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To Compare and Evaluate the Hemodynamic Effects of Etomidate and Propofol in Patients with Controlled Hypertension Undergoing Abdominal Surgery

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Abstract

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INTRODUCTION

Inducing a patient in General anaesthesia during most of the times involve giving intravenous anaesthetic agent and securing a definitive airway. It is observed that most of the patients experience three periods of circulatory instability during general anaesthesia: during induction, during and after tracheal intubation, and during the immediate period surrounding awakening or extubation. We desire an agent for induction which should preserve hemodynamic stability during induction and during endotracheal intubation, produce minimal cardiovascular side effects.

Patients with hypertension frequently present for surgical procedures. Hypertension may be associated with either abnormal baseline elevation of cardiac output, systemic vascular resistance, or both. Concentric left ventricular hypertrophy and altered diastolic function ensues in patients with chronic hypertension. Dingle (1966) and Forbes and Dally (1970) suggested that the hypertensive response of normal subjects to laryngoscopy and intubation might be enhanced and prove dangerous to hypertensive subjects [12](1, 2).

Since the introduction of general anaesthesia, no ideal induction agent has yet been discovered in terms of providing a stable hemodynamic during endotracheal intubation. Also, there are a few published studies in the literature that have compared the physiological effect of various induction agents on hypertensive patients.

This study is an attempt to compare the effect on hemodynamic parameters and other side effects of both drug administered in titrated doses to achieve adequate depth of anaesthesia in order to choose a safe induction agent in hypertensive patients undergoing abdominal surgery under general anaesthesia.

Methodology and Results

This study was conducted in a tertiary level institute. After approval of institutional ethical committee, 90 patients of either sex who gave consent for the study and who were previously diagnosed with hypertension, receiving any antihypertensive medication, single or combined and were having controlled blood pressure (≤ 150/ 90 mm Hg) at the time of pre-anaesthetic check-up, scheduled for elective open abdominal surgeries under general anaesthesia were taken for study. The patients were randomly but equally placed into two groups, Group P (Induction with Propofol), and Group E (Induction with Etomidate).

Patients with ASA physical status III & IV, undergoing Emergency surgery, Patient with history

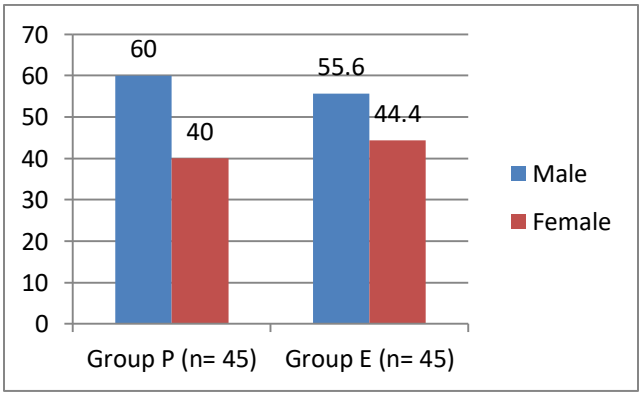
of hypersensitivity to Propofol or Etomidate, Patients with anticipated difficult airway, Heart block or dysrhythmia or Bleeding diathesis were not taken up for study.

Group P patients received Propofol and Group E patients received Etomidate as induction agent till there was inability to respond to verbal commands. Muscle relaxant, vecuronium was given to facilitate endotracheal intubation. 60s after the induction of anaesthesia and just before endotracheal intubation, haemodynamic variables were recorded. The patients were intubated with appropriate size endotracheal tube. At the end of the surgery, residual neuromuscular blockade was reversed and extubation was performed. Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), Mean blood pressure (MBP) and oxygen saturation (spO_2) were continuously monitored and recorded at 1,5,10,15,25,30 minutes after the endotracheal intubation and 1, 5, 30 minutes after extubation.

Statistical Analysis

The obtained data was compared and presented as Mean ± SD, frequency and percentage. The various categorical variables studied during observation period were compared using student's t test. The critical value of `p' indicating the probability of significant difference was taken as <0.05 for comparison.

Results



Graph 1: Sex distribution vs. Group (in percentage)

Graph 1 shows distribution of male and females in study. In group P, out of 45 patients, 27 (60%) were male and 18 (40%) were female. In group E, out of 45 patients, 25 (55.6%) were male and 20 (44.4%) were female. Intergroup comparison between groups showed p=0.670 which was statistically non-significant (p>0.05).

