

Comparative Evaluation of Hemodynamic Response to Induction and Endotracheal Intubation in Normotensive and Controlled Hypertensive Patients

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Conflict of interest: Nil

Abstract:

Background: The hemodynamic responses associated with laryngoscopy and racheal intubation may be harmful to patients with hypertension. myocardial ischemia, or cerebrovascular disease. Hence, anti-hypertensive medication is mandatory to control hypertension.

Method: Out of 100 (one hundred) patients, 50 were classified as normotensive and so were controlled hypertensive. Blood pressure, heart rate, and SPO₂ were recorded in both groups of patients, and significant parameters were noted.

Results: 42 (84%) patients had no co-morbidity, 4 (8%) had type II DM, and 1 (2%) had DM with hypothyroidism. In comparison, heart rate (HR) after intubation at 4 minutes, 6 minutes, and 8 minutes had a significant p value ($p < 0.001$). After medication, after intubation, 0 minutes, 2nd minutes, 4th minutes, 15 minutes, and 30 minutes had a significant p value ($p < 0.001$). In comparison of DBP (diastolic blood pressure) pre-operatively on the day of surgery before medication after intubation at zero mediation, the 2nd and 4th minutes had a significant p value ($p < 0.001$). In the comparison of SPO₂ before medications, both parameters had a significant p value ($p < 0.001$).

Conclusion: In the present pregnant study, it was concluded that controlled hypertensive patients can be safely induced and endotracheal intubation can be carried out for general anesthesia, and no cardio-vascular risk was observed.

Keywords: normotensive, controlled, hypertensive, endotracheal, intubation, general anesthesia, hemodynamic pressure.

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Introduction

General anesthesia is usually done by securing a definitive airway. Endotracheal intubation by laryngoscopy is one of the most famous and frequent methods for securing the airway [1]. But the conduct of laryngoscopy and intubation of the trachea and endotrachea most of the time results in transient tachycardia, varied arrhythmias, and hypertension due to the sympathetic response and release of catecholamines [2].

This sympathetic response may not be desirable in patients who already have hypertension, myocardial ischemia, or cerebrovascular disease [3].

Tracheal intubation with a conventional Macintosh laryngoscope is often associated with an increase in arterial blood pressure and heart rate events. In hypertensive patients, hemodynamic responses to laryngoscopy and tracheal intubation are more pronounced than in normotensive patients and

greatly increase the risk of myocardial infarction (MI) or stroke [4].

Hence, an attempt was made to compare the normotensive and controlled hypertensive patients undergoing endotracheal intubation by laryngoscopy, and various parameters like heart rate, blood pressure, and co-morbidities were also noted.

Material and Method

100 (one hundred) patients admitted to Lokmanya Tilak Municipal Medical College and General Hospital Sion Mumbai-400022 were studied.

A clinical-based study involving elective surgery was selected for study; anesthesia was studied.

Inclusive Criteria: ASAID II, Age 35–70 years Patients for elective surgery requiring general anesthesia with endotracheal intubation, either normotensive or hypertensive, who gave their

consent in writing for their treatment were selected for study.

Exclusion Criteria: Patients with airway deformity or anticipated difficult intubation. Uncontrolled hypertensive patients, patients with gastro-esophageal reflux disease. Patients with respiratory diseases causing dyspnea on mild exertion, pregnant women, dementia, trauma, and emergency patients.

Methodology

A thorough preoperative assessment, including history and examination, was carried out. A history of hypertension was sought, and if present, its duration and the treatment the patient received was noted. The blood pressure was checked on two separate occasions. All relevant investigations were checked, and inclusion and exclusion criteria were assessed. Patients who fulfilled all inclusion and exclusion criteria were explained about the study and invited to participate in it. Informed written consent was obtained. Patients were divided into two groups of 50 each.

Group N: normotensive patients. Group H: controlled hypertensives were on antihypertensive medication. The known hypertensive patient was considered to be well controlled when blood pressure on two separate occasions on the previous day of surgery and on the day of surgery was less than 140/90 mm Hg.

