



The effect of propofol versus thiopentone on APGAR score of babies delivered and recovery of pregnant mothers undergoing elective cesarean section

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Abstract

Background and objectives: The Apgar score is a vital indicator of the baby's well-being. The aim of this study is to compare the effects of propofol and thiopental anesthetics on babies' Apgar scores and mothers' recovery times, this study was carried out.

Methods: This single-arm interventional study was conducted in Zhyan and Soma Hospital in Sulaimani, Kurdistan Region of Iraq from February 2022 to July 2022. Separate doses of propofol and thiopental were given to 140 pregnant women who were candidates for elective cesarean section in two separate groups. Apgar scores at 1 and 5 minutes after birth, recovery time, and hemodynamic changes before and after the intervention were evaluated and compared.

Results: The results of the diastolic pressure variable after the intervention and the hemodynamic variables were significantly different in each group before and after the intervention ($P < 0.001$). The mean recovery time in propofol and thiopental groups was 21.4 ± 2.4 and 26.0 ± 1.8 minutes, respectively, and they were statistically significantly different ($p < 0.001$). There was a statistically significant difference in the Apgar score at the 5th minute between the two groups ($p = 0.03$). In terms of the need for resuscitation after the first minute, the results were in favor of the propofol group ($p < 0.001$).

Conclusion: Propofol can be used more safely since patients who had anesthesia with it had better hemodynamics, quicker recovery times, neonates with higher Apgar scores, and less need for postpartum resuscitation.

Keywords: Apgar score, General Anesthesia, Propofol, Recovery time, Thiopentone

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Introduction

Although neuroaxial anesthesia (spinal and epidural) methods are popular among the general public in cesarean sections; But, general anesthesia is used in situations of coagulopathy, infection in the location of regional anesthetic administration, hypovolemia, severe fetal distress, and patient refusal of regional anesthesia.¹ Sodium Thiopental and propofol are two medications commonly used to induce anesthesia. In most situations, Sodium Thiopental is employed, however, propofol has gained popularity in anesthesia in the last decade. Propofol enhances recovery time and quality and is related to a decreased proportion of postoperative nausea and vomiting.² Other important qualities of the medicine include its rapid disposal, absence of cumulative effects, and bronchodilator effects. Propofol, on the other hand, can somewhat lower the patient's blood pressure. This characteristic is crucial in preeclampsia and helps control the rise in blood pressure after intubation.³ Both thiopental and propofol pass the placental barrier, lowering the fetus's central nervous system and potentially altering the newborn's outcome, mostly determined by the Apgar Score, which is regularly examined at 1, 5, and 10 minutes after delivery.⁴ The Apgar score is a rapid way to assess a newborn child's health in relation to infant mortality. This score is calculated by evaluating the newborn infant on five basic criteria on a scale of zero to two. This grading system employs three parameters (breathing, heart rate, and skin color) to indicate how and when resuscitation should begin, while the other two Apgar components (muscle tone and irritability response) determine neurological condition. For each criterion, the resultant score ranges from 0 to 10.⁵ The results of the study by Moghadam et al (2021).³ showed that propofol and thiopental do not have a

significant difference in Apgar score, but it seems that propofol can be better option for induction of anesthesia for elective cesarean section.⁶ In the study of Çakırtekin et al (2015), due to its superior anesthetic depth and quicker recovery time compared to thiopental, propofol is a more suitable anesthetic drug for cesarean operations.⁷ Considering that a few studies have been conducted on the recovery conditions after anesthesia and the effect on maternal and fetal hemodynamics, as well as the duration of the maternal, and neonatal recovery process. Therefore, the aim of this study is to investigate the effect of propofol versus thiopentone on APGAR score and recovery time from general anesthesia.

Materials and methods

This study was a single-arm interventional study. This research was conducted in maternity, at Zhyan and Soma Hospital in Sulaimani, Kurdistan Region of Iraq from February 2022 to July 2022.

