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Original Research Article

A Comparative Study of Intravenous Propofol and Inhalational Sevoflurane for Preoperative Induction

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Abstract

Background and Objectives: Propofol is commonly used for anesthesia induction, while Sevoflurane is favored for pediatric inhalational induction and adult needle-phobic patients. This study aims to compare Propofol and Sevoflurane induction agents and their impact on intubation conditions, particularly in relation to Sevoflurane's interaction with vecuronium, a non-depolarizing muscle relaxant.

Methods: ASA Grade I and II patients (20-65 years) undergoing surgeries were randomized into two groups. Group P received Propofol induction, and Group S received Sevoflurane induction using vital capacity breath technique (8% Sevoflurane).

Results: Propofol induced more significant blood pressure reduction, though induction time was slightly shorter. Sevoflurane heightened vecuronium's effects. One Sevoflurane subject experienced laryngospasm (excluded). Four Propofol patients had injection pain. Both groups had instances of groaning, while Sevoflurane group showed induction-related coughing.

Conclusion: Propofol and Sevoflurane exhibit similar induction speed. Sevoflurane enhances non-depolarizing muscle relaxant effects during induction, making it preferable for patients intolerant to brief blood pressure decline.

Keywords: Sevoflurane, Propofol, Vital Capacity, Intubation, Adult.

Introduction

Pharmacological advancements offer anesthesiologists a diverse array of options for anesthesia induction. Intravenous induction remains favored due to predictability and independence from patient cooperation. Inhalational induction, historically used in pediatric practice to alleviate the discomfort of awake intravenous access, was led by halothane. The advent of Sevoflurane introduced an additional non-irritating gas option, characterized by rapid onset, quick elimination, and emergence [1]. Sevoflurane's utility has expanded to adult anesthesia induction, particularly for individuals with needle phobias. This study juxtaposes two prominent induction agents, Propofol and Sevoflurane, while also assessing the speed of achieving intubation-conducive conditions. The investigation takes into account Sevoflurane's synergistic interaction with vecuronium, a non-depolarizing muscle relaxant.

Material & Methods

This prospective randomized study was conducted at a tertiary care teaching hospital in Central India. The study encompassed patients (20-65 years) classified under American Society of Anesthesiologists (ASA) Grade I and II, scheduled for elective surgeries under general anesthesia within a one-year period. Exclusion criteria encompassed a history of coronary artery disease, cerebrovascular accidents, epilepsy, malignant hyperthermia, ASA III or IV, expected difficult airway, Propofol allergy, hepatic/renal disease, uncontrolled hypertension, or body mass index >30 kg/m². Patients were randomly allocated into two groups, with a sample size of 56 each. Group P received Propofol induction, and Group S received Sevoflurane induction (8% Sevoflurane). Pre-induction measures included electrocardiography, non-invasive blood pressure (BP), and pulse oximetry. After pre-oxygenation and administering midazolam and fentanyl, induction commenced with the respective agent. Verbal contact and eyelash reflex loss indicated induction endpoints. Vecuronium (0.1 mg/kg) was given

intravenously pre-intubation. In the Propofol group, 2% preservative-free lignocaine (1.5 mg/kg) preceded 1% Propofol (2 mg/kg). In the Sevoflurane group, 2% preservative-free lignocaine (1.5 mg/kg) preceded 8% Sevoflurane, which was later reduced to 2%. Verbal contact and eyelash reflex loss signaled the need for 2% Sevoflurane and 50% oxygen. Hemodynamic variables were monitored pre-induction and post-induction every 2 minutes. Train of four ratios monitored every 12 seconds after vecuronium administration. Data analysis utilized SPSS, employing statistical tests such as Student's t-test for quantitative data and the Chi-square test for associations between variables. Successful anesthesia induction indicated the absence of side effects. Hemodynamic instability was defined as BP or pulse rate changes exceeding ±20% baseline values, managed through rapid fluid infusion and, if necessary, intravenous ephedrine.

Results

The study's sample exhibited age comparability. A single participant from the Sevoflurane group was excluded due to induction-related laryngospasm, leaving 55 subjects in that group for the subsequent analysis. Notably, this incident was documented within the compilation of complications. Throughout the study, oxygen saturation monitoring failed to reveal any statistically significant distinctions between the two groups at any given point. The study revealed an absence of statistically noteworthy disparity in the average period of induction between the two cohorts (P = 0.198), as illustrated in Table 1.

Table 1: Comparison of Induction time and time to TOF "0" in both groups

Parameter	Group S (n=55) (Mean ± SD)	Group P (n=56) (Mean ± SD)	P value
Induction time (in seconds)	68.75 ± 25.92	61.89 ± 10.36	0.198
Time to TOF "0" (in seconds)	206.14 ± 33.76	237.25 ± 47.82	<0.05

The variation in heart rate, as evidenced by the disparity in values, does not attain clinical significance, with corresponding p-values of 0.18 and 0.15 for the respective groups, as demonstrated in Table 2.

