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Comparison of frequency of acute hypertension with sevoflurane and propofol during laryngoscopy and endotracheal intubation in normotensive patients

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Abstract

The present study was intendant to assess the comparison of frequency of acute hypertension with sevoflurane and propofol during laryngoscopy and endotracheal intubation in normotensive patients in general OT of Khyber teaching hospital Peshawar. A comparative cross-sectional study was conducted. Duration 4 months study 110 patient male and female were selected. Mainly there were two groups of patients i.e. group A and group B. Group A comprising propofol and group B comprising sevoflurane. Group A had 30 male and 25 female and group B had also 30 male and 25 female. In this study we want to see the systolic blood pressure and diastolic blood pressure and we take at in four variable pre-induction values, T1 (1min after laryngoscopy), T2 (3mins after laryngoscopy) and T3 (5mins after laryngoscopy). The systolic blood pressure revealed that before induction the systolic blood pressure recorded normal in both groups A and B. After laryngoscopy in T1 the systolic blood pressure in both groups A and B are acutely increased and in T2 in both groups the systolic blood pressure is decreased and likewise after sometime it is almost become normal as baseline values in T3 an both groups A and B. The diastolic blood pressure revealed that before induction the diastolic blood pressure recorded normal in both groups A and B as same as systolic blood pressure. After laryngoscopy in T1 the diastolic blood pressure are also acutely increased in both groups A and B and in T2 it is decreased in both groups and it became normal as baseline values in T3. So this result shows that both systolic and diastolic blood pressure are acutely increased in 1min after laryngoscopy in both groups, and then decreased up to some extent 3mins after laryngoscopy and after 5mins these both pressures are almost come to same as baseline values.

Keywords: Hypertension; Systolic BP; Diastolic BP; Laryngoscopy; Sevoflurane; Propofol

1. Introduction

Hypertension (HTN), also known as high blood pressure (HBP), is a chronic medical condition characterized by persistently elevated arterial blood pressure [1]. It constitutes a major risk factor for cardiovascular diseases, including coronary artery disease, stroke, heart failure, atrial fibrillation, peripheral vascular disease, vision loss, chronic kidney disease, and dementia [2,3]. Hypertension is classified as either primary (essential) or secondary. Approximately 90–95% of cases are primary hypertension, attributed to multifactorial lifestyle and genetic influences such as excessive dietary salt intake, obesity, smoking, and alcohol consumption. The remaining 5–10% of cases are secondary hypertension, resulting from identifiable causes such as chronic kidney disease, renal artery stenosis, endocrine disorders, or medication use, including oral contraceptives [4]. Hypertension is generally diagnosed when resting blood pressure consistently exceeds thresholds of 130/80 mmHg or 140/90 mmHg. Normal resting blood pressure ranges between 100–130 mmHg systolic and 60–80 mmHg diastolic [5,6].

Sevoflurane is a volatile, non-flammable, highly fluorinated methyl isopropyl ether used as an inhalational anesthetic agent for induction and maintenance of general anesthesia [7]. Following desflurane, it is the volatile anesthetic with the fastest onset and offset. Sevoflurane is widely employed across all age groups, including pediatric and veterinary

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anesthesia, often administered in combination with nitrous oxide and oxygen [8,9]. It has a favorable safety profile but ongoing investigations assess potential neurotoxicity, particularly in infants and young children, with concerns about effects on the developing brain. Sevoflurane is preferred for mask induction due to its low airway irritability. It was first introduced into clinical practice in Japan in 1990 and is now globally available as a standard anesthetic agent [10,11,12].

Propofol, marketed under the brand name Diprivan among others, is a short-acting intravenous anesthetic that induces rapid loss of consciousness and amnesia. It is used for induction and maintenance of general anesthesia, sedation in mechanically ventilated adults, and procedural sedation [13]. Propofol's onset occurs within approximately two minutes, with effects lasting five to ten minutes. Common adverse effects include hypotension, arrhythmias, pain on injection, and respiratory depression. Serious risks include seizures, abuse potential, and propofol infusion syndrome with prolonged use [14]. Although generally considered safe during pregnancy, it is not recommended for cesarean sections. Propofol acts primarily via potentiation of gamma-aminobutyric acid (GABA) receptors. It is included in the World Health Organization's List of Essential Medicines and is also utilized in veterinary anesthesia [15,16].

