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Original Research Article

Comparative study of propofol and etomidate as intravenous induction agents for general anesthesia: hemodynamic effects, adrenal suppression, and blood glucose response in controlled hypertensive patients

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ABSTRACT

Background: General anesthesia induces unconsciousness and loss of reflexes, facilitating complex medical treatments. The induction of anesthesia is crucial for patient comfort and procedural success, with propofol and etomidate being common intravenous induction agents. Propofol offers a rapid onset and short duration, while etomidate is known for cardiovascular stability.
Methods: A prospective randomized controlled trial involving 100 controlled hypertensive patients compared propofol and etomidate for induction. Hemodynamic parameters and biochemical responses were monitored at various intervals. Injection site discomfort and myoclonus were assessed, and cortisol and glucose levels were measured.
Results: Baseline hemodynamic values were similar. Etomidate resulted in stable hemodynamics as compared to propofol. Blood sugars were comparable. Though serum cortisol levels were reduced after etomidate was given. But it came back to normal range 24 hours after surgery. Injection site pain was reported by 20% of etomidate patients and 10% of propofol patients. No myoclonus occurred.
Conclusions: Etomidate is an effective induction agent for controlled hypertensive individuals, causing transient adrenal suppression without affecting blood sugar levels.

Keywords: Adrenal suppression, Controlled hypertension, Etomidate, General anesthesia induction

INTRODUCTION

General anesthesia, a medically induced state of unconsciousness with the loss of protective reflexes, is a cornerstone of modern medicine, enabling complex and painful medical procedures. The administration of general anesthesia involves the use of various anesthetic agents that induce and maintain unconsciousness, analgesia, and muscle relaxation, thus ensuring patient comfort during surgical interventions.[1] One of the critical aspects of general anesthesia is the process of induction, which involves initiating the anesthetic state swiftly and smoothly to minimize patient discomfort and ensure procedural success.[2]

Induction of anesthesia is achieved through the administration of induction agents, which bring about rapid loss of consciousness and allow for the seamless transition into the anesthetic state. These agents have evolved over the years, each with its advantages and disadvantages, and their selection depends on factors such as patient characteristics, the nature of the procedure, and potential side effects.[3]

Among the intravenous induction agents commonly employed are propofol and etomidate. Propofol, a widely used hypnotic agent, offers rapid onset, short duration, and a favorable side effect profile. Etomidate, on the other hand, is recognized for its cardiovascular stability and suitability for patients with hemodynamic concerns. Both agents have been instrumental in the field of anesthesia, yet they exhibit differences in their pharmacodynamic effects and adverse event profiles.[4]

This manuscript presents a comprehensive study aimed at comparing the hemodynamic effects, adrenal suppression, and blood glucose response of propofol and etomidate in controlled hypertensive patients undergoing general anesthesia. Hypertensive patients pose a unique challenge due to their compromised cardiovascular status, and selecting the most suitable induction agent becomes crucial to ensuring a safe and effective anesthesia induction process.[5]

The study seeks to shed light on the intricate interactions between these two induction agents and the physiological responses of hypertensive patients. By investigating parameters such as hemodynamic stability, adrenal suppression, and blood glucose levels, this research contributes to the understanding of the optimal agent for induction in hypertensive patients undergoing surgery. The results of this study hold the potential to influence clinical decision-making, ultimately enhancing patient care and safety during the induction phase of general anesthesia.[6]

Through a detailed exploration of the pharmacological characteristics, effects on the central nervous system, cardiovascular impact, and potential adverse reactions of propofol and etomidate, this manuscript provides a comprehensive overview of these agents' roles in modern anesthesia practice. The study's findings have the potential to guide anesthesiologists in making informed choices about induction agents based on patient-specific factors, procedural requirements, and desired outcomes.[7]

This study aims to compare the hemodynamic effects, adrenal suppression, and blood glucose response between the intravenous induction agents propofol and etomidate in controlled hypertensive patients undergoing general anesthesia, with the goal of determining the most suitable agent for safe and effective anesthesia induction in this specific patient population. This research contributes to clinical decision-making, enhancing patient care and safety during the induction phase of general anesthesia for hypertensive individuals.

