Comparison of Two Different Bupivacaine Doses with Sufentanil for Epidural Obstetric Analgesia

Epidural Doğum Analjezisinde Sufentanil Eklenen İki Farklı Bupivakain Dozunun Karşılaştırılması

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ABSTRACT Objective: Addition of opioids to local anesthetics for epidural obstetric analgesia provides effective analgesia with decreased side effects. We compared the analgesic quality of 0,0625% bupivacaine and 0,1% bupivacaine with 0.5 μg/mL sufentanil. **Material and Methods:** Study participants were 18-45-year-old, primiparous 30 parturients. An epidural catheter was placed, 8-10 mL of 0.0625% bupivacaine with 0.5 μg/mL sufentanil and 0.1% bupivacaine with 0.5 μg/mL sufentanil were given to Group I and Group II, respectively. Hemodynamic parameters, obstetric examination findings, pain grades, time to reach visual analog scale (VAS)<4 and the first dose interval were recorded. Satisfaction levels, motor and sensorial blocks, oxytocin and valetamate bromide consumption, side effects were assessed. Total and additional drug use, duration of second stage of the delivery, mean delivery times, instrumental delivery, Apgar scores, fetal heart rates and uterine contraction pressures were recorded. The percentage of participation of the parturients to the delivery was assessed. **Results:** Median VAS values were significantly lower in Group II. Median VAS values were lower than 4 in both groups after 15th minute. The time to the second analgesic dose was longer in Group II. Systolic, diastolic and mean arterial blood pressures were measured lower in Group II. Satisfaction scores were significantly higher in Group II. **Conclusion:** In the present study, satisfactory analgesia was produced in both groups. Although median VAS scores were lower in Group II, VAS<4 could be reached in Group I. We concluded that 0.0625% bupivacaine+0.5 μg/mL sufentanil combination, as providing VAS<4, could be a preferable alternative to 0.1% bupivacaine+0.5 μg/mL sufentanil.

Key Words: Analgesia, obstetrical; analgesia, epidural

ÖZET Amaç: Epidural obstetrik analjezi için lokal anesteziklere opioidlerin eklenmesi daha efektif bir analjezi sağlar ve yan etkileri azaltır. Biz bu çalışmada %0,0625 bupivakain ve %0,1 bupivakaine 0,5 mikrog/mL sufentanil ekleyerek analjezi kalitesini karşılaştırdık. **Gereç ve Yöntemler:** Çalışmaya, 18-45 yaşları arasında, 30 primipar gebe dahil edildi. Epidural kateter yerleştirildikten sonra %0,0625 bupivakain ile 0,5 mikrog/mL sufentanil veya %0,1 bupivakain ile 0,5 mikrog/mL sufentanil sırasıyla Grup I ve Grup II olarak belirlendi ve 8-10 mL uygulandı. Hemodinamik parametreler, obstetrik muayene bulguları, ağrı düzeyleri, vizuel analo skala (VAS)<4 olma zamanı ve ilk analjezik gereksinim zamanı kayıt edildi. Memnuniyet dereceleri, motor ve duyusal blok, oksitosin ve valetamat bromür kullanımı ve yan etkiler değerlendirildi. Toplam ve ek ilaç kullanımı, doğumun 2. evresinin süresi, doğumun toplam süresi, doğumda yardımcı alet kullanımı, Apgar skorları, fetal kalp hızı ve uterin kontraksiyon basınçları kayıt edildi. Gebelerin doğuma katılım yüzdeleri değerlendirildi. **Bulgular:** Median VAS değerleri Grup II'de anlamlı şekilde düşük bulundu. İlk 15 dakikadan sonra her iki grupta da VAS değerleri 4'ün altında devam etti. İkinci dozun yapılma zamanı Grup II'de daha uzundu. Sistolik, diyastolik ve ortalama arter basınç değerleri Grup II'de daha düşük bulundu. Memnuniyet düzeyleri Grup II'de anlamlı şekilde yüksekti. **Sonuç:** Bu çalışma, her iki grupta da analjezi memnuniyeti sağlandı. Median VAS değerleri Grup II'de daha düşük bulundu ve fakat Grup I'de de VAS<4 düzeyinde oldu. Sonuç olarak, %0,0625 bupivakain+0,5 mikrog/mL sufentanil kombinasyonu VAS<4 düzeylerini sağlayabildiğinden, %0,1 bupivakain+0,5 mikrog/mL sufentanile iyi bir alternatiftir.

