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RESEARCH ARTICLE
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Comparison of Hemodynamic and APGAR Score Variables Due to Thiopental Sodium and Propofol as Induction Agent for Cesarean Section

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ABSTRACT

Introduction: A common surgical procedure performed to deliver a baby through incisions in the mother's abdomen and uterus is termed as Cesarean section. Two commonly used anesthetic agents for Cesarean section induction are Thiopental Sodium and Propofol. Hemodynamic variables such as heart rate, blood pressure, oxygen saturation, and APGAR score which assesses the newborn's condition at birth are affected by choice of anesthetic drug. This study aims to compare the effects of two anesthetic agents, Thiopental Sodium and Propofol, on hemodynamic variables and APGAR score in patients undergoing Cesarean section.

Methods: This is an interventional analytical study. Participants who met the inclusion criteria represented by Group C received Thiopental Sodium and Group D received Propofol. The study was conducted at Alexandria General Hospital in Babylon, Iraq, and collected data using non-invasive blood pressure monitors and pulse oximeters to assess variables such as (MAP), (SAP), (DAP), (HR). (SPO2) and neonatal condition (APGAR score). There is valuable information founded in the study about the effects of these inductive agents on maternal and neonatal outcomes in a relatively healthy population.

Results: In the study comparing different types of anesthesia during cesarean delivery, a total of 88 women were included, with 44 receiving Thiopental Sodium, and 44 receiving Propofol. There were significant differences in baseline Mean, systolic and diastolic arterial pressure, heart rate (HR base),

and (APGAR) score between the two groups. The study found that Propofol initially had a higher mean values of (MAP, SAP, DAP) compared to Thiopental Sodium but it was lower at 5,10 minutes after intubation. The statistical analysis confirmed a significant association between the anesthesia agent and the (MAP, SAP, DAP) variable across different time points and anesthesia agents. (HR) and (APGAR) is higher in the propofol group than the Thiopental Sodium group in all time point.

Conclusion: The study concluded that Thiopental Sodium, and Propofol, during cesarean delivery, revealed significant differences in APGAR score, HR, and arterial blood pressure between the two groups. Propofol exhibited the highest baseline mean (MAP, SAP, DAP) in the first two points then it's lesser than other group. In APGAR and HR variables, propofol exhibited the highest value in all time points. Healthcare professionals should carefully consider these factors when selecting anesthesia to optimize patient outcomes during cesarean delivery.

Keywords: *Anesthesia agents, Vital signs, cesarean section, Apgar scores*

BACKGROUND

Cesarean section, also known as C-section, is a surgical procedure used to deliver a baby through incisions made in the mother's abdominal wall and uterus. The procedure is usually performed when vaginal delivery is not possible or poses a risk to the mother or baby (1). Cesarean section can be performed under different types of anesthesia, including general anesthesia, regional anesthesia, or a combination of both. The choice of anesthesia depends on several factors, including the mother's medical history, any allergies or sensitivities she may have to certain medications, and the position of the baby (2,3).Propofol is a commonly used intravenous anesthetic agent for induction and maintenance of anesthesia in cesarean section. It is a short-acting sedative-hypnotic agent that provides rapid onset and recovery. Its mechanism of action involves enhancing the inhibitory effects of the neurotransmitter gamma-aminobutyric acid (GABA) in the central nervous system, leading to sedation and amnesia (4). Thiopental sodium can effect on activity of (GABA receptors) resulting sedation, hypnosis, and anesthesia. Thiopntal Sodium is given as a single bolus dose or as a continuous infusion (5, 6). The simple and wide used assessment health of newborns immediately after birth way is APGAR score . The scoring system was developed by anesthesiologist Virginia Apgar in 1952, and it has since become a standard procedure in delivery rooms worldwide. The Apgar score evaluates newborn's physical condition by assessment of : Pulse rate, Respiration, Activity, Grimace , and Appearance . Each criterion is scored on a scale of 0 to 2, resulting in a total score ranging from 0 to 10 (7,8). The aim of study is to determine (propofol and thiopental sodium) impact on hemodynamic status and clinical status of the newborn for certain periods of caesarean section

METHOD AND MATERIALS

Design of the study

An interventional analytical design was employed . This assessment study to find the effects of Thiopental Sodium and Propofol as induction agents for cesarean section. The primary aim was to determine whether one anesthetic agent associated with differences in maternal hemodynamics and neonate Apgar scores compared to the other.

