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A Comparative Study of Haemodynamic Changes after Induction with either Propofol, Thiopentone or Etomidate in Patients Undergoing Cervical Spine Surgeries

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Abstract

Aims and Objectives: The present study was conducted to compare the hemodynamic effects in patients undergoing cervical spine surgeries after induction with Propofol, Etomidate and Thiopentone.

Material and Methods: The Prospective interventional randomised comparative study was conducted in Department of Anaesthesia and Intensive care, VMMC & Safdarjung hospital. Randomisation of study population into three groups:

Group P (n=30) was induced with Propofol (1.5 mg/kg)

Group E (n=30) was induced with Etomidate (0.2 mg/kg)

Group T (n=30) was induced with Thiopentone (3 mg/kg).

Results: In this study, hypotension rate was 70% in group P which was significantly higher as compared to hypotension rate in group E (0%) and T (26.67%). (P<.05) Incidence of hypotension was not seen in any of the patient in group E whereas 8 patients in group T had hypotension; this difference was statistically significant. 16.67% of patients in group P had bradycardia which was significantly higher as compared to group E and T.(borderline significance) None of the patient in group E and T had bradycardia.

Conclusion: Group E was found stable drug than group P and group T in patients undergoing cervical spine surgeries.

1. INTRODUCTION

Cervical spinal surgery is generally performed to relieve compression of the spinal cord or spinal nerve roots which may occur due to trauma, tumours, infection, cervical spondylosis .etc. Acute spinal cord transection initially produces flaccid paralysis with total absence of sensation below the level of spinal cord injury.

The extent of physiological effects from spinal cord injury depends on the level of injury, with the most severe physiological derangements occurring with injury to the cervical cord and lesser pertuberations occurring with more caudal cord injuries. Reduction in systemic blood pressures are common especially with cervical cord injury.[1] Loss of sympathetic nervous system activity and diminution of systemic vascular resistance. Bradycardia due to loss of the T1-T4 sympathetic innervation to the heart.[2]

Severe weeks after acute spinal cord transection, the spinal cord reflexes gradually return and the patients enter a more chronic stage characterized by over-activity of the sympathetic nervous system and involuntary muscle spasms. This Autonomic hyper-reflexia occurs in 85%

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of patients with spinal cord lesions above T5. Afferent impulses originating from bowel, bladder, manipulations of urinary tract, child birth or surgical stimulation are transmitted through pelvic, pudendal and hypogastric nerves to the isolated spinal cord and cause massive sympathetic response from adrenal medulla and sympathetic nervous system which is no longer under the central hypothalamic control. Vasoconstriction occurs below the level of the lesion causing hypertension. Baroreceptor reflexes produce bradycardia, heart block, ventricular arrhythmias and even cardiac arrest. Compensatory vasodilation above the level of injury results in headache, flushing and nasal congestion. Some of the serious consequences of autonomic hyperreflexia include retinal, cerebral or subarachnoid haemorrhage.

The absence of compensatory sympathetic nervous system makes patients with cervical or high thoracic spinal cord injuries particularly vulnerable to decrease in blood pressure while in chronic stage there is a risk of uncontrolled hypertension and bradycardia leading to various complications. The most vital element in providing safe anesthesia is use of anesthetic technique that maintains stable hemodynamics. Sudden changes in blood pressure during anesthesia may be catastrophic especially in cervical spine injury patients. So main objective in these patients is to maintain blood pressure within normal limits during induction of anaesthesia.[3] Treatment of hypotension in these patients should comprise of a combination of intravascular volume replacement, inotropes and vasopressors.[4]

Hemodynamic management of quadriplegic patients includes a complete assessment, with a pulmonary artery catheter if necessary, as early as possible after injury. In many as 25% of patients with cervical spinal cord injuries, left ventricular dysfunction may contribute to the hypotension.[5] Propofol has more profound cardiovascular depressant effect than those of thiopental. Both direct myocardial depressive effects and decreased systemic vascular resistance have been implicated as important factors in producing cardiovascular depression. Direct myocardial depression and peripheral vasodilation are dose and concentration dependent. In addition to arterial vasodilation, Propofol produces venodilation which further contributes to its hypotensive effect[6]. Etomidate causes minimal cardiorespiratory depression even in the presence of cardiovascular and pulmonary disease. Etomidate is considered to be the induction agent of choice for poor-risk patients with cardio respiratory disease, as well as in those situations in which preservation of a normal blood pressure is crucial.[6] The cardiovascular effects of Thiopental include decrease in cardiac output, systemic arterial pressure and peripheral vascular resistance. The depressive effects of Thiopental on cardiac output are primarily a result of decrease in venous return caused by peripheral prolong as well a result of a direct myocardial depressant effect, which assumes increasing importance in the presence of hypovolemia and myocardial disease.The present study was conducted to compare the hemodynamic effects in patients undergoing cervical spine surgeries after induction with Propofol, Etomidate and Thiopentone.

2. MATERIALS AND METHOD

The Prospective interventional randomised comparative study was conducted in Department of Anaesthesia and Intensive care, VMMC & Safdarjung hospital after obtaining Hospital ethical committee clearance and informed consent from the study population.

STUDY DURATION- 18 months

Inclusion Criteria

Patients aged 18-65 years, belonging to ASA grade I, II or III scheduled for elective cervical spine surgery under GA with ETT for airway management.

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Exclusion Criteria

- Patients with known sensitivity to Propofol/Thiopental/Etomidate.
- Patients with co-existing systemic illness
- Recent URI.
- Patients with risk of regurgitation and aspiration

Sample Size

After induction with Propofol, etomidate and Thiopentone, with 30 patients in each group, there was 80% power at an alpha 0.05 with an effect size of 0.75 to detect a difference between any two groups.

