ORIGINAL ARTICLE

Medical Journal of Western Black Sea
Batı Karadeniz Tıp Dergisi

Med J West Black Sea 2024;8(3): 307-313
DOI: 10.29058/mjwbs.1569202

Evaluation of Epidural Analgesia for Vaginal Delivery: A Retrospective Analysis of a State Hospital

Vajinal Doğum için Uygulanan Epidural Analjezinin Değerlendirilmesi: Bir Devlet Hastanesinin Retrospektif Analizi

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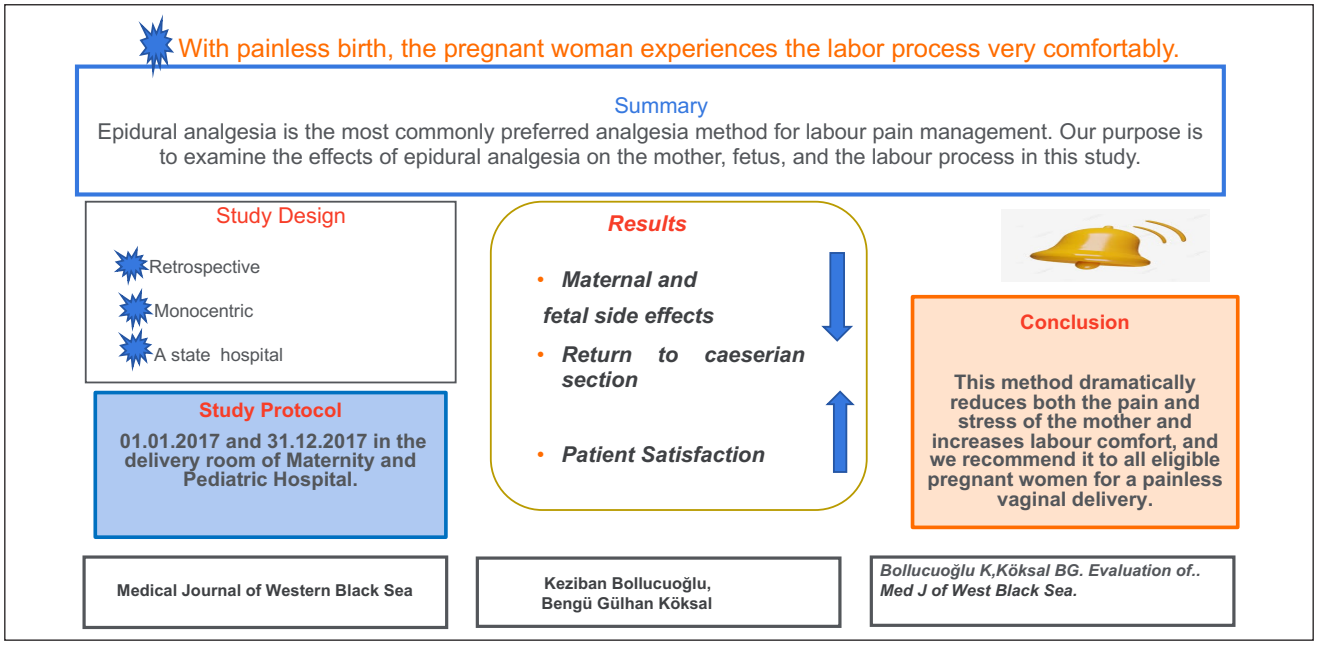
Cite this article as: *Bollucuoğlu K and Köksal BG. Evaluation of epidural analgesia for vaginal delivery: a retrospective analysis of a state hospital. Med J West Black Sea. 2024;8(3):307-313.*

GRAPHICAL ABSTRACT



ABSTRACT

Aim: Epidural analgesia is the most commonly preferred analgesia method for labour pain management. Our purpose is to examine the effects of epidural analgesia on the mother, fetus, and the labour process in this study.

Material and Methods: The files of pregnant women undergoing epidural analgesia for labour between January and December 2017 were examined retrospectively. Demographic data, hemodynamic parameters, duration of labour stages, rates of conversion to caesarean section, visual analogue scale (VAS) scores before and after epidural, APGAR score, maternal and fetal side effects, and satisfaction of pregnant women were evaluated.