Table 1: Age Distribution (In years) vs. Group

Group	Mean ± SD	t-value	p-value
P	53.47±8.195	-0.012	0.990 (NS)
E	53.49±9.251		

In both the groups, patients were between 31 to 71 years of age. The mean age of group P is 53.47±8.195 years and that of group E is 53.49±9.251 years. The mean age of both groups were compared by Students t test. The t-value was -0.012 and p value was 0.990 which was statistically non-significant.

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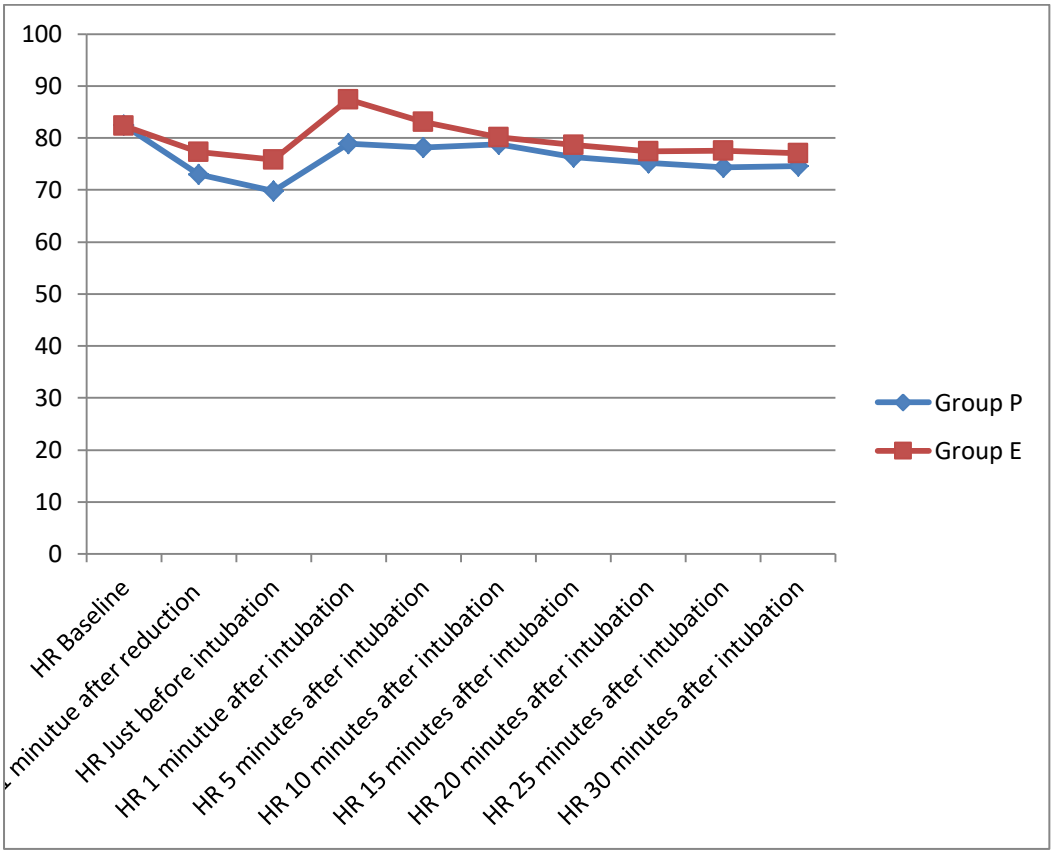
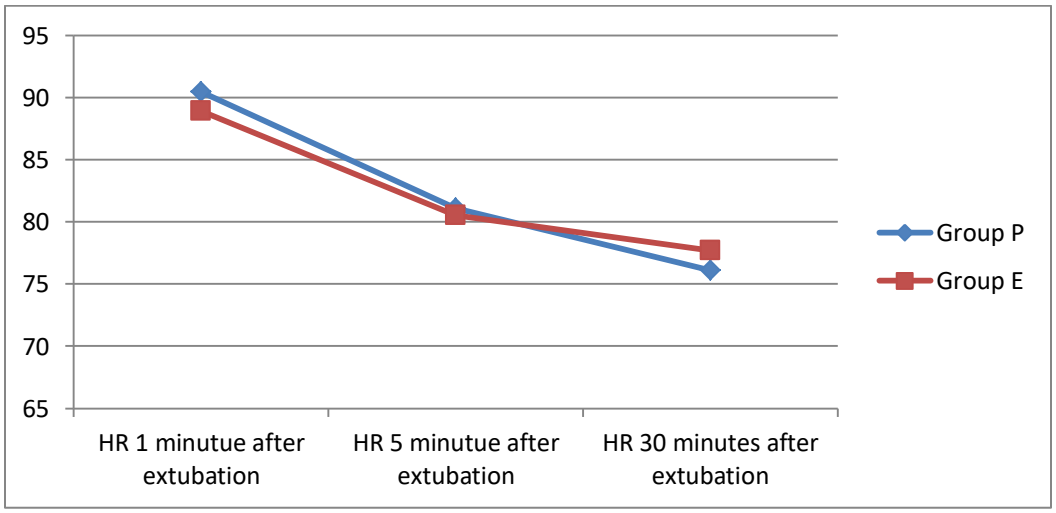
Graph 2: Mean Heart Rate (HR) in beats per minute (bpm)





