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Comparison of the effect of patient-controlled epidural anesthesia (PCEA) and parenteral use of opioid analgesics on the postpartum condition of the newborn

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Abstract

Aim: To evaluate the effect of different forms of pharmacological intrapartum analgesia on the birth state of the newborns by comparing the results of blood gas umbilical cord artery as well as Apgar score at 5th minute of life.

Material and methods: 160 pregnant women ≥ 37 weeks, which attempted vaginal delivery in the Department of Obstetrics and Gynecology of the Pomeranian Medical University in Szczecin, were divided into four groups:

1. PCEA (n = 40) women giving birth under patient-controlled epidural anesthesia (PCEA) in a horizontal position;
2. Pethidine (n = 30) women giving birth subjected to analgesia by parenteral supply of pethidine;
3. Fentanyl (n = 30) women giving birth subjected to analgesia by parenteral supply of fentanyl;
4. Control (n = 60) women giving birth without analgesia.

In each of the groups newborn status was assessed on the basis of Apgar score in the 5th minute of life and on the basis of umbilical artery cord blood pH immediately after birth.

Results: The analysis showed no significant differences in Apgar score in the 5th minute of life between the study groups, as well as between the subgroups of nulliparous and multiparous. Analysis of the blood pH value of the umbilical cord artery revealed that in the case of pethidine anesthesia the values were significantly lower compared to the other groups. While patients anesthetized by PCEA demonstrated statistically significant maximum value of this parameter. Similar relations were observed in the subgroups of nulliparous. No differences were detected in this range between subgroups of multiparous.

Conclusions: The use of patient-controlled epidural anesthesia does not affect the postnatal status of newborn's evaluated on the basis of the analysis of umbilical cord artery blood pH and Apgar score at the 5th minute of life. In comparison to the formula of patient-controlled epidural anesthesia, as well as to the parenteral supply fentanyl anesthesia, intrapartum parenteral supply of pethidine results in a significantly lower pH values of umbilical artery cord blood of newborns immediately after birth.

Key words: fentanyl, newborn status, patient-controlled epidural anaesthesia, pethidine

Introduction

Birth of a child is a unique time in the life of every woman. Unfortunately, labor is often one of the most painful and traumatic experiences suffered in her life [1]. Therefore, we should fully agree with the opinion of the American Society of Obstetricians and Gynecologists, that there are no medical reasons for justifying the acceptance of the pain of childbirth and the request of woman giving birth should be sufficient reason to give her support by medical personnel [2]. One of the tasks of modern obstetrics is relieving the pain that accompanies the laboring woman, and through this a reduction or even complete elimination of its negative impact on the mother and child [3]. However, it is extremely important that modern methods of intrapartum analgesia must be enough effective on the one hand, and on the other as little as possible affect on the course of labor and the condition of the mother and child.

The aim of this study was to evaluate the effect of different forms of pharmacological intrapartum analgesia on the birth state of the newborns by comparing the results of blood gas umbilical cord artery as well as Apgar score at 5 minute of life.

Material and methods

The study included 160 pregnant women ≥ 37 weeks, which attempted vaginal delivery in the Department of Obstetrics and Gynecology of the Pomeranian Medical University in Szczecin in 2013-2017. The study was approved by the University Bioethic Committee No. KB-0012/56/13.

The women were divided into four groups:

5. PCEA (n = 40) women giving birth under patient-controlled epidural anesthesia (PCEA) in a horizontal position (in 7 cases (17.5%) completed the birth by cesarean section)

6. Pethidine (n = 30) women giving birth subjected to analgesia by parenteral supply of pethidine (in 6 cases (20%) completed the birth by cesarean section)
7. Fentanyl (n = 30) women giving birth subjected to analgesia by parenteral supply of fentanyl (5 cases (16.7%) completed the birth by cesarean section)
8. Control (n = 60) women giving birth without analgesia (in 14 cases (23.3%) completed the birth by cesarean section)

In each of the groups newborn status was assessed on the basis of Apgar score in the fifth minute of life and on the basis of umbilical artery cord blood pH immediately after birth.

Statistical analysis was performed using the statistical program STATA 11. Statistical differences between groups were made using analysis of variance test (ANOVA) test or the Kruskal-Wallis test.

Results

The analysis showed no significant differences in Apgar score in the 5th minute of life between the groups (Tab. 1).

Table 1. Assessment of the newborn Apgar score in the 5th minute of life in groups.

Group	N	Mean	SD	Min.	Max.	Q25	Median	Q75	p
PCEA	33	9.48	0.87	7.00	10.00	9.00	10.00	10.00	NS
Pethidine	24	9.42	1.06	6.00	10.00	9.00	10.00	10.00	
Fentanyl	25	9.52	0.71	8.00	10.00	9.00	10.00	10.00	
Control	46	9.58	0.69	7.00	10.00	9.00	10.00	10.00	

There were also no significant differences in the value of Apgar score in the 5th minute of newborn's life after the division of patients in terms of parity (Tab. 2 and 3).

Table 2. Assessment of the newborn Apgar score in the 5th minute of life in subgroups of nulliparous.

