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Original Research Article

Labor epidural analgesia and the incidence of instrumental assisted delivery

Kęstutis Rimaitis [a,*], Olga Klimenko [a], Marius Rimaitis [a], Asta Morkūnaitė [b], Andrius Macas [a]

[a] Department of Anesthesiology, Medical Academy, Lithuanian University of Health Sciences, Kaunas, Lithuania
[b] Tauragė Hospital, Tauragė, Lithuania

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ABSTRACT

Objective: To assess the influence of labor epidural analgesia on the course of labor and to determine its association with instrumental assisted delivery rate.

Materials and methods: A retrospective case–control study was performed during 2007–2011 aiming to identify the relation between epidural analgesia (EA) and instrumental assisted delivery (IAD) rate. All patients in whom instrumental assistance for delivery was applied were allocated into either case (parturients who received EA and had IAD) or control (parturients who did not receive EA but had IAD) groups. Maternal demographic data, pregnancy and delivery characteristics as well as neonatal short-term outcome were studied.

Results: A total of 7675 vaginal deliveries occurred during the study period and 187 (2.43%) patients had IAD. Vacuum extraction was applied to 67 (2.16%) parturients who received EA, and to 120 (2.61%) who did not. The median duration of the first stage of labor was 510 min in the EA group as compared to 390 min in the control group ($P = 0.001$). The median duration of the second stage of labor among cases and controls was 60 and 40 min, respectively ($P < 0.0005$). Cases more often had their labor induced by oxytocin 80.3% as compared to 58.3% among controls ($P = 0.003$). There was no significant association between the use of EA and increased IAD rate (OR = 0.81; 95% CI, 0.60–1.09).

Conclusions: Labor EA did not increase the incidence of IAD and the risk of adverse neonatal outcomes, but was associated with prolonged first and second stages of labor.

* *Corresponding author at*: Department of Anesthesiology, Medical Academy, Lithuanian University of Health Sciences, Eivenių 2, 50161 Kaunas, Lithuania.
E-mail address: kestutis.rimaitis@kaunoklinikos.lt (K. Rimaitis).

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1. Introduction

Labor epidural analgesia (EA) is an increasingly used technique for pain relief of a parturient. In a recent Cochrane database review regarding pain management for women in labor, EA was acknowledged as the most effective pain management technique as compared with inhaled analgesia, systemic opioid and nonopioid analgesics, and nonpharmacologic interventions [1]. It enables to achieve high maternal satisfaction rates with regard to pain management, sense of control in labor, and overall childbirth experience [1,2]. In addition to analgesic efficacy, physiological benefits of EA for the mother and fetus are well-documented: it improves maternal cardiovascular and pulmonary physiology, uteroplacental perfusion and acid–base status of the fetus [3–6]. Since EA was introduced for labor pain relief, the controversy about the relation between EA and instrumental deliveries, cesarean section, as well as prolonged labor has originated. Further studies, however, found no EA association with increased cesarean section rate, but discussions regarding its influence on instrumental assisted delivery (IAD) rate and duration of labor persist [7–21].

2. Materials and methods

The study was performed in the maternal unit of a tertiary perinatology center. All the patients in whom instrumental assistance for delivery was applied from January 1, 2007, until November 24, 2011, were studied. All computer registry data and medical records were analyzed. Study patients were allocated into two groups: the epidural analgesia group (cases) comprised parturients who received EA and had vacuum extraction, and the control group (controls) consisted of parturients who did not receive EA, but had vacuum extraction. Epidural catheters for analgesia were placed at the L_2–L_3, L_3–L_4 or L_4–L_5 interspace, when patients had cervical dilation of ≥3 cm. A 3-mL epidural test dose of lidocaine (15 mg/mL) with epinephrine (5 μg/mL) was given to all patients. Parturients were subsequently administered an initial epidural bolus of 10–15 mL bupivacaine (1 mg/mL) with fentanyl (2.5 μg/mL), which was followed by a continuous infusion of bupivacaine (1 mg/mL) with fentanyl (2 μg/mL) at a rate of 7–10 mL/h. Maternal demographic data, pregnancy and delivery characteristics, use of oxytocin and duration of delivery stages were studied. Neonatal outcomes of interest were birth weight, height, neonatal arterial pH, and Apgar scores at the first and fifth minutes. We performed our statistical analysis using SPSS for Windows (version 15). Demographic variables were assessed using descriptive statistics. Odds ratio with 95% confidence interval for IAD was estimated. Statistical analysis was performed using Student *t* test, Mann–Whitney *U* test and χ^2 test where appropriate. All data are presented as mean ± standard deviation (SD) unless indicated otherwise. A *P* value of less than 0.05 was considered statistically significant.

