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A COMPARATIVE STUDY ON THE TOTAL DOSE REQUIREMENTS AND HEMODYNAMIC ALTERATIONS WITH AND WITHOUT THE APPLICATION OF PRIMING PRINCIPLE AMONG PATIENTS INDUCED WITH PROPOFOL

Anesthesiology

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ABSTRACT

Background:- Propofol given at standard induction dose, is known to produce haemodynamic instability, especially hypotension. Application of "priming principle" helps to reduce the total dose of propofol.

Objectives:- To study the total dose requirements of propofol and peri-intubation haemodynamic stability in patients undergoing surgery under GACV when priming principle is applied.

Methodology:- This was an observational study among 54 ASA I and II patients undergoing surgery under GACV, who were randomly divided into three groups of 18 patients each. All patients received fentanyl 1 mcg/kg over 30 seconds followed by propofol. Group 1 patients received the total (100%) calculated dose of propofol. Group 2 and 3 patients received 20% and 40% of the dose respectively as priming dose, and the remaining was given 30 seconds later, until there was loss of eyelash reflex. The total dose of propofol given, the heart rate, systolic and diastolic blood pressures, mean arterial pressures at various time intervals before, during and after induction and intubation, and complications observed were compared and statistically analysed using SPSS 2.0.

Results:- The mean induction dose of propofol was significantly lower in the priming groups (71.7 ± 17.2mg in group 2 and 80.0 ± 17.1mg in group 3) compared to group1 (107.9 ± 8.0mg). The fall in mean arterial pressure was significantly lower in groups 2 and 3 ($p<0.05$) compared to group1 at one minute post-induction.

Conclusion:-Application of priming principle reduces the induction dose of propofol and is associated with better peri-intubation haemodynamic stability.

KEYWORDS

Propofol, priming principle, induction dose

INTRODUCTION

Propofol is the most commonly used intravenous anaesthetic agent worldwide (1, 2) because of its favourable properties like rapid and smooth induction with minimal excitation phenomena, terminal half-life time and low incidence of postoperative nausea and vomiting (PONV). It is widely used for sedation and anaesthesia for almost all types of surgery, especially in patients undergoing ambulatory surgery and neurosurgery.

A smooth induction of anaesthesia usually requires administration of propofol at a dose of 2-2.5mg/kg, and the dose must be titrated against the response of the patient until the clinical signs show the onset of anaesthesia.

The most important side effect of propofol is haemodynamic instability seen in the peri-intubation period, especially hypotension which is dose dependent, others being apnoea, bradycardia, pain on injection and allergic reactions. Various methods have been tried to reduce the total dose of propofol administered, and the application of priming principle or auto-co-induction has been found to be very effective (3).

When applying priming principle to propofol, a sub-anaesthetic doe is administered prior to its actual anaesthetic dose, thus utilizing its sedative, anxiolytic & amnestic properties (4) at sub hypnotic dosage when given a few minutes prior to induction. When the total induction dose of propofol is reduced, the hemodynamic changes are attenuated and the frequency and severity of dose related effects also falls.

MATERIALS AND METHODS

After institutional ethics committee approval & obtaining an informed consent, this study was undertaken on 54 ASA I and II category patients aged 18 -55 years, undergoing surgery under general anaesthesia in Pushpagiri Institute of Medical Sciences, Kerala. The patients were randomly divided into three groups of 18 each. Patients with history of allergy to eggs, anticipated difficult intubation, and pregnant and lactating women were excluded. All patients received premedication with Ranitidine 150mg, Metoclopromide 10mg and Alprazolam 0.25mg night before and 2 hours prior to surgery. Vital parameters including systolic, diastolic and mean arterial pressures and pulse rate were recorded. Glycopyrrolate (0.004mg/kg) and Midazolam(0.03mg/kg) were administered IV 15 minutes prior to surgery.

All patients received fentanyl (1microg/kg) for a period of 30s intravenously following which propofol was administered.

Group 1 patients (control group) were induced with the whole calculated dose of propofol 2mg/kg until loss of eyelash reflex.

Group 2 patients received 20% of total calculated dose of propofol 30s prior, and then induced from the remaining calculated dose of propofol till loss of eyelash reflex.

Group 3 patients received 40% of total calculated dose of propofol 30s prior and then induced from the remaining calculated dose of propofol till loss of eyelash reflex.

Subsequent relaxation and intubation were accomplished with Succinyl choline 1mg/kg IV and anaesthesia maintained with Oxygen, N2O and sevoflurane, and muscle relaxation maintained with vecuronium intra-op. All complications during procedure including vomiting, apnoea, fasciculations, laryngospasm and coughing were noted. The total dose of propofol received, pulse rate, blood pressure just before induction, one minute after induction, immediately after intubation and five minutes after intubation were recorded, and the data was analysed using Kruskal-Wallis ANOVA. A p value of less than 0.05 was considered as statistically significant.

OBSERVATION AND RESULTS

The demographic data were comparable for age, weight. gender and ASA status.

The total dose of propofol given to the three groups of patients is shown in table 1.

A statistically significant reduction in the mean induction dose of propofol given was observed when priming principle was applied. However, the difference in the dose between groups 2 and 3 was not statistically significant.

Table 1: Dose Of Propofol Given

Group	Mean induction dose (mg)	SD (mg)	N	F	Sig.	Scheffe Multiple *Comparisons		
						Pair	F`	p
Group 1 (A)	107.9	8	18	29.63	p<0.01	A &B	27	p<0.01
Group 2 (B)	71.7	17.2	18			A & C	16	p<0.01
Group 3 (C)	80	17.1	18			B & C	1.4	0.249

The mean pulse rate was lower in the control group compared to both the priming groups during the entire period of induction and intubation.