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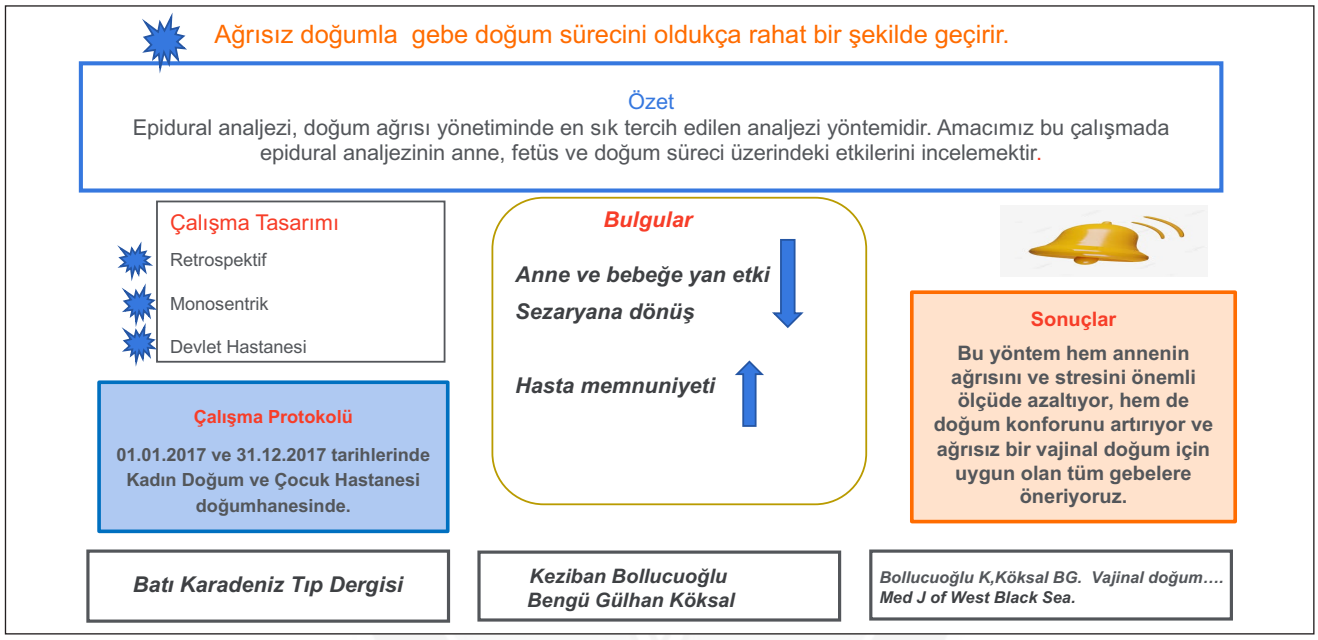
Results: It was seen that VAS scores were 2-3 with our painless labor analgesia protocol, caesarean rate was 2% among 153 labourers, the hypotension rate was 3.9% as a material side effect, the pregnancy satisfaction rate and the rate of requesting another epidural were 85.6%, and the 1st- and 5th-minute APGAR scores were 9-10 without any adverse effects.

Conclusion: Epidural analgesia is a method that should be applied with a multi-disciplinary approach by experienced practitioners and obstetricians. This method dramatically reduces both the pain and stress of the mother and increases labour comfort, and we recommend it to all eligible pregnant women for a painless vaginal delivery.

Keywords: Epidural analgesia, painless delivery, pregnant satisfaction

GRAFİKSEL ÖZET



ÖZ

Amaç: Epidural analjezi doğum ağrısı kontrolünde en çok uygulanan analjezi yöntemidir. Amacımız; epidural analjezinin anne-fetus ve doğum eylemi üzerine etkisini araştırmaktır.

Gereç ve Yöntemler: 2017 yılında (Ocak- Aralık) arasında doğum için epidural analjezi uygulanan gebelerin dosyaları retrospektif olarak incelendi. Gebelerin demografik verileri, hemodinamik parametreleri, doğum evrelerinin süreleri, sezeryana dönüş oranları, epidural öncesi ve sonrası vizuel analog skala (VAS) değerleri, APGAR skoru, maternal ve fetal yan etkiler, gebelerin memnuniyeti değerlendirildi.