Group	N	Mean	SD	Min.	Max.	Q25	Median	Q75	p
PCEA	22	9.50	0.80	7.00	10.00	9.00	10.00	10.00	NS
Pethidine	19	9.47	0.84	7.00	10.00	9.00	10.00	10.00	
Fentanyl	14	9.36	0.74	8.00	10.00	9.00	9.50	10.00	
Control	23	9.55	0.51	9.00	10.00	9.00	10.00	10.00	

Table 3. Assessment of the newborn Apgar score in the 5th minute of life in the subgroups of multiparous.

Group	N	Mean	SD	Min.	Max.	Q25	Median	Q75	p
PCEA	11	9.45	1.04	7.00	10.00	9.00	10.00	10.00	NS
Pethidine	5	9.20	1.79	6.00	10.00	10.00	10.00	10.00	
Fentanyl	11	9.73	0.65	8.00	10.00	10.00	10.00	10.00	
Control	23	9.61	0.84	7.00	10.00	10.00	10.00	10.00	

Analysis of the blood pH value of the umbilical cord artery revealed that in the case of pethidine anesthesia the values were significantly lower compared to the other groups. While patients anaesthetized by PCEA demonstrated a statistically significant maximum value of this parameter (tab.4).

Table 4. pH values of umbilical cord blood artery in the groups.

Group	N	Mean	SD	Min.	Max.	Q25	Median	Q75	p
PCEA	32	7.33	0.08	7.18	7.52	7.28	7.34	7.38	**0.0054**
Pethidine	24	7.24	0.12	6.92	7.47	7.21	7.26	7.29	**0.0177**
Fentanyl	24	7.26	0.09	7.08	7.41	7.19	7.27	7.32	NS
Control	46	7.29	0.07	7.09	7.42	7.24	7.31	7.35	NS

After the division of patients in terms of parity, the newborns of nulliparous anaesthetized with pethidine showed significantly lower values of pH of umbilical

artery cord blood compared to other groups, while children of women anaesthetized with PCEA showed significantly highest values of this parameter (Tab. 5). No differences were detected in this range between subgroups of multiparous (Tab. 6).

Table 5. pH values of umbilical cord blood artery in the subgroups of nulliparous.

Group	N	Mean	SD	Min.	Max.	Q25	Median	Q75	p
PCEA	21	7.32	0.08	7.18	7.47	7.27	7.31	7.39	**0.0021**
Pethidine	19	7.21	0.11	6.92	7.37	7.14	7.26	7.28	**0.0131**
Fentanyl	13	7.25	0.07	7.09	7.34	7.19	7.27	7.29	NS
Control	23	7.27	0.06	7.15	7.37	7.22	7.28	7.32	NS

Table 6. pH values of umbilical cord blood artery in the subgroups of multiparous.

Group	N	Mean	SD	Min.	Max.	Q25	Median	Q75	p
PCEA	11	7.34	0.09	7.18	7.52	7.29	7.34	7.38	NS
Pethidine	5	7.33	0.09	7.22	7.47	7.29	7.34	7.35	
Fentanyl	11	7.27	0.11	7.08	7.41	7.18	7.24	7.38	
Control	23	7.32	0.08	7.09	7.42	7.26	7.33	7.38	

Discussion

In this study we showed no difference in the birth status of the newborns between the study groups. The average value of Apgar score in the 5th minute of life was similar in all groups, both in general and with regard to their division into nulliparous and multiparous. Similarly, in a study conducted by Weigel et al. [4] Halpern [5] and Reynolds [6], there was no effect of epidural anesthesia on the value of the Apgar score. Anim-Somuah [77], who on the basis of Cochrane base analyzed 18 trials involving a total of 6898 patients also did not observe significant differences in the incidence of less than 7 points of Apgar at 5th of life between the groups of patients with epidural anesthesia and other groups.

Analysis of the newborn's birth status based on a pH of artery umbilical cord blood found significantly higher values in patients anaesthetized by PCEA. Similar results were obtained by Reynolds in the meta-analysis from the year 2002 [8] which compared the pH of artery umbilical cord blood of newborns born by mothers anesthetized with systemic supply of opioids and by epidural anesthesia. The author explains the relationship of higher pH umbilical artery blood values with the occurrence of the phenomenon of hyperventilation in the mother. Epidural anesthesia shows a significant association with better parameters of acid-base balance in the newborn, which proves that the sympathetic blockade and good analgesia does not affect the quality of the placental exchange. Although epidural anesthesia may cause hypotension in labor and extension of the second stage of labor it appears that these potential disadvantages are outweighed by the benefits of improved acid-base balance in newborns [9]. Observations of Tugrul [10] also confirm the lack of effect of epidural anesthesia on umbilical artery cord blood pH values, with the exception that he has not reported significantly higher values of this parameter in the group of PCEA. However, they remain consistent with the observations resulting from its own research.

Conclusions:

1. The use of patient-controlled epidural anesthesia does not affect the postnatal status of newborn's evaluated on the basis of the analysis of umbilical cord artery blood pH and Apgar score at the 5th minute of life.
2. In comparison to the formula of patient-controlled epidural anesthesia, as well as to the parenteral supply fentanyl anesthesia, intrapartum parenteral supply of pethidine results in a significantly lower pH values of umbilical artery cord blood of newborns immediately after birth.

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