Research Article

Comparison of induction and recovery profiles of intravenous propofol and thiopentone anesthesia

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Abstract

Background: In day care anesthesia, postoperative recovery is of importance. In addition to economical gains, the inconvenience, which is avoided, and the time gained by the patient to resume daily life are notable.

Objective: To compare the induction and recovery profiles of the propofol with thiopentone in day care patients.

Materials and Methods: A prospective, randomized, patient-blinded, parallel-group, noncrossover trial carried out in Department of Anesthesia of our teaching hospital. Hundred females of ASA group I and II aged between 20 and 45 years, scheduled for minor gynecological procedures, were randomly allocated to two groups that received either propofol or thiopentone. Induction time was measured. The occurrences of cough/hiccup, pain, apneic episodes, twitching, or movements during induction and maintenance were recorded. Blood pressure, SpO_2, and pulse rate were recorded at intervals. During recovery, waking time, talking time, sitting time, and standing time were observed. Psychomotor recovery was studied by the performance of aiming test and dexterity test. The patients were observed for complaints of any adverse effects up to 4 h of recovery. Independent statistician applied unpaired *t*-test, repeated-measures ANOVA, and Fischer's exact test, according to requirements, using GraphPad Prism, 5.01.

Result: In this study, the mean induction dose of propofol was 2.31 ± 0.01 mg/kg and thiopentone was 4.55 ± 0.02 mg/kg. The mean induction time was 30.16 ± 1.23 and 29.56 ± 1.16 min, respectively. Apnea was 50% with propofol induction, and only 30% with thiopentone. Involuntary movements were more in propofol group, whereas hiccup/cough was more with thiopentone. There was significant fall in blood pressures in propofol group during induction. Recovery was faster with propofol, than thiopentone. Postoperative aiming scores and dexterity time in thiopentone group were significantly low than those in the propofol group. Comparison with baseline scores, at first and second hours, showed significantly low scores in thiopentone group, but at 4 h, the difference was not statistically significant in either group. Adverse effects were more common with thiopentone.

Conclusion: The recovery characteristics of propofol are superior to those of thiopentone. The return of psychomotor performance and cognitive functions are more rapid in propofol group.

KEY WORS: Day care surgery, propofol, thiopentone, psychomotor recovery.

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Introduction

Day care surgery anesthesia is now practiced throughout the world. The postoperative recovery is of importance in day care surgery if it is to expand with all its advantages. The financial gains by this method of treatment are remarkable. Hospital cost per patient is reduced by using day care surgery. In addition to these economical gains, the inconvenience, which is avoided, and the time gained by the patient being

able to go home at the same day are notable. Most of them go to work sooner, return to daily activities, and reduce the risk of infection.[1] Thus, it was decided to study the comparison of commonly used inducing agents. However, ketamine did not fit in this research owing to its dissociative type of anesthesia and emergence phenomenon during recovery.[2] In addition, etomidate has prolonged recovery time with high incidence of pain on injection, myoclonic activity, and heavy cost.[2] Thus, we decided to compare the induction and recovery profiles of the propofol with thiopentone in day care patients.

We took up this research with the objectives to evaluate the changes in cardiorespiratory parameters during induction with intravenous (IV) propofol or thiopentone. We also destined to compare the recovery times and psychomotor recovery in these two groups.

Materials and Methods

This was a prospective, randomized, single-blind (patient-blinded) parallel-group, noncrossover, two-limb study. The study was approved by Institutional ethics committee. Gynecology operation theater of our tertiary-care teaching hospital was the site of research. Hundred females of ASA (American Society of Anesthesiologists) groups I and II aged between 20 and 45 years were scheduled for minor gynecological procedures, after giving written informed consent, and were randomly allocated to two groups, which received either propofol or thiopentone as sole anesthetic agent. Exclusions were made in case of contraindication to either anesthesia techniques such as allergy, coagulopathy, localized infection, or psychoneurological diseases.

During preoperative visits, patient was instructed and allowed to become familiar with psychometric tests. They were made to perform tests repeatedly to achieve the best performance. The patient performed all the tests pre and postoperatively in sitting position to avoid error owing to the change of posture.

