Pharmacologic management of pain during labor and delivery

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INTRODUCTION

- The way pain is experienced is a reflection of the individual's emotional, motivational, cognitive, social, and cultural circumstances. The pain of childbirth is likely to be the most severe pain that a woman experiences during her lifetime.

- The pain of labor and delivery varies among women, and each labor of an individual woman may be quite different. As an example, an abnormal fetal presentation (eg, occiput posterior) is associated with more severe pain.

- Pharmacological treatment of labor pain was introduced in the mid-nineteenth century.

- ACOG supports the concept that maternal request alone is a sufficient medical indication for labor analgesia.

PAIN PATHWAYS

- Pain originates from different sites as the process of labor and delivery progresses.

First stage of labor

- The pain signal enters the spinal cord after traversing the T10, T11, T12, and L1.

SECOND STAGE OF LABOR

- Second stage pain is more severe than first stage pain and is characterized by a combination of visceral pain from uterine contractions and cervical stretching and somatic pain from distention of vaginal and perineal tissues.

- The pain signal is transmitted to the spinal cord via three sacral nerves (S2, S3, and S4), which comprise the pudendal nerve.

ADVERSE CONSEQUENCES OF LABOR PAIN

HYPERVENTILATION

- Hypocarbia may result in maternal hypoxemia, lightheadedness, and loss of consciousness.
- Respiratory alkalosis, which impairs placental oxygen transfer from the maternal to fetal circulation.
- Maternal alkalosis can impair fetal oxygen availability via utero - placental vasoconstriction, which decreases uterine blood flow.

Neurohumoral effects

- Neurohumoral responses to stress and pain may adversely affect placental perfusion and fetal oxygenation.
- Pain increased circulating catecholamines and significantly decreased blood flow to the uterus.
- Epidural analgesia results in a reduction of plasma beta-endorphin and cortisol levels.

PSYCHOLOGICAL EFFECTS

- Unrelieved pain may be a factor that contributes to the development of postpartum psychological trauma.

- Women who experience unrelieved pain during childbirth may be more likely to develop postpartum depression.

ANALGESIA FOR THE FIRST STAGE OF LABOR

- Pharmacologic approaches to manage childbirth pain can be broadly classified as either systemic or locoregional.

- Systemic administration includes the intravenous, intramuscular, and inhalation routes.

- Regional techniques (neuraxial) consist of epidurals, spinals and combined spinal-epidurals.

- Local injection may also be administered to achieve paracervical or pudendal nerve block.

SYSTEMIC ANALGESICS

- Systemic analgesics are useful for patients who prefer less invasive techniques, or in whom regional techniques are contraindicated or not available.

- They are not as effective and often have side-effects such as sedation and respiratory depression.

- The most popular systemic agents are opioids .

Opioid analgesia

- Opioids have the advantages of ease of administration, wide availability, lower cost, and are less invasive than neuraxial techniques, though substantial relief of labor pain is generally not achieved.

- Opioid drugs were associated with maternal nausea, vomiting, and drowsiness.

- A portion of the opioid dose also crosses the placenta, manifested in utero by decreased fetal heart rate variability and in the neonate by respiratory depression

PATIENT CONTROLLED ANALGESIA (PCA)

- Use of a PCA pump allows the patient to intravenously self-administer a programmed dose of medication with minimum intervals between doses.

- PCA provides rapid onset of analgesia, better control of pain relative to side effects than parenteral opioid injection, and a sense of control for the patient.

- Fentanyl provides the best combination of effective pain relief and low risk of side effects, although data are limited to a few small studies.

Nitrous oxide

- Nitrous oxide is eliminated quickly via the lungs, it does not accumulate in the mother or fetus/neonate or cause newborn depression.
- It does not affect contractile activity.
- Pulse oximetry and gas scavenging systems are essential during its use.

NITROUS OXIDE

- The analgesic efficacy of nitrous oxide for labor is unclear.
- Nitrous oxide may be used during part or all of labor.
- Side effects include nausea in 5 to 40 percent of women and vomiting in up to 15 percent.
- It should not be used in women with oxygen saturation <95 percent and some pulmonary conditions, and should be used with caution in combination with opioids because of the risk of respiratory depression.

NERVE BLOCKS

- Various nerve blocks have been developed over the years to provide pain relief during labor and/or delivery.