Table 2: Variation in Pulse rate in both groups

Change in pulse rate	Group S (n=55)		Group P (n=56)		P Value
	Count	Expected count	Count	Expected count	
at 2 min					
<20%	54	50.2	50	51.6	0.18
≥20%	1	4.8	6	4.4	
at 4 min					
<20%	49	45.8	44	45.9	0.15
≥20%	6	9.2	12	10.1	

The oscillation observed in systolic blood pressure (SBP) consistently manifested as a reduction from the initial baseline levels at both the 2 and 4-minute intervals. Notably, the contrast between the groups yielded a statistically significant divergence (Table 3).

Table 3: Variation in SBP in both groups

Change in SBP	Group S (n=55)		Group P (n=56)		P Value
	Count	Expected count	Count	Expected count	
at 2 min					
<20%	47	38.4	31	38.9	< 0.05
≥20%	8	16.6	25	17.1	
at 4 min					
<20%	21	11.1	1	11.3	< 0.05
≥20%	34	43.9	55	44.7	

The DBP variation consistently presented as a decline from the baseline measurements. Notably, the statistical assessment indicated that Propofol elicited a notably greater reduction in diastolic blood pressure, thereby inducing a state of hemodynamic instability when compared to the administration of Sevoflurane [Table 4].

Table 4: Variation in DBP in both groups

Change in DBP	Group S (n=55)		Group P (n=56)		P Value
	Count	Expected count	Count	Expected count	
at 2 min					
<20%	52	37.7	24	38.2	<0.05
≥20%	3	17.3	32	17.8	
at 4 min					
<20%	31	18.8	7	19.2	<0.05
≥20%	24	36.2	49	36.8	

In relation to the MBP, akin to the patterns observed with SBP and DBP values, a consistent decline from the baseline levels was noted. Notably, this decline was more pronounced within the Propofol group, as delineated in Table 5.

Table 5: Variation in MBP in both groups

Change in MBP	Group S (n=55)		Group P (n=56)		P Value
	Count	Expected count	Count	Expected count	
at 2 min					
<20%	52	38.9	27	39.8	<0.05
≥20%	3	16.1	29	16.2	
at 4 min					
<20%	31	19.5	8	19.9	<0.05
≥20%	24	35.5	48	36.1	

Adverse events occurring during the induction phase were meticulously examined within the two cohorts, yet did not exhibit any statistically significant occurrences within either group [Table 6].

Table 6: Comparison of Complications in both groups

Complications	Group S (n=55)	Group P (n=56)	P Value
Absent	48	50	0.51
Present	8	6	

Discussion

In the existing body of literature, numerous investigations have demonstrated a marked acceleration in induction time with intravenous Propofol administration in comparison to inhalation of Sevoflurane [2-9]. In a specific instance, expedited induction time was observed through the utilization of the vital capacity breath technique employing an 8% concentration of Sevoflurane [10]. Conversely, another study reported no significant differentiation in induction time when employing either Propofol or Sevoflurane [11]. These disparities appear to be attributed to variations in methodologies, such as the utilization of higher Sevoflurane concentrations and larger inhalational volumes during vital capacity induction. The velocity of Propofol injection also stands as a noteworthy factor, warranting consideration. Both the inhaled volume and injection speed bear a subjective element contingent upon patient cooperation, vital capacity, venous line specifications, patient size, and flow rate. Our study's findings regarding heart rate fluctuations concur with observations in the pertinent literature [12]. Our observations regarding blood pressure fluctuations align with established literature, where a preponderance of studies unequivocally underscores the potential risk associated with Propofol induction, surpassing Sevoflurane in this regard [13]. However, in our study cohort, the parametric variations in blood pressure bore no clinically significant implications, resulting in an absence of attributable complications. Extensive documentation in the literature underscores Sevoflurane's propensity to enhance the neuromuscular-blocking effects of nondepolarizing muscle relaxants [14-17], a property largely absent with Propofol in most studies [18]. Our findings align harmoniously with the foundational tenets elucidated in classical literature. Notably, reports indicate that post-operative nausea and vomiting tend to be less prevalent with Propofol as compared to Sevoflurane [19]. However, it's imperative to acknowledge that this aspect remained outside the purview of our present study.

Conclusion

In controlled clinical contexts involving adult patients, both Propofol and Sevoflurane demonstrate comparable efficacy in swiftly inducing anesthesia. The heart rate remains relatively stable during the induction phase for both agents. However, Propofol elicits a more pronounced decline in blood pressure compared to Sevoflurane. Furthermore, Sevoflurane displays an augmented effect on non-depolarizing muscle relaxants during induction when contrasted with Propofol. Adverse events attributed to either agent are infrequent and can be promptly identified through vigilant monitoring, subsequently managed

through standard interventions. In scenarios where a transient decrease in blood pressure may not be well-tolerated, even momentarily, Sevoflurane emerges as a potentially preferable choice over Propofol as an induction agent.

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