The number of participants in this research was 140 pregnant women, all of whom were ranked 1 and 2 according to the American Society of Anesthesiologists (ASA). The age of mothers was between 27-40 years old, and all of their healthy weight was between 50-80 Kg. The study included that patients underwent cesarean sections with inclusion criteria :(those baby delivered by cesarean section). Exclusion criteria include: preterm, post-term, placenta previa, placenta inclement, cord prolapse, placenta abruption, shoulder dystocia, breech presentation, aberrant presentation. Patients with known allergies to study drugs, cardiopulmonary disease, liver and kidney failure, preeclampsia or eclampsia, history of alcohol or substance addiction, multiple pregnancies, fetal growth retardation, emergency cases, patients who did not want to continue participating were excluded from this study.



To collect the data for this study, the information in the patients' files, hemodynamic data before and after the test, Apgar score (1, 5, and 10 minutes), and a comparison of recovery time were used. Demographic information included the age, sex, height, weight, BMI, and gestational age of patients. Hemodynamic data included pulse measurement and systolic and diastolic blood pressures. Apgar's scores were calculated and recorded based on 5 criteria (Appearance, Pulse, Grimace, Activity, and Respiration). Ethical codes based on the Declaration of Helsinki were observed by researchers, and informed consent was obtained from patients to participate in the study. Also, the necessary permits were obtained from the university research committee and hospital center officials. This study has been approved by Sulaimani University Research Ethics Committee with code 4573. Participants were randomly divided into two groups. In this study, two drugs were used as induction of anesthesia (Propofol 2-3 mg/kg, for propofol group parturient), and (Thiopental 4-5 mg/kg, for thiopental group parturient). Pulse and blood pressure were recorded for all patients before and after induction of anesthesia. To maintain anesthesia, only sevoflurane was used as anesthetics. In this study, only propofol or thiopental was used and only one drug was used in each participant. For example, in patient one, patient two, and patient three, only one drug was used, P1, P2, and P3 (P=propofol), and another drug was used for the other three patients. For example, T4, T5, and T6 (T = thiopental). After delivery, Apgar scores at minute 1 and minute 5 were recorded step by step in both propofol and thiopental groups. In the second part of the research, the recovery time was recorded for all the propofol and thiopental groups. After obtaining the results of the tests, the data were entered into the SPSS software version 22, and then descriptive statistical tests, t-student

and chi-square were used for analysis considering the significance level less than 0.05.

Results

A total of 140 pregnant were included in the study, the Mean \pm SD of their age was 34.2 ± 4.1 ; And the mean of their gestational age was 38.2 ± 1.0 . There was no statistically significant difference in the mean pulse of mothers before and after the induction of anesthesia, or between their systolic and diastolic blood pressures prior to the injection of propofol and thiopental. But after induction of anesthesia with propofol and thiopental, systolic blood pressure was 99.2 ± 7.3 and 104.6 ± 6.5 mmHg, respectively, and they were statistically significantly different from each other ($P < 0.001$). Also, diastolic blood pressure after induction of anesthesia with propofol and thiopental was 62.5 ± 9.4 and 69.7 ± 8.7 mmHg, respectively, and they were statistically significantly different from each other ($P < 0.001$). The results showed that the mean Apgar score in the first minute was 5.4 ± 0.9 in the propofol group and 5.2 ± 0.9 in the thiopental group, and statistically, the two groups were not significantly different. Also, the results showed that the mean Apgar score in the fifth minute was 7.1 ± 0.8 in the propofol group and 6.8 ± 0.9 in the thiopental group, and statistically, the two groups had a statistically significant difference ($P = 0.03$). Regarding the recovery time of mothers after the end of anesthesia with propofol and thiopental, the results showed that the mean recovery time after the end of anesthesia was 21.4 ± 2.4 and 26.0 ± 1.8 minutes for propofol and thiopental, respectively, and statistically there were significant differences, In other words, the results have shown that the mean recovery time was lower in the propofol group. ($P < 0.001$) (Table 1).



Table (1): Distribution of the difference in (pulse rate, SBP, DBP, Apgar score, and recovery time) between the two medications propofol and thiopental.

