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Measurement of blood pressure before anesthetic induction by chemical drugs in patients with normal and hypertensive blood pressure

Masoud Parish[a] |Maryam Ordibeheshti Khiaban[b] |Nagisa Ranjbarnejad Azari[c] |Naghi Abedini[a,*]

[a]*Associate Professor of Anesthesiology, Department of Anesthesiology, School of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran*

[b]*PhD of Midwifery, Islamic Azad University, Tabriz, Iran*

[c]*Department of Anesthesiology, School of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran*

***Corresponding Author:**
Naghi Abedini
Email: dr_dr_tabriz@yahoo.com
Tel.: 09127620132

The present study aimed at evaluating the level of blood pressure before anesthetic induction by chemical drugs in patients with normal and hypertensive blood pressure. The present study was performed on 100 patients (50 patients with a history of hypertension and 50 others with normal blood pressure) who were candidates for orthopedic surgery in 2019. The subjects were examined for blood pressure and heart rate after entering the operating room and before chemical anesthetic induction (10 minutes). The changes in blood pressure were recorded during surgery, and the results were compared between the two groups. Patients with normal or hypertensive blood pressure experienced an increase in blood pressure level in the preoperative period. The frequency of patients with systolic hypertension (above 140 mmHg) was significantly higher in the hypertensive group than the normal group at the time points after chemical anesthetic induction and two minutes after baseline. The results showed that patients with a history of hypertension experienced an increase in blood pressure level after anesthetic induction and two minutes after baseline. Perioperative hypertension is even observed in individuals with normal blood pressure, and increased blood pressure cannot be a reason for surgical delay. It is better to consider factors contributing to increased blood pressure in patients with hypertension, due to the lack of significant difference with the ones with normal blood pressure, and precisely examine early cancellation of surgery.

KEYWORDS

Normal blood pressure; hypertension; chemical anesthesia; pre-anesthesia period.

Introduction

Management of blood pressure in patients with hypertension during the preoperative period demands extensive responsibility of health care workers to ensure that the complication just occurred or the patient had poor control over it [1,2]. There is a scarcity of evidence of perianesthetic and perisurgerical complications caused by preoperative high blood pressure, as it might be false and dread of surgery, such stresses always exist [3,4].

In the study on 253 cases of carotid endarterectomy, postoperative hypertension was associated with an increase in neurological disease and mortality. The incidence of cardiovascular events before

surgery was 40% in patients with isolated systolic hypertension. Also, up to 25% of patients undergoing a major, non-cardiac surgery develop preoperative hypertension; it is the most common avoidable medical reason for surgical delay [5]. However, there are no global guidelines for the cancellation of elective surgeries at a certain blood pressure level. It is worth noting that patients with high blood pressure may experience a significant reduction in heart rate and blood pressure during preoperative anesthesia. On the other hand, moderate blood pressure is a good determinant in guiding surgery and preventing anesthetic complications during surgery [6]. Hypertension is a risk factor for anesthesia. It is recommended to perform surgery with no delays if diastolic blood pressure is below 110 mmHg, and vital signs are stable. The blood pressure is carefully measured and monitored before surgery, and hypertensive and hypotensive periods are specifically managed (1). Likewise, if diastolic blood pressure is ≥100 mmHg (with and without antihypertensive therapy), surgery should be postponed until better control.

Preoperative stress increases blood pressure levels in hypertensive patients, but the occurrence of the same condition is not confirmed in those with normal blood pressure. Hence, the present study aimed at evaluating the blood pressure level before anesthetic induction in patients with hypertensive and normal blood pressure.

Methodology

Study design

The present descriptive-analytical, cross-sectional study was performed from the beginning to the end of 2019 in an orthopedic specialty hospital located in Tabriz, Iran, considering the inclusion and exclusion criteria. The minimum sample size was determined 50 in each group using the sample volume formula considering α=5%, optimal P-value =0.5, and the error coefficient =0.1%. A total of 100 patients were enrolled in the study using the convenience and purposive sampling method based on the inclusion and exclusion criteria.

Inclusion and exclusion criteria

Inclusion criteria were: age 14 years and above and willingness to participate in the study. Exclusion criteria included using sedatives and antidepressants, having kidney diseases, being an emergency surgery case, being considered high-risk following cardiologist consultation, and being intubated and admitted to the intensive care unit, as well.