Mean heart rate for each group was calculated at each time interval and was compared using Students't test. The baseline heart rate for each group was comparable, with group P having a mean Heart Rate of 82.5±11.2 and group E having a mean Heart Rate of 82.3±11.5. The t value was 0.083 and p value was 0.934. Therefore, there was no statistical significance seen between the groups at baseline Heart Rate.

Whereas, significant difference (p- value – 0.032, 0.003, 0.000, 0.020) in heart rate among the groups was seen at 1 minute after induction, before intubation, 1 minute and 5 minutes after intubation i.e. heart rate decreased more in group P in

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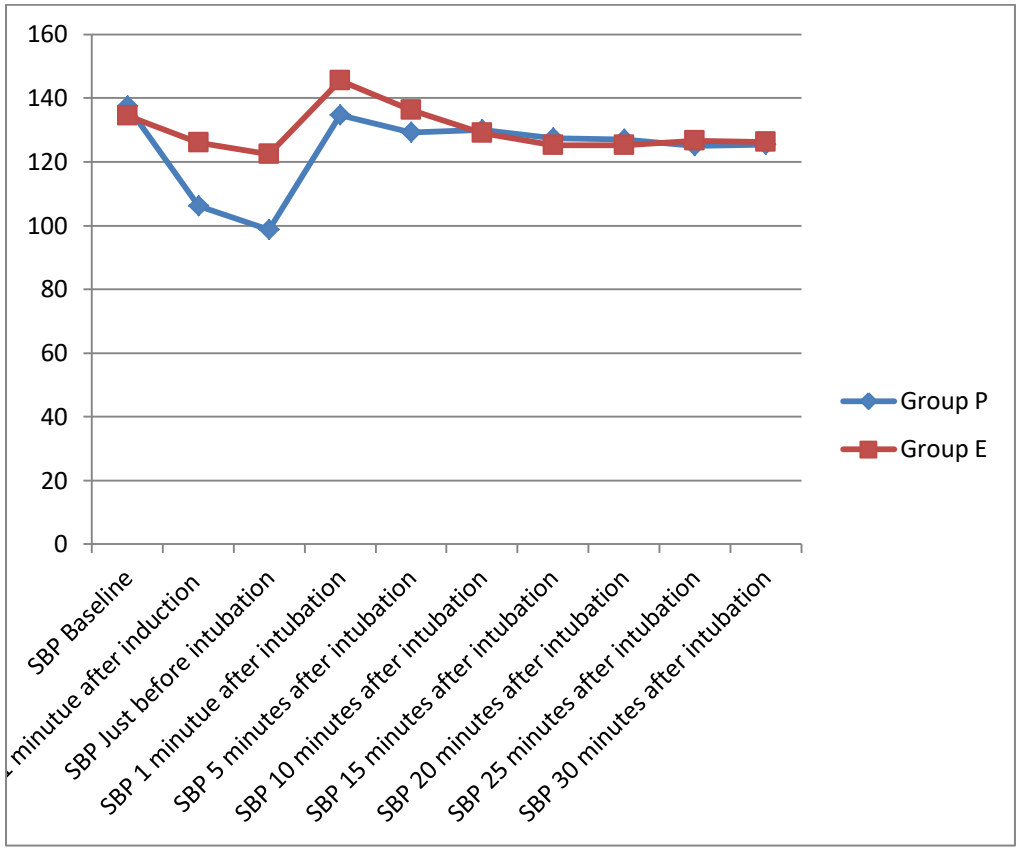
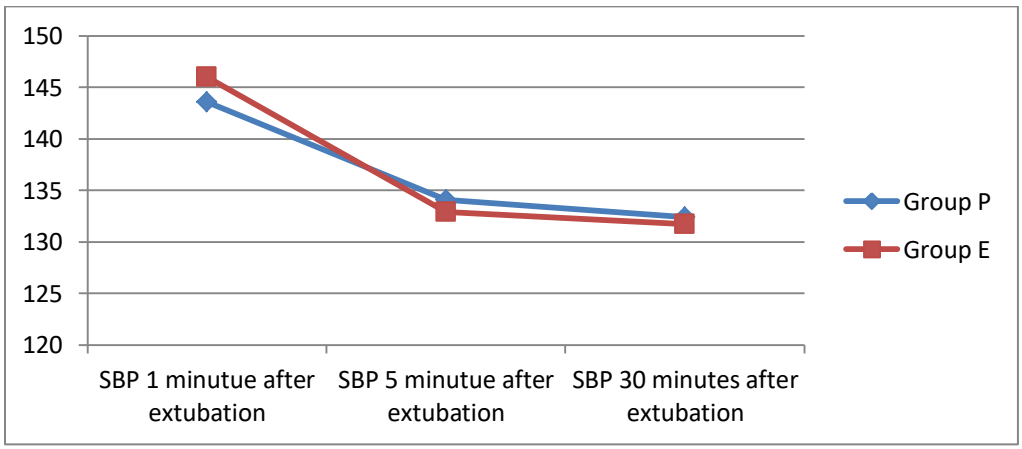
comparison to group E. No significant difference in heart rate was observed after 10 minutes of intubation and the p values were >0.05. Heart Rate after extubation in both the groups was also comparable and there was no statistically significant difference between the groups at 1 minute, 5 minutes and 30 minutes after extubation.