3. Results

A total of 7675 vaginal deliveries occurred in our maternal unit during the study period and 187 (2.43%) women had vacuum extraction. EA was given to 3093 (40.3%) parturients whereas 4582 (59.7%) received systemic opioid, inhalation analgesia or no analgesia at all. Instrumental assistance for delivery was applied to 67 (2.16%) women in labor who received EA and to 120 (2.61%) who did not. Three entries (1 case and 2 controls) were not studied due to lack of medical records (Fig. 1).

Patient demographics such as maternal age, height, weight, weight gain, and gestational age were comparable between groups. The mean age of study patients was 26 years with a mean gestational age of 38 weeks. Nulliparas requested EA significantly more often than multiparas: 54 and 12, respectively ($P = 0.041$) (Table 1). The median duration of the first stage of labor was 510 min in the EA group as compared with 390 min in the control group ($P = 0.001$). The median duration of the second stage of labor among cases and controls was 60 and 40 min, respectively ($P < 0.0005$). As presented in Table 2, the first stage of labor was statistically significantly prolonged in primiparas with EA, but not in multiparas. However, the

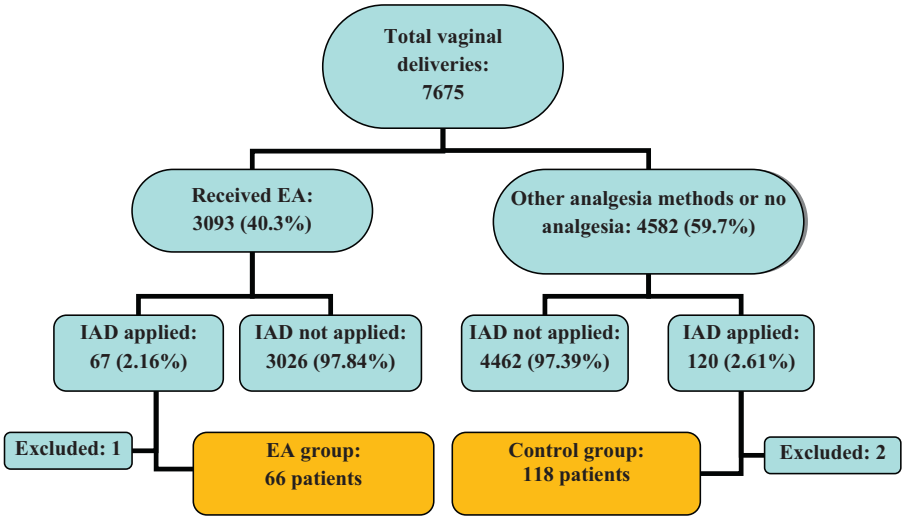

Fig. 1 – Flow chart of the study. EA, epidural analgesia; IAD, instrumental assisted delivery.

Table 1 – Maternal and pregnancy characteristics in study groups.

Variable	EA group (Cases) ($n = 66$)	Control group (Controls) ($n = 118$)	P value
Maternal characteristics			
Age, years	26.5 ± 5.5	26.4 ± 6.2	0.846
Height, cm	166.7 ± 5.5	166.1 ± 5.7	0.505
Weight, kg	76.5 ± 12.0	76.0 ± 13.4	0.781
Weight gain, kg	15.5 ± 4.9	15.2 ± 5.2	0.62
Pregnancy characteristics, n (%)			
Nulliparous	54 (81.8)	72 (61.0)	0.003
Multiparous	12 (18.2)	46 (39.0)	0.003
Gestational age, weeks	38.7 ± 5.1	38.4 ± 5.5	0.73

Data are expressed as mean ± standard deviation unless otherwise indicated.

Table 2 – Duration of the first and second stages of labor with regard to the use of EA in nulliparas and multiparas.

Variable		EA group $n = 66$	Control group $n = 118$	P value
Nulliparas	1st stage of labor, min	540 (330)	435 (154)	<0.05
	2nd stage of labor, min	56.5 (76)	42 (35)	<0.05
Multiparas	1st stage of labor, min	435 (266)	300 (283)	>0.05
	2nd stage of labor, min	67.5 (49)	30 (38)	<0.05

Data are expressed as median (interquartile range).

second stage of labor was significantly longer in primiparas and multiparas with EA ($P < 0.05$) (Table 2). There was no significant association between the use of EA and increased IAD rate (OR = 0.81; 95% CI, 0.60–1.09).

The patients who requested for EA had labor induced by oxytocin significantly more often: 80.3% vs. 58.3% among cases and controls, respectively ($P = 0.003$). As presented in Table 3, there were no significant differences between study groups with regard to neonatal weight, height, Apgar score, and neonatal arterial pH.

