A COMPARATIVE STUDY OF THE EFFECT OF PROPOFOL AND ETOMIDATE AS AN INDUCTION AGENT ON HAEMODYNAMIC CHANGES DURING INDUCTION AND ENDOTRACHEAL INTUBTION

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ABSTRACT

Aims: Presently Propofol and Etomidate are popular as rapid acting inducing agents. Due to reflex sympathetic stimulation, direct laryngoscopy and endotracheal intubation typically cause a cardiovascular stress response characterised by hypertension and tachycardia. This study is conducted to compare the effects of these two drugs on hemodynamic responses during induction and endotracheal intubation, to compare time of induction to choose the better induction agent and to study adverse effects of the two drugs, if any.
Study design: Prospective double blind study
Place and Duration of Study: Department of anaesthesiology Dr D.Y Patil medical college hospital and research centre Pimpri Pune Duration -Sept.2018 -sept 2021.
Methodology: This is prospective randomized double-blind study. 60 ASA I and II patients randomly divided into two groups group P and group E of 30 each of either sex in age group of 18-65 years posted for elective surgery under general anesthesia. Group P:(n-30) received 2.5mg/kg Propofol and Group E:(n-30) received 0.3mg/kg Etomidate for induction. vital parameters such as HR, SBP, DBP, MAP, and SPO2 recorded at baseline(T0),before induction(T1), after induction(T2), during laryngoscopy(T3) ,after intubation at 1min, 2min, 3min, 5min and at 10 min. Time of induction was taken as period between time of start of study drug till loss of eyelash reflex
Conclusion: Induction time between the two study groups was statistically insignificant. ($p>0.05$) The fall in heart rate at post induction(T2), at 1 min, 2 min after intubation in Group P as compared to Group E was statistically significant, fall in SBP, DBP and MAP at post induction(T2), at 1 min, 2 min, 3 min and 5 min after intubation in Group P as compared to Group E was statistically significant. Pain on injection was more with propofol. However, myoclonus was more with etomidate

Keywords: **:** *Propofol, Etomidate, Laryngoscopy, endotracheal intubation*

1. INTRODUCTION

Anesthesiologists' tools for maintaining airway integrity include endotracheal intubation and laryngoscopy. Following its description by Rawbothem and Magill in 1921, endotracheal intubation has become a vital aspect of the anaesthetic management and critical care of the patient [1].

Reid and Brace characterised the hemodynamic response to laryngoscopy and tracheal intubation for the first time in 1940[2]. Due to reflex sympathetic stimulation, direct laryngoscopy and endotracheal intubation typically cause a cardiovascular stress response characterised by hypertension and tachycardia. This response is brief, lasting less than 10 minutes and occurring 30 seconds after laryngoscopy and intubation [3].

Hemodynamic stability, little respiratory side effects, and quick clearance are all desirable qualities in a general anaesthesia induction drug. Presently Propofol and Etomidate are popular as rapid acting inducing agents. Propofol, 2,6 diisopropylphenyl, is the most popular induction agent with its characteristics of rapid and smooth induction and recovery, decreased incidence of nausea and vomiting etc. while on the other side, it decreases blood pressure, cardiac output, and systemic vascular resistance[4,5] due to inhibition of sympathetic vasoconstriction and impairment of baroreceptor reflex regulatory system [6,7].

Propofol

Propofol chemically 2,6–diisopropofol, one of the groups of alkyl phenols. These are oils at room temperature, are insoluble in water and highly lipid soluble.

Metabolism:

Propofol is rapidly metabolized in liver by conjugation with glucuronide and sulphate, produce water soluble compounds, which are excreted in the kidney. The metabolites of propofol are inactive.

Kidneys and Lungs, are extrahepatic metabolism for propofol.

Pharmacokinetics:

- Initial distribution half-life of propofol is 2-8 minutes
- Elimination half-life is 4-23hours.
- Volume of distribution in central compartment is 20 -40 seconds.
- Clearance of propofol is 1.5 – 2.2 litre/min.
- Time of peak effect is 90-100seconds.
- Pharmacokinetics of propofol is altered by various factors like sex, weight, age, co morbidities and ongoing medication.

Etomidate

Etomidate is a carboxylate imidazole-containing molecule with hemodynamic stability, low respiratory depression, and protective actions on the brain. It has no effect on sympathetic nervous system, baroreceptor reflex regulatory system and it has an effect of increased coronary perfusion even on patients with moderate cardiac dysfunction; this makes it an induction agent of choice in cardiac disease patients.

Etomidate, imidazole derivative(R-(+)-pentylethyl-1H-imidazole-5 carboxylate sulfate), molecular weight is 342.36 kg water insoluble and is unstable in a neutral solution."

Solvents: 2mg/mL propylene glycol (35% by volume) solution with a pH of 6.9 lipid emulsion to reduce some of the side effects of etomidate

Metabolism: Etomidate is metabolized in the liver by

- Ester hydrolysis primarily
- N-dealkylation.

The main metabolite is inactive. Only 2% of the drug is excreted unchanged, the rest being excreted as metabolites by the kidney (85%) and in bile (13%)

Pharmacokinetics:
The kinetics of etomidate is best described by “An open three-compartment model”.
The drug has an initial distribution half-life of 2.7 minutes, a redistribution half-life of 29 minutes, and an elimination half-life that varies from 2.9 to 5.3 hours. Clearance of etomidate by the liver is high (18 to 25 mL/kg/min). Etomidate is 75% protein bound.
“In patients with cirrhosis, the volume of distribution is doubled, but clearance is normal; the result is an elimination half-life that is twice normal.”

Considering the common use of Propofol and Etomidate as an induction agent, this study is conducted to compare the effects of these two drugs on hemodynamic responses during induction and endotracheal intubation in a patient undergoing elective surgery under general anesthesia.

2. MATERIAL AND METHODS

After approval from medical ethics committee, Dr D Y Patil Medical College and Hospital, Pune, written informed consent taken from all the patients participating in the study. The study was carried out on sixty (60) patients ASA I and II undergoing elective surgeries under standard general anaesthesia. Unwilling patients, pregnant patients, patients with heart diseases were excluded from studies. 60 patients were divided into two groups of 30 each. Randomized, double blinded method was used for grouping the patients. The patients and investigator were not aware of the drugs given. Drugs were prepared and administered by the theatre anaesthesiologist who was not part of data collection or analysis.

- Group P:(n-30) received 2.5mg/kg Propofol iv given slowly for induction
- Group E:(n-30) received 0.3mg/kg Etomidate iv given slowly for induction.

