Moving Beyond the Debate: A Holistic Approach to Understanding and Treating Effects of Neuraxial Analgesia

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ABSTRACT: Neuraxial analgesia is here to stay, yet, spirited debate continues over potential harms and the quality of research that fails to identify them. This paper proposes moving beyond the debate and examining holistically the impact of neuraxial analgesia on the psychophysiology of mother and baby. A review of alterations in functioning of many systems is followed by a suggested four-part protocol to partially restore normal physiology and emotional well-being, and improve outcomes of neuraxial analgesia. (BIRTH 39:4 December 2012)

Key words: cardiovascular system, emotional needs, endocrine system, epidural analgesia, fetus, genitourinary system, musculoskeletal system, nervous system, neuraxial analgesia, newborn, side effects, undesired effects

And so these men of Indostan
Disputed loud and long,
Each in his own opinion
Exceeding stiff and strong,
Though each was partly in the right,
And all were in the wrong! (1)
–From “The Blind Men and the Elephant,” by John Godfrey Saxe, American Poet (1816–1887)

Over the past decade, the term neuraxial analgesia has replaced epidural or spinal in the anesthesia literature. This umbrella term covers the genre of pain relief techniques that employ opioids, with or without local anesthetics that are injected or continuously infused into the intradural or extradural space. (See the list of different forms of neuraxial analgesia, below). A spirited debate over the scientific validity of studies examining the effects, advantages, disadvantages, benefits, and harms of epidural or neuraxial analgesia has raged since the 1960s, when it became widely available. Although the benefits of excellent pain relief, mental awareness, and an opportunity to rest are agreed on, the trade-offs are where enormous disagreement lies. Does neuraxial analgesia increase labor dystocia, fetal malpositions, maternal fever, fetal intolerance of labor, cesareans, instrumental deliveries, low Apgar scores, neonatal intensive care unit admissions, perineal damage, breastfeeding difficulties, and other adverse outcomes? Research findings on these questions and many others are inconsistent, and the quality of the research studies is equally inconsistent.

Disagreement persists partly because of the enormous challenges of conducting generalizable research on neuraxial analgesia. Background conditions in the research hospitals, such as “usual care” policies, presence of midwives, and rates of interventions and surgery, vary and will influence the external validity of findings. Furthermore, ethical considerations must allow women to “cross-over” from one assigned group to another, and outcomes must be reported according to their assigned treatment group rather than according to the actual treatment received. Cross-over rates are generally high, leaving interpretation of the results confusing or

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meaningless. These problems and many others are well described in the literature (2–5).

The different perspectives among maternity care practitioners, scholars, researchers, and the public bring to mind the well-known Indian parable, “The Blind Men and the Elephant” (1). Briefly, it goes like this: A group of blind men examined an elephant by touch, to learn what an elephant is like. Each one felt a different part of the elephant’s body, and based his impressions of the whole elephant on the one part. For example, the one who felt the tail described the elephant as a rope; he who felt the trunk said it was a tree branch; he who felt the ear said it was a fan; he who felt the leg said it was a tree; and so on. The verse, quoted at the beginning of this article, describes the ensuing heated debate over what an elephant is.

Neuraxial analgesia encompasses a variety of techniques, all of which involve the neuraxis, listed as follows (6): spinal anesthesia, intrathecal opioids, epidural opioids, patient-controlled epidural analgesia, standard epidural, segmental epidural, and combined spinal-epidural.

Attempts to understand the truth about neuraxial analgesia resemble the parable—looking at the bits (the desirable and undesirable effects) instead of how it affects the whole fetoplacental-maternal unit. We are missing the “elephant” for its parts.

A more holistic approach includes, first, focusing on the physiology of the maternal-fetal-placental unit in pregnancy and labor; second, reviewing alterations in physiology caused by neuraxial analgesia; third, considering simple practices or interventions to reduce some of the undesirable effects; and fourth, understanding the psychological and emotional challenges of laboring women—even though they have no pain—to increase their sense of accomplishment and satisfaction with their birth experience. We should not assume that a pain-free woman needs little attention to her emotional needs.

