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Original Article

A Comparative Study of Injection Propofol Continuous Infusion and Bolus Doses for Maintenance of Anesthesia in Short Surgical Procedure

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Abstract

Introduction: propofol is an intravenous anesthetic that is being used since years and it is most commonly used induction agent now a days.it has become very popular because of its characteristics of smooth induction and smooth recovery as well. in our study we studied the use of propofol during maintance of anesthesia and we compared two techniques of propofol administeration: continous infusion and bolus doses of propofol.

Material and methods: This was an hospital based randomized control prospective study. After assessing patients and recorded all the vital parameters,patient was induced with iv propofol and in Group I, maintenance of anesthesia was achieved with an infusion of propofol at the dose of 100 µg/kg/min, while in Group II, maintenance of anesthesia was achieved with infusion in IB dose of 0.5 mg/kg on the need basis.Hemodynamic and other monitoring parameters were observed continuously and noted at an interval of 5 min during the operation.Intraoperative depth of sedation was measured by observers assessment of alertness and sedation scale. Score of 1 was considered to be the adequate depth of sedation while score 2 or more was considered to be inadequate depth. CI group patients with inadequate depth were excluded from the study. IB group with inadequate depth was given boluses dose of injection propofol 0.5 mg/kg.Patients were ventilated with 100% oxygen with Bains Circuit. After surgery was over in IB group, no additional dose was given while in continuous group infusion was stopped immediately.

Result: There was no statistical significant differences among demographic parameters such as age, weight and sex. After 30 min of induction, there was a significant reduction of systolic blood pressure in both the groups and the statistically significant difference was there between GroupsI and II (P= 0.05). there was a significant reduction of DBP from the baseline, and statistically, significant difference was there between GroupsI andII (P=0.033). The mean dose of propofol was required more in CI as compared to IB. There was a statistically highly significant difference between both the group with respect to a dose of propofol (P= 0.001).71% of study subjects did not have any side effects. 14% had hypotension and 7% had bradycardia. Apnea was more in group II than group I subjects.

Conclusion: In our study, we compared two commonly used methods of dosing regimens, i.e., IB and CI. Both regimens provided comparable hemodynamic stability, depth of sedation, the incidence of adverse effects and recovery time. CI was associated with higher dose requirement and hence higher cost while it was also found to be the more satisfactory mode of anesthesia for both surgeons and patients. Each mode has its own advantage and disadvantage, and hence the method of choice depends on anesthetist's preference, availability of equipment and patients factors.

Key words: Propofol, Total intravenous anesthesia, Propofol infusion, Propofol bolus

action within 3–4 min.[1]

Propofol was discovered in the year 1977 and gained popularity as an intravenous inducing agent of choice. It is

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Intraoperative monitoring during procedures has shown that CI method leads to an adequate depth of anesthesia with less hemodynamic variability in most of the cases. Disadvantages of CI are the complexity of infusion pumps, cost of equipment, high-dose requirements, and delayed recovery. IB dose method is, hence, adopted in most of the scenarios. Although the intermittent dose is associated with more hemodynamic variability and post-operative complications, it is yet very simple and less cumbersome for short procedures. According to our hypothesis, CI

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of propofol might exert a sustained sedative effect by maintaining a constant concentration in the body, which will lead to better intraoperative sedation and hemodynamic stability. However, at the same time, it may lead to drug overdoses, prolong recovery, and side effects.

Development of an ideal drug delivery system has always been an area of interest for clinicians. Drugs used in the practice of anesthesia and critical care are used for a short period of time, but a constant drug concentration is also required. For this reason, different mode of delivering drugs has been studied. Propofol is delivered in form of bolus or CI regimen. Bolus doses are more popular for induction of anesthesia while continuous regimen is frequently used for maintenance of anesthesia and sedation in intensive care unit. For adequate depth of anesthesia, it is important to achieve a constant plasma concentration of the drug. For propofol this concentration is 3–5 μg/ml.[6]

This study was planned to compare both drug regimens for intraoperative hemodynamic stability, recovery characteristics, and post-operative complications. We also assessed the satisfaction level among patient and surgeons with both regimens during short surgical procedures. Cost-effectiveness of both regimens is also evaluated. Short surgical cases are very commonly performed in routine practice. Hemodynamic stability is of utmost importance for an anesthetist while quick recovery and less post-operative complications are also important for surgeon and patients. Ideal drug delivery system for short duration of procedures is still a debatable topic, and question remains unanswered. We attempt to find the answer to this query that which one is better method, IB, or CI?