The formula for calculated sample size is given below

$n = (\sigma 12 + \sigma 22) . [Z 1- \alpha/2 + Z 1- \beta]2 / (M1 - M2)2$

where $Z\alpha/2$ is the critical value of the Normal distribution at $\alpha/2$ (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96), $Z\beta$ is the critical value of the Normal distribution at β (e.g. for a power of 80%, β is 0.2) and M1 and M2 are the expected sample mean of the two groups. $\sigma 1$and $\sigma 2$ are the expected sample Sd of the two groups. Sample Size is determined based on the previous study entitled Effects of Thiopentone, Etomidate and Propofol on the hemodynamic response to tracheal intubation13

Randomisation of study population into three groups was done using sealed envelope method

Group P(n=30) was induced with Propofol (1.5 mg/kg)

Group E(n=30) was induced with Etomidate (0.2 mg/kg)

Group T(n=30) was induced with Thiopentone (3 mg/kg).

PRE-OPERATIVE PREPARATION

All the patients were undergo overnight fasting and was receive oral alprazolam 0.25mg night before surgery. Tab. Ranitidine 50mg and Tab.metoclopramide 10mg was given orally 2hours before surgery with sips of water .The patients were randomised into 3 group by sealed envelope method.

Anaesthesia Technique

After institutional ethical committee approval and informed consent, 90 ASA I, II and III patients listed for cervical spinal surgeries was selected in a randomized fashion. The patients will be systematically allocated in order to ensure equal number of patients in each group.

In the operation theatre standard monitor was attached for non-invasive blood pressure, spo2 and ECG. The baseline parameter was noted. IV access was established with an 18G cannula. Reduced volume of distribution renders spinal cord injury patients sensitive to intravenous inducing agents due to the absence of sympathetic reflex. Thus, preloading with 500 ml of crystalloids were done to prevent the chance of hypotension at induction. Thereafter Ringer's lactate was infused at the rate of 10 ml/min.

Induction

Patient was placed in supine with head on a pillow in the sniffing position. Inj. Fentanyl 2 mcg per kg of bodyweight intravenously was administered. Patient was pre-oxygenated with appropriate sized mask supplying 100% oxygen at 6L/min. After 3 min, Inj. Lignocaine 1 ml of 1% will be given. 30 seconds later, the induction agent was administered accordingly to the group assigned.

After checking for adequate ventilation, vecuronium bromide 0.1mg/kg body weight was given intravenously for muscle relaxation. The patient was mask ventilated with 50% Nitrous oxide in oxygen and 0.4% to 1% Isoflurane to maintain the MAC of 1. After 4 minutes, the patient's

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trachea was intubated with a cuffed endotracheal tube of appropriate size. Hemodynamic parameters -Heart rate, NIBP, SpO2, End tidal carbon dioxide, ECG was monitored. Any fall in MABP of > 20% will be managed with the increased rate of intravenous fluids. If it was unresponsive then Inj. Mephenteramine 0.1 mg per kg intravenously will be given. If the patient heart rate is less than 45 then the patient was treated with Inj. Atropine 0.01 mg/kg.
Paarameters to be observed are Blood pressure [SBP, DBP and MABP], Heart rate and SpO2 was recorded at baseline T0, 3 minutes after giving fentanyl TF, 1 minutes after induction agent TI1, 2 minutes after induction agent TI2, 3 minutes after induction agent TI3, at the time of intubation TE0, 1 min after intubation TE1, 3 min after intubation TE3, 5 min after intubation TE5, 7 min after intubation TE7 and 10 min after intubation TE10.
After 10 minutes, the study was over. Anaesthesia and surgery was continued as per patient's requirements.

3. OBSERVATION AND RESULTS

In this study, majority (40%) of the patients were in the age group of 18-30 years with 14 patients in group P, 13 patients in group E and 9 patients in group T, followed by 30% of patients in the age group 31-40 years. Around 18% of patients were in the age group of 41-50 years and very few patients were in the age group of more than 50 years. The mean age of the patients in our study was 34.53 ± 11.31 years. The mean age of the patients in Group P was 32.03 ± 11.88 years, in Group E was 33.97 ± 11.62 years and in Group T was 37.6 ± 10 years. No significant difference in the age distribution of three groups was seen in the study. (P>0.05).
In this study, weights of majority (68.89%) of the patients were between 61-70 kg with 20 patients in group P, 25 patients in group E and 17 patients in group T. Weights of around 13-18% of patients were between 51-60 kg and 71-80 kg. The mean weight of the patients in our study was 66.17 ± 4.82 kg. The mean weight of the patients in Group P was 66.9 ± 5.37 kg, in Group E was 65.47 ± 3.31 kg and in Group T was 66.13 ± 5.51 kg. No significant difference in the weight distribution of three groups was seen in the study. (P>0.05).

HR (bpm)
At baseline, heart rate was comparable between the three groups with no significant difference between them (P>.05). At 3 minutes after giving fentanyl, heart rate was significantly lower in group E as compared to group P with mean values of 72.33 ± 3.69 bpm and 75.4 ± 5.82 bpm in group E and P respectively. Heart rate in group T (73.47 ± 3.04 bpm) was comparable with the group E and P. (P>.05). At 1 minute after induction, at the time of intubation, 1 minute after intubation and 3 minutes after intubation, heart rate was comparable between group E and T but was significantly higher as compared to heart rate in group P. At 2 minutes after induction, 3 minutes after induction, 5 minutes after intubation, 7 minutes after intubation and 10 minutes after intubation, heart rate was significantly lower in group P (69.4 ± 8.78 bpm, 71.03 ± 3.12 bpm, 78.47 ± 8.68 bpm, 78.9 ± 9.62 bpm , 76.87 ± 8.54 bpm respectively) as compared to group E (88.7 ± 3.19 bpm, 87.97 ± 3.99 bpm, 94.07 ± 3.43 bpm, 94.6 ± 4.5 bpm, 88.13 ± 6.89 bpm respectively) and T (91.5 ± 6.52 bpm, 91.63 ± 6.55 bpm, 98.57 ± 7.59 bpm, 98.6 ± 7.73 bpm, 93.33 ± 3.91 bpm respectively). At these time intervals, heart rate in group T was significantly higher as compared to group E. (P<.05)
Patients in group E and T had comparable heart rate at each time interval except at 2 minutes after induction, 3 minutes after induction, 5 minutes after intubation, 7 minutes after intubation and 10 minutes after intubation whereas in patients of group P, heart rate was significantly lower at each time interval except at baseline and 3 minutes after giving fentanyl as compared