On arrival in operation theater, IV access was secured, and after recording baseline vital parameters, all the patients were medicated with IV glycopyrrolate (0.2 mg), IV fentanil (25 mg), and IV midazolam (0.5 mg). Anesthesia was induced with either IV 1% propofol or IV 2.5% thiopentone, till the loss of eyelash reflex. The anesthesia was maintained with the increments of 10 mg propofol or 25 mg thiopentone. Induction time was measured from the start of injection to the loss of eyelash reflex. The occurrences of cough/hiccup, pain on injection, feeling of coldness, apneic episodes, twitching, or movements during induction and maintenance were recorded. Quality of anesthesia was graded as good, adequate, or poor. Those patients who showed apnea of more than 30 s were given assisted ventilation. Blood pressure, SpO2, and pulse rate were recorded at 1, 2, and 3 min.

As the patient started responding to oral commands, the recovery was studied as follows:

1. Waking time: The duration from the end of anesthesia till able to respond to oral commands.
2. Talking time: The duration from the end of anesthesia till able to talk.
3. Sitting time: The duration from the end of anesthesia till able to sit without support.
4. Standing time: The duration from the end of anesthesia till able to stand without support.

Psycomotor recovery was studied by psychomotor tests for the performance of the following:

1. Aiming test: Two hundred 5-mm diameter circles linked in lines of 20 each, across a sheet of paper, were presented to patients, asked to place dot inside each circle within a time limit of 90 s. The numbers of dots correctly placed within circles were recorded. This assessed hand–eye coordination.
2. Dexterity test: The task was to guide a loop along a length of a wire; when the loop touches the wire, the buzzer went on along with the flashing of light. This task incorporates a visual component and primarily assesses manual dexterity. For each hand, the time and the number of touches were recorded and the mean of the score for two hands taken.

   The patients were observed for subjective complaints of sleepiness, headache, nausea, and vomiting up to 4 h of recovery.

Statistical Analysis

The collected data were analyzed by an independent statistician. He applied unpaired *t*-test for comparison of means of hemodynamics, induction, and recovery times. The hemodynamic and psychomotor parameters were compared with baseline values within the group by repeated-measures ANOVA with post hoc Dunnett's test. The differences in proportion were analyzed by Fischer's exact test. All the statistical analysis was done using GraphPad Prism, 5.01. The p value of <0.05 was considered as statistically significant.

Results

The recruited 100 patients were equally divided into two groups, each receiving IV propofol or thiopentone as inducing agent. Demographic parameters and induction parameters of the study participants are shown in Table 1. In this study, the mean induction dose of propofol was 2.31 ± 0.01 mg/kg and of thiopentone was 4.55 ± 0.02 mg/kg. The mean total dose of propofol was 173.9 ± 25.56 mg and of thiopentone was 326.6 ± 47.7 mg. The mean induction time was 30.16 ± 1.23 s in the propofol group and 29.56 ± 1.6 s in the thiopentone group [Table 1].

The feeling of injection occurred in 23 patients in the propofol group, described as coldness or pain. In the thiopentone group, only four patients described such sensations. Apnea occurred after induction in both the groups. However, clinically significant apnea of more than 30 s was common (25 patients) with propofol induction, whereas only 15 patients

Table 1: Demographic parameters and induction parameters of study participants

Parameters	Propofol (*n* = 50) (mean ± SD)	Thiopentone (*n* = 50) (mean ± SD)
Age (years)	29.88 ± 6.42	30.38 ± 6.46
Weight (kg)	46.7 ± 2.25	47.68 ± 2.28
Dose (mg)		
Induction (total dose in mg)	108.8 ± 8.54	217.4 ± 10.21
Induction (mg/kg)	2.31 ± 0.01	4.55 ± 0.02
Maintenance (mg)	65.04 ± 22.56	109 ± 45.47
Total (mg)	173.9 ± 25.26	326.6 ± 47.70
Overall (mg/kg)	3.71 ± 0.07	6.86 ± 0.14

Table 2: Induction profile of the patients (mean ± SD)

