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ORIGINAL ARTICLE

Impact of Epidural Analgesia on Labor: Length of Labor, Operative Vaginal Delivery Rate and Occiput Posterior

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SUMMARY

Introduction. Epidural analgesia (EA) is widely used as labor analgesia. It has been reported that EA can slow down the course of labor and increase the risk of operative vaginal delivery. Slower course of labor can lead to an increased risk of abnormal fetal heart rate (FHR). Some studies have also demonstrated an increase in occiput posterior position of the fetal head at delivery if EA is used. It represents a mechanism that may contribute to the lower rate of spontaneous vaginal delivery.

Aim of study. To evaluate the impact of EA on the length of labor and the rate of operative vaginal delivery, and to determine whether EA increases the rate of occiput posterior of the fetal head at delivery

Material and methods. We carried out a retrospective case-control study based on clinical records from parturients admitted to Riga Maternity Hospital in 2013. Parturients were divided into two groups: case group comprised parturients who had EA, while parturients of control group did not have EA. Groups were further subdivided into primiparas and multiparas and comparisons were made according to parity. We excluded parturients who had obstructed labor, pathological labor, induction of the labor, history of C-section and significant anomaly of the fetus.

Results. A total of 832 parturients were included in the study, 304 in EA group (220 primiparas and 84 multiparas) and 528 in control group (257 primiparas and 271 multiparas). Primiparas of EA group had longer latent phase of the first stage of labor in comparison to primiparas of control group (p=0.001), while multiparas of EA group had longer first stage (p=0.031) of labor and longer latent phase of labor (p<0.001) than their respective controls. Vacuum extraction was used in 1.27% of all deliveries with EA. Moreover, vacuum extraction was used only in primiparas an there was no statistically significant difference between EA group primiparas and control group primiparas (1.7% vs. 1.2%, p=0.593). EA did not increase the rate of occiput posterior positon of fetal head. However, primiparas with EA and occiput posterior were more likely to have an abnormal FHR tracing in comparison to primiparas with EA and without occiput posterior position of fetal head (40% vs. 9.8%, p=0.029; RR=4.09, 95% CI 1.3-12.9). There was no statistically significant link between occiput posterior position and abnormal FHR tracing in control group primiparas.

Conclusion. EA does not increase the likelihood of operative vaginal delivery. However, parturients with EA have longer latent phase of the first stage of labor. Risk for occiput posterior at delivery is not increased in labor with EA. However, the risk for abnormal FHR among primiparas who receive EA is increased in case of occiput posterior position of the fetal head.

Key words: epidural analgesia, labor, operative-vaginal delivery, occiput posterior

INTRODUCTION

Epidural analgesia (EA) is widely used in obstetrics as one of the most effective methods for pain relief during labor and its usage has increased over the past decades. EA is beneficial not only for pain relief, but it also causes reduction in production of maternal stress hormones, decreases hyperventilation, causes uterine vasodilatation and improves fetal acid-base status (3, 21, 22). However, despite its apparent advantages the concerns regarding its safety and negative implications on labor have remained.

Some of the most widely discussed disadvantages of EA are prolongation of labor and increase in operative vaginal delivery as well as C-section rates. Previous studies have demonstrated an increased length of the second stage of labor if EA is used (1, 3, 11, 12, 18). Also, women receiving EA have augmentation of labor with oxytocin more frequently (3). Whether EA increases C-section rates has been an object of discussion, but Cochrane review of the recent evidence has shown no association between EA and increased risk for C-section (3). However, the question whether there is a causal relationship between EA and operative vaginal delivery as well as prolonged labor remains unclear.

