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## EPIDURAL ANALGESIA IN LABOR – CONTROVERSIES

Nada Bilić<sup>1</sup>, Ivka Djaković<sup>2</sup>, Katarina Kličan-Jaić<sup>1</sup>, Senka Sabolović Rudman<sup>2</sup> and Željko Ivanec<sup>1</sup>

<sup>1</sup>Department of Anesthesiology and ICU, <sup>2</sup>Clinical Department of Gynecology and Obstetrics, Sestre milosrdnice University Hospital Center, Zagreb, Croatia

**SUMMARY** – Labor pain is one of the most severe pains. Labor is a complex and individual process with varying maternal requesting analgesia. Labor analgesia must be safe and accompanied by minimal amount of unwanted consequences for both the mother and the child, as well as for the delivery procedure. Epidural analgesia is the treatment that best meets these demands. According to the American Congress of Obstetrics and Gynecology and American Society of Anesthesiologists, mother's demand is a reason enough for the introduction of epidural analgesia in labor, providing that no contraindications exist. The application of analgesics should not cease at the end of the second stage of labor, but it is recommended that lower concentration analgesics be then applied. Based on the latest studies, it can be claimed that epidural analgesia can be applied during the major part of the first and second stage of labor. According to previous investigations, there is no definitive conclusion about the incidence of instrumental delivery, duration of second stage of labor, time of epidural analgesia initiation, and long term outcomes for the newborn. Cooperation of obstetric and anesthesiology personnel, as well as appropriate technical equipment significantly decrease the need of instrumental completion of a delivery, as well as other complications encountered in the application of epidural analgesia. Our hospital offers 24/7 epidural analgesia service. The majority of pregnant women in our hospital were aware of the advantages of epidural analgesia for labor, however, only a small proportion of them used it, mainly because of inadequate level of information.

**Key words:** *Analgesia, epidural – utilization; Labor pain; Analgesia, epidural – contraindications; Labor onset; Delivery, obstetric – instrumentation; Labor stages*

### Introduction

The perception of pain in labor is extremely variable depending on the individuals' reaction to the phenomenon of pain and pain threshold<sup>1</sup>. There is no explanation for labor pain, although the Bible offers a reason. Midwives were burned at the stake in the 15<sup>th</sup> century if they offered labor analgesia<sup>2</sup>. Any entanglement in labor was considered unnatural, dangerous and morally questionable. Great change in the

application of labor analgesia occurred in 1847 when James Simpson applied ether during delivery, whereas in 1853 John Snow applied chloroform in Queen Victoria's labor<sup>3</sup>.

In order to apply it appropriately, it is essential to know the effects of analgesia on the dynamics of labor, uterus, abdominal musculature, condition of the mother and the baby, as well as the possible complications<sup>4-6</sup>. The ideal labor analgesia must be both efficient and safe, with minimal effect on the course and completion of labor, and without negative influence on either the newborn or the mother.

Development of modern analgesic pharmacology and regional anesthesia marked the beginning of the new modern age with attenuation of pain in labor<sup>7-11</sup>.

Correspondence to: *Nada Bilić, MD*, Department of Anesthesiology and ICU, Sestre milosrdnice University Hospital Center, Vinogradska c. 29, HR-10000 Zagreb, Croatia  
E-mail: drnadabilic@gmail.com

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## Epidural Analgesia: Mechanism, Indications and Contraindications

According to the International Association for the Study of Pain definition, pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage<sup>12</sup>.

Due to the contraction of uterus and dilatation of cervix in the first stage of labor, pain is transmitted by visceral afferent (sympathetic) nerves (Th10-L1), while in the second stage of labor due to the descent of the fetus through the soft birth canal and expansion of the perineum, pain is transmitted by pudendal and sacral nerves (S2-S4)<sup>13,14</sup>. Due to this stressful experience, the mother's body responds with an increased release of cortisol, noradrenaline, beta-endorphin and adrenaline<sup>15-19</sup>. The release of adrenaline postpones delivery. The increase in the level of noradrenaline by 25% decreases uterine blood flow by 50%. The mother's cardiac output, systemic vascular resistance and oxygen demand increase, which can be of importance in managing laboring women with cardiac and pulmonary disorders<sup>15,18,20,21</sup>.