Laryngoscopy refers to the visualization or examination of the larynx, typically performed to facilitate tracheal intubation and airway management in anesthesia and critical care. Direct laryngoscopy, employing a rigid laryngoscope to expose the vocal cords under direct vision, has been the standard technique for over a century. Indirect methods, including flexible fiberoptic scopes, video laryngoscopes, and rigid optical stylets, have been developed to improve visualization without direct line-of-sight [17,18]. The first laryngoscope was described in 1805, with direct laryngoscopy introduced as an intubation technique in 1913. Modifications by Miller and Macintosh in the 1940s established widely used blade designs. Endotracheal intubation is critical during general anesthesia, particularly in pediatric patients or those with airway abnormalities [19]. While neuromuscular blocking agents facilitate intubation, they carry risks such as myalgia, increased intraocular and intracranial pressure, hyperkalemia, masseter spasm, and malignant hyperthermia. Among inhalational agents, sevoflurane is favored for its pleasant odor, low airway irritability, low blood-gas solubility, and reduced myocardial depression and arrhythmogenic potential, contributing to favorable intubation conditions [20]. The main objective of this study to measure and compare the acute hypertensive response to laryngoscopy and endotracheal intubation when using propofol versus sevoflurane as induction agents, analyzing differences across genders and assessing the duration of the hypertensive response.

2. Literature Review

Laryngoscopy and endotracheal intubation provoke a sympathetic response that affects cardiovascular parameters, a reaction that is notably intensified in patients with severe pre-eclampsia [21]. This study aimed to evaluate the effects of dexmedetomidine administered 10 minutes prior and fentanyl given over 3 minutes before anesthesia induction on hemodynamic changes during laryngoscopy and intubation, as well as neonatal outcomes in severe pre-eclamptic patients undergoing elective cesarean section. Eighty-eight patients were randomly assigned to receive either dexmedetomidine (0.5 μg/kg) or fentanyl (1 μg/kg). Systolic, diastolic, and mean arterial pressures, along with heart rate, were recorded at one-minute intervals before and after laryngoscopy and intubation. Neonatal outcomes were assessed using APGAR scores at 1, 5, and 10 minutes post-delivery and umbilical cord blood gas analysis [22].

Results indicated that dexmedetomidine significantly reduced arterial pressures after intubation compared to baseline (e.g., mean arterial pressure decreased from 112.89 ± 5.14 to 101.56 ± 3.89 mmHg, $p < 0.05$), whereas fentanyl administration was associated with a significant increase in mean arterial pressure post-intubation (from 111.75 ± 5.15 to 118.07 ± 4.05 mmHg, $p < 0.05$). No statistically significant differences were observed between the two groups regarding neonatal APGAR scores or umbilical artery blood gases [23,24]. These findings suggest that dexmedetomidine, when given sufficiently in advance of anesthesia induction, effectively attenuates the hemodynamic stress response to intubation in severe pre-eclampsia without adverse neonatal effects [25].

In normotensive patients, Forbes (1970) observed that laryngoscopy and intubation induced an average increase in mean arterial pressure of 25 mmHg, with no significant differences between groups pre-treated with morphine or amylobarbital. Importantly, no permanent psychological or neurological damage was reported, although potential cardiac or neurological risks remain a consideration in high-risk populations. Sarner et al.[26] reported that the time to complete intubation varied with anesthetic technique, noting longer durations with sevoflurane-based induction compared to propofol-succinylcholine regimens. Studies by [27,28] demonstrated high success rates for intubation conditions using 70% nitrous oxide and sevoflurane, with fixed acceptance times of 150–180 seconds. The quality of intubation conditions was assessed using the Hellebo-Hansen score, which evaluates laryngoscopy ease, vocal cord positioning, coughing, and limb movement. Scores of 1–4 indicate excellent intubating conditions, 5–6 good, 9–12 poor, and 13–16 terrible, with scores ≤6 considered clinically acceptable [29]. Comparative studies showed that propofol-succinylcholine combinations generally yielded superior intubating conditions compared to sevoflurane alone, possibly

due to the absence of analgesics in the latter. [30]. reported excellent intubation conditions in all patients using sevoflurane induction followed by propofol administration and intubation at 5.5 minutes, highlighting the role of propofol in suppressing pharyngeal and laryngeal reflexes.