Anahtar Kelimeler: Analjezi, obstetrik; analjezi, epidural

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Adding opioids to local anesthetics for epidural obstetric analgesia provides use of more diluted concentrations of opioids and local anesthetics with effective analgesia and decreased side effects.[1] Bupivacaine is the local anesthetic that provides the best analgesia. Sufentanil is the most potent opioid.[2-7] Bupivacaine and sufentanil are frequently used together.[1,8-10] However, the lowest doses that produce effective analgesia is still controversial.

In the present study, we compared the analgesic quality of 0.0625% bupivacaine and 0.1% bupivacaine with 0.5 μg/mL sufentanil.

MATERIAL AND METHODS

After approval of the ethics committee and written informed consent of the patients, 18-45 years old, ASA I-II, primipar 30 parturients were enrolled to the study. The parturients with uncomplicated pregnancy, BMI<30, 4-6 cm cervical dilatation, who were in active labor and in whom epidural catheter could be placed were included. Multiparity, multiple pregnancy, history of Cesarean section, prematurity, BMI>30, medical and obstetric complications, contraindication for epidural analgesia, allergy to local anesthetics or sufentanil, abnormal presentation of the fetus and abnormal pelvic anatomy were the exclusion criteria.

The study was designed as a double-blind, prospective study, and patients were randomized into two groups as Group I and Group II. After standard monitoring including electrocardiogram, non-invasive blood pressure and pulse oxymetry, a peripheral venous catheter was inserted and 250 mL 0.9% NaCl solution was infused to the patients. An epidural catheter was placed at L2-L3 or L3-L4 intervertebral space with 18 Gauge Touhy needle using loss of resistance technique to saline at intervals without contraction in sitting or lateral decubitis position. Epidural catheter was advanced 3-4 cm into the epidural space. When there was no cerebrospinal fluid and blood leak from the catheter, 3 ml of 2% lidocaine was given for test dose to confirm the place of the catheter. After test dose, 8-10 mL of 0.0625% bupivacaine with 0.5 μg/mL sufentanil and 0.1% bupivacaine with 0.5 μg/mL sufentanil were given via epidural catheter to Group I and Group II, respectively. The dose would be repeated if visual analog scale (VAS) score reached >4 after initial dose during delivery. Local lidocaine was infiltrated to perineum if analgesia was needed for episiotomy.

Hemodynamic parameters, obstetric examination findings, pain grades (using VAS scale), time to reach VAS<4 after the first analgesic dose and the first dose interval were recorded before placement of epidural catheter, with 5 min intervals during first 20 minutes, 30th, 45th and 60th minutes and with 30 minutes intervals thereafter. The patients were asked for the satisfaction levels of the delivery by using a five point scale (0=unsatisfactory, 1=poor, 2=fair, 3=good, 4=excellent).[10] The questions " would you choose the same technique for your next delivery?" and "would you suggest this technique to other parturients?" were also asked. Motor block and sensorial block were assessed using Modified Bromage Scale and pin-prick test, respectively.

Oxytocin and valetamate bromide consumption, side effects like nausea, vomiting, hypotension, pruritus, shievering, motor block, respiratory depression, urinary retention, sedation, fetal bradycardia, total and additional drug usage via epidural catheter, duration of second stage of the delivery, mean delivery times, assistance to delivery like forceps or vacuum, Apgar scores at 1st and 5th minutes, fetal heart rates and uterine contraction pressures (which were monitored continuously) were recorded.

The percentage of participation of the parturient to the delivery was assessed by the obstetrician and recorded at the end of the delivery.