My contention is that not all the problems with epidurals result from the analgesia, but some may be created or exacerbated by the management that accompanies them.

Physiological Adjustments That Support Fetal Growth and Well-Being

The dramatic physiological shifts taking place in the mother and her growing fetus during pregnancy improve her tolerance of the physiological burden of growing a fetus and newborn and enhance their chances of survival and good health. Every maternal organ system adapts to meet the fetus’s needs. Then, in late pregnancy, the fetal lungs mature and initiate a cascade of hormones from the fetal hypothalamus, pituitary, and adrenal glands that climaxes in labor and birth. In a complex series of events, the contributions from the fetus and placenta combine with the mother’s physiological and psychological resources, resulting in a well-orchestrated process that ends with a robust alert newborn in the arms of a tired but eager mother. If the couple is relatively undisturbed and undistracted, another flood of hormones—beta-endorphins, oxytocin, catecholamines, and prolactin—binds them together while they employ all their senses in getting to know one another (7).

This elegant process is usually reliable, and even works pretty well when the laboring woman’s activities, such as walking, moving freely, eating, and drinking, are restricted, and when additional interventions and medications are used. Side effects exist, however, and the challenge with elective interventions is to understand how the normal process is altered, and to recognize the trade-offs—what is gained and what is lost. This knowledge may enable reduction or elimination of some undesired side effects, or replacement of the intervention with a more acceptable alternative. Neuraxial analgesia, widely used during normal labors, would benefit from this type of analysis.

Multisystem Effects of Neuraxial Analgesia in Labor

Although described as regional analgesia, meaning that only a portion of the body is affected by neuraxial analgesia, the effects are ubiquitous and alter most organ systems. A summary follows of some of those effects on different physiological systems: the endocrine system, the central and peripheral nervous systems, the cardiovascular system, the musculoskeletal system, and the genitourinary system.

The Endocrine System

Three major hormones—oxytocin, beta-endorphins, and catecholamines—and the delicate interplay among them have an enormous influence over such crucial factors as labor progress; the woman’s mental state throughout labor; her level of alertness; pain tolerance; energy; capacity to expel her baby; entrainment and mutual regulation between mother and baby; and the mother’s capacity to feed her baby. Loneliness, fear, anger, systemic illness, and some drugs such as synthetic oxytocin, epinephrine, tocolytics, and others result in inhibition, overproduction, or imbalance among these hormones. In addition, it is clear that neuraxial analgesia, containing sufentanil or fentanyl, and the “-caine” family of anesthetic agents, also disrupts these hormonal interactions (8).

Neuraxial analgesia often slows normal labor by blocking the normal oxytocin surge and resulting
spontaneous expulsive efforts of second stage (8). Maximum maternal effort and instrumental delivery or a cesarean delivery are often required to expedite the birth. Furthermore, the normal late-labor catecholamine surge, which causes maternal alertness and a burst of energy needed to expel the baby, is blocked by neuraxial medications. Finally, also blocked is production of beta-endorphins, the body’s own narcotic-like pain relievers, which foster a sense of well-being and instinctual behavior, and euphoria after birth (7,8).

On the other hand, first-stage labor progress is sometimes slowed abnormally by extreme fear or distress, which may lead to an abnormally high production of maternal catecholamines (the “fight-or-flight” response). Although normal and beneficial in late labor, high catecholamine levels earlier in labor can decrease uterine blood flow and prolong labor. In such cases, neuraxial analgesia reduces catecholamine production, especially epinephrine, causing, in effect, a “mind-body split,” which, according to anecdotal reports, seems to allow progress to improve. This same catecholamine-reducing phenomenon may, however, also lead to fetal bradycardia. Although the mechanism for this effect is not clear, one hypothesis states that the sudden drop in circulating epinephrine (especially after intrathecal opioid administration) may increase uterine tone to unsafe levels, and ultimately result in fetal bradycardia. The size of the effect varies, and it is usually temporary (6).