Graph 3: Systolic blood pressure (SBP) (mmHg)





Systolic blood pressure (SBP) was compared in both the groups using Students''t' test at various time intervals before and after intubation and after extubation. The baseline SBP were comparable among both the groups with no statistical significance (p value = 0.074). But the difference in SBP of both the groups at 1min after induction, just before intubation and 1, 5 minutes after induction was

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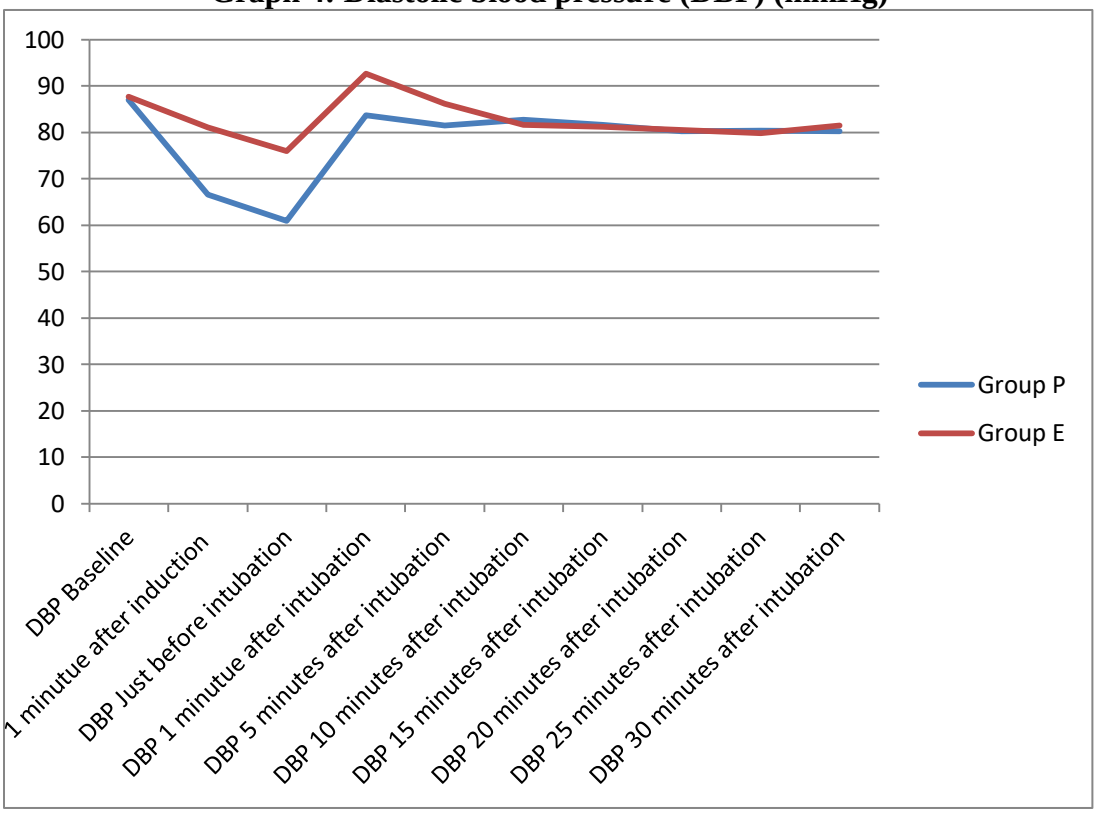
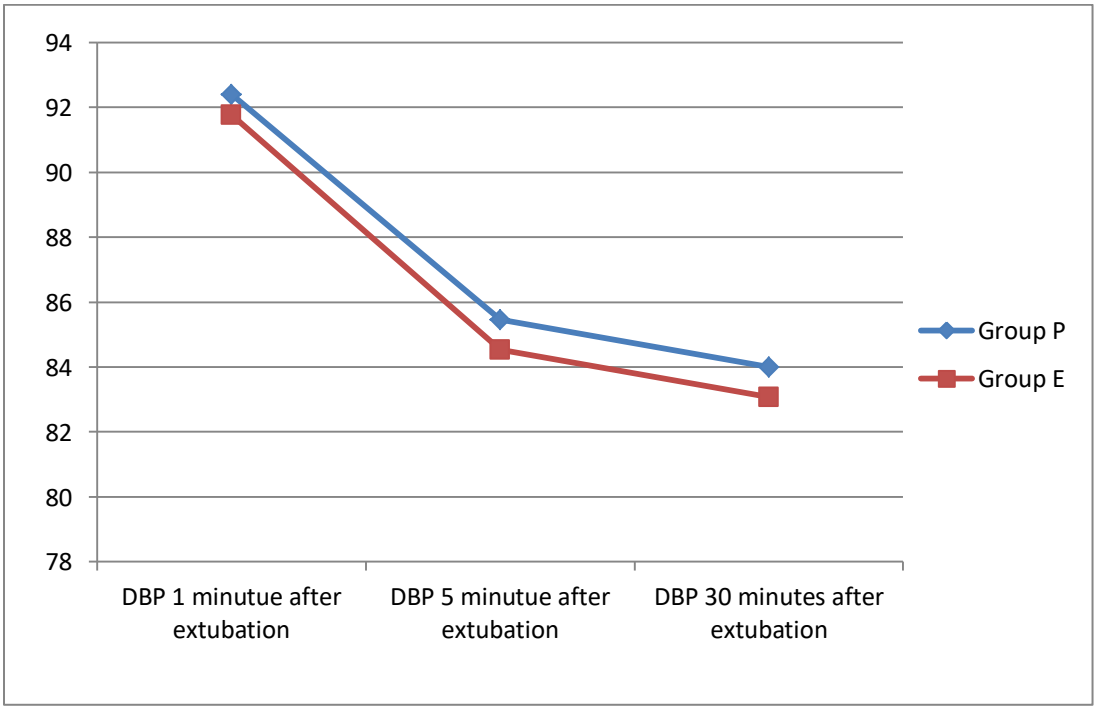
statistically significant with p values going below 0.01. The fall in SBP in group P was more than in group E just after induction till 5 minutes after intubation. There was no significant difference in SBP in both the groups at 10, 15, 25, 30 minutes after intubation and after extubation.