After confirming starvation, the patient was taken to the operating room. Monitors, including non-invasive blood pressure, a pulse oximeter, and a cardioscope, were connected, and vital parameters such as blood pressure, heart rate, and spo2 were recorded at intervals mentioned in the case record form. An intravenous access was secured using an indwelling cannula of appropriate size. All patients in the study were pre-medicated with Inj. Glycopyrrolate 0.004 mg/kg, Inj. Fentanyl 2µg/kg, Inj. Midazolam 0.02 mg/kg, and Inj. Ranitidine 1 mg/kg. Then the patient was preoxygenated with 100% oxygen for 3 minutes. Anesthesia was induced with Inj. Propofol 2-2.5 mg/kg given slowly in graded doses till central fixation of eyeballs was noted. Ventilation was checked. Neuromuscular blockade was achieved with Inj. Scoline 1.5 mg/kg.

The patient's head and neck were kept in a "sniffing position," and direct laryngoscopy was done using a McIntosh laryngoscope, and the patient was intubated with a proper-size ETT. The time required for laryngoscopy and intubation and the total number of intubation attempts were noted. The hemodynamic response in the form of a change in pulse rate and blood pressure was noted at the following intervals: 1-After premedication, 2-After induction, 3-After intubation, 4-Every 2 minutes until 10 minutes, 5-Every 5 min till 30 min

Any complications, such as dysrhythmias and ECG changes, were also noted. The measures taken to treat the hemodynamic fluctuations such as tachycardia, bradycardia, hypotension, or hypertension and the interventions done were noted.

The blinding was achieved by keeping two separate anesthesiologists measuring the blood pressure in the preoperative period and during the induction of anesthesia, intubation, and thereafter. The person who measured the blood pressure in the preoperative period segregated and coded the patients as normotensive (Group N) or controlled hypertensive on medications (Group H). The patients who had preoperative blood pressure greater than 140/90 mmHg were excluded from the study. Only this anesthesiologist was aware of which group the patient belonged to: normotensive (N) or controlled hypertensive (H). When the patient was taken into the OT.

The anesthesiologist who was to administer anesthesia was totally oblivious to the patient's group and carried out routine anesthesia induction and intubation. A dedicated person was appointed to note down the parameters mentioned in the study. A neutral person analyzed the parameters without knowing the patient's group. The person doing the preoperative checkup was different from the person checking the blood pressure in the operation theater and the one analyzing the results. Thus, blinding in the study was ensured.

The duration of the study was May 2011 to June 2013.

Statistical Analysis:

The data was expressed as the mean \pm standard deviation. Demographic data and complications were analyzed using the chi-square test and hemodynamic variables using the paired and unpaired t tests. A P value of ≤ 0.05 was considered significant.

Observation and Results

Table 1: Distribution of co-morbidity in the experimental (hypertensive) group: 42 (84%) No co-morbidity; 4 (8%) type II DM and IHD; 3 (6%) only II DM; 1 (2%) DM with hypothyroidism

Table 2: Comparison of heart rate in normotensive and controlled hypertensive patients

- After intubation: mean value: 94.4 (± 11.5) in normal, 94.86 (± 16.30) in HTN, t test: 3.50, and $p < 0.001$.
- At 4 minutes: 89.90 (± 12.9) in normal, 91.44 (± 13.3) in HTN group, t test was 2.07 and $p < 0.004$
- At 6 minutes, 83.18 (± 13.3) in Normal, 86.6 (± 12.6) in HTN, the t test was 2.43 and $p < 0.02$.
- At 8 minutes: 80.9 (± 13.4) in normal, 85.8 (± 13.0) in HTN group, t test was 2.21 and $p < 0.03$

All remaining values at different values up to 30 minutes were insignificant.

Table 3:

Comparison of systolic blood pressure in normal and controlled HTN patients Pre-operative on the day of surgery before premedication 0 minutes, 2 minutes, 4 minutes, 15 minutes, and 30 minutes had a significant p value ($p < 0.001$).

Table 4: Comparison of Diastolic Blood Pressure in Normal and HTN Patients

Pre-operative: $82.28 (\pm 4.24)$ in normal, $78.36 (\pm 5.74)$ in HTN; t test was 3.88 and $p < 0.01$.

On the day of surgery before premedication, after intubation at zero medication, at 2nd minutes and 4 minutes, p values were highly significant, and the remaining parameters were insignificant ($p > 0.001$).

Table 5: Comparison of SPO2 in both normotensive and hypertensive patients. Before premedication, $99.04 (\pm 0.19)$ in normal, $99.24 (\pm 0.43)$ in HTN, the t test was 2.98 and $p < 0.001$.