The Central Nervous System and Peripheral Nervous System (Sensory, Motor, and Autonomic, Which Includes the Sympathetic and Parasympathetic Nervous Systems)

Depending on the placement of the neuraxial analgesic “cocktail” (within the dural sac or extradurally), transmission of sensory and motor impulses is blocked or diminished either from within the central nervous system (as with intrathecal opioids and spinal anesthesia) or within the peripheral nervous system (as with epidural opioids, the segmental or standard epidural block). The combined spinal-epidural analgesia affects transmission in both systems. The opioid agents (e.g., fentanyl or sufentanil), whether given intrathecally or epidurally, also reach the woman’s brain by means of the circulation, and may depress respiration. Nausea, itching, and mild sedation also may result from the opioids reaching the central nervous system. The fetus and newborn also receive these medications (see below). Effects are dose-dependent.

The pain-relieving success of neuraxial analgesia comes from blocking transmission of pain and other impulses over the sensory neurons that connect muscles and organs with the spinal cord and brain. Sensation is blocked throughout the mid-trunk and reduced in the lower body, giving relief from labor pain. The accompanying motor block decreases the woman’s control over movements in her lower body and decreases pelvic floor muscle tone. Blocking the parasympathetic nervous system results in decreased uterine contractility; alterations in temperature regulation; vasodilation in the affected areas; and reduced ability to dissipate heat because no sweating occurs in the affected areas. These effects, some of which are dose-dependent and duration-dependent, contribute to maternal and fetal pyrexia and fetal tachycardia (6,9).

The Cardiovascular or Circulatory System

Hypotension occurs secondary to the vasodilation in the part of the body affected by analgesia. Higher concentrations of medication appear to increase the likelihood of this side effect, and it is also more severe if the woman is supine. A secondary effect of maternal hypotension is inadequate perfusion of the placenta, which is evidenced by nonreassuring fetal heart tones.

The Musculoskeletal System

Effects of motor nerve blockage include reduction or loss of the woman’s control over voluntary muscles in her middle and lower trunk, and her legs are temporarily weakened or paralyzed. Bearing-down efforts are less effective. Pelvic muscle tone is reduced, which impairs fetal rotation and increases the risk of occiput posterior position at delivery (10). Delaying bearing-down efforts until the fetal head is visible at the introitus reduces the likelihood of occiput posterior at delivery (11). Use of gravity-enhancing positions and movements is impossible or possible only with assistance. The extent of these effects varies with the route of administration, selection of medication, dosage, and duration of administration of the analgesic medication (11).

Injury to pelvic floor musculature and anal, urinary, and flank incontinence are all increased by the kind of pushing usually required of women (prolonged maximal breath holding and straining), and the increased incidence of fetal malposition at delivery, which requires instrumental delivery (10–12).

The Genitourinary System

The lack of sensation from the woman’s bladder and inability to void voluntarily increase the possibility of
urinary retention or bladder distention during and after labor. The woman requires careful observation for evidence of bladder distention, monitoring of fluid intake and output, and continuous or periodic catheterization to empty her bladder. In addition, secondary to the increased need for instrumental delivery, the chances of perineal trauma are increased, including third- and fourth-degree lacerations. The likelihood of urinary and anal incontinence increases after instrumental delivery (12).

What about the Fetus and Newborn?

Direct effects on the fetus and newborn of the medications used in neuraxial analgesia are difficult to identify, partly because of the low doses used (compared with systemic opioids), and the low rates of transfer across the placenta. Fentanyl and sufentanil are detectable in newborn blood for a day or more. Because of numerous confounding variables, it is not possible to quantify direct effects on the newborn, although studies of breastfeeding initiation and the newborn’s neurobehavior raise some concerns about difficulties in establishing breastfeeding (2). Indirect effects on the newborn, however, have been clearly demonstrated and are significant (2). Maternal fever may lead to fetal hyperthermia, tachycardia, and possible surgical delivery. Epidurals are associated with a significant increase in cesarean deliveries for fetal distress (4). The use of synthetic oxytocin increases risks of uterine hyperstimulation and fetal intolerance of labor. The higher rate of fetal malposition at birth and the mother’s less effective expulsive efforts lead to more instrumental deliveries (4, 8, 10, 12) and possible injury to the newborn.

