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Effects of Preoperative Anxiety and General Anesthetic Administration on Intraoperative Awareness in Patients Undergoing Cesarean Section

Gebelerde Preoperatif Anksiyetenin ve Genel Anestezi Uygulamalarının İntraoperatif Farkındalık Üzerine Etkisi

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Abstract

Aim: The aim was to investigate the effects of preoperative anxiety and general anesthetic administrations on intraoperative awareness among patients undergoing cesarean section.

Methods: This prospective randomized study included 90 pregnant subjects. Preoperative anxiety was assessed using the Beck Anxiety Inventory. The patients were divided into three groups: group P received propofol 2.5 mg/kg, group T thiopental 5 mg/kg and group K received ketamine 1 mg/kg. Data on intraoperative hemodynamics, isolated forearm (IFA) responses and time to first pain and to first analgesic requirement evaluated using postoperative numerical rating scale were recorded. The Modified Brice Scale (MBS) was used to assess awareness.

Results: The preoperative anxiety levels in the groups were low and demographic data were similar (p>0.05). There was no statistically significant difference in IFA response between the groups (p>0.05). Group T had higher MAP at all times and NRS values at hour 0 compared to the other groups (p<0.05), and had shorter time to first analgesic requirement (p<0.05). MBS responses were evaluated as recall in 12 cases in group K, four in group P and three in group T.

Conclusion: As the anxiety levels in pregnants were low, the superiority of agents used in induction over each other regarding awareness could not be shown.

Keywords: Anxiety, bispectral index, cesarean section, end-tidal sevoflurane, awareness, isolated forearm

Öz

Amaç: Sezaryen seksiyo olgularında, preoperatif anksiyetenin ve genel anestezi uygulamalarının intraoperatif farkındalık üzerine etkilerinin araştırılması amaçlanmıştır.

Yöntemler: Prospektif, randomize çalışmaya 90 gebe dahil edildi. Preoperatif anksiyeteleri, Beck Anksiyete ölçeği ile değerlendirildi. Üç gruba ayrılan olgulara indüksiyonda; propofol 2,5mg/kg (grup P), tiyopental 5mg/kg (grup T) ve ketamin 1mg/kg (grup K) uygulandı. İntraoperatif hemodinamik veriler, izole önkol (İÖK) yanıtları kaydedildi. Postoperatif dönemde Sayısal Ağrı Skoru (NRS), ilk analjezik yapılma zamanı ve Modifiye Brice Skalası (MBS) ile farkındalıkları değerlendirildi.

Bulgular: Grupların preoperatif anksiyete seviyeleri düşük, demografik verileri benzerdi (p>0,05). İÖK yanıtlarında istatistiksel fark yoktu (p>0,05). Grup T'de tüm zamanlardaki ortalama arter basıncı ve 0. saatteki NRS değerleri diğer gruplardan yüksek (p<0,05), ilk analjezik yapılma zamanı daha erkendi (p<0,05). MBS yanıtları incelendiğinde; grup K'de 12, grup P'de dört, grup T'de üç olguda hatırlama olduğu belirlendi.

Sonuç: Gebelerdeki anksiyete düzeyleri düşüktü. İndüksiyonda kullanılan ajanların her birinin farkındalık üzerinde üstünlüğü gösterilememiştir.

Anahtar Sözcükler: Anksiyete, bispektral indeks, sezaryen seksiyo, end-tidal sevofluran, farkındalık, izole önkol

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Introduction

In the preoperative period, 60-80% of patients undergoing surgery experience anxiety, known to negatively affect surgery, anesthesia and recovery (1-3). The incidence of anxiety in the obstetric population is 73.3-86% (2,4,5). Preoperative anxiety may lead to hypertension and dysrhythmia causing requirements for more anesthetic agents for induction, thus, increasing the risk of intraoperative awareness (IOA) and postoperative analgesic consumption and longer length of hospital stay (3,6-8).

Awareness is defined as postoperative recall of events occurring during the period of general anesthesia (GA) (8). In obstetrics, the incidence of IOA is known to be higher compared to other surgical populations (9-10).