All remaining parameters are insignificant, i.e., both groups were quite normal.

Table 1: Distribution of co-morbidity in Experimental (Hypertensive) group (No of Patients: 50)

Associated Co-Morbidity (Hypertensive Group)	Frequency	Percentage
No co-morbidity	42	84.0
DM, IHD	4	8.0
Only DM	3	6.0
DM, Hypothyroidism	1	2.0
Total	50	100.0

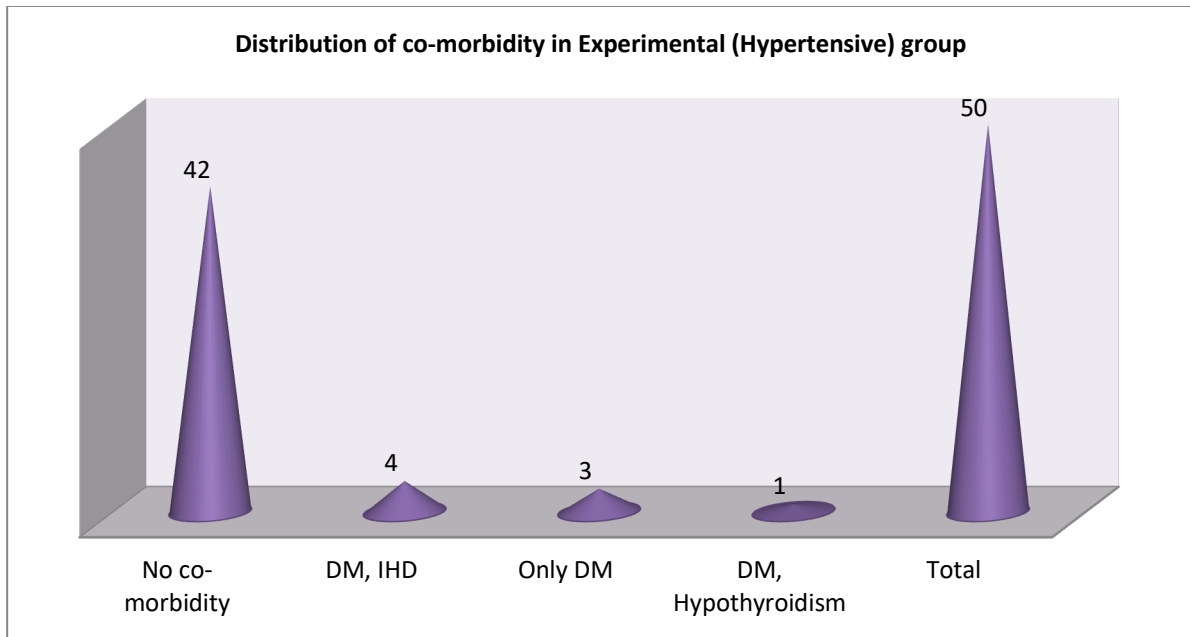


Figure 1: Distribution of co-morbidity in Experimental (Hypertensive) group

Table 2: Comparison of heart rate in normotensive and controlled hypertensive patients

Heart Rate		No	Mean	Std. Deviation	95% C. I. for Mean		t test	df	P value
					Lower Bound	Upper Bound			
Pre-operative	H	50	82.04	11.071	78.89	85.19	1.32	98	0.19
	N	50	79.38	9.057	76.81	81.95			
On day of surgery	H	50	87.30	11.812	83.94	90.66	1.51	98	0.14
	N	50	84.10	9.279	81.46	86.74			
Before premedication	H	50	90.10	14.849	85.88	94.32	-0.10	98	0.92
	N	50	90.36	12.158	86.90	93.82			
After premedication	H	50	87.62	15.653	83.17	92.07	1.60	98	0.11
	N	50	83.36	10.458	80.39	86.33			
After induction	H	50	85.66	14.342	81.58	89.74	-0.65	98	0.52
	N	50	87.44	13.014	83.74	91.14			
After	H	50	103.78	14.966	99.53	108.03	3.50	98	0.001[@]