	Mean ± SD			p value *
	Propofol	Thiopental	Total	
Pre induction Pulse rate (Beat/ minute)	77.8 ± 10.7	79.1 ± 11.9	78.5 ± 11.3	0.52
Post induction Pulse rate (Beat/ minute)	77.2 ± 9.3	79.0 ± 9.4	78.1 ± 9.4	0.27
Pre induction Systolic blood pressure (mm/Hg)	120.8 ± 11.3	122.3 ± 16.3	121.6 ± 14.0	0.53
Post induction Systolic blood pressure (mm/Hg)#	99.2 ± 7.3	104.6 ± 6.5	102.0 ± 7.4	< 0.001
Pre induction Diastolic blood pressure (mm/Hg)	77.1 ± 8.9	77.9 ± 7.6	77.5 ± 8.3	0.58
Post induction Diastolic blood pressure (mm/Hg)	62.5 ± 9.4	69.7 ± 8.7	66.2 ± 9.7	< 0.001
Recovery time (minutes)	21.4 ± 2.4	26.0 ± 1.8	23.8 ± 3.1	< 0.001
APGAR score first minute	5.4 ± 0.9	5.2 ± 0.9	5.3 ± 0.9	0.11*
APGAR score fifth minute	7.1 ± 0.8	6.8 ± 0.9	6.9 ± 0.9	0.03*
Recovery time (Mean ± Standard deviation)	21.4 ± 2.4	26.0 ± 1.8	23.8 ± 3.1	< 0.001 *

* performed by independent t test

The results of examining the mean hemodynamic variables in both groups showed that before and after anesthesia induction, the mean hemodynamic variables before and after anesthesia induction have statistically significant differences. The mean pulse of mothers in the propofol group before and after induction was 77.8 ± 10.7 and 77.2 ± 9.3 beats per minute, respectively. These values in the thiopental group were equal to 79.1 ± 11.9 and 79.0 ± 9.4 beats per minute ($P < 0.001$). The mean systolic blood pressure of mothers in the propofol group before and after induction of anesthesia was 120.8 ± 11.3

and 99.2 ± 7.3 mm/hg, respectively, and in the thiopental group, it was 122.3 ± 16.3 and 104.6 ± 6.5 mm/hg ($P < 0.001$). Regarding diastolic blood pressure, it was 77.1 ± 8.9 and 62.5 ± 9.4 mm/hg in the propofol group, respectively; and in the thiopental group, it was equal to 77.9 ± 7.6 and 69.7 ± 8.7 mm/hg, which was statistically significant ($P < 0.001$). (Table 2).



Table (2): The comparison between the effect of the two medications (propofol and thiopental) on pre and post induction (pulse rate, SBP, and DBP).

		Mean ± Standard deviation		p value *
		Pre induction	Post induction	
Pulse rate	Propofol	77.8 ± 10.7	77.2 ± 9.3	< 0.001
	Thiopental	79.1 ± 11.9	79.0 ± 9.4	< 0.001
Systolic blood pressure	Propofol	120.8 ± 11.3	99.2 ± 7.3	< 0.001
	Thiopental	122.3 ± 16.3	104.6 ± 6.5	< 0.001
Diastolic blood pressure	Propofol	77.1 ± 8.9	62.5 ± 9.4	< 0.001
	Thiopental	77.9 ± 7.6	69.7 ± 8.7	< 0.001

* performed by Paired t test

The results of the mean Apgar variable in the first minute in the propofol group and in the thiopental group showed that there was no statistically significant difference. However, the Apgar score of the fifth minute was 7.1 ± 0.8 in the propofol group and 6.8 ± 0.9 in the

thiopental group, which were statistically different ($p= 0.03$) (Figure 1 and 2). Also, the results of the mean recovery time variable were 21.4 ± 2.4 in the propofol group and 26.0 ± 1.8 in the thiopental group, which was statistically significant ($p < 0.001$). (Table 1)