SPSS 13.0 was used for statistical analysis. Parametric variables were analyzed with Kolmogorov-Smirnov test for normal distribution. Variables showing normal distribution were assessed using T-test, and variables not showing normal distribution were assessed using Mann-Whitney U test. Categorical variables were assessed by Fisher's exact test. $p<0.05$ was accepted as statistically significant.

RESULTS

Demographic and obstetric data of the parturients were similar in two groups (Table 1). Apgar scores of the newborns were similar (Apgar 1st and 5th min p values are 0.49 and 0.31, respectively). No fetal abnormality was observed and none of the newborns needed resuscitation. While assistance to delivery was needed in 2 parturients in Group I, no assistance was needed in Group II (p=0.17). There was no difference between the duration of the first and second stage of delivery in two groups (Table 2).

Median VAS values were significantly lower in Group II compared to Group I at 20th, 30th, 45th and 60th minutes. Median VAS values were lower than 4 in both groups after 15th minute (Figure 1 and Table 3). VAS values reached "0" in all of the patients in Group II but only in 6 patients in Group I, and this was statistically significant (p=0.01). The time to reach VAS<4 was indifferent between groups (Table 4). The second analgesic dose was administered when VAS value was ≥4. The time to the second analgesic dose was longer in Group II (Table 4). While total drug volume and amount of sufentanil were similar between groups, the amount of bupivacaine used was significantly higher in Group II (Table 4).

Systolic arterial blood pressures decreased significantly at 30th, 60th and 90th minutes in Group II compared to Group I (p= 0.04, 0.01, 0.01). In addition, diastolic (p= 0.03, 0.01)and mean arterial pressures (p=0.04, 0.02) were significantly lower in Group II at 30th and 60th minutes, respectively. Hypotension that required medical treatment was observed in only one parturient in Group II, and ephedrine 5 mg IV was given for treatment.

TABLE 1: Demographic and obstetric data of the groups.

	Group 1	Group 2	p
Age (years)	23.4±5.0	22.8±3.5	0.71
Weight (kg)	69.3±9.5	67.5±8.3	0.60
Height (cm)	159.3±4.6	159.1±5.1	0.88
Pregnancy week	38.8±1.1	39.3±0.9	0.18
Cervical dilatation (cm)	5.0±0.8	4.5±0.6	0.06
Effacement (%)	73.0±10.6	78.3±7.0	0.12

Values are expressed as Mean±Standard Deviation.

TABLE 2: Duration of stages of delivery.

	Group 1	Group 2	p
1st stage (min)	94.3±36.9	142.0±104.8	0.12
2nd stage (min)	58.6±31.3	51.3±30.3	0.54

Values are expressed as Mean±Standard Deviation.

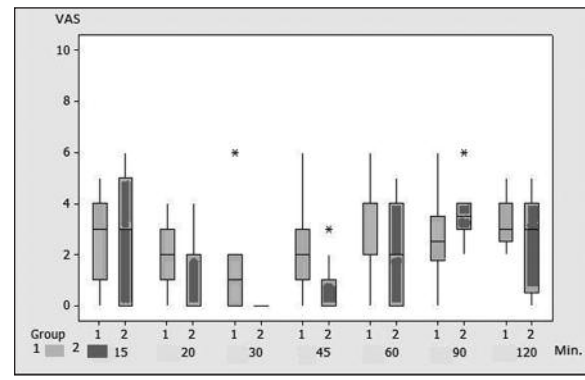

FIGURE 1: Median values of groups.
*: value can not be represented.

Heart rates, oxygen saturations of the patients, fetal heart rates and uterine contraction pressures were similar in both groups (p>0.05).

TABLE 3: VAS values.

		15th min	20th min	30th min	45th min	60th min	90th min	120th min
Group 1	Median	3	2	1	2	4	2,5	3
	Min	0	0	0	0	0	0	2
	Max	5	4	6	6	6	6	5
Group 2	Median	3	0	0	0	2	3,5	3
	Min	0	0	0	0	0	2	0
	Max	6	4	2	3	5	6	5

Min: Minimum, Max: Maximum.