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to other two groups. At 3 minutes after giving fentanyl, heart rate in group P was significantly lower as compared to group E but was comparable with group T.

In this study, reduction in the heart rate was significantly higher in group P as compared to group E and T at each time interval except at 3 minutes after giving fentanyl, where reduction in heart with respect to baseline was comparable between group P and T (2.25 ± 5.5% in group P and 2.46 ± 8.11% in group T) and was significantly lower as compared to group T. At 3 minutes after giving fentanyl, reduction in heart rate in group E (7.63 ± 8.39 %) was significantly higher as compared to group T (2.46 ± 8.11%) and after that, at each time interval percentage change in heart rate was positive in both group E and T with respect to baseline with significantly higher increase in group T as compared to group E except at the time of intubation, 1 minute after intubation and 3 minute after intubation where percentage increase in heart rate was comparable between them (21.94 ± 11.16 %, 21.15 ± 11.5% and 21.37 ± 11.53% in group E vs 27.68 ± 13.64 %, 27.38 ± 13.72 % and 26.91 ± 13.97 % in group T at the time of intubation, at 1 minute after intubation and 3 minute after intubation respectively).

Declining trend was seen in heart rate from baseline (77.17 ± 4.46 bpm) to 2 minute after induction (69.4 ± 8.78 bpm) in group P. Till 3 minutes after induction, heart rate was significantly lower as compared to heart rate of baseline and after that, at time to intubation (80.6 ± 7.06 bpm) and at 7 minutes after intubation (78.9 ± 9.62 bpm), heart rate was significantly higher as compared to baseline; initially increasing trend and then small fluctuations were seen in heart rate after 2 minutes of induction. At 1 minute after intubation (81.93 ± 7.85 bpm), 3 minutes after intubation (79.3 ± 8.99 bpm) and 5 minutes after intubation (78.47 ± 8.68 bpm), heart rate was comparable with baseline with no significant difference. (P>.05)

There was a significant fall in heart rate at 3 minutes after giving fentanyl from 78.8 ± 6.75 bpm to 72.33 ± 3.69 bpm. At 1 minute after induction, heart rate was comparable with baseline and then overall an increasing trend was seen in the heart rate with a slight fall in values at 10 minutes after intubation. From 2 minutes after induction (88.7 ± 3.19 bpm) till 10 minutes after intubation (88.13 ± 6.89 bpm), heart rate was significantly higher than at baseline at each time interval in group E

Though fall in heart rate at 3 minutes after giving fentanyl from 75.77 ± 6.48 bpm to 73.47 ± 3.04 bpm was seen but the difference in heart rate between baseline and 3 minutes after giving fentanyl was non-significant. After 3 minutes after giving fentanyl, overall an increasing trend was seen in the heart rate with a slight fall in values at 10 minutes after intubation. From 1 minute after induction (84.63 ± 5.6 bpm) till 10 minutes after intubation (93.33 ± 3.91 bpm), heart rate was significantly higher than heart rate at baseline at each time interval in group T.

Systolic Blood Pressure (mm Hg)

At baseline and at 3 minutes after giving fentanyl, systolic blood pressure was comparable between the three groups with no significant difference between them (P>.05). At 1 minute after induction and 2 minutes after induction, systolic blood pressure was significantly lower in group P (91.7 ± 7.66 mm hg, 94.3 ± 8.54mm hg respectively) as compared to group E (114.97 ± 7.85 mm hg, 112.97 ± 8.01 mm hg respectively) and T (101.43 ± 6.18 mm hg, 100.13 ± 7.51 mm hg respectively). At these time intervals, systolic blood pressure in group T was significantly lower as compared to group E. (P<.05). After 2 minutes of induction, systolic blood pressure was significantly lower in group P as compared to group E and was comparable with group T. Systolic blood pressure was significantly lower in group T as compared to group E at each time interval after 2 minutes of induction. Patients in group P and T had comparable systolic blood pressure at each time interval except at 1 minute after induction, and 2 minutes

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after induction. Systolic blood pressure in group E was significantly higher as compared to both groups after 3 minutes after giving fentanyl.

In this study, reduction in the systolic blood pressure was comparable between the three groups at 3 minutes after giving fentanyl (3.39 ± 4.71% in group P, 4.09 ± 6.5% in group E and 4.72 ± 4.04% in group T). At 1 minute after induction, significant difference was seen in the percentage change in systolic blood pressure between the three groups. Change in systolic blood pressure was significantly higher in group P(-11.65 ± 8.87%) as compared to group E(10.37 ± 9.21%) and group T(-4.25 ± 6.42%). From 2 minutes after induction to 10 minutes after intubation, in group E there was an increase in systolic blood pressure whereas reduction in systolic blood pressure was seen in group P and group T except at the time of intubation and 1,3 and 5 minutes after intubation where an increase in systolic blood pressure was observed in group P and increase in systolic blood pressure was seen in group T at 1 minute after intubation. Statistically significant difference in percentage change in systolic blood pressure was seen in group E as compared to group P and T and on the other hand percentage change in systolic blood pressure was comparable between group P and T.