intubation 0 Min	N	50	94.42	11.567	91.13	97.71			
2 Min	H	50	94.86	16.364	90.21	99.51	1.68	98	0.10
	N	50	89.90	12.982	86.21	93.59			
4 Min	H	50	91.44	13.369	87.64	95.24	2.07	98	0.04@
	N	50	86.14	12.214	82.67	89.61			
6 Min	H	50	89.62	13.132	85.89	93.35	2.43	98	0.02@
	N	50	83.18	13.353	79.38	86.98			
8 Min	H	50	86.66	12.606	83.08	90.24	2.21	98	0.03@
	N	50	80.90	13.484	77.07	84.73			
10 Min	H	50	85.38	13.099	81.66	89.10	1.87	98	0.06
	N	50	80.44	13.281	76.67	84.21			
15 Min	H	50	84.78	12.866	81.12	88.44	1.40	98	0.17
	N	50	81.18	12.923	77.51	84.85			
20 Min	H	50	84.38	12.142	80.93	87.83	1.32	98	0.19
	N	50	81.02	13.316	77.24	84.80			
25 Min	H	50	83.38	12.876	79.72	87.04	1.22	98	0.23
	N	50	80.30	12.331	76.80	83.80			
30 Min	H	50	82.58	11.110	79.42	85.74	1.38	98	0.17
	N	50	79.32	12.540	75.76	82.88			

Note: @- P value (< 0.05) is Significant

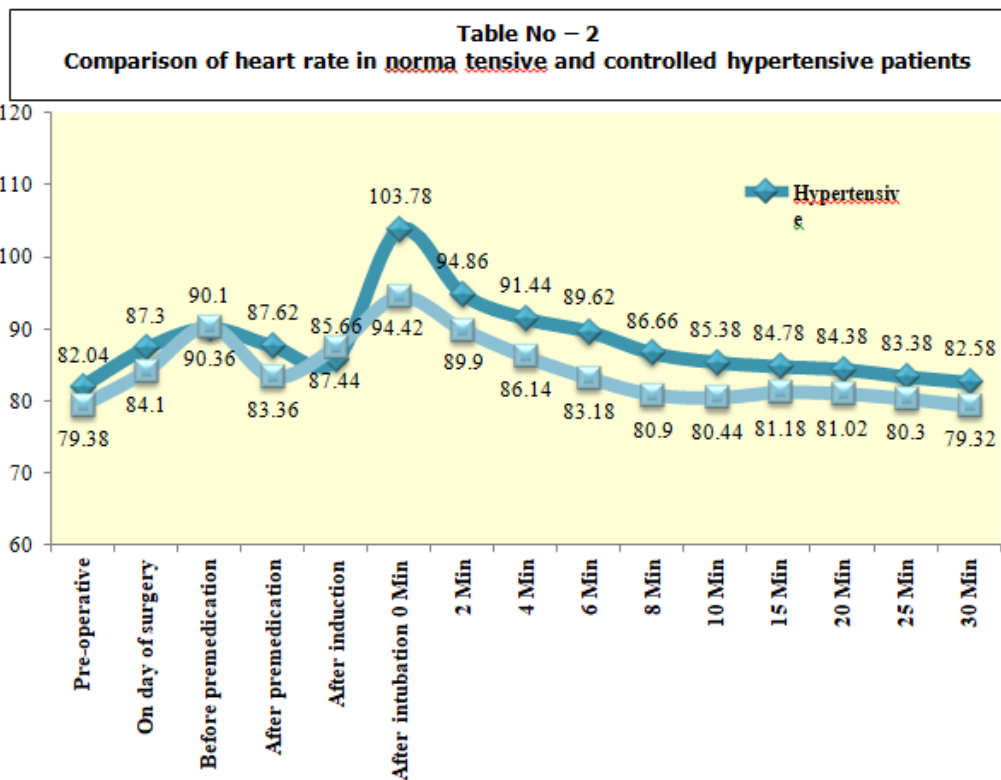


Figure 2: Comparison of heart rate in normal tensive and controlled hypertensive patients