METHODS

Study type

This was a prospective randomized comparative study.

Study place and period

The study was conducted at the Department of Anaesthesiology and Intensive Care Unit, Government Medical College and Associated Hospitals, Jammu, from September 2014 to October 2015.

Inclusion criteria

Patients who refused to participate in the study, had hypersensitivity to the study drugs, suffered from asthma or diabetes mellitus, had an anticipated difficult airway (MPG grade 3 or 4), were affected by primary or secondary adrenal insufficiency, were on steroid medication, or had a history of seizure disorder were excluded from the study.

Exclusion criteria

Distance from the centre of the asterion to tip of the mastoid process and distance from the centre of the asterion to supramastoid crest were excluded.

Procedure

Informed written consent was obtained from all patients. Pre-anesthetic evaluation included a detailed history, clinical examination, and routine investigations. Patients were prepared by overnight fasting and received prescribed medications. In the pre-operative room, an intravenous line was established with a 20G cannula. Baseline blood samples for serum cortisol and blood glucose levels were drawn. Anesthesia induction involved preoxygenation, administration of Fentanyl, and induction agents as per group allocation. Hemodynamic parameters were monitored throughout the procedure. Maintenance of anesthesia was provided with Isoflurane and vecuronium. Any hypertensive or hypotensive episodes were managed accordingly. Intravenous paracetamol was administered as an analgesic. Residual neuromuscular block was reversed, and patients were extubated. Incidence of post-operative nausea and vomiting (PONV) was noted.

Statistical analysis

Data was compiled and entered into a spreadsheet (Microsoft Excel) and analyzed using SPSS Version 20.0. Continuous variables were presented as Mean ± SD, and categorical variables as frequencies and percentages. Student's independent t-test and chi-square test or Fisher's

exact test were used for comparisons, as appropriate. A P-value less than 0.05 was considered statistically significant, with two-tailed tests applied. Data was also graphically presented using bar diagrams and line diagrams.

RESULTS

Above table shows [table 1] that the age distribution in both the groups was not statistically significant (p>0.05).

Table 1: Demographic distribution of patients.

Age (years)	Group E		Group P		P value
	N	% age	N	N	
40-49	22	44	19	38	
50-59	21	42	28	56	
≥ 60	7	14	3	6	0.096
Total	50	100	50	100	
Mean±SD	49.9±7.14		51.8±4.12		

Table 2 shows distribution of SBP in two groups at different time intervals. There was statistically no significant difference in SBP of two groups before induction and 1 minute after induction. Intergroup comparison showed statistically significant difference in SBP in two groups at the time of intubation and subsequent intervals.

Table 3 shows distribution of DBP in two groups. There was statistically no significant difference in DBP of two groups at baseline. There was statistically significant difference in DBP in two groups at the time of intubation and subsequent intervals.

Table 4 shows distribution of MAP in two groups. There was no statistically significant difference in MAP of two groups before induction and 1 minute after induction. There was statistically significant difference in MAP of two groups at the time of intubation and subsequent intervals.

Table 2: Comparison based on SBP (mmHg) in two groups at various intervals of time.

	Group E		Group P		P value
	Mean	SD	Mean	SD	
Before induction	130.42	8.81	130.36	9.04	0.973
1 min after induction	127.14	9.73	123.88	8.87	0.083
At the time of intubation (3 min A/ind)	130.50	6.83	119.60	9.18	<0.001*
1 min after intubation	130.52	7.30	116.16	9.11	<0.001*
2 min after intubation	125.96	6.54	111.24	7.71	<0.001*
3 min after intubation	124.54	7.53	107.12	9.89	<0.001*
5 min after intubation	125.18	6.18	106.00	9.44	<0.001*
10 min after intubation	123.62	4.97	104.16	9.80	<0.001*

*Statistically Significant Difference (p value<0.05).