The mean systolic BP after administration of propofol was lower in the control group at 1 minute after induction and immediately after intubation. A significantly increased fall in systolic blood pressure was observed 1 minute after induction in the control group compared to the two priming groups. No statistically significant difference was noted among the two priming groups.

The mean diastolic blood pressure was highest in the 40% priming group at one minute after induction and immediately after intubation. On comparing the fall in diastolic BP at 1 minute after induction, statistically significant difference was noted between the control group and 40% priming group. No significant difference was observed among the two priming groups.

The mean arterial pressure after administration of propofol was lower in the control group at 1 minute after induction and immediately after intubation (Figure 1). The fall in MAP 1 minute after induction was significantly higher in in the control group compared to the priming group. However no statistically significant difference was noted among the two priming groups.

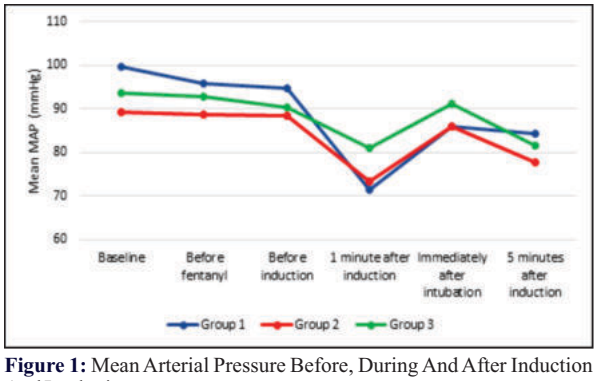

Figure 1: Mean Arterial Pressure Before, During And After Induction And Intubation

The overall incidence of complications was 89% in the control group (no priming), whereas it was 61.1 % and 50 % in the study groups where 20% and 40% priming were applied respectively.

The pattern of complications also differed among the control and study groups as shown in table 2.

Table 2: Distribution Of Complications

Complications	Group 1		Group 2		Group 3	
	Count	Percent	Count	Percent	Count	Percent
Nil	2	11.1	7	38.9	9	50
Fasciculations	1	5.6	8	44.4	7	38.9
Apnoea	7	38.9	3	16.7	2	11.1
Hypotension	7	38.9	0	0	0	0
Apnoea + hypotension	1	5.6	0	0	0	0

DISCUSSION

Induction is considered as one of the most vital steps during general anaesthesia. Among the different intravenous anaesthetic induction agents, propofol is the one which is widely used worldwide. The main disadvantage of propofol is the haemodynamic instability produced by the administration of standard dose of 2-3mg/kg (5). Various methods have been tried to reduce this dose of propofol without compromising on the anaesthetic activity, and priming principle or auto co-induction has been one which shows promise.

A reduction of 41.4 % and 33.4% in the dose of propofol given was observed in the 20% priming group and 40 % priming group respectively. This finding was similar to that by Kumar et al (27.48% reduction with 20% priming) (6) and Prathapadas et al (40 % reduction with 20% priming) (7).

For a given dose of propofol, the effective plasma concentration has been found to be higher in a patient with low cardiac output than one with a high cardiac output. During induction of anaesthesia, cardiac output may be increased by patient anxiety. In auto-co-induction, the initial priming dose of propofol produces anxiolytic and amnestic effects which reduces the cardiac output, and thus, an increased effective plasma-site concentration is achieved with a significantly lower dose of propofol (8).

In our study, no significant change in pulse rate was noted with the application of priming principle compared to the control group which was similar to the findings by Pensado et al and Claey et al (5) but different from the findings of Kumar et al and Biswal et al, who observed a higher mean pulse rate at 1 minute after intubation in the control group (6,7). This may be attributed to the use of N2O concurrently during induction with propofol, which causes a resetting of the heart rate baroreflex set point (9).

Rapid induction with propofol is associated with hypotension. In our study the fall in mean arterial pressure after propofol administration was lesser in the two priming groups compared to control group with statistically significant difference between the priming and non-priming groups at 1 minute after induction. This was similar to the results obtained by Biswal et al and Gvalani et al (10), however the magnitude of fall in MAP observed in our study was higher.

The most prominent cardiovascular effect of propofol is systemic blood pressure reduction accompanied by a decrease in cardiac output. This effect is dose-dependent, and is mediated by a significant reduction in sympathetic tone accompanied by a decrease in vascular resistance (11). Application of priming principle reduces the total dose of propofol administered to the patient, thus reducing the hypotension occurring after administration of propofol which is dose-dependent.

In the study by Kumar et al, higher incidence of apnoea and hypotension was seen in the no-priming group similar to our study, but the proportion of patients developing them was much lower (8%) (6). In our study, the priming groups showed a higher incidence of fasciculations after administration of succinyl choline compared to the control group. Though the exact mechanism of fasciculations is unknown, various hypotheses suggest the prejunctional depolarisation of suxamethonium as the cause. It may be assumed that the lower dose of propofol received by the priming groups may be inadequate to prevent fasciculations after succinyl choline.

CONCLUSIONS

Based on the results of our study, it may be concluded that when the principle of priming is applied, there is a significant reduction in the total induction dose requirement of propofol along with a significant reduction in the incidence of propofol induced hypotension. However, the change in pulse rate after propofol administration was not significantly affected by the application of priming principle. No significant difference in dose requirements and hemodynamic stability was observed when two different priming doses were applied.

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