Significant fall in systolic blood pressure at 3 minutes after giving fentanyl (100.37 ± 3.62 mm Hg), 1 minute after induction (91.7 ± 7.66 mm Hg), 2 minutes after induction (94.3 ± 8.54 mm Hg) and 3 minutes after induction (98.7 ± 4.88 mm Hg) was seen with respect to baseline (104.03 ± 4.47 mm Hg) as shown in group P. From time to intubation to 10 minutes after intubation, systolic blood pressure was comparable with baseline at each time interval with very minor fluctuations in the mean values.

There was a significant fall in systolic blood pressure at 3 minutes after giving fentanyl from 104.4 ± 5.44 mm Hg to 99.87 ± 4.45 mm Hg. After 3 minutes of giving fentanyl, overall an increasing trend was seen in the systolic blood pressure with a slight fluctuation in between. From 1 minute after induction (114.97 ± 7.85 mm Hg) till 10 minutes after intubation (117.1 ± 6.36 mm Hg), systolic blood pressure was significantly higher as compared to baseline systolic blood pressure at each time interval in group E

Significant fall in systolic blood pressure at 3 minutes after giving fentanyl (100.97 ± 4.2 mm Hg), 1 minute after induction (101.43 ± 6.18 mm Hg), 2 minutes after induction (100.13 ± 7.51 mm Hg) and 3 minutes after induction (96.57 ± 9.24 mm Hg) was seen with respect to baseline (106.07 ± 4.51 mm Hg) as shown in group T. From time to intubation to 10 minutes after intubation, systolic blood pressure was comparable with baseline at each time interval with very minor fluctuations in the mean values.

Diastolic Blood Pressure (mm Hg)

At baseline, diastolic blood pressure was comparable between the three groups with no significant difference between them (P>.05). At 3 minutes after giving fentanyl, diastolic blood pressure was significantly higher in group T (72.83 ± 4.03 mm Hg) as compared to diastolic blood pressure in group P (70.63 ± 3.13 mm hg) and group E (69.97 ± 3.7 mm hg). Diastolic blood pressure at 3 minutes after giving fentanyl was comparable between group P and group E. At 2 minutes after induction, at 5 minutes after intubation, 7 minutes after intubation and 10 minutes after intubation, significantly higher diastolic blood pressure was observed in group E as compared to group P and T and diastolic blood pressure was comparable between P and T. Diastolic blood pressure was significantly lower in group T as compared to group P and E at 3 minutes after induction. At 1 minute after induction, at the time of intubation, and at 1 and 3 minutes after intubation, diastolic blood pressure was significantly higher in group E as compared to group P and T. At these time intervals, diastolic blood pressure in group T was

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significantly lower as compared to group P except at 1 minute after induction where diastolic blood pressure was significantly lower in group P as compared to group T. (P<.05)
In this study, reduction in the diastolic blood pressure was comparable between group P and E; at 3 minutes after giving fentanyl (5.25 ± 5.69% in group P, and 4.44 ± 6.42% in group E) and in group T significantly lower reduction in diastolic blood pressure was seen as compared to group P and E. At 1 minute after induction, significant difference was seen in the percentage change in diastolic blood pressure between the three groups. Change in diastolic blood pressure was significantly higher in group P(-10.82 ± 9.43%) as compared to group E(7.31 ± 10.26%) and group T(-0.07 ± 8.06%). From 2 minutes after induction to 10 minutes after intubation, in group E there was an increase in diastolic blood pressure with respect to baseline whereas reduction in diastolic blood pressure was seen in group P and group T till 3 minutes after induction and afterwards diastolic blood pressure was higher as compared to baseline at each time interval in all the groups except at 7 minutes after intubation in group P. Difference in percentage change in diastolic blood pressure was significant between group E as compared to group P and T and on the other hand percentage change in diastolic blood pressure was comparable between group P and T.
Significant fall in diastolic blood pressure at 3 minutes after giving fentanyl (70.63 ± 3.13 mm Hg), 1 minute after induction (66.6 ± 7.64 mm Hg), and 2 minutes after induction (70.97 ± 6.16 mm Hg) was seen with respect to baseline (74.7 ± 3.73 mm Hg) as shown in group P. From 3 minutes after induction to 10 minutes after intubation, diastolic blood pressure was comparable with baseline at each time interval with very minor fluctuations in the mean values.
There was a significant fall in diastolic blood pressure at 3 minutes after giving fentanyl from 73.37 ± 3.66 mm Hg to 69.97 ± 3.7 mm Hg. After 3 minutes of giving fentanyl, overall an increasing trend was seen in the diastolic blood pressure with a slight fluctuation in between. From 1 minute after induction (78.47 ± 5.39 mm Hg) till 10 minutes after intubation (80.8 ± 4.63 mm Hg), diastolic blood pressure was significantly higher as compared to baseline diastolic blood pressure at each time interval in group E
No significant difference was seen in diastolic blood pressure from 3 minutes after giving fentanyl (72.83 ± 4.03 mm Hg) till 3 minutes after intubation (73.07 ± 5.43 mm Hg) and at 7 minutes after intubation (74.93 ± 5.91 mmHg) with respect to baseline as shown in group T. At 5 minutes after intubation and at 10 minutes after intubation, diastolic blood pressure was significantly higher as compared to baseline diastolic blood pressure.