Table 3: Comparison of Systolic blood pressure in both groups

Systolic Blood Pressure	No	Mean	Std. Deviation	95% C. I. for Mean		t test	df	P value	
				Lower Bound	Upper Bound				
Pre-operative	H	50	130.70	4.954	129.29	132.11	6.66	98	< 0.001@
	N	50	122.08	7.690	119.89	124.27			
On day of surgery	H	50	132.04	5.402	130.50	133.58	5.57	98	< 0.001@
	N	50	123.12	9.960	120.29	125.95			
Before	H	50	137.74	9.536	135.03	140.45	5.30	98	< 0.001@

premedication	N	50	124.08	15.535	119.66	128.50			
After premedication	H	50	121.74	14.217	117.70	125.78	3.51	98	0.001[@]
	N	50	112.22	12.856	108.57	115.87			
After induction	H	50	117.24	12.185	113.78	120.70	1.06	98	0.29
	N	50	114.60	12.798	110.96	118.24			
After intubation 0 Min	H	50	148.88	17.601	143.88	153.88	6.78	98	< 0.001[@]
	N	50	128.88	11.224	125.69	132.07			
2 Min	H	50	135.32	17.833	130.25	140.39	5.46	98	< 0.001[@]
	N	50	119.08	11.148	115.91	122.25			
4 Min	H	50	124.24	19.123	118.81	129.67	3.30	98	0.001[@]
	N	50	114.08	10.394	111.13	117.03			
6 Min	H	50	117.12	14.480	113.00	121.24	1.43	98	0.16
	N	50	113.72	8.454	111.32	116.12			
8 Min	H	50	117.38	16.734	112.62	122.14	0.16	98	0.88
	N	50	116.94	10.599	113.93	119.95			
10 Min	H	50	118.92	14.165	114.89	122.95	1.12	98	0.27
	N	50	116.16	10.271	113.24	119.08			
15 Min	H	50	120.56	13.311	116.78	124.34	2.12	98	0.04[@]
	N	50	115.84	8.433	113.44	118.24			
20 Min	H	50	119.74	9.465	117.05	122.43	1.30	98	0.20
	N	50	117.32	9.281	114.68	119.96			
25 Min	H	50	121.04	9.638	118.30	123.78	1.71	98	0.09
	N	50	117.88	8.803	115.38	120.38			
30 Min	H	50	120.34	9.843	117.54	123.14	2.15	98	0.03[@]
	N	50	116.56	7.635	114.39	118.73			

