

University of Alabama School of Medicine  
Obstetrics and Gynecology Clerkship  
Obstetric Anesthesia Workbook

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## Rotation Description and Expectations

Obstetric anesthesia is the subspecialty of anesthesia devoted to peripartum, perioperative, pain and anesthetic management of women during pregnancy and the puerperium. The subspecialty is recognized by the ACGME as an accredited fellowship within the specialty of Anesthesiology. For more information on this subspecialty, visit <https://soap.org/>.

During your experience, you will work with OB anesthesia-trained faculty, the OB anesthesia fellow, and residents within the Department of Anesthesiology and Perioperative Medicine at UAB. You will be exposed to patients at all stages of pregnancy and learn the anesthetic management of these patients. This will include peripartum planning and optimization of high-risk obstetric patients, labor analgesic techniques, anesthesia for obstetrical surgery, and management of postpartum complications.

Expectations from you include:

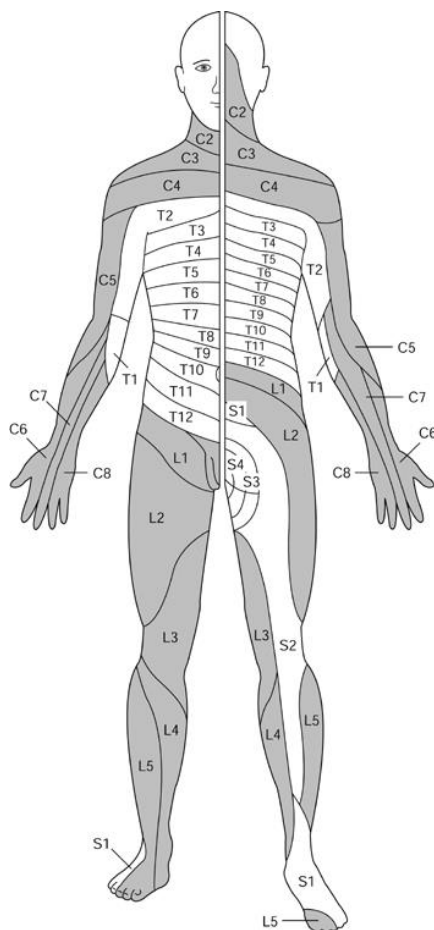
1. Be on time for the start of each day. We have a resident lecture every morning except Tuesday at 0640 in the anesthesia work area of labor and delivery. We expect you to attend this lecture. You can arrive on Tuesday at 0800.
2. Be involved in patient care and ask questions. This will likely be the only time during your medical school training you will see pain management strategies for the parturient. Active engagement in their care will increase your ability to retain this information.
3. Be respectful of the patients and their families. We serve a diverse patient population, with patients coming from different backgrounds; however, all are experiencing a life-changing event. This event might be perceived as positive or negative. As a physician, it is important that we help support them through this time.
4. Communicate any needs you have with our residents, fellow, or faculty. We are here to help with your education. If there is something you need, please let us know.

## Anatomy of Labor Pain

The type and location of pain can change throughout labor. Each patient will perceive pain differently and have a different expectation of pain and pain control during labor. As consultants, we will discuss expectations with each patient and determine an anesthetic plan based on the individual patient's needs. Typically, we attempt to control pain for two stages of labor: Stage 1 and Stage 2. Rarely, do we need to provide pain control after delivery. Each stage of labor is innervated by different nerve fibers and can require an adjustment in medications to effectively relieve the pain. Below is a table that summarizes these stages.

Stage	Cause of Pain	Dermatome Level	Pain Type
1	Uterine contraction and cervical dilation	T <sub>10</sub> – L <sub>1</sub>	Visceral, non-localized
2	Vaginal and perineum distention and injury	S <sub>2</sub> – S <sub>4</sub> (Pudendal nerve)	Somatic, localized

Below is a dermatome diagram demonstrating where sensory loss has to occur to control the pain associated with each stage of labor. The major anatomical landmark to assess the upper limit to produce adequate analgesia (T<sub>10</sub> dermatome) is the umbilicus.



## Local Anesthetics

Effective control of labor pain is accomplished by the use of local anesthetics. Local anesthetics work by inhibiting nerve conduction by blockade of sodium channels on the intracellular portion of the neuronal cell membrane.