Graph 4: Diastolic blood pressure (DBP) (mmHg)





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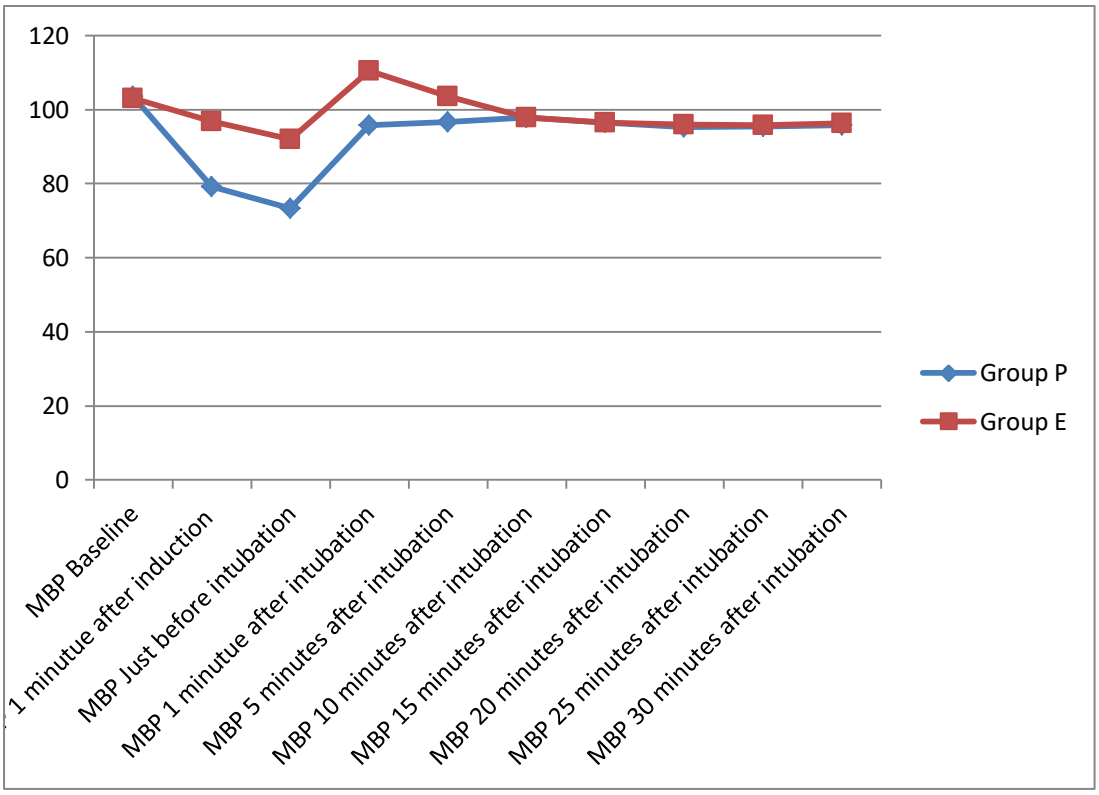
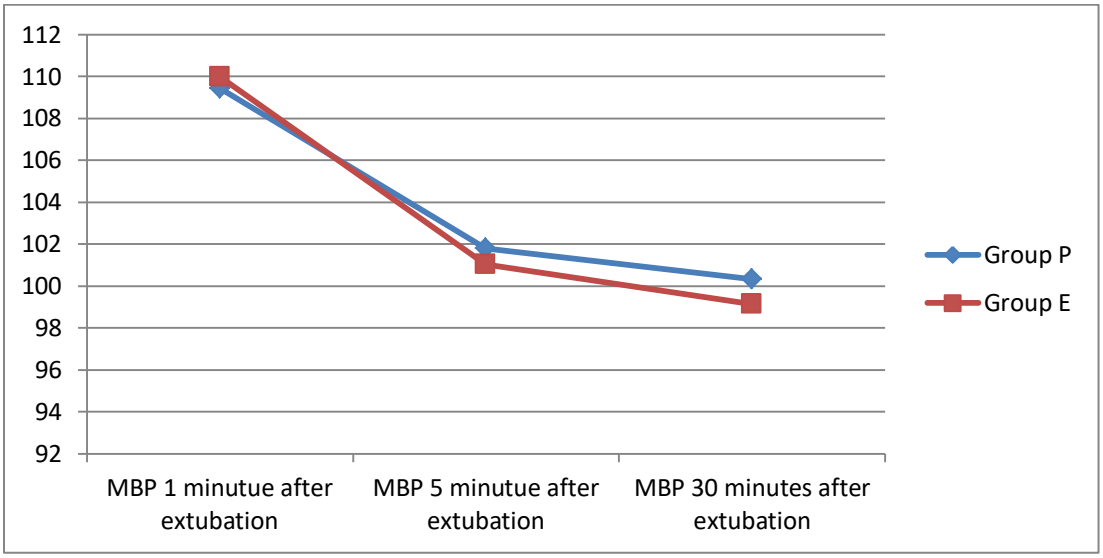
The baseline Diastolic Blood Pressure (DBP) in group P was 86.95±4.17 and in group E was 87.64±3.82. This was not statistically significant as the p value was 0.416. There was significant difference in the DBP between both the groups at 1 minutes after induction, just before intubation and 1, and 5 minutes after intubation (p-value for all was <0.01). The fall in DBP in group P was more than that in group E. There was no significant difference among the groups at 10, 15,20,25,30 minutes after intubation and after extubation 1, 5 and 30 minutes.