Bulgular: Ağrısız doğum analjezi protokolümüz ile VAS değerlerinin 2-3 olduğu , 153 gebeden sezaryana dönüş oranının %2 olduğu, maternal yan etki olarak hipotansiyon % 3,9 oranında görüldüğü, gebe memnuniyet oranının ve tekrar epidural tercih etme oranının %85,6, 1. ve 5. dak. APGAR skorunun da 9-10 olduğu, olumsuz bir etkisi olmadığı görüldü.

Sonuç: Epidural analjezi; tecrübeli uygulayıcılarla kadın doğum doktoru ile işbirliği içerisinde multidisipliner yaklaşılması gereken bir müdahaledir. Annenin yaşadığı ağrı ile beraber stresini de büyük oranda azaltarak doğumun konforunu da artıran bu yöntemi ağrısız vajinal doğum için uygun tüm gebelere öneriyoruz.

Anahtar Sözcükler: Ağrısız doğum, epidural analjezi, gebe memnuniyeti

INTRODUCTION

Labor pain is one of the most severe pains identified so far. Today, one of the regional techniques among pharmacological methods, the epidural analgesia method, is the most commonly used labor analgesia technique (1). While epidural analgesia is safe and effective during labour, it is also noted that there is no increase in the to caesarean section ratio (2). Epidural analgesia is applied safely at any stage of the labor process, including the second phase.

During the labor, uterus contraction and cervical dilatation stimulate nociceptive afferent fibers extending to T10-L1 spinal cord neurons and cause visceral pain. While the fetus travels upside-down, it stretches the perineum and vagina, and pain fibres are activated through the pudendal nerve and spinal cord roots S2-4 (3,4). To optimize pain management during epidural analgesia, local anesthetics with low concentration, opioids, and other adjuvants are applied via the epidural catheter. Each clinic has its specific epidural analgesia protocols. Inserting the needle might cause short-term local pain that might last a couple of days in the area (5). Other potential side effects include hypotension, itchiness, nausea-vomiting, urinary retention, fever, and shaking.

Epidural analgesia is applied in many different ways and doses. The most commonly preferred one is the combination of low-dose bupivacaine and fentanyl. In the meta-analysis of nine randomized controlled studies, it is stated that the optimal method to proceed with epidural labour analgesia is continuous epidural analgesia accompanied by intermittent bolus doses (6). It ensures a basic analgesia level, independent of patient participation, and allows a personalized approach that includes the versatility of pain perception among women, the stage and advancement of labour, and the differences in patient participation.

In our study, we aimed to investigate the effects of epidural analgesia applied for painless vaginal delivery on mother, fetus and labour.

MATERIALS and METHODS

Study Design

This study was conducted retrospectively by including pregnant women who underwent epidural analgesia between 01.01.2017 and 31.12.2017 in the delivery room of Maternity and Pediatric Hospital. Pregnant women with a hematological disease and trauma history, fetal and placental anomalies, and obstetric complications (preeclampsia, diabetes mellitus, decollement placenta, and intrauterine growth restriction) and emergency deliveries are excluded from the study. Medical records, laboratory and archive data were retrospectively evaluated by accessing the data processing automation system.

Procedure

Fetal heart rate (FHR) reactivity is monitored by the obstetric team after the pregnant women scheduled for elective delivery are admitted to the delivery room. The pregnant whose cervical dilatation exceeds 4cm during active labor and whose cervical effacement is happening between 50 and 70% is informed about epidural analgesia, and her consent is taken. The standard monitorization defined by the American Society of Anesthesiologists (ASA) is applied. maternal heart rate (MHR), mean arterial pressure (MAB), oxygen saturation (SpO_2), and respiratory rate are recorded. After the pregnant woman is given 10 ml/kg isotonic sodium chloride within 30 minutes, a catheter is inserted into the epidural space in the sitting or left lateral position. After catheter insertion, pain is determined using a visual analog scale (VAS) score; if the VAS is higher than 3, analgesic solution 10 ml (bupivacaine 0.5% 2 ml, fentanil 100 mcg, sodium chloride 6 ml 0.9%) is administered as a bolus through a epidural catheter and repeated intermittently (Figure 1). During the labour process, several tests and evaluations are conducted to monitor the mother and baby's health. These include the VAS score, Bromage scale for motor block, and Pinprick test for sensory block before and 15 minutes after epidural analgesia. The fetal heart rate (FHR) and uterine contractions are monitored through a cardiotocograph. Additionally, the mother's heart rate (MHR), mean arterial pressure (MAP), and any side effects are evaluated every 15 minutes after the first epidural dose. Other important details that are recorded include the mode of delivery, duration of the first and second stages of labour, birth weight, and APGAR scores at 1 and 5 minutes after birth. The degree of difficulty in inserting the epidural catheter, number of attempts made, and insertion site are also evaluated and ranked on a scale of 0 to 3 (0: easy, 1: moderate, 2: difficult, 3: very difficult). After the catheter is removed, the patient's satisfaction with the epidural analgesia is assessed on a scale of 1 to 4 (1: very satisfied, 2: satisfied, 3: undecided, 4: not satisfied). If the patient becomes pregnant again, they will be asked whether they would prefer to have epidural analgesia again.