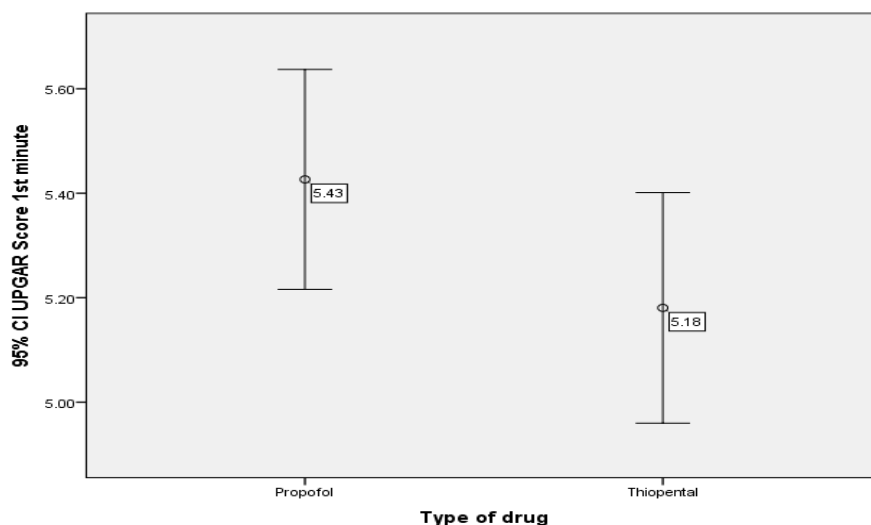


Figure (1):The comparison between the effect of the two medications (propofol and thiopental) on the Apgar score at 1st minute.

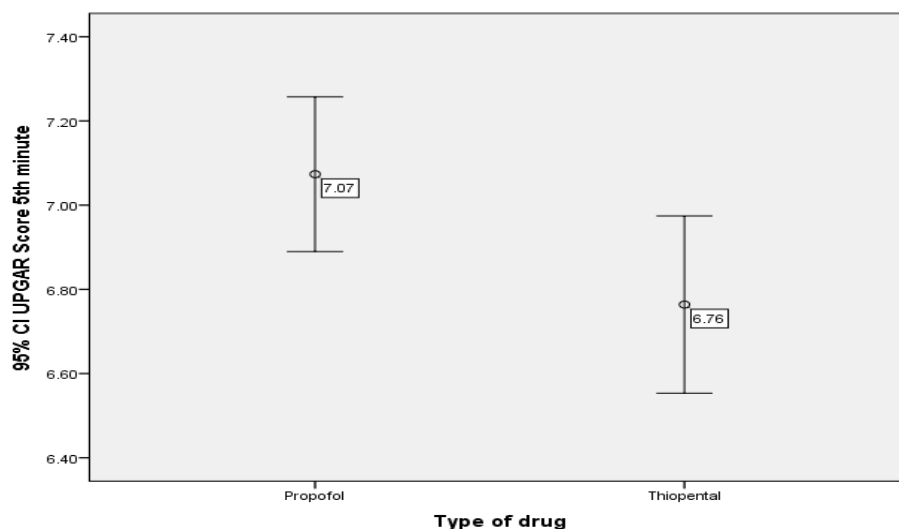


Figure (2):The comparison between the effect of the two medications (propofol and thiopental) on the Apgar score at 5 minutes.

The mean weight of infants born to mothers who were anesthetized with propofol and thiopental was 2.96 ± 0.27 and 3.06 ± 0.27 , respectively, which statistically had a significant difference between the two groups ($P=0.03$). The results of examining the variables of the appearance of the newborns in the first minute showed that the values between the two groups were not statistically significant ($P=0.28$). The results of the examination of the pulse variable in the first minute of the babies showed that the values between the two groups are not statistically significant ($P=0.70$). The findings of the Grimace assessment in the first minute revealed that 14 newborns in the propofol group scored 0, 53 infants scored 1, and 1 child scored 2, whereas 22 infants in the thiopental group scored 0, 49 infants scored 1, and 1 infant scored 2. There was no statistically significant difference in these values between the two groups ($P=0.40$). Also, the results of examining the variables of newborns' breathing ($P=0.41$), activity ($P=0.40$), and the mean Apgar in the first