Graph 5: Mean blood pressure (MBP) (mmHg)





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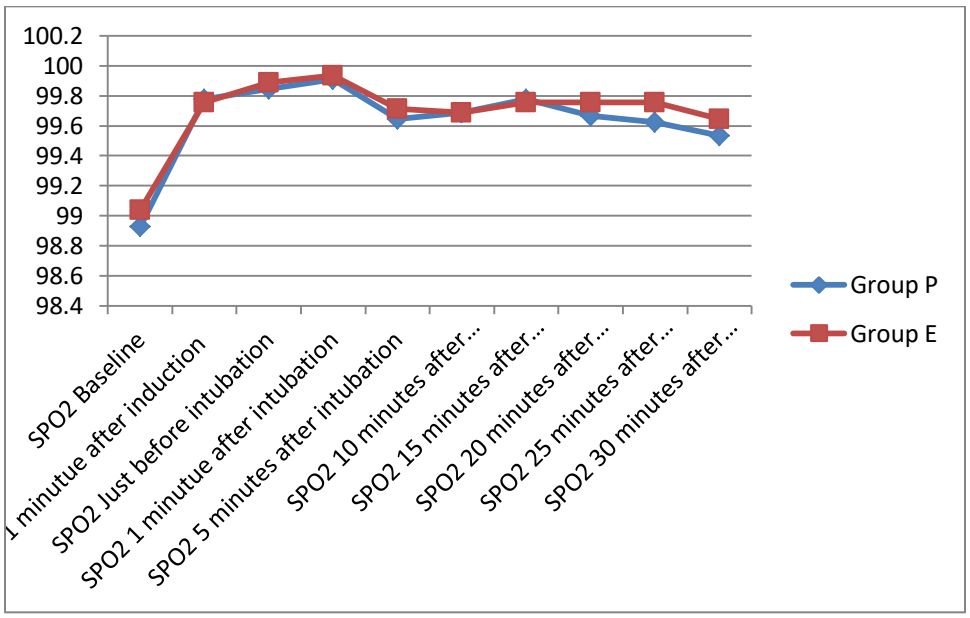
Corresponding mean blood pressure (MBP) at each interval among the two groups was compared for statistical evaluation using Student's-t test. Baseline MBP was comparable in both the groups and the difference was not statistically significant (p value = 0.558). The p-values of the difference between both the groups at MBP 1 minute after induction, before intubation and 1, 5 minutes after extubation were all <0.01 making them statistically significant. Whereas there was no significant difference among the MBP in both the groups at 10,15,20,25,30 minutes after intubation and 1,5,30 minutes after extubation as their p-value was >0.05.

Hence, in both the groups, there was significant difference after induction till 5 minutes after intubation when HR, SBP, DBP and MBP were compared whereas at 10, 15, 20, 25, 30 minutes after intubation and till 30 minutes after extubation there was no difference among the above parameters in both the groups as compared to the baseline.

Graph 6: SpO_2



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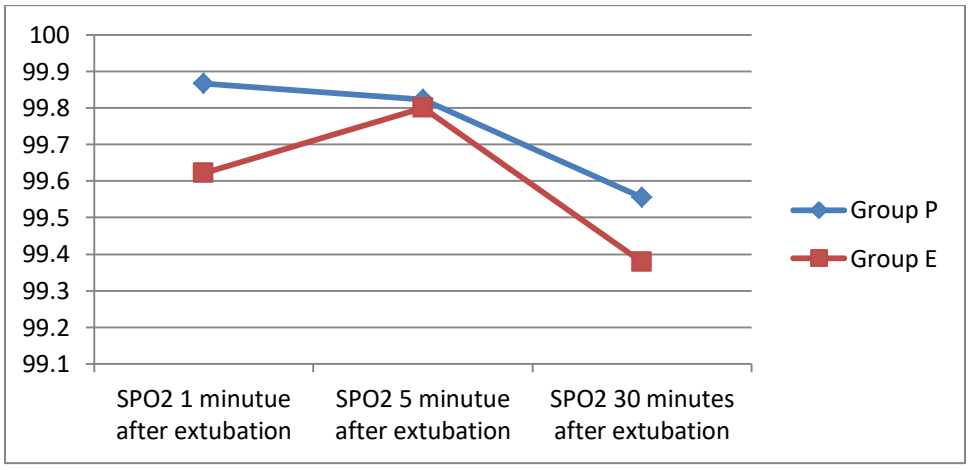