According to the painless delivery protocol mentioned above, epidural analgesia was applied to pregnant women whose cervical dilatation exceeded 4 cm. After starting epidural analgesia, MHR, MAP, respiratory rate, FHR, VAS score,

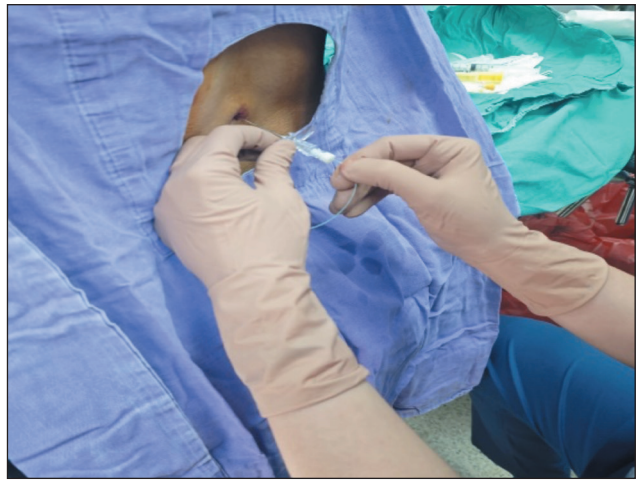


Figure 1. Epidural catheter application to pregnant women.

motor block level, sensory block level were recorded at the beginning, 5th, 10th, 15th, 30th, 45th, and 60th minutes and then every 30 minutes until the end of a birth. When the VAS was higher than 4, the same dose bolus was applied additionally. A systolic blood pressure less than 90 mmHg or a 20% decrease is considered hypotension. Ephedrine 5 mg/ml i.v. is administered as needed. If labour does not progress, a cesarean section is performed.

Outcome Measures

After first epidural dose, MHR, MAP, maternal respiratory rate, FHR, VAS score, motor block level, sensory block level were recorded every 15 minutes from onset to delivery. Duration of the first and second stages of labour, birth weight, APGAR scores at 1 and 5 minutes after birth, the degree of difficulty in inserting the epidural catheter, number of attempts made, insertion site, patient's satisfaction were recorded.

Statistical Analysis

The study findings were evaluated using the SPSS 24.0 Statistics package software. Descriptive statistical methods were used for frequency, percentage, mean, and standard deviation. The Kolmogorov-Smirnov test was used to examine the normal distribution of the research data. The changes that occurred during measurements were analysed using the Friedman test. When a significant difference was obtained in the Friedman Test, the Wilcoxon Signed Rank Test was performed. The results were evaluated within a 95% confidence interval at a significance level of $p<0.05$.

RESULTS

Demographic data: The study included 153 patients aged between 20 and 42 years. Demographic characteristics of all pregnant women who participated in the study are given in Table 1. The mean age of the participants was 29.16±4.98 years. When the education levels were analyzed, high school graduates were more common (60%). Mean BMI was 27.69±2.39 kg/m^2. Pregnancy status was 49% primiparous and 5% multiparaous. Mean their gestational age was 39.25 weeks.