There are two main classes of local anesthetics. They are amino-**esters** and amino-**amides** and are named for the type of bond (ester vs. amide) connecting the aromatic ring and hydrocarbon chain. Esters are metabolized by pseudocholinesterase and examples include procaine, chlorprocaine, tetracaine, and cocaine. Amides are metabolized in the liver and examples are lidocaine, bupivacaine, and ropivacaine. Below is a table highlighting properties of common local anesthetics used on labor and delivery. These properties will affect the local anesthetic's onset of action (pKa), potency (lipid solubility), and duration of action (protein binding).

Local Anesthetic	pKa	Relative Lipid Solubility	Relative Protein Binding	Max Dose (mg/kg)
Chlorprocaine	8.7	-	-	12
Lidocaine	7.8	++	++	4.5; 7 (with epinephrine)
Bupivacaine	8.1	++++	+++	3
Ropivacaine	8.1	+++	+++	3

Other medications can be given in combination with the local anesthetics to enhance the block. Common additives include:

1. Opioids: Site of action is on the dorsal horn of the spinal cord. Examples include morphine (water-soluble opioid) and fentanyl (lipid-soluble opioid).
2. Sodium bicarbonate: Increases the pH of the surrounding environment to speed up the onset of action.
3. Epinephrine: Can increase the duration of action of the local anesthetic (vasoconstriction and reduced systemic absorption) and quality of the block ( $\alpha_2$  agonism).
4. Clonidine: Can increase the duration of action and quality of the block ( $\alpha_2$  agonism).

## Types of Neuraxial Blocks

There are three main types of neuraxial blocks used on labor and delivery. The three techniques used are: epidural, spinal, and combined spinal-epidural (CSE). These blocks describe *where* the medication is placed and not the type or reason for the placement of the medication. Each type of block has its advantages and disadvantages. The clinical situation will dictate the type of block performed. These blocks are described below.

1. Epidural: Placement of a catheter or medication into the epidural space. The epidural space is a potential space located between the ligamentum flavum (LV) and the dura mater. Contents of this space include fat, arteries, veins, lymphatics, and nerves. The venous plexus network consists of valveless veins that will distend with increases in intra-abdominal pressure (i.e. contractions). The greatest depth of the epidural space (the distance from LV to dura mater) is located midline between L<sub>2</sub> and L<sub>3</sub> and is approximately 5.0 and 6.0 mm deep.
2. Spinal: Placement of a catheter (rare) or medication into the cerebrospinal fluid (CSF). The spinal space will be anterior (or deep) to the dura mater.
3. Combined spinal-epidural (CSE): Placement of a catheter or medication into both the CSF and epidural space.

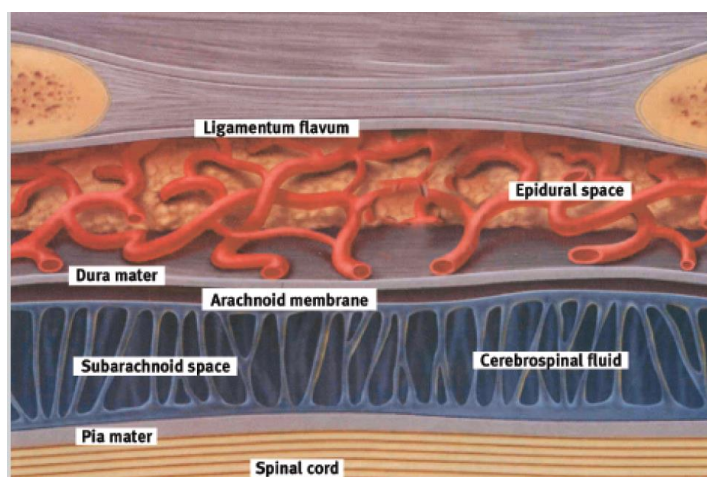


Image: Kalil A. Unintended subdural injection: A complication of epidural anesthesia: a case report. AANA Journal

Neuraxial Type	Advantages	Disadvantages
Epidural	Continuous infusion of medication; control of onset; no dural puncture	Requires large amounts of medications (can increase risk of toxicity); slow onset
Spinal	Reliable block; rapid onset; small amounts of medication	Limited duration (without catheter); dural puncture
Combined Spinal-Epidural	Rapid onset with ability to provide continuous infusion	Inability to immediately test epidural catheter; dural puncture; risk of toxicity

## Treatment of Labor Pain

There are multiple options for the treatment of labor pain. Several of the more common therapies are described below.