Induction profile	Propofol (*n* = 50) (mean ± SD)	Thiopentone (*n* = 50) (mean ± SD)
Induction time (s)	30.16 ± 1.23	29.56 ± 1.16
Apnea (*n*)		
0–30 s	25	35
>30 s	25	15
Side effects (*n*)		
Coldness	14	3
Pain on injection	9	1
Involuntary movements	7	2
Cough/hiccup	1	7
Quality of induction		
Good	47	39
Adequate	3	9
Poor	0	2
Quality of maintenance		
Good	45	44
Adequate	4	5
Poor	1	1

Table 3: Comparison of hemodynamic between the two groups

Parameter	Propofol (*n* = 50) (mean ± SD)	Thiopentone (*n* = 50) (mean ± SD)	*p*
Pulse rate (per minute)			
Baseline	80.14 ± 4.67	80.28 ± 5.55	NS
At 1 min	81.67 ± 4.67	82.76 ± 5.86	NS
At 2 min	81.44 ± 3.92	82.44 ± 4.69	NS
At 3 min	82.28 ± 3.40	80.80 ± 4.87	NS
Systolic blood pressure (mm Hg)			
Baseline	115.08 ± 6.55	113.40 ± 6.79	NS
At 1 min	105.64 ± 7.57	108.80 ± 6.08	<0.05
At 2 min	100.56 ± 6.42	104.36 ± 3.12	<0.05
At 3 min	96.36 ± 6.49	103.40 ± 5.79	<0.05
Diastolic blood pressure (mm Hg)			
Baseline	77.16 ± 3.70	74.88 ± 4.10	NS
At 1 min	69.44 ± 3.33	71.92 ± 3.33	<0.05
At 2 min	65.48 ± 3.07	72.18 ± 3.36	<0.05
At 3 min	63.52 ± 4.23	72.32 ± 3.88	<0.05

p value of <0.05 was considered as statistically significant.

Table 4: Comparison of recovery parameters between the two groups

	Propofol (*n* = 50) (mean ± SD)	Thiopentone (*n* = 50) (mean ± SD)	*p*
Duration of surgery (min)	14.96 ± 3.77	14.36 ± 3.52	NS
Waking time (min)	6.02 ± 1.15	11.81 ± 1.73	<0.05
Talking time (min)	10.02 ± 1.23	18.30 ± 3.38	<0.05
Sitting time (min)	21.82 ± 4.69	38.54 ± 6.80	<0.05
Standing time (min)	50.16 ± 10.88	82.80 ± 16.73	<0.05

p value of <0.05 was considered as statistically significant.

Table 5: Comparison of psychomotor parameters between the two groups

	Propofol (*n* = 50) (mean ± SD)	Thiopentone (*n* = 50) (mean ± SD)	*p*
Aiming test score			
Baseline (preoperative)	158.7 ± 16.63	156.3 ± 19.44	NS
At 1 h	154.9 ± 16.81	122.9 ± 19.92	<0.05
At 2 h	156.3 ± 16.62	136.8 ± 19.43	<0.05
At 4 h	160.3 ± 16.70	149.06 ± 19.63	<0.05
Dexterity time (s) (mean of two hands)			
Baseline (preoperative)	22.92 ± 3.21	22.16 ± 2.95	NS
At 1 h	22.16 ± 2.96	28.30 ± 4.12	<0.05
At 2 h	21.26 ± 2.52	25.92 ± 3.90	<0.05
At 4 h	21.32 ± 2.44	25.92 ± 4.12	<0.05
Number of errors in dexterity test			
Baseline (preoperative)	0	0	
At 1 h	1	7	
At 2 h	0	2	
At 4 h	0	0	

p value of <0.05 was considered as statistically significant.

Table 6: Comparison of adverse effects in the two groups

Adverse effects	Propofol (*n* = 50)	Thiopentone (*n* = 50)
Sleepiness	10	15
Headache	1	9
Nausea	2	5
Vomiting	2	10

of thiopentone showed such apnea. Involuntary movements occurred in seven patients receiving propofol and in two patients receiving thiopentone [Table 2].