Parenteral opioids, nitrous oxide, low-dose sevoflurane, hypnosis, acupuncture, hydrotherapy, transcutaneous neural stimulation and central neural analgesia are all applied in labor analgesia<sup>22-26</sup>.

Epidural analgesia (EA) is, according to conducted research, the method of choice for diminishing pain efficiently without any significant influence on other functions. It lowers the risk of respiratory depression and unwanted sedation, in comparison to parenteral and inhalational analgesia, while at the same time increasing the uteroplacental blood flow and improving oxygenation of the fetus and the mother<sup>15,27-30</sup>.

The use of regional analgesia may be contraindicated in the presence of severe coagulopathy, acute hypovolemia, or infection at the site of needle insertion. Chorioamnionitis itself, without frank sepsis, is not a contraindication for central neuraxial blockade in obstetrics<sup>1</sup>.

In the absence of medical contraindication, maternal request is a sufficient medical indication for pain relief during labor<sup>63</sup>.

## Epidural Analgesia: Characteristics, Technique, Drug Application and Complications

The following drugs are used in EA: local anesthetics, opioids, alpha-adrenergic antagonists, and anticholinergics<sup>35-43</sup>. The application of EA in laboring women is technically more demanding and associated with a higher risk than its application in general population<sup>4</sup>. The positioning is difficult due to the presence of distended uterus. Bone orientation can be concealed due to the increase in body weight. However, detailed knowledge of the pregnancy-related variability of the lumbar spine anatomy and its flanking ligaments is not available. At our department, parturients often present with abnormal anatomic conditions such as scoliosis, hyperlordosis or kyphosis of the lumbar spine, obesity or local edema, which can obscure anatomical landmarks. Additionally, hormonal changes during pregnancy result in alteration in tissue consistency. Collagen concentration and organization, relative molecular proportions and water content of the tissue are altered<sup>31,32</sup>. Subsequently, the structure of the interspinous ligament becomes softer and inhomogeneous. This often causes false loss of resistance, which can lead to malplacement of the epidural catheter. The increased abdominal pressure is transferred onto the epidural and subdural space. Epidural veins are varicose and can be easily injured during puncture. The risk of vascular lesion is 10%-20%, while it is only 1% in the general population<sup>4,44,45</sup>. The epidural space is reduced, which can induce a smaller quantity of anesthetic solution. The method of choice for the application of anesthetic is the epidural catheter positioning from L2 to L4, 4 cm deep, with a goal of analgesia up to Th10. The puncture is applied in a seated or lateral decubitus position, with prior disinfection and local dermal anesthesia, and infusion of crystalloids. After the identification of the epidural space with loss of resistance or pendant drop method, the catheter is placed at the desired depth (2-5 cm). At first, a test dose is applied through the catheter (with 2-3 mL 2% lidocaine with 5 mcg/mL adrenaline), and if no negative reaction to the test dosage is observed in 5-10 minutes, an initial dose of a local anesthetic with an opioid is applied (10 mL bupivacaine 0.125%-0.25% with 2 mcg/mL fentanyl and 4 mcg/mL adrenaline)<sup>46,47</sup>. The analgesia can be maintained in three ways: by intermittent boluses, continuous an-

algnesia and patient-controlled analgesia (PCEA)<sup>15,46</sup>. If low doses of local anesthetics are used for PCEA, the patient can be active until second stage of labor (walking anesthesia). This method has positive effects on pain with small amounts of drugs<sup>13,33,34</sup>.

Besides EA in labor, spinal analgesia can be applied alone or as combined spinal-epidural analgesia. Spinal analgesia relieves pain fast and is recommended in the last two hours of labor. The possible complications are hypotension and fetal bradycardia<sup>13,46</sup>. Combined spinal-epidural analgesia has advantages of both methods. Spinal analgesia provides fast sacral block and tranquilizes patient, while EA provides pain relief<sup>4,42,45</sup>.