Day surgery is now widely accepted as the default position for the vast majority of patients requiring surgery with inpatient stay chosen only by exclusion. There are very few absolute contraindications.

Day surgery patients have a finite time on the day surgery unit before discharge that same day. Therefore, prompt management of pain and nausea and vomiting and early mobilization are paramount. A more rapid recovery from anesthesia results in quicker turnaround, improved patient experience, and reduced costs.[7]

TIVA

TIVA can be defined as a technique of general anesthesia using a combination of agents given solely by the intravenous route and in the absence of all inhalational agents including nitrous oxide.[8] The intravenous route has been used to administer drugs for hundreds of years, and the provision of anesthesia solely by the intravenous route using chloral hydrate was documented as early as the 1870's.[9]

Thiopentone was introduced into clinical practice in 1934 and made intravenous induction of anesthesia popular. Propofol was introduced into clinical practice in 1986 and now seems to be taking over that role. It has also become widely used as a component of TIVA.

TIVA has become popular, practical and possible only in relatively recent times. There are two main reasons for this. First, unlike other popular intravenous agents of the past, the pharmacokinetic and pharmacodynamic properties of modern drugs such as propofol and the newer synthetic, and short-acting opioids make them very suitable for administration by CI.[10] Second, new concepts in pharmacokinetic modeling and advances in computer technology have allowed the development of sophisticated delivery systems which make control of anesthesia given by the intravenous route as straightforward and user-friendly as conventional inhalational techniques.[11]

Advantages of TIVA

TIVA has many advantages over inhalational anesthesia such as:

- No operating room pollutions
- Minimal cardiac depression
- Lesser neurohumoral response
- Decreased oxygen consumption
- Avoids distension of air-filled spaces within the patient's body, thus producing optimum operating conditions for the surgeon
- Avoids post-operative diffusion hypoxemia
- Decreases the incidence of PONV
- In day care surgery.[12]

TIVA can be administered with a variety of equipments. Very simple to operate Syringe Infusion Pumps is easily available. TCI pumps are sophisticated computer derived pumps which maintain steady-state concentration of propofol for adequate depth of sedation.[13] Recent advance in this field is in the form of closed-loop anesthesia delivery systems. It incorporates input from the patient's depth of sedation and adjusts the dose of anesthetic agents to maintain the depth of sedation.[14]

MATERIALS AND METHODS

Study Design

This was a hospital-based randomized interventional analytical study.

Study Area

This was Peoples College of Medical Sciences and Research Centre, Bhopal.

Study Population
Patients are coming for short surgical procedures admitted at PCMS and RC, Bhopal during November 14–March 16).

Sample Size and Group Division
Sample size calculation was based on a pilot study involving 10 patients. A error was fixed at 0.05% with a power of study >80%. Sample size calculated was 100 patients that come in the defined period and fulfilling the inclusion criteria.

Randomization
Each patient had an equal probability to get selected in either group with the help of randomization. They were randomized into two groups, that is, Group A IV IB and Group B CI.

Inclusion Criteria
The following criteria were included in the study:
- Elective cases of ASA Grade I and II
- Age group 18–60 years
- Patients undergoing short surgical procedure.

Exclusion Criteria
The following criteria were excluded from the study:
- Cases of ASA Grade III and above and emergency procedures
- Patients with the cardiovascular and respiratory disease
- Pregnant patients.

Methodology
With Institutional Review Board Committee approval and written consent from all 100 patients of age group 18–60 years, undergoing elective surgeries of 45 min duration were randomized into two groups, using simple randomization technique, each group receiving either CI or IB doses of propofol.

Anesthesia Technique
The standard anesthetic technique was used in all the patients. After securing intravenous line, monitoring gadgets were attached which included electrocardiography, SpO_2, and non-invasive BP cuff. Baseline parameters were observed and recorded. Oxygen was delivered initially by face mask at 4 L/min.

