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## **A cross sectional observational study of cardiovascular response after propofol and etomidate anaesthesia induction**

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**Abstract**--Etomidate and propofol are two common anaesthetic drugs. Etomidate can be used in patients with little hemodynamic reserve, whereas Propofol can result in more hemodynamic instability, according to prior research. During the induction of anaesthesia with Etomidate or, as a comparison, Propofol in elective surgeries, the cardiovascular response was examined in this study. Patients who were admitted for elective surgeries and ranged in age from 18 to 60 were included in this cross-sectional observational study. The cardiovascular responses of 50 (47) patients were assessed prior to induction, after the induction of anaesthesia with drugs, and at 1, 3, 5, and 10 minutes following the laryngoscopy. These measurements included systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR), and O<sub>2</sub> saturation (O<sub>2</sub> sat). In terms of patient gender, age, and weight, there were no statistically significant differences between the two groups. At different times, changes in groups I and II's SBP, DBP, MAP, and HR were statistically significant. There were no discernible differences between groups I and II in terms of O<sub>2</sub> saturation. Conclusion: Because Etomidate-treated patients have improved hemodynamic stability, it

may be preferable to Propofol for general anaesthesia in the absence of contraindications.

**Keywords**--cardiovascular response, etomidate, hemodynamic changes, laryngoscopy, propofol.

## Introduction

Induction agents are drugs that, when administered intravenously at the proper dose, result in a sudden loss of consciousness. Induction agents are utilised to begin the process of inducing anaesthesia prior to the administration of other drugs that are used to maintain anaesthesia, as the sole drug for short procedures, to maintain anaesthesia for longer procedures by intravenous infusion, and to provide conscious sedation during procedures that are carried out in the intensive care unit and in the area of local anaesthesia. Propofol, also known as 2,6-diisopropylphenol, is the most widely used induction agent due to the favourable properties it possesses, including rapid and smooth induction and recovery, a lower incidence of nausea and vomiting, and a number of other benefits. [1,2] While on the other hand, the most significant negative effects include a drop in blood pressure, dose-dependent depression of ventilation, and pain during injection. [3-5] Etomidate is a carboxylated form of imidazole that has been shown to maintain hemodynamic stability, have only a mild depressant effect on respiratory function, and protect the brain.

Because it does not have any effect on the sympathetic nervous system or the baroreceptor reflex regulatory system, and because it can increase coronary perfusion even in patients with moderate cardiac dysfunction, it is an excellent choice as an induction agent for patients who suffer from cardiac disease. [6-9] Nevertheless, there are some undesirable adverse effects, including pain during injection, thrombophlebitis, and myoclonus. These are some of the adverse effects. [10,11] This study is an attempt to evaluate the effects of Propofol and Etomidate by comparing certain parameters such as change in blood pressure (SBP, DBP, MAP), Saturation (spo<sub>2</sub>), and heart rate at baseline (before induction) (TB), after intubation (TI), one minute, three minutes, five Minutes and ten minutes after induction as a outcome; so that we can choose a safer induction agent.

## Materials and Methods

This is a cross-sectional observational study that was carried out on a total of one hundred patients, all of whom were grade I and II according to the American Society of Anaesthesiologist (ASA) and ranged in age from 18 to 60 years old, regardless of gender. All of the patients were scheduled to undergo an elective surgical procedure that required general anaesthesia and endotracheal intubation.

- Group I ( $n = 50$ ): received Inj. Etomidate (0.3 mg/kg of body weight)
- Group II ( $n = 50$ ): received Inj. Propofol 1% (2 mg/kg of body weight)

Patients who had a history of an allergy to the drugs being studied, a history of seizure disorder, the presence of primary and secondary steroid deficiency or who were taking steroid medication and hypotensive patients were not allowed to participate in the study. Every patient was given a premedication tablet the night before their surgery consisting of alprazolam 0.25 mg and ranitidine 150 mg, and they were instructed to fast for a period of eight hours. As soon as patients entered the operating room, they were hooked up to the standard anaesthesia monitoring equipment, which consisted of an electrocardiogram (ECG), a non-invasive blood pressure monitor (NIBP), a pulse oximeter, and a recorder for their baseline vital parameters. After securing an intravenous (IV) cannula of 18G in the patient's left hand, ringer lactate at a rate of 10 mL/kg/h was initiated. After administering an intravenous injection of fentanyl 3 mcg/kg, glycopyrrolate 0.2 mg, and midazolam 0.02 mg/kg, the patients received an induction dose of either propofol (Propofol spiva 1 percent, Claris Lifesciences Limited) or etomidate (Etomidate Lipuro, B. Braun, India).

