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Comparison of hemodynamic response during general anesthesia in treated and untreated hypertensive with normotensive patients

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Abstract
Background: Hypertension is one of the many challenges that anesthesiologist face day and after. Fluctuation in blood pressure is more marked in the untreated and inadequately controlled patients than normotensive patients. We aimed to compare the changes in hemodynamic response during general anesthesia in treated, untreated hypertensive patients with normotensive patients.
Methods: We had taken 25 treated, 25 untreated hypertensive and 25 normotensive patients undergoing different surgical and gynecological procedure under general anesthesia for this study. After pre-anesthetic check-up and premedication induction of anesthesia was done followed by intubation, maintenance of anesthesia, reversal of anesthesia. Systolic blood pressure, Diastolic blood pressure, Mean arterial pressure and Heart rate were recorded before intubation, at 1, 3, 5, minutes after intubation and thereafter every 15 minutes throughout the surgery till reversal & recovery.
Result: There was a general tendency of fall in systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate after premedication and induction while rise during endotracheal intubation. Fluctuation in blood pressure and heart rate was more marked among untreated hypertensive patients than normotensive patients.
Conclusion: The fluctuation in hemodynamic response (systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate) of untreated hypertensive patients under general anesthesia was more than normotensive patients.

Keywords: untreated hypertensive patient, normotensive patient, hemodynamic changes

Introduction

With increasing stress & strain hypertension has become one of the commonest clinical conditions of the world. The prevalence of hypertension is about 29.8% in India in which33% of urban Indian and 25% rural Indians. Among those 25% rural Indian and 42% urban Indians are unaware of their hypertensive status [1]. Only 25% rural and 38% of urban Indians are taking treatment of hypertension. Hypertension is one of the many challenges that anesthesiologists face day and after. Blood pressure is mainly regulated by an integrated set of physiological control mechanisms. The long-term blood pressure is controlled by renin– angiotensin–aldosterone system (RAAS) [2].

In primary hypertensive patient, the set point for blood pressure control is elevated for which multi factorial mechanism like environmental factors with a genetic tendency is responsible to raised blood pressure. Preoperative antihypertensive therapy reduces perioperative complications. It is found that marked hemodynamic variations occurs during anesthesia induction, tracheal intubationand surgery procedure which is relatively common in untreated hypertensive patient than normotensive patient. The hemodynamic stress response to tracheal intubation can precipitate adverse cardiovascular events in patients with and without cardiovascular disease.[3]Fluctuation in blood pressure during tracheal intubation is more with hypertensive patients then normotensive. Hypertensive patients have an exaggerated hemodynamic stress response compared with normotensive patients [4] this is related to increased catecholamine levels and increased sensitiveness of peripheral vessels to catecholamine [5] as a whole we can say that fluctuation in blood pressure is more marked in the untreated and inadequately controlled patients than normotensive patients. It is also reported that untreated and inadequately controlled patient show transient dysarrhythmia. These mainly occur during endotracheal intubation and disappear within 15-30 min [6].

This present study has been undertaken to compare the changes in hemodynamic response during general anesthesia in treated (group III), untreated (group II), hypertensive patients with normotensive patients (group I).

Methods

The present prospective, randomized, double blinded study was done in patients admitted to Darbhanga Medical College and Hospital, Bihar, India from January 2014 to July 2015 for major surgery after ethical clearance. We have taken 25 treated, 25 untreated hypertensive patients and 25 normotensive patients, undergoing different surgical and gynecological procedures under general anesthesia. Patients fulfilling selection criteria were selected for the study and briefed about the nature of study and explained about anesthesia procedure. A written informed consent was obtained from the patients. A complete pre-anesthetic examination and preparation was done prior to administration of anesthesia.

Exclusion criteria for the study was extreme of age, ASA grade 3&4 any significant arrhythmia, laparoscopic surgery,

neurological disorder, lungs, cardiac, liver, kidney, mental, psychological or endocrine disorder, chronic use of opiates, benzodiazepines, anticonvulsants; or ingestion of α2 adrenoceptor agonist within 12 hrs of surgery, body weight not within ideal range, history of hypersensitivity to anesthetic or any other drug, participated in any investigational drug trial within 12 weeks before the day of surgery, pregnant or breast feeding women etc.

A complete history of headache, dizziness, visual disturbance, palpitation, pain chest, fainting, edema, ascites, breathlessness, tremor, epigastric pain, flushing, sweating, anxiety, and past history of rheumatic fever, hypertension with or without treatment, renal disease, myocardial ischemia or infarction was recorded. Physical examination with special attention to cardiovascular, renal and central nervous system was done. Group I consisted of 25 normotensive patients whose blood pressure ranges from 120-139/80-89 mm of Hg and heart rate from 60 to90 per minute while Group II comprised of 25untreated hypertensive patients who had no history of hypertension but mild hypertension (stage 1) and heart rate from 60 to 90 per minute was detected during hospital admission and pre-anesthetic check-up and did not required treatment. Group III consisted of 30 adequately treated hypertensive patients whose blood pressure were above 150/90 mm of Hg (as recorded by history of the patient) and antihypertensive drug continued during intra-operative period. Patient was given midazolam 7.5 mg orally the night before surgery as premedication. After preoxygeneted with 100% oxygen for 5 minute patient was induced with fentanyl 2mcg/kg bodyweight (b.w.) and thiopentone sodium 3-5 mg/kg bodyweight intravenous given till loss of consciousness ascertained by loss of verbal communication and eye lash reflex then vecuronium 0.8 mg/kg b.w. i.v. was given and continued as required. Each patient received intravenous fluid i.e. Lactated Ringer (Hartmanns Solution) as per standard protocol. With the onset of adequate neuromuscular blockade (3 mins) checked by a relaxed jaw visualization of the vocal cords was undertaken with Macintosh laryngoscope and intubation was performed with appropriate size cuffed endotracheal tube. Fresh gas flow of N2O and O2 mixture in 60:40 ratios with intermittent positive pressure ventilation was undertaken by the close circuit of DatexOhmeda Anesthesia machine. Systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) and heart rate (HR) were recorded before intubation, at 1, 3, 5, minutes after intubation and thereafter every 15 minutes throughout the surgery till reversal & recovery. SpO2 (oxygen saturation) was kept between 99-100 % (mainly 100%) throughout the surgery. Muscle relaxant used for maintenance of relaxation was vecuronium bromide and given as per variation in EtCO2 graph and tidal volume, movement of the finger or eyebrow, flickering of the respiratory movement, inadequate surgical relaxation mainly 20-25 minute interval. Top up dose was given as required 0.02 mg/kg i.v. and inhalation agent isoflurane (0.8%) was used. Peripheral nerve stimulator was not used due to non-availability and was judged by clinical assessment.

Complete reversal from muscle relaxant effect was known by noting the following findings: Start of spontaneous respiration with normal tidal volume and rate, return of laryngeal reflexes, and response to verbal commands *viz.* opening eyes, showing tongue, active deglutition, lifting of limbs and head. Patient was asked to cough and colour of the skin was observed. Postoperative pulse and blood pressure were recorded. The results so obtained during the period of anesthesia were compiled and compared with respect to the effect on cardiovascular system mainly pulse rate & blood pressure in different groups of patients. Systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate were recorded before intubation, at 1,3,5 minutes after intubation and thereafter every 15 minutes throughout the surgery till reversal & recovery from various monitors.

Statistical analysis

Data so collected was tabulated in an excel sheet, under the guidance of statistician. Data was analyzed using IBM SPSS. Statistics Windows, Version 20.0. (Armonk, NY: IBMCorp) for the generation of descriptive and inferential statistics.

Results

Total number of cases included in this series was 90. Largest number of operation performed were open cholecystectomy 25 (27%) and the minimum number of case operated was hemicolectomy that was one in number. The patients selected were of 35 to 70 years of age; 72% cases were male and 28% cases were female. In group I, it was found that 5 cases had no changes in B.P. while mild fall in B.P.

was observed in 20 cases. On the other hand in group II and III, 18&16 cases showed mild fall and 7&9 cases showed moderate fall in B.P. respectively (table 1). When effect of premedication on blood pressure during surgery was compared statistically among the groups, it was found to be statistically significant as $p<0.05$.

Table 1: Effect of Premedication on blood pressure among the study groups

Group	Pre- medication	Changes in B.P						Fisher's exact test	p value
		Rise			Fall				
		Mild	Moderate	Severe	Mild	Moderate	Severe		
I	M + F	-	-	-	20	-	-	2.02	0.04*
II	M + F	-	-	-	18	7	-		
III	M + F	-	-	-	16	9	-		

M = Midazolam, F = Fentanyl, *: statistically significant

Table 2 showed that there was general tendency of B.P. to rise during and after intubation. The rise in B.P. was mild to moderate. It was more in group II as compared to group I and III with statistically insignificant difference as $p>0.05$.

Table 2: Effect of intubation on blood pressure among the study groups

Group	Drug Used	Changes in B.P					
		Rise			Fall		
		Mild	Moderate	Severe	Mild	Moderate	Severe
I	Fentanyl + thiopenton + vecuronium	15	1	-	-	-	-
II	Fentanyl + thiopenton + vecuronium	19	4	-	-	-	-
III	Fentanyl + thiopenton+ vecuronium	18	3	-	-	-	-
Chi Square Test		7.88					
p value		0.09					

Mean MAP before and after premedication was 99.8 & 95.52, 113.96 & 109.36,100.64 & 96.16 mmHg among group I, II and III respectively. Significant difference was found between the three groups when mean MAP was compared after medication using Anova test. Post medication at 120 min, mean MAP was found maximum in group II (104 mmHg) followed by group III (89.17 mmHg) and group I (88.43mmHg). Significant difference was found between group I & II as well as group II & III as shown in table 3.

Table 3: Intra operative mean arterial pressure comparison among the study groups at different intervals

Group	Before premedication	After premedication	After induction	At 30min	At 60 min	At 90 min	At 105 min	At 120 min
I	99.84	95.52	94.76	94	91.4	89.09	88.86	88.43
II	113.96	109.36	108.32	110	107.2	106.1	103.75	104
III	100.64	96.16	96	96.1	93.58	90.09	90.67	89.12
Anova test	11.98	12.63	10.87	11.18	14.58	17.88	14.32	12.91
p value	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*

*: statistically significant

Discussion

The present study was carried out on 25 treated, 25 untreated hypertensive patients and its changes in blood pressure were compared with 25 normotensive patients. The patients selected were of 35 to 70 years of age; 72% cases were male and 28% cases were female. It was found that incidence of hypertension is more in males than female in India [7] In untreated group 100% cases were of mild hypertension with no treatment required. There was no case of moderate or severe hypertension included in this study. Adequate premedication is essential in all patients including hypertensive patient, as inadequate premedication cause's apprehension and rise of blood pressure which is in proportion to the severity of hypertension [8].

In the present study patients were given midazolam 7.5mg orallynight before operation and in operation there after fentanyl 2µgm kg-1 bodyweight. i.v. slowly in all three groups [9, 10] In almost all cases mild fall in blood pressure was recorded, though more in untreated as compared to treated hypertensive patient. We found that there was a general tendency of fall in blood pressure after premedication. The fall in blood pressure may be due to labile nature of blood pressure and to the sedative action of premedication which removed psychic factor, excitement and fear which is more in untreated hypertensive patients.

In the present series inductions were done with thiopentone sodium 3-5 mg/kg bodyweight. Thiopentone did not produce change in B.P when given slowly. The vasodilatation produced by thiopentone is compensated by constriction of splanchnic and renal vessels and thereby maintaining the cardiac output and B.P.The hypotensive effect of thiopentione is enhanced when the peripheral vascular tone and compensatory ability of the myocardium are already impaired by sympathetic blockade. Therefore, slow injection in sleep dose of thiopentone could be used safely for induction of anesthesia in hypertensive patient. Further fall in blood pressure was found in the present series of patients after induction and more marked in untreated hypertensive patients [11] All cases were intubated after 3 min of injecting vecuronium [12] There was a general tendency of rise in blood pressure in all groups of patients during intubation [13] The tendency of rise in blood pressure was attenuated by the use of fentanyl [14] these changes were of transient nature. The rise in blood pressure during endotracheal intubation in both normotensive and untreated hypertensive patient was associated with slight increase in heart rate and rise in systolic pressure [15] There were no incidences of dysrrhythmia or myocardial ischemia when adequate premedication was used [16, 17] During maintenance of anesthesia fluctuation in blood pressure was more marked in untreated hypertensive patient [18] In the present study 0.4 mg of glycopyrrolate mixed with 2.5 mg. of neostigmine was administered very slowly till sign of spontaneous breathing returned. The reversal of anesthesia did not produce any appreciable change in blood pressure, though mild tachycardia and rise in blood pressure was seen in untreated hypertensive patients [19] Reversal of anesthesia with neostigmine and glycopyrrolate were quick, effective and excellent in all the cases of present series.

Conclusion

We concluded that the fluctuation in hemodynamic response (systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate) during general anesthesia is least in normotensive group of patients while more marked in untreated hypertensive patients. Therefore for untreated hypertensive patients, patients should be treated properly and then surgery should be done for elective cases.

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