minute ($P=0.07$), showed that the values between the two groups were not statistically significant. Out of 68 infants born to mothers anesthetized with propofol, 34 had Apgar scores of 4-5 and 34 had scored 6-8, and out of 72 infants born to mothers anesthetized with thiopental, 47 had Apgar scores of 5-4 and 25 cases had scores between 6-8, which were not statistically significantly different between the two groups ($P=0.07$).

The results of the resuscitation variable showed that 15 infants from the propofol group and 43 infants from the thiopental group needed resuscitation, which was statistically significant ($P<0.001$) (Table 3).



Table (3): Comparison of neonatal outcomes based on Apgar scores 1st and 5th minute between two groups of anesthesia induction with Propofol and Thiopental

Neonatal outcome		Propofol		Thiopental	Total	p value					
Birth weight	Mean ± SD	2.96 ± 0.27		3.06 ± 0.27	3.01 ± 0.27	0.03					
Birth weight	< 2500 gram	1		0	1	0.3					
	2500 - 3700 gram	67		72	139						
		Propofol	Thiopental	Total	P value	Propofol	Thiopental	Total	p value		
		1st minute				5th minute					
Appearance	One	65	71	136	0.28	45	57	102	0.08		
	Two	3	1	4		23	15	38			
Pulse	One	29	33	62	0.70	9	7	16	0.51		
	Two	39	39	78		59	65	124			
Grimace	Zero	14	22	36	0.40	4	7	11	0.27		
	One	53	49	102		60	64	124			
	Two	1	1	2		4	1	5			
Activity	Zero	13	20	33	0.40	2	4	6	0.53		
	One	54	50	104		61	60	121			
	Two	1	2	3		5	8	13			
Respiration	One	54	61	115	0.41	14	19	33	0.42		
	Two	14	11	25		54	53	107			
Total APGAR	Mean ± SD	5.46 ± 0.95	5.17 ± 0.89	5.31 ± 0.93	0.07	7.04 ± 0.85	6.82 ± 0.81	6.93 ± 0.84	0.11		
Total APGAR		4 - 5	34	47	81	0.07				0.15	
		6 - 8	34	25	59						
		5 - 6						17	26		43
		7 - 9						51	46		97
Resuscitation	Yes	15	43	58	< 0.001						
	No	53	29	82							
Total		68	72	140		68	72	140			

The results of examining the variables of appearance (P=0.08), pulse (P=0.51), activity (P=0.53), breathing (P=0.42), and Apgar mean (P=0.11); In infants at minute 5, it showed that the values between the two groups are not statistically significant. In the propofol group, 4 newborns scored 0, 60 infants scored 1, and 4 infants scored 2, whereas in the thiopental group, 7 infants scored 0, 64 infants scored 1, and 1 infant

scored 2, and there was no statistically significant difference in these values between the two groups (P=0.27). Out of 68 infants born to mothers anesthetized with propofol, 17 had Apgar scores 5-6 and 51 had scored 7-9, and out of 72 infants born to mothers anesthetized with thiopental, 26 had Apgar scores 5-6 and 46 cases had scores 7-9, which statistically had no significant difference between the two groups (P=0.15).



