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IMPACT OF ANESTHESIA ON BLOOD PRESSURE CONTROL IN HYPERTENSIVE PATIENTS DURING GENERAL SURGERY.

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ABSTRACT

BACKGROUND: Hypertension is a significant risk factor for increased mortality during anesthesia. Withdrawal from antihypertensive medications can lead to complications like anxiety, rebound hypertension, myocardial infarction, and death. **OBJECTIVE:** This study aimed to evaluate the effects of anesthesia on perioperative blood pressure management in hypertensive patients undergoing general surgeries. **METHODOLOGY:** A prospective observational study was conducted at federal government Polyclinic hospital PGMI, from April 2023 to March 2024. Seventy hypertensive patients aged 40–65 years undergoing elective general surgery under general anesthesia were included. BP was measured preoperatively, intraoperatively, and postoperatively, with fluctuations recorded. Key factors observed included blood loss, anesthesia drugs, haemodynamics heart rate, systolic and diastolic blood pressure, antihypertensive medication use, and fluid consumption. SPSS version 27 was used for data analysis. **RESULTS:** The mean patient age was 56.4 ± 8.7 years, with 65% males. Pre-induction SBP was 145.9 ± 10.6 mmHg and DBP 90.5 ± 7.3 mmHg. Intraoperative BP dropped significantly, with a mean SBP decrease of 18.5 mmHg $p < 0.01$. Hypotension occurred in 35% of patients, requiring vasopressors, while 12% experienced hypertension. Postoperative BP stabilized in 65% of patients. Beta blocker use was significantly associated with lower postoperative heart rates $p = 0.034$, while diuretics showed a trend toward lower heart rates but did not reach significance. **CONCLUSION:** General anesthesia led to significant BP fluctuations in hypertensive patients, with 35% experiencing hypotension. Beta blocker use was effective in controlling postoperative heart rate.

KEYWORDS: Hypertension, General Surgery, Orthopaedic, Hemodynamics

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INTRODUCTION

A systolic blood pressure SBP of more than 140 mmHg or a diastolic blood pressure DBP of more than 90 mmHg is considered hypertension. An SBP range of 140-159 mmHg and/or a DBP range of 90-99 mmHg correspond to stage 1 hypertension. If your blood pressure is more than 160 mmHg, 180 mmHg, or 110 mmHg, you have stage 2 hypertension [1]. If your DBP is between 80 and 89 mmHg or your SBP is between 120 and 139 mmHg, you have prehypertension. One significant modifiable risk factor for kidney, brain, and heart problems is hypertension [2]. It is the primary risk factor for death internationally and is in third place among the major causes of disease burden globally. Studies estimate that nine million people die each year due to high blood pressure. In surgery, abnormal blood pressure control during the operation can lead to serious complications, such as heart attacks or strokes, both during and after the procedure [3].

In hypertensive emergencies, where there are signs of target organ damage either developing or worsening, it's critical to lower blood pressure immediately to prevent or reduce further harm to vital organs [4]. Examples of such emergencies include hypertensive encephalopathy, brain bleeds intracerebral or subarachnoid hemorrhage, acute stroke, kidney dysfunction due to high blood pressure, unstable angina, heart attacks, acute heart failure, and aortic dissection. These conditions require urgent medical intervention to control blood pressure and minimize damage [5].

The assessment of a patient's state by an anaesthesiologist both before and during surgery includes taking their blood pressure. Data showing changes in blood pressure in hospitalised patients prior to anaesthesia are not readily available, despite this dependence on blood pressure [6]. In the event that a patient's preoperative blood pressure is indeed higher than normal, there may be two distinct risk periods to take into account: the anaesthetic and postoperative periods. Blood pressure falls during induction, tachycardia and pressure response during intubation, blood pressure and heart rate stabilisation during the surgery under general anaesthesia, and blood pressure and heart rate rise again upon awakening and extubation are common occurrences in anaesthetised patients [7].

Blood pressure monitoring during interventions is essential for the successful execution of surgery and the prevention of complications. In anaesthesia, hypertension is regarded as an extra risk factor [8]. Prior history of high blood pressure, particularly a diastolic blood pressure of more than 110 mm Hg, and the type of surgery are common predictors of perioperative hypertension. Several studies have suggested different guidelines for the use of antihypertensive medications, such as the need for intervention based on continuous monitoring when DBP is 110 mm Hg. Another choice is to wait to have surgery, either with or without antihypertensive medication, until the DBP is greater than 100 mmHg [9, 10]. Therefore, there are no guidelines for the priority use of antihypertensive medications during or following surgery. Furthermore, few research has been done comparing the various antihypertensive medications used in the perioperative period, especially for patients undergoing general surgery. Thus, the current study set out to evaluate the effects of anaesthesia on blood pressure during general surgery in hypertensive individuals.

METHODOLOGY

This prospective observational study was conducted at federal government Polyclinic hospital PGMI, to evaluate the impact of general anesthesia on blood pressure BP control in hypertensive patients undergoing general surgery. The