We recorded any instances of myoclonic movements and pain that occurred during the injection process. After three minutes of administering an intubating dose of vecuronium (0.1 mg/kg) intravenously, the trachea was intubated using an endotracheal tube of the appropriate size. After ensuring that the endotracheal tube was in the appropriate position, it was secured, and then positive pressure ventilation was started. Throughout the entirety of the surgical procedure, the patient was kept under anaesthesia by administering intermittent boluses of vecuronium and oxygen and nitrous oxide in the ratio of 70:30 in isoflurane. At the conclusion of the operation, the patient was given neostigmine (0.05 mg/kg) and glycopyrrolate (0.01 mg/kg) intravenously. This was done in order to reverse the remaining neuromuscular block, and extubation was carried out once the patient was able to respond appropriately to verbal instructions. Baseline (TB), after induction (TI), as well as at 1, 3, 5, and 10 minutes after induction, the patient's heart rate, as well as their systolic and diastolic blood pressures and mean arterial pressure, were continuously monitored and recorded.

## **Result**

Out of 100 participants, 95 participants were taken in to study as in 5 participants (3 from group 1 & 2 from group 2) the intubation time is more than the 30 seconds which can affect the final outcome. According to Table 1, the average age of participants in group 1 was  $32.06 \pm 9.69$  years old, while the average age of participants in group 2 was  $32.51 \pm 9.13$  years old. The majority of them were over the age of 40, followed by those between the ages of 39 and 30, then those between 29 and 20, and the youngest participants in both groups were under the age of 20. In comparison, the preponderance of females can be found in group 2, while the majority of men are found in group 1. The participants in the first group had a mean weight of  $57.98 \pm 5.76$  Kgs, while the participants in the second group had a mean weight of  $56.77 \pm 6.29$  Kgs. The majority of patients in both groups had a weight that fell between 50 and 59 kilograms.

Table 1  
Demographic Profile of Participants

Particulars	Sub-particulars	Group I (Etomidate)	Group II (Propofol)
Age	<20	4	5
	20--29	14	17
	30--39	14	10
	>40	15	16
	Mean age	32.06±9.69	32.51±9.13
Gender	Male	29	19
	Female	18	29
	40-49	7	4
Weight	50--59	29	23
	60-69	9	21
	>70	2	0
	Mean Weight	57.98±5.76	56.77±6.29