TABLE 4: Time to reach VAS<4, time for second analgesic dose, total drug volume, amount of bupivacaine and sufentanil consumed.

	Group 1	Group	p
Time to reach VAS<4 (min)	14.6±3.5	13.3±5.6	0.44
Time to 2nd analgesic (min)	62.0±16.9	84.0±16.8	0.01
Total drug volume (mL)	21,0±5,7	20,5±7,7	0.85
Total bupivacaine consumption (mg)	13,1±3,6	20,5±7,7	0.01
Total sufentanil consumption (mg)	10,5±2,9	10,3±3,9	0.85

Values are expressed as Mean±Standard Deviation.

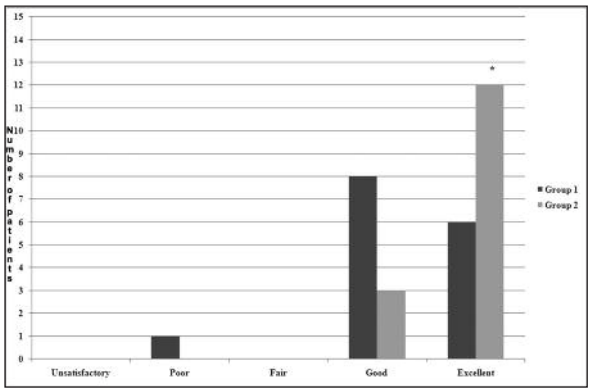

FIGURE 2: Satisfaction scores of the patients.

*: p=0.04 vs Group 1.

Satisfaction scores were significantly higher in Group II (p=0.04) (Figure 2). The questions "would you choose the same technique for your next delivery?" and "would you suggest this technique to other parturients?" were answered as "yes" by all the parturients. One parturient in Group I whose satisfaction score was poor, also answered the question as "yes".

The percentage of participation of the parturients to the delivery which was assessed by the obstetrician was found similar between groups (p=0.25). However, the percentage of participation to the delivery showed an increase by the increase in education levels of the patients.

Bromage scores of all patients were "0" during follow ups. Doses of drugs for labor induction were also similar in both groups (p=0.32). Side effects were similar in both groups (Table 5).

DISCUSSION

The present study showed that the two different low concentrated bupivacaine and sufentanil combinations provided safe and effective analgesia in both groups of parturients. Although VAS scores were lower and dose intervals were longer in Group II, bupivacaine consumption was more and there was a slight decrease in blood pressure values. These two doses are important limits for transition from good to excellent in patient satisfaction.

Bupivacaine is the most preferred local anesthetic in obstetric epidural analgesia because of long duration of action, less motor block effect and minimal fetal and neonatal effects.[11,12]

In a study, Buyse et al. studied bupivacaine, ropivacaine and levobupivacaine, and they added 0.75 μg/mL sufentanil to all three local anesthetics and studied 6 groups in total.[8] They reported that bupivacaine was significantly more potent than levobupivacaine and ropivacaine. Bupivacaine requirement decreased most and the minimum local anesthetic concentration (MLAC) of bupivacaine decreased 90% by addition of sufentanil.

It was reported that ropivacaine was 40% less potent than bupivacaine and levobupivacaine is slightly less potent than bupivacaine.[13-15] Data from epidural motor block and intrathecal analgesia studies have emerged the potency hierarchy as bupivacaine>levobupivacaine>ropivacaine.[2-5,16]

In another study, adding sufentanil to 0.25% bupivacaine provided rapid onset of analgesia and prolonged the duration of analgesia, but the qual-

TABLE 5: Side effects.