4. Discussion

Epidural analgesia is an increasingly popular labor pain management technique with well documented favorable efficacy and safety profile. However, controversial opinion about relation between EA and cesarean section, instrumental deliveries, prolonged labor still exists. According to our study results, labor EA did not increase the incidence of IAD, which is in accordance with findings of previous reports [11,14,18,22–27]. In contrast to our findings, a retrospective case-control study performed in 2012 by Junichi et al. [28] demonstrated increased IAD rate (vacuum extraction 6.5% vs. 2.9%, $P < 0.001$) in parturients who received EA as compared with those who did not. Neonatal variables did not differ significantly between cases and controls even when subjects were stratified by the mode of delivery (spontaneous delivery, cesarean section, vacuum extraction) in that study, which corresponds to our results. However, it should be noticed that parturient age differed significantly between studies, as our study enrolled younger women (26.5 ± 5.5 vs. 32.2 ± 6.3). Maternal age may be a potential factor influencing the outcome of labor.

A systemic review performed in 2011 by Anim-Somuah et al. [19] involved 23 randomized controlled trials with 7935 women comparing labor EA vs. nonpharmacologic interventions or no analgesia at all. They reported an increased risk of IAD associated with EA (RR = 1.42; 95% CI, 1.28–1.57). However, limitations of this review should be noticed as analyzed trials varied with regard to characteristics of participants, labor management protocols and epidural regimens. Moreover, studies using high and low concentrations of local anesthetics for EA as well as studies maintaining the block during the second stage of labor and those discontinuing it, were enrolled into the same analysis. These factors might have influenced the findings regarding the course of labor, pain relief requirements, outcomes and, particularly, the duration of labor and IAD rates.

Table 3 – Neonatal characteristics in study groups.

Variable	EA group (Cases) ($n = 66$)	Control group (Controls) ($n = 118$)	P value
Apgar at 1 min	7.15 ± 1.92	7.05 ± 1.94	0.79
Apgar at 5 min	8.35 ± 1.02	7.36 ± 1.13	0.875
Neonatal arterial pH	7.20 ± 0.10	7.20 ± 0.11	0.891
Weight, g	3393 ± 516	3338 ± 480	0.483
Height, cm	51.1 ± 2.3	50.8 ± 2.1	0.385

Data are expressed as mean ± standard deviation.

Interestingly, a retrospective study by Toledo et al. [29] with 2072 parturients found that women who experienced breakthrough pain during the first stage of labor were more likely to undergo IAD. This finding suggesting that early-onset severe pain and higher labor analgesia requirements increase the risk of abnormal labor and surgical delivery might explain the association between EA and surgical delivery [30].

Previous trials have demonstrated that EA slows the progress of labor [7,27,28,31] and significantly prolongs the duration of the second stage of labor [7,11,19]. However, data regarding the effect of EA on the first stage of labor remains conflicting. The duration of labor stages was analyzed in our study as well. Our results showed that the first and second stages were significantly prolonged in patients who received EA, and are in accordance with similar findings of many studies [7,10,27,28,31,32]. In contrast, Ohel et al. [14] reported that the first stage of labor was not prolonged or even was shorter in parturients who received early EA in their study. However, the definition of first stage of labor differed between studies; therefore its duration could have been interpreted differently.

We have to note that EA was used more often if labor was induced by oxytocin. Presumably, pharmacologically induced labor is more painful.

We have found no significant differences in neonatal Apgar scores between study groups as demonstrated in previous studies and systematic reviews [16,19,28,33]. Furthermore, there were no significant differences in neonatal arterial pH, which is in conflict with results of other studies [34,35]. This mismatch might be explained by the heterogeneity of our control group, as it consisted of women who received systematic opioid, inhalation analgesia or no analgesia at all.

We have to face several limitations of our study. Firstly, a retrospective study is inevitably associated with selection bias as women with long painful labors and with increased risk of intervention are more likely to request EA, and those women deemed at high risk are actually recommended or encouraged to have an epidural. Furthermore, the use of oxytocin during labor was not documented in women who received EA. As oxytocin stimulates uterine contractions, it could have influenced the mode of delivery. Secondly, the majority of our parturients who received EA were nulliparous (81.8% vs. 18.2%). This might have affected the total duration of labor as well as the duration of distinct labor stages. Subgroup analysis of primiparous vs. multiparous parturients with EA showed significantly prolonged first stage of labor among primiparas, whereas among multiparas this was not significant.

5. Conclusions

According to our study, labor EA did not increase the incidence of instrumental assisted delivery and the risk of adverse neonatal outcomes. EA was associated with prolonged first and second stages of labor. The rate of labor induction with oxytocin was statistically significantly higher in the group of parturients who had requested EA. There are many variables influencing parturient physiology and overall course of labor, therefore the choice of labor EA should be based not only on anesthesiologist's clinical decision but on patient values and preferences as well.

Conflict of interest

Authors state no conflict of interest.

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