping, and local anesthesia are performed as for diagnostic lumbar puncture.
4. A dilute narcotic solution is drawn up and mixed in syringe with filter-tip needle. Preservative-free morphine, fentanyl, and sufentanil; or combinations of the above, are commonly used (Table 4). Combinations of narcotics may be mixed and injected in the same syringe.
5. Relocate the appropriate spinal interspace. Pass introducer through the skin and into the supraspinous ligament. Introducer is usually at a 30° to 45° angle cephalad when properly placed. When the introducer is in the supraspinous ligament, it feels firmly placed (Figure).
6. Pass the narrow gauge anesthesia needle through the introducer and then through the interspinous ligament, ligamentum flavum, and dura. A distinct pop or snap should be felt as the needle passes through the dura. Remove the trocar from the anesthesia needle and check for return of cerebrospinal fluid. Confirm free flow of fluid through a 360° rotation of the needle (Figure).
7. Place syringe with the narcotic solution onto the anesthesia needle. Aspirate slightly to confirm flow of cerebrospinal fluid into the syringe. Inject solution over a 5- to 10-second period. Inject between uterine contractions. Hold the syringe, anesthesia needle, and introducer as a unit, and maintain contact with the patient's back, in order to avoid dislodging the needle if the patient moves. At the completion of the injection, again aspirate slightly to confirm flow of spinal fluid into the syringe. If aspiration is unsuccessful, injection may have occurred outside the thecal sac, which is unlikely to cause the patient harm, but will not be effective for pain relief. Observe the patient closely for 30 or more minutes (depending on the anticipated onset of action of the medications used). If no effects or side effects are observed, consider an alternative method for analgesia.
8. Remove the syringe, anesthesia needle, and introducer as a unit. Reposition the patient onto her back, and place fetal monitor and maternal blood pressure cuff. Patient and fetus must be monitored closely for 30 to 60 minutes after injection (continuous fetal monitoring and frequent maternal blood pressure checks). After initial monitoring, if no abnormalities are seen, patient may assume position of comfort or ambulate, and fetal monitoring may be continuous or intermittent consistent with facility protocol. Patient must be monitored in the hospital for 24 hours after the injection to watch for respiratory depression.

TABLE 3

Equipment Needed for Intrathecal Analgesia

- Lumbar puncture tray plus:
 - Injectable (preservative free) saline
 - Anesthesia needle and introducer
 - Syringe with filter tip needle for preparing solution for injection
- Narcotics for injection
- Naloxone
- Ephedrine
- Automatic blood pressure monitor, or personnel to monitor blood pressure frequently initially after injection
- Continuous fetal monitor