For cesarean section (CS) operations, GA is chosen due to reasons like the status of mother and fetus, mother's request or contraindications for neuraxial anesthesia (11). The use of low concentrations due to reasons, such as physiological changes in pregnancy, administration of rapid sequence anesthesia induction, lack of use of opioids and benzodiazepines before birth, short period between induction and the start of surgery and uterine atony caused by volatile anesthetics, are listed among factors contributing to IOA in CS (12-13).

Hemodynamic parameters and subjective clinical signs, such as movement, sweating, and tears, are routinely used to determine depth of anesthesia during GA (12). Although there is no fully sensitive and specific monitor to assess anesthesia depth, technological developments have ensured efficacy in assessing GA (12,14). Bispectral index (BIS) is an electroencephalogram method of producing a numerical value from 0 to 100 to specifically, practically and continuously measure the effects of hypnosis caused by administration of anesthetic and sedative medications on the brain. Thus, the medication dose may be set and appropriate anesthesia depth may be ensured without increasing the IOA risk (9,14). For surgeries like CS with IOA risk, a BIS score of <60 has been reported to be sufficient as a target value (12-16).

The isolated forearm (IFA) technique was first used by Tunstall (17) to identify IOA during CS.

Although minimum alveolar concentration (MAC) is known to be lower in pregnant women, electroencephalographic analysis studies have determined no difference (15,16,18,19).

As depth of anesthesia in pregnant women may be low during the first stages of laryngoscopy, intubation and surgery, exaggerated hemodynamic responses and awareness are commonly observed in these periods. Anesthesia induction and maintenance are important in pregnant women considering transmission of medications through the placenta and effects on the baby. In our study, the aim was to research the effects of preoperative anxiety and different GA administration on IOA in elective CS cases.

Methods

Our study began after receiving permission from Bülent Ecevit University Faculty of Medicine Clinical Research Ethics Committee (meeting protocol no: 2013-59-24/04, date: 31.07.2013) and informed consent was obtained from the pregnant women. The study was performed in a prospective randomized manner from August 2013 to August 2014. The study included 90 patients aged 18-45 years, in the American Society of Anesthesiologists (ASA) risk groups I-II, who were scheduled for elective CS and refused spinal anesthesia. Exclusion criteria were history of late intubation, psychiatric or neurologic disorder, preterm pregnancies, diabetes mellitus, hypertension and obstetric complications.

All patients had the Beck Anxiety Inventory (BAI) applied and demographic information recorded during one-to-one interviews in the waiting room with an anesthesiologist not participating in the study. The BAI is a 21-item assessment scale with the aim of determining the incidence and severity of anxiety experienced by an individual. Each item is rated on a scale of 0 to 3. Total score, ranging between 0 and 63, increases with the severity of anxiety (20). Turkish validity and reliability has been determined by Ulusoy et al. (21).

The patients had standard monitoring applied in the operating room [mean arterial pressure (MAP), heart rate (HR), and peripheral oxygen saturation (SpO_2)]. Each patient had a BIS probe placed on the forehead region. An Intravenous (IV) therapy 0.9 NaCl infusion was started. The patients were laid in 10-15 degree left lateral position to prevent aorto-caval compression. The forearm without intravenous access and blood pressure sleeve was wrapped with cotton with pneumatic tourniquet placed for the IFA (Immunofluorescent assay) technique.

After three minutes (min) of preoxygenation, the patients randomly divided into three groups (n=30 each) had induction administered IV with 2.5 mg/kg propofol (Propofol 1%, Fresenius Kabi, Avusturia) in group P, 5 mg/kg Na-thiopental (Pental thiopental Na flacon, İbrahim Etem, İstanbul, Turkey) in group T and 1 mg/kg ketamine (Ketamine HCL, Eczacıbaşı, Kırklareli, Turkey) in group K. For the IFA technique, the pneumatic tourniquet was inflated to 250 mmHg and isolation of the arm was ensured. Then, 1.5 mg/kg succinylcholine (Lysthenon, Linz Pharmaceuticals, Austria) IV was administered and intubation was completed. For anesthesia maintenance, all groups had 4 L/min 50/50% O_2/air and 2%

sevoflurane. After intubation, end-tidal carbon dioxide pressure and end-tidal sevoflurane (Etsev) concentration were monitored. After delivery, all patients had 1 mcg/kg fentanyl IV and 20 units of oxytocin infusion administered. After the peritoneum was closed, all cases had 1 mg/kg IV tramadol administered. Sevoflurane was stopped on the start of subcutaneous suturing. The IFA test was completed at intubation (T1), skin incision (SI, T2), 1 min after intubation (AI, T3), at uterine incision (UI, T4) and at birth of the baby (T5). For the test, the patients were asked to squeeze the researcher's hand every 2 min and responses were recorded as positive (+) if hand squeezing occurred and negative (-) if did not occur. After the baby was born, the tourniquet was loosened.