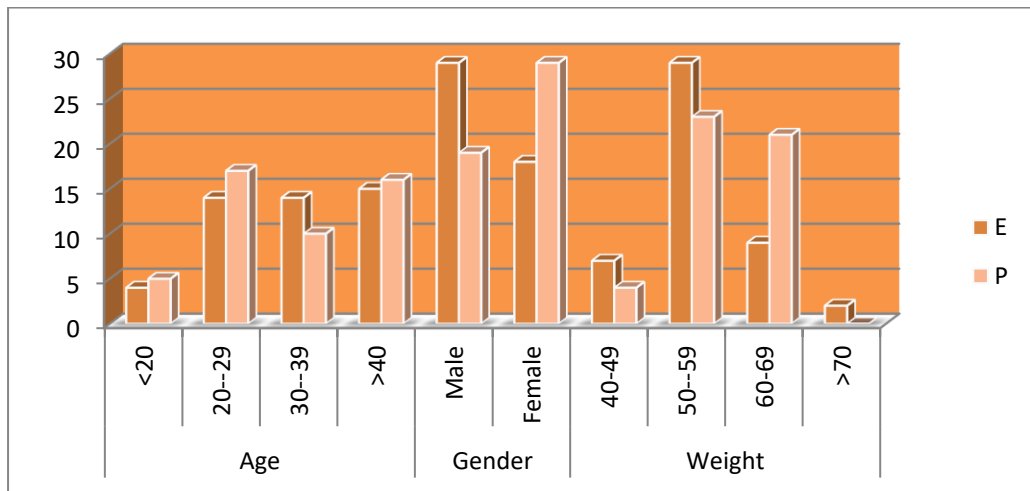


Figure 1. Demographic Profile of Participants

The SBP, DBP, MAP, Heart Rate and Saturation percentage expressed in terms of mean and standard deviation presented in Table 2 shows the mean and standard deviation of the SBP, DBP, MAP, Heart Rate, and Saturation percentages. There was a significant difference in blood pressure between the two groups based on the mean systolic blood pressure of the two groups. There was a decrease in SBP after induction (T1) and an increase in blood pressure after intubation (T1). There is a statistically significant difference between two drugs at all time intervals after intubation. There is a significant statistical difference in diastolic blood pressure between the two drugs at the T1, T3, and T5 time intervals after induction. The mean arterial blood pressure difference between groups I and II is also statistically significant at T1, T3, and T10. HR differences between two groups, there was a significant difference in HR at T3, T5, and T10, but the difference was not statistically significant. The mean saturation between the two groups was

98.8 percent for group I and 98.6 percent for group II, with a P value of 0.13 indicating an insignificant difference.

Table 2  
The Mean and Standard Deviation of various parameter at different time intervals

Particulars	Sub-particulars	Group I (Etomidate)		Group II (Propofol)		p-value
		Mean	Std. Deviation	Mean	Std. Deviation	
SBP [mmHg]	TB	109.9	8.6	111.3	7.5	0.42
	TI	107.4	11.6	95.1	7.8	<0.001
	T1	123.2	12.6	110.8	10.0	<0.001
	T3	115.6	11.7	105.1	10.3	<0.001
	T5	109.5	10.6	100.7	9.0	<0.001
DBP [mmHg]	T10	105.7	11.0	97.5	10.9	<0.001
	TB	66.7	6.9	69.1	6.3	0.072
	TI	62.7	6.9	59.9	5.6	0.032
	T1	78.4	10.9	68.9	7.5	<0.001
	T3	71.5	9.5	64.3	6.8	<0.001
MAP [mmHg]	T5	66.7	9.9	60.8	7.0	0.001
	T10	63.5	9.1	58.3	7.1	0.003
	TB	80.6	7.0	82.5	6.4	0.18
	TI	76.8	7.8	71.0	5.8	<0.001
	T1	92.7	10.5	82.0	8.2	<0.001
HR [per minute]	T3	85.3	8.9	77.5	7.3	<0.001
	T5	78.7	13.1	73.5	6.6	0.017
	T10	77.3	8.6	70.6	7.1	<0.001
	TB	83.9	10.4	83.0	12.0	0.72
	TI	81.0	11.1	76.8	13.1	0.11
Saturation [as percentage]	T1	96.6	11.2	90.5	15.1	0.29
	T3	90.5	13.2	83.3	12.7	0.008
	T5	84.6	12.6	77.3	11.4	0.04
	T10	80.2	12.4	72.7	11.3	0.03
	TB	97.6	1.1	97.7	0.8	
Mean saturation	TI	98.5	0.6	98.1	0.5	
	T1	98.8	0.6	98.6	0.5	
	T3	99.1	0.6	98.5	0.6	P = 0.13
	T5	99.2	0.6	98.6	0.6	
	T10	99.4	0.6	98.5	0.5	
Mean saturation	Mean	98.8	0.7	98.6	0.6	