Maneki et al. [31] found that adding atracurium to a propofol-fentanyl induction regimen improved intubation conditions and reduced postoperative vocal cord complications. Hemodynamic responses differed between propofol-succinylcholine and sevoflurane groups, with the former showing greater reductions in heart rate due to pharmacologic effects. The addition of fentanyl and lignocaine has also been shown to attenuate laryngoscopy-induced pressor responses[32,33]. No patients in these studies experienced significant desaturation, bronchospasm, or airway injury, indicating that both propofol-succinylcholine and sevoflurane regimens provide favorable conditions for intubation. However, a small incidence of laryngospasm was noted in sevoflurane groups, consistent with previous findings [34]. Thwaites et al .[35] suggested that sevoflurane alone may not be optimal for airway preparation solely for intubation. Overall, these studies confirm that anesthetic choice and timing significantly influence intubation conditions and hemodynamic stability, with combined regimens often providing superior outcomes. The Hellebo-Hansen score remains a valuable tool for assessing intubation quality, and the incorporation of adjunct agents such as fentanyl, lignocaine, and muscle relaxants can optimize patient safety and comfort..

3. Material and Methods

The study was an in-service cross-sectional comparative study carried out at the General Operating Theatre of Khyber Teaching Hospital, Peshawar, in a period of four months between March 2019 and June 2019. After the institutional ethics review board gave its approval, 110 patients were enlisted in the study. The RaoSoft online calculator was used to calculate the sample size under the assumption of a 5% level of significance and a 95% confidence interval. A non-probability convenient sampling procedure was used to select patients. The population of the study included normotensive anesthesia patients with a physical condition of the American Society of Anesthesiologists (ASA) of I, of both sexes, and patients who had elective surgical operations. Before the inclusion, pre-anesthetic assessment had been done and patients who had a history of high blood pressure or cardiac and renal comorbidities were excluded. Other exclusion criteria were a predicted difficult airway, induction by other than the study drugs using intravenous anesthetic agents (ketamine), and the administration of sympathomimetic drugs in the induction period.

With the informed consent, the 110 qualified patients were randomly divided into two groups (55 each). Group A was given an intravenous dose of the induction propofol at 2 mg/kg, whereas Group B was subject to sevoflurane inhalational induction. All patients were monitored using standard practices when they arrived in the operating theatre and included non-invasive blood pressure (NIBP) monitoring, pulse oximetry, and electrocardiography (ECG). Airways and anesthesia equipment such as laryngoscopes, endotracheal tubes, anesthesia delivery systems, etc. were ready. All participants were recorded in demographic data such as age and gender.

The major outcome measure was the response of the hemodynamic to laryngoscopy, which was measured by recording the systolic and diagnoses blood pressures at four determining moments; at baseline (pre-induction upon arrival in the OT), 1 minutes (T1), 3 minutes (T2), and 5 minutes (T3) of the laryngoscopy. All the registered patients had elective operations that lasted between 1-60 minutes.

The analysis of the data was conducted with the assistance of SPSS 22. Continuous variables were computed using descriptive statistics in form of mean ± standard deviation. A one way Analysis of Variance (ANOVA) was used to compare the mean blood pressure values at the various time intervals in the two independent groups (propofol vs. sevoflurane). All analyses were taken to have a p-value of below 0.05 as a significant result..

4. Results

The group A had 30 males and 25 females and the group B had also30 males and 25 females. There is no age limitation in both groups. The range for weight was 22 to 70 kg in the both groups A and B respectively. The two groups were comparable in terms of demographic data as there were no significant differences between the 2 groups in terms of sex, weight and ASA classification.