- **Neuraxial block:** This is the most common form of labor analgesia with >90% of patients requesting this at UAB. This is achieved by placing a catheter in the epidural space either by an epidural or CSE block. A continuous infusion of a local anesthetic/opioid mixture is administered throughout labor and delivery with a goal of anesthetizing nerve fibers from T<sub>10</sub>–L<sub>1</sub> during stage 1 of labor and T<sub>10</sub>–S<sub>4</sub> during stage 2.
- **Parenteral opioids:** This option is less effective than neuraxial analgesia. The most commonly used opioid at UAB is **fentanyl**. It is highly potent, has a fast-onset and short duration of action, and does not have active metabolites. These properties are what makes it one of the most ideal opioids for labor analgesia. **Remifentanyl** is a highly-potent, rapidly metabolized opioid. It can be used to control labor pain, but because of significant side effects (drowsiness, respiratory failure, and chest rigidity), it is routinely not used at UAB. A secondary opioid used at UAB is **butorphanol** (Stadol), a mixed agonist-antagonist. Morphine, meperidine, and hydromorphone are not used for pain control for labor at UAB.
- **Nitrous oxide:** This modality is safe for both the mother and newborn. Patients report high satisfaction with its use; however, it is not effective at providing significant pain relief. The majority of patients who use nitrous oxide for labor will switch to another pain management technique prior to delivery. This plus the expense of the equipment and need for a scavenging system limits its usefulness, and it is not offered at UAB.
- **Paracervical block:** Pain relief for stage 1 of labor (nerve fibers T<sub>10</sub>–L<sub>1</sub>). This technique will block nerve fibers at the paracervical ganglion (Frankenhauser's ganglion) – located immediately posterolateral to the cervicouterine junction. 5-10 ml of a low-concentration local anesthetic (without epinephrine) is injected bilaterally. Complications of this block include: vaginal mucosal injury, hematoma, neuropathy, abscess, vasovagal syncope, local anesthetic toxicity, direct injection into the fetal scalp and its consequences, and fetal bradycardia (most common fetal complication).
- **Pudendal nerve block:** Pain relief for stage 2 of labor (nerve fibers S<sub>2</sub>–S<sub>4</sub>). The needle is positioned medially and posterior to the ischial spine. The nerve lies in close proximity to the pudendal artery, so aspiration must occur before injection. 5-10 ml of a low-concentration local anesthetic is inject bilaterally. Fetal complications are rare with this block. Maternal complications are similar to that of the paracervical block.

## Anesthesia for Surgical Procedures on Labor & Delivery

There are four common procedures performed on the labor and delivery suite. The table below will list these procedures and considerations for each.

Procedure	Typical Surgical Duration (min)	Required Surgical Level	Neuraxial Type
Cesarean Delivery	45-120 minutes	T <sub>4</sub> -T <sub>6</sub>	Spinal, epidural, or CSE
Bilateral Tubal Ligation	15-30 minutes	T <sub>4</sub> -T <sub>6</sub>	Spinal, epidural, or CSE
Cervical Cerclage Placement	15-30 minutes	T <sub>10</sub>	Spinal
Dilation & Curettage	15-30 minutes	T <sub>10</sub>	Spinal

The table listed above accounts for average surgical cases. There are outliers for every case, so anesthetic determinations are determined on a case-by-case basis. Knowledge of the fundamental properties of local anesthetics (discussed on page 3) and surgical requirements will help the anesthesiologist determine the appropriate local anesthetic and dose to administer for each procedure. As a spinal anesthetic is the most commonly chosen type of neuraxial block for each procedure, the anesthesiologist has to administer a local anesthetic that will reach the appropriate surgical level, provide surgical anesthesia for the duration of the case, and regress at a rate that won't prolong recovery from the block.



## Suggested Reading

- Chestnut DH, Wong CA, Tsen LC, et al. eds. *Chestnut's Obstetric Anesthesia: Principles and Practice*. 6th ed. Philadelphia, PA: Elsevier.
  - Chapter 12: Spinal, epidural, and caudal anesthesia: anatomy, physiology, and technique
  - Chapter 13: Local anesthetics and opioids
  - Chapter 22: Systemic analgesia: parenteral and inhalational agents
  - Chapter 23: Epidural and spinal analgesia: anesthesia for labor and vaginal delivery
  - Chapter 24: Alternative regional analgesic techniques for labor and vaginal delivery