tion is within the scope of most hospitals providing obstetrical care.⁸

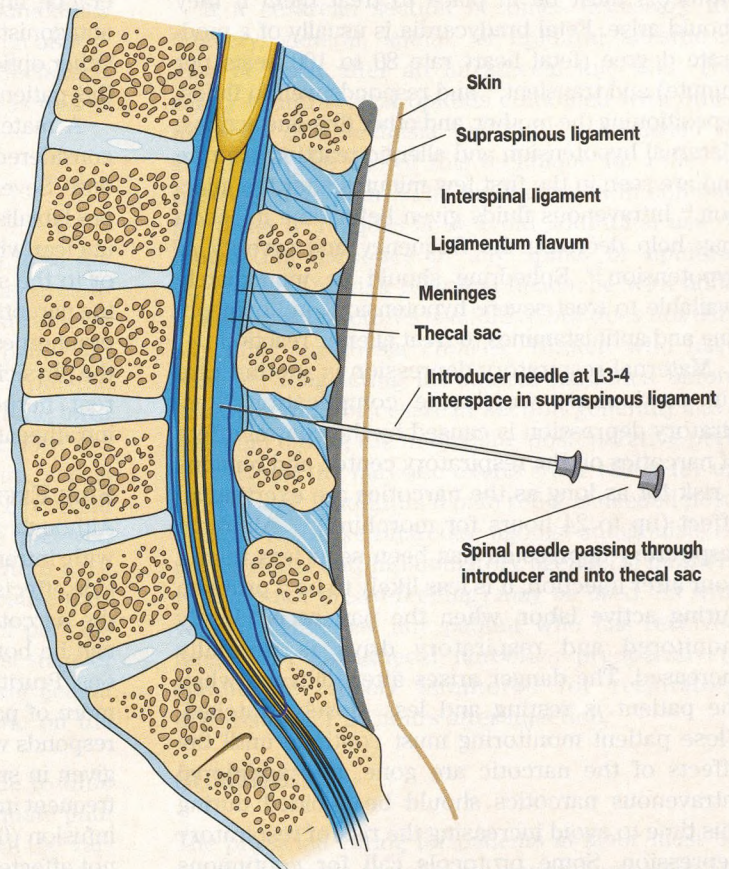
DISADVANTAGES

COMPLICATIONS

Major complications are rare with intrathecal analgesia. Spinal headache occurs in 1% to 5% of patients, varying with operator technique and equipment used.^{4,6,8} Treatment options include a blood patch, or conservative management with bed rest, fluids, analgesics, and caffeine. Other rare complications directly related to the dural puncture include meningitis and spinal nerve injury. The risk of these is approximately the same as with diagnostic lumbar puncture.

FIGURE

Site of intrathecal injection. An 18- or 19-gauge needle is introduced through the skin into the supraspinous ligament, and a narrow-gauge needle (24 to 27 gauge) is passed through the introducer needle and delivers the narcotic into the thecal sac.



tion of medication during the procedure is not dangerous because of the small doses of narcotics and because no local anesthetics are injected.

The low dose of narcotics used with intrathecal injection avoids some side effects seen with larger doses of intravenous narcotics. Infants experience no depression of respiratory effort or neurobehavior, and there is no loss of variability on fetal monitoring strips due to intrathecal narcotics.⁷

Intrathecal analgesia may be an ideal pain management option in situations where epidural anesthesia is not available. In many rural and community hospitals, the only choices for pain relief in labor are relaxation techniques and intravenous narcotics.¹ Often this is because of limited nursing or physician resources. Intrathecal injection is a simple technique that can be learned by most physicians. Continuous physician presence is not required after the injection because of the low incidence of serious side effects.⁸ The nursing care and patient monitoring needed after intrathecal injec-

TABLE 4

Duration of Action of Intrathecal Narcotics

Narcotic	Dosage	Onset of Action (in minutes)	Duration of Action (in hours)
Morphine	0.2-0.5 mg	15 to 60	6 to 10
Fentanyl	15-25 µg	5 to 10	1.5 to 3.5
Sufentanil	3-15 µg	5 to 10	2 (average)
Meperidine	10-20 mg	5 to 10	1.5 to 2

Compiled from Honet JE, Arkoosh VA, Norris MC, et al. Comparison among intrathecal fentanyl, meperidine, and sufentanil for labor analgesia. *Anesth Analg* 1992; 75:734-9; and Arkoosh VA. Spinal analgesia for labor. In: Norris MC. *Obstetric anesthesia*. Philadelphia, Pa: JB Lippincott Co, 1992:341-55.

Maternal respiratory depression, allergic reaction, hypotension, and transient fetal bradycardia are other potentially serious complications. Although these are rare, they are unpredictable, and protocols must be in place to treat them if they should arise. Fetal bradycardia is usually of a moderate degree (fetal heart rate 80 to 100 beats per minute) and transient,^{6,9} and responds well to fluids, repositioning the mother, and other first-line actions. Maternal hypotension and allergic reaction are rare and are seen in the first few minutes after the injection.¹⁰ Intravenous fluids given before the injection may help decrease the frequency and severity of hypotension.^{2,9} Ephedrine should be immediately available to treat severe hypotension, and epinephrine and antihistamines to treat allergic reaction.

Maternal respiratory depression is another rare but particularly worrisome complication. Respiratory depression is caused by the central effect of narcotics on the respiratory center, and remains a risk for as long as the narcotics are exerting an effect (up to 24 hours for morphine).^{5,11} Although respiratory depression has been seen less than 1 hour after injection, it is less likely to be a problem during active labor, when the patient is closely monitored and respiratory drive is normally increased. The danger arises after delivery, when the patient is resting and less closely watched. Close patient monitoring must continue until the effects of the narcotic are gone, and additional intravenous narcotics should be avoided during this time to avoid increasing the risk of respiratory depression. Some protocols call for continuous

pulse oximetry during this time, others for hourly or more frequent measurement of mental status and vital signs.^{2,10} Treatment for respiratory depression consists of intravenous naloxone, oxygen, and respiratory support.¹⁰⁻¹² Naloxone may need to be repeated frequently, as it is relatively short acting. Oral naltrexone (25 to 50 mg) given prophylactically after delivery may decrease the risk of respiratory depression.^{8,10}