Table 1 Demographic and clinical characteristics of study participants

	Group A		**Group B**	**P value**
Mean age (year)	27.2		27.8	0.672
Gender Male	30		30	1.00
Female	25		25	1.00
ASA	1		1	0.00
Mean age and gender Group A			Mean age and gender Group B	
	Age	Gender of respondent	Age	Gender of respondent
N valid	55	55	55	55
Missing	0	0	0	0
Mean	27.27	1.45	27.89	1.45
SD	6.751	0.503	7.390	0.503

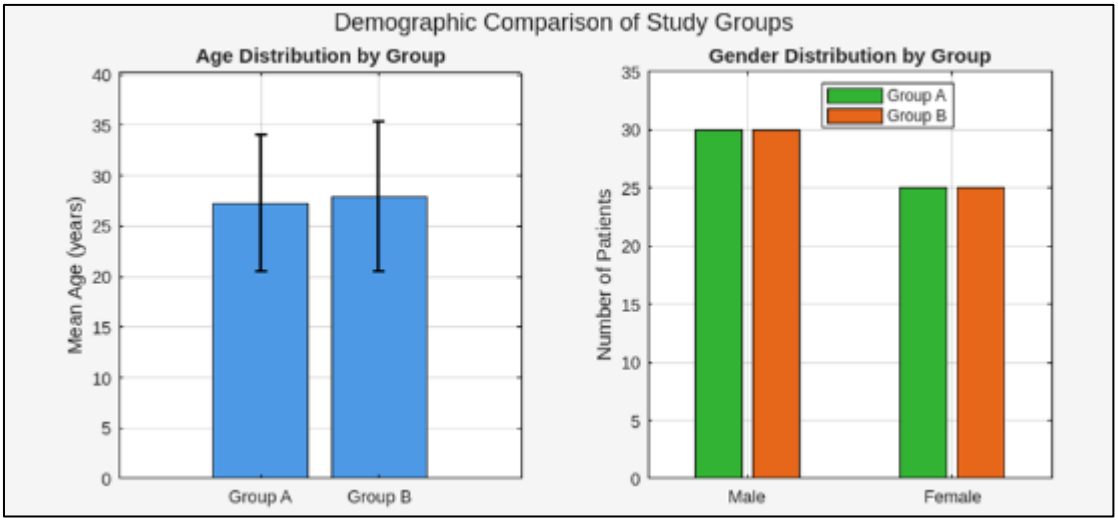

Figure 1 Graphical representation of gender Group A and Group B

Table 2 Mean age and gender of Group A & Group B

Mean age and gender Group A					**Mean age and gender Group B**			
	Frequency	**Percent**	**Valid %**	**Cumulative %**	**Frequency**	**Percent**	**Valid %**	**Cumulative %**
Male	30	54.5	54.5	54.5	30	54.5	54.5	54.5
Female	25	45.5	45.5	100.0	25	45.5	45.5	100
Total	55	100.0	100.0		55	100.0	100.0	