All patients received premedication of injection ranitidine (1 mg/kg), injection ondansetron (0.08 mg/kg), injection midazolam (0.02 mg/kg), injection glycopyrrolate (0.004 mg/kg), and injection pentazocine (0.5 mg/kg).

Induction of Anesthesia
Induction of anesthesia in patients of both groups was done with propofol 1.0 mg/kg body weight as IV bolus doses.

Hemodynamic and other monitoring parameters were observed continuously and recorded at an interval of 5 min.

Maintenance of Anesthesia
In Group I, maintenance of anesthesia was achieved with an infusion of propofol at the dose of 100 μg/kg/min, while in Group II, maintenance of anesthesia was achieved with infusion in IB dose of 0.5 mg/kg on the need basis.

Hemodynamic and other monitoring parameters were observed continuously and noted at an interval of 5 min during the operation.

Intraoperative depth of sedation was measured by observers assessment of alertness and sedation scale. Score of 1 was considered to be the adequate depth of sedation while score 2 or more was considered to be inadequate depth. CI group patients with inadequate depth were excluded from the study. IB group with inadequate depth was given boluses dose of injection propofol 0.5 mg/kg.

Patients were ventilated with 100% oxygen with Bains Circuit.

After surgery was over in IB group, no additional dose was given while in continuous group infusion was stopped immediately.

Hemodynamic monitoring was continued until patient regained consciousness. Any complication during the procedure was noted and treated according to the protocol.

Recovery
Recovery time to assess the shifting to recovery was done by Modified Aldrete score and patient was shifted when the score was >9 surgeons were asked to fill surgeon satisfaction score, and reading was noted. The patient was shifted to post anesthesia care unit (PACU) for monitoring.

Patients were asked to fill patient satisfaction score after 2 h of shifting from PACU and reading was noted. The incidence of PONV was noted in both groups. Post-operative pain score was noted with the help of visual analog scale.

OAS/S
Surgeon's Satisfaction Scale
On scale of 1–5, 1 being least satisfied and 5 being highly satisfied.
- How satisfied are you with depth of anesthesia?
- How satisfied are you with intraoperative hemodynamics?
- How satisfied are you with recovery time?

- How satisfied are you with post-operative complications?
- How satisfied are you with the overall procedure?

Patient's Satisfaction Scale

On a scale of 1–5, 1 being least satisfied and 5 being highly satisfied.

- How satisfied you are with awareness during procedure?
- How satisfied you are with pain during procedure?
- How satisfied you are with pain in post-operative period?
- How satisfied you are with nausea and vomiting in post-operative period?
- How satisfied you are with the overall experience of anesthesia services?

Statistical Analysis

The data obtained were subjected to statistical analysis with the consult of a statistician. The data so obtained were compiled systematically. A master table was prepared, and the total data were subdivided and distributed meaningfully and presented as individual Tables 1 and 2 along with graphs.

Statistical procedures were carried out in two steps:

1. Data compilation and presentation
2. Statistical analysis.

Statistical analysis was done using Statistical Package of the Social Sciences (SPSS Version 20; Chicago Inc., USA). Data comparison was done by applying specific statistical tests to find out the statistical significance of the comparisons. Quantitative variables were compared using mean values and qualitative variables using proportions.

Table 1: Observer's assessment of alertness/sedation scale

Observation	Score level
Responds readily to name spoken in normal tone	5
Lethargic response to name spoken in normal tone	4
Responds only after name is called loudly and/or repeatedly	3
Responds only after mild prodding or shaking	2
Does not respond to mild prodding or shaking	1

Table 2: Demographic distribution of study subjects according to study groups and gender

Gender	Group I Continuous infusion *n* (%)	Group II Intermittent bolus *n* (%)	Total *n* (%)
Male	15 (30.0)	21 (42.0)	36 (36.0)
Female	35 (70)	29 (58.0)	64 (64)
Total	50	50	100
Chi-square value	1.563		
P value	0.211 (NS)		

Significance level was fixed at $P < 0.05$.