The patients were kept nil per orally for 8 hrs. prior to surgery. On arrival in operation theatre standard anesthesia monitors including pulse oximeter, NIBP, ECG, etc. connected to the patient. Baseline vital parameters such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP), and SPO2 recorded. (T0)

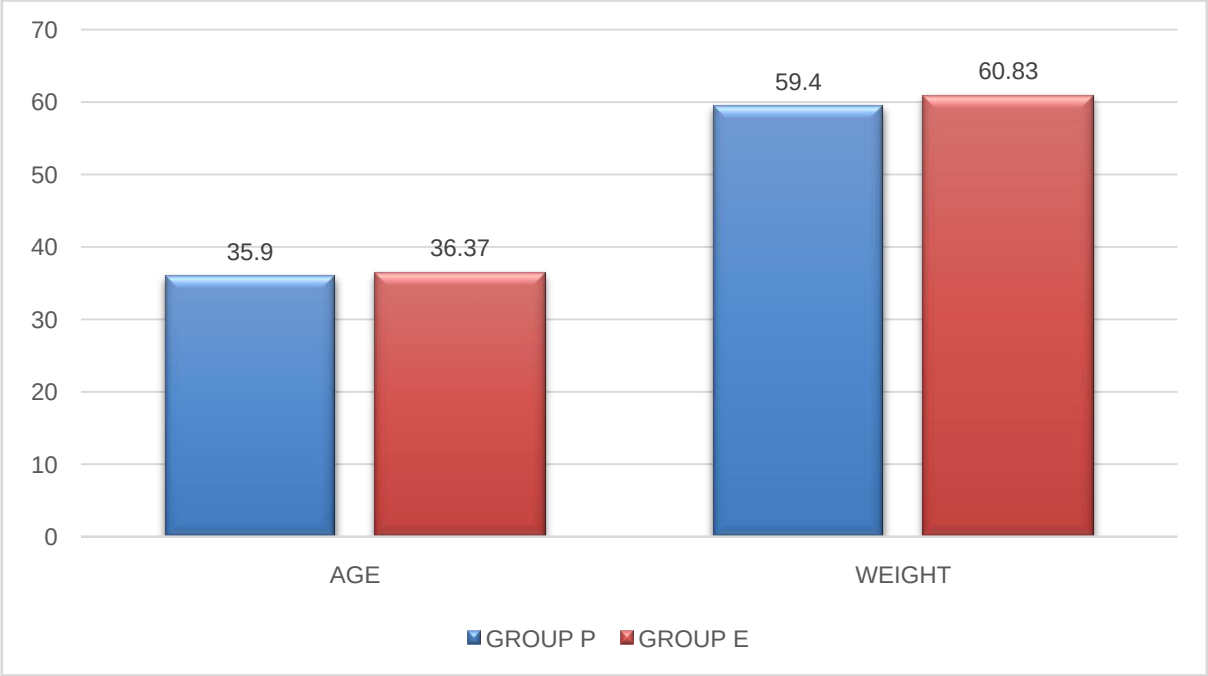
Premedication:
Patient was premedicated with Ondansetron 0.1 mg/kg i.v., inj. Midazolam 0.02 mg/kg i.v. and inj. Fentanyl 2 mcg/kg i.v PREOXYGENATION Patient was pre-oxygenated with 100% oxygen for 3 minutes. All vital parameters were recorded again(T1).

For induction - group P received Inj. Propofol 2.5mg/kg i.v and group E received Inj. Etomidate 0.3mg/kg i.v. given over 30 sec. After induction of anesthesia hemodynamic parameters were recorded(T2). Time of induction was taken as period between time of start of study drug till loss of eyelash reflex. The choice of muscle relaxant will be Inj. succinylcholine(2mg/kg) given after administering induction agent. Laryngoscopy and tracheal intubation attempted with appropriate size of endotracheal tube. All vital parameters will be recorded again during Laryngoscopy. (T3) Proper placement of endotracheal tube was confirmed by capnography and bilateral auscultation of chest. Periodic monitoring of vital parameters carried out at 1, 2, 3, 5 and 10 minute intervals post intubation. Anesthesia maintained with Oxygen, Nitrous oxide (33:66) and Isoflurane, along with intermittent boluses of muscle relaxant inj. vecuronium i.v. 0.1mg/kg as and when required throughout the surgery. At the end of surgery, patient will be reversed with inj. Glycopyrrolate 0.008 mg/kg i.v. along with Inj. Neostigmine methyl sulphate 0.05mg/kg intravenously.

3. RESULTS AND DISCUSSION

TABLE NO.1 AGE AND WEIGHT

VARIABLE	GROUP P MEAN ± SD	GROUP E MEAN ± SD	P VALUE
AGE	35.9 ± 10.39	36.37 ± 9.525	0.857
WEIGHT	59.4 ± 11.56	60.83 ± 14.14	0.669



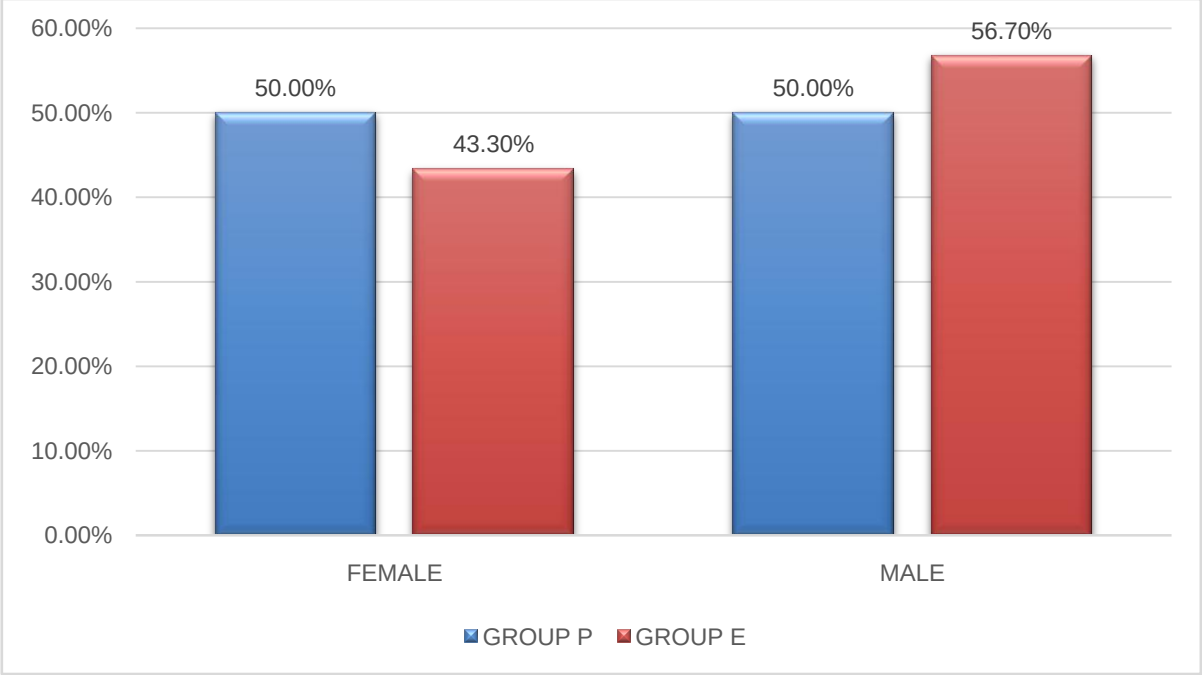
Graph 1: Bar graph showing comparison of mean age and weight between two groups

Table no.1 and graph 1 shows mean age and weight among two groups. There was no statistically considerable difference in two study groups.

