Effects of epidural analgesia using ropivacaine on the mother and the newborn during labor

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ABSTRACT

Objective: To evaluate the effects of epidural analgesia using 0.2% Ropivacaine on the mother, newborn and during labor.

Methods: This study was conducted at the Zeynep Kamil Obstetric, Gynecology, and Pediatric Research and Training Hospital in Istanbul, Turkey, between July 2003 and April 2004. Eighty pregnant women of 37-41 weeks' gestation were enrolled in the study. Forty cases received epidural analgesia (group 1) and the control group composed 40 cases (group 2). Duration of labor, systolic and diastolic blood pressures at initial, 15th, 30th, 45th and 60th minutes, and number of breathing per minute, pulse rates, fetal heart rates and presence of motor block were recorded. Blood gas assessments from the umbilical cord, 1st and 5th minute Apgar scores were noted following the delivery. Way of delivery, adverse effects and complications of the epidural analgesia were recorded.

Results: Mean age of the cases was 24.79 ± 4.72 years. Duration between full cervical dilation and delivery (phase 2) was significantly longer in group 1 ($p<0.01$). Sixty minutes systolic arterial pressure was significantly lower in group 1 ($p<0.05$). In group 1, diastolic arterial pressures at 15th, 45th, 60th minutes ($p<0.01$) and 30th minute ($p<0.05$) were significantly lower when compared to the initial values. No significant differences were recorded in terms of breathing rates, umbilical cord CO_2, O_2, pH levels and Apgar scores between the 2 groups. The most common adverse effect of epidural analgesia was sedation (59%). The second dose of Ropivacaine was needed in 24 (61.5%) cases in group 1. In group 1, 29 (74.4%) patients expressed their pleasure as very good regarding the epidural analgesia.

Conclusion: Epidural analgesia, if administered by a specialist to a properly selected patient at proper time, leads to a comfortable delivery by relieving the pain. It can be performed safely after taking an informed consent.

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Epidural analgesia used during labor, has many favorable effects such as relieving the pain, lowering stress levels, balancing the breathing rate and amplitude, maintaining the acid-base balance and the uteroplacental perfusion and lowering the blood pressure in pre-eclamptic patients. Besides these physiological benefits, patients mention a comfort due to the relieve in the pain. Epidural analgesia at the active phase of the labor is the most common method of delivery analgesia with low complication rates if performed properly. In delivery analgesia, there are several methods used such as combined spinal-epidural anesthesia, continuous epidural infusion, bolus epidural injection and patient controlled epidural infusion.[1] In our study, we aimed to evaluate the effects of epidural analgesia using 0.2% Ropivacaine on the mother and the newborn, during labor, duration of dilation of the cervix and the need of operative delivery.

Methods. Pregnant women in labor, with 3-5cm cervical dilation were enrolled in this prospective

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controlled study conducted at the Zeynep Kamil Women and Children Research and Training Hospital in Istanbul, Turkey, between July 2003 and April 2004. A total of 80 participants were required with the following criteria: 37-41 weeks of gestation, singleton pregnancies with vertex presentation, absence of cephalopelvic disproportion and any systemic disease, a reassuring nonreactive stress test (NST) with adequate amniotic fluid. Forty cases encompassed the study group receiving epidural analgesia (group 1) and 40 cases were the control group (group 2). The patients were selected randomly in group 1. All patients were given detailed information about the procedure and their written consent was taken. Age, height, weight, weeks of gestation, gravida, parity, educational level, basal systolic and diastolic pressure, breathing per minute, pulse rate and total blood count of each participant were recorded. Nonreactive stress test was performed to each patient and reactive fetal heart pattern and the amplitude, frequency and duration of the uterine contractions were recorded. Thirty minutes prior to epidural analgesia, ringer lactate (10 ml/kg with 20G venous catheter) was infused to all patients in group 1. Following the insertion of 18G Tuohy epidural catheter by the anesthesiologist, patients' heads were elevated 35-45 degrees and they were placed to left recumbent position. A test dose of 2 ml lidocaine (2%) was administered and waited for 5 minutes. The procedure was continued if no motor block was developed and a significant relieve of pain was detected. Fifteen ml of 0.2% Ropivacaine was then administered to the epidural space. Oxytocin infusion was started for augmentation if the uterine contractions were <3 in 10 minutes monitored by tocography in the first and second stages of the labor. Dose of oxytocin was gradually rise until effective uterine contractions occurred. The first stage of labor ended when cervix was fully dilated and effaced. The second stage of labor ended with the delivery of the fetus and the third stage completed with the delivery of the placenta and fetal membranes. Durations of all 3 stages were recorded. Perineal analgesia was assessed when patients were taken into the delivery room. In case of insufficient analgesia, additional 5 ml of lidocaine was administered through the epidural catheter and waited for 5 minutes while the pregnant was in the sitting position. Following the initial dose of epidural analgesia, systolic and diastolic arterial blood pressures, number of ventilation per minute, fetal heart rates and whether motor block was developed or not were detected in 15 minute intervals. After the delivery, blood gas from the umbilical cord was assessed. Route of delivery, gender and weight of the newborn, 1st and 5th minute Apgar scores, adverse effects and complications of the delivery were recorded. Epidural catheters were pulled out 2 hours after the delivery. Control hemogram of the mothers were obtained in the 12th hour of postpartum period and were compared to the prepartum values.