There was no statistically significant difference in pulse rates with the use of both the study drugs at 1 (p = 0.34), 2 (p = 0.2), and 3 min (p = 0.08) [Table 3]. However, there was statistically significant fall in systolic blood pressures in the propofol group when compared with the thiopentone group at the end of first (105.64 ± 7.57 vs. 108.80 ± 6.08 mm Hg), second (100.56 ± 6.42 vs. 104.36 ± 3.12 mm Hg), and third minutes (96.36 ± 6.49 vs. 103.40 ± 5.79 mm Hg) after induction. Similarly, diastolic blood pressure also showed significant fall at 1 (69.44 ± 3.33 vs. 71.92 ± 3.33 mm Hg), 2 (65.48 ± 3.07 vs. 72.18 ± 3.36 mm Hg), and 3 min (63.52 ± 4.23 vs. 72.32 ± 3.88) [Table 3].

Comparison of all the recovery parameters, viz., waking time (6.02 ± 1.15 vs. 11.81 ± 1.73 min), talking time (10.02 ± 1.23 vs. 18.30 ± 3.38 min), sitting time (21.82 ± 4.69 vs. 38.54 ± 6.80 min), and standing time (50.16 ± 10.88 vs. 82.80 ± 16.73 min) showed that propofol induced patients recovered at significantly faster pace than thiopentone [Table 4].

Postoperative aiming scores at first hour (154.9 ± 16.81 vs. 122.9 ± 19.92), second hour (156.3 ± 16.62 vs. 136.8 ± 19.43), and fourth hour (160.3 ± 16.70 vs. 149.06 ± 19.63) in the propofol group were significantly high when compared with those in the thiopentone group. The dexterity times were as follows: at first hour, 22.16 ± 2.96 vs. 28.30 ± 4.12; second hour, 21.26 ± 2.52 vs. 25.92 ± 3.90; and fourth hour, 21.32 ± 2.44 vs. 25.92 ± 4.12 [Table 5]. Table 6 shows that thiopentone produced higher number of adverse drug reactions (ADRs) than propofol.

Discussion

We conducted this study in 100 patients, equally divided into two groups. In this study, the mean induction dose of propofol was 2.31 ± 0.01 mg/kg and of thiopentone was

4.55 ± 0.02 mg/kg. Sanders et al.[3] reported the mean induction dose of propofol to be 4.4 ± 0.5 mg/kg and that of thiopentone was 12.1 ± 3.8 mg/kg in unpremedicated patients for short gynecological procedures. However, the doses required in that study were within the equipotency ratio (1:1.8) as that of this study.

The mean induction time was statistically similar in both our study groups. This finding matches with the results of previous researchers such as Mouton et al.,[4] Edelist,[5] and Grant and Mackenzie.[6]

Many of the previous studies[4,6–8] have reported the pain on propofol injection to be around 25%–27%. In this research, we also observed similar (28%) incidence. Similarly, such pain was reported in less than 5% patients of thiopentone group by previous reports, whereas we found it to be 6%.[4,6–8] Thus, propofol causes feeling of burning/pain on injection in significant number of patients, when compared with thiopentone but without any evidence of thrombophlebitis at fourth postoperative hour.

Table 2 shows that apnea of more than 30 s was common (50%) with propofol induction and required assisted ventilation in such patients, whereas only 30% patients of thiopentone required such attention. The studies of Key et al.,[4] Mouton et al.,[6] and Mackenzie et al.[9] support our findings.

Table 2 also shows that involuntary movements were more in the propofol group, whereas hiccup/cough was more in the thiopentone group. Mouton et al.[4] and Grant and Mackenzie[6] also reported that involuntary movements were more in the propofol group when compared with the thiopentone group. Sampson et al.[8] and Reader and Misvaer[10] reported hiccups/cough more in the thiopentone group when compared with the propofol group. Both the drugs were comparable in quality of induction and maintenance of anesthesia.

There was no statistically significant difference in pulse rate with the use of both the study drugs [Table 3]. However, there was statistically significant fall in systolic and diastolic blood pressures in the propofol group when compared with the thiopentone group at the end of first, second, and third minutes after induction. Mouton et al.,[4] Grant and Mackenzie,[6] and Grounds et al.[11] also found that propofol markedly decreased blood pressure parameters.

Comparison of all the recovery parameters shows that propofol-induced patients recovered at significantly faster pace than the thiopentone group [Table 4]. Rolly and Versichelen[12] also found that waking and talking times in the thiopentone group were significantly prolonged than those of the propofol group.[12] Similarly, Sanders et al.[3] found all these parameters were significantly delayed in the thiopentone group. Thus, many researchers[6,10,13] have found delayed recovery profiles in the thiopentone-induced group.