Study method

The patients' medical history was taken after referring to the hospital, and the duration of hypertension and the other underlying diseases, as well as medication regimen, were recorded in the questionnaire if there were any. After entering the operating room, the patients were asked to lay on the bed for five minutes, and only the monitoring equipment was attached to them. Then, systolic and diastolic blood pressure, mean arterial pressure, and heart rate were measured and recorded at baseline (the first blood pressure measured in the operating room) and two minutes after that. The values were recorded by a person who was blind to the patients' medical history.

Ethical considerations

The study protocol was approved by the Ethics Committee of Tabriz University of Medical Sciences (IR.IAU.TABRIZ.REC.1398.056). The informed consent was taken from all the participants. The questionnaires were analyzed anonymously, and the confidentiality of patients' information was considered. For this, a code was allocated to each participant.

Statistical analysis

Data were analyzed using SPSS version 21. The normality of the data was assessed using the Kolmogorov–Smirnov test. Descriptive data were expressed as frequency (percentage), and the quantitative ones as mean (standard deviation) if normal; in case of non-normality, data were expressed as median (25^{th} and 75^{th} percentiles). Qualitative data were analyzed using the Chi-square test or the Fisher exact if the Chi-square test was not applicable. Quantitative data were analyzed using independent samples t-test if normal and the Mann-Whitney test in case of non-normality. Time series data in the two groups were analyzed using the Cochran test if were qualitative, repeated measures ANOVA, and Sidak post hoc test were utilized if the quantitative data were normal. The Friedman test was also used if the quantitative data were non-normal. The p-value of 5% was considered the level of significance.

Results

A total of 100 patients who were candidates for surgery within the age range of 14 to 91 years were studied. The mean±SD age of the subjects was 56.64±17.8 years. The mean±SD age in the hypertensive and normal groups was 66.20±10.3 and 47.08±18.6, respectively. Also, 56 subjects were male (56%) and the rest female, of whom 16 (32%) and 40 (80%) males were in the hypertensive and normal groups, respectively. The most common underlying disease was diabetes (n=21, 21%), of which 15 (15%) and six (6%) belonged to the hypertensive and normal groups, respectively. Of the subjects in the hypertensive group (n=50), 48 (48%) had a history of hypertension. Table 1 indicates the duration of hypertension and medication regimen (drug type and daily dosage), if any, in subjects with a history of this medical condition. The mean±SD duration of hypertension was 6.5±4 4.4 years in the study subjects, 96% were taking drugs, and Losartan was the commonest drug taken by the subjects (n=47, 98%). The mean±SD number of drugs used daily was 1.4±0.49.

TABLE 1 Medical History of the Subjects with a History of Hypertension

Duration of hypertension	Min	6 months
	Max	20 years
	M±SD	6.5(4.5) years
Drug status	Yes	46(96)
	No	2(4)
Type of Drug	Losartan ($C_{22}H_{23}ClN_6O$)	47(98)
	Amlodipine ($C_{20}H_{25}ClN_2O_5$)	5(10)
	Metoral ($C_{15}H_{25}NO_3$)	2(4)
	Other	6(12)
Number	Min	0.5
	Max	2
	M±SD	1.4(±0/49)

The results of systolic and diastolic blood pressure were based on the studied time points at baseline and two minutes after that are listed in Table 2. Accordingly, systolic blood pressure significantly reduced in the hypertensive group at both time points after anesthetic induction and two minutes after baseline, whereas it was significantly lower in the normal group compared with baseline only after anesthetic induction. Systolic blood pressure was higher in the hypertensive group than that of the normal group at both time points, and the difference was statistically significant. In the hypertensive group, diastolic blood pressure was significantly lower than the baseline only two

minutes after that, while it was significantly lower than that of baseline in the normal group only after anesthetic induction. There was no significant difference in diastolic blood pressure between the two groups at both time points.

TABLE 2 Results of changes in systolic and diastolic blood pressure two minutes after baseline compared to baseline in the study participants

2 Minutes after		After Induction		Base		Groups	Variable
P-value	Amounts	P-value	Amounts	P-value	Amounts		
0.999	22.5(±155.7)	0.09	25.7(±156.3)	…	23.8(±161.6)	High blood pressure	Systolic blood pressure
0.20	15.8(±143.5)	0.01	21.5(±138.5)	…	17.2 (±146.2)	Normal	
	0.999		0.999		0.999	P-value Intergroup	
0.02	2.13(±8.87)	0.54	14.6(±89.2)	…	13.5 (±90.8)	High blood pressure	Diastolic blood pressure
0.66	4.12(±6.88)	0.04	14.9(±85.5)	…	12.7(±90.2)	Normal	
	0.76		0.21		0.80	P-value Intergroup	