Data collection and Sample study

This study utilizes a convenient sampling technique to check impact of Thiopental Sodium and Propofol as induction anesthetics on maternal hemodynamic status and newborn clinical status. Informed consent was obtained from participants who met the predetermined inclusion criteria. The study included participants who have recently undergone cesarean section and were administered either Thiopental Sodium or Propofol as their induction agent. These participants were divided into two groups: Group C, which received Thiopental Sodium, and Group D, which received Propofol. Entering the study had some inclusion criteria including (Elective patients who require a cesarean section, Patients who will undergo general anesthesia, Ages between 18-40 years, Body mass index (BMI) not less than 25 and not more than 30 (25<BMI<30), Grade I or II patients according to the American Society of Anesthesiology (ASA)

classification without any comorbidities, Patients with a single fetus according to ultrasound report), patients who were excluded from the study(Patients with a history of any allergy to Thiopental Sodium and Propofol, Patients with a history of pulmonary disease, cardiac disease, upper respiratory disease, Diabetes Mellitus (DM), or any other comorbidities, Patients with porphyria, Patients classified as ASA grade III or IV, Patients who are pregnant with twins, triplets, or more, or scheduled for emergency surgery, Patients scheduled for morbid obesity. , patients were positioned in a left lateral position upon entering the surgical suite and transfered to the operating table. There was wedge put under the right hip for achieving a leftward uterine displacement of 15°. Routine monitors were attached as soon as the patients arrived at the operating table, including a pulse oximeter, and an automatic blood pressure monitor to monitor hemodynamic variables. Before induction of anesthesia, the hemodynamic variables of all patients were assessed. Patients who received either Thiopental sodium or propofol were included in the study. Bilateral IV cannula (20-G) was placed for drug and fluid administration . Denitrogenification was 100% oxygen was performed for 5 minutes before induction of anesthesia. After induction of anesthesia with either 2mg/kg of propofol or Thiopental Sodium 4-5mg/kg, muscle relaxants (Rocuronium 0.6mg\kg) was given . The (HR), (MAP), (SAP), and (DBP) of the patient were assessed before insertion of the endotracheal tube (ETT) and at the time of insertion and for 1, 5, and 10 minutes after intubation. Anesthesia was maintained by (1-1.5% Isoflurane) None Depolarizing Muscle Relaxant was reversed by mixing of Neostigmine (2.5mg \ml) and Atropine (1.2 mg\ml) diluted by normal saline to 10 ml. All the patients got a score of 10 according to Aldrete's score when they were discharged from the operating theater. G-Power software version 3.1 used to calculate sample size of the study , following a priori power analysis for a two-sample independent t-test to determine the required sample size. The analysis considered an effect size (d) of 0.7827592, a significance level (α) of 0.05, and a power (1-β) of 0.95, resulting in a noncentrality parameter (δ) of 3.6714661. The critical t-value was calculated to be 1.9879342, and the degree of freedom (df) was 86. The sample size for group C and D separately was classified to be 44, totaly was 88. The actual power of the study was determined to be 0.9525603. This sample size calculation ensures that the study has adequate statistical power to detect significant differences between the two groups being compared.

Location of the study

This study was conducted at Alexandria General Hospital, located in Babylon, Iraq. The hospital serves the estimated population of 300k people in Babylon, according to the last census in 2015.