OBSERVATIONS AND RESULTS

Demographic Distribution

Sex distribution

Table 2 reveals the demographic distribution of study subjects. Out of 100 study subjects, 36% were male and 64% were females. There was no statistically significant difference among both the groups with respect to gender ($P = 0.211$).

Case-wise distribution

Table 3 reveals the distribution of study subjects according to respective specialties. Out of 100 subjects, maximum 44% were from gynecology department. There was no statistically significant difference among both the groups with respect to the department ($P = 0.868$).

Age and weight wise distribution

Table 4 reveals mean age and weight of study subjects according to groups. There was no statistically significant difference among both the groups with respect to age ($P = 0.181$) and weight ($P = 0.980$).

Systolic Pressure

Table 5 reveals mean systolic blood pressure (SBP) (mmHg) among the groups at a different time interval. After 30 min of induction, there was a significant reduction of SBP in both the groups and the statistically significant difference was there between Groups I and II ($P = 0.05$).

Diastolic Pressure

Table 6 reveals mean diastolic blood pressure (DBP) (mmHg) of the groups at different time interval. After 30 min of induction, there was a significant reduction of DBP from the baseline, and statistically, significant difference was there between Groups I and II ($P = 0.033$).

Table 7 reveals mean heart rate (beat/min) among both the group at a different time interval. There was no statistically

Table 3: Case-wise distribution of study subjects

Departments	Group I Continuous infusion *n* (%)	Group II Intermittent bolus *n* (%)	Total *n* (%)
Gynecology	22 (44.0)	22 (44.0)	44 (44.0)
Surgery	8 (16.0)	10 (20.0)	18 (18.0)
Orthopedics	15 (30.0)	15 (30.00	30 (30.0)
Others	5 (10.0)	3 (6.0)	8 (8.0)
Total	50	50	100
Chi-square value	0.722		
P value	0.868 (NS)		

Table 4: Mean age and weight of study subjects according to groups

Demographic Parameters	Group I Continuous infusion	Group II Intermittent bolus *n* (%)	Student's *t*-test value	*P* value
Mean age (years)	32.54	29.56	1.349	0.181 (NS)
SD	12.184	9.782		
Range (years)	18–56	18–60		
Mean weight (kg)	65.24	65.20	0.025	0.980 (NS)
SD	8.115	7.843		
Range	48–82	48–82		

Table 5: Comparison of mean systolic blood pressure (mmHg) among the group at a different time interval

Groups	Mean systolic blood pressure (mmHg)					
	Baseline		10 min		30 min	
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median
Group I continuous infusion	122.04±12.8	120.50	106.58±10.9	108.0	111.04±10.6	109.0
Group II intermittent bolus	120.68±12.3	119.0	109.00±10.9	109.0	106.38±9.5	106.50
Mann–Whitney U-test value	1188.500		1089.500		967.000	
Significance *P* value	0.671 (NS)		0.267 (NS)		0.05 (S)	

Table 6: Comparison of mean diastolic blood pressure (mmHg) among the group at a different time interval

Group	10 min		30 min	
	Mean±SD	Median	Mean±SD	Median
Group I Continuous infusion	61.64±7.2	60.0	61.84±5.5	62.50
Group II Intermittent bolus	58.50±7.1	58.0	59.52±6.7	58.0
Mann–Whitney U-test value	961.500		942.500	
Significance *P* value	0.046 (S)		0.033 (S)	

significant difference between the groups with respect to pulse rate ($P = 0.959$).

Table 8 reveals the mean respiratory rate among the group at a different time interval. There was no statistical difference.

Table 9 reveals mean oxygen saturation SpO_2 (%) among the groups at a different time interval. Statistically, no significant difference was observed between both the groups ($P = 0.676$).

Table 10 reveals mean observer assessment of sedation score (OASS) among the group at a different time interval. After 5 min mean, OASS was 2.60 ± 0.53 and 2.46 ± 0.57 in Groups I and II, respectively, and there was no statistically significant difference ($P = 0.293$). At 10 and 20 min, the value significantly reduces to almost zero. After 30 min, it again increased to 4.10 ± 1.5 and 3.84 ± 1.8 in Groups I and II, respectively, and there was again no statistically significant difference between groups ($P = 0.512$).