For HR, MAP, SpO_2, BIS and Etsev, values were recorded as baseline values before induction (T0) and at T1, T2, T3, T4, T5, 5 min AI (T6), 7 min AI (T7) and while completing subdermal (T8) and skin suturing (T9). The duration of anesthesia, surgery, extubation, and recovery were recorded. Additionally, the induction-birth interval (ID) and uterine incision-birth interval were recorded. The 1 and 5 minute APGAR scores of newborns and postoperative nausea-vomiting of the mothers were recorded.

The pain Numerical Rating Scale (NRS), on which patients rate their current pain intensity from 0 ("no pain") to 10 ("worst possible pain"), has become the most widely used instrument for pain screening. Although it was not developed or validated as a screening test, the NRS is ubiquitous as a screening method in many health care environments (22). The patients had NRS values recorded in the postoperative 0, 1 and 3 hours and time to first analgesic recorded. All cases had awareness assessed as responses to the following questions on the Modified Brice Scale (MBS) in the postoperative 1st and 3rd hours and 1st and 3rd days: 1- What was the last thing you recalled before losing consciousness? 2- What was the first thing you recalled when waking? 3-Do you recall anything from the period between losing consciousness and waking? 4- Did you dream during the procedure? 5-Did you hear any sounds or music during the operation? (23). Interviews recorded statements of patients about dreaming intraoperatively or hearing sounds.

Statistical Analysis

Statistical analysis in the study was completed using the SPSS 24.0 software. When assessing the study data, descriptive statistical methods (frequency, mean, standard deviation) were used in addition to the Kolmogorov-Smirnov test to investigate normal distribution. Comparison between the 3 groups of variables with normal distribution used the one way analysis of variance (ANOVA). Quantitative variables without normal distribution had the Mann-Whitney U test applied for statistical assessment. The Pearson chi-square test and Fisher's exact test were used for comparison of qualitative data. The results were assessed in the 95% confidence interval with the level of significance $p<0.05$.

Results

A total of 90 pregnant women were included in the study. There was no statistical difference between the groups in terms of demographic data, ASA risks, BAI values, anesthesia, surgery, extubation and recovery durations ($p>0.05$; Table 1). There was no significant difference in mean HR value between the groups, except at T4 measurement time ($p>0.05$; Table 2). In terms of MAP values between the groups, there was a significant difference identified ($p<0.05$), apart from at T8 and T9 measurement times. After induction, the increase in blood pressure was observed to be greater in group T (Table 3). Apart from the baseline BIS values ($p=0.229$), there were significant differences identified in BIS values measured

Table 1. General distribution of groups (mean ± standard deviation)

	Group P (n=30)	Group T (n=30)	Group K (n=30)	p
Age (year)	29.13±4.95	29.40±5.91	28.60±4.37	0.827
Weight (kg)	77.40±15.34	76.53±14.10	75.37±12.09	0.831
Height (cm)	162.17±5.53	162.90±4.94	160.53±6.50	0.730
Body mass index (kg/m^2)	29.35±5.20	28.71±4.70	29.11±4.34	0.869
ASA (I/II) (n)	10/20	16/14	16/14	0.195
BAI	7.36±4.50	7.46±3.66	7.26±4.28	0.983
Anesthesia duration (min)	36.20±11.56	35.83±16.60	40.10±17.69	0.501
Surgery duration (min)	36.37±11.62	37.60±16.16	40.90±17.44	0.497
Extubation duration (sec)	270.50±12.80	286.50±97.95	287.00±94.43	0.788
Recovery duration (sec)	439.33±147.10	477.33±111.41	505.67±129.34	0.147