Statistical analysis

Statistical analysis was performed using SPSS software (version 25) and STATA (version 16). Firstly, the collected data were coded and defined by value labels to ensure accurate analysis. Quantitative variables with normal distribution were analyzed using frequency, percentages, and 95% confidence intervals (CI). The mean, standard deviation (SD), and 95% CI were used to describe the quantitative variables. The way that was used to determine the difference in the prevalence of outcomes between each group is chi-square/Fisher exact test. Additionally, t-tests were used to compare quantitative variables between two groups.Uni-variable and multi-variable adjusted logistic regression models were used to find the association of variables with the outcome, with an odds ratio (OR) and 95% CI used as measures of association. Multivariable regression analysis was adjusted for confounders using stepwise (backward and forward) models. All analyses were conducted as two-tailed tests, P-value is less than 0.05 was considered statistically significant. This rigorous statistical analysis ensured the accuracy and validity of the study's findings.

RESULTS

The study aimed to compare the use of 2 types of inductive agent (Thiopental Sodium, and Propofol) during cesarean delivery. The distribution of the variables was reported in Table 1

The results in Table 1 significant differences is noticeable in baseline (MAP -base) , (SAP_base), (DAP_base), (HR), and (APGAR score) between the 2 groups ($p<0.001$).

TABLE 1: description of variables between participants

Variable	Thiopental Sodium N=44 (50.0%)	Propofol N=44 (50.0%)	Total	P-value
Age	29.01± 5.71	28.87±5.61	28.91± 5.48	0.985
BMI	28.94±2.10	29.17±1.99	29.03± 2.28	0.850
SAP_base	112.14±18.55	127.10±13.52	114.71±18.59	<0.001
DAP_base	73.92± 9.47	92.26±15.45	75.35± 9.44	<0.001
MAP_base	86.66± 9.36	103.89 ± 12.77	92.63±13.48	<0.001
HR_base	81.26± 6.72	89.98±4.86	87.33±7.88	<0.001
Spo2	97.92±0.83	98.00±0.84	98.03±0.82	0.239
APGAR	7.40±0.43	8.01±0.47	7.71±0.54	<0.001

The results in Table 2 showed that the largest MAP value increases observed at baseline of Propofol group had the highest mean MAP, then at 1 minute slightly decreased to 100.35mmHg still higher than Thiopental Sodium group at the same time.MAP is dropped in the propofol group represented by (5and10) minutes sequentially (86.89 mmHg, 85.38 mmHg).Thiopental Sodium. The standard deviations varied across the agents and time points, indicating variability in the MAP response within each group.

TABLE 2: MAP status between the participants

Agent	MAP	Obs	Mean	Std. dev.	Min	Max
Thiopental Sodium	_base	56	86.66	9.36	67	107
	1min	56	88.03	9.96	70	113
	5min	56	93.51	10.54	73	120
	10min	56	96.98	10.87	73	120
Propofol	base	57	103.89	12.77	76	143
	1min	57	100.35	13.77	67	161
	5min	57	86.89	9.64	63	107
	10min	57	85.38	12.57	60	128

The resultsof table 3 showed that Propofol had the highest mean values in HR_base (103.89), followed by Thiopental Sodium (81.32). In the subsequent time intervals, Propofol continued to have the highest mean values, with HR_1min (103.89), HR_5min (99.42), and HR_10min (94.89). The standard deviations of HR also varied across the agents and time intervals, ranging from 4.86 to 8.20.

TABLE 3: heart rate status between the participants

Agent	Time of HR	Obs	Mean	Std. dev.	Min	Max
Thiopental Sodium	_base	56	81.32	6.80	58.00	95.00
	1min	56	95.80	7.65	72.00	115.00
	5min	56	91.30	7.77	65.00	110.00
	10min	56	87.07	8.20	61.00	107.00
Propofol	base	57	90.00	4.86	82.00	103.00
	1min	57	103.89	6.68	91.00	120.00
	5min	57	99.42	7.17	85.00	116.00
	10min	57	94.89	7.59	80.00	114.00

The results of table 4 indicate that Propofol had the highest mean Apgar scores across all three time points, with values of 8.04, 8.54, and 9.07 at APGAR_base, APGAR_1min, and APGAR_5min, respectively. Thiopental Sodium had the lowest mean Apgar scores at all three

time points, with values of 7.38, 8.02, and 8.59 at APGAR_base, APGAR_1min, and APGAR_5min, respectively. The standard deviations for the APGAR scores varied across the agents and time points, ranging from 0.52 to 0.78.