Note: @- P value (< 0.05) is Significant

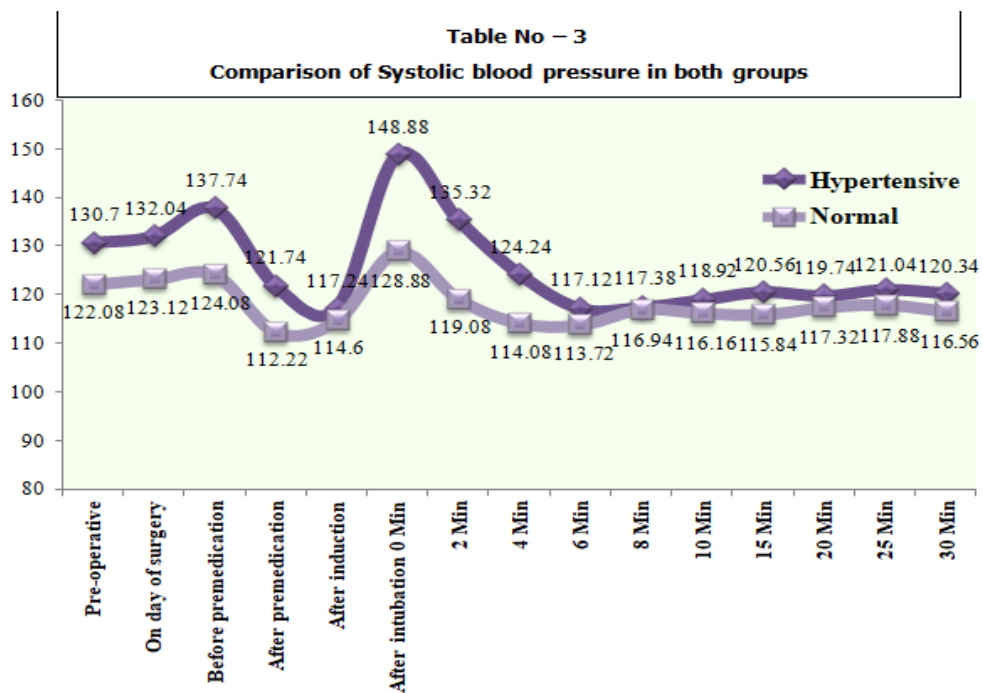


Figure 3: Comparison of systolic blood pressure in both groups

Table 4: Comparison of Diastolic blood pressure

Diastolic Blood Pressure		No.	Mean	Std. Deviation	95% C. I. for Mean		t test	df	P value
					Lower Bound	Upper Bound			
Pre-operative	H	50	82.28	4.243	81.07	83.49	3.88	98	< 0.001 [@]
	N	50	78.36	5.745	76.73	79.99			
On day of surgery	H	50	81.86	6.289	80.07	83.65	2.76	98	0.01 [@]
	N	50	78.36	6.372	76.55	80.17			
Before premedication	H	50	84.10	6.475	82.26	85.94	3.69	98	< 0.001 [@]
	N	50	78.16	9.379	75.49	80.83			
After premedication	H	50	78.34	8.966	75.79	80.89	2.34	98	0.02 [@]
	N	50	73.84	10.241	70.93	76.75			
After induction	H	50	77.92	8.136	75.61	80.23	0.77	98	0.45
	N	50	76.62	8.825	74.11	79.13			
After Intubation 0 Min	H	50	95.36	10.337	92.42	98.30	5.83	98	< 0.001 [@]
	N	50	84.22	8.693	81.75	86.69			
2 Min	H	50	87.10	10.344	84.10	90.10	4.57	97	< 0.001 [@]
	N	50	78.08	9.142	75.48	80.68			
4 Min	H	50	80.20	9.008	77.64	82.76	2.15	98	0.03 [@]
	N	50	76.28	9.201	73.67	78.89			
6 Min	H	50	76.30	6.920	74.33	78.27	-0.18	98	0.86
	N	50	76.60	9.594	73.87	79.33			
8 Min	H	50	76.40	11.780	73.05	79.75	-0.25	98	0.80
	N	50	76.92	8.540	74.49	79.35			
10 Min	H	50	78.32	9.544	75.61	81.03	0.25	98	0.80
	N	50	77.86	8.678	75.39	80.33			
15 Min	H	50	78.30	8.140	75.99	80.61	0.20	98	0.84
	N	50	77.98	7.849	75.75	80.21			
20 Min	H	50	77.98	7.638	75.81	80.15	0.46	98	0.65
	N	50	77.30	7.109	75.28	79.32			
25 Min	H	50	78.10	7.186	76.06	80.14	-0.26	98	0.80
	N	50	78.46	6.896	76.50	80.42			
30 Min	H	50	77.80	6.437	75.97	79.63	0.70	98	0.49
	N	50	76.92	6.127	75.18	78.66			

