The anesthetic management of uncomplicated labor and delivery using the segmental technique of continuous lumbar epidural analgesia

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Upon reading the Joint Commission on Accreditation of Hospitals' manual, it becomes obvious that the standard for anesthesia care available for the obstetrical service shall be equal to the standard available for the surgical service. As a result, there is an increasing demand by obstetricians for anesthetists who are fully trained in all aspects of obstetrical anesthesia. The anesthesia armamentarium for obstetrical anesthesia is wide ranging: paracervical block; caudal and lumbar epidural block, both single injection and continuous technique; spinal block; inhalation analgesia; and general anesthesia.

This article focuses on continuous lumbar epidural (CLE) analgesia using the segmental technique. The segmental technique refers to the practice of blocking selected spinal nerves during the different stages of labor. Spinal nerves from T₁₀ to L₁ are blocked in the first stage of labor and spinal nerves S₂-₅ are blocked in the second stage of labor.

The safety of CLE for both the mother and fetus has been well documented. In a protracted, painful labor, CLE frequently allows uterine contractions to become more coordinated. It can reduce the incidence of metabolic acidosis and prevent decreases in uterine blood flow resulting from high endogenous catecholamines. CLE is a technique that allows excellent control of both the intensity of analgesia and the area of analgesia coverage. This safety and precision, when coupled with extended time intervals, makes CLE an excellent choice for analgesia in labor and delivery.

There is a subtle difference in administering anesthesia for labor that has to be appreciated if misunderstanding and conflict between obstetrician and anesthetist is to be avoided. This difference is that the goal is minimal sensory analgesia, not profound anesthesia as administered during surgery. Sensory analgesia allows the mother to participate in labor. It does not increase the incidence of transverse arrest, posterior presentations, and forceps applications.

The laboring mother and expectant father want to participate in the birthing process. They often have been to prenatal classes and are aware of media reports extolling the benefits of natural childbirth. It is not proper for anesthetists to administer anesthesia to the degree where this desire is thwarted. With properly administered CLE, the laboring mother should be able to feel perineal and abdominal pressure during contractions, be able to push during the second stage of labor, and most importantly—not feel she is a failure as a mother and as a woman because she received anes-
Anesthesia. The importance of this participation has been well documented.20,21

One of the cardinal maneuvers of labor is internal rotation, whereby the occiput of the fetus is forced by uterine contractions against muscles of the pelvic floor, principally the levator ani, and rotates more towards the symphysis pubis. This maneuver is necessary for delivery except in small neonates. If there is premature motor blockade of these pelvic muscles the tonus is reduced and the presenting part, instead of meeting resistance to rotate against, encounters a flaccid muscle. Consequently, transverse arrest or posterior presentations are possible complications. Internal rotation normally does not occur in about 5% of parturients who have received no anesthesia.22

Anesthetic agents

Currently, the drug of choice for CLE is bupivacaine. Bupivacaine binds to maternal plasma protein to such a high degree that there is either none available for fetal circulation or if there is any present in the fetus, it is in minute amounts.28 Results of newborn neurobehavioral tests on neonates whose mothers had received bupivacaine for CLE during labor were equal to neonates whose mothers had received no anesthesia.23,24

Lidocaine and mepivacaine, since they are not as highly bound to maternal plasma protein, rapidly cross the placental barrier and may be detected in the fetal circulation for as long as eight and 24 hours, respectively, after birth.28

Recently, there have been several published reports concerning major CNS sensory and motor deficits following the use of 2-chloroprocaine.26,27 Consequently, this drug is not being used to the extent that it previously had been.

Anesthesia management

The following analgesic technique can be used during an uncomplicated labor. Prior to beginning CLE, the status of the IV infusion is noted and increased if necessary for hypotension prophylaxis and the history and physical are reviewed. The analgesia is explained to both the mother and father. They are told that following pain relief, there will still be perineal pressure during contractions. Lastly, the parents are reassured that their contributions during the labor process are extremely important.

The CLE needle and catheter are inserted and secured as previously described.9 The parturient is placed in a relatively supine position with the right hip elevated for uterine displacement. The catheter is then aspirated for blood or cerebral spinal fluid and if none is observed, a 3 ml test dose of 0.25% bupivacaine is injected.28 A vascular injection should be noted in less than a minute and an intrathecal injection usually within five minutes. During this time, a fetal monitor tracing is observed for any signs of fetal distress and the blood pressure is taken frequently to detect any signs of aortal-caval compression or hypotension.

If the parturient's condition is stable after five minutes, the remainder of the anesthetic solution, 4 ml of 0.25% bupivacaine, is injected. On those infrequent occasions when 0.5% bupivacaine is used, the test dose is 2 ml and after five minutes, a further 2 ml is injected. These volumes produce adequate sensory analgesia, thus avoiding motor blockade. The importance of only producing sensory analgesia and avoiding motor blockade is crucial and cannot be over-emphasized.

