AATD, 2016; 1(1): 7-13

Comparison of The Effects of Propofol Sedation on Mother and Newborn During Spinal Anesthesia for Elective Cesarean Section

Elektif Sezeryan Operasyonlarında Spinal Anestezi Uygulama Sırasında Propofol Sedasyonunun Anne ve Yenidoğan Üzerindeki Etkilerinin Karşılaştırılması

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Öz

Regional anestezi, bilinç açıklığı sağlaması, spontan solunumun devamı, havayolu reflekslerinin korunması, aspirasyon riskinin olmaması, yeni doğanda solunum depresyonu olmaması, uterusta atoni olmaması nedeniyle sezaryen operasyonlar ında tercih edilir. 30 hastaya herhangi bir sedasyon olmadan (Grup K), 30 hastalık başka bir gruba da (Grup P) 0.5 mg/kg propofol spinal anestezi başlangıcında bolus tarzında verildi. Oksijen satürasyonu, Ramsey Sedasyon Skalası ve yüze yansıyan ağrı skalası 0, 1, 5, 7, 10, 15, 20nci dakikalarda ve operasyon sona erene kadar beşer dakika arayla ölçüldü ve kaydedildi.
Sonuç olarak; propofol her ne kadar sezaryen operasyonlarında güvenilir ve geçerli bir anestezik ajan olarak kabul edilse de propofolün yeni doğan üzerindeki nörolojik, davranışsal ve ağrı etkisini değerlendirmek için gelecekte daha kapsamlı çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: Ağrı, Propofol, Sezeryan

Abstract

Regional anesthesia is preferred in cesarean sections, since it provides consciousness, continuation of spontaneous respiration, protection of airway reflexes, and causes no risk of aspiration, no respiratory depression in the newborn, and no uterine atony. Spinal anesthesia was administered to 30 patients without the application of any sedation (Group K) and in the other 30 cases, a single dose of 0.5 mg/kg propofol (Group P) was administered as an i.v. bolus at the beginning of the anesthesia. SaO2, Ramsey Sedation Scale and facial expression pain scale were measured and recorded at 0, 1, 5, 7, 10, 15, and 20 minutes and at five-minute intervals until the end of the operation following propofol administration.
In conclusion although propofol is considered as a safe and reliable anesthetic agent in cesarian sections we sug gest that more comprehensive studies to determine the neurologic, behavioral and pain effects of propofol on newborns are needed in the future.

Key Words: Pain, Propofol, Cesarean Sections

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Makelenin Geliş Tarihi: Şubat 2016 **Kabul Tarihi:** Haziran 2016

Introduction

Regional anesthesia is preferred in cesarean sections, since it provides consciousness, continuation of spontaneous respiration, protection of airway reflexes, and causes no risk of aspiration, no respiratory depression in the newborn, and no uterine atony [1,2]. Additionally, the continuation of the postoperative neural blockage effect provides effective and safe analgesia [3]. The Apgar score and umbilical blood gas analysis have been demonstrated in various research studies to be good parameters for the evaluation of the wellness of the newborn [4,5]. The Neonatal Infant Pain Scale (NIPS) is a behavioral evaluation tool developed to measure pain in premature babies and newborns [6]. We used NIPS, Apgar score, and umbilical blood gas analysis parameters in the evaluation of newborns.

The current study aimed to compare the effects of propofol sedation in elective cesarean sections under spinal anesthesia on maternal hemodynamics, oxygen saturation, intraoperative vasopressor requirement, sedation score and facial expression pain scale in mothers and Apgar score, newborn pain score and umbilical cord gases in newborns.

Method

After obtaining an approval from the ethics board, 60 cases that will undergo elective surgery in ASA I-II group, with an age range of 18-40 years were included in the study. No premedication was administered to the patients. The patients were informed and written consent was obtained. Prior to spinal anesthesia, arrival heart rate (HR), diastolic arterial pressure (DAP), systolic arterial pressure (SAP), mean arterial pressure (MAP), transdermal peripheral oxygen saturation (SaO2), Ramsay sedation score (RSS), and the intraoperative requirement of ephedrine were measured and recorded. Spinal anesthesia using 10 mg hyperbaric bupivacaine was applied in all cases in the seated position.

Spinal anesthesia was administered to 30 patients without the application of any sedation (Group K) and in the other 30 cases, a single dose of 0.5 mg/kg propofol (Group P) was administered as an i.v. bolus at the beginning of the anesthesia. SAP, DAP, MAP, SaO2, intraoperative ephedrine requirement, RSS, and facial expression pain scale were measured and recorded at 0, 1, 5, 7, 10, 15, and 20 minutes and at five-minute intervals until the end of the operation following propofol administration. In the newborns, the Apgar score at the first, third, and fifth minutes, and the NIPS score measuring umbilical cord blood gases were measured and recorded.