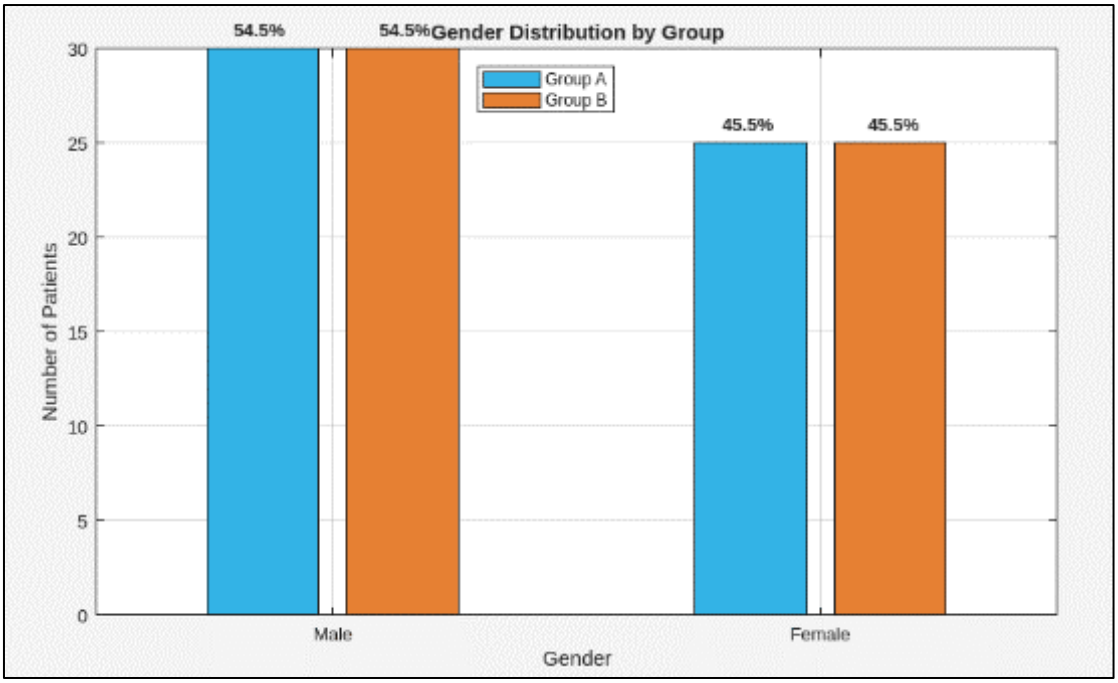

Figure 2 Graphical representation of gender Group A and Group B

Table 3 Mean systolic blood pressure at different times among Group A and Group B

	Group A mean± SD	**Group B mean ± SD**	**P value**
Pre induction	121.9±5.4	123.1±4.1	0.198
T1	147.5±4.9	148.3±4.4	0.353
T2	138.5±5.2	139.6±4.8	0.248
T3	123.8±5.7	125.3±4.2	0.107

Systolic BP Group A

	Systolic BP Pre operative	Systolic BP T1	Systolic BP T2	Systolic BP T3
N valid	55	55	55	55
Missing	0	0	0	0
Mean	121.9455	147.5091	138.5636	123.8000
SD	5.45153	4.98469	5.27666	5.76194

Systolic BP Group B

	Systolic BP Pre operative	Systolic BP T1	Systolic BP T2	Systolic BP T3
N valid	55	55	55	55
Missing	0	0	0	0
Mean	123.1455	148.3455	139.6909	125.3636
SD	4.19178	4.41050	4.89850	4.21797

