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Deepak Monga
Principal Specialist, Govt. Hospital, Sri Ganganagar, Rajasthan, India

Corresponding Author:
Deepak Monga
Principal Specialist, Govt. Hospital, Sri Ganganagar, Rajasthan, India

Role of priming principle in the induction dose requirement of propofol and hemodynamic stability

Deepak Monga

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Abstract
Aim: To study the role of priming principle in the induction dose requirement of propofol and hemodynamic stability.
Methods: This observational study conducted in the, Department of Anaesthesia. 80 patients of age between 20-57 years, come under ASA-I or ASA-II category undergoing surgery which requires general anaesthesia as a mode of anaesthesia chosen to determine effect of priming principle in relation to Propofol.
Results: The mean induction dose in group A was 81.22±9.68 and in group B it was 113.02±12.63. Thus we observed a 25% reduction in induction dose requirement in group A.
The rise in Pulse rate was highly significant at one minute after induction, during intubation, immediately after intubation & 5 minutes later. Two groups were comparable to each other with respect to age, weight, ASA physical status. There was no significant difference in baseline pulse rate & baseline SBP, DBP & MAP, oxygen saturation between group A & Group B (p value > 0.05).
Conclusion: Based on the results from this study it is concluded that application of priming principle to the induction dose of propofol will reduce the total induction dose of propofol.

Keywords: Priming, induction, requirement, propofol, hemodynamic

Introduction
One of the most crucial events in anesthesiology is induction of anesthesia as it is associated with changes in the hemodynamic system and in the physiology of the other body system. The preferred mode of inducing anesthesia is through intravenous injection. Various drugs have been used for induction having different pharmacokinetic and dynamic properties [1]. Among most of the drugs propofol is being considered as the most preferred agent for induction because of its smooth induction, rapid awakening and orientation times, providing good intubating conditions like supressing the upper airway reflexes, clear headed recovery and less incidence of post-operative nausea and vomiting [2]. In anesthesia propofol induction is administered at a dose of 2mg/kg as a single bolus and when given at this dose the commonest problem faced by the anesthetist is the sudden drop in the blood pressure, as the hypotensive effect of propofol is proportional to the dose and rate of administration [3, 4]. Various methods were proposed to alleviate this problem but each had one or the other side effect and finally a method called priming principle was introduced to overcome these problems. In this technique a pre-calculated dose of the induction agent is given prior to the full calculated dose of the same induction agent and so this technique is also called as auto-conduction [5]. This concept of priming principle was very well documented in the use of muscle relaxants in which 10% of the total dose is given 2- 4 minutes prior to the second large dose for tracheal intubation [6]. Propofol is the most recent intravenous anaesthetic agent released for general use in 1989. Propofol is the most frequently used intravenous agent for induction and maintenance of anaesthesia as well as for sedation during regional anaesthesia or intensive care unit. Use of propofol has advantages like fast induction, short duration of action, fast and clear-headed recovery, inactive metabolites, no post- operative nausea, vomiting and patient rapidly becoming roadworthy. The main disadvantages are pain on injection, hypotension, bradycardia, anaphylaxis reactions and high cost. A decrease of 26-28% of systolic blood pressure, 19% of diastolic blood pressure and 11% of mean arterial pressure, without any change in systemic vascular resistance and cardiac output were observed when patients are induced with 2mg/kg of propofol [7, 8].

Most of these hemodynamic side effects of propofol are dose related. A search of the literature reveals that many methods were used to reduce the induction dose requirements of propofol, like use of nitrous oxide, opioids, barbiturates like thiopentone, benzodiazepines like midazolam, use of local anaesthetics, magnesium sulphate and use of 'Priming Principle' [9-12].

Material and Methods

This observational study conducted in the, Department of anaesthesia, after taking the approval of the protocol review committee and institutional ethics committee. 80 patients of age between 20-57 years [12], come under ASA-I or ASA-II category undergoing surgery which requires general anaesthesia as a mode of anaesthesia chosen to determine effect of priming principle in relation to Propofol. Adult patients of both sexes between 20-57 years of age, Patients undergoing elective surgeries undergoing general anaesthesia and Patients of ASA status -I &II were included in this study. patients unwillingness of the patient, History of allergy to opioids, eggs, History of opioid abuse, Patient is on opioid analgesic, phenothiazine, tranquilizer, sedatives, hypnotics or any other CNS depressants and anticipated difficult intubation were excluded from the study.