Table 11 reveals a mean dose of propofol (mg) among both the group. The mean dose of propofol was required more in CI as compared to IB. There was a statistically highly significant difference between both the group with respect to a dose of propofol ($P = 0.001$).

Table 12 reveals the incidence of side effects among both the group. 71% of study subjects did not have any side effects. 14% had hypotension and 7% had bradycardia. Apnea was more in Group II study subjects as compared to Group I.

Table 13 reveals the surgeon's satisfaction score among the group. Mean surgeon's satisfaction score was 22.68 ± 1.30 and 21.72 ± 1.73 in Groups I and II, respectively, and there was the statistically significant difference between both the group ($P = 0.008$).

Table 14 reveals recovery time among the group. It was more in IB as compared to CI group study subjects, and there was no statistically significant difference between both the group ($P = 0.450$).

DISCUSSION

Daycare surgery is an evolving concept among surgeons and anesthetists. In the current practice of health-care services, it

Table 7: Comparison of mean heart rate (beat/min) among the group at a different time interval

Groups	Mean heart rate (beat/min)					
	Baseline		10 min		30 min	
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median
Group I Continuous infusion)	77.62±11.1	78.0	71.08±11.5	70.50	71.70±10.2	71.0
Group II Intermittent bolus	77.44±9.8	79.0	71.88±13.7	76.0	71.98±10.5	72.0
Mann–Whitney U-test value	1230.000		1157.000		1242.500	
Significance *P* value	0.890 (NS)		0.521 (NS)		0.959 (NS)	

Table 8: Comparison of mean respiratory rate among the group at a different time interval

Groups	Mean respiratory rate/min					
	Baseline		10 min		30 min	
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median
Group I Continuous infusion	11.80±1.8	12.0	10.32±2.7	11.0	11.96±1.5	12.0
Group II intermittent bolus	11.32±1.8	11.0	10.24±2.8	11.0	11.40±1.9	11.5
Mann–Whitney U-test value	1032.000		1239.500		1078.000	
Significance *P* value	0.126 (NS)		0.942 (NS)		0.228 (NS)	

Table 9: Comparison of mean SpO_2 (%) among both the group at a different time interval.

Groups	Mean SpO_2 (%)					
	Baseline		10 min		30 min	
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median
Group I Continuous infusion	98.58±0.60	99.0	97.84±1.8	98.0	98.28±0.83	98.0
Group II Intermittent bolus	98.70±0.58	99.0	97.16±2.8	98.0	97.96±1.5	98.0
Mann–Whitney U-test value	1109.000		1110.500		1194.000	
Significance *P* value	0.225 (NS)		0.308 (NS)		0.676 (NS)	

Table 10: Comparison of mean observer assessment of sedation score among both the group at a different time interval

Groups	Mean OASS							
	5 min		10 min		20 min		30 min	
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median
Group I Continuous infusion	2.60±0.53	3.0	0.06±0.24	0.0	0.16±0.42	0.0	4.10±1.5	5.0
Group II Intermittent bolus	2.46±0.57	2.5	0.24±0.43	0.0	0.16±0.37	0.0	3.84±1.8	5.0
Mann–Whitney U-test value	1116.500		1025.000		1229.000		1173.000	
Significance P value	0.293 (NS)		0.012 (S)		0.815 (NS)		0.512 (NS)	

Table 11: Comparison of mean dose of propofol (mg) among both the group

Groups	Mean±SD	Median	Range
Group I Continuous infusion	250.30± 29.76	245	180–320
Group II Intermittent bolus	198.60± 19.51	195.0	160–260
Mann–Whitney U-test value	167.000		
Significance *P* value	0.001 (HS)		

Table 12: Incidence of side effects among both the group

Departments	Group I Continuous infusion *n* (%)	Group II Intermittent bolus *n* (%)	Total *n* (%)
No side effects	38 (76.0)	33 (66.0)	71 (71.0)
Hypotension	7 (14.0)	7 (14.0)	14 (14.0)
Apnea	2 (4.0)	6 (12.0)	8 (8.0)
Bradycardia	3 (6.0)	4 (8.0)	7 (7.0)

is important to consider the length of hospital stay, patient's safety and comfort to improvise the health-care system.