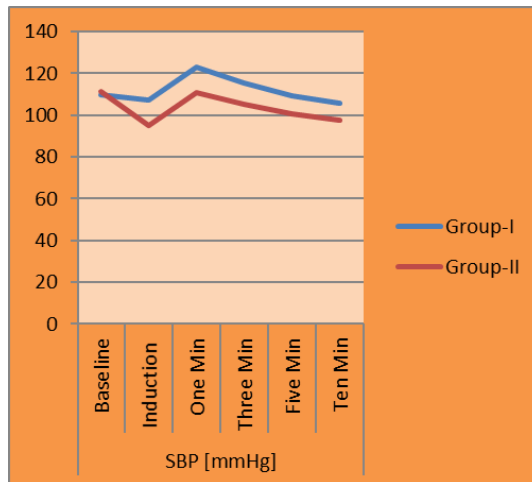


Figure 1. Comparison of SBP in group I &II

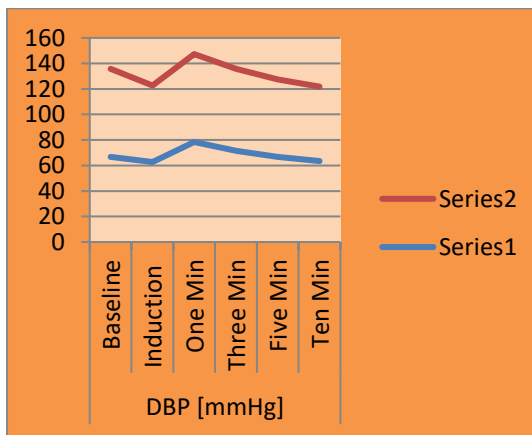


Figure 2. Comparison of DBP in group I &II

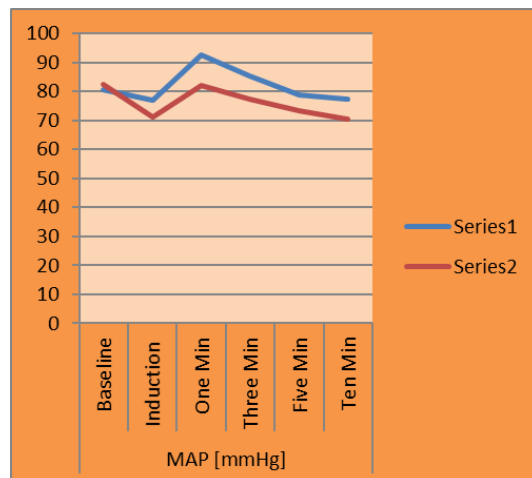


Figure 3. Comparison Of MAP In Group I &II

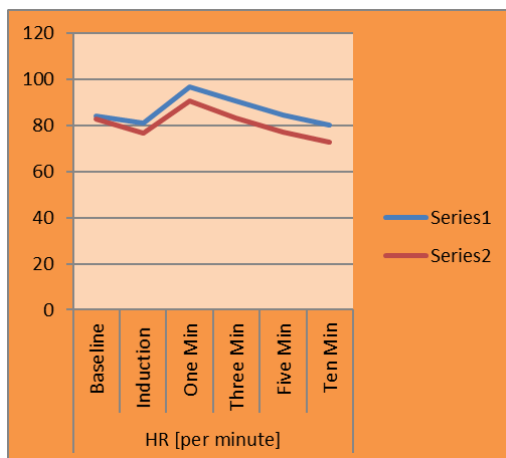


Figure 4. Comparison Of Heart Rate In Group I &II

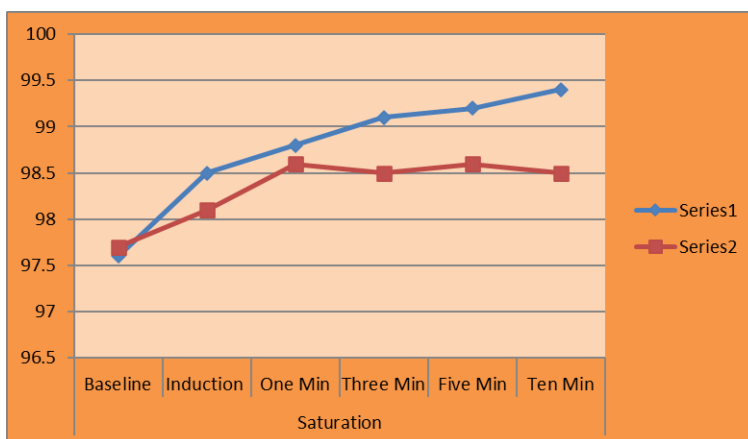


Figure 5. Comparison Of Oxygen Saturation In Group I &II

## Discussion

The study's primary objective was to compare the cardiovascular response to laryngoscopy and endotracheal intubation after propofol or etomidate anaesthesia. There was no significant difference in age, weight, laryngoscopy time, or grades between the two groups, according to the findings. According to the findings, there was a significant difference in SBP, DBP, and MAP between the two groups, with patients in group II showing more hypotension and patients in group I showing more stable blood pressure. Hiller et al, Reves JG et al, and Billard V et al previously demonstrated that inducing anaesthesia with propofol at a dose of 2-2.5 mg/kg body weight could lower blood pressure by up to 40%; this hypotension would occur in all patients, regardless of any underlying conditions [12,13,14]. In our study, we also discovered hypotension in 18.8 percent of the patients after propofol induction.