- These include pudendal, paracervical, and neuraxial blocks such as spinal, epidural, and combined spinal-epidural techniques.

Pudendal Block

- Pain with vaginal delivery arises from stimuli from the lower genital tract.
- These are transmitted primarily through the pudendal nerve, the peripheral branches of which provide sensory innervation to the perineum, anus, vulva, and clitoris.
- Sensory nerve fibers of the pudendal nerve are derived from ventral branches of the S2 through S4 nerves.



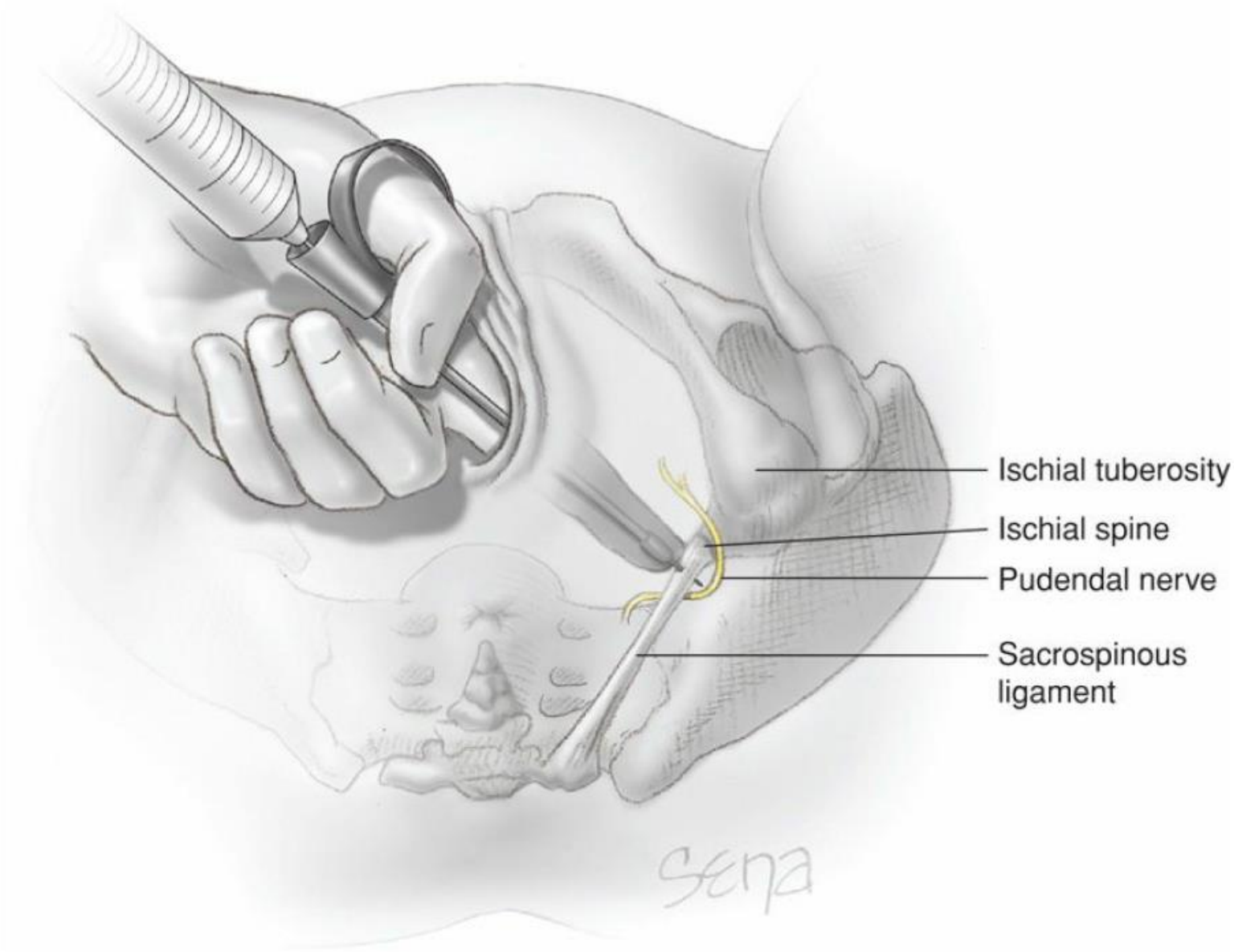


FIGURE 25-2 Local infiltration of the pudendal nerve. Transvaginal technique showing the needle extended beyond the needle guard and passing through the sacrospinous ligament to reach the pudendal nerve.