Statistical Analysis

SPSS (Statistical Package for Social Science) for Windows 11.5 was used for statistic alanalysis. Student's t test was used to evaluate the difference between-groups in terms of mean values and Mann-Whitney U test for median values. Nominal variables were-examined using Pearson's chi-square test. Repeated Measures Analysis of Variance hemodynamicmeasurements (Repeated Measurements of ANOVA) was assessed using the Greenhouse-Geisser test statistic. In groups Wilks' Lambda test Bonferroni correction-was used for multiple comparison test. Ramsey and facial expressions to show a significant change in the time of the pain scale score was studied by Friedman test. P value of <0.05 was considered statistically significant. However, the Bonferroni correction was made in this study to control Type I error at all possible multiple comparisons.

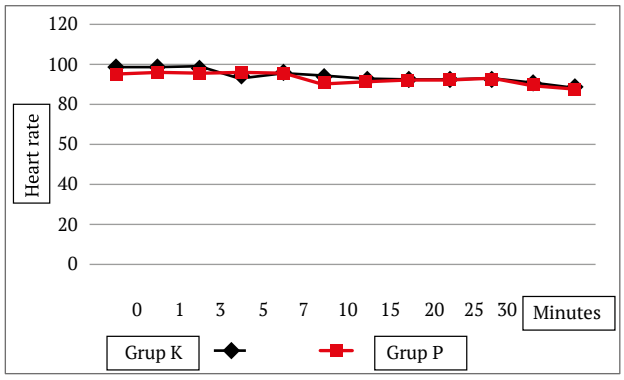
Results

Heart Rate, Blood Pressure and Oxygen Saturation

Sistolic, diastolic, and mean arterial pressures were similar between groups, and p values were 0.071, 0.795, 0.704 respectively.

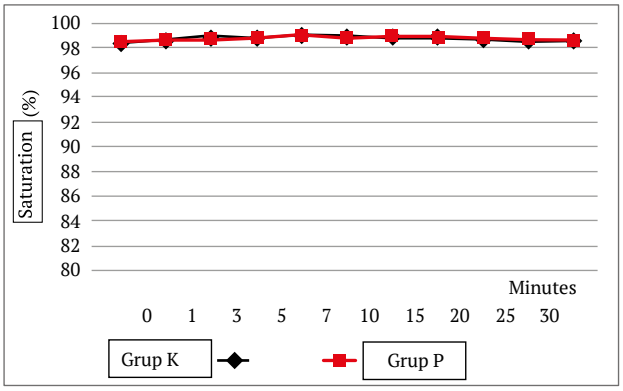
Changes in the heart rate during the follow-up period were statistically similar in Group K and Group P ($p=0.844$). In both Group K and Group P, a statistically significant difference was observed in mean heart rates between initial and last measurement. ($p<0.001$ and $p=0.014$) (Fig 1). SpO2 values of both groups in all time periods were similar (Fig 2).

Figure 1. Mean heart rates of both groups by follow-up time



The results were significant according to the Wilks' Lambda test, Bonferroni correction at p<0.025

Figure 2. Mean maternal transdermal SpO2 levels (%) by follow-up time



There was no statistically significant difference between groups. (P=NS).

Ramsay Sedation Score:

The Ramsay sedation score demonstrated a statistically significantly higher increase at 3, 10, 15, and 20 minutes compared to minute 0 in Group P compared to Group K (p<0.001). However, at other time points, changes in the Ramsey sedation scores were statistically similar between Group K and Group P (p=NS) (Table 1).

Newborn Apgar Scores and Pain Score:

Median Apgar scores at minutes 1, 3, and 5 between Group K and Group P were statistically similar (p=0.218, p=0.317, and p=1.000, respectively).

The NIPS score at minute 1 was statistically significantly higher in Group P compared to Group K, although not clinically significant (p=0.004). The median NIPS scores at minutes 3 and 5 were statistically similar in Group K and Group P (p=1.000 and p=1.000, respectively) (Table 2).

Table 1. Ramsey Sedation Scores by follow-up time

Time (Minute)	Group K (n:30)	Group P (n:30)
0	1 (1-1)	1 (1-1)
1	1 (1-1)	1 (1-2)
3	1 (1-1)	1,5 (1-2)
5	1 (1-1)	1 (1-1)b
7	1 (1-2)	1 (1-2)
10	1 (1-1)	1 (1-2)
15	1 (1-1)	2 (1-2)
20	1 (1-2)	21 (1-2)
25	1 (1-2)	1 (1-2)
30	1 (1-2)	1 (1-2)
P value +	0,051	<0,001

There was significantly higher increase at 3, 10, 15, and 20 minutes compared to minute 0 in Group P compared to Group K (p<0.001).