Statistical Package of Social Sciences version 10.0 for Windows (Chicago, Illinois) was used for statistical assessments. Besides descriptive methods (frequency, mean, standard deviation), independent samples x^2 test, Mann Whitney U test and paired samples t test were used for parametric assessments. Nonparametric data were compared by t-test. Probability values ≤0.05 were considered as statistically significant.

Results. The mean age of the patients was 24.79 ± 4.72. In group 1, 39 patients had normal vaginal delivery while one (2.5%) had undergone cesarean section. In group 2, all participants had normal vaginal delivery. There was no statistical difference in terms of age, height, weight, gestational week, initial cervical dilation, gravida, parity and educational level of the patients among the 2 groups (p>0.05) (**Table 1**). Duration until full cervical dilation (Phase 1) was not found to be different between the 2 groups (p>0.05)

Table 1 - Demographic characteristics.

Characteristics	Received epidural analgesia group I		Not recevied epidural analgesia group II		*P* value
Age (Mean ± SD)	24.47 ± 4.64		25.10 ± 4.85		0.558
Height (Mean ± SD)	159.32 ± 5.03		160.37 ± 3.70		0.291
Weight (Mean ± SD)	68.65 ± 8.73		70.57 ± 9.34		0.344
Gestational week (Mean ± SD)	39.45 ± 1.29		39.30 ± 1.19		0.592
Cervical dilation (Mean ± SD)	4.08 ± 0.68		3.82 ± 0.47		0.062
Gravida (%)					0.741
1	19	(47.5)	18	(45.0)	
2	8	(20.0)	12	(30.0)	
3	10	(25.0)	8	(20.0)	
4	3	(7.5)	2	(50.0)	
Parity (%)					0.995
0	21	(52.5)	20	(50.0)	
1	10	(25.0)	11	(27.5)	
2	8	(20.0)	8	(20.0)	
3	1	(2.5)	1	(2.5)	
Educational status					0.765
Illiterate	1	(2.5)	1	(2.5)	
Literate	-	-	2	(5.0)	
Primary school	20	(50.0)	18	(45.0)	
Junior high school	6	(15.0)	8	(20.0)	
High school	12	(30.0)	10	(25.0)	
University	1	(2.5)	1	(2.5)	