In addition to prolonged labor and increased rate of operative vaginal delivery, published data also suggests the association between EA and increased rate of occiput posterior position of the fetal head at delivery (16, 17). Occiput posterior positions at birth occur approximately in 5% of deliveries, and may result from malrotation of an original occiput anterior position or a persistent occiput posterior that has failed to rotate anteriorly (9). Occiput posterior position of the fetal head has been associated with increased rates of operative vaginal delivery and third and fourth degree perineal tears (8, 20). Lieberman et al. suggested that occiput posterior position of the fetal head at delivery might contribute to the lower rate of spontaneous vaginal delivery

consistently observed when EA is used (17).
It has been reported that timing of EA might have an impact on the increased operative vaginal delivery rate, prolonged labor and other possible complications. However, recent Cochrane database review regarding early versus late initiation of EA showed that the impact on length of labor, instrumental and Cesarean delivery rates, and occiput posterior rates was the same comparing early or late initiation of EA (27).

AIM OF THE STUDY

Our aim was to evaluate the impact of EA on the length of labor and the rate of operative vaginal delivery, and to determine whether EA increases the rate of occiput posterior of the fetal head at delivery

MATERIAL AND METHODS

We carried out a retrospective case-control study using clinical records from parturients admitted to Riga Maternity Hospital Delivery Ward between January 1, 2013 and December 31, 2013. Clinical records were obtained from Riga Maternity Hospital Archive.
Inclusion criteria for the case group (EA group) were following: singleton pregnancy ≥ 37 weeks of gestation, cephalic presentation, vaginal delivery, EA was used on demand, birth happened ≥ 1 hour after EA was used. While for the control group inclusion criteria were: singleton pregnancy ≥37 weeks of gestation, cephalic presentation, and vaginal delivery. We excluded both from the case group and the control group parturients who had any of the following criteria: obstructed labor, induction of the labor, pathological labor (except for the operative vaginal delivery; 3rd and 4th grade perineal tears, 3rd grade cervical tears), significant anomaly of the fetus, C-section in anamnesis. Each group (case group and control group) was subdivided into primiparas and multiparas and comparisons between groups were made accordingly. In the EA group we included all the parturients who had delivery in 2013 and corresponded to our inclusion and exclusion criteria. Control group comprised all the parturients who had the delivery from January 1 until April 1 and who corresponded to our inclusion and exclusion criteria.
We registered and analysed following data: age, parity, augmentation of labor (amniotomy, oxytocin), length of stages of labor (first and second stage), cervical dilation when EA was started (for EA group), documented presence of abnormal fetal hear rate (FHR) tracing during labor, position of the fetal head at delivery (occiput anterior/occiput posterior/occiput transverse), type of vaginal delivery (operative or non-operative), newborn outcome (weight, length, Apgar scores), blood loss during delivery , lacerations of the birth canal and presence of episiotomy.
Length of stages of labor were defined according to WHO (29). The first stage commencing from the onset of true labor until the cervical dilatation of 10 cm (latent phase until cervical dilatation of 4 cm and active phase from dilation of 4 cm onwards). The second stage beginning at the full cervical dilation and lasting until the birth of the baby.
Statistical analysis was performed using software SPSS 22.0. Data were tested for normality using Shapiro-Wilk test. Normally distributed data were compared using Independent Samples T-Test and displayed as mean ± standard deviation (SD). Data with skewed distribution were compared using Mann-Whitney U test and displayed as median and interquartile range [IQR]. For comparison of categorical data Chi-Square test was used and data were displayed as percentages and absolute values. P value <0.05 was considered statistically significant.

RESULTS

A total of 832 parturients were included in the study: 304 in the epidural group and 528 in the control group. Each group was further subdivided into primiparas (220 in epidural group and 257 in control group) and multiparas (84 in epidural group and 271 in control group).
Both primiparas and multiparas who received EA were older (mean±SD) than their respective controls – primiparas 27.6±4.3 years vs. 26.1±4.6 years (p=0.003), multiparas 32.4±4.4 years vs. 30.8±5.0 years (p=0.003). Other maternal characteristics such as body mass index, weight gain and gestational age were comparable between the groups (Table 1).