All the selected patients were explained about the purpose, procedure & side effects of the study. After this a written & informed consent was taken. Tab. ranitidine 150 mg & Tab, diazepam 10 mg was given to all patients the night before the surgery. Group of patients: Patients were randomly allocated into 2 groups of 50 patients each.

Group A (study) (n=40): Induction using priming principle (20% of the total calculated dose of Propofol -2 mg/kg followed by rest of the required dose after 2 minutes till loss of eyelash reflex [12].

Group B (Control) (n=40): Induction with total calculated dose of Inj. Propofol-2 mg/kg till loss of eyelash reflex.[12]

Anaesthetic procedure: Premedication: Inj. Glycopyrolate 0.004mg/kg IV and Inj. Midazolam 0.03 mg/kg IV 15 minutes before induction [9]. Induction: (Anaesthetic technique) [9, 10] Preoxygenation with 100% O2 for 3 min.

Group A: Inj. Fentanyl 1µg/kgover 30 seconds followed by priming with 20% of the total calculated dose of Propofol-2 mg/kg followed by rest of the required dose after 2 minutes till loss of eyelash reflex [12].

Group B: Inj. Fentanyl 1 µg/kg over 30seconds followed by induction with total calculated dose of Inj. Propofol-2 mg/kg till loss of eyelash reflex.

Inj. Succinylcholine- 1.5 mg/kg IV. Severity of fasciculations observed clinically. Laryngoscopy & Intubation 60 seconds later with portex oral cuffed endotracheal tube of appropriate size.

Maintenance: O_2 & N_2O with Isofluorane 1%.

Inj. Vecuronium Bromide- 0.1 mg/kg as loading dose, & then 0.025mg/kg supplemented SOS.

Fluids: As per the requirement Parameters observed:

A. Total dose requirement of Propofol in both the groups including priming dose in study group.
B. Hemodynamic parameters during induction *viz.* [9].

Pulse rate, Systolic blood pressure, diastolic blood pressure, mean blood pressure, oxygen saturation. (SpO_2) Observed at various intervals *viz* [12] Baseline, Just before induction, One minute after induction, during intubation immediately after intubation, 5 minutes later After completion of surgery reversal was achieved with inj. glycopylorrate 10 ug/kg & inj. neostigmine 50ug/kg. Patient then extubated after fulfilling extubation criteria.

Stastical analysis

The results of study were tabulated & stastically compared. Chi square test was used for qualitative data. For rest of the quantitative data student unpaired t test was used $p< 0.05$ was considered as significant & $p< 0.001$ was considered as highly significant.

Results

Two groups were comparable to each other with respect to age, weight, ASA physical status. There was no significant difference in baseline pulse rate & baseline SBP, DBP & MAP, oxygen saturation between Group A & Group B (p value > 0.05). The mean induction dose in group A was 81.22±9.68 and in group B it was 113.02±12.63. Thus we observed a 25% reduction in induction dose requirement in group A. (Table1)

Table 1: Dose required in Propofol

Group	Mean Induction dose(mgms)	p-value
Group A (Study group)	81.22±9.68	<0.001
Group B (Control group)	113.02±12.63	

The rise in Pulse rate was highly significant at one minute after induction, during intubation, immediately after intubation & 5 minutes later. (Table2)

Table 2: Changes in the Group A and Group B in Mean Pulse Rate (BPM)

Time	Group A	Intragroup p value	Group B	Intragroup p value	Intergroup p- value
Baseline	92.02±11.06	>0.05	90.02±11.13	>0.05	>0.05
Just before induction	90.11±10.73	>0.05	89.03±11.18	>0.05	>0.05
One minute after induction	90.09±11.26	>0.05	99.06±9.11	<0.001	<0.001
During intubation	92.11±12.85	>0.05	105.01±10.38	<0.001	<0.001
Immediately after intubation	96.22±11.08	>0.05	110.02±11.6	<0.001	<0.001
5 minutes later	94.21±10.36	>0.05	106.11±10.4	<0.001	<0.001

There was highly significant fall in MAP at one minute after induction, during intubation, immediately after intubation and 5 minutes later. (Table3)

Table 3: Changes in Group A and Group B in Mean Arterial Pressure (Mm of Hg)

Time	Group A	Intra group p value	Group B	Intra group p value	Inter Group p-value
Baseline	102.02±8.63	p>0.05	99.11±17.37	p>0.05	>0.05
Just before induction	99.05 ±9.36	p>0.05	100.26±10.56	p>0.05	>0.05
One minute after induction	96.6±11.21	p>0.05	85.09±10.91	<0.001	<0.001
During intubation	98.16±8.79	p>0.05	84.22±10.55	<0.001	<0.001
Immediately after intubation	100.02±9.36	p>0.05	86.54±11.20	<0.001	<0.001
5 minutes later	97.63±8.74	p>0.05	85.29±10.8	<0.001	<0.001

The changes in SBP & DBP followed the same pattern as MAP.

