REVIEW / DERLEME

NEURAXIAL ANALGESIA FOR LABOR: STANDARD TECHNIQUES VERSUS NOVEL APPROACH

DOĞUMDA NÖRAKSİYEL ANALJEZİ: STANDART TEKNİKLER VE YENİ YAKLAŞIMLAR

Selin EREL, Berrin GUNAYDIN

Gazi University Faculty of Medicine Department of Anesthesiology and Reanimation, Ankara, Turkey

Gazi Üniversitesi Tıp Fakültesi Anesteziyoloji ve Reanimasyon Anabilim Dalı, Ankara, Türkiye

Received Euroanaesthesia 2017 Young Teaching Recognition Award in Geneva, Switzerland and partly presented in ESA Newsletter Autumn 2017 issue 71.

SUMMARY

Standard neuraxial labor analgesia techniques that include epidural and combined spinal epidural (CSE) and comparison of these standard techniques with novel neuraxial approach which is dural puncture epidural (DPE) are presented. After brief overview of neuraxial analgesia management, advantages and disadvantages of standard neuraxial techniques versus novel approach are summarized. Based on the latest evidences, DPE appears to offer favorable risk benefit ratio for labor analgesia. However, choice of a specific neuraxial technique should be individualized based on the anesthetic and obstetric risk factors, patient preferences, progress of labor and resources of the facility.

KEY WORDS: *Neuraxial labor analgesia, Epidural, Combined spinal epidural (CSE), Dural puncture epidural (DPE)*

ÖZET

Bu çalışmada epidural ve kombine spinal epidural (KSE) tekniklerini içeren standart nöraksiyel doğum analjezisi ile yeni bir nöraksiyel yaklaşım olan dural ponksiyonlu epidural (DPE) tekniğinin karşılaştırılması sunulmuştur. Nöraksiyel analjezi yönetimine kısaca değindikten sonra standart nöroaksiyel teknikler ile yeni yaklaşımların avantaj ve dezavantajlarını özetleyerek karşılaştırdık. Son yıllardaki kanıtlara göre DPE, daha uygun risk yarar oranı sunmaktadır. Fakat hangi nöraksiyel tekniğin seçileceği obstetrik risk faktörleri, hastanın tercihi, doğumun gelişim süreci, hastanedeki imkanlar da göz önünde bulundurularak kişiye özel planlanmalıdır.

ANAHTAR KELİMELER: *Nöraksiyel analjezi, Epidural, Kombine Spinal Epidural, Dural Ponksiyonlu Epidural*

Labor analgesia has a long journey from the days of ether and chloroform until today's comprehensive programme of labour pain management using evidence based medicine. Hereby, overview of standard neuraxial labor analgesia techniques that include epidural and combined spinal epidural (CSE) and comparison of these standard techniques with novel neuraxial approach which is dural puncture epidural (DPE) are presented.

Pain relief management methods for labor are mainly classified as non-pharmacological and pharmacological. Non-pharmacological approaches to pain management include a wide variety of techniques such as antenatal preparation, emotional support, touch and massage, therapeutic use of heat and cold, hydrotherapy, vertical position or upright posture, transcutaneous electrical nerve stimulation, acupuncture, aromatherapy and sterile intradermal water blocks (1, 2).

On the other hand pharmacologic methods consist of inhalation analgesia, systemic opioid analgesia and neuraxial blocks. Neuraxial labor analgesia (either epidural or CSE) is the most effective pain relief method during childbirth providing complete analgesia without maternal or fetal sedation. Currently, standard epidural and CSE are commonly performed with a low dose and concentration of a local anesthetic (bupivacaine or ropivacaine) with a lipid soluble opioid (fentanyl or sufentanil). Neuraxial analgesia does not increase rate of cesarean delivery when compared to systemic analgesia

Çıkar çatışması/*Conflict of Interest*: Yazarlar herhangi bir çıkar çatışması bildirmemişlerdir./ *Authors do not report any conflict of interest.*
Geliş tarihi/*Received*: 24/07/2017 Kabul tarihi/*Accepted*: 28/07/2017

Yazışma Adresi (Correspondence):
Dr. Berrin GÜNAYDIN, Gazi University Faculty of Medicine, Department of Anesthesiology and Reanimation, Besevler 06500, Ankara, Turkey
E-posta (E-mail): gunaydin@gazi.edu.tr

but it may increase the risk of instrumental delivery mostly due to dense block (3). Additionally, neuraxial analgesia is not associated with a longer 1st stage of labor but it may prolong the 2nd stage of labor (4).

According to the American College of Obstetricians and Gynecologists (ACOG) and American Society of Anesthesiologists (ASA), maternal request is a sufficient indication for pain relief during labor in the absence of any medical contraindication (5,6). Other indications for labor analgesia include hypertensive or preexisting diseases, abnormal fetal presentation, previous cesarean section, prolonged labor and deterioration in fetal well-being. Contraindications include increased intracranial pressure, coagulopathy, thrombocytopenia, local or systemic infection, uncorrected hypovolemia, inadequate staffing or facilities (4).