Mean Arterial Pressure (mm Hg)

At baseline and at 3 minutes after giving fentanyl, mean arterial pressure was comparable between the three groups with no significant difference between them (P>.05). At 1 minute after induction and 2 minutes after induction, mean arterial pressure was significantly higher in group E (93.43 ± 7.14 mm hg, 90.6 ± 6.3 mm hg respectively) as compared to group P (75.87 ± 7.01 mm hg, 79.63 ± 6.66 mm hg respectively) and T (81.97 ± 5.29 mm hg, 80.8 ± 5.87 mm hg respectively). At 1 minute after induction, mean arterial pressure in group T was significantly higher as compared to group P and was comparable at 2 minutes after induction. From 3 minutes after induction till 10 minutes after intubation, mean arterial pressure was significantly higher in group E as compared to group P and T. Mean arterial pressure was significantly higher in group P as compared to group T except at 5,7,10 minutes after intubation. Patients in group P and T had comparable mean arterial pressure at each time interval except at 1 minute after induction, 3 minutes after induction, at the time of intubation and 1 and 3 minutes after intubation. Mean arterial pressure in group E was significantly higher as compared to both groups after 3 minutes after giving fentanyl.

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In this study, reduction in the mean arterial pressure was comparable between the three groups at 3 minutes after giving fentanyl (4.11 ± 5.09% in group P, 3.96 ± 6.42% in group E and 1.16 ± 6.72% in group T). At 1 minute after induction, significant difference was seen in the percentage change in mean arterial pressure between the three groups. Change in mean arterial pressure was significantly different in all the three groups; group P(-9.92 ± 8.13%), group E(13.03 ± 10.93%) and group T -0.1 ± 7.73%). From 2 minutes after induction to 10 minutes after intubation, in group E there was an increase in mean arterial pressure with respect to baseline whereas reduction in mean arterial pressure was seen in group P and group T till 3 minutes after induction and afterwards mean arterial pressure was higher as compared to baseline at each time interval in all the groups except at 7 minutes after intubation in group P. Difference in percentage change in mean arterial pressure was significant in group E as compared to group P and T and on the other hand percentage change in mean arterial pressure was comparable between group P and T except at 7 minutes after intubation.

Significant fall in mean arterial pressure at 3 minutes after giving fentanyl (80.73 ± 4.16 mm Hg), 1 minute after induction (75.87 ± 7.01 mm Hg), and 2 minutes after induction (79.63 ± 6.66mm Hg) was seen with respect to baseline (84.3 ± 4.14 mm Hg) as shown in group P. AT 3 minutes after induction, and from 3 minutes after intubation to 10 minutes after intubation, mean arterial pressure was comparable with baseline at each time interval with very minor fluctuations in the mean values. Mean arterial pressure was significantly higher at the time of intubation and at 1 minute after intubation as compared to baseline.

There was a significant fall in mean arterial pressure at 3 minutes after giving fentanyl from 82.87 ± 3.29 mm Hg to 79.43 ± 3.56 mm Hg. After 3 minutes of giving fentanyl, initially sharp increase in mean arterial pressure was seen at 1 minute after induction and then mean arterial pressure became stable with a slight fluctuation in between. From 1 minute after induction (93.43 ± 7.14 mm Hg) till 10 minutes after intubation (93.27 ± 4.25 mm Hg), mean arterial pressure was significantly higher as compared to baseline mean arterial pressure at each time interval in group E.

Significant fall in mean arterial pressure at 3 minutes after induction (78.63 ± 6.39 mm Hg), and significant increase at the time of intubation (84.33 ± 4.9 mm Hg), at 1 minute after intubation (84.9 ± 5.47 mm Hg) and at 5 minutes after intubation (85.67 ± 6.25 mm Hg) was seen with respect to baseline (82.2 ± 3.53 mm Hg) as shown in group T. At 3 minutes after giving fentanyl, 1 and 2 minutes after induction and at 3, 7 and 10 minutes after intubation, mean arterial pressure was comparable with baseline with very minor fluctuations in the mean values.

Table 1: Comparison of Interventions between Three Groups.

Interventions		Group			Total(n=90)	P vs E	P vs T	E vs T
		P(n=30)	E(n=30)	T(n=30)				
Baseline	Nil	30 (100%)	30 (100%)	30 (100%)	90 (100%)	-	-	-
3 minutes after giving fentanyl	Nil	30 (100%)	30 (100%)	30 (100%)	90 (100%)	-	-	-
1 minute after induction	Atropine	1 (3.33 %)	0 (0%)	0 (0%)	1 (1.11 %)	<.0001	<.0001	-

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	Mephenteramine	17 (56.67 %)	0 (0.00 %)	0 (0%)	17 (18.89 %)			
	Mephenteramine,Atropine	1 (3.33 %)	0 (0%)	0 (0%)	1 (1.11 %)			
	Nil	11 (36.67 %)	30 (100%)	30 (100%)	71 (78.89 %)			
2 minutes after induction	Mephenteramine	7 (23.33 %)	0 (0.00 %)	2 (6.67 %)	9 (10.00 %)	0.002	0.029	0.492
	Mephenteramine, Atropine	3 (10%)	0 (0%)	0 (0%)	3 (3.33 %)			
	Nil	20 (66.67 %)	30 (100%)	28 (93.33 %)	78 (86.67 %)			
3 minutes after induction	Mephenteramine	3 (10%)	0 (0%)	6 (20%)	9 (10%)	0.237	0.472	0.024
	Nil	27 (90.00 %)	30 (100%)	24 (80.00 %)	81 (90.00 %)			
At the time of intubation	Mephenteramine	1 (3.33 %)	0 (0%)	0 (0%)	1 (1.11 %)	1	1	-
	Nil	29 (96.67 %)	30 (100%)	30 (100%)	89 (98.89 %)			
1 minutes after intubation	Nil	30 (100%)	30 (100%)	30 (100%)	90 (100%)	-	-	-
3 minutes after intubation	Mephenteramine	0 (0.00 %)	0 (0%)	3 (10%)	3 (3.33 %)	-	0.237	0.237
	Nil	30 (100%)	30 (100%)	27 (90.00 %)	87 (96.67 %)			
5 minutes after intubation	Nil	30 (100%)	30 (100%)	30 (100%)	90 (100%)	-	-	-
7 minutes after intubation	Mephenteramine	3 (10%)	0 (0%)	4 (13.33 %)	7 (7.78 %)	0.237	1	0.112
	Nil	27 (90.00 %)	30 (100%)	26 (86.67 %)	83 (92.22 %)			