Postoperative aiming scores and dexterity time in the thiopentone group were significantly low when compared with the propofol group, at 1, 2, and 4 h [Table 5]. However, when compared with the baseline scores, the scores of first and second hours were significantly low in the thiopentone group; but at 4 h, the difference was not statistically significant in any group.

Kashtan et al.[13] compared the psychomotor performance by using Trieger's dot test and reported that such performance was low with the thiopentone group in the postoperative period. Sanders et al. also found significant impairment in visual–motor coordination in the thiopentone group. They also commented about significant decrease in the aiming scores at first and second hours in the thiopentone group.[3]

Table 6 shows that thiopentone produced higher number of ADRs than propofol. In both the groups, the commonly observed ADRs were sleepiness, headache, nausea, and vomiting. Many of the researchers have found similar ADRs in their studies.[8,10,13]

Conclusion

Thus, we can summarize that, during induction, propofol produces lesser hemodynamic instability when compared with thiopentone. Even in postoperative period, it shows faster recovery time and psychomotor recovery and less number of ADRs. The recovery characteristics of propofol are superior to those of thiopentone. The return of psychomotor performance and cognitive functions are more rapid in the propofol group. Thus, it produces rapid, smooth, pleasant, and safe anesthesia with lesser hemodynamic instability and rapid, smoother subjective, and psychomotor recovery. So, IV propofol appears to be suitable agent for day-care patients.

References

1. Reed WA, Crouch BL, Ford JL. Anesthesia and operations on outpatients. Clin Anesth. 1974;10(3):335–56.
2. White PF, Meldrum BS. General anesthetics. In: *Basic and Clinical Pharmacology*, 11th edn. Katzung BG, Trevor AJ, Masters SB (Eds.). New York: McGraw-Hill companies, 2009.
3. Sanders LD, Clyburn PA, Rosen M, Robinson JO. Propofol in short gynaecological procedures. Comparison of recovery over 2 days after anaesthesia with propofol or thiopentone as sole anaethetic agent. Anaesthesia.1991;46:451-5.
4. Mouton SM, Bullington J, Davis L, Fisher K, Ramsey S, Wood M. A comparison of Diprivan and thiopental for the induction of anesthesia. Anesthesiology 1985;63(3):A364.
5. Edelist G. A comparison of propofol and thiopentone as induction agaents in outpatient surgery. Can J Anaesth 1987;34(2): 110–6.
6. Grant IS, Mackenzie N. Recovery following propofol ('Diprivin') anaesthesia—a review of three different anaesthetic techniques. Postgrad Med J 1985;61 Suppl 3:133–7.
7. Johnston R, Noseworthy T, Anderson B, Konopad E, Grace M. Propofol versus thiopental for outpatient anesthesia. Anesthesiology 1987;67(3):431–3.
8. Sampson IH, Plosker H, Cohen M, Kaplan JA. Comparison of propofol and thiamylal for induction and maintainance of anaesthesia for outpatient surgery. Br J Anaesth 1988;61(6): 707–11.
9. Uppington J, Kay NH, Sear JW. Propofol (Diprivan) as supplement to nitrous oxide-oxygen for maintenance of anaesthesia. Postgrad Med J 1985;61 Suppl 3:80–3.

10. Raeder JG, Misvaer G. A comparison of propofol induction with thiopentone or methohexitone in short outpatient general anaesthesia. Acta Anaesthesiol Scand 1988;32:607–13.
11. Grounds RM, Twigley AJ, Carli F, Whitwam JG, Morgan M. The haemodynamic effects of intravenous induction. Comparison of the effects of thiopentone and propofol. Anaesthesia 1985; 40:735–40.
12. Rolly G, Versichelen L. Comparison o f propofol and thiopentone for induction of anaesthesia in premedicated patients. Anaesthesia 1985;40:945–8.
13. Kashtan H, Edelist G, Mallon J, Kapala D. Comparative evaluation of propofol and thiopentone for total intravenous anaesthesia. Can Anaesth J 1990;37(2):170–6.

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