The mother with neuraxial analgesia is not flooded with oxytocin and beta-endorphins at birth (7) and may experience a more muted immediate response to her newborn, although the significance of such an effect is unclear. Until the extent of these newborn effects (direct or indirect) has been clarified, it seems wisest to provide conditions to foster optimal mother-infant interactions—skin-to-skin contact, unrushed baby-led or “laid back” breastfeeding opportunities, quiet dim-lit undisturbed surroundings that allow for unobtrusive assessment of the newborn, and postponement of procedures and separation. These practices enhance maternal and newborn adaptation and mutual regulation (13, 14).

Can Changes in Obstetric Management Reduce Problems of Neuraxial Analgesia?

Neuraxial analgesia is here to stay. Although the debate on true effects will and should continue, more attention must be given to other questions. Can some of the disruption in labor physiology be prevented or reversed by different management? Can different management reduce some of the undesired effects of neuraxial analgesia, improve some outcomes, lower costs, and increase the woman’s participation in the process? If nonpharmacological approaches to maintain labor progress and relieve other symptoms were included in management, might some benefits result? Following is a four-part management proposal for maternity health practitioners:

1. Inform the woman ahead of time, in complete childbirth education classes and prenatal discussions between the woman and her caregiver, with a) the standard information on risks and benefits; b) complete explanations of how the analgesia is administered; and c) the package of hospital policies and procedures (often surprising to the woman) required to ensure that it is a safe procedure (i.e., intravenous fluids and synthetic oxytocin, continuous electronic fetal monitoring, limitation of movement, bladder catheterization, frequent blood pressure monitoring, pulse oximetry, and others). In addition, describe some common although potentially frightening or disturbing effects (e.g., actions required if there is a drop in the woman’s blood pressure or fetal bradycardia; difficulties or frustrations over pushing without sensation; newborn care practices if fever has occurred). Forewarned is forearmed, and unpleasant surprises and maternal distress may be reduced.

2. Try to shorten the duration of exposure by delaying the administration of neuraxial analgesia. Some side effects develop and worsen with time, such as slow labor progress; maternal fever; fetal tachycardia; increasing motor loss in lower limbs; possible need for cesarean (although this is controversial) for poor progress, fetal malposition, or fetal intolerance of labor; and delay in successful breastfeeding. If labor is intolerable, however, an epidural should not be delayed (15).

3. Treat the woman as much as possible like a person who does not have an epidural. Adopt practices that encourage behavior resembling what women do when not anesthetized, for example:

- Employ cooling measures as soon as the woman’s temperature begins to rise (do not wait until it reaches clinical fever temperature), with cool packs over the parts of her body where sensation is normal, an electric fan, lowering the room temperature, and removing blankets. (This practice has not been scientifically evaluated, and definitely merits controlled...
investigation of whether it results in fewer maternal and neonatal fevers, fewer neonatal intensive care unit admissions, fewer fetal occiput posterior positions, and less use of antibiotics to the mother and newborn) (2,16).