Note: @- P value (< 0.05) is Significant

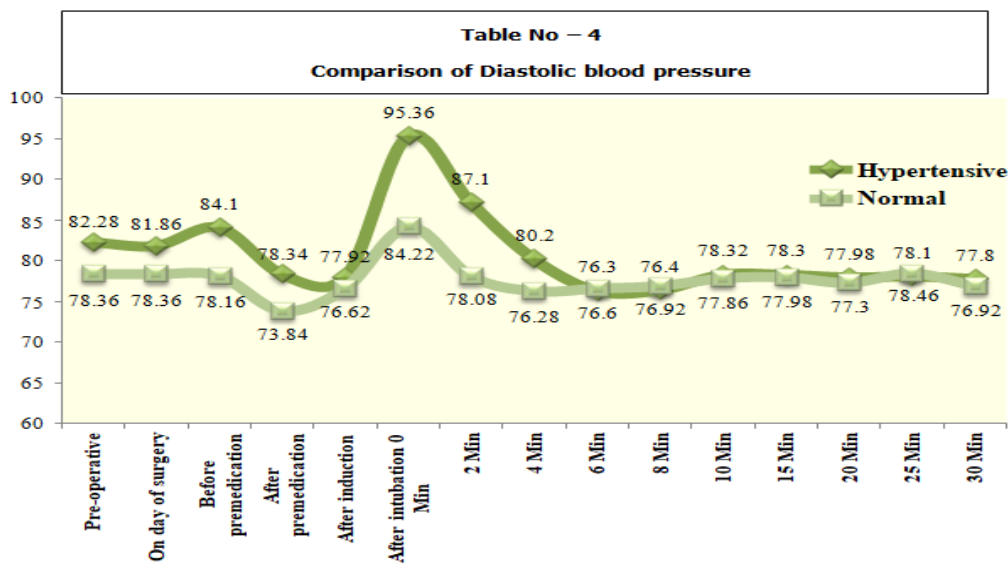


Figure 4: Comparison of diastolic blood pressure

Table 5: Comparison of SPO₂ in both groups

SPO ₂	N	Mean	Std. Deviation	95% C. I. for Mean		t test	df	P value	
				Lower Bound	Upper Bound				
Pre-operative	H	50	99.00	0.000	99.00	99.00	-	98	-
	N	50	99.00	0.000	99.00	99.00			
On day of Surgery	H	50	99.00	0.000	99.00	99.00	-1.00	98	0.32
	N	50	99.02	0.141	98.98	99.06			
Before Premedication	H	50	99.04	0.198	98.98	99.10	-2.98	98	0.004@
	N	50	99.24	0.431	99.12	99.36			
After Premedication	H	50	99.14	0.351	99.04	99.24	-1.73	98	0.09
	N	50	99.28	0.454	99.15	99.41			
After induction	H	50	99.14	0.351	99.04	99.24	-0.54	98	0.59
	N	50	99.18	0.388	99.07	99.29			
After intubation 0 Min	H	50	99.08	0.274	99.00	99.16	-0.95	98	0.34
	N	50	99.14	0.351	99.04	99.24			
6 Min	H	50	99.04	0.198	98.98	99.10	-1.48	98	0.14
	N	50	99.12	0.328	99.03	99.21			
8 Min	H	50	99.02	0.141	98.98	99.06	-1.38	98	0.17
	N	50	99.08	0.274	99.00	99.16			
10 Min	H	50	99.00	0.000	99.00	99.00	-	98	-
	N	50	99.00	0.000	99.00	99.00			
15 Min	H	50	99.00	0.000	99.00	99.00	-1.00	98	0.32
	N	50	99.02	0.141	98.98	99.06			
20 Min	H	50	99.00	0.000	99.00	99.00	-1.43	98	0.16
	N	50	99.04	0.198	98.98	99.10			
25 Min	H	50	99.00	0.000	99.00	99.00	-1.00	98	0.32
	N	50	99.02	0.141	98.98	99.06			
30 Min	H	50	99.00	0.000	99.00	99.00	-1.43	98	0.16
	N	50	99.04	0.198	98.98	99.10			