	Group 1	Group 2	p
Sedation	3(20)	2(13,3)	1
Hypotension	0(0)	2(13,3)	0,48
Puriritis	2(13,3)	2(13,3)	1
Shievering	3(20)	2(13,3)	1
Urinary retantion	3(20)	4(26,7)	1
Nausea	3(20)	2(13,3)	1
Vomiting	0(0)	1(6,7)	1

Values were presented as n(%).

ity did not differ from bupivacaine alone. The incidence of cardiac and central toxicity decreased, possible complications due to IV and intrathecal injection of local anesthetic would be less, risk of maternal hypotension decreased and minimal motor block was produced.[10]

The potency ratio of epidural sufentanil:fentanyl was reported as 5:1 by Herman et al. and 5.9:1 by Capogna et al., and they observed less side effects like somnolence and pruritus with sufentanil compared to fentanyl.[6,7]

Sufentanil is preferred for epidural administration because of its high lipid solubility and high affinity for mu opioid receptors. It penetrates to spinal cord rapidly, leaving cerebrospinal fluid and this prevents the delayed respiratory depression.[10] In our study, we also preferred sufentanil, a potent opioid, which would allow use of lower concentration of bupivacaine.

The maximal safe dose of epidural sufentanil is 30 μg for the mother and the newborn.[1] Intrathecal injection of sufentanil can cause hypotension, respiratory arrest, changes in mental status, aphasia and cerebral thrombosis.[17-19] However, no side effects like these had been reported after epidural injection.

Dahl et al. reported that 0.0625% bupivacaine+1 μg/mL sufentanil decreased motor block, hypotension, urinary retention and required less instrumental delivery but did not decrease the feeling of urge to push.[9]

Eriksson et al. randomized parturients into 3 groups to receive 0.5 μg/mL, 0.75 μg/mL or 1 μg/mL sufentanil in addition to bupivacaine 0.625 mg/mL+adrenaline 1.25 μg/mL.[1] They found no difference in the analgesic effect between three different concentrations of sufentanil. Pruritus, hypotension and urinary retention were seen more frequently in the group where 1 μg/mL sufentanil was used. As a result, the lowest studied dose (0.5 μg/mL) of sufentanil was recommended since it gave satisfactory analgesia.

In the present study, we did not add adrenaline to our local anesthetic solution and 0.5 μg/mL sufentanil was preferred. We found no difference between the groups regarding sufentanil consumption. Additionally, motor block was not observed in any parturient and local anesthetic consumption was low.

Özmert and Şen reported more side effects and local anesthetic consumption in continuous epidural infusion group.[20] Lim et al. found lower incidence of breakthrough pain and higher maternal satisfaction in patients using automated regular bolus delivery of epidural analgesia when compared to continuous infusion.[21]

Patient or physician controlled intermittent injections increases the workload compared to continuous infusion technique. We used intermittent epidural injection technique in our obstetric unit. In the present study, patient controlled analgesia devices or infusion sets were not used and this decreased the cost.

Despite the higher satisfaction scores in Group II, all patients answered the questions as "yes". This showed satisfactory analgesia was achieved in both groups.

In the present study, satisfactory analgesia was produced in both groups. Although median VAS scores were lower in Group II, VAS<4 could be reached in Group I. In addition, hemodynamic side effects were not seen in any patient of the Group I. As a result, 0.0625% bupivacaine+0.5 μg/mL sufentanil combination as providing VAS<4 could be a preferable alternative to 0.1% bupivacaine+0.5 μg/ml sufentanil.

The VAS scores were found similar in both groups. In Group I, total bupivacaine consumption was lower. Similar analgesia could be achieved in Group I with similar volumes but lower amounts of bupivacaine. We concluded that as well as the concentration of drugs, the volume administered was also important in providing analgesia. Further studies are needed to confirm this hypothesis.