The largest prospective study of complications in epidural and spinal anesthesia conducted so far has shown that major complications occur at a rate of less than 1:20000<sup>47,48</sup>. Early complications are low blood pressure (up to 80% of cases), malplacement of the catheter in the blood vessel, intrathecal entry of either the needle or the catheter (1%-2%), shimmering, and failed block or unilateral block. Late complications of EA are epidural hematoma (1:168000), epidural abscess or meningitis (1:145000), transitory neurological deficit (1:6700), permanent neurological deficit (1:240000), and headache (1%-3%)<sup>49</sup>.

Epidural analgesia can be amplified to epidural anesthesia if the delivery does not develop satisfactorily or there is a risk to the fetus. Elective cesarean section is rarely performed under epidural anesthesia. Regularly, there is sufficient time (15-20 min) for the bolus of an anesthetic of a higher concentration that induced epidural anesthesia (for instance, bupivacaine 0.5% 10-20 mL). If we wish to accelerate the anesthesia, a bolus of 1.5% lidocaine 10-15 mL with Na-bicarbonate 8.4% 0.5 mL/10 mL solution can be applied. Occasionally, surgery is urgently required and there is no time to wait, so it has to be conducted under general endotracheal anesthesia<sup>50,51</sup>.

### Epidural Analgesia Controversies

The application of EA in labor is a relatively novel procedure, so it is not possible to make any definitive conclusions. The majority of authors note the increasing need for an instrumental delivery<sup>37,52-56</sup>, but some of them suggest that the number of cesarean sections does not increase with EA<sup>4,57-59</sup>. This disparity of the

results could be attributed to different protocols of leading the labor, different risk factors, parity and age of the patients, and choice of anesthetics.

It has been known that EA shortens the first and lengthens the second stage of labor by one hour on average<sup>60-62</sup>. In 1989, the American Congress of Obstetrics and Gynecology (ACOG) has redefined the duration of the second stage of labor with EA to two hours for multiparae and three hours for primiparae, which is one hour more than for those that did not receive EA<sup>38,63</sup>. It was necessary to enable passive descending of the newborn's head with good uterine contractions. This resulted in a decrease of instrumental delivery. Effects on the newborn are minimal. The Pushing Early or Pushing Late with Epidural (PEOPLE) study supports delayed pushing for the mothers receiving EA in order to increase the number of vaginal deliveries<sup>64,65</sup>.

The use of lower concentration of anesthetics reduces the overall rate of unwanted side effects. In a large randomized trial on 1054 patients (the COMET study), the introduction of a small dose of epidural infusion was associated with 25% decrease in the number of instrumental vaginal deliveries<sup>66</sup>. In order to reduce the rate of instrumental delivery, an attempt was made to stop the induction of analgesics at the end of the first stage of labor and in the second stage of labor, thus enhancing the mother's ability to push; however, this procedure proved ineffective<sup>67</sup>. Torvaldsen *et al.* concluded that reduction in the number of instrumental deliveries was not statistically significant in the group of mothers in which EA was stopped in the second stage of labor, in comparison to the mothers that received EA until the end of the delivery. On the other hand, the increase in pain intensity was statistically significant when EA was terminated (22% *vs.* 6%)<sup>68</sup>.

The timing of EA introduction is also open to discussion. In 1993, Thorp *et al.* published a report in which they claimed that the number of cesarean sections increased when EA was introduced early in the course of delivery<sup>69</sup>. A decade later, Wong *et al.* proved that there was no difference in the rate of cesarean sections if EA was introduced early in the labor in comparison to later introduction<sup>70,71</sup>. The present position of the ACOG and the American Society of Anesthesiologists (ASA) is that the mother's request for

labor pain relief is a reason enough for the introduction of EA<sup>32,63</sup>.

Higher doses of EA influence cardiotocography (CTG). The usual lower doses accompanied by hemodynamic stability do not influence fetal CTG<sup>23</sup>. In their systematic review, Lieberman and O'Donoghue concluded that there was no difference in the umbilical pH and Apgar score between the treated and control groups<sup>57</sup>. Neonatal behavioral scores were also compared. There was no difference between the two groups, or the treated group had even a slightly higher Apgar score. EA compared with the application of opioids had better analgesia and better stress response blockage in the mother, which resulted in better uteroplacental exchange, oxygenation, higher pH, base excess, Apgar score in first minute, neurological scores and adaptation scores<sup>27,28,58</sup>.