TABLE NO. 2 GENDER

			GROUP		Total
			GROUP P	GROUP E	
SEX	FEMALE	Count	15	13	28
		%	50.0%	43.3%	46.7%
	MALE	Count	15	17	32
		%	50.0%	56.7%	53.3%
Total		Count	30	30	60
		%	100.0%	100.0%	100.0%

CHI SQUARE = 0.067, P VALUE = 0.706



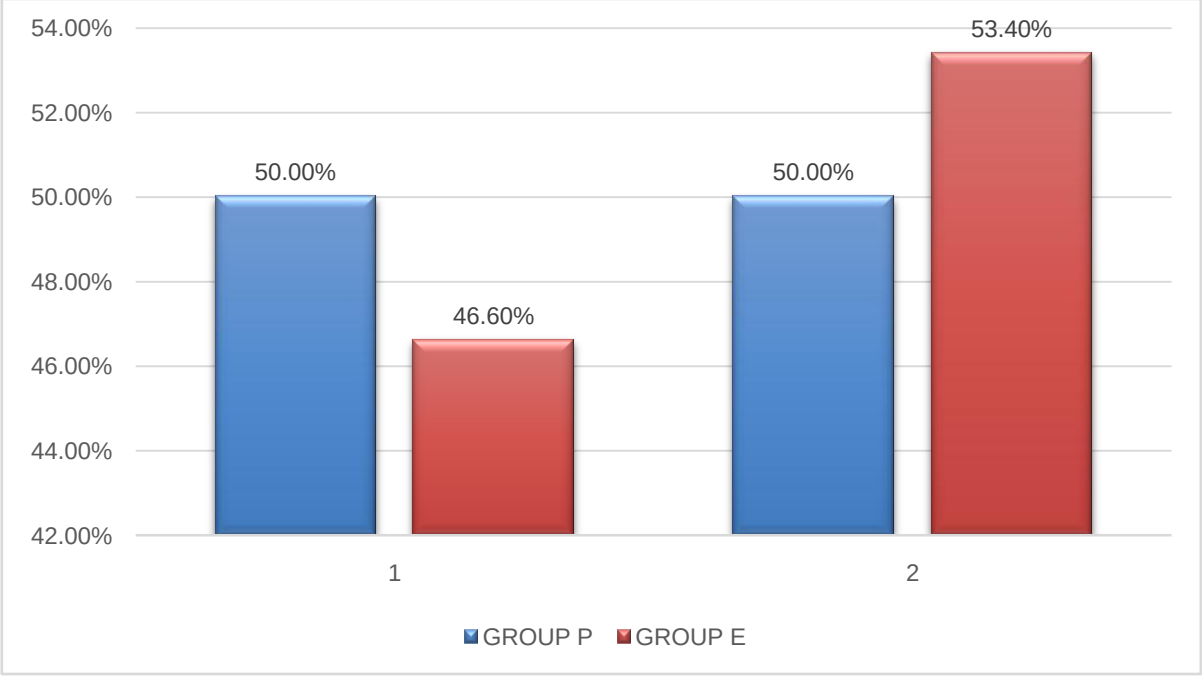
Graph 2: Bar graph showing gender distribution between two groups

Table no.2 and graph 2 shows gender wise distribution of cases in two study groups. There was no statistically considerable difference in two study groups

TABLE NO. 3 ASA GRADING

			GROUP		Total
			GROUP P	GROUP E	
ASA	I	Count	15	14	29
		%	50.0%	46.6%	48.3%
	II	Count	15	16	31
		%	50.0%	53.4%	51.7%
Total		Count	30	30	60
		%	100.0%	100.0%	100.0%

CHI SQUARE = 0.001, P VALUE = 1.000

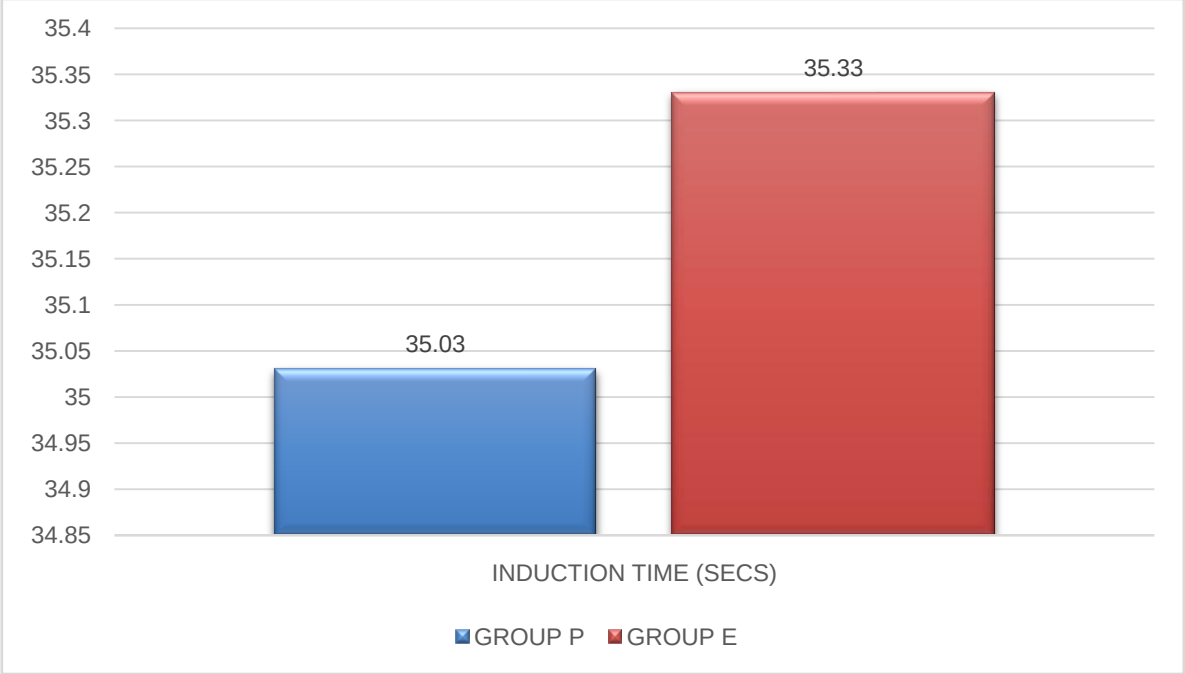


Graph 3: Bar graph showing ASA grade distribution of patients between the two study groups

Table no.3 and graph 3 show ASA grade wise distribution of cases in study groups. There was no statistically considerable difference in two study groups. Patients belonging to ASA grade I & II were only considered in the study.

TABLE NO.4 TIME OF INDUCTION

VARIABLE	GROUP P MEAN ± SD	GROUP E MEAN ± SD	P VALUE
INDUCTION TIME (SECS)	35.03 ± 2.498	35.33 ± 2.218	0.625

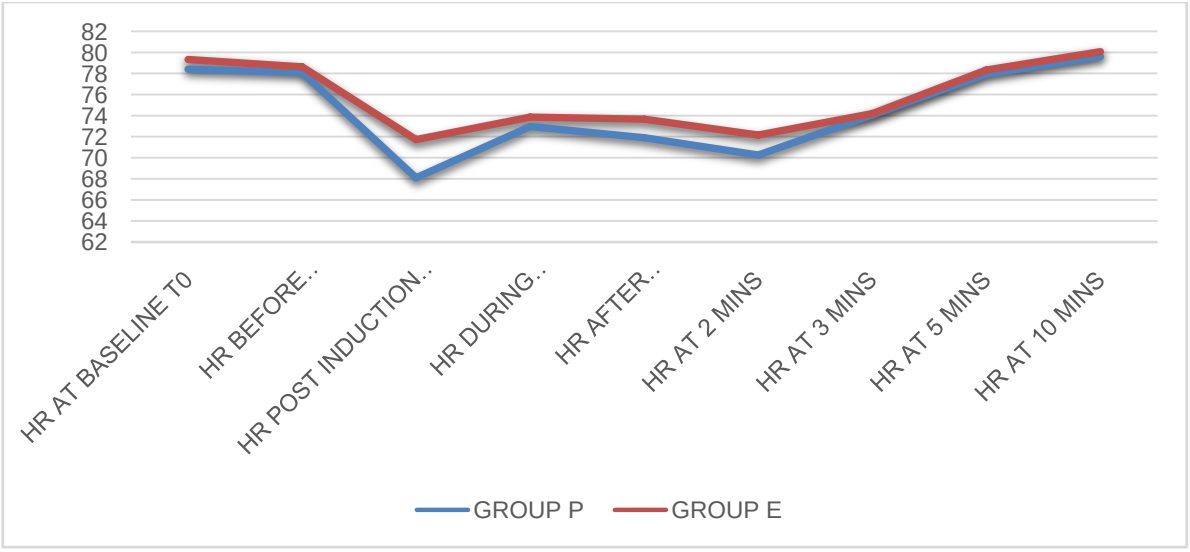


Graph 4: Bar graph showing induction time between two group

Table 4 and bar diagram 4 show induction time in Group P and Group E. Induction time between the two study groups was statistically insignificant. (p>0.05)