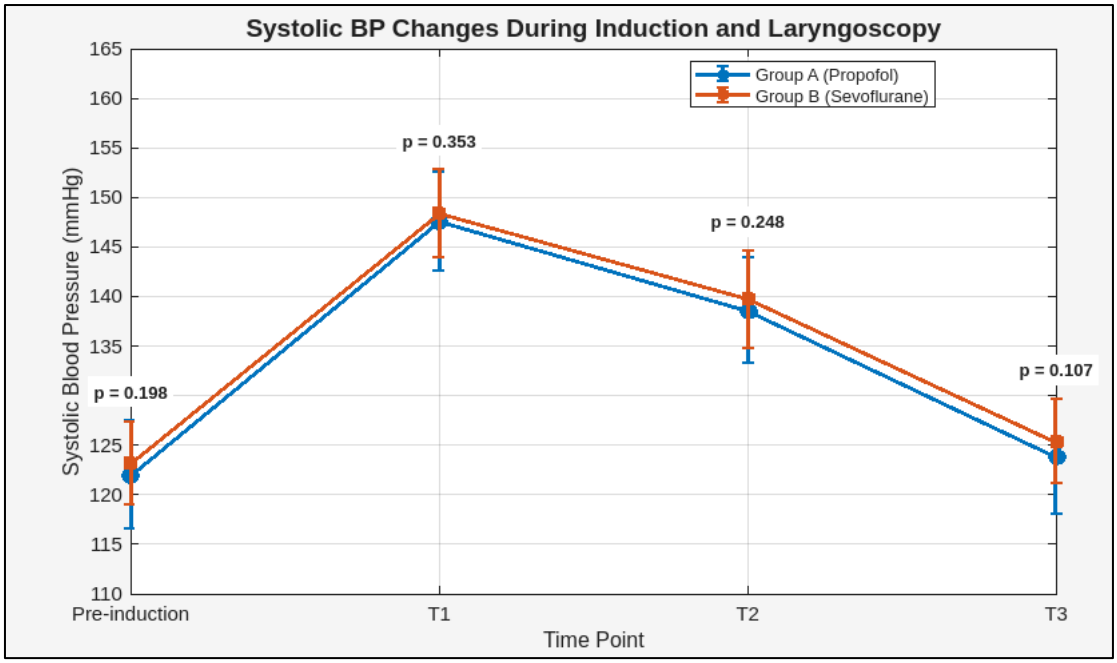

Figure 3 Systolic BP changes during Induction and laryngoscopy

The systolic blood pressure of the 2 groups was comparable at induction. At pre-induction, the systolic blood pressure is about normal in both groups. After induction (T1) the systolic blood pressure is rapidly increased up to 25mmhg in both groups A and B. The systolic blood pressure is then decreases about 9mmhg in both groups A and B in T2 and in T3 the systolic blood pressure are come to baseline values or 2 to 4mmhg increase from baseline values. There is no significant difference in group A and in group B in all times but there is a big difference between T1, T2 and T3. In all times the systolic blood pressure is increased in both groups.

Table 4 Mean diastolic blood pressure at different time among group A and group B

	Group A mean± SD	**Group B mean ± SD**	**P value**
Pre induction	80.1±3.4	80.9±3.0	0.178
T1	98.9±3.3	100.0±3.0	0.076
T2	89.8±3.4	91.6±2.9	0.004
T3	81.1±4.0	81.9±3.5	0.277

Diastolic BP Group A

	Diastolic BP Pre operative	Diastolic BP T1	Diastolic BP T2	Diastolic BP T3
N valid	55	55	55	55
Missing	0	0	0	0
Mean	80.1091	98.9273	89.8364	81.1091
SD	3.41930	3.30462	3.45213	4.07191

Diastolic BP Group B

	Diastolic BP Pre operative	Diastolic BP T1	Diastolic BP T2	Diastolic BP T3
N valid	55	55	55	55
Missing	0	0	0	0