There were no statistically significant changes in $SP0_2$ in both the groups.

Incidence of hypotension was more in group B while post-suxamethonium fasciculations was more in group A [12]. (Table 4)

Table 4: Complications

Complications	Group A	Group B	p-value
Pain on injecting Propofol	6	8	p>0.05
Respiratory depression	7	11	P>0.05
Post suxamethonium fasciculations	18	7	*p*< 0.001
Hypotension	3	19	*P*< 0.001

Discussion

Induction of anaesthesia is one of the most important event in the conduct of general anesthesia as it is generally associated with a wide range of hemodynamic variations. Various induction agents have been used for the inducing anesthesia among which propofol had gained wider acceptance because to its pharmacokinetic profile, but the major disadvantage in it was its wide hemodynamic variations which is mostly dose dependant. So maintaining hemodynamic stability during induction is a challenging task for the anesthetist. To maintain the hemodynamic stability during the induction of propofol various methods were followed such as 1) concurrent use of N_2O, 2) giving Opioids, 3) use of Benzodiazepines like Midazolam, 4) augmentation with local anesthetics or Magnesium sulphate and 5) use of priming principle [13]. "Priming principle" is a technique of giving a pre-calculated dose of induction agent prior to giving the full dose of same induction agent; this technique is also known as "the auto co-induction" [12, 14-18]. Propofol is known to produce sedation and anxiolysis at low, doses. Initial administration of low dose (priming dose) of propofol (25% of the total dose requirement) is thought to produce anxiolysis and thereby reduces the associated sympathetic drive and the induction dose to produce hypnosis [12, 17-19]. Thus we observed a 35% reduction in the induction dose requirement of propofol by applying priming principle, which is statistically highly significant.(p< 0.001)

The application of priming principle is associated with the stability in the pulse rate during peri-intubation period compared to control group [12].

Also there was a lesser fall in SBP, DBP& MAP at one minute after induction, during intubation, immediately after intubation and 5 minutes later.

Propofol is known to have a biphasic effect on the cardiovascular system. Firstly, immediately after injection, decrease in the systemic vascular resistance and mean arterial pressure predominate. This decrease in the systemic vascular resistance causes reflex increase in the sympathetic activity, which is mediated by the baroreceptors present in the carotid sinus and aortic arch, thereby causing an increase in the heart rate [13, 20].

Secondly, from 2 minutes after injection, despite less than normal systemic vascular resistance, the heart rate and stroke volume are decreased to less than baseline. This is attributed to „resetting" of the baroreceptor reflex to a smaller pressure value than normal by propofol [18, 21, 22].

The lesser fall blood pressure in propofol group was probably because of reduction in total induction dose of propofol after its autoco-induction [13, 18].

We looked for various side effects and complications during our study like pain on injecting propofol, respiratory depression, hypotension and post- suxamethonium fasciculations. The lower incidence of pain on injection of propofol in our study could be attributed to injecting propofol in the larger peripheral vein and prior administration fentanyl [23, 24]. Hypotension was seen in group B compared to group A because of the greater amount of dose requirement of propofol and consequent dose dependent fall in blood pressure. But this seemed to be transient and within physiological limit and didn't require any intervention [17].

Post-suxamethonium fasciculations was found more in group A compared to group

B. It has been documented through several studies that the incidence of fasciculations varies with the depth of anaesthesia at the time of administration of suxamethonium. The lesser incidence of fasciculations in group B of our study can be attributed to the adequate depth offered by bolus dose of propofol. Logical thinking implies that the patients of group A in our study received only about 75% of the bolus dose of propofol, which obviously could not offer protection against occurrence of fasciculations [12].

Conclusion

Hence, Priming principle when applied for the induction agent like Propofol is associated with significant reduction in total induction dose requirement of Propofol and improved peri-intubation hemodynamic stability.