TABLE NO. 5 HEART RATE

VARIABLE	GROUP P MEAN ± SD	GROUP E MEAN ± SD	P VALUE
HR AT BASELINE T0	78.4 ± 2.74	79.33 ± 1.918	0.133
HR BEFORE INDUCTION T1	78.1 ± 2.59	78.63 ± 1.847	0.362
HR POST INDUCTION T2	68.10 ± 6.48	71.73 ± 2.016	*0.005
HR DURING LARYNGOSCOPY T3	72.97 ± 1.99	73.87 ± 3.181	0.194
HR AFTER INTUBATION 1 MIN	71.90 ± 1.32	73.67 ± 3.315	*0.009
HR AT 2 MINS	70.27 ± 1.23	72.17 ± 1.683	*0.001
HR AT 3 MINS	74.07 ± 3.07	74.20 ± 3.022	0.866
HR AT 5 MINS	77.93 ± 1.23	78.33 ± 1.493	0.262
HR AT 10 MINS	79.60 ± 1.30	80.07 ± 1.337	0.176

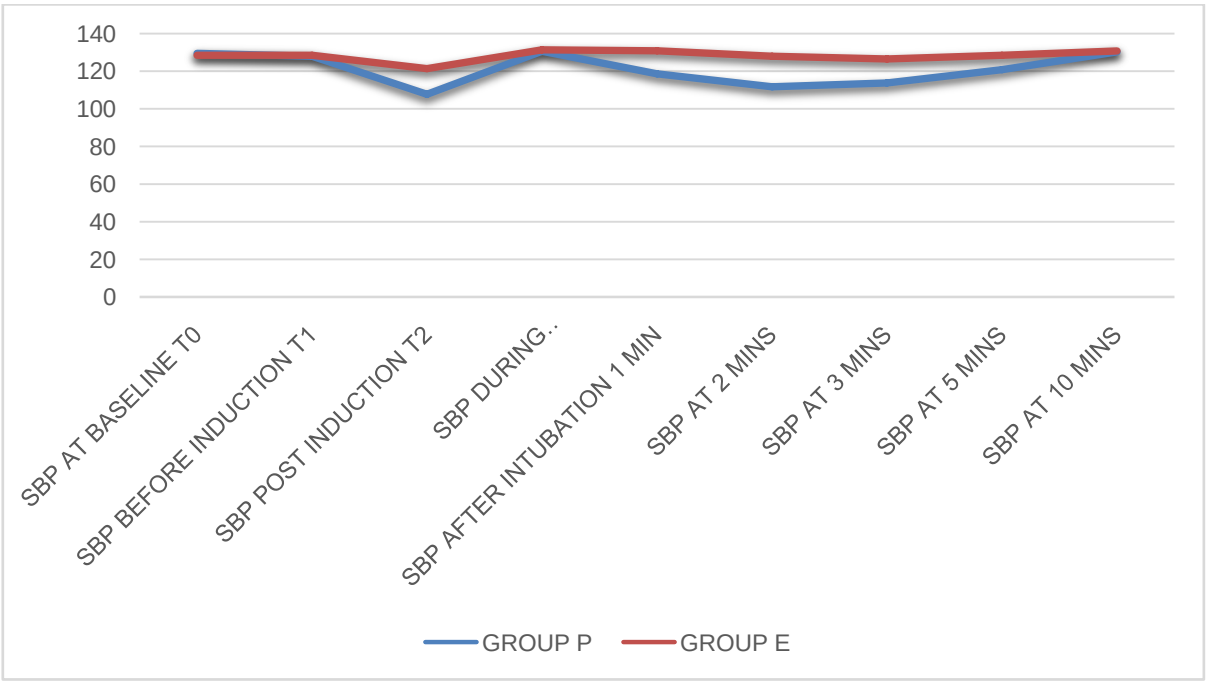


Graph 5

Table 5 and graph 5 show comparison of heart rate between two groups. In group P, HR decreased at post induction(T2) (68.10±6.48), at post intubation 1min (71.90±1.32) and at 2 min (70.27±1.23) as compared to group E. It was statistically significant.

TABLE NO. 6 SBP

VARIABLE	GROUP P MEAN ± SD	GROUP E MEAN ± SD	P VALUE
SBP AT BASELINE T0	129.53 ± 3.048	128.53 ± 1.961	0.136
SBP BEFORE INDUCTION T1	128.00 ± 1.742	128.33 ± 1.900	0.482
SBP POST INDUCTION T2	107.80 ± 2.483	121.43 ± 1.960	*0.001
SBP DURING LARYNGOSCOPY T3	130.70 ± 1.119	131.40 ± 1.673	0.062
SBP AFTER INTUBATION 1 MIN	118.67 ± 1.988	130.93 ± 1.143	*0.001
SBP AT 2 MINS	111.80 ± 3.078	128.07 ± 3.542	*0.001
SBP AT 3 MINS	113.87 ± 3.598	126.60 ± 1.499	*0.001
SBP AT 5 MINS	120.90 ± 1.125	128.53 ± 1.479	*0.001
SBP AT 10 MINS	130.33 ± 0.922	130.80 ± 1.126	0.084