ASA: American Society of Anesthesiologists, n: Number of cases, BAI: Beck Anxiety Inventory, min: Minute, sec: Second

at all times. After intubation, the BIS values in group K were identified to be always higher compared to the other two groups (p<0.001; Table 4). From intubation to birth, there was no significant difference in IFA responses identified between the groups (p>0.05; Table 5). There was no significant difference in the mean Etsev at all times between the groups (p>0.05; Figure 1). When all groups were assessed together, in the duration from intubation to birth, there was no statistically significant difference identified between IFA responses, Etsev and BIS values for the group means (p>0.05; Table 6). At T3, the mean Etsev (0.642) in patients without IFA response was found to be higher than the mean Etsev (0.489) in patients with IFA response (p=0.008). There was a statistically significant difference between the groups in terms of pain scores at postoperative hour 0 (p=0.003) and the time to first analgesic requirement (p<0.001; Table 7). There was no difference between the groups in terms of APGAR scores, nausea-vomiting, ephedrine, atropine and additional muscle relaxant administration and operation durations (p>0.05).

During interviews in the postoperative 1st and 3rd hours and 1st and 3rd days, in the 1st h, 1 patient in group P reported dreaming, while by the 3rd day the number of patients reporting dreaming increased to 2. In group K, in the 1st h, 6 patients reported dreaming, while by the 3rd day, this number had risen to 10. In group T, at all interviews, 1 patient reported dreaming. Again in group K, in the 1st hour, 1 patient and by the 3rd day 3 people reported hearing voices and music during the operation, while 1 and 2 patients reported hearing voices and music in group P and group T, respectively; and this number did not increase.

Table 2. Heart rate values in the groups (beats/minimum) (mean ± standard deviation)

Time	Group P (n=30)	Group T (n=30)	Group K (n=30)	p
T0	92.90±11.94	95.90±13.64	95.83±15.62	0.632
T1	108.83±15.36	109.70±19.60	100.77±15.27	0.083
T2	105.47±16.62	110.40±16.52	102.37±16.43	0.171
T3	105.80±16.41	109.03±17.35	103.23±18.22	0.434
T4	95.23±18.21	106.07±15.24*	99.53±15.69	0.041
T5	93.20±17.26	99.57±15.44	97.73±18.14	0.332
T6	90.73±16.45	98.83±16.18	95.50±18.21	0.184
T7	86.97±17.72	92.50±13.42	92.80±20.15	0.345
T8	89.00±13.77	90.23±11.80	91.27±14.80	0.810
T9	88.07±11.85	89.27±12.39	91.27±14.06	0.622

T0: Basal, T1: Endotracheal intubation, T2: Skin incision, T3: 1 min after intubation, T4: Uterine incision, T5: Birth of baby, T6: 5 min after intubation, T7: 7 min after intubation, T8: Subdermal suturing, T9: Skin suturing
*Group T compared with group P

Table 3. Mean arterial pressure values in the groups (mmHg) (mean ± standard deviation)

Time	Group P (n=30)	Group T (n=30)	Group K (n=30)	p
T0	102.83±14.45	108.07±17.21*	97.20±15.41	0.032
T1	111.90±17.21	133.87±18.71**	117.03±21.34	0.000
T2	111.53±16.21	129.33±18.64**	114.00±16.84	0.000
T3	111.03±16.19	129.10±25.10ϖ	116.13±20.10	0.004
T4	99.93±12.44	117.13±19.78**	104.50±15.37	0.000
T5	94.77±16.08	120.07±18.51**	102.03±15.58	0.000
T6	93.70±21.94	111.33±20.62ϖ	97.10±13.29	0.001
T7	82.20±15.08	97.37±16.67ϖ	90.63±12.17	0.001
T8	82.47±14.71	91.67±14.37ϖ	85.97±9.89	0.028
T9	88.67±13.53	94.83±11.66	89.10±11.95	0.106

T0: Basal, T1: Endotracheal intubation, T2: Skin incision, T3: 1 min after intubation, T4: Uterine incision, T5: Birth of baby, T6: 5 min after intubation, T7: 7 min after intubation, T8: Subdermal suturing, T9: Skin suturing
*Group T compared with group K, **Group T compared with group P and group K, ϖGroup T compared with group P