- Provide the woman with beverages in small amounts for her comfort and sense of normalcy (17).
- Keep the woman moving as safety permits; for example, use the “rollover,” in which she spends 30 minutes in each of the following positions: 1) semi-reclining; 2) left side-lying; 3) left Sims’ (semi-prone, with upper hip and knee flexed); 4) kneeling on the lowered foot of the bed and leaning forward onto a pile of pillows, or kneeling over a birth ball; 5) right Sims’; and 6) right side-lying. Of course, if she has too little muscle tone or the fetus does not tolerate one or more positions, use the other positions. Pelvic shape and gravity effects are altered with the rollover. Recruit her support team to help her with position changes. If she is exhausted and needs sleep, you should not waken her to change positions so often (18). (Such a protocol has not been studied and deserves scientific evaluation of its effects on fetal position, labor progress, and mode of delivery.)
- Delay maternal bearing down until the fetal head is visible, or the woman has an urge to push (11).
- Once the woman begins pushing, model for her how to push like a woman who is pushing spontaneously without an epidural—breath holding and straining for 5 to 7 seconds, then taking 4 to 6 quick breaths, and bearing down again. She should repeat these actions until the contraction wanes. Keep an eye on the contraction monitor and give her feedback on how the numbers go up as she bears down, and how much she adds to the intensity of the contractions. This approach is far more motivating and empowering than requiring constant straining for 10 seconds at a time.
- During labor, avoid twisting the woman’s trunk while helping her to change positions. During pushing, if supporting her legs, respect the limits of her hip and knee joints and low back by not spreading her legs as far apart or as close to her ears as possible. These precautions may avoid damaging her joints, which she would not feel until afterwards. Thirty to fifty percent of women report backache after childbirth (6). Perhaps some backache is caused unintentionally and is preventable.
- Place the baby skin-to-skin with the mother, and do assessments and procedures while they are together. Allow plenty of time for un rushed breastfeeding, with minimal instruction or handling of her breasts (14).

4. Attend to the woman’s emotional needs. The staff and her partner are likely to assume that because she has no pain, she is emotionally content (19). Although they are very glad for the pain relief, many women still have distress over other things, which may leave them feeling lonely, worried, disappointed, or even mistreated. Here are some examples of emotionally stressful events associated with the use of neuraxial analgesia:

- Having to wait for an available anesthesiologist
- Administration of the epidural, especially if it does not go in smoothly
- Surprise or shock over the many safety precautions or interventions (listed above)
- Feeling alone, if her partner and nurse go out of the room, leaving her with no one to talk to or to ask for small comforts (sip of water or ice chips, extra pillow, etc.)
- Little control over what is done to her, and passive cooperation while the nurse makes all decisions (regarding drinking, changing position, and others)
- Helplessness and immobility; discomfort with numbness, itching, nausea, breakthrough pain
- Fright when the staff rush in to correct her drop in blood pressure and in the fetal heart tones
- Worries about the baby’s well-being; impatience over the length of labor
- Tension, anxiety if her temperature is beginning to rise, or the baby is becoming tachycardic; feeling incompetent and frustrated over difficulty with pushing, being directed to “Push, Push, Push” when she feels she is pushing as hard as she can.

Few studies have been done of women’s emotional responses with neuraxial analgesia during labor. One, however, found that although pain decreased markedly when women received an epidural, their distress levels did not, and were actually similar to those of women without epidurals. In other words, the women’s distress over their pain shifted to concerns over other things (such as those described above) after the epidural (19). Another study of nulliparas’ experiences of labor with an epidural found that the women were pleased with the pain relief and stress reduction it provided, but some felt unsettled or ambivalent afterwards. These experiences were caused by two main factors: the
attitudes, actions, and treatment by health caregivers; and insufficient knowledge about side effects and how these are managed. The authors concluded that the epidural “does not guarantee a quality birth experience” (20). The take-home message from these studies is that women still need education and emotional support for satisfaction with childbirth, even if they are free of pain.

**Restoring Women to a Central Role**

Studies of neuraxial analgesia have not brought people closer to agreement on its safety, its side effects, and its role, direct or indirect, in causing untoward outcomes. Supporters of routine use of neuraxial analgesia in early labor clash with those who advocate lower rates and later administration. Each side has produced evidence supporting its point of view, and has argued that their opponents are wrong, like the blind men and the elephant.

The intention here is not to add fuel to the controversy. Rather, it is to suggest that it is time to shift the focus from the parts—the end effects—to the whole body and psyche of the maternal-fetal-placental being, and how it is transformed by neuraxial analgesia. This more holistic approach provides a context for understanding side effects and encourages constructive efforts to prevent these effects by preserving normal physiological function as much as possible. The goal, of course, is to avoid some of the riskier interventions by maintaining normal physiology where possible. This approach restores the woman to a central role. When she becomes more active in her labor and receives attention to her psychological needs, some outcomes will improve and her satisfaction will be enhanced.

**References**