Mean	80.9455	100.0182	91.6545	81.9091
SD	3.04545	3.08815	2.97656	3.59152

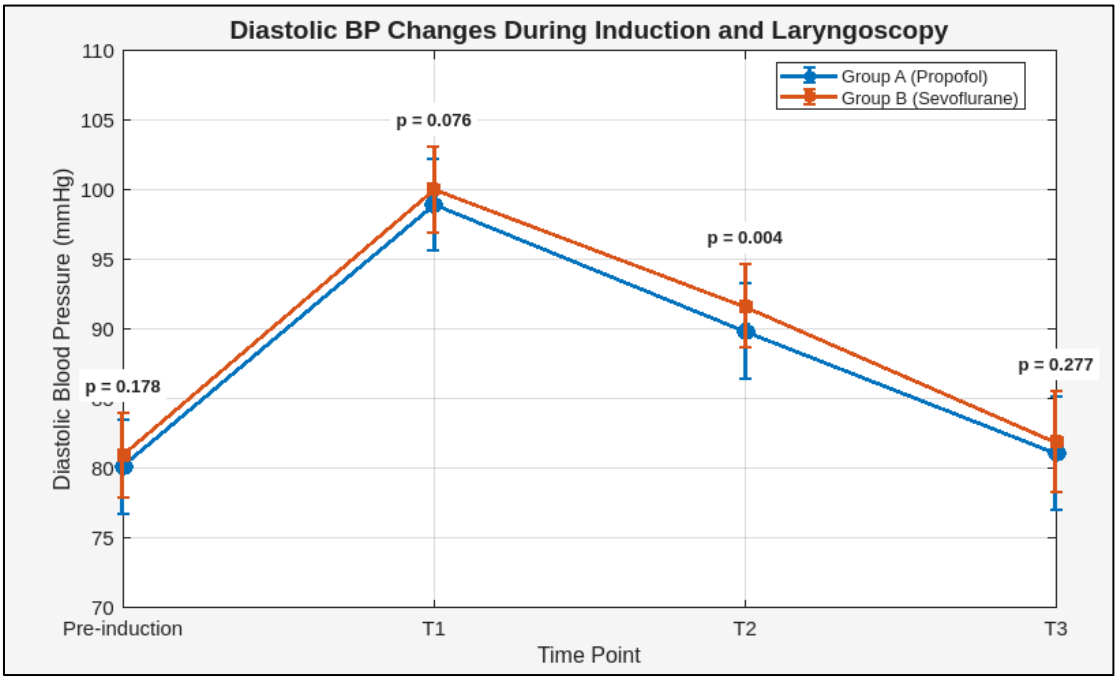

Figure 4 Diastolic BP changes during induction and Laryngoscopy

The diastolic blood pressure in the two groups was comparable at baseline. At pre-induction the baseline values of diastolic blood pressure is about normal in both groups. At T1 the diastolic blood pressure is increased up to 20mmhg in both groups A and B. This systolic blood pressure is then decreased about 9mmhg in both groups A and B in T2. In T3 the diastolic blood is come to normal as baseline values. So there is no significant difference in both groups in all times. The difference between T1 DBP, T2 DBP and T3 DBP is very high.

5. Discussion

The present investigation was configuration to look at the examination of recurrence of intense hypertension with sevoflorane and Propofol during laryngoscoy and endotracheal intubation in normotensive patient. This investigation shows that intense hypertension with sevoflorane and Propofol during laryngoscoy and endotracheal intubation in normotensive patient is reachable. The patients were basically partitioned into two essential groups i.e., Group A and Group B.. Aftereffects of our investigation demonstrate that the systolic circulatory strain of the 2 groups was practically identical at acceptance. At pre-enlistment, the systolic pulse is about typical in the two groups. After enlistment (T1) the systolic pulse is quickly expanded up to 25mmhg in the two groups A and B. The systolic pulse is then diminishes about 9mmhg in the two groups A and B in T2 and in T3 the systolic circulatory strain are come to standard qualities or 2 to 4mmhg increment from gauge esteems.

There is no huge contrast in group A and in group B in all occasions yet there is a major distinction between T1, T2 and T3. In all occasions the systolic pulse is expanded in the twogroups.Thwaites et al. By examination, the definite approval time was 150 in both the profolsuxamethonium and sevoflurane assemblies. They had satisfactory clinical conditions regardless of this set time of 150 s on the basis that patients were additionally placed on isoflurane in the propofolsuxamethonium assembly after the drug was given. This may be in charge of their prosperity rate in their investigations. On their examination, the portion of the propofol was 3–4 mg / kg

and saxamethonium 2 mg / kg, which was higher than the portion used in this test. He had the option of meeting a clinically satisfactory intubation condition in his sevoflurane group despite attempts at 150 s in light of the fact that sevoflurane had a higher fixation (8% in nitrous oxide and oxygen) Had started and the patients were physically ventilated.None of the patients experienced desaturation (SpO2 <90%), bronchospasm, and injury to the aviation route,

noting that both propofol-saxamethonium and sevoflurane assemblies had very good conditions for intubation. Just 6.1% had laryngospasm in the sevoflurane Group which was like examinations done by Rhedu et al. what's more, Thwaites et al.[9],[10] This proposes utilizing sevoflurane may not totally give a prepared aviation route to intubation. In this list study, Helbo–Hansen score was <2 in every rule which was considered clinically worthy, and tracheal intubation was effective in all youngsters. This was like outcomes gotten by Thwaites et al. who additionally exhibited high achievement rates.[10] In our investigation the diastolic circulatory strain in the two groups was similar at pattern. At pre-acceptance the baseline estimations of diastolic circulatory strain is about ordinary in the two groups. At T1 the diastolic pulse is expanded up to 20mmhg in the two Group A and B. This systolic circulatory strain is then diminished about 9mmhg in the two Group A and B in T2. In T3 the diastolic blood is come to almost baseline values. So there is no noteworthy contrast in the twoGroup in all occasions. The distinction between T1 DBP, T2 DBP and T3 DBP is acutly high.