Propofol-induced hypotension is caused by a decrease in heart preload and afterload, which is not synchronised with compensatory responses such as increased cardiac output and HR, as observed by Schmidt C et al in their study

[15]. This hemodynamic drop would be exacerbated by high drug doses and rapid drug injection [16]. Brohon et al. investigated the effect of propofol or etomidate in combination with alfentanil or sufentanil on lumbar spinal surgeries and discovered that SBP decreased in the etomidate group when combined with sufentanil or alfentanil, but did not change in the propofol group when combined with each of them [17]. Bradycardia was reported in only one patient (2.1 percent) in the current study, but it was not statistically significant. Hug et al's study on 25000 patients found that propofol caused bradycardia in 4.2 percent of patients and hypotension in 15.7 percent of patients [18]. HR decreased significantly 5 and 10 minutes after induction, which was consistent with the findings of the Ko YK et al. study [19].

Tachycardia was observed in both groups following intubation, but it was not statistically significant ( $p = 0.19$ ). Sarkar M et al, Eames WO et al, and Zed PJ et al discovered that etomidate's effect on patients' hemodynamic conditions is more controllable than propofol's effect [20,21,22]. Previous research by Shah SB et al and Kaushal RP et al demonstrated that etomidate had greater haemodynamic stability [23,24]; similarly, in our study, we discovered that there was less variability in haemodynamics when compared to propofol, and etomidate had a better haemodynamic profile. However, Muriel C et al and Singh R discovered that etomidate caused a significant increase in blood pressure and heart rate after intubation[25,26].

## Conclusion

In the study, we discovered that etomidate produced more stable haemodynamic conditions than propofol-induced anaesthesia. Propofol caused a significant drop in blood pressure, resulting in hypotension, whereas etomidate showed stable haemodynamics. Tachycardia and hypertension were observed in both groups after intubation, but they were statistically insignificant. As a result, we can conclude that etomidate is a better choice for general anaesthesia induction than propofol.

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Conflict of interest: None declared

Ethical approval: taken

## References

1. Billard V, Moulla F, Bourgain JL, Megnigbeto A, Stanski DR. Hemodynamic response to induction. Propofol/fentanyl interaction. *Anesthesiology*. 1994 Dec;81(6):1384-93
2. Brohon E, Hans P, Schoofs R, Merciny F. Comparison of 4 anesthesia induction protocols on hemodynamic changes in tracheal intubation. *Agressologie*. 1993;34:83-4. [PubMed: 7802151]
3. Eames WO, Rooke GA, Wu RS, Bishop MJ. Comparison of the effects of etomidate, propofol, and thiopental on respiratory resistance after tracheal intubation. *Anesthesiology*. 1996;84:1307-11. [PubMed: 8669670]
4. Ed's Morgan GE, Mikhail MS, Murray MJ. 4th ed. New York: McGraw-Hill; 2006. *Clinical Anesthesiology*; pp. 200-2.