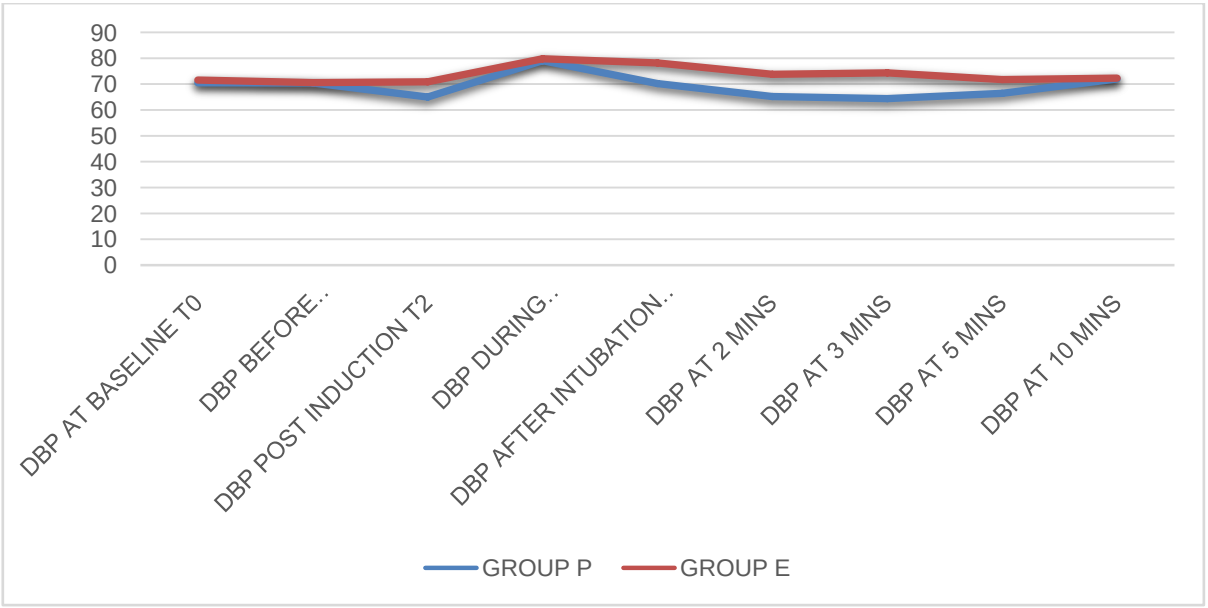


Graph 6

Table no 6 & Graph 6 show comparison in systolic blood pressure between two groups. In Group P, SBP decreased at post induction (T2) (107.80±2.483), after intubation at 1 min (118.67±1.988), at 2 mins (111.80±3.078), at 3 mins (113.87±3.598) & at 5 min (120.90±1.125).as compared to group E. It was statistically significant.

TABLE NO. 7 DBP

VARIABLE	GROUP P MEAN ± SD	GROUP E MEAN ± SD	P VALUE
DBP AT BASELINE T0	70.53 ± 3.319	71.60 ± 2.749	0.180
DBP BEFORE INDUCTION T1	70.47 ± 2.813	70.60 ± 2.978	0.859
DBP POST INDUCTION T2	65.00 ± 2.393	70.93 ± 3.051	*0.001
DBP DURING LARYNGOSCOPY T3	79.07 ± 2.227	79.80 ± 2.941	0.281
DBP AFTER INTUBATION 1 MIN	70.20 ± 2.592	78.20 ± 2.483	*0.001
DBP AT 2 MINS	65.20 ± 2.821	73.80 ± 2.295	*0.001
DBP AT 3 MINS	64.40 ± 2.660	74.37 ± 2.076	*0.001
DBP AT 5 MINS	66.47 ± 2.837	71.77 ± 3.126	*0.001
DBP AT 10 MINS	72.00 ± 2.913	72.30 ± 3.042	0.698

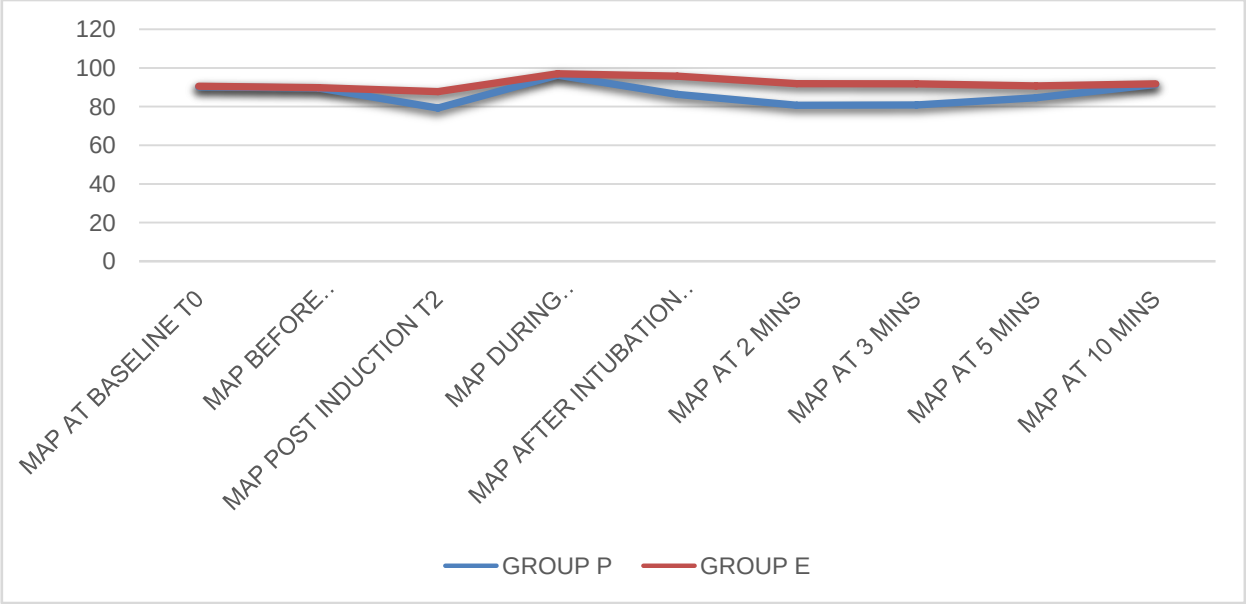


Graph 7

Table no 7 & Graph 7 show comparison of Diastolic Blood Pressure between two groups. In Group P, DBP decreased at post induction (T2) (65.10±2.393), after intubation at 1 min (70.20±2.592), 2 mins (65.20±2.821), 3 mins (64.40±2.660), and 5 mins (66.47±2.837) as compared to group E. It was statistically significant.

TABLE NO. 8 MAP

VARIABLE	GROUP P MEAN ± SD	GROUP E MEAN ± SD	P VALUE
MAP AT BASELINE T0	90.20 ± 2.33	90.57 ± 1.87	0.492
MAP BEFORE INDUCTION T1	89.64 ± 1.91	89.84 ± 2.01	0.695
MAP POST INDUCTION T2	79.26 ± 1.77	87.76 ± 2.04	*0.001
MAP DURING LARYNGOSCOPY T3	96.27 ± 1.57	97.00 ± 1.88	0.113
MAP AFTER INTUBATION 1 MIN	86.35 ± 1.85	95.77 ± 1.69	*0.001
MAP AT 2 MINS	80.73 ± 2.08	91.88 ± 2.00	*0.001
MAP AT 3 MINS	80.88 ± 2.00	91.77 ± 1.38	*0.001
MAP AT 5 MINS	84.61 ± 1.94	90.68 ± 2.16	*0.001
MAP AT 10 MINS	91.44 ± 1.99	91.80 ± 2.05	0.499



Graph 8

Table 8 & Graph 8 show comparison of Mean Arterial Pressure between two groups In Group P - MAP decreased at post induction (T2) (79.26±1.77), after intubation at 1 min (86.35±1.85), 2 mins (80.73±2.08), 3 mins (80.88±2), and 5 mins (84.61±1.94) as compared to group E. It was statistically significant.