There were no significant differences in oxygen saturation among both groups at any point of time.

Discussion

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The commonest cardiovascular response to anaesthesia induction is hypotension, which is changed to tachycardia and hypertension during intubation because of increase in sympathetic activity[3], although bradycardias associated with increased parasympathetic activity are also common[4]. Myocardial oxygenation in patients with coronary insufficiency may be severely compromised under these circumstances and ischemic changes and actual infarction have been reported[5, 6]. Chronic hypertensive patients because of persistent increased sympathetic activity are volume constricted and more prone for hypotension during induction.[7] Predictors of hypotension after induction of general anaesthesia have been found to be : ASA III–V, baseline MAP <70 mm Hg, age ≥50 years, the use of propofol for induction of anaesthesia, and increasing induction dosage of fentanyl.[8] The main objective of this study was to compare efficacy of propofol and etomidate as induction agent in maintaining cardiovascular and haemodynamic stability in elective surgery in patients who are diagnosed as hypertensive and are on some drug and have controlled blood pressure.

Scheffer *et al* [9] studied beat-to-beat fluctuations of heart rate and blood pressure during induction with thiopentone, propofol and etomidate in thirty-five un-premedicated female patients of ASA grade I, without any cardiovascular complaints or diabetic history, scheduled to undergo a variety of minor elective gynaecological procedures. Rapid and significant decreases in systolic blood pressure was produced by propofol (- 31 %) and thiopentone (- 20%), were not seen with etomidate (+ 2%).

It has also been demonstrated that etomidate does not cause any changes in the arterial pressures and left ventricle diameters, however propofol causes simultaneous negative inotropy and afterload reduction.[10]

The incidence of hypotension has been found to be high during induction of anaesthesia in hypertensive patients who are chronically treated with ACEIs, however, it can be easily treated with intravenous crystalloids and small doses of vasopressors.[11]

Malgorzata Malinowska-Zaprzalka *et al* [12] studied haemodynamic effect of propofol in enalapril-treated hypertensive patients during induction of general anesthesia. They found thar Systolic Blood Pressure after induction with propofol in enalapril-treated patients was significantly lower 3 min after injection than before ($p < 0.01$) than in hypertensive or healthy patients given etomidate. Propofol given to normotensive patients also lowered Systolic Blood Pressure, but changes were not significant. Propofol given in enalapril treated group also reduced Diastolic Blood Pressure at this time ($p < 0.05$). This observation confirms data of authors, indicating that this drug lowers blood pressure during anesthesia. They also noted that Hypotensive episodes were more frequent in Propofol given group and particularly with propofol given to enalapril treated group than in etomidate-given groups.

Similar to the above studies finding, our study revealed that etomidate preserves the haemodynamics during induction than propofol. Patients given propofol had more fall in heart rate, and blood pressure during induction and at 1 minute and 5 minute after intubation. However there was no significant difference after 5 minutes of intubation. We did not observe any changes in electrocardiography during induction and after intubation in any patient. This was because all the patients were on some antihypertensives and had controlled blood pressure before surgery. We also did not observed any incidence of myoclonus in patients given etomidate. This might be because all the patients were well premedicated before induction.

Comparisons of intravenous anaesthetic agents require the use of equipotent doses. Our end point of stopping propofol or etomidate was loss of verbal response.

Since we had not taken into consideration the type of antihypertensive drug the patient was taking, we are not able to comment specifically on haemodynamic changes observed in the patients taking different drugs. There were no significant differences in the oxygen saturation by pulse oximetery in either of the groups.

Conclusion:

The present study revealed that induction with etomidate is associated with lesser fall in haemodynamic parameters and should be the induction agent of choice in patients who are known hypertensives. However this study shows that

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propofol is associated with better blunting of sympathetic response caused by laryngoscopy.

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