Daycare surgeries which comprise 10–40% of total surgeries in the western world have an important economic impact. Many procedures can be performed under the definition of daycare surgery. Hence, a comprehensive and scientific approach is required to conduct these surgeries.

Table 13: Comparison of mean surgeon's satisfaction score among the group

Groups	Surgeon's satisfaction score		
	Mean±SD	Median	Range
Group I Continuous infusion	22.68±1.30	23.0	20–25
Group II Intermittent bolus)	21.72±1.73	22.0	18–24
Mann–Whitney U-test value	872.000		
Significance *P* value	0.008 (S)		

Table 14: Comparison of mean recovery time among the group

Groups	Mean recovery time (min)		
	Mean±SD	Median	Range
Group I Continuous infusion	4.96±1.71	5.0	2–9
Group II Intermittent bolus	5.20±1.78	5.0	2–9
Mann–Whitney U-test value	1142.000		
Significance *P* value	0.450 (NS)		

Patient selection is important criteria for success of the surgeries, and it needs to be stressed on that not all patients are fit for the daycare surgeries. Likewise not all but many surgeries qualifies for daycare surgeries. Among all techniques available for anesthesia, TIVA has gained popularity and trust.

TIVA has evolved from very simple methods of drug administration by peripheral intravenous line to highly sophisticated closed-loop anesthesia delivery devices.

All these dosing regimens have been developed to achieve an appropriate and constant concentration of drugs in plasma. This, in turn, will lead to better hemodynamic characteristics, constant depth of sedation and hence better outcome of anesthesia.

TIVA in day surgery is advantageous due to rapid recovery without agitation and behavioral disorders. It is simple to use without the need for sophisticated gas delivery systems and scavenger equipment. It avoids the risks of failure of regional blocks, residual paralysis and less chance of side effects like PONV. It also avoids environmental pollution and also avoids the possibility of malignant hyperthermia. The disadvantages include pump failure, disconnection, and awareness.[15] The use of N_2O is associated with increased risk of PONV.

Sevoflurane and desflurane are associated with rapid emergence than propofol. Desflurane emergence is faster than sevoflurane even in prolonged procedures, especially in obese patients.[8]

In this study, we compared two dosing regimen of injection propofol for patient posted for short surgical procedures (<40 min) under TIVA. In IB group, after induction with injection propofol and IB of injection propofol was used to maintain the depth of anesthesia until the end of the procedure. In CI group, after induction with injection propofol, CI of injection propofol was started with the help of syringe infusion pump until the end of the procedure to maintain adequate depth of anesthesia.

We compared the hemodynamic parameters, depth of sedation, the incidence of side effects, total doses required, patients and surgeons satisfaction with anesthesia services, recovery time, and post-operative pain score in two dosing regimens. 100 patients of ASA Grade I and II of both gender were enrolled for the study. Among 100 patients, 36 were male and 64 were females. 84 belonged to ASA I and 16 were of ASA II. Patients with higher ASA grading were excluded from the study. There was no statistically significant difference between two groups ($P = 0.211$). Written informed consent was obtained from all the patients. The patients were randomized into two groups, namely Group CI, i.e., CI and Group IB, i.e., IB.

Two groups were comparable with regard to their demographic variables. Wide range of surgeries was performed such as Dilatation and Curettage, Resuturing, Incision and Drainage, Implant removal, endoscopy, and foreign body removal. Gynecological procedures comprised 44% of total cases, 30% were from orthopedics and 18% were from surgery. Patients were preloaded with lactated ringers solution at the rate of 20 ml/kg/h. Standard monitoring equipment were attached, and baseline parameters such as Pulse, Blood Pressure, Respiratory Rate, SpO_2, and level of consciousness were recorded and noted.

Induction of anesthesia was done by propofol 1.5 mg/kg over 60 s in both the groups. In CI group after induction propofol was administered with syringe infusion pump connected with PMO line. Dose was 100 μg/kg/min. In IB group, propofol was given as Boluses of 0.5 mg/kg as required. The requirement was determined with the help of hemodynamic parameters. Increase in HR and BP and the presence of muscle movement was considered to be the point of IB dose.