TABLE NO. 9 SPO2

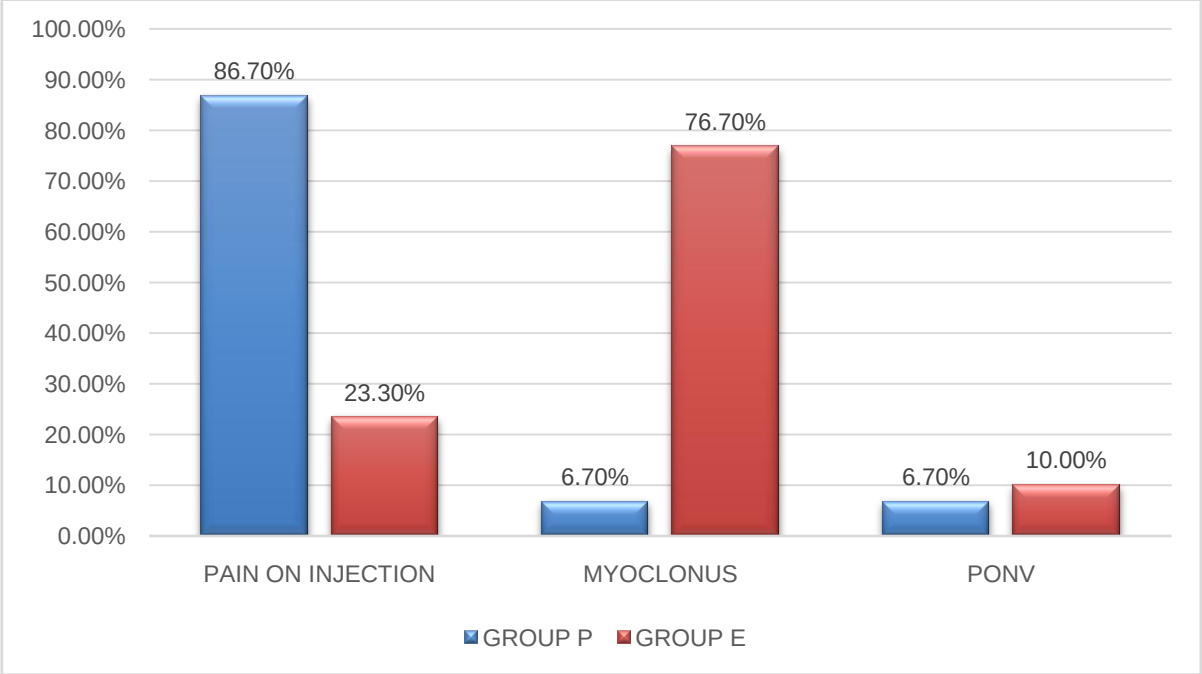
VARIABLE	GROUP P MEAN ± SD	GROUP E MEAN ± SD	P VALUE
SPO2 AT BASELINE T0	99.63 ± 0.490	99.63 ± 0.490	1.000
SPO2 BEFORE INDUCTION T1	99.63 ± 0.490	99.60 ± 0.498	0.795
SPO2 POST INDUCTION T2	99.60 ± 0.498	99.63 ± 0.490	0.795
SPO2 DURING LARYNGOSCOPY T3	99.63 ± 0.490	99.60 ± 0.498	0.795
SPO2 AFTER INTUBATION 1 MIN	99.60 ± 0.498	99.63 ± 0.490	0.795

SPO2 AT 2 MINS	99.60 ± 0.498	99.63 ± 0.490	0.795
SPO2 AT 3 MINS	99.60 ± 0.498	99.63 ± 0.490	0.795
SPO2 AT 5 MINS	99.60 ± 0.498	99.60 ± 0.498	1.000
SPO2 AT 10 MINS	99.63 ± 0.490	99.63 ± 0.490	1.000

Episodes of apnea were not observed in both the groups. There was no significant difference in oxygen saturation data between two groups. Samples are matched with $P > 0.05$.

TABLE NO. 10 SIDE EFFECTS

	GROUP P (N=30)	GROUP E (N=30)	P VALUE
PAIN ON INJECTION	26 (86.7%)	7 (23.3%)	0.001*
MYOCLONUS	2 (6.7%)	23 (76.7%)	0.001*
PONV	2 (6.7%)	3 (10.0%)	1.000



Graph 9

Table no 10 and Graph 9 show side effects of study drugs. In Group P - 26 patients out of 30 had pain on injection (86.7%) whereas in group E - 7 patients out of 30 had pain (23.3%). There was significant difference in incidence of pain on injection between the two groups. Sample showed P value < 0.05.

In Group P - 2 patients out of 30 had myoclonus activity (6.7%), whereas in Group E- 23 patients out of 30 had myoclonus activity (76.7%.). There was statistically significant difference in incidence of myoclonus activity between the two groups. Sample showed P value < 0.05.

In group P- 2 patients out of 30 had PONV (6.7%) whereas in Group E- 3 patients out of 30 had PONV (10%). There was no statistically significant difference in incidence of PONV between the two groups. Sample showed P value > 0.05.

Discussion

The autonomic nervous system's baseline tone and baroreceptor reflex modulation of autonomic outflow influence cardiac function and peripheral vascular resistance, allowing for hemodynamic stability during anaesthesia induction. Propofol is an intravenous induction agent which combines the desirable characteristics of smooth induction and rapid recovery from anesthesia. Propofol also reduces preload, afterload and contractility which directly effects on vascular smooth muscle and has venous dilating properties. It causes reduction in tonic levels of sympathetic activity.

Etomidate's key characteristics, such as hemodynamic stability, little respiratory depression, and favourable pharmacokinetics, allow for quick recovery after a single dose. Etomidate causes reduction in myocardial function and basal sympathetic tone. It maintains hemodynamic stability by preserving or augmenting baroreflex mechanisms.

Demographic profile

In the present study, there was no significant difference in demographic data between the two groups in relation to Age, weight, gender, and ASA grades. Samples are matched with p > 0.05. [Table 1,2 and 3].

Hemodynamic Parameters

Baseline Parameters:

In this study, the baseline values (before drug administration) of HR, SBP, DBP & MAP were comparable in all two groups (p = 0.133, p = 0.136, p = 0.180, p = 0.492 respectively) i.e., p value was not significant (p > 0.05).

For premedication, Inj Ondansetron 0.1mg/kg iv, Inj Midazolam0.02mg/kg iv and Inj fentanyl 2mcg/kg iv was used in all the cases.

Selected patients were induced with either Inj propofol 2.5 mg/kg iv or inj. Etomidate 0.3 mg iv according to the allocated groups.

Induction Time: According to our study the mean induction time in group P was 35.03 ±2.498 sec whereas in Group E was 35.33±2.218sec, which was statistically insignificant.

Dr. Supriya Agarwal et al[10] in 2020 conducted a comparative study between etomidate and propofol as an induction agent during induction, laryngoscopy and intubation showed that mean duration of time to loss of consciousness between two groups was statistically insignificant.

Results of our study was similar to above mentioned study

Haemodynamic parameters

Heart Rate:

Table 5 and graph 5 shows comparison of HR between the two groups at baseline (T0), before induction (T1), post induction (T2), during laryngoscopy (T3), after intubation at 1, 2, 3, 5 & 10min.

Our observations showed statistically significant difference in HR values at post induction (T2), after intubation at 1min and 2 min

There was decrease in heart rate in group P as compared to group E at Post induction (T2) group P (68.10+6.48) vs group E (71.73±2.016), at 1 min after intubation group P (71.90±1.32) vs group E (73.67±3.315), at 2 min After intubation group P (70.27±1.23).vs group E (72.17±1.683) and it was statistically significant with $P<0.05$.

The fall in heart rate at post induction(T2), at 1 min, 2 min after intubation in Group P as compared to Group E was statistically significant with P value (<0.05).

Djordjević B, Stojiljković M P. et al[11] in 1999 Jan-Feb, conducted a study to compare the cardio vascular effects of induction doses of propofol, etomidate and thiopentone on total 165 female patients randomly divided into three groups each one received a different anestheshetic agent propofol 2.5 mg/kg (n=58), etomidate 0.3mg/kg (n=54) or thiopentone 5mg/kg (n=53) showed that slowing down of radial pulse was more marked in propofol, than in etomidate or thiopentone group at 2 min, 5 min,10 min after induction of anesthesia.