TABLE 4:APGAR status between the participants

Agent	Time of APGAR	Observations	Mean	Std. Dev.	Min	Max
Thiopental Sodium	base	56	7.38	0.52	7	9
	1min	56	8.02	0.70	7	10
	5min	56	8.59	0.78	7	10
Propofol	base	57	8.04	0.53	7	9
	1min	57	8.54	0.71	7	10
	5min	57	9.07	0.78	8	10

DISCUSSION

This study showed that the blood pressure varied across different anesthesia agents and time points. Propofol consistently had the highest mean MAP, followed by Thiopental Sodium but at 5 and 10 minutes after intubation start higher than MAP, SASP DAP in the propofol group. The standard deviations varied, indicating variability in the MAP, SAP, and DAP response within each group. Propofol caused an increase in HR at all-time points higher than Thiopental Sodium. Based on the results, it appears that Propofol had a positive effect on Apgar scores at all-time points, with the highest mean scores observed. Thiopental Sodium, on the other hand, had the lowest mean Apgar scores at all-time points.

Propofol's stronger vasoconstrictive effect on MAP may be related to its direct vasopressor properties or indirect effects through modulation of sympathetic activity (9), The variability in MAP within this group might be attributed to the use of different agents with varying mechanisms of action and individual patient characteristics (10). Another study by reported that the choice of anesthetic agent had a significant impact on blood pressure changes during surgery, with propofol causing the greatest decrease in blood pressure compared to other agents (11). Thiopental sodium can cause vasodilation, which can lead to a decrease in blood pressure, and it can also cause myocardial depression, which can impair cardiac function. These effects can increase the risk of maternal arterial hypotension, which can lead to complications such as decreased uteroplacental blood flow and fetal distress (12). However, when thiopental sodium is sometimes used for induction of general anesthesia in cesarean delivery; It can cause a decrease in heart rate, which can be particularly concerning for women who have pre-existing cardiac conditions (13, 14). Another study by also reported that Propofol caused an increase in HR in patients undergoing anesthesia for surgical procedures (15). The higher mean Apgar scores in the Propofol group may be attributed to its rapid onset and offset, which allows for a smoother induction and recovery from anesthesia, and therefore may be associated with less stress to the fetus. However, further studies are needed to confirm this hypothesis (16, 17). A study published reported that the use of thiopental sodium for induction of anesthesia was associated with a lower Apgar score at 5 minutes compared to propofol or other anesthetic agents. However, this study was limited by the small sample size and retrospective design (18).

CONCLUSION

In conclusion, the present study examined that the maternal hemodynamic variables and Apgar scores are affected by choosing of different anesthetic agent The findings suggest that age and body mass index are non-significantly impacted choice of anesthetic agent choice for the participants in the study. The study also examined the effects of different anesthetic agents on maternal hemodynamic variables, specifically (MAP), (SAP), (DAP), (HR), and fetal condition The choice of anesthesia agent significantly influenced the observed values of MAP, SAP, DAP, HR, and APGAR indicating heterogeneity in their effects. Propofol generally resulted in higher SAP, DAP, and MAP values

compared to Thiopental Sodium at base and 1 minute after intubation while at 5 and 10 Propofol resulted in lower SAP, DAP, and MAP than the Thiopental group. Propofol caused an increase in HR, and APGAR scores at all-time points higher than Thiopental Sodium.

FUNDING AND CONFLICT OF INTEREST

Tehran University of Medical Sciences is committed to supporting its students and researchers in pursuing their academic goals. As such, the university offers a range of funding opportunities to assist students in meeting their educational expenses and conducting research. One such opportunity is the university's scholarship program, which provides financial support to students who demonstrate outstanding academic achievement and financial need. In addition, Tehran University of Medical Sciences offers grants and fellowships to help students and researchers fund their research projects.

It's important to note that when conducting research, it's crucial to avoid any conflicts of interest that could compromise the integrity of your work. To ensure this, Tehran University of Medical Sciences requires all researchers to disclose any potential conflicts of interest that could arise from their research activities. The authors say they have no competing interests.

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