Klein *et al.*, in 2003, studied intermittent and CI of propofol in pediatric oncology and found that both methods were equal in terms of hemodynamic stability and satisfaction among patient and physician, although CI was associated with higher doses and more reduction in blood pressure.[16,17] We had similar findings in our study.

Riphaeus *et al.*, in 2012, studied both regimens for deep sedation in interventional endoscopy. They found both regimens were equally good in terms of hemodynamic stability and depth of sedation. Infusion group was associated with less recovery time and more hypotension.[18]

González-Santiago *et al.*, in 2013, studied IB versus continuous, and they found both methods to be equally satisfactory.[5]

In our study, we used the standard anesthetic technique so that the groups were as comparable as possible except the study intervention. Baseline OAS/S score before premedication was noted in both the groups. After induction, all patients had OAS/S of 0 which was acceptable to start the procedure.

Changes in SBP, DBP, and mean arterial pressure were noted every 10 min during the procedure. Total 7(14%) patients in Group CI and 7(14%) in Group IB developed hypotension, i.e., 20% less than the baseline and were treated. Changes in heart rate were noted every 10 min during the procedure. Total 3 (6%) patients in Group CI while 4 (8%) in Group IB developed bradycardia, i.e., <50 BPM and were treated. Changes in respiratory rate was noted every 10 min during the procedure. Total 3 (6%) patients in Group CI while 4(8%) in Group IB developed apnea, i.e., temporary cessation of breathing. Bag and mask ventilation was done in these patients until respiration is regained.

Depth of sedation was noted every 10 min during the procedure. In Group CI adequate depth of sedation was maintained during the procedure and no additional boluses were required. Both groups had the comparable depth of sedation.

Recovery time was noted in both groups. Recovery was assessed with a modified Aldrete Score. Score of 9 was considered to be fit for discharge. In Group CI mean recovery time was 4.96 min while in Group IB mean recovery time was 5.2 min. There was no statistically significant difference between both groups in terms of recovery time.

Total doses of propofol were noted after each procedure. Total dose includes induction and maintenance by infusion or by IB. Dose required ranges from 180 to 320 mg in the CI group and mean of 250 ± 29.76. In Group IB dose ranged from 160 to 260 mg with a mean of 198.60 ± 19.51. This difference was statistically significant ($P = 0.001$), and Group CI was associated with higher doses of propofol and hence higher cost of the procedure.

Immediately after the procedure, the operating surgeon was asked to fill a 5 point questionnaire. The response was noted and evaluated. In CI group score was ranged from 20 to 25, with a mean score of 22.68 ± 1.30 and median of 23.0 In IB group score ranged from 18 to 24, with a mean score of 21.72 ± 1.73 and median of 22.0. Mann–Whitney U-test value was 872.000. There was the statistically significant difference between both groups ($P = 0.008$), and CI group was associated with more satisfaction among the surgeons.

The primary objective of the study was to compare hemodynamic parameters, depth of sedation, incidence of side effects, total doses required, patients and surgeons satisfaction with anesthesia services, recovery time, and post-operative pain score of IB, and CI of propofol for maintenance of anesthesia in short surgical cases.

We observed that there was no significant difference in the context of hemodynamic stability, depth of sedation, incidence of side effects, recovery time, and post-operative pain score. IB group was found to be more cost effective due to low doses of propofol required to maintain the adequate depth of anesthesia ($P < 0.05$). In CI group satisfaction among patients and surgeons both with the anesthesia services was higher than IB group ($P < 0.05$).

SUMMARY AND CONCLUSION

Propofol has been used by anesthetists since its discovery for induction and maintenance of anesthesia. It is an agent of choice for TIVA due to its favorable pharmacokinetic and dynamic profile. Propofol can be administered to patients by various methods including IB, CI, TCIs**,** and Closed Loop Pumps. Each mode has its own advantage and disadvantage, and hence the method of choice depends on anesthetist's preference, availability of equipments and patients factors.

In our study, we compared two commonly used methods of dosing regimens, i.e., IB and CI. Both regimens provided comparable hemodynamic stability, depth of sedation, the incidence of adverse effects and recovery time. CI was associated with higher dose requirement and hence higher cost while it was also found to be the more satisfactory mode of anesthesia for both surgeons and patients.

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