- Pudendal block usually does not provide adequate analgesia when delivery requires extensive obstetrical manipulation.

- Moreover, such analgesia is usually inadequate for women in whom complete visualization of the cervix and upper vagina or manual exploration of the uterine cavity is indicated.

COMPLICATIONS

- Intravascular injection of a local anesthetic agent may cause serious systemic toxicity.
- Hematoma formation from perforation of a blood vessel is most likely when there is a coagulopathy.
- Rarely, severe infection may originate at the injection site.
- The infection may spread posteriorly to the hip joint, into the gluteal musculature, or into the retropsoas space.

Paracervical Block

- This block usually provides satisfactory pain relief during first-stage labor. However, because the pudendal nerves are not blocked, additional analgesia is required for delivery.

- Because these anesthetics are relatively short acting, paracervical block may have to be repeated during labor.

- Fetal bradycardia is a worrisome complication that occurs in approximately 15 percent of paracervical blocks. Bradycardia usually develops within 10 minutes and may last up to 30 minutes.

Neuraxial Regional Blocks

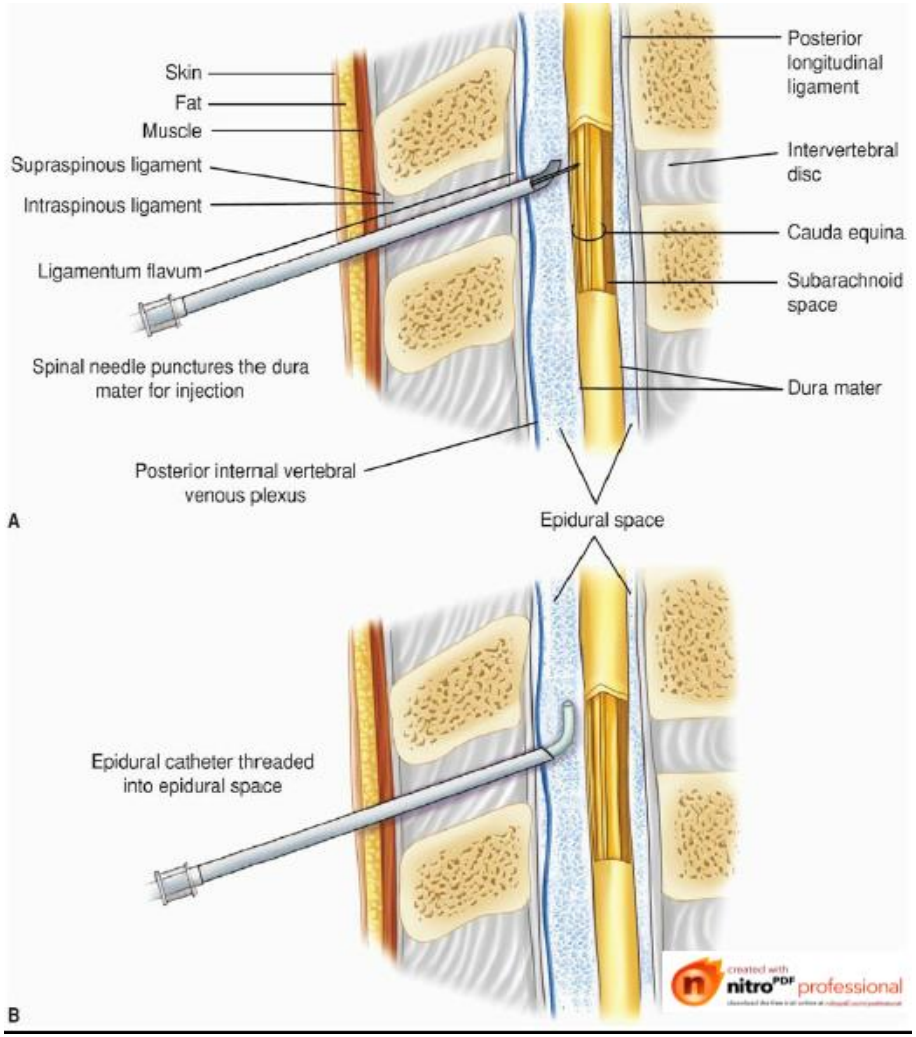


FIGURE 25-3 Neuraxial analgesia. A. Combined spinal-epidural analgesia. B. Epidural analgesia.