Discussion

Nowadays, cesarean section operations are very popular among pregnant women. Although neuraxial anesthesia, especially spinal anesthesia is preferred, general anesthesia (thiopental and propofol as induction agents) is used in some situations.⁸ Therefore, the aim of this study is to investigate the effect of propofol versus thiopental on Apgar score and recovery time from general anesthesia. The muscle relaxant that used in this study was rocuronium, The study comprised 140 pregnant women with a mean age of 34.2 ± 4.1 and a mean gestational age of 38.2 ± 1.0 . The mean gestational age in this study is similar to the mean gestational age in studies by Tumukunde et al,⁶ and by Çakırtekin et al.⁷ Also, based on the results of the above two studies and the study by Montandro et al, the mean age of mothers in our study was higher.⁴ The pulse rate of pregnant women before and after anesthesia did not differ significantly in the two groups. Nevertheless, statistically significant findings were achieved when each medication was compared to its own group in the propofol group ($P < 0.001$), and in the thiopental group ($P < 0.001$). This is congruent with the finding by Çakırtekin.⁷ According to the findings by Rabiee et al,⁹ the propofol group's mean heart rate fell before and after anesthesia induction, which contradicts our findings. This conclusion might be attributed to the injection of other medications specified in their study. The results However there were no significant difference in mean systolic blood pressure (as well mean diastolic blood pressure) between the two groups before induction, and both groups shows the reduction in the mean systolic and diastolic blood pressure after induction but the reduction (of mean SBP and DBP) in the Propofol group was greater after induction i.e. the thiopental group shows significantly higher mean SBP and DBP than Propofol

group. These results are consistent with the findings by Sahraei,¹¹ and Shetabi,¹² And diastolic blood pressure has decreased, and this reduction is more evident in the propofol group. But in the study of Kayalha et al, diastolic blood pressure has increased, which may be due to the use of Electroconvulsive therapy (ECT) with different treatment goals.¹³ The results of the variable examination of mothers' recovery time showed that the mean recovery time is in favor of the propofol group. The findings of this study with the general findings of the study by Moghadam et al,³ was consistent. In this study, the recovery time between the two groups was 4.6 minutes, which was in favor of the propofol group, but in the study of Çakırtekin et al.⁷ It was 1.83 minutes, which shows a significant difference. The cause of this difference may be due to the errors of the device used in time measurement, variable drug doses, and the mean age of the participants in the study. The results of the first-minute mean Apgar variable showed not statistically significant difference. But, the propofol group's mean Apgar score at the fifth minute was greater than the thiopental group's, a statistically significant difference, which is consistent with the findings of Mahjoubi Fard et al,¹⁶ and Dadras et al.¹⁷ Ghodrati et al,¹⁴ found no significant difference between Apgar scores (minutes 1, 5, 10, and 15) of cesarean neonates given propofol or thiopental. This conclusion contrasts with the present study's findings that being primiparous or multiparous, as well as race, are major and effective determinants of Apgar scores. Also, Mercan et al,¹⁵ state that the effect of these two drugs on the Apgar score of babies is the same. It seems that in the past studies, propofol is mostly dismissed and the results of these studies force us to review the previous findings and enjoy the benefits of propofol in special conditions. In terms of five criteria, the Apgar score revealed no statistically



significant difference between the two groups receiving propofol and thiopental. The findings of the study by Gulfam et al,¹⁸ revealed that, with the exception of the infant's heart rate in the first thirty seconds, which was considerably lower in the propofol group than in the thiopental group, there was no statistically significant difference between the two groups. This drop in heart rate was mild and temporary, and the results showed that it had no influence on the newborns' APGAR scores in minutes one and five. The findings show that there is a statistically significant difference in the requirement for resuscitation between the thiopental and propofol groups, with the infants delivered in the thiopental group having a greater rate of resuscitation. These findings are in line with the study of Moghadam et al.¹⁶ But it is contrary to the findings of the study of Tumukunde et al;⁶ Because in this study, the thiopental group needed little resuscitation. This difference in the results may be caused by the volume of the samples, and the dosage error of the drugs.

Limitation

In this study, the number of samples was relatively small. Another limitation was the preference of neuroaxial anesthesia over general anesthesia, which attributed the small number of samples.

Conclusion

In the study that was conducted, the results showed that the mean criteria of the review are in favor of the propofol group, and propofol can replace thiopental with the same type of application and perhaps with better safety and efficacy. Overall, the results of APGAR score, recovery time and hemodynamic variables were in favor of the propofol group. Based on this, it seems that replacing thiopental with propofol is a safer and better option.

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Conflict of interest:

The authors recorded no conflict of interest.

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