REFERENCES

1. Eriksson SL, Frykholm P, Stenlund PM, Olofsson C. A comparison of three doses of sufentanil in combination with bupivacaine-adrenaline in continuous epidural analgesia during labour. Acta Anaesthesiol Scand 2000; 44(8):919-23.
2. Lacassie HJ, Columb MO. The relative motor blocking potencies of bupivacaine and levobupivacaine in labor. Anesth Analg 2003; 97(5):1509-13.
3. Ergin A. [Epidural analgesia for painless childbirth]. Turkiye Klinikleri J Surg Med Sci 2007; 3(32):29-33.
4. Lacassie HJ, Columb MO, Lacassie HP, Lantadilla RA. The relative motor blocking potencies of epidural bupivacaine and ropivacaine in labor. Anesth Analg 2002;95(1):204-8, table of contents.
5. Camorcia M, Capogna G, Columb MO. Minimum local analgesic doses of ropivacaine, levobupivacaine, and bupivacaine for intrathecal labor analgesia. Anesthesiology 2005;102(3): 646-50.
6. Herman NL, Sheu KL, Van Decar TK, Rubin JD, Gadalla F, Koff HD, et al. Determination of the analgesic dose-response relationship for epidural fentanyl and sufentanil with bupivacaine 0.125% in laboring patients. J Clin Anesth 1998;10(8):670-7.
7. Capogna G, Camorcia M, Columb MO. Minimum analgesic doses of fentanyl and sufentanil for epidural analgesia in the first stage of labor. Anesth Analg 2003;96(4):1178-82, table of contents.
8. Buyse I, Stockman W, Columb M, Vandermeersch E, Van de Velde M. Effect of sufentanil on minimum local analgesic concentrations of epidural bupivacaine, ropivacaine and levobupivacaine in nullipara in early labour. Int J Obstet Anesth 2007;16(1):22-8.
9. Dahl V, Hagen I, Koss KS, Nordentoft J, Raeder JC. Bupivacaine 2.5 mg/ml versus bupivacaine 0.625 mg/ml and sufentanil l microg/ml with or without epinephrine 1 microg/ml for epidural analgesia in labour. Int J Obstet Anesth 1999;8(3):155-60.
10. Phillips GH. Epidural sufentanil/bupivacaine combinations for analgesia during labor: effect of varying sufentanil doses. Anesthesiology 1987;67(5):835-8.
11. Bernard JM, Le Roux D, Frouin J. Ropivacaine and fentanyl concentrations in patient-controlled epidural analgesia during labor: a volume-range study. Anesth Analg 2003; 97(6):1800-7.
12. Beilin Y, Halpern S. Focused review: ropivacaine versus bupivacaine for epidural labor analgesia. Anesth Analg 2010;111(2):482-7.
13. Polley LS, Columb MO, Naughton NN, Wagner DS, van de Ven CJ. Relative analgesic potencies of ropivacaine and bupivacaine for epidural analgesia in labor: implications for therapeutic indexes. Anesthesiology 1999; 90(4):944-50.
14. Capogna G, Celleno D, Fusco P, Lyons G, Columb M. Relative potencies of bupivacaine and ropivacaine for analgesia in labour. Br J Anaesth 1999;82(3):371-3.
15. Lyons G, Columb M, Wilson RC, Johnson RV. Epidural pain relief in labour: potencies of levobupivacaine and racemic bupivacaine. Br J Anaesth 1998;81(6):899-901.
16. Akarsu T. Levobupivacaine plus fentanyl versus bupivacaine plus fentanyl in epidural anesthesia for lumbar disc surgery. Turkiye Klinikleri J Med Sci 2011;31(1):100-8.
17. Ferouz F, Norris MC, Leighton BL. Risk of respiratory arrest after intrathecal sufentanil. Anesth Analg 1997;85(5):1088-90.
18. Fragneto RY, Fisher A. Mental status change and aphasia after labor analgesia with intrathecal sufentanil/bupivacaine. Anesth Analg 2000;90(5):1175-6.
19. Kapessidou Y, Vokaer M, Laureys M, Bier JC, Boogaerts JG. Case report: cerebral vein thrombosis after subarachnoid analgesia for labour. Can J Anaesth 2006;53(10):1015-9.
20. Özmert G, Şen S, Şekerci S, Çalışkan E, Özalp G, Dilbaz B. [Comparison of patient controlled analgesia and continious epidural infusion analgesia in labour pain relief]. Türk Anesteziyoloji ve Reanimasyon Der Dergisi 2004;32(1):47-53.
21. Lim Y, Sia AT, Ocampo C. Automated regular boluses for epidural analgesia: a comparison with continuous infusion. Int J Obstet Anesth 2005;14(4):305-9.