Table 3: Comparison based on DBP (mmHg) in two groups at various intervals of time.

DBP (mmHg)	Group E		Group P		P value
	Mean	SD	Mean	SD	
Before Induction	81.16	6.72	83.40	6.74	0.099
1 min after induction	78.36	8.20	77.32	6.74	0.491
At the time of intubation(3 min A/ind)	79.04	6.69	74.00	6.50	<0.001*
1 min after intubation	78.74	7.16	70.48	6.51	<0.001*
2 min after intubation	76.16	6.23	66.96	5.36	<0.001*
3 min after intubation	76.32	6.89	65.20	6.87	<0.001*
5 min after intubation	79.44	7.20	63.84	6.63	<0.001*
10 min after intubation	76.62	6.83	62.16	6.79	<0.001*

*Statistically Significant Difference (p value<0.05).

Table 4: Comparison based on MAP (mmHg) in two groups at various intervals of time.

MAP (mmHg)	Group E		Group P		P value
	Mean	SD	Mean	SD	
Before induction	97.58	6.65	99.05	7.08	0.286
1 min after induction	94.62	8.24	92.84	7.06	0.249
At the time of intubation(3 min A/ind)	96.19	6.02	89.20	7.15	<0.001*
1 min after intubation	96.00	6.99	85.71	7.12	<0.001*
2 min after intubation	92.76	5.79	81.72	5.81	<0.001*

Continued.

MAP (mmHg)	Group E		Group P		P value
	Mean	SD	Mean	SD	
3 min after intubation	92.39	6.56	79.17	7.59	<0.001*
5 min after intubation	94.69	5.60	77.89	7.32	<0.001*
10 min after intubation	92.29	5.03	76.16	7.53	<0.001*

*Statistically Significant Difference (p value <0.05).

Table 5: Comparison based on serum cortisol (µg/dl) between two groups.

Serum Cortisol	Group E		Group P		P value
	Mean	SD	Mean	SD	
Before induction	13.16	1.79	12.74	1.38	0.194
After completion of surgery	7.59	0.70	12.70	1.16	<0.001*
24 hours after induction	13.67	1.84	13.26	1.12	0.189

*Statistically Significant Difference (p value <0.05).

Above Table 5 shows distribution of serum cortisol in two groups. There was no statistically significant difference in serum cortisol levels in two groups before induction and 24 hours after induction. There was statistically significant difference in serum cortisol levels in two groups after completion of surgery.

DISCUSSION

The results of this study suggest that etomidate is a better induction agent than propofol for controlled hypertensive patients. Etomidate causes less hypotension, tachycardia, even though post-surgery cortisol levels were reduced it came back to normal in 24 hours. Additionally, etomidate has fewer side effects than propofol.[8]

However, it is important to note that this study was relatively small and was conducted in a single setting. Therefore, it is important to interpret the findings with caution and to conduct further research to confirm the results.[9]

In addition, it is important to consider the individual patient's specific risk factors when choosing an induction agent. For example, patients with adrenal insufficiency should not be given etomidate because it can further suppress cortisol levels.[10]

Overall, the results of this study suggest that etomidate is a safe and effective induction agent for controlled hypertensive patients. However, it is important to consider the individual patient's specific risk factors when making the decision of which induction agent to use. Etomidate may be a better choice than propofol for induction of anesthesia in controlled hypertensive patients who are at risk of hypotension.[11]

Etomidate may also be a better choice for induction of anesthesia in controlled hypertensive patients who are at risk of postoperative nausea and vomiting. Further research is needed to confirm the findings of this study and to determine the optimal induction agent for controlled hypertensive patients.[12]

CONCLUSION

In conclusion, etomidate proves effective for induction in controlled hypertensive patients. It provides temporary adrenal suppression without affecting blood sugar levels. While etomidate emerges as a promising option, further research is needed to validate these findings across larger and diverse patient populations.

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