Table 4. Bispectral index values (mean ± standard deviation)

Time	Group P (n=30)	Group T (n=30)	Group K (n=30)	p
T0	96.57±3.29	97.50±0.68	97.20±1.51	0.229
T1	44.70±7.75	49.07±9.42	89.97±6.17*	<0.001
T2	44.03±9.56	55.90±10.80ϖ	88.70±6.87*	<0.001
T3	44.50±10.23	55.63±11.66ϖ	86.13±16.35*	<0.001
T4	45.33±10.92	58.43±10.18ϖ	83.67±9.17*	<0.001
T5	44.37±11.44	62.77±7.29ϖ	80.47±11.06*	<0.001
T6	47.20±9.94	61.27±9.45ϖ	73.40±11.45*	<0.001
T7	49.60±9.58	60.57±9.15ϖ	68.87±13.10*	<0.001
T8	50.57±9.90	52.43±10.94	61.40±7.53*	<0.001
T9	51.47±9.93	53.10±9.64	61.40±7.75*	<0.001

T0: Basal, T1: Endotracheal intubation, T2: Skin incision, T3: 1 min after intubation, T4: Uterine incision, T5: Birth of baby, T6: 5 min after intubation, T7: 7 min after intubation, T8: Subdermal suturing, T9: Skin suturing,
*Group K compared with group P and group T, ϖGroup T compared with group P

Table 5. Isolated forearm test responses in the groups

Time	Group P (n, +/-)	Group T (n, +/-)	Group K (n, +/-)	p
T1	2/28	4/26	1/29	0.338
T2	3/27	5/25	1/29	0.201
T3	3/27	5/25	1/29	0.201
T4	3/27	3/27	1/29	0.492
T5	2/28	2/28	1/29	0.794

n: Number of cases, +: Positive response, -: Negative response; T1: Endotracheal intubation, T2: Skin incision, T3: 1 min after intubation, T4: Uterine incision, T5: Birth of baby

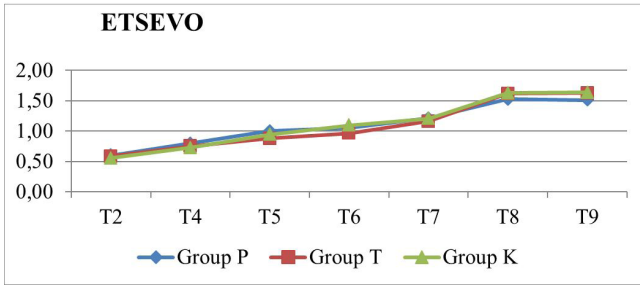

Figure 1. End-tidal Sevoflurane values in groups P, T and K. T2: Skin incision, T4: Uterine incision, T5: Birth of baby, T6: 5 min after intubation, T7: 7 min after intubation, T8: Subdermal suturing T9: Skin suturing

Table 6. Isolated forearm response responses, end tidal sevoflurane concentration and bispectral index values in the groups (mean ± standard deviation)

Time	IFA (n, +/-)	Etsev	BIS	p1	p2
T1	7/83	50.85±21.60/62.12±21.86	-	0.165	-
T2	9/81	0.47±0.10/0.59±0.16	61.44±19.03/63.03±21.39	0.824	0.606
T3	9/81	0.48±0.10/0.64±0.17	63.33±18.77/61.95±22.30	0.819	0.008
T4	7/83	0.72±0.17/0.76±0.23	65.28±18.20/62.24±19.01	0.712	0.732
T5	5/85	0.94±0.23/0.94±0.23	70.60±20.40/63.11±16.68	0.286	0.796

IFA: Isolated forearm response (+: Positive response, -: Negative response), n: Number of cases; Etsev: End tidal sevoflurane concentration; BIS: Bispectral index; T1: Endotracheal intubation, T2: Skin incision, T3: 1 minute after intubation, T4: Uterine incision, T5: Birth of baby; p1=IFA compared with BIS, p2=IFA compared with Etsev

Table 7. Numerical rating scale and duration to first analgesic (mean ± standard deviation)