Characteristics and side effects of epidural analgesia, and patient satisfaction: In this study, epidural catheter was mostly applied at the L4-L5 level. The most common maternal side effect was hypotension and the most common fetal side effect was tachycardia. Motor block did not develop in any patient. The median duration of the first, second and third stages of labour was 150, 10 and 21 minutes, respectively 82.4% of pregnant women stated that they were satisfied with epidural analgesia, and 85.6% of them stated that they would prefer it again during delivery. The mean durations of 1st, 2nd and 3rd stage of labor were 152.32, 10.3, 21.38 minutes. The mean VAS score was 6 before epidural and 2 after epidural. 1st and 5th minute APGAR was normal (Table 2).

Hemodynamic datas: Maternal heart rate and MAP of pregnant women before and after epidural analgesia are given in Table 3. There is a difference between MHR and MAP values at 0, 5, 10 and 15 minutes ($p<0.001$).

DISCUSSION

In our study, epidural analgesia had very few maternal and fetal side effects, did not affect APGAR scores and did not increase the rate of conversion to cesarean section. In addition, pregnant satisfaction was very high. The most common side effects of epidural analgesia are nausea, vomiting, hypotension, and headache. The rarer side effects are urinary retention, bradycardia, and sedation.. There might also occur complications such as dural puncture, intravenous and intrathecal injection, and minimal motor blockade (7,8) . Pregnant women may also find the extreme motor and sensory blockade uncomfortable (9,10). If epidural opioids are used, itching is common and affects 60-100% of pregnant women and may require symptom control with antihistamines or, in severe cases, opioid receptor antagonists. Epidural opioids may also cause urinary retention and nausea and vomiting are also associated and affect 21%-53% and 30% of recipients respectively, depending on the dose (10) . In a meta-analysis where 40 articles were reviewed, examining more than 10,000 pregnant women who received analgesia with and without epidural and those who received no analgesia; Women who received epidural had more hypotension, motor block, fever and urinary retention than those who received opioids, and it was also determined that the likelihood of respiratory depression and nausea and vomiting requiring oxygen therapy was less common in women who received epidural. However, there was no significant difference between the groups in terms of postpartum depression, headache, itching, tremors, and

Table 1: Demographic characteristics of pregnant women

Characteristics	Findings (n=153)	
Age (years± SD) Min-Max	29.16±4.98	20-42
Level of Education, n (%)		
Secondary School	19 (12.4)	
High School	93 (60.8)	
University	41 (26.8)	
BMI (kg/m^2± SD)	27.69±2.39	24-40
Pregnancy Status, n (%)		
Pirimiparous	75 (49)	
Multiparous	78 (51)	
Pregnancy Week (Week± SD)	39.25±0.98	37-41

BMI: Body mass index

Table 2: Characteristics and effects of epidural analgesia, side effects, patient satisfaction distribution

Characteristics	Findings (n=153)	
Catheter Level, n (%)		
L3-L4/ L4-L5/ L5-S1	38 (24.8) / 90 (58.8) / 25 (16.4)	
Maternal side effect, n (%)		
None/hypotension	147 (96.1) / 6 (3.9)	
Fetal side effect, n (%)		
Bradycardia/Tachycardia	2 (1.3) / 151 (98.7)	
Return to Cesarian, n (%)		
Yes/No	3 (2) / 150 (98)	
To choose again, n (%)		
Yes/No	131 (85.6) / 22 (14.4)	
Patient satisfaction, n (%)		
1/2/3/4	76 (49.7) / 50 (32.7) / 14 (9.2) / 13 (8.5)	
Number of interventions, Median (Min-Max)	1 (1-3)	
Duration of first stage (minutes)*	152.32±45	150 (88-222)
Duration of second stage (minutes)*	10.3±3.43	10 (5-25)
Duration of third stage (minutes)*	21.38±3.28	21 (14-30)
VAS before epidural**		6 (4-10)
VAS after epidural**		2 (2-6)
Motor block		0
Baby weight (gr) *	3173±246.93	3187 (2640-4100)
APGAR 1. min**		9 (8-10)
APGAR 5. min**		10 (9-10)

Data are shown as ***(mean**±SD**), Median (Min-Max), ** Median (Min-Max).** VAS: Visual Analog Scale, Duration of first stage: labor begins and ends with full cervical dilation, Duration of second stage: complete cervical dilation and ends with the delivery of the fetus Duration of third stage (min): From the birth of the fetus to the exit of the placenta

drowsiness (2). In our study, headache, itching, tremors, and drowsiness were not observed in pregnant women, while hypotension was observed in 3.9% and fetal bradycardia was observed in 1.3%, and it was controlled with ephedrine and intravenous fluid.