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10 minutes after intubation	Mephenteramine	1 (3.33 %)	0 (0%)	0 (0%)	1 (1.11 %)	0.076	1	0.112
	Myoclonus	0 (0%)	4 (13.33 %)	0 (0%)	4 (4.44 %)			
	Nil	29 (96.67 %)	26 (86.67 %)	30 (100%)	85 (94.44 %)			

In this study, none of the patient required intervention at baseline and at 3 minutes after giving fentanyl in all the three groups. Intervention required at 1 minute after induction and at 2 minutes after induction was significantly higher in group P as compared to group E and T .None of the patient in group E and T at 1 minute after induction required intervention and none of the patient in group E, only 2 patients in group T required intervention at 2 minutes after induction. At 3 minutes after induction, 20% in group T required intervention whereas no patient in group E required intervention. (P<.05) From time of intubation till 10 minutes after intubation, requirement of intervention was comparable between the groups with no significant difference between them.

Table 2: Comparison of Complications between Three Groups.

	Group			**Total (n=90)**	**P value**	**P vs E**	**P vs T**	**E vs T**
	P(n=30)	**E(n=30)**	**T(n=30)**					
No	9 (30.00%)	30 (100.00%)	22 (73.33%)	61 (67.78%)	<.0001	<.0001	0.0008	0.005
Yes	21 (70.00%)	0 (0.00%)	8 (26.67%)	29 (32.22%)				
Total	30 (100%)	30 (100.00%)	30 (100.00%)	90 (100.00%)				

In this study, complication rate was 70% in group P which was significantly higher as compared to complication rate in group E (0%) and T (26.67%). (P<.05) Complication was not seen in any of the patient in group E whereas 8 patients in group T had complications; this difference was statistically significant.

Table 3: Comparison of Hypotension between Three Groups.

	Group			**Total (n=90)**	**P value**	**P vs E**	**P vs T**	**E vs T**
	P(n=30)	**E(n=30)**	**T(n=30)**					
No	9 (30.00%)	30 (100.00%)	22 (73.33%)	61 (67.78%)	<.0001	<.0001	0.0008	0.005
Yes	21 (70.00%)	0 (0.00%)	8 (26.67%)	29 (32.22%)				
Total	30 (100.00%)	30 (100.00%)	30 (100.00%)	90 (100.00%)				

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In this study, hypotension rate was 70% in group P which was significantly higher as compared to hypotension rate in group E (0%) and T (26.67%). (P<.05) Incidence of hypotension was not seen in any of the patient in group E whereas 8 patients in group T had hypotension; this difference was statistically significant.

Table 4: Comparison of Bradycardia between Three Groups.

	Group			Total (n=90)	P vs E	P vs T	E vs T
	P(n=30)	E(n=30)	T(n=30)				
No	25 (83.33%)	30 (100.00%)	30 (100.00%)	85 (94.44%)	0.052	0.052	-
Yes	5 (16.67%)	0 (0.00%)	0 (0.00%)	5 (5.56%)			
Total	30 (100. %)	30 (100.00%)	30 (100.00%)	90 (100.00%)			

In this study, 16.67% of patients in group P had bradycardia which was significantly higher as compared to group E and T. (borderline significance) none of the patient in group E and T had bradycardia

4. DISCUSSION

In this study, majority (40%) of the patients were in the age group of 18-30 years with 14 patients in group P, 13 patients in group E and 9 patients in group T, followed by 30% of patients in the age group 31-40 years. Around 18% of patients were in the age group of 41-50 years and very few patients were in the age group of more than 50 years. The mean age of the patients in our study was 34.53 ± 11.31 years. The mean age of the patients in Group P was 32.03 ± 11.88 years, in Group E was 33.97 ± 11.62 years and in Group T was 37.6 ± 10 years. No significant difference in the age distribution of three groups was seen in the study. (P>0.05)
In this study, weights of majority (68.89%) of the patients were between 61-70 kg with 20 patients in group P, 25 patients in group E and 17 patients in group T. Weights of around 13-18% of patients were between 51-60 kg and 71-80 kg. The mean weight of the patients in our study was 66.17 ± 4.82 kg. The mean weight of the patients in Group P was 66.9 ± 5.37 kg, in Group E was 65.47 ± 3.31 kg and in Group T was 66.13 ± 5.51 kg. No significant difference in the weight distribution of three groups was seen in the study
At baseline, heart rate was comparable between the three groups with no significant difference between them (P>.05).
At 3 minutes after giving fentanyl, heart rate was significantly lower in group E as compared to group P with mean values of 72.33 ± 3.69 bpm and 75.4 ± 5.82 bpm in group E and P respectively. Heart rate in group T (73.47 ± 3.04 bpm) was comparable with the group E and P. (P>.05)

Effect on Heart Rate
There was no statistically significant increase or decrease in the heart rate among the three groups after administering IV fentanyl. At 1 minute after induction, at the time of intubation, 1 minute after intubation and 3 minutes after intubation, heart rate was comparable between group E and T but was significantly higher as compared to heart rate in group P.
At 2 minutes after induction, 3 minutes after induction, 5 minutes after intubation, 7 minutes after intubation and 10 minutes after intubation, heart rate was significantly lower in group P