Time	Group P (n=30)	Group T (n=30)	Group K (n=30)	p
0. NRS (h)	1.97±2.14	2.93±2.31*	1.00±1.14	0.003
1. NRS (h)	2.10±1.34	2.17±0.87	1.90±1.15	0.446
3. NRS (h)	0.77±0.72	0.93±0.82	0.83±0.69	0.734
First analgesic time (min)	33.17±29.60	20.33±18.79*	40.50±27.86	<0.001

Group P: Propofol, Group T: Thiopental, Group K: Ketamine; NRS: Numerical rating scale; h: Hour, min: Minute, *Group T compared to group K

Discussion

In our study, as the preoperative anxiety levels in all groups were low, the effect of anxiety on IOA could not be determined. In cases with response to IFA test in the 1st minute after intubation, especially, the Etsev values were low and we did not identify a difference in BIS values between patients who responded to the IFA test and those who did not. For identification of awareness in the period from induction to birth, BIS, Etsev, IFA responses and postoperative MBS interviews were not sufficient and we believe it is appropriate to perform interviews in the late postoperative period. Ketamine may increase awareness, while thiopental may prevent perception of awareness by increasing analgesia requirements due to not having analgesic properties, and propofol causes less awareness and thus, we believe that it is an appropriate choice for CS.

Patients' fears of anesthesia and surgery, death and pain as well as fears about the health of the infant may result in anxiety and awareness (3). Though fear of birth has been stated to increase anxiety among pregnant women, there are studies reporting the contrary (24,25). Time is important in preoperative anxiety measurements, however, there is no clear difference reported between levels of anxiety assessed at different times (3,8,14). In our study, we believe that the pregnant women had low anxiety levels because they were informed at the previous visit and demographic data were similar.

As clinical signs, such as elevated blood pressure and pulse rate, are regulated by the autonomous system, they may be affected by other factors (hypervolemia, hypoxia, hypercapnia, pain, beta blocker use) apart from IOA (12,26,27). In pregnant women, the hypotensive effect is observed more commonly with propofol induction and there are worries about ensuring sufficient anesthesia depth (12). However, propofol dose of 2.5 mg/kg is sufficient to prevent awareness, has the advantage of reducing maternal blood pressure for hypertensive patients and is reported to reduce the cardiovascular response to laryngoscopy and intubation (28). Similarly, it has been reported that medications with different doses and combinations may be used for CS (29,30). In our study, we believe that the reason for the clear increases in MAP and HR in group T compared to the other groups was the fact that thiopental suppresses catecholamine release less and has no analgesic effect.

To identify awareness, methods like BIS monitoring, end tidal agent concentration, MBS interviews and IFA techniques are recommended (12,13,31-33). Although the use of BIS monitoring has been reported to reduce the incidence of awareness, there are studies reporting the contrary (9,13,14,18,34,35). In our study, especially after intubation, there were higher BIS values (61-89) in group K compared to the other two groups and according to BIS, we can say that anesthesia depth was appropriate for all patients apart from group K. Due to the very short duration until birth in CS, we believe that the induction agent still affects BIS values until birth.

It has been reported that BIS monitoring may be helpful in determining the volatile anesthetic concentration required to ensure sufficient anesthesia depth in the duration until the fetus in born in CS (8,9,13-16,31). Chin and Yeo (15) stated that there was a risk of high awareness in the period before delivery in CS and that Etsev should be at least 1.2-1.3% to obtain a BIS value of <60 for this period. The use of subanesthetic doses of sevoflurane in the preoxygenation period in pregnant women has been said to reduce the time to reach the targeted end-tidal concentration and aid in setting BIS <60 (32). Ok et al. (18) stated that 1.0% Etsev did not provide BIS<60 until birth; thus, higher Etsev or IV administration of anesthetics or opioids after birth might be better. Zand et al. (31) recommended that volatile anesthetic concentration above 1 MAC not be used in CS due to the properties of fetal depression and dose-linked myometrial relaxation. Mashour et al. (34) stated that BIS observation might be better in preventing awareness compared to monitoring end tidal agent concentration. In our study, in all groups with 1 MAC sevoflurane, chosen due to low blood/gas coefficient, 1.2% Etsev was reached only in the 7th minute and in groups P and T we identified that, BIS was <60 with Etsev ≥1.2%.