Table 1. Maternal and pregnancy characteristics

Variable	Primiparas		p value	Multiparas		p value
	EA group (n=220)	Control group (n=257)		EA group (n=84)	Control group (n=271)	
Age, years, mean (±SD)	27.6±4.3	26.1±4.6	0.003	32.4±4.4	30.8±5.0	0.003
Body mass index, kg/m^2, mean (±SD)	21.5±3.1	22.1±3.7	0.08	23.4±3.9	23.5±4.4	0.873
Weight gain, kg, median (IQR)	14.75 (11.7-18.5)	15 (11.4-18.8)	0.951	15 (10.0-17.5)	14.6 (11.0-17.9)	0.951
Gestational age, weeks, median (IQR)	40 (39-40.4)	39.5 (39-40.5)	0.240	40 (39-40.5)	39.5 (39-40.5)	0.252

EA group primiparas had longer latent phase of the first stage of labor than control group primiparas (median (IQR): 240 (180-330) min vs. 210 (150-277) min, p=0.001). EA group multiparas had longer first stage of labor (median (IQR): 340 (270-433) min vs. 310 (240-390) min, p=0.031) and longer latent phase of the first stage of labor (median (IQR): 180 (120-261) min vs.149 (90-192) min, p<0.001) than multiparas in control group (Table 2).

Table 2. Length of labor

	Primiparas		p value	Multiparas		p value
	EA group (n=220)	Control group (n=257)		EA group (n=84)	Control group (n=271)	
First stage, min	480 (392.5-580)	450 (360-552.5)	0.089	340 (270-433)	310 (240-390)	0.031
Latent phase, min	240 (180-330)	210 (150-227)	0.001	180 (120-261)	149 (90-192)	<0.001
Active phase, min	240 (180-270)	240 (180-312.5)	0.099	150 (109-210)	160 (120-210)	0.293
Second stage, min	42 (34.25-60)	40 (30-58)	0.166	21 (17-32)	20 (13-29)	0.208

Results are displayed as median (IQR).

In most cases EA in both primiparas and multiparas was initiated in the active phase of the first stage of labor (cervical dilatation of ≥4cm). Only 10.5% of primiparas and 8.3% of multiparas had their epidural started in the latent phase. However timing of EA was not the essential reason for the prolongation of the latent phase: while primiparous parturients who received EA in the latent phase did have longer latent phase compared to those who received it in the active phase (285(217.5-382.5) vs. 240(180-307.8), p=0.035) (Table 3), primiparas with EA started in the active phase still had longer latent phase when compared to control group (240 (180-307.7) vs. 210 (150-277.5), p=0.006).

Table 3. Impact of timing of EA on the length of delivery

	Primiparas		p value	Multiparas		p value
	EA started in the latent phase (n=23)	EA started in the active phase (n=197)		EA started in the latent phase (n=7)	EA started in the active phase (n=77)	
First stage, min	480 (420-570)	480 (390-587.5)	0.843	320 (240-420)	360 (270-442)	0.456
Latent phase, min	285 (217.5-382.5)	240 (180-307.75)	0.035	150 (120-270)	180 (120-260)	0.686
Active phase, min	195 (150-240)	240 (180-272.5)	0.043	185 (90-215)	150 (110-210)	0.802
Second stage, min	49 (35-72)	42 (34.25-58.75)	0.157	18 (16-26)	21 (17-34)	0.571

Results are displayed as median (IQR)

Parturients who requested EA had augmentation of the labor with oxytocin in the first stage more often compared to control groups: in primiparas 87.3% vs. 20.2% (p<0.001), in multiparas 81.0% vs. 12.9% (p<0.001).
No difference between case and control groups was found in the frequency of abnormal FHR tracing, neither in primiparas (10.5% vs.9.7%, p=0.792), nor in multiparas (3.6% vs. 2.2%, p=0.447). Apgar scores after 1st and 5th minute <7 also did not differ significantly between groups (Table 4).