NEURAXIAL ANALGESIA MANAGEMENT:

1. Preanesthetic evaluation and preparation

The anesthesiologist should conduct a focused history and physical examination before providing obstetric anesthesia care. This should include a relevant obstetric history, a baseline blood pressure measurement, and an airway, heart, and lung examination in addition to reviewing maternal health and anesthetic history. Patient's back should be carefully examined before neuraxial anesthesia as well. In case of recognizing significant any anesthetic or obstetric risk factors, consultation between obstetrician and the anesthesiologist should be encouraged. Routine platelet count and blood type and screen or cross-match are not mandatory in the healthy uncomplicated parturients but the decision to order these laboratory tests should be based on maternal history and anticipated hemorrhagic complications (7).

Timing of neuraxial analgesia has been considered as a concern due to the increased risk of cesarean delivery. However, it has been reported that neuraxial analgesia in early labor provided better analgesia and resulted in shorter duration of labor than systemic analgesia without increasing rate of cesarean delivery. Lately, it has been suggested that laboring women should receive labor analgesia when they request instead of delaying it until cervix dilates at least 4-5 cm (8).

2. Induction of neuraxial (epidural and CSE) analgesia

Regardless of the specific neuraxial technique chosen, primary goal is to provide adequate maternal analgesia without fetal and neonatal adverse effects if possible, with using local anesthetics and/or lipid soluble opioids. Amide type local anesthetics including bupivacaine, ropivacaine, or levobupivacaine with lipid soluble opioids like fentanyl and its analog sufentanil have been used as an adjuvant where each of them has useful features (4).

a) Epidural analgesia induction

Commonly 15-20 mL of bupivacaine (0.0625%-0.125%) or ropivacaine (0.08%-0.2%) with fentanyl (2 μg mL^{-1}) or sufentanil (0.2-0.33 μg mL^{-1}) are administered after the test dose (3 mL of lidocaine 1.5%) (3).

b) CSE analgesia induction

Intrathecal injection of lipid soluble opioids results more rapid onset of analgesia. Intrathecal injection of fentanyl or sufentanil combined with bupivacaine or ropivacaine result in effective labor analgesia depending on the selected dose in earlier studies. Lately, bupivacaine 1.7 mg (where accurate ED95 is 1.66 mg) combined with fentanyl 15 μg mL^{-1} (ED50) is one of the most preferred evidence based rational regimens (9).

3. Maintenance of neuraxial analgesia

Intrathecal injection of a lipid soluble opioid without local anesthetic provides rapid onset of analgesia (usually within 2-3 minutes) and a duration of 70- 100 minutes without motor block. As an example, CSE analgesia initiated by intrathecal fentanyl 20 μg alone followed by patient controlled epidural analgesia (PCEA) provided adequate and satisfactory analgesia similar to labor analgesia induced by conventional epidural analgesia followed by PCEA set to bolus on demand (10).

A wide variety of PCEA settings including continuous background infusion and/or boluson demand have been described. The most favorable protocol is bupivacaine 0.125%-0.0625 with fentanyl 2 μg mL^{-1} in varying basal infusion rates(8-15 mL h^{-1}), a bolus dose of 5-10 mL with avarying lock out interval of 10-20 min (3, 4).

Neuraxial analgesia techniques for labor are not limited to epidural and CSE blocks. A novel method called DPE which is a modification of CSE has been first described in 1996 (11). Epidural space is identified with an epidural needle using loss of resistance technique to saline followed by proceeding a 26 Gauge (G) Whitacre spinal needle via needle through needle technique just like CSE. After confirming free flow of cerebrospinal fluid, the spinal needle is withdrawn without any subarachnoid drug administration. Then, epidural catheter is placed into epidural space to administer drug solutions via catheter. Suzuki et al (11) are the first investigators to demonstrate the increased caudal spread of analgesia induced by epidural local anesthetic

solution after DPE technique using 26 G Whitacre spinal needle for orthopedics surgery. The underlying mechanism is most likely due to the translocation of epidural medications through a dural puncture into subarachnoid space. Afterwards two studies with DPE technique in laboring women using 27G and 25 G Whitacre spinal needles were published in 2005 and 2008, respectively (12, 13). Thomas et al (12), who used 27 G Whitacre spinal needle for DPE technique were unable to show improved epidural labor analgesia quality or reduction in catheter manipulation or replacement rate when compared to traditional epidural analgesia. However, Cappiello et al (13) proved that DPE with 25 G Whitacre spinal needle is responsible from improved sacral spread and onset of analgesia with bilateral pain relief compared to standard epidural technique in laboring nulliparous patients in the obstetrics. More recently improved block quality with DPE over epidural and fewer maternal and fetal side effects with DPE over CSE have been reported (14).