Table 2. Apgar and NIPS scores of newborn by follow-up time

	K(n=30) (min-max)	P(n=30) (min-max)	p-
Apgar			
1.	10 (8-10)	10 (8-10)	NS
3.	10 (9-10)	10 (10-10)	NS
5.	10 (10-10)	10 (10-10)	NS
NIPS			
1.	2 (1-2)	2 (1-3)	**0,004****
3.	0 (0-0)	0 (0-0)	NS
5.	0 (0-0)	0 (0-0)	NS

The NIPS score at minute 1 was statistically significantly higher in Group P compared to Group K, (p=0.004).

Umbilical Venous Blood Gases:
Mean pH was statistically similar in Group K and Group P (p=0,133). Mean PCO_2 was also statistically similar in Group K and Group P (p=0.578). The mean PO_2 was also statistically similar in Group K and Group P (p=0.075). The mean HCO_3 was also statistically similar in Group K and Group P (p=0.160). The mean BE level was statistically significantly higher in Group P compared to Group K (p=0.012) (Table 3).

Table 3. Comparison of umbilical venous blood gases of groups.

	K (n=30)	P(n=30)	p-
	Ort± SS	Ort± SS	
pH	7,38 ± 0,03	7,36 ± 0,03	NS
PCO_2 (mmHg)	39,2 ± 4,3	38,5 ± 5,4	NS
PO_2 (mmHg)	30,5 ± 6,9	37,3 ± 7,0	NS
HCO_2 (mEq/lt)	22,6 ± 1,9	21,7 ± 2,7	NS
BE (mmol/lt)	-1,7 ± 1,7	-3,0 ± 2,2	**0,012**

Discussion

Cesarean sections are one of the most widely applied procedures in our country [7].

In surgical procedures other than obstetric surgery the safety of only one patient should be provided during cesarean section, the safety of mother and fetus which is affected by physiological and hemodynamic changes occurring in the mother's body, should be provided. This demonstrated the importance and specificity of the anesthesia for cesarean sections [8].

Carvalho et al. [9] reported the dose of hyperbaric bupivacaine in their study as ED_{50} 7.6 mg and ED_{95} 11.2. Michie et al.[10] demonstrated that the efficacy of bupivacaine, administered intrathecally during spinal anesthesia, was determined by the given dose rather than volume and concentration and that intrathecally administered 10-15 mg hyperbaric bupivacaine provided a good sensorial block and a lower requirement of additional anesthetic drugs during the postoperative period. We aimed to use the dose of the effective local anesthetic drug to be between the ED50 and ED95 levels, and thus used 10 mg bupivacaine. In this study, no additional anesthetic drug requirement developed, which is compatible with the findings in the literature.

The incidence of maternal hypotension has been reported to be higher than 80% in cesarean sections performed using spinal anesthesia [11,12]. Dahlgren et al. [13], Sahar et al. [14] and Glosten et al. [134] reported that the biggest problem they encountered in their studies in cases with spinal anesthesia was hypotension. In another study, hypotension that persists for a long time without immediate treatment was reported to cause fetal acidosis, hypoxia, and low Apgar scores, in addition to uteroplacental decreased blood flow; however, hypotension was reported not to cause a major problem unless the patient is pre-eclamptic or has bleeding[13,15] The sudden interruption of sympathetic activation upon the administration of spinal anesthesia, in addition to the pressure of the uterus on the vena cava inferior in the supine position, and thus aortic occlusion, all cause decreased venous return to the heart. As a result, these cause greater hypotension. However, although hypotension that lasts less than two minutes creates no harm on the fetus, fetal hypoxia and acidosis develop due to a decrease in uteroplacental perfusion when the period of hypotension is increased[16,17]. Kasaba et al.[18] reported that the most important procedure to prevent hypotension due to regional anesthesia is to provide adequate hydration of the patient. Roud et al.[19] reported the incidence of hypotension in pregnant women undergoing Cesarean sections under spinal anesthesia was 66% and 71% respectively in a group of patients who were preloaded with a crystalloid solution prior to blockage at a dose of 20 ml/kg/hour and in a group without preloading. They concluded that crystalloid administration had no effect on the prevention of hypotension. Changes in the mean arterial pressures by follow-up time points were statistically similar in Group K and Group P (p=0.704). In our study, we considered that the reason for the presence of similar mean arterial pressures in the groups was due to the application of regional anesthesia following prophylactic fluid administration and the immediate treatment of hypotension with ephedrine. For this reason, although the number of patients with hypotension was high in the propofol group, it caused no statis-

tically significant difference since the hypotensive episodes were treated immediately.