There are only a small number of studies assessing the effect of EA on breastfeeding<sup>72,73</sup>. Leighton and Halpem found no correlation between EA and lactation failure<sup>58</sup>. Studies have not associated persistent back pain with EA<sup>40</sup>.

In parturients administered EA, body temperature is elevated by up to 1 °C. The cause of this phenomenon remains unknown, and it is managed successfully with adequate hydration. No antipyretics or antibiotics are necessary. In the general population receiving EA, body temperature decreases by 0.5 °C<sup>58,74</sup>.

## Conclusion

Epidural anesthesia is the method of choice for labor pain relief, administered on patient's demand and if there is an obstetric indication. There are only few obstetric and anesthetic contraindications. Severe complications are extremely rare. Although EA is technically more difficult to perform in labor than in the general population, comfort and cooperation of the mother and safety of the newborn make it the best solution so far. In order to avoid motor block, cardiotoxicity and neurotoxicity, lower concentrations of anesthetics are recommended. By active labor conduction, lengthening of the second stage of labor to three hours in primiparae and two hours in multiparae to enable passive descending of the newborn's head, it is possible to reduce the number of instrumental deliveries. So far, there are no data on poor short-term

neonatal outcome, but there are some controversies. Further investigations of the long-term effects on the newborn are necessary. Cooperation of obstetrician and anesthesiologist can lead to the utilization of all favorable effects of EA.

In our hospital, about 18% of parturients receive epidural analgesia, whether on mother's request or for medical indication. EA is more likely to be indicated in preeclampsia, serious cardiovascular disease and prolonged labor.

Although a large number of our study participants knew about EA as a pain relief method, a small proportion of them used it. Only small proportions are taking advantage of this service, probably because of insufficient information, traditional beliefs, fear from complications and limited equipment availability.

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#### Sažetak

### EPIDURALNA ANALGEZIJA U PORODNIŠTVU – PROTURJEČJA

*N. Bilić, I. Djaković, K. Kličan-Jaić, S. Sabolović Rudman i Ž. Ivanec*

Bol kod porođaja smatra se jednom od najjačih boli. Porođaj je složen i individualan proces s različitim željama žena za analgezijom. Analgezija u porođaju mora biti sigurna i s minimalnim neželjenim posljedicama za majku, dijete i za tijek porođaja. Tim uvjetima najbolje udovoljava epiduralna analgezija (EA). Prema *American College of Obstetrics and Gynecology* i *American Society of Anesthesiologists* za primjenu EA u porođaju dovoljna je želja roditelja ako ne postoji kontraindikacija. Davanje analgetika ne treba prestati na kraju drugog porođajnog doba, ali se tada preporučuju niske koncentracije lokalnog anestetika te dodavanje adjuvansa. Novije studije ukazuju na to da se EA može primijeniti u najvećem dijelu prvog i drugog porođajnog doba. Bez obzira na dosadašnja iskustva i istraživanja ne postoji slaganje oko učestalosti instrumentalnog dovršenja porođaja, trajanja drugog porođajnog doba uz EA i vremena uvođenja EA te dugoročnog utjecaja na dijete. Dobra suradnja opstetričkog i anesteziološkog osoblja i dobra tehnička opremljenost znatno smanjuju potrebu za instrumentalnim dovršenjem porođaja, kao i druge komplikacije EA. Naša bolnica nudi EA za olakšani porođaj tijekom 24 sata. Većina trudnica je svjesna prednosti primjene EA za vaginalni porođaj, međutim, samo mali broj trudnica iskoristi tu mogućnost, uglavnom zbog nedovoljne obaviještenosti o toj metodi.

Ključne riječi: *Analgezija, epiduralna – primjena; Analgezija, epiduralna – kontraindikacije; Porođajna bol; Porođaj – instrumentacija; Porođajna doba*