Cochrane reviews and meta-analyses, epidural analgesia has been suggested to extend the first stage of labor by 30 minutes and the second stage by 15 minutes, when compared with alternative forms of analgesia (11). Additionally, there are studies showing that epidural analgesia prolongs both the first and second phases (12). Luo et al. (13) concluded that epidural analgesia shortened the first stage of labor. It was stated that the first stage was 3.2 hours and the second stage was 25.78 minutes in the epidural group of primipara women, whereas the first stage was 2.06 hours and the second stage was 17.06 minutes in the epidural group of multipara women. In another study with primipara women, it was seen that when epidural analgesia was applied, the duration of the first stage significantly decreased (217.9 min), and the duration of the second stage significantly increased (29.6 min), compared to the group without epidural analgesia (14). In our study where we includ-

Table 3: Hemodynamic data of pregnant women

Time*	MHR (beats/min)			
T 0	94.07±6.61[a]	94	90	99
T 5	90.72±6.65[b]	90	86	96
T 10	88.78±7.08[c]	88	84	94
T 15	73.04±2.82[d]	72	71	75
		***p<0.001**		
Time*	**MAP (mmHg)**			
T 0	87.26±5.22[a]	86	84	90
T 5	83.68±4.93[b]	84	80	86
T 10	81.94±4.77[c]	82	80	86
T 15	79.97±6.87[d]	80	76	84
		***p<0.001**		

*Data are shown as Mean±standart deviation, Median, 1st quartile, 3rd quartile.

There is no difference between times with the same letter. **T0: The period immediately before epidural analgesia was administered, **T5:** 5th minute after epidural analgesia, **T10:** 10th minute after epidural analgesia, **T15:**15.th minute after epidural analgesia, **MHR:** Maternal heart rate, **MAB:** Mean Arterial Pressure (MAB) ***P-value:** Comparison of MHR and MAP between time periods

ed both nullipara and multipara pregnant women, the first stage lasted 180 minutes, and the second stage lasted 10.3 minutes on average. The reason why different results were obtained is because of the local anesthetic concentration used for epidural analgesia, or agents (opioids) added into local anesthetics , or because we have not evaluated the pregnant women separately as nullipara and multipara.

The sustainment of epidural analgesia during the delivery can be maintained with different protocols, and the effectiveness of the analgesia can vary. Intermittent bolus, patient-controlled epidural analgesia, continuous infusion and computer-integrated patient-controlled epidural analgesia have been described (15,16). In a meta-analysis of 2573 pregnant women, clinician-administered intermittent bolus versus continuous infusion for epidural analgesia was compared. In this study, no significant difference was observed in terms of adverse events or mode of delivery, but the duration of labor was significantly longer in patients receiving continuous epidural infusion (15). Roofthooft et al. (17) concluded that the patients receiving patient-controlled analgesia were less likely to need anaesthetic intervention, required lesser doses of local anaesthesia, and experienced lesser motor blockade. In our study, epidural analgesia was administered as an intermittent bolus. We believe that the bolus analgesia dose we apply when necessary does not negatively affect the labour process as it effectively relieves pain without causing motor block and does not prevent contractions

The purpose of epidural analgesia during labour is to make the pain tolerable, to facilitate the birth, and to keep the pregnant woman away from the complications of caesarean section. In the literature, there are studies indicating that epidural analgesia causes an increase in caesarean section rates as well as it does not (18,19). In our study, similar to the literature, the rate of return to caesarean section was found to be very low with an incidence of 2%. We think that the reason for this is that effective analgesia was provided with the appropriate analgesic dose and the delivery was performed under the supervision of experienced midwives and doctors because it was a maternity hospital.

APGAR score is calculated at the 1st and 5th minutes for all babies, and every 5 minutes until 20 minutes for babies with a score of 7 or lower. For the 5th-minute APGAR score, 7-10 is considered safe, 4-6 is considered abnormal, and 0-3 is considered low. In studies that compare APGAR scores and umbilical artery and umbilical vein pH and fetal acidosis as the predictor of asphyxia, no negative impacts of epidural analgesia were seen (20,21). Likewise, in our study, it was seen that 1st- and 5th-minute APGAR scores were 9-10, and there was no negative impact of epidural analgesia on the APGAR score.