The pain of the first stage of labor (dilatation stage) arises primarily from dilatation of the cervix and lower uterine segments and enters the spinal cord between T10 and L1.29 Occasionally, pain in the groin during an otherwise satisfactory block may be due to stretching of the round ligament during contractions with the noxious stimuli entering the spinal cord at T8.9 If the L4-5 interspace is used and the catheter advanced 5 cm cephalad, the tip of the catheter should be approximately at the L1-2 interspace. Since it only requires approximately 1.5 ml per dermatome,30 7 ml of 0.25% bupivacaine should be adequate for sensory analgesia.

During the next 15 minutes, the fetal monitor is observed and the blood pressure checked frequently. If the perineal pressure during contractions is too intense, an additional 2 ml of 0.25% bupivacaine is administered. The parturient is cautioned not to lie supine. Analgesia should last about 90 minutes; however, it can range from 45-180 minutes. The timing of repeat injections and the volume injected is dependent on the clinical response.

Analgesia is allowed to wear off when the parturient reaches complete dilatation, thus ending the first stage of labor. Although analgesia is no longer present, the pushing effort seems to obviate the pain somewhat. Also, the pain from cervical dilatation is no longer present.

Pain during the second stage of labor (expulsive stage) is caused by distention of the lower birth canal, vulva and perineum. Nerves from these structures enter the spinal cord between S2-5.9 Once the presenting part is on the perineum, the bed back is elevated, a test dose is given, and after waiting several minutes, 12 ml of 0.25%
bupivacaine is injected. The parturient is allowed to sit, time permitting, for gravity to assist caudal spread of the anesthetic solution.

If the time factor does not allow the patient 10 minutes for sitting, local infiltration may be necessary to perform an episiotomy. Anesthesia for the episiotomy repair should be satisfactory. Most obstetricians do not object to the occasional need for local infiltration since the enhanced pushing ability reduces the need for forceps application.

After delivery, the epidural catheter is removed. There are no restrictions on post-partum activity because of the CLE.

Complications

Although CLE is an excellent choice for labor and delivery, there are complications and disadvantages encountered with the technique. These include catastrophic CNS problems, total spinal anesthesia, convulsions, hypotension, increased incidence of forceps application and posterior presentations, cessation of labor and the inability to push.

The first three complications (catastrophic CNS problems, total spinal anesthesia and convulsions), while major problems, are rare. These problems are discussed in a definitive manner in several excellent publications. It is mandatory that equipment and protocol for resuscitation be immediately available.

Hypotension, while potentially a severe problem, can also be an insidious problem in obstetrics - insidious because maternal blood pressure may be adequate but uterine blood pressure and perfusion pressure may be inadequate for fetal safety. Numerous studies have explained aortal-caval compression and hypotension in labor and their treatment. It is recommended that IV hydration of 500-1000 ml of a balanced salt solution be infused prior to starting CLE and left uterine displacement, either by placing the parturient on her left side or by elevating her right hip. Usually these actions will prevent or correct any hypotension. If a vasopressor must be given, ephedrine is the drug of choice since it does not reduce uterine blood flow.

It has been shown that initiating CLE after the parturient is in the active stage of labor (4-5 cm in a multigravida and 5-6 cm in a primagravida) does not result in a cessation or prolongation of the first stage of labor. The earlier that CLE is begun prior to entering the active stage of labor, the greater is the possibility for slowing labor. If the parturient is in extreme discomfort and understands that labor may have to be augmented with oxytocin (Pitocin®), many obstetricians choose to initiate CLE early. Conversely, if a parturient has been in a protracted painful labor with only minimal cervical dilatation, by relieving the pain, CLE has frequently resulted in a rapid complete dilatation.

The second stage of labor, the expulsive stage, may be prolonged due to a decreased urge to push and extensive motor blockade of the abdominal muscles. Transverse arrest, posterior presentations and the inability to push during the second stage of labor are complications that have probably resulted in more distress by obstetricians, refusal to allow CLE to be administered, and questioning of analgesia management than any other factors associated with CLE. Unfortunately, obstetricians are frequently correct about anesthesia interfering with the normal progress of labor. While these problems are not always the result of anesthesia mismanagement, they are frequently caused by too concentrated an anesthetic solution and too large an anesthetic volume being injected. This results in an inappropriate motor blockade of the muscles of the pelvic floor and abdomen.

Conclusion

This article should not be construed as presenting the only acceptable management technique for labor. This management regimen does achieve the goals of safety for the mother and fetus while providing sensory analgesia and preventing unnecessary motor blockade during labor. Lastly, this management technique establishes a starting point from where the anesthetist can make necessary modifications in any particular situation.

REFERENCES


**AUTHOR**

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