Note: @- P value (< 0.05) is Significant

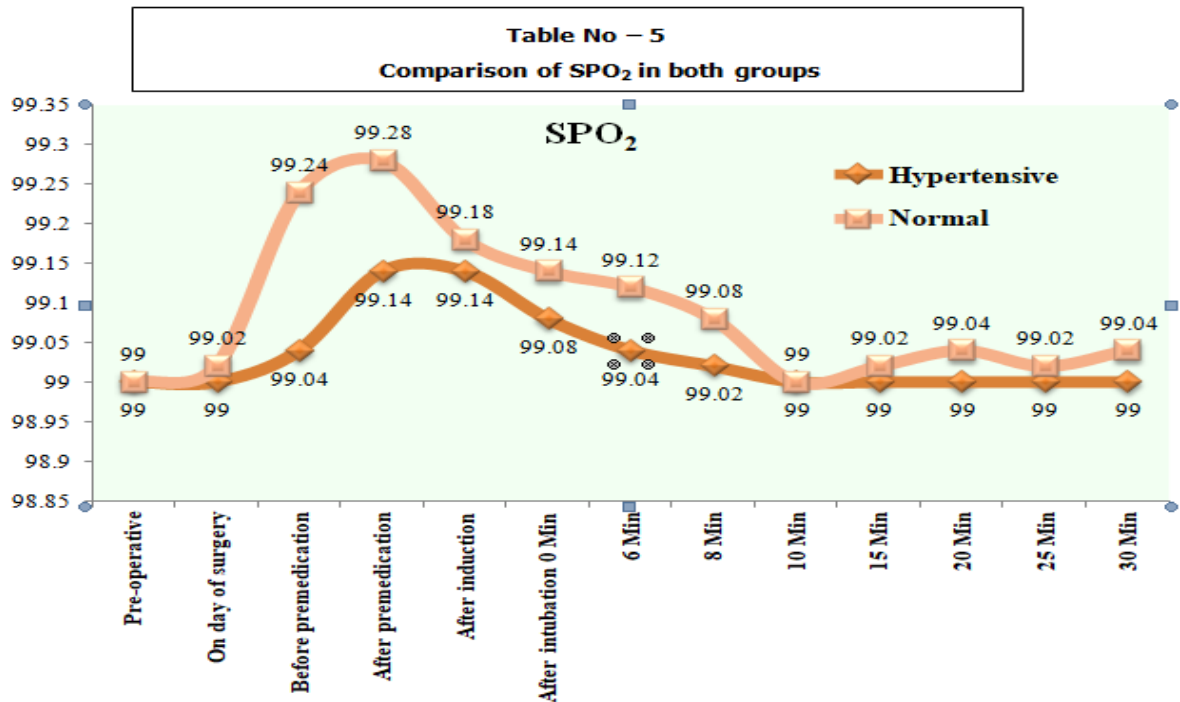


Figure 5: Comparison of SPO₂ in both groups

Discussion

In the present comparative evaluation of hemodynamic response to induction in normotensive and controlled hypertensive patients of the Maharashtra population, The co-morbidities were 42 (84%) no co-morbidity, 4 (8%) type-II DM, 3 (6%) only type-II DM, 1 (2%) DM and hypothyroidism (Table 1). In the comparison of heart rate in normotensive and hypertensive patients, after intubation after 4 minutes, after 6th minutes, and after 8 minutes, 8th minutes have a significant p value ($p < 0.001$) (Table 2).

In the comparison of systolic blood pressure in normotensive and controlled hypertensive patients during pre-operative on day of surgery before medication, after medication after induction at zero minute, 2nd minute, 4th minute, 15th minute, and 30th minute, the p value is highly significant ($p < 0.001$) (Table 3). In the comparison of diastolic blood pressure in both groups on the pre-operative day of surgery, before pre-medication, after medication, and after intubation on the zero minute, 2nd minute, and 4th minute, the p value is highly significant ($p < 0.001$) (Table 4). In the comparison of SPO₂ before and after pre-medication, only the p value is highly significant ($p < 0.001$) (Table 5). These findings are more or less in agreement with previous studies [5,6,7]. It indicates SPO₂ parameter studies remain normal in both groups.

Laryngoscopy and tracheal intubation are noxious stimuli that lead to stimulation of the sympathetic adrenalin system and the release of catecholamine, causing an increase in heart rate and blood pressure [8,9]. In normotensive patients, increases in heart rate and blood pressure are transient and limited, but HTN patients already having arteriolar luminal narrowing and high blood pressure, if not controlled pre-operatively, show an exaggerated response [10,11].

This exaggerated response affects various organs and may precipitate complications like myocardial ischemia or infection, left ventricular failure (LVF), pulmonary oedema, and cerebral hemorrhage [12,13]. Hence, to avoid such morbidities and mortalities, blood pressure must be controlled pre-operatively, and such patients must be kept under surveillance during and after surgery so that hemodynamic pressure can be under control.

It is reported that tracheal intubation with a Macintosh laryngoscope (MAC) might result in severe cardio-vascular complications in normotensive and HTN patients as well. Video laryngoscopes, which minimize oro pharyngeal and laryngeal structures, may decrease hemodynamic changes [14]. Unlike MAC (UE), videolaryngoscopy facilitates tracheal intubation without alignment of the oral pharyngeal and transverse axis in one line to view the glottis. The

UE video-intubation stylet (VA) is an optical stylet that allows retro-molar approach to the larynx to insert the tracheal tube between the vocal cords into the trachea with minimal manipulation of the epiglottis [15]. Hence, it is hypothesized that UE and VS have a lesser effect on cardiac output and hemodynamic changes of tracheal intubation than MAC in normotensive and HTN patients.

Summary and Conclusion

In the present comparative evaluation of hemodynamic response to induction and endotracheal intubation in normotensive and controlled HTN patients, it is concluded that HTN patients must be treated with suitable HTN drugs, and an ECG and echocardiographic evaluation must be carried out before induction and endotracheal intubation. Moreover, the latest technologies, such as the UE video laryngoscopy video intubation stylet (VS), attenuate the hemodynamic response to intubation in both normotensive and HTN patients.

Limitation of study:

Owing to the remote location of the research center, the small number of patients, and the lack of the latest technologies, we have limited findings and results.

This research paper was approved by the Ethical Committee of the Lokamanya Tilak municipal medical college and general hospital Sion Mumbai, Maharashtra-400022.

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