Reference

1. Schwarz S, Ilias W. Rapid Tracheal Intubation with Vecuronium: The Priming Principal. Anesthesiology 1985;62:388-91.
2. Baumgarten RK, Carter CE, Reynolds WJ, Brown JL, DeVera HV. Priming with nondepolarizing relaxants for rapid tracheal intubation: a double-blind evaluation. Can J Anaesth 1988;35(1):5-11. Doi:10.1007/BF03010536.
3. Ben-Shlomo I, Finger J, Bar-Av E, Perl AZ, Etchin A, Tverskoy M et al. Propofol and fentanyl act additively for induction of anaesthesia. Anaesthesia 1993;48:111.
4. Naguib M, Sari-Kouzel A. Thiopentone-propofol hypnotic synergism in patients. Br J Anaesth 1991;67:4-6.

5. Arekapudi AK, Sanicop CS, Kotur PF. Effect of priming principle on the induction dose requirements of propofol - A randomized clinical trial. Indian J Anaesth 2006;50:283-7.
6. Cressey DM, Claydon P, Bhaskaran NC, Reilly CS. Effects of midazolam pre-treatment on induction dose requirements of propofol in combination with fentanyl in younger and older adults. Anaesthesia 2001;56:108-13.
7. Caleys MA, Gepts E, Camu F. Haemodynamic changes during anesthesia induced and maintained with propofol. Br. J Anaesth 1988;60:3-9.
8. Pensado A, Molins W, Alvarez J. Haemodynamic effects of propofol during coronary bypass surgery. Br J Anaesth 1993;71:586-588.
9. Maroof M, Khan RM. 'Priming Principle' and the induction dose of propofol. Anesth Analg 1996;82:S301.
10. Naphade RW, Puspha Agarwal I. Effect of priming principle on the induction dose of propofol. ISA GoldCON 2002, 2-3.
11. Na WN, Hwang N. Inhaling nitrous oxide reduces the induction dose of anesthesia. Anaesthesia 1993;48:111-3.
12. Anilkumar A, Sanikop CS et al. Effect of Priming Principle on the Induction dose requirements of Propofol-A Randomized Clinical Trial. Indian J Anaesthesia 2006;50:283-287.
13. Ben-Shlomo I, Finger J, Bar-Av E, Perl AZ, Etchin A, Tverskoy M. Propofol and fentanyl act additively for induction of anaesthesia. Anaesthesia 1993;48:111-3. Doi: 10.1111/j.1365- 2044.1993.tb06846.x
14. Anderson L, Robb H. A Comparison of Midazolam Co-induction with Propofol Predosing for Induction of Anaesthesia 1998;53(11):1117-20.
15. Cressey DM, Claydon P, Bhaskaran NC, Reilly CS. Effect of midazolam pretreatment on induction dose requirements of propofol in combination with fentanyl in younger and older adults 2001;56(2):108-13.
16. Jones NA, Elliott S, Knight J. A comparison between midazolam co- induction and propofolpredosing for the induction of anaesthesia in the elderly. Anaesthesia 2002;57(7):649-53.
17. RoopamKataria, Ajay Singhal, Sukirti Prakash, Ishwar Singh. A comparative study of efficacy of (Indian Journal of Anaesthesia 2010, 54(6).
18. Djaiani G, Ribes-pastor Mp Propofol Auto-co-induction As an Alternative to Midazolam Co-induction For ambulatory Surgery 1999;54(1):63-7.
19. Srivastava U, Sharma N, Kumar A, Saxena S. Small dose propofol or ketamine as an alternative to midazolam co- induction to propofol. IJA 2006;50(2):112-114.
20. Polster MR, Gray PA, O'sulliva G, Mccarthy RA, Park GR. Comparison of the sedative and amnesic effects of midazolam and propofol. Br. J Anaesth 1993;70:612-616.
21. Short TG, Chul PT. Propofol and Midazolam Act Synergistically In Combination. (Oxford Journals, Medicine, BJA 1991;67(45):539-545.
22. Wilder-smith Oh, Ravussin Pa, Decosterd La, Despland Pa, Bissonnette B. Midazolam Premedication Reduces Propofol Dose Requirements For Multiple Anaesthetic Endpoints. Can J Anaesth 2001;48(5):439-45.
23. Lim YS, Kang HK, Kim SH, Jang TH, Kim KH. The cardiovascular effects of midazolam co-induction to propofol for induction in aged patients. Korean j Anaesthesiology 2012;62(6):536-542.
24. Wei-dong M, Sakai T, Takahashi S, Matsuki A. Haemodynamic and Electroencephalograph Responses to Intubation during induction with propofol or Propofol/Fentanyl. Canadian Journal of Anaesthesia 1998;45(1):19-22.