The incidence of bradycardia during spinal anesthesia varies between 8.9 and 13%. Atropine, in a dose of 0.01 mg/kg, may be administered for the treatment of bradycardia that develops in the postoperative period. Dopamine infusion may be applied when hypotension and bradycardia persist[20,21]. In this study, changes in the heart rate by follow-up time points were statistically similar in Group K and Group P (p=0.844). Atropine administration was not necessary in the present study since never bradycardia developed in any patient. Holmen et al. [22] reported that when ultrasonography is used in combination with the Doppler method, umbilical cord blood flow change is very little following regional anesthesia and that the decrease in the intervillous blood flow causes a change in umbilical cord blood pH to be more acidic. Roberts et al. [23] reported that the rate of fetal acidemia is significantly higher in pregnant women who were administered regional anesthesia and almost 18% of the infants exposed to regional anesthesia had an umbilical artery pH below 7.19. Muller et al. [24] demonstrated the development of fetal acidemia due to decrease in uteroplacental blood flow in pregnant women who underwent elective Cesarean sections under regional anesthesia. Datta et al. [25] found that maternal hypotension has a negative effect on umbilical cord blood gas values.

In the present study, umbilical cord blood mean pH (p=0.133), mean PCO_2 (p=0.578) mean PO_2 (p=0.075), and mean HCO_3 (p=0.160) were statistically similar in Group K and Group P. However, the mean BE was statistically significantly higher in Group K compared to Group P (p=0.012). Intraoperative short-term hypotensive attacks were treated rapidly by the administration of i.v. ephedrine. High levels of BE in the propofol group were attributed to the short-term maternal hypotensive attacks secondary to regional anesthesia, which was compatible with the literature; thus the decrease in the intervillous blood flow due to the alpha-mimetic effects of ephedrine that we used.

Sedation is of major importance in cases with regional anesthesia since it decreases the operative stress in the patient and increases the comfort of the patient and adjustment to the environment [26]. Propofol is commonly used in daily practice for sedation since its initiation of effect and duration of termination are short [27]. Smith et al. [28] reported that propofol infusion administered in subanesthetic doses provides an easily controllable sedation of adequate deepness and quick recovery with a low incidence of side effects. It has a short duration of effect and is cleared rapidly from the circulation[29]. Propofol is a commonly preferred agent with easy titration, low incidence of nausea and vomiting, and early recovery[30,31]. Propofol has been demonstrated not to be teratogenic in animal studies[32]. It is the preferred anesthetic agent for short surgical procedures[33]. For all of the reasons stated above, we chose to use propofol for sedation in the present study. In the present study, which was compatible with the literature, a sedation of adequate deepness with rapidly reversible sedation and minimal side effects was provided. Cheng et al.[34] administered propofol for sedation in a dose of 0.3mg/kg i.v. bolus at induction, followed by an infusion in a dose of 3 mg/hour, in cases that underwent Cesarean sections under spinal anesthesia. In this present study, we administered propofol in a single i.v.dose of 0.5 mg/ kg for sedation during spinal anesthesia.

White and Negus [35] compared propofol and midazolam infusions in cases that underwent regional anesthesia. When the drug dose was titrated in order to provide a sedation score of 3, they reported that recovery from the residual effects of the drug on the central nervous system was more rapid and cognitive functions were reversed more rapidly in a group in which propofol sedation was applied, compared to the group that received midazolam. The Ramsay score was also used in the present study and propofol sedation was provided by i.v. bolus dose. The Ramsay sedation score (RSS) demonstrated a statistically significantly higher increase at 3, 10, 15, and 20 minutes compared to minute 0 in Group P compared to Group K (p<0.001); however, changes in the Ramsey scores at other time points were statistically similar in Group P compared to Group K (p>0.001). The difference in our study can be explained by the fact that propofol, when applied in a subhypnotic dose provides a sedation of adequate deepness in the propofol group, which was compatible with the literature.

The NIPS scale is a scale developed for premature babies and newborns by Lawrence et al [6]. The use of the facial expression scale composed of facial expressions, used to describe the intensity of pain, has been reported in the literature[36]. We also used this scale in the present study to compare the pain intensity between the two groups. The changes in the facial expression scale during the follow-up compared to minute 0 were statistically similar in Group P and Group K (p>0.001). A statistically significant difference was found in the median facial scale scores at minute 1 between Group P and Group K (p<0.001). The newborn pain score (NIPS) at minute 1 was statistically significantly higher in Group P compared to Group K, (p=0.004). In their study Cellenoet. al. showed that there was a generalized irritability in 25% of newborns 1 hour after birth after maternal anesthesia with propofol and Gregory and colleagues reported poorer neurologic and adaptive capacity scores at two hours in high propofol infusion group[37,38].

In conclusion although propofol is considered as a safe and reliable anesthetic agent in cesarian sections we suggest that more comprehensive studies to determine the neurologic, behavioral and pain effects of propofol on newborns are needed.

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