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(69.4 ± 8.78 bpm, 71.03 ± 3.12 bpm, 78.47 ± 8.68 bpm, 78.9 ± 9.62 bpm , 76.87 ± 8.54 bpm respectively) as compared to group E (88.7 ± 3.19 bpm, 87.97 ± 3.99 bpm, 94.07 ± 3.43 bpm, 94.6 ± 4.5 bpm, 88.13 ± 6.89 bpm respectively) and T (91.5 ± 6.52 bpm, 91.63 ± 6.55 bpm, 98.57 ± 7.59 bpm, 98.6 ± 7.73 bpm, 93.33 ± 3.91 bpm respectively). At these time intervals, heart rate in group T was significantly higher as compared to group E. (P<.05)

Patients in group E and T had comparable heart rate at each time interval except at 2 minutes after induction, 3 minutes after induction, 5 minutes after intubation, 7 minutes after intubation and 10 minutes after intubation whereas in patients of group P, heart rate was significantly lower at each time interval except at baseline. Declining trend was seen in heart rate from baseline (77.17 ± 4.46 bpm) to 2 minute after induction (69.4 ± 8.78 bpm) in group P. Till 3 minutes after induction, heart rate was significantly lower as compared to heart rate of baseline and after that, at time to intubation (80.6 ± 7.06 bpm) and at 7 minutes after intubation (78.9 ± 9.62 bpm), heart rate was significantly higher as compared to baseline; initially increasing trend and then small fluctuations were seen in heart rate after 2 minutes of induction .

At 1 minute after intubation (81.93 ± 7.85 bpm), 3 minutes after intubation (79.3 ± 8.99 bpm) and 5 minutes after intubation (78.47 ± 8.68 bpm), heart rate was comparable with baseline with no significant difference. (P>.05)

At 1 minute after induction, heart rate was comparable with baseline and then overall an increasing trend was seen in the heart rate with a slight fall in values at 10 minutes after intubation. From 2 minutes after induction (88.7 ± 3.19 bpm) till 10 minutes after intubation (88.13 ± 6.89 bpm), heart rate was significantly higher than at baseline at each time interval .

From 1 minute after induction (84.63 ± 5.6 bpm) till 10 minutes after intubation (93.33 ± 3.91 bpm), heart rate was significantly higher than heart rate at baseline at each time interval .

In a study conducted by Kaushal RP in 2015 on the 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 showed no significant difference in the heart rate of subjects after administering these agents.[7]

A study conducted by Sceffer GJ et al on Effects of thiopentone, etomidate and propofol on beat-to-beat cardiovascular signals in man showed significant decrease in heart rate after administering IV propofol and increase in heart rate with thiopentone while the heart rate was more stable and showed insignificant decrease with IV etomidate.[8]

Effect on Systolic Blood Pressure

At baseline and at 3 minutes after giving fentanyl, systolic blood pressure was comparable between the three groups with no significant difference between them (P>.05).

At 1 minute after induction and 2 minutes after induction, systolic blood pressure was significantly lower in group P (91.7 ± 7.66 mm hg, 94.3 ± 8.54mm hg respectively) as compared to group E (114.97 ± 7.85 mm hg, 112.97 ± 8.01 mm hg respectively) and T (101.43 ± 6.18 mm hg, 100.13 ± 7.51 mm hg respectively). At these time intervals, systolic blood pressure in group T was significantly lower as compared to group E. (P<.05)

Significant fall in systolic blood pressure 1 minute after induction (91.7 ± 7.66 mm Hg), 2 minutes after induction (94.3 ± 8.54 mm Hg) and 3 minutes after induction (98.7 ± 4.88 mm Hg) was seen with respect to baseline (104.03 ± 4.47 mm Hg) in patients administered with propofol.

Haris et al. Evaluated thiopental (4 mg kg^{-1}), etomidate (0.3 mg kg^{-1}) and propofol (2.5 mg kg^{-1}) in tracheal intubation by adding 2 μg kg^{-1} fentanyl or not. They detected that there was a significant decrease in SAP values in the group receiving only propofol, and there were

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significant increases in SAP values in the group receiving only thiopental and etomidate after intubation.[9]
In a Turkish study conducted by Mehmet levent et al in 2014, remarkable decreases in SAP values were observed, especially in the propofol group in the 1st minute after induction (T1) and in the 5th minute after intubation (T4).[10]
Findings in our study was similar to the above mentioned studies.

Effect on Diastolic Blood Pressure

At baseline, diastolic blood pressure was comparable between the three groups with no significant difference between them (P>.05).
At 1 minute after induction, significant difference was seen in the percentage change in diastolic blood pressure between the three groups. Change in diastolic blood pressure was significantly higher in group P (-10.82 ± 9.43%) as compared to group E (7.31 ± 10.26%) and group T (-0.07 ± 8.06%).
At 2 minutes after induction, at 5 minutes after intubation, 7 minutes after intubation and 10 minutes after intubation, significantly higher diastolic blood pressure was observed in group E as compared to group P and T and diastolic blood pressure was comparable between P and T. Diastolic blood pressure was significantly lower in group T as compared to group P and E at 3 minutes after induction. At 1 minute after induction, at the time of intubation, and at 1 and 3 minutes after intubation, diastolic blood pressure was significantly higher in group E as compared to group P and T. At these time intervals, diastolic blood pressure in group T was significantly lower as compared to group P except at 1 minute after induction where diastolic blood pressure was significantly lower in group P as compared to group T. (P<.05)
In a Turkish study conducted by Mehmet levent et al in 2014 decrease in DBP in Group P after induction (T1) was found to be statistically significantly different from the simultaneously recorded DAP values of Group T and Group E (p<0.01).