Being able to actively participate in birth without pain, which is the best feeling women can experience in their lives, has significant effects on both the mother and the fetus. In the monocentric survey studies conducted on pregnant women undergoing epidural analgesia during vaginal labor, it was stated that the labor pain was significantly reduced, and the satisfaction of patients delivering babies was very high. It was also emphasized that the median pain evaluation before epidural analgesia was 8 [7-8] and 3 [2-5] after analgesia, and the median satisfaction level of epidural analgesia was 10 [7-19] (22). In our study, it was seen that the rate of preferring epidural analgesia again was 85.6%, and the satisfaction rate of pregnant patients was 82.4%. It was determined that while the mean VAS before epidural was 6 [4-10], it was 2 [2-6] after epidural. We think that the reason for the high satisfaction rates is that half of the pregnant women had previously experienced pain during normal vaginal delivery and that the patient was closely monitored and well managed throughout the delivery.

In conclusion epidural analgesia is a necessary intervention that needs to be approached multi-disciplinarily with the cooperation of experienced practitioners and obstetricians. This method dramatically reduces both the pain and stress of the mother and increases labor comfort, and we recommend it to all eligible pregnant women for a painless vaginal delivery. The limitations of the study are firstly, only pregnant women who underwent epidural analgesia were included, secondly, the study was conducted in a monocentric, and thirdly, the study was planned retrospectively.

Acknowledgment

We thanks to obstetrician of the Maternity and Pediatric Diseases Hospital for their follow-up of patients during labor.

Author Contributions

Concept: **Keziban Bollucuoğlu Bengü Gülhan Köksal,** Design: **Keziban Bollucuoğlu, Bengü Gülhan Köksal,** Data Collection or Processing: **Keziban Bollucuoğlu,** Analysis or Interpretation: **Bengü Gülhan Köksal,** Literature search: **Keziban Bollucuoğlu, Bengü Gülhan Köksal,** Writing: **Keziban Bollucuoğlu Bengü Gülhan Köksal,** Approval: **Bengü Gülhan Köksal.**

Conflicts of Interest

All authors declare no conflict of interest.

Financial Support

The authors declared that this study has received no financial support.

Ethical Approval

The study was approved by the Clinical Researches Ethics Committee of Zonguldak Bülent Ecevit University ((Date:23.06.2021 , Number:2021/12)

Review Process

Externally and extremely peer-reviewed.