5. Frazee BW, Park RS, Lowery D, et al. Propofol for deep procedural sedation in the ED. *Am J Emerg Med.* 2005;23:190--5.
6. Gandamay, I. B. M., Antari, N. W. S., & Strisanti, I. A. S. (2022). The level of community compliance in implementing health protocols to prevent the spread of COVID-19. *International Journal of Health & Medical Sciences*, 5(2), 177-182. <https://doi.org/10.21744/ijhms.v5n2.1897>
7. Grundmann U, Silomon M, Bach F, et al. Recovery profile and side effects of remifentanil-based anaesthesia with desflurane or propofol for laparoscopic cholecystectomy. *Acta Anaesthesiol Scand.* 2001;45:320--6.
8. Hiller SC, Mazurek MS. Monitored anesthesia care. In: Barash PG, Cullen BF, Stoelting RK, editors. *Clinical Anesthesia*. 5th ed. Philadelphia: Lippincott Williams and Wilkins; 2006. pp. 1246-61.
9. Hug CC, Jr, McLeskey CH, Nahrwold ML, Roizen MF, Stanley TH, Thisted RA, et al. Hemodynamic effects of propofol: Data from over 25,000 patients. *Anesth Analg.* 1993;77:S21-9. [PubMed: 8214693]
10. Kaushal RP, Vatal A, Pathak R. Effect of etomidate and propofol induction on hemodynamic and endocrine response in patients undergoing coronary artery bypass grafting/mitral valve and aortic valve replacement surgery on cardiopulmonary bypass. *Ann Card Anaesth.* 2015 Apr-Jun;18(2):172-8
11. Kim TK, Park IS. Comparative study of brain protection effect between thiopental and etomidate using bispectral index during temporary arterial occlusion. *J Korean Neurosurg Soc.* 2011;50:497---502.
12. Ko YK, Kim YH, Park SI, Chung WS, Noh C, Lee JU. Comparison of etomidate and propofol on intubating conditions and the onset time associated with cisatracurium administration. *Korean J Anesthesiol.* 2015 Apr;68(2):136-40
13. Maruyama K, Nishikawa Y, Nakagawa H, et al. Can intravenous atropine prevent bradycardia and hypotension during induction of total intravenous anesthesia with propofol and remifentanil? *J Anesth.* 2010;24:293---6.
14. Morel J, Salard M, Castelain C, et al. Haemodynamic consequences of etomidate administration in elective cardiac surgery: a randomized double-blinded study. *Br J Anaesth.* 2011;107:503---9.
15. Muriel C, Santos J, Espinel C. Comparative study of propofol with thiopental and etomidate in anesthetic induction. *Rev Esp Anesthesiol Reanim.* 1991 sep-oct;38(5):301-4
16. Nyman Y, Von Hofsten K, Palm C, et al. Etomidate-Lipuro is associated with considerably less injection pain in children compared with propofol with added lidocaine. *Br J Anaesth.* 2006;97:536---9.
17. Nyman Y, von Hofsten K, Ritzmo C, et al. Effect of a small priming dose on myoclonic movements after intravenous anaesthesia induction with Etomidate-Lipuro in children. *Br J Anaesth.* 2011;107:225---8.
18. Ozgul U, Begec Z, Erdogan MA, et al. Effect of alkalisation of lignocaine for propofol injection pain: a prospective, randomised, double-blind study. *Anaesth Intensive Care.* 2013;4:501---4.
19. Paris A, Philipp M, Tonner PH, et al. Activation of alpha 2B-adrenoceptors mediates the cardiovascular effects of etomidate. *Anesthesiology.* 2003;99:889---95.
20. Reves JG, Glass P, Lubarsky DA, McEvoy MD, Martinez-Ruiz R. Intravenous anesthesia. In: Miller RD, editor. *Anesthesia*. 7th ed. New York: Churchill Livingstone; 2010. pp. 719-58.

21. Sarkar M, Laussen PC, Zurakowski D, et al. Hemodynamic responses to etomidate on induction of anesthesia in pediatric patients. *Anesth Analg.* 2005;101:645---50.
22. Sarkar M, Laussen PC, Zurakowski D, Shukla A, Kussman B, Odegard KC. Hemodynamic responses to etomidate on induction of anesthesia in pediatric patients. *Anesth Analg.* 2005;101:645-50. table of contents. [PubMed: 16115968]
23. Schmidt C, Roosens C, Struys M, Deryck YL, Van Nooten G, Colardyn F, et al. Contractility in humans after coronary artery surgery. *Anesthesiology.* 1999;91:58-70. [PubMed: 10422929]
24. Shah SB, Chowdhury I, Bhargava AK, Sabbharwal B. Comparison of hemodynamic effects of intravenous etomidate versus propofol during induction and intubation using entropy guided hypnosis levels. *J Anaesthesio Clin Pharmacol.* 2015 Apr-Jun;31(2):180-5
25. Shinn HK, Lee MH, Moon SY, et al. Post-operative nausea and vomiting after gynecologic laparoscopic surgery: comparison between propofol and sevoflurane. *Korean J Anesthesiol.* 2011;60:36---40.
26. Singh R, Choudhury M, Kapoor PM, Kiran U. A randomized trial of anesthetic induction agents in patients with coronary disease and left ventricular dysfunction. *Ann Card Anaesth.* 2010 Sep-Dec; 13(3):217-23
27. Widana, I.K., Sumetri, N.W., Sutapa, I.K., Suryasa, W. (2021). Anthropometric measures for better cardiovascular and musculoskeletal health. *Computer Applications in Engineering Education*, 29(3), 550-561. <https://doi.org/10.1002/cae.22202>
28. Zed PJ, Mabasa VH, Slavik RS, Abu-Laban RB. Etomidate for rapid sequence intubation in the emergency department: Is adrenal suppression a concern? *CJEM.* 2006;8:347-50. [PubMed: 17338847]