Table 4. Abnormal FHR tracing rates and Apgar score

Primiparas			
	EA group	Control group	p value
Abnormal FHR tracing, n (%)	23 (10.5%)	25(9.7%)	0.792
Apgar score <7 – 1.min, n (%)	1 (0.5%)	4 (1.6%)	0.239
Apgar score <7 – 5.min, n (%)	0 (0.0%)	1 (0.4%)	0.354
Multiparas			
Abnormal FHR tracing, n (%)	3 (3.6%)	6 (2.2%)	0.447
Apgar score <7 – 1.min, n (%)	0 (0.0%)	1 (0.4%)	1
Apgar score <7 – 5.min, n (%)	0	0	-

Operative vaginal delivery rate was 1.27% of all deliveries with EA and only vacuum extraction was used. Moreover, vacuum extraction was used only in primiparas and there was no statistically significant difference between EA group primiparas and control group primiparas (1.7% vs. 1.2%, p=0.593).

EA did not increase the rate of occiput posterior of the fetal head. Occiput posterior was encountered only in primiparas with similar rates between EA and control group (2.3% (n=5) vs. 2.3% (n=6), p=0.964). All parturients with occiput posterior had their epidural started in the active phase of the first stage. We also found that primiparas with EA and occiput posterior were more likely to have an abnormal FHR tracing during delivery in comparison to primiparas with EA and without occiput posterior position of fetal head (40% vs. 9.8%, p=0.029). Relative risk for abnormal FHR tracing in primiparas with EA and occiput posterior was 4.09, 95% CI 1.3-12.9. There was no statistically significant link between occiput posterior position and abnormal FHR tracing in control group primiparas. We also analysed lacerations of the birth canal. Only cervical lacerations in primiparas of EA group were seen more frequently than in control group primiparas (22.3% vs. 14.4%, p=0.024). Other type of lacerations did not differ significantly between EA and control group primiparas. No significant difference was noted in frequency of lacerations also comparing EA group multiparas with control group multiparas (Table 5).

Table 5. Lacerations of the birth canal

	Primiparas		p value	Multiparas		p value
	EA group	Control group		EA group	Control group	
Perineal	78(35.5%)	89(34.6%)	0.851	30(35.7%)	78(28.8%)	0.228
1st grade	48(21.8%)	52(20.2%)	0.672	26(31.0%)	66(24.4%)	0.228
2nd grade	11(5.0%)	15(5.8%)	0.688	2(2.4%)	7(2.6%)	0.918
3rd grade	0 (0.0%)	1(0.4%)	0.354	-	-	-
4th grade	-	-	-	-	-	-
Imminent	19(8.6%)	21(8.2%)	0.855	2(2.4%)	5(1.8%)	0.758
Labial	15(6.8%)	19(7.4%)	0.808	3(3.6%)	11(4.1%)	0.841
Minor	14(6.4%)	19(7.4%)	0.659	2(2.4%)	11(4.1%)	0.474
Major	1(0.5%)	0(0.0%)	0.279	1(1.2%)	0(0.0%)	0.072
Vaginal	70(31.8%)	102(39.7%)	0.074	12(14.3%)	44(16.2%)	0.688
Superficial	60(27.3%)	85(33.1%)	0.170	12(14.3%)	42(15.5%)	0.787
Profound	10(4.5%)	17(6.6%)	0.330	0(0.0%)	2(0.7%)	0.430
Cervical	49(22.3%)	37(14.4%)	0.024	8(9.5%)	17(6.3%)	0.309
1st degree	41(18.6%)	34(13.2%)	0.106	7(8.3%)	14(5.2%)	0.282
2nd degree	8(3.6%)	3(1.2%)	0.073	1(1.2%)	3(1.1%)	0.950
Episiotomy	72(32.7%)	103(40.1%)	0.097	6(7.1%)	19(7.0%)	0.967

Results are displayed as absolute values (%)

DISCUSSION

Parturients in EA group were older than controls both primiparas and multiparas. Since EA is a commercial service, in order to afford it parturient has to have a higher salary, which in turn requires a higher level of education. Moreover, higher level of education might mean better awareness about labor analgesia, which might contribute to the age difference between groups.