(**Table 2**). In group 1, the duration from full dilation of the cervix to the delivery (Phase 2) was longer compared to group 2 ($p<0.01$) (**Table 2**). There was no difference in placental separation times of the groups ($p>0.05$) (**Table 2**). When the 2 groups were compared, prepartum and postpartum hemoglobin, hematocrit, leucocyte and platelet counts were not statistically different ($p>0.05$). There was a significant decrease in hemoglobin and hematocrit levels and an increase in leucocyte levels after delivery when compared to the prepartum levels for both groups ($p<0.01$) (**Table 3**). No significant change was recorded in platelet levels for both groups ($p>0.05$) (**Table 3**). In group 1, 60th minute systolic arterial pressure was significantly lower than group 2 ($p<0.05$) while initial, 15th, 30th and 45th minute values were not different ($p>0.05$)(**Table 4**). Decline in systolic arterial pressure levels in group 1 at 15th, 30th, 45th and 60th minutes were found statistically significant ($p<0.01$) (**Table 4**). In contrary, there was no significant change in group 2 ($p>0.05$) (**Table 4**). Initial, 15th, 30th, 45th and 60th minute diastolic arterial pressures showed no significant difference between the 2 groups ($p>0.05$). In the epidural analgesia group, decrease in diastolic arterial pressure at 15th, 45th, 60th ($p<0.01$) and 30th ($p<0.05$) minutes were found significant (**Table 4**). In the control group, there was no significant change in the diastolic arterial pressure at certain intervals ($p>0.05$) (**Table 4**). The number of ventilation per minute at the baseline, 15th, 30th, 45th and 60th minutes did not show any difference between the groups ($p>0.05$). In the control group there was a significant rise in the number of ventilation per minute at 30th, 45th and 60th minutes ($p<0.01$), whereas no change was recorded in the epidural analgesia group ($p>0.05$). Median values of systolic arterial pressure differences in group 2 were found significantly higher than group 1 in 15th, 30th, 45th and 60th minutes (**Table 5**) ($p<0.01$). Similarly, median values of diastolic arterial pressure differences in group 2 were found significantly higher

Table 2 - Comparison according to the stages of labor.

Stages	Received epidural analgesia group I Duration (minute)	Not received epidural analgesia group II (control) Duration (minute)	*P* value
Phase 1	112.95 ± 65.89	95.87 ± 43.14	0.179
Phase 2	32.61 ± 19.63	16.10 ± 6.68	0.001*
Phase 3	11.18 ± 4.59	13.30 ± 7.45	0.133

*$p<0.01$

Table 3 - Comparison of complete blood count parameters.

Parameters	Received epidural analgesia, group I Mean ± SD	Notreceived epidural analgesia, group II (control) Mean ± SD	*P* value
Hemoglobin			
Prepartum	11.65 ± 1.53	11.66 ± 1.15	0.974
Postpartum	10.30 ± 1.61	10.29 ± 1.25	0.969
P value	0.001*	0.001*	
Hematocrit			
Prepartum	34.52 ± 4.45	34.26 ± 3.47	0.769
Postpartum	30.36 ± 4.44	31.02 ± 3.78	0.475
P value	0.001*	0.001*	
Leukocyte			
Prepartum	10267.5 ± 2563.8	9990.0 ± 2944.4	0.654
Postpartum	12276.9 ± 3836.9	12137.5 ± 4315.7	0.880
P value	0.001*	0.001*	
Platelet			
Prepartum	208125.0 ± 63419.3	221325.0 ± 59079.9	0.338
Postpartum	211641.0 ± 57843.9	221225.0 ± 53288.9	0.446
P value	0.780	0.978	

*p<0,01

Table 4 - Intergroup and intragroup comparisons of SAP, DAP, pulse rates, number of ventilation per minute and maternal fever.

Intergroup and intragroup comparisons	Group I Mean ± SD		Group II Mean ± SD		*P* value
SAP					
Beginning	115.75	12.99	112.00	14.18	0.221
15 minute	108.50‡	12.92	112.50	12.76	0.168
30 minute	108.72‡	11.96	113.25	14.44	0.133
45 minute	108.46‡	16.31	111.87	13.94	0.320
60 minute	106.92‡	13.79	114.00	13.36	0.023*
DAP					
Beginning	74.00	10.81	71.00	11.50	0.233
15 minute	68.62‡	12.14	71.37	10.92	0.290
30 minute	70.00†	11.70	71.62	12.83	0.558
45 minute	69.23‡	13.25	71.25	10.73	0.458
60 minute	69.49‡	11.23	72.72	11.43	0.208
Pulse					
Beginning	84.20	9.91	86.07	11.40	0.435
15 minute	86.47	9.85	85.67	10.74	0.729
30 minute	84.38	10.43	85.90	9.06	0.492
45 minute	87.05	12.68	86.07	9.92	0.704
60 minute	85.00	13.96	87.00	8.34	0.440
No. of ventilation per minute					
Beginning	17.85	3.81	17.00	2.23	0.227
15 minute	17.55	3.10	17.30	2.32	0.685
30 minute	17.54	3.40	18.05‡	2.37	0.442
45 minute	17.67	2.97	18.10‡	2.53	0.487
60 minute	17.87	3.14	18.57‡	2.59	0.280
Fever					
Beginning	36.61	0.37	36.68	0.30	0.322
60 minute	36.76	0.37	36.74	0.28	0.772