Spinal (Subarachnoid) Block

- Advantages include a short procedure time, rapid blockade onset, and high success rate.

- Neither is administered until the cervix is fully dilated, and all other criteria for safe forceps delivery have been fulfilled.

- Preanalgesic intravenous hydration with 1 L of crystalloid solution will prevent or minimize hypotension in many cases.

COMPLICATIONS

- **Hypotension**

- This common complication may develop soon after injection of the local anesthetic agent.

- It is the consequence of vasodilatation from sympathetic blockade and is compounded by obstructed venous return due to uterine compression of the great vessels.

Complications

- **High Spinal Blockade**

- Most often, complete spinal blockade follows administration of an excessive dose of local anesthetic.

- With complete spinal blockade, hypotension and apnea promptly develop and must be immediately treated to prevent cardiac arrest.

Management

In the undelivered woman:

- (1) the uterus is immediately displaced laterally to minimize aortocaval compression
- (2) effective ventilation is established preferably with tracheal intubation
- (3) intravenous fluids and ephedrine are given to correct hypotension.

Complications

- **Postdural Puncture Headache**

- Leakage of cerebrospinal fluid (CSF) from the meningeal puncture site can lead to postdural puncture or “spinal headache.”

- Presumably, when the woman sits or stands, the diminished CSF volume creates traction on pain-sensitive central nervous system structures.

- Rates of this complication can be reduced by using a small-gauge spinal needle and avoiding multiple punctures.

Management

- There is no good evidence that placing a woman absolutely flat on her back for several hours is effective in preventing headache.
- Vigorous hydration may be of value, but compelling evidence to support its use is also lacking.
- The administration of caffeine, a cerebral vasoconstrictor, has been shown in randomized studies to afford temporary relief.
- With severe headache, an epidural blood patch is most effective. 10 - 20 mL of autologous blood are obtained aseptically by venipuncture into a tube without anticoagulant. This blood is then injected into the epidural space at the site of dural puncture.

Complications

- **Convulsions**
- **Dysfunction of bladder**
- **Arachnoiditis and Meningitis**

Contraindications to Spinal Analgesia

TABLE 25-6. Absolute Contraindications to Neuraxial Analgesia

Refractory maternal hypotension
Maternal coagulopathy
Thrombocytopenia (variously defined)
Low-molecular-weight heparin within 12 hours
Untreated maternal bacteremia
Skin infection over site of needle placement
Increased intracranial pressure caused by a mass lesion



Epidural Analgesia

Complications

- Total Spinal Blockade
- Ineffective Analgesia
- Hypotension
- Central Nervous Stimulation
- Maternal Fever
- Back Pain
- spinal or epidural hematoma
- Epidural abscesses

Contraindications

- **Thrombocytopenia**

The American College of Obstetricians and Gynecologists (2013b) has concluded that women with a platelet count of 50,000 to 100,000/μL may be candidates for regional analgesia.

CONTRAINDICATIONS

- **Anticoagulation**

1. Women receiving UFH therapy should be able to receive regional analgesia if they have a normal Aptt.

2. Women receiving prophylactic doses of UFH or low-dose aspirin are not at increased risk and can be offered regional analgesia.

3. For women receiving once-daily low-dose LMWH, regional analgesia should not be placed until 12 hours after the last injection.

4. LMWH should be withheld for at least 2 hours after epidural catheter removal.

5. The safety of regional analgesia in women receiving twice-daily LMWH has not been studied sufficiently. It is not known whether delaying regional analgesia for 24 hours after the last injection is adequate.

CONTRAINDICATIONS

- **Severe Preeclampsia-Eclampsia**

- Potential concerns with epidural analgesia in those with severe preeclampsia include hypotension as well as hypertension from pressor agents given to correct hypotension.

- Additionally, there is the potential for pulmonary edema following infusion of large volumes of crystalloid.

Effect on Labor

- Epidural analgesia increased the need for operative vaginal delivery because of prolonged second-stage labor, but importantly, without adverse neonatal effects.

- This association between epidural analgesia and prolonged second-stage labor as well as operative vaginal delivery has been attributed to local-anesthetic induced motor blockade and resultant impaired maternal expulsive efforts.

Effect on Labor

- **Fetal Heart Rate**
- **Cesarean Delivery Rates**