CONTRAINDICATIONS

In certain circumstances, intrathecal injection may be contraindicated. It should not be used if there is a skin infection overlying the area of injection, in patients with increased intracranial pressure, if there is an allergy to the narcotic being injected, or in the presence of fetal distress. It should be used with great caution, if at all, in the presence of a known coagulation defect.⁴ The use of intrathecal narcotics in chronic narcotic users is problematic. The medications may be less effective because of patient tolerance, and treatment for side effects with narcotic antagonists may precipitate narcotic withdrawal.^{4,5} Other options for pain relief should be considered in this patient population.

A maternal history of herpes labialis should be considered a relative contraindication to the procedure. Several reports have linked recurrences of herpes labialis to intrathecal and epidural narcotics. It is unclear whether a recurrence is due to the narcotics or to the side effect of the pruritus associated with the narcotics. Because a mother with a recurrence of oral herpes may pass that infection to her newborn, the physician should inquire about a history of recurrent herpes labialis before proceeding with an intrathecal injection.^{13,14}

SIDE EFFECTS

Although the incidence of serious complications with intrathecal narcotics is low, the incidence of side effects is high. They are caused by the effects of the narcotics on the central nervous system. They can be bothersome, but not usually medically serious. Pruritus is quite common, happening in 50% or more of patients.^{8,10} This can be severe, but usually responds well to treatment of intravenous naloxone, given in small boluses (0.1 mg, may be repeated at frequent intervals up to five times) or in a continuous infusion (0.2 mg per hour).¹² The analgesic effect is not affected by this treatment.¹⁵ Because the itching

is not related to histamine release,^{4,5,7} antihistamines usually do not help with this side effect.

Nausea and vomiting occur in 30% to 50% of patients,^{3,7} which can be treated with antiemetics or metoclopramide.^{3,8} Urinary retention can also occur after intrathecal analgesia, and should be treated with intermittent catheterization as needed. It is seen in approximately 30% of patients.^{3,5} Maternal somnolence is seen in 40% to 60% of patients,^{4,7} but is generally mild and does not require treatment.⁷ If treatment becomes necessary, naloxone may be given in the dosages described above. After delivery, narcotic antagonists (naloxone or oral naltrexone) remain effective for treatment for side effects.^{2,8} The side effects usually do not last longer than the period of analgesic effectiveness.

In our experience, these side effects are generally acceptable to patients because treatment for side effects is so effective, and because of the benefit the patient receives from the pain relief. For maximal patient satisfaction, treatment for itching and nausea should be given early and aggressively, sometimes even when the patient perceives them as an annoyance rather than a complaint. These side effects tend to progress in severity, and do not respond as well to treatment when they are severe.

OTHER CONSIDERATIONS

Pain in the first stage of labor originates from the force of uterine contractions, ligamentous stretching, and cervical dilation and effacement. Intrathecal analgesia is very effective for this type of pain. Pain in the second stage of labor originates from the descent and passage of the infant through the birth canal and introitus. Intrathecal analgesia does not alter sensation in the vagina and perineum, and is not as useful for pain relief in this stage.⁷ In clinical experience, however, women who have received intrathecal injections in the first stage seem to have an easier second stage.^{2,3} This may be because they are still getting relief from uterine pain, or perhaps because they are less fatigued from the first stage of labor. For additional pain relief in the lower genital tract, a pudendal block or local anesthetic on the perineum may be used.

One of the physician's goals should be to time the injection so that the patient has adequate pain relief through to delivery. Familiarity with the various medications and their durations of action

help with this decision (Table 4).^{4,6} If the analgesic effect has diminished before delivery, however, additional pain relief can be problematic. Additional intravenous narcotics should be avoided because the risk of postpartum respiratory depression can be increased. In clinical practice, some physicians report good results with a second intrathecal injection of a short-acting narcotic, or with intravenous administration of a mixed narcotic agonist-antagonist, eg, butorphanol, nalbuphine, or buprenorphine. These practices, however, have not been well studied as to effectiveness or safety. As an alternative, some anesthesiologists perform a combination intrathecal-epidural, in which an epidural catheter is placed at the time of intrathecal injection. This catheter may be used later if additional pain relief or an operative delivery becomes necessary.¹⁶ This option allows the intrathecal narcotic to be used for pain relief earlier in labor, but is feasible only in facilities where epidural anesthesia is used.