The distinction in prompt post-intubation pulse was not factually noteworthy between the two groups. The decrease in pulse at 1 and 3 min was more in the propofol/suxamethonium group because of their pharmacological impact on pulse. The utilization of fentanyl and lignocaine could likewise have added to weakening of laryngopressor reaction. The quick post-enlistment and post-intubation symptoms were negligible in this examination.. Nevertheless, there was a large scale difference between diastolic circulation stress and propofol / saxamethonium deposition (group I) in sevoflurane assembly (group II) with lower post-intubation diastolic blood load in group I. Diastolic weight is a ratio of fundamental vascular obstruction and propofol causes a more significant decrease in fundamental vascular resistance. [8] Excellent conditions are less every now and again connected with laryngeal dreariness as indicated by concentrates done by Mencke et al.[7] From their investigation, they presumed that the nature of tracheal intubation adds to laryngeal horribleness, and brilliant conditions are less much of the time related with post-employable raspiness and vocal line sequelae. Adding atracurium to a propofol-fentanyl acceptance routine altogether improved the nature of tracheal intubation and diminished post-usable raspiness and vocal rope sequelae. From that point, laryngoscopy and intubation were done at 5.5 min.[6] This high achievement rate could be ascribed to the utilization of sevoflurane till the patients were apnoeic at 4.5 min and utilization of propofol which causes apnoea in the entirety of their patients. Propofol additionally causes concealment of pharyngeal and laryngeal reflexes. Great intubating conditions were seen in 100% of patients in an investigation by Kumar et al.,[5] sevoflurane was utilized for enlistment and intubation following apnoea at 4.5 min, and afterward, intravenous propofol 1 mg/kg was controlled. Blair et al.[2] exhibited that phenomenal intubating conditions-which was a score of 1 in every basis - were accomplished in 70% of the propofolsuxamethonium group in 45% of the sevoflurane group.The nature of tracheal intubation, controlled by the Hellebo-Henson score, is a score of 1–4 in every regimen and includes laryngoscopy, positioning of the vocal cords, hacking, and appendage development.Great intubating conditions is a score of 3–4, great intubating conditions is a score of 5–6, while 9–12 is viewed as poor and 13–16 is terrible. Incredible and great scores are considered as clinically satisfactory, reasonable and poor scores are considered as clinically unsatisfactory .[4]. The present investigation was configuration like that the group A had 30 males and 25 females and the gathering B had additionally 30 males and 25 females. There is no age restriction in the two gatherings. The range for weight was 22 to 70 kg in the two groups A and B individually. The two groups were equivalent as far as statistic information as there were no noteworthy contrasts between the 2 groups as far as gender, weight and ASA characterization. In Blair et al's. study and Sabapathy et al's. study,[2],[3] the achievement pace of adequate clinical conditions for intubation utilizing 8% sevoflurane in 60% nitrous oxide and oxygen was 87.5%. This examination exhibited a higher achievement rate where every one of the patients had adequate clinical conditions for intubation. These examinations utilized a fixed acceptance time for intubation (150 and 180 s, separately); their high achievement rate in spite of short enlistment time could be credited to overpressure procedure in which the circuit was prepared with sevoflurane.

6. Conclusion

We conclude that after laryngoscopy there is acute rise in blood pressure it means hypertension occurs. We noticed in our study that in group A after laryngoscopy there is acute rise in SBP and DBP in T1. In T2 this SBP and DBP are decreased up to some extent and in T3 it become almost equal to the baseline values. In group B after laryngoscopy there is also acute rise in SBP and DBP in T1. In T2 as almost same to group A the SBP and DBP are decreased up to some extent and in T3 it become almost equal to baseline values. So we also noticed in our study that in group A (propofol) the blood pressure is little raised as compare to group B (sevoflurane). Now on the gender base the blood pressure is also more raised in male then female.

The diastolic blood pressure revealed that before induction the diastolic blood pressure recorded normal in both groups A and B as same as systolic blood pressure. After laryngoscopy in T1 the diastolic blood pressure are also acutely increased in both groups A and B and in T2 it is decreased in both groups and it became normal as baseline values in T3. So this result shows that both systolic and diastolic blood pressure are acutely increased in 1min after laryngoscopy

in both groups, and then decreased up to some extent 3mins after laryngoscopy and after 5mins these both pressures are almost come to same as baseline values.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed

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