In our study rate of operative vaginal delivery in both groups was lower than in published data (2). This could be explained by our exclusion criteria which comprised obstructed labor and also by high rate of labor augmentation. Although there is some evidence that EA can increase the rate of operative vaginal delivery (3) our study failed to show higher operative vaginal delivery rates in EA group, and our results are similar to some previous reports (7, 23, 26, 30). This could be explained by the fact that majority of parturients who received EA had oxytocin administration in labor. However, a Cochrane review found that oxytocin use for augmentation of labor if EA is used had no advantage in reducing operative vaginal delivery rate, and no differences in Apgar scores, admission to neonatal intensive care unit, uterine hyperstimulation and postpartum haemorrhage was observed. Nevertheless, these findings should be studied further, as this review included only 2 double blinded randomised controlled trials including total of 319 women (6). Besides augmentation with oxytocin other possible activities have been studied to avoid operative vaginal delivery, for example, positioning of the parturient in the second stage and discontinuation of EA late in labor (14, 24, 28). The practice to discontinue EA late in labor to avoid operative vaginal delivery has shown no benefit of reducing operative vaginal delivery rate, and there is evidence that it increases the rate of inadequate pain relief in the second stage of labor (28).

Previous reports are suggesting that EA prolongs the duration of labor (12, 23, 30) especially the second stage of labor (1, 3, 11, 12, 18). In our study EA group parturients, both primiparas and multiparas, had longer latent phase of the first stage of labor than their respective controls, in comparison to most other studies were longer second stage was seen. It should be noted that in our study in majority of cases EA was started during the active phase of the first stage, therefore in most of the cases, EA could not have influenced the length of latent phase. Parturients with longer latent phase of labor possibly were more inclined to demand

EA than control group parturients with shorter latent phase. Thus, possibly EA is not the cause of longer latent phase but a consequence.

While there are reports suggesting that EA is associated with higher rate of occiput posterior, our study failed to show this association (16, 17). In addition, it is unclear whether EA is the cause of occiput posterior or whether parturients with occiput posterior demand EA more often. Lieberman et al. monitored fetal position during labor using serial ultrasound examinations and found that women requesting EA were not more likely to have fetuses in the occiput posterior position at enrollment, at the time of EA initiated and 4 hours after, indicating that occiput posterior was not the reason for requesting EA (17). In our study occiput posterior position of the fetal head was associated with an increased risk for abnormal FHR tracing in EA group, but not in control group. There is evidence suggesting that occiput posterior by itself is associated with higher risk for abnormal FHR tracing (13). Sympathectomy produced by EA lowers maternal blood pressure, this mechanism might contribute to development of abnormal FHR in case of occiput posterior (10). However, the rate of occiput posterior position in our study was low, therefore any conclusions regarding the influence of EA on deliveries with occiput posterior should be made with caution.

While there are several studies indicating that EA is associated with higher rate of severe lacerations of birth canal (5, 19, 25) in our study only cervical tears were more frequent in primiparas who received epidural in comparison to controls. Bodner-Adler et al. also did not find the difference in rates of perineal, vaginal and labial tears (4). More severe perineal trauma in labor with EA could be a consequence of a prolonged second stage of labor and to an increased rate of operative vaginal delivery not demonstrated in our study (3, 15).

There are certain limitations in our study. Firstly, the number of parturients included in the study was not large enough to study the influence of occiput posterior position of the fetal head on the delivery. Also, our control group comprised parturients who had a delivery during the first three months of 2013, while case group comprised parturients who had a delivery all year round. It would have been more correctly to include in the control group parturients who had the delivery all year round. Moreover, since our study is retrospective we could not analyse blood pressure after epidural was started because it was not uniformly documented in the protocols, thus we could not study blood pressure in respect to fetal distress in case of occiput posterior.

CONCLUSIONS

EA does not increase the likelihood of operative vaginal delivery. However, parturients with EA have longer latent phase of the first stage of labor. Risk for occiput posterior at delivery is not increased in labor with EA. However, the risk for abnormal FHR among primiparas who receive EA is increased in case of occiput posterior position of the fetal head.

Conflict of interest: None

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