Changes in systolic and diastolic blood pressure two minutes after baseline compared to baseline in the study participants based on blood pressure 120/80 mmHg are reported in Table 3. Accordingly, the frequency of patients with a systolic blood pressure above 120 mmHg was not significantly different in the hypertensive group at the time points of after anesthetic induction and two minutes after baseline, whereas it was significant in the normal group, which might be related to anesthetic induction period that was shorter than the baseline. The frequency of patients with a systolic blood pressure above 120 mmHg was not significantly different at both time points between the two groups. On the other hand, the frequency of patients with diastolic blood pressure above 80 mmHg was not significantly different in the hypertensive group at any time points, while it was significant in the normal group, which might be related to the period after anesthetic induction, which is shorter than baseline. There was no significant difference in the frequency of patients with diastolic blood pressure above 80 mmHg between the two groups at both time points.

The results of changes in systolic and diastolic blood pressure two minutes after baseline were compared to baseline in the study participants based on blood pressure 140/90 mmHg are depicted in Table 4. Accordingly, the frequency of systolic blood pressure above 140 mmHg had no significant differences in the hypertensive group between the time points of after anesthetic induction and two minutes after baseline, while it was significantly different in the normal group, which might be related to the anesthetic induction period that was shorter than baseline. The frequency of patients with systolic blood pressure above 140 mmHg was significantly higher in the hypertensive group than the normal group at both time points after anesthetic induction and two minutes after baseline. On the other hand, the frequency of patients with diastolic blood pressure above 90 mmHg had no significant difference between the two groups at any of the time points. The frequency of patients with diastolic blood pressure above 90 mmHg was not significantly different between the two groups.

TABLE 3 Results of changes in systolic and diastolic blood pressure two minutes after baseline compared to baseline in participants based on blood pressure 120/80 mmHg

P-value IntergroupIntergroup	2 Minutes after	After Induction	Base	Groups	Variable
0.10	98(49)	92(46)	96(48)	High blood pressure	Systolic blood pressure >120
0.02	90(45)	80(40)	96(48)	Normal	
	0.20	0.15	1.00	P-value Between groups	
0.91	74(37)	74(37)	76(38)	High blood pressure	Diastolic blood pressure >80
0.999	72(36)	56(28)	82(41)	Normal	
	0.82	0.09	0.62	P-value Between groups	

TABLE 4 Results of changes in systolic and diastolic blood pressure two minutes after the baseline compared to baseline in participants based on blood pressure 140/90 mmHg

P-value IntergroupIntergroup	2 Minutes after	After Induction	Base	Groups	Variable
0.08	42(84)	72(36)	)82(41)	High blood pressure	Systolic blood pressure >140
0.999	28(56)	40(20)	66(33)	Normal	
	0.999	0.999	0.11	P-value Between groups	
0.25	44(22)	46(23)	54(27)	High blood pressure	Diastolic blood pressure >90
0.25	42(21)	23(16)	40(20)	Normal	
	0.84	0.22	0.23	P-value Between groups	

Discussion

The present study aimed at evaluating the blood pressure level before anesthetic induction in patients with normal and hypertensive blood pressure. The results illustrated no significant differences in the frequency of patients with systolic blood pressure above 140 mmHg in the hypertensive group between the two-time points of after anesthetic induction and two minutes after baseline compared to baseline, whereas it was significant in the normal group, which might be related to after anesthetic induction period that was shorter than the baseline. Furthermore, the frequency of patients with a systolic blood pressure above 140 mmHg was significantly higher in the hypertensive group than the normal group at both time points after anesthetic induction and two minutes after baseline. On the other hand, the frequency of patients with diastolic blood pressure above 90 mmHg in both hypertensive and normal groups had no