Effect on Mean Arterial Pressure

At baseline and at 3 minutes after giving fentanyl, mean arterial pressure was comparable between the three groups with no significant difference between them (P>.05).
At 1 minute after induction and 2 minutes after induction, mean arterial pressure was significantly higher in group E (93.43 ± 7.14 mm hg, 90.6 ± 6.3 mm hg respectively) as compared to group P (75.87 ± 7.01 mm hg, 79.63 ± 6.66 mm hg respectively) and T (81.97 ± 5.29 mm hg, 80.8 ± 5.87 mm hg respectively). At 1 minute after induction, mean arterial pressure in group T was significantly higher as compared to group P and was comparable at 2 minutes after induction.
From 3 minutes after induction till 10 minutes after intubation, mean arterial pressure was significantly higher in group E as compared to group P and T. Mean arterial pressure was significantly higher in group P as compared to group T except at 5,7,10 minutes after intubation. At 1 minute after induction, significant difference was seen in the percentage change in mean arterial pressure between the three groups. Change in mean arterial pressure was significantly different in all the three groups; group P (-9.92 ± 8.13%), group E (13.03 ± 10.93%) and group T -0.1 ± 7.73%). From 2 minutes after induction to 10 minutes after intubation, in group E there was an increase in mean arterial pressure with respect to baseline whereas reduction in mean arterial pressure was seen in group P and group T till 3 minutes after induction and afterwards mean arterial pressure was higher as compared to baseline at each time interval in all the groups except at 7 minutes after intubation in group P. Difference in percentage change in mean arterial pressure was significant in group E as compared to group

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P and T and on the other hand percentage change in mean arterial pressure was comparable between group P and T except at 7 minutes after intubation. Mean arterial pressure was significantly higher at the time of intubation and at 1 minute after intubation as compared to baseline.

Significant fall in mean arterial pressure at 3 minutes after induction (78.63 ± 6.39 mm Hg), and significant increase at the time of intubation (84.33 ± 4.9 mm Hg), at 1 minute after intubation (84.9 ± 5.47 mm Hg) and at 5 minutes after intubation (85.67 ± 6.25 mm Hg) was seen with respect to baseline (82.2 ± 3.53 mm Hg) .

In a Turkish study conducted by Levent M et al in 2014 ,there is decrease of MAP in Group P after induction (T1) and in the 1st minute after intubation (T2) were statistically significantly different than the MAP values of Group T and Group E that were recorded at the same time ($p<0.01$)[10]

Interventions and Complications

In this study, none of the patient required intervention at baseline and at 3 minutes after giving fentanyl in all the three groups.Intervention required at 1 minute after induction and at 2 minutes after induction was significantly higher in group P as compared to group E and T .None of the patient in group E and T at 1 minute after induction required intervention and none of the patient in group E, only 2 patients in group T required intervention at 2 minutes after induction.At 3 minutes after induction, 20% in group T required intervention whereas no patient in group E required intervention.(P<.05) From time of intubation till 10 minutes after intubation, requirement of intervention was comparable between the groups with no significant difference between them.

In this study, complication rate was 70% in group P which was significantly higher as compared to complication rate in group E (0%) and T (26.67%). (P<.05) Complication was not seen in any of the patient in group E whereas 8 patients in group T had complications; this difference was statistically significant. In this study, hypotension rate was 70% in group P which was significantly higher as compared to hypotension rate in group E (0%) and T (26.67%). (P<.05) Incidence of hypotension was not seen in any of the patient in group E whereas 8 patients in group T had hypotension; this difference was statistically significant.

In this study, 16.67% of patients in group P had bradycardia which was significantly higher as compared to group E and T. (borderline significance) none of the patient in group E and T had bradycardia.

5. CONCLUSION

Group E was found stable drug than group P and group T in patients undergoing cervical spine surgeries.

6. REFERENCES

1. Keys TE. The History of Surgical Anesthesia. Arguably the best ‘short’ book on the subject; the first edition (1945) was published in the USA by Schuman, and reprinted by the Wood Library-Museum of Park Ridge, USA in 1996. A second, enlarged edition appeared in 1963 from Dover Publications, Inc of New York.
2. Duncum B.M. Oxford University Press; London: 1947. The Development of Inhalation Anaesthesia; 131–134

ISSN: 0975-3583, 0976-2833 VOL16, ISSUE1, 2025

3. Smith W.D.A. A history of nitrous oxide and oxygen anaesthesia. Part X: the early manufacture, storage and purity of nitrous oxide. BJA. 1967;39:351–381
4. DAVISON MH. The evolution of anaesthesia. Br J Anaesth. 1957;29(6):284-91; contd
5. Sykes WS. Essays on the First Hundred Years of Anaesthesia. Volume 1 – Edinburgh: E & S Livingstone Ltd, 1960; Volume 2 – Edinburgh: E & S Livingstone Ltd, 1961; Volume 3 (Ed Ellis RH) Edinburgh: Churchill Livingstone, 1982
6. Valk BI, Struys MMRF. Etomidate and its Analogs: A Review of Pharmacokinetics and Pharmacodynamics. Clin Pharmacokinet. 2021;60(10):1253-1269
7. 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; 18(2):172-8.
8. Scheffer GJ, Tenvoorde BJ, Karemaker JM, Ros HH, deLange JJ. Effects of thiopentone, etomidate and Propofol on beat-to-beat cardiovascular signals in man. Anaesthesia.1993;48:849-55
9. Harris E, Murray AM, Anderson JM, Grounds RM, Morgan M. Effects of thiopentone, etomidate and propofol on the haemodynamic response to tracheal intubation. Anaesthesia. 2007;43:32–6
10. Levent UM, Ersoy A, Artan A, Ervatan Z, kamal S; Comparison of the Haemodynamic Effects of Three Different Methods at the Induction of Anaesthesia, Tirkish journal of anaesthesiology and reanimation.2014;42(6):308-312