The results of our study were similar to the one obtained by the above-mentioned study.

Systolic Blood pressure

In our study, SBP was compared between two groups at baseline (T0), before induction (T1), post induction (T2), during laryngoscopy (T3), after intubation at 1, 2, 3, 5 & 10min

Our observations showed statistically significant difference in SBP values at post induction (T2), after intubation at 1min and 2 min,3min and 5 min.

In our study, it was found that in group P at post induction(T2) mean SBP was 107.80± 2.483 whereas in Group E it was 121.43 ± 1.960, at 1 min after intubation in the Group P mean SBP was 118.67+1.988 whereas in Group E it was 130.93±1.143, At 2 min after intubation in the Group P mean SBP was 111.80± 3.078 whereas in Group E it was128.07±3.542, at 3min after intubation in the group P mean SBP was 113.87±3.598 whereas in Group E it was 126.6±1.499 and at 5 min after intubation in the Group P mean SBP was 120.9 ±1.125 whereas in Group E it was 128.58± 1.479

The fall in SBP at post induction(T2), at 1 min, 2 min, 3 min and 5 min after intubation in Group P as compared to Group E was statistically significant with P value (<0.05).

The following study shows similar results like our study

Thomas J Elbert[12] et al 1992 compared inj propofol 2.5mg/kg and etomidate 0.3mg/kg to study the sympathetic response, and found that cardiac and baroslopoes were well maintained with etomidate but decreased with propofol. Haemodynamic stability was seen more with etomidate due to preservation of sympathetic outflow and autonomic reflexes.

Djordjević B, Stojiljković MP et al[11] in 1999 Jan-Feb. Conducted a study to compare the cardio vascular effects of induction doses of propofol, etomidate and thiopentone on total 165 female scheduled for abortion patients randomly divided into three groups each one received a different anestheshetic agent propofol 2.5 mg/kg (n=58), etomidate 0.3mg/kg (n=54) or thiopentone 5mg/kg (n=53) showed significant greater decrease in blood pressure was in propofol group than etomidate or propofol after induction at 2,5 and 10 min after induction.

P. Savanth Kumar, P Lokesh et al[13] in 2021 conducted a study on etomidate vursus propofol for induction of general anesthesia, in this study group P comprised of 40 patients induced with inj. Propofol 2mg/kg and group E comprised of 40 patients induced with etomidate 0.3mg/kg. Study showed SBP decreased in propofol group from base line value at 1min,2min and 3 min of induction, at 1 min and 2 min of post intubation compared to group E and it was statistically significant.

Diastolic Blood Pressure

In our study, the DBP was compared between two study groups at baseline (T0), before induction (T1), post induction (T2), during laryngoscopy (T3), after intubation at 1, 2, 3, 5 & 10min.

Our observations showed statistically significant difference in DBP in group P compared to group E at post induction (T2), after intubation at 1min and 2 min,3min and 5 min.

In group P at post induction (T2) mean DBP was 65.00±2.393 whereas in group E it was 70.93±3.051, after intubation at 1 min in group P mean DBP was 70.20±2.592 whereas in group E it was 78.20±2.483, at 2min after intubation in group P mean DBP was 65.20± 2.821 whereas in group E it was 73.80±2.295, at 3min after intubation in group P mean DBP was 64.40±2.660 where as in group E it was 74.37±2.076 and at 5 min after intubation in group P mean DBP was 66.47+2.837 whereas in group E it was 71.77±3.126 [Table 6]

The fall in DBP at post induction(T2), at 1 min, 2 min, 3 min and 5 min after intubation in Group P as compared to Group E was statistically significant with P value (<0.05).

Following study shows similar results like our study

Shah, Jigna, et al[14]. in 2018 conducted a "Comparative study of propofol vs etomidate as an induction agent to evaluate hemodynamic changes during induction of anesthesia in controlled hypertensive patients". Sixty patients undergoing surgery under general anesthesia. 30 patients Group P were given inj fentanyl 2 mcg/kg, followed by inj propofol 1-2 mg/kg; and patients of Group-E were given inj fentanyl 2 mcg/kg, followed by inj etomidate 0.2-0.4 mg/kg. The fall mean in DBP in group P from baseline compered to group E was statistically significant at 1min ,3 min ,5 min and 10 min after induction.

Mean Arterial Pressure

In our study, the MAP was compared between two study groups at baseline (T0), before induction (T1), post induction (T2), during laryngoscopy (T3), after intubation at 1, 2, 3, 5 & 10min.

Our observations showed statistically significant difference in MAP values at post induction (T2), after intubation at 1min and 2 min,3min and 5 min.

In group P at post induction (T2) MAP was 79.26±1.77 whereas in group E it was 87.76±2.04, after intubation at 1 min in group P MAP was 86.35±1.85 whereas in Group E it was 95.77±1.69, at 2min after intubation in group P MAP was 80.73± 2.08) whereas in Group E it was 91.88±2.00, after intubation at 3 min in group P MAP was 80.88+2.00 whereas in group E it was 91.77±1.38 and at 5min after intubation in group P MAP was 84.61±1.94) whereas in group E 90.68±2.16.

The fall in Mean Arterial Pressure, post induction(T2), at 1 min, 2 min, 3 min and 5 min after intubation in Group P as compared to Group E was statistically significant with P value (<0.05).

Following studies show similar results like our study

Shah, Jigna, et al[14] in 2018 conducted a "Comparative study of propofol vs etomidate as an induction agent to evaluate hemodynamic changes during induction of anesthesia in controlled hypertensive patients". Sixty patients undergoing surgery under general anesthesia were randomly divided into two equal groups. Patients of Group P were given inj fentanyl 2 mcg/kg, followed by inj propofol 1-2 mg/kg; and patients of Group-E were given inj fentanyl 2 mcg/kg, followed by inj etomidate 0.2 to 0.4 mg/kg. The fall in mean MAP in group P compered to group E was statistically significant at 1min ,3 min ,5 min and 10 min after induction.

P. Savanth Kumar, P Lokesh et al[13] in 2021 conducted a study on etomidate vursus propofol for induction of general anesthesia , in this study group P comprised of 40 patients induced with inj. propofol 2mg/kg and group E comprised of 40 patients induced with etomidate 0.3mg/kg showed following induction, SBP, DBP and MAP decreased in propofol group from base line value at 1min,2min and 3 min, etomidate group show stable SBP,DBP and MAP at 1min, 2 min and 3 min of induction, at 1 min and 2 min of post intubation it was statistically significant.

Etomidate is considered to be an ideal induction agent specially for cardiac patients and small short-term surgeries.[38]

The myocardial oxygen supply demand ratio is well maintained with Etomidate. It provides a better safety during induction in patients at risk of cardiac disease with less cardiovascular depression than propofol.[39]

Oxygen Saturation

As per our study, there was no significant difference in oxygen saturation data between the two groups. Samples are matched with $p > 0.05$. [Table 8]. The episodes of apnea were not significant following induction and not associated with any fall in oxygen saturation.

JC Song[15] **et al** 2015 in his randomized clinical trial of Etomidate Anesthesia during ERCP Caused More Stable Haemodynamic Responses Compared with Propofol, in his study it showed that no patient from etomidate or propofol group experienced desaturation or apnea, oxygen saturation noted at point T0 = baseline values, 5 min after entering the endoscopy room; T1 = 5 min after the patients received midazolam; T2= when BIS was 50 (after induction of etomidate or propofol); T3 = at scope intubation and T4-10 = by 5-min intervals during the ERCP.