Studies comparing BIS with IFA technique have not observed hand movements with BIS<60 without laryngoscopy, intubation or painful stimuli, however, in the presence of a strong painful stimulus even at BIS<50, patient's response to commands was not prevented. As a result, it was stated that BIS monitoring was insufficient to determine IFA response (31,36). There is a very low rate of correlation reported between intraoperative response assessed with BIS and the IFA technique (37). A study by Jeon et al. (38) using the IFA technique reported that there was no awareness between skin incision with BIS<75 and immediately after birth with BIS<85. In our study, there was no difference between the groups in terms of IFA response, with the least number of positive responses obtained from group K. In the presence of painful stimuli, responses are obtained from the IFA test independent of BIS, and we believe that the analgesic effect of ketamine may be effective in preventing this response and the initial low Etsev may cause positive responses to the IFA test.

Ketamine at subanesthetic doses has been reported to reduce postoperative pain levels and 24-hour analgesic requirements among CS patients (28-30,39). In our study,

we observed that the time to first analgesic requirement was longer and the postoperative analgesic consumption was lower in group K. We believe that administration of ketamine before nociceptive stimulation ensured preemptive analgesia.

Together with the consideration that dreaming or possible awareness is a result of superficial anesthesia, there is a very weak relationship between dreaming during anesthesia and depth of anesthesia (8,40). Wanna et al. (41) observed no awareness among pregnant women with propofol and ketamine induction, with a very low number of patients dreaming in both groups, no difference between the groups and stated that propofol and ketamine might be safely used for pregnant women. In the postoperative recovery room, patients may be groggy and feel a continuous desire to sleep so they may roughly explain their experience, without stating details. In the early postoperative period, pain and nausea-vomiting may prevent recollection of intraoperative experiences (42). As the first postoperative interview to determine awareness may not be reliable, it is recommended that this type of evaluation be performed two or three times at different times (13,16,18,29,31,34,35). We found that the highest number of patients who dreamed was in group K. Additionally, we identified that 1 patient in group P, 1 patient in group T and four patients in group K heard noise and music during the operation. In group T, 1 patient heard the commands given in the IFA assessment, did not dream and heard a baby crying during the operation. We believe that repeated interviews in the postoperative 1st week or in the later periods will increase the reported incidence of awareness.

Study Limitations

The first is that as ASA I-II pregnant patients were included, we cannot know whether the results can be generalized, especially among high-risk pregnancies. Second, instead of continuously assessing the IFA responses, we checked hand movements at certain time points. As a result, we did not identify awareness between these time points. Third, we did not use a peripheral nerve stimulator to ensure no tourniquet paralysis of the hand. Though there is a very low possibility of this occurring, unexpected paralysis of the same hand may be responsible for cases not responding in spite of high BIS values.

Conclusion

IOA is a significant complication of GA. In our study, since the preoperative anxiety levels in patients undergoing CS were low, we could not assess their effect on awareness. We believe that the available GA and monitoring methods are insufficient to assess the depth of anesthesia. Ketamine causes more dreaming and hearing of sounds during the operation compared to other anesthetics and we believe that this may cause problems in terms of awareness. Due to its antianalgesic properties, thiopental increases analgesic requirements in the early postoperative period and we assume that this may have prevented recall of experiences and thus identification of awareness. Propofol lowered BIS values, caused less IFA response compared to thiopental and caused less awareness when the MBS results were examined. As a result, we point out that the use of propofol for anesthesia induction is appropriate for CS.

Authorship Contributions

Surgical and Medical Practices: N.N.G., G.K., B.G.A., M.İ.H., H.A. Concept: N.N.G., G.K., B.G.A., M.İ.H., H.A. Design: N.N.G., G.K., B.G.A., M.İ.H., H.A. Data Collection or Processing: N.N.G., G.K., B.G.A., D.R.O., Ö.P., Ü.S. Analysis or Interpretation: N.N.G., G.K., B.G.A., D.R.O., Ö.P. Literature Search: N.N.G., G.K., Writing: N.N.G., G.K., B.G.A., H.A.

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