REFERENCES

1. Wong CA. Epidural and spinal analgesia/anesthesia for labor and vaginal delivery. In: Chestnut's Obstetric Anesthesia: Principles and Practice. 5th ed. Philadelphia, PA: Elsevier/Saunders; 2014:457-517
2. Anim-Somuah M, Smyth RM, Cyna AM, Cuthbert A. Epidural versus non-epidural or no analgesia for pain management in labour. Cochrane Database Syst Rev. 2018;5(5):CD000331. doi: 10.1002/14651858.CD000331.
3. Arendt K, Segal S. Why epidurals do not always work. Rev Obstet Gynecol. 2008 Spring;1(2):49-55. PMID: 18769661; PMCID: PMC2505163.
4. Bautista L, George RB. Epidural analgesia in labour. CMAJ. 2020;192(19):E509. doi: 10.1503/cmaj.191372.
5. George RB, Allen TK, Habib AS. Intermittent epidural bolus compared with continuous epidural infusions for labor analgesia: a systematic review and meta-analysis. Anesth Analg. 2013;116(1):133-144. doi: 10.1213/ANE.0b013e3182713b26.
6. Nanji JA, Carvalho B. Pain management during labor and vaginal birth. Best Pract Res Clin Obstet Gynaecol. 2020;67:100-112. doi: 10.1016/j.bpobgyn.2020.03.002.
7. Zimmer EZ, Jakobi P, Itskovitz-Eldor J, et al. Adverse effects of epidural analgesia in labor. Eur J Obstet Gynecol Reprod Biol. 2000;89(2):153-157. doi: 10.1016/s0301-2115(99)00191-8.
8. Simmons SW, Taghizadeh N, Dennis AT, Hughes D, Cyna AM. Combined spinal-epidural versus epidural analgesia in labour. Cochrane Database Syst Rev. 2012;10(10):CD003401. doi: 10.1002/14651858.CD003401.pub3.
9. Hattler J, Klimek M, Rossaint R, Heesen M. The effect of combined spinal–epidural versus epidural analgesia in laboring women on nonreassuring fetal heart rate tracings: systematic review and meta-analysis. Anesth Analg. 2016;123(4): 955-964.
10. Halliday L, Nelson SM, Kearns RJ. Epidural analgesia in labor: A narrative review. Int J Gynaecol Obstet. 2022;159(2):356-364. doi: 10.1002/ijgo.14175.
11. Callahan EC, Lee W, Aleshi P, George RB. Modern labor epidural analgesia: implications for labor outcomes and maternal-fetal health. Am J Obstet Gynecol. 2023 May;228(5S):S1260-S1269. doi: 10.1016/j.ajog.2022.06.017. Epub 2023 Mar 20. PMID: 37164496.
12. Olszynska A, Di Martino Z, Pawlowska A, et al. Epidural analgesia: effect on labor duration and delivery mode - a single-center cohort study. Ginekol Pol. 2023 Jun 7. doi: 10.5603/GP.a2023.0048. Epub ahead of print. PMID: 37284824.
13. Luo D, Yuan Y, Guo L, Chen Z. A comparative study of epidural labor analgesia and natural delivery without analgesia. Am J Transl Res. 2021;13(6):7015-7021.
14. Genc M, Sahin N, Maral J, Celik E, Kar AA, Usar P, et al. Does bupivacaine and fentanyl combination for epidural analgesia shorten the duration of labour? J Obstet Gynaecol. 2015;35(7):672-675. doi: 10.3109/01443615.2014.991299.
15. Liu X, Zhang H, Zhang H, Guo M, Gao Y, Du C. Intermittent epidural bolus versus continuous epidural infusions for labor analgesia: A meta-analysis of randomized controlled trials. PLoS One. 2020 ;15(6):e0234353. doi: 10.1371/journal.pone.0234353.
16. Sng BL, Sia ATH, Lim Y, Woo D, Ocampo C. Comparison of computer-integrated patient-controlled epidural analgesia and patient-controlled epidural analgesia with a basal infusion for labour and delivery. Anaesth Intensive Care. 2009 Jan;37(1):46-53. doi: 10.1177/0310057X0903700119.
17. Roofthooft E, Barbé A, Schildermans J, et al. Programmed intermittent epidural bolus vs. patient-controlled epidural analgesia for maintenance of labour analgesia: a two-centre, double-blind, randomised study†. Anaesthesia. 2020;75(12):1635-1642. doi: 10.1111/anae.15149.
18. Agrawal D, Makhija B, Arora M, Haritwal A, Gurha P. The effect of epidural analgesia on labour, mode of delivery and neonatal outcome in nullipara of India, 2011-2014. J Clin Diagn Res. 2014;8(10):OC03-6. doi: 10.7860/JCDR/2014/9974.4930.
19. Wassen MM, Smits LJ, Scheepers HC. Routine labour epidural analgesia versus labour analgesia on request: a randomised non-inferiority trial. BJOG. 2015;122(3):344-350. doi: 10.1111/1471-0528.12854.
20. Wang K, Cao L, Deng Q, et al. The effects of epidural/spinal opioids in labour analgesia on neonatal outcomes: A meta-analysis of randomized controlled trials. Can J Anaesth. 2014;61(8):695-709. doi: 10.1007/s12630-014-0185-y.
21. George RB, Allen TK, Habib AS. Intermittent epidural bolus compared with continuous epidural infusions for labor analgesia: A systematic review and meta-analysis. Anesth Analg. 2013;116(1):133-144. doi: 10.1213/ANE.0b013e3182713b26.
22. Šakić L, Vidaković Z, Šakić K, Radoš I, Včev A. Satisfaction Of Parturients With Epidural Analgesia During Delivery: Analysis Of Questionnaire At A Single Hospital Center. Acta Clin Croat. 2022 ;61(Suppl 2):9-14. doi: 10.20471/acc.2022.61.s2.01.