Results of our study are similar to above mentioned study

Adverse effects

On comparing the adverse effects Use of propofol was associated with increased pain on injection than etomidate ($p<0.05$). Out of 30 patients, 26 patients in group P had pain on injection (86.7%) where as in group E- 7 patients out of 30 had pain on injection (23.3%) [Table 9].

Our findings in consistent with finding of **Agarwal S et al**[16] in 2016 who did a comparive study between etomidate and propofol 100 patients undergoing general anesthesia, similar findings observed in comparive study of the effects of Etomidate and propofol in patient undergoing laparoscopic cholecystectomy conducted by **Zarina Wahab et al**[17] in 2020

Use of etomidate was associated with high incidence of myoclonus than propofol (p value<0.05). Out of 30 patients 2 patients in group P had myoclonus activity (6.7%). In group E 23 patients out of 30 had myoclonus activity (76.7%.) [Table 10]

Fragen, Robert J.MD et al[18] in 1976 in his comparative study between Etomidate and thiopental for induction of general anesthesia high incidence of myoclonia was seen with etomidate. Myoclonus does not originate from an epileptic focus. It arises due to subcortical disinhibition, leading to irritable leg syndrome during normal sleep. Myoclonus is characterised by uncomfortable legs, irritability, disability to sleep and numbness, with normal neurological examination.

Fatma Saricaoglu et al[19] 2011 in his study comparison of etomidate-lipuro, propofol and admixture at induction. 90 patients assigned into three groups; higher incidence of myoclonus seen in etomidate-lipuro group

Findings of our study are similar findings of above-mentioned studies

In our study, incidence of nausea and vomiting higher in group E 3 out of 30 patients (10%) as in group P 2 out of 30 patients (6.7%), although the difference was not statistically insignificant our findings are similar to the finding of Kumar A et al[20] 2018 study on propofol and etomidate as an anestheshetic agent for elective non cardiac surgery.

4. CONCLUSION

It is concluded that Propofol and etomidate are both safe anaesthetics. As an induction drug, Etomidate retains superior haemodynamic stability than Propofol. Propofol caused increased pain during injection. Etomidate, on the other hand, caused increased myoclonus. There were no severe adverse effects or complications associated with either treatment.

ETHICAL APPROVAL

The authors of this study hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

Consent

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Dr Bhavini Shah and Dr Shweta Birajdar, the authors of this study, declare that no competing interests exist.

AUTHORS' CONTRIBUTIONS

'Dr Bhavini Shah' designed the study. 'Dr. Shweta Birajdar' performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. 'Dr Bhavini Shah' and 'Dr. Shweta Birajdar' managed the analyses of the study. Both authors read and approved the final manuscript.

REFERENCES

1. Magill, Endotracheal Anesthesia: Proceedings of the Royal Society of Medicine. 1928;22(2): p985-989.
2. Ried IC, Brace DE - Irritation of the respiratory tract and its reflex effect upon heart; Surg Gynaec and Obst; 1940:70: pg 157-162.
3. Stoelting RK, Circulatory changes during laryngoscopy and tracheal intubation: influence of duration of laryngoscopy with or without lidocaine. Anesthesiology:1977; 47 pg 381-841
4. Hugo Van Aken H, Meinshausen E, Prien T, et al. The influence of fentanyl and tracheal intubation on the hemodynamic effects of anesthesia induction with propofol/N2O in humans. Anesthesiology 1988; 68: pg 157-163.
5. Stoelting, Roberta L. Hinges, Katherine E. Marschall. Stoelting's Anesthesia and Co-existing Disease. 5th Edition. Philadelphia: Churchill Livingstone, 2009.
6. Paris A, Philipp M. Tonner PH, et al. Activation of alpha 2B-adrenoceptors mediates the cardiovascular effects of etomidate. Anesthesiology. 2003:99:889-895.
7. Morel J. Salard M, Castelain C, et al. Haemodynamic consequences of etomidate administration in elective cardiac surgery: a randomized double-blinded study. Br J Anesthesh. 2011; 107:503-509
8. Snell RS. The Respiratory System in the Head and Neck. In: Clinical Anatomy by regions. 9th edition. Taylor C, editor. Lippincott Williams and Wilkins; Philadelphia: 2012;639-649.

9. Bishop MJ, Bedford RF, Kil HK. Physiologic and Pathophysiologic responses to intubation. In: Benumof JL. Airway Management – Principles and Practise. 1st edition. Mosby; New York: 1996;102-118
10. Dr. Agarwal Supriya, Sharma Vidushi et al A comparative study between Etomidate and Propofol as an induction agent during induction, laryngoscopy and intubation, International Journal of Medical and Biomedical Studies, 2020; Volume 4(12):165-167.
11. Djordjević B, Stojiljković MP, Loncar-Stojiljković D, Krivokapić D, Vojnosanit et al A clinical comparison of Cardiovascular effects of induction doses of the intravenous anesthetic, propofol, etomidate and thiopentone]. Pregl. 1999 Jan-Feb;56(1):15-19. Serbian.
12. Ebert TJ, Muzi M, Berens R, et al. Sympathetic responses to induction of anesthesia in humans with propofol or etomidate. Anesthesiology 1992; 76:725-733.
13. P. Savanth Kumar, P. Lokesh, Balad Karunakar et al A Study on Etomidate versus Propofol for Induction of General Anesthesia-A Comparative Study International Journal of Health and Clinical Research, 2021;4(8):101-107.
14. Shah Jigna, et al. Comparative study of propofol vs etomidate as an induction agent to evaluate hemodynamic changes during induction of anesthesia in controlled hypertensive patients. Anesthesia, Pain & Intensive Care: An international journal of anesthesiology, pain management, intensive care & resuscitation, 2018; 22(3): 361-367.
15. Song JC, Lu ZJ, Jiao YF, Yang B, Gao H, Zhang J, Yu WF. Etomidate Anesthesia during ERCP Caused More Stable Haemodynamic Responses Compared with Propofol: A Randomized Clinical Trial. Int J Med Sci 2015; 12(7):559-565.
16. Aggarwal S, Goyal VK, Chaturvedi SK, Mathur V, Baj B, Kumar A. A comparative study between propofol and etomidate in patients under general anesthesia. Braz J Anesthesiol. 2016 May-Jun;66(3):237-241.
17. Wahab Z, Heisnam I, Nushrat M, et al. A comparative study of the effect of etomidate and propofol induction on haemodynamic response and serum cortisol levels in patients undergoing laparoscopic cholecystectomy. J. Evid. Based Med. Healthc. 2020; 7(4), 186-190.
18. J. Fragen, Nancy Caldwell, Edward A. Brunner. Clinical use of Etomidate for anestheshetic induction: A preliminary report. Anesthesia analgesia 1976; 55:730-731.
19. Fatma Saricoaglu, Sennur Uzun, Oguzhan Arun, Funda Arun, Ulku Aypar, et al. A clinical comparison of etomidate –lipuro and admixture at induction. Saudi journal of anesthesia 2011; 5:62-66.
20. Kumar A, Shekhawat KK, Sharma R, et al. A comparison of propofol and etomidate as anestheshetic agents for elective non-cardiac surgery. Int J Res Med Sci 2018;6 (10):3454-3460.