Comparison of standard neuraxial analgesia techniques (epidural or CSE) versus DPE technique is listed below and significantly marked outcomes are summarized in Table I:

• Onset of analgesia which is assessed as time elapsed to reach numeric pain rating scale (NPRS) ≤1 is significantly early with CSE than either epidural or DPE as anticipated ($p<0.0001$). However, onset of analgesia with DPE is markedly shorter than standard epidural.

• Significantly more parturients have sacral analgesia (bilateral block at S2) 10, 20 and 30 minutes after DPE than epidural ($p<0.001$, $p<0.001$ and $p=0.034$). DPE and CSE have almost similar sacral analgesia at 20 and 30 minutes.

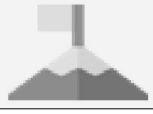
• Need for epidural catheter adjustment is markedly less with DPE.

• Time to 1st physician top up requirement is markedly longer with DPE.

• Rate of pruritus and hypotension are almost same with DPE and epidural which are markedly less than CSE. No postdural puncture headache is observed after DPE.

• Frequency of fetal heart rate decelations with DPE and epidural are similarly less than that of CSE.

Table I. Comparison of standard neuraxial analgesia techniques versus DPE technique.

	Standard		Novel
	EPL	CSE	DPE
Onset of analgesia	Slowest 	Fastest 	Modest 
Spread of analgesia		Better 	
Requirement for Catheter adjustment			
Block quality		Better 	
Need for physician top up	Modest	Earlier	Fewer
Maternal side effects hypotension& pruritus	Fewer	Higher	Fewer
Uterine contractions (hypertonus tachysystole)	Less 	Greatest 	Less 

EPL: Epidural, **CSE:** Combined Spinal Epidural, **DPE:** Dural Puncture Epidural

• Rate of cesarean and instrumental delivery are greater with CSE and DPE, respectively versus others.

• Significantly less newborns have Apgar score ≤7 at 1 minute after DPE. Additionally, none of the newborns have Apgar score ≤7 at 5 minute after standard or novel neuraxial analgesia technique.

In conclusion DPE appears to offer favorable risk benefit ratio for labor analgesia. However, choice of a specific neuraxial technique should be individualized based on the anesthetic and obstetric risk factors, patient preferences, progress of labor and resources of the facility.

REFERENCES

1. Camann W, Alexander KJ. Easy Labor. New York: Ballatine's Books 2006 (Çeviri: Gunaydin B. Kolay Doğum Ankara: İlke Yayınevi 2008).
2. Kuczkowski KM, Drobnik L. International Textbook of Obstetric Anaesthesia and Perinatal Medicine. In: Gunaydin B. Obstetric pain and its management in the perinatal period: What do we need to know? Warsaw: Medmedia 2010; 34-39.
3. Wong CA. Advances in laboranalgesia. Int J Women'sHealth 2009;1: 139-154.
4. Chestnut D, Wong C, Tsen L, Kee WDN, Beilin Y, Mhyre J. 2014. Chestnut's Obstetric Anesthesia: Principles and Practice. 5th ed. Philadelphia: Saunders.
5. ACOG Committee on Obstetric Practice. Opinion No: 269. Obstet Gynecol 2002; 93: 369-370.
6. http:// asahq/publicationsAndservices/standards/47.pdf; reaffirmed in 2007; Date last accessed. June 8, 2008.
7. Practice Guidelines for Obstetric Anesthesia. An updated report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia and the Society of Obstetric Anesthesia and Perinatology. Anesthesiology 2016; 124: 270-300.
8. Wong CA, Scavone BM, Peaceman AM et al. The risk of cesarean delivery with given early versus late in labor. New Eng J Med 2005; 352: 655-665.
9. Whitty R, Goldszmidt E, Parkes RK, Carvalho JC. Determination of the ED95 for intrathecal plain bupivacaine combined with fentanyl in active labor. Int J Obstet Anesth. 2007; 16: 341-345.
10. Sezer OA, Gunaydin B. Efficacy of patient-controlled epidural analgesia after initiation with epidural or combined spinal epidural analgesia. Int J Obstet Anesth 2007; 16: 226-230.
11. Suzuki N, Koganemaru M, Onizuka S, Takasaki M. Dural puncture with a 26-Gauge spinal needle affects spread of epidural anesthesia. Anesth Analg 1996; 82: 1040-1042.
12. Thomas JA, Pan PH, Harris LC, Owen MD, D'Angelo R. Dural puncture with 27 Gauge Whitacre spinal needle as part of a CSE technique does not improve labor epidural catheter function. Anesthesiology 2005; 103: 1046-1051.
13. Cappiello E, O'Rourke N, Segal S, Tsen LC. A randomized trial of dural puncture epidural (DPE) technique compared with standard epidural technique for labor analgesia. Anesth Analg 2008; 107: 1646-1651.
14. Chau A, Bibbo C, Huang CC et al. Dural puncture epidural technique (DPE) improves labor analgesia quality with fewer side effects compared with epidural and CSE techniques: A randomized clinical trial. Anesth Analg 2017; 124: 560-569.