If a cesarean section becomes necessary for delivery, general, spinal, or epidural anesthesia may be used after an intrathecal injection. The safety of intrathecal opioids combined with other methods of anesthesia has been established in studies on the use of this technique for relief of postoperative pain.¹⁰ The main caution in combining these techniques is to avoid additional use of long-acting narcotics in any spinal or epidural injections. The risk of spinal headache with additional dural punctures is additive but does not usually limit anesthesia choices. Women who have received long-acting intrathecal narcotics before or at the time of cesarean section generally have less pain during the immediate postoperative period because the narcotic exerts some effect for up to 24 hours. If additional pain relief is needed postoperatively, mixed narcotic agonist-antagonists or nonsteroidal anti-inflammatory agents (in mothers who are not breast-feeding) may be used. As with vaginal deliveries, any patient who has received long-acting intrathecal narcotics preoperatively should be closely monitored for respiratory depression for 24 hours after injection.

SUMMARY

The physician caring for patients in labor must be careful to try to match pain management interven-

tions with the particular circumstances at each birth. Intrathecal analgesia is one choice in a wide range of options for labor pain relief. Many obstetrical providers may find that it is a tool that fits well into their current practices. By expanding analgesia options for women in labor, we can more effectively meet the dual goals of optimal medical outcomes and positive birth experiences.

REFERENCES

1. Gibbs CP, Krischer J, Peckham BM, Sharp H, Kirschbaum TH. Obstetric anesthesia: a national survey. *Anesthesiology* 1986; 65:298-306.
2. 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; 69:122-5.
3. Scott PV, Bowen FE, Cartwright P, Mohan Rao BC, Deely D, Wotherspoon HG, Sumrein IMA. Intrathecal morphine as sole analgesic during labour. *BMJ* 1980; 281:351-3.
4. Arkoosh VA. Spinal analgesia for labor. In: Norris MC. *Obstetric anesthesia*. Philadelphia, Pa: JB Lippincott Co, 1992:341-55.
5. Cousins MJ, Mather LE. Intrathecal and epidural administration of opioids. *Anesthesiology* 1984; 61:276-310.
6. 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; 5:734-9.
7. Baraka A, Noueihid R, Hajj S. Intrathecal injection of morphine for obstetric analgesia. *Anesthesiology* 1981; 4:136-40.
8. Rust LA, Waring RW, Hall GL, Nelson EI. Intrathecal narcotics for obstetric analgesia in a community hospital. *Am J Obstet Gynecol* 1994; 170:1643-8.
9. Cohen SE, Cherry CM, Holbrook RH, El-Sayed YY, Gibson RN, Jaffe RA. Intrathecal sufentanil for labor analgesia—sensory changes, side effects, and fetal heart rate changes. *Anesth Analg* 1993;77:1155-60.
10. Morgan M. The rational use of intrathecal and extradural opioids. *Br J Anaesth* 1989; 63:165-88.
11. Palmer CM. Early respiratory depression following intrathecal fentanyl-morphine combination. *Anesthesiology* 1991; 74:1153-5.
12. Entrup MH, Davis FG. Perioperative complications of anesthesia. *Surg Clin North Am* 1991; 71:1151-73.
13. Ross A, Hill A. Intrathecal morphine and herpes reactivation [letter]. *Anaesth Intensive Care* 1993; 21:126.
14. Duffy BL. Intrathecal morphine and herpes reactivation [letter]. *Anaesth Intensive Care* 1993; 21:377.
15. Jones RDM, Jones JG. Intrathecal morphine: naloxone reverses respiratory depression but not analgesia. *BMJ* 1980; 281:645-6.
16. Abouleish E, Rawal N, Shaw J, Lorenz T, Rashad MN. Intrathecal morphine 0.2 mg versus epidural bupivacaine 0.125% or their combination: effects on parturients. *Anesthesiology* 1991; 74:711-16.