*$p<0.05$: significant, †Significant in $p<0.05$ level when compared to baseline. ‡Significant in $p<0.01$ level when compared to baseline. SAP - Systolic arterial pressure, DAP - Diastolic arterial pressures,

than group 1 in 15th and 60th minutes ($p<0.01$) and 30th and 45th minutes ($p<0.05$) (**Table 5**). The number of ventilation per minute did not show any difference between baseline and 15th minutes for both groups ($p>0.05$). However, the median values of the number of ventilation per minute differences in 30th, 45th and 60th minutes when compared to the baseline values were higher in group 2 than group 1 ($p<0.01$) (**Table 5**). In terms of the umbilical cord CO_2, O_2, pH levels and Apgar scores, no significant difference was observed between the 2 groups ($p>0.05$) (**Table 6**). In the epidural analgesia group, the most common adverse effects were sedation (59%) and nausea (25.6%). A 200 mg trimethobenzamide HCL (Vomet amp) was administered intramuscularly to the patients complaining nausea. Other adverse effects were vomiting, tremor and bradycardia. The second dose of Ropivacaine was needed in 24 patients (61.5%) in group 1. In the epidural analgesia group, 29 (74.4%) patients reported their satisfaction as very good, while it was good in 8 (20.5%) patients and moderate in 2 (5.1%) patients.

Table 5 - Intergroup comparisons of differences according to beginning, SAP, DAP, pulse rates, number of ventilation per minute.

Intergroup comparisons of differences	Group I Mean Rank	Group II Mean Rank	*P* value
SAP			
Beginning - 15 minute	32.76	48.24	0.001†
Beginning - 30 minute	32.54	47.28	0.001†
Beginning - 45 minute	33.04	46.79	0.001†
Beginning - 60 minute	29.51	50.22	0.001†
DAP			
Beginning - 15 minute	33.69	47.31	0.004†
Beginning - 30 minute	34.88	44.99	0.039*
Beginning - 45 minute	34.19	45.66	0.019*
Beginning - 60 minute	32.67	47.15	0.003†
Pulse			
Beginning - 15 minute	42.75	38.25	0.383
Beginning - 30 minute	39.54	40.45	0.860
Beginning - 45 minute	40.12	39.89	0.965
Beginning - 60 minute	39.38	40.60	0.813
No. of ventilation per minute			
Beginning - 15 minute	36.25	44.75	0.076
Beginning - 30 minute	32.79	47.03	0.005†
Beginning - 45 minute	33.46	46.38	0.011*
Beginning - 60 minute	32.53	47.29	0.004†

*$p<0.05$, †$p<0.01$.
SAP - Systolic arterial pressure, DAP - Diastolic arterial pressure

Discussion. Use of epidural analgesia has gained popularity in many obstetric clinics. Uterine contractions lead to an increase in endogenous catecholamines of pregnant women in labor. These catecholamines cause an extra load on cardiovascular system of the pregnant women, decrease the uteroplacental perfusion and finally prolong the labor by inducing irregular uterine contractions.[2,3] It has been observed that the use of epidural analgesia during labor decreases the catecholamine levels.[4] All sensory afferents can be suppressed by administering a local anesthetic via a lumbar catheter. Adverse effects such as intoxication, allergy, motor and sympathetic block can be prevented by using the proper technique and local anesthetic. Ropivacaine and Bupivacaine are the most commonly used local anesthetic agents in epidural analgesia lately. Both have been used at varying concentrations and combined with opioid analgesics.[1,3,4] Ropivacaine and Bupivacaine have same efficacy at same doses, on the other hand, when compared to Bupivacaine, Ropivacaine has a wider safety range making it possible to use at higher concentrations with lower systemic toxicity risk. In recent years, many studies have been conducted to compare the efficiency and adverse effects of Ropivacaine and Bupivacaine.[1,4,5] In general, no significant difference was recorded in the newborn Apgar scores between Ropivacaine and Bupivacaine. Frequency of motor block has been found significantly lower with Ropivacaine compared to Bupivacaine. Operative delivery was found lower in bupivacaine group while cesarean-section rates were the same.[1-6] For these reasons, we have used Ropivacaine in the present study. In literature, ropivacaine have been administered at variable doses, either as a bolus or a continuous epidural injection via an epidural catheter.[7] In our study, we have administered 15 ml

Table 6 - Comparison of Apgar and blood gas levels.

Paramets	Received epidural analgesia group I Mean ± SD	Not received epidural analgesia group II (control) Mean ± SD	*P* value
Blood gas			
Co_2	49.49 ± 3.74	48.38 ± 3.51	0.181
O_2	26.58 ± 2.56	26.94 ± 3.41	0.522
pH	7.27 ± 0.03	7.26 ± 0.02	0.146
Apgar			
1	8.18 ± 1.02	8.50 ± 0.88	0.139
2	9.61 ± 0.63	9.75 ± 0.44	0.277

of 0.2% ropivacaine as a bolus injection. A second dose of 10 ml ropivacaine was needed in 61.5% of the cases in this study. Controversial studies are present on the effects of epidural analgesia in different stages of labor. Halpern et al[8] in a meta-analysis of 2369 patients, detected significant elongation of the first and second stages of labor. Similarly, Leighton et al[9] observed an elongation of the second stage but no difference in the first stage of labor. Gomer et al[10] also supported these findings. On the contrary, Lurie et al[11] stated that first and second stage of labor shortens with epidural analgesia. In our study, we observed that duration of the first stage does not change; however, second stage significantly gets longer. Bodner et al[12] stated that there was no difference in the newborns' Apgar scores and umbilical cord blood pH levels between the epidural analgesia and control groups. Many studies had similar results.[3,13] Likewise, the first and fifth minute Apgar scores, umbilical arterial pH, pO_2 and pCO_2 levels were found similar in both groups in our study. Rates of cesarean-section in patients who had received epidural analgesia are in a wide range. In a previous study, they reported a 14.7 fold increase of cesarean-section rates while in another study they found no difference. The common result in meta-analysis is, with correct timing, proper technique and patient selection; epidural analgesia does not increase the rate of cesarean-section.[14-16] In our study, one case (2.5%) in the epidural analgesia group have undergone cesarean-section while all pregnants had vaginal delivery in the control group. No statistical significant difference was found between the 2 groups. Halpern et al[8] reported 2.19 fold and Zhang et al[17] reported 4.72 fold increases in the instrumental deliveries with epidural analgesia. There are many studies supporting these results.[14,15] On the other hand, Leighton and Halpern[16] stated that epidural analgesia has no promoting effect on instrumental delivery. In the present study, there was not any instrumental delivery in both groups. In 2 different studies by Lieberman,[18,19] it was pointed out the coexistence of maternal fever and newborn sepsis in deliveries with epidural analgesia. Gonen et al[20] also supported these results. Mostly, elongation of labor has been hold responsible for maternal fever and newborn sepsis. Besides, some researchers believed that the agents used and some unknown factors may be in charge. Walker and O'Brien[21] in a study of 233 patients have not detected an increase in maternal fever. We have not observed any increase in maternal fever in both groups. Lehmann et al[2] reported no change in cardiovascular system functions in pregnants receiving epidural analgesia and stated that decrease in blood pressure, pulse and breathing rates were due to lower stress levels. In our study, decrease in systolic and diastolic pressures, pulse and breathing rate changes in epidural analgesia group were found similar with the literature. Hypotension was the most reported adverse effect related to epidural analgesia. Other side effects were perforation of dura, urinary retention, nausea, vomiting, intravenous injection, intrathecal injection, bradycardia, headache, sedation and pruritus.[14-16] Unlike the literature, we have seen hypotension only in 5 cases (12.8%) and treated with 1 mg of ephedrine. The most common adverse effects in our study were sedation (59%), nausea (25.6%) and vomiting (15.4%). There were no study evaluating the total blood count parameters before and after the delivery in patients receiving epidural analgesia. In our study, no significant difference was recorded as expected.

In conclusion, epidural analgesia, if administered by an experienced anesthesiologist, to a properly selected patient with correct timing, is a method which relieves the pain, making the delivery more comfortable. Possible complications and adverse effects are at acceptable rates. To minimize the complications of epidural analgesia, a careful obstetric and anesthetic follow up is needed. After giving detailed information about the procedure to the mother to be, epidural analgesia can be performed safely with the patient's consent.

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