significant differences in any of the time points. Also, the frequency of patients with diastolic blood pressure above 90 mmHg was not significantly different between the two groups at both time points. High blood pressure is a risk factor during anesthesia and surgery. In early 1929, Sprague reported the death rate of 30% in patients with hypertension undergoing surgery; several subsequent reports also emphasized the high risk of anesthesia and surgery in such cases. Prys-Roberts and Meloche [7] reported a difference in risks between patients with controlled and uncontrolled hypertension. Primary systemic hypertension affects 10%-25% of individuals undergoing surgery and anesthesia and is an important reason for the cancellation of elective surgeries. Most dreads are rooted in the fact that high blood pressure can lead to postoperative adverse outcomes. Although long-term hypertension increases the risk of stroke, renal dysfunction, or significant cardiac adverse effects, it is not usually detected if blood pressure varies >110-180 mmHg. It was among the major issues considered in recent guidelines for blood pressure management. Claude-Charles Balick Weber *et al*. (2011) [8] conducted a study on high pulse pressure or preoperative cardiac diastolic dysfunction along with intraoperative hemodynamic instability among 61 patients with hypertension and 21 individuals with normal blood pressure undergoing surgery under general anesthesia. Considering preoperative Doppler echocardiogram assessments, diastolic dysfunction and the elevated pulse pressure were measured during preoperative anesthesia consultation. Among patients with hypertensive blood pressure, 30 (49%) had no diastolic dysfunction, 19 (31%) had mild pulse pressure, and 12 (20%) moderate or severe diastolic dysfunction. Hemodynamic instability during hypertension was significantly higher in cases compared to controls. Patients with hypertension without diastolic dysfunction had a similar hemodynamic instability index. The index was significantly associated with a high pulse pressure even after the adjustment of age, body mass index, and mean arterial pressure. Their study provided evidence of increased intraoperative hemodynamic instability during general anesthesia, which is associated with preoperative hypertension in patients with hypertension. Diastolic dysfunction does not contribute to intraoperative hemodynamic instability.

A study considered pain, stress, anxiety and emotions, cold, hypercarbia, hypoxia, excessive intravenous (IV) fluid intake, the presence of a tracheal tube, aspiration of secretions passing through the endotracheal tube and endotracheal extubation, transfer of the patient from bed to recovery room, and rapid recovery from anesthesia as the factors contributing to postoperative hypertension. This elevation in blood pressure starts 20 to 30 minutes after the operation and lasts for 2-3 hours and even more. Patients with hypertension are more sensitive to the above factors, so to prevent further complications, necessary measures should be taken (in terms of the management of blood pressure). Short-term hypertension is usually benign and does not cause adverse effects, but may cause cardiovascular complications (arrhythmia, cardiac failure) if it lasts more than three hours, which should be controlled. Antihypertensives may cause severe hypoglycemia and impair tissue perfusion, which in turn exacerbates the patient condition [2,9].

In the study by Mozos *et al.* [10], changes in blood pressure during local and general anesthesia in maxillofacial surgery were evaluated in 39 patients with normal and hypertensive blood pressure. Systolic and diastolic blood pressure was measured in the subjects before surgery (M1), after local anesthesia (M2), after general anesthesia (M3), during surgery (M4), and after surgery (M5). There were significant changes in systolic and diastolic blood pressure from M2

to M5 compared with M1. Systolic and diastolic blood pressure significantly decreased during surgery and after local anesthesia. However, no significant differences were observed in systolic and diastolic blood pressure when comparing M2 and M5. There was a significant correlation only between the use of articine as a local anesthetic agent (not for lidocaine) and systolic (not diastolic) blood pressure. Both systolic and diastolic blood pressures were significantly higher in patients during M1-M5, despite treatment of hypertension. Hence, blood pressure decreases during maxillofacial surgery, especially in local anesthesia with articine and surgery.

Lack of information and recording of stress before surgery, lack of recording the duration of laryngoscopy and intubation, interference of patients with different Mallampati scores in the study, lack of accurate information about preoperative hydration, and inability to control factors, such as pain, before surgery were some of the study limitations.

Conclusion

Hypertension is even observed in individuals with normal blood pressure in the preoperative period, and it cannot be a reason for the surgical postponement. It is recommended to consider factors contributing to elevated blood pressure in patients with hypertension and examine surgery cancellation more carefully due to the lack of significant differences between them and those with normal blood pressure. It is suggested to eliminate the study limitations in future researches. In addition, it seems that blood pressure, especially the systolic, was higher during surgery in patients with hypertension compared to those with normal blood pressure. Considering little studies in this field in Iran and the importance of blood pressure as a serious and influential factor in health, it is suggested to perform a more comprehensive study to investigate the issue more accurately, considering other related factors, such as the effect of sedatives before surgery.

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Orcid:

Masoud Parish:
https://www.orcid.org/0000-0002-3926-4885
Maryam Ordibeheshti Khiaban:
https://www.orcid.org/0000-0003-1489-6596
Nagisa Ranjbarnejad Azari:
https://www.orcid.org/0000-0003-4526-1002
Naghi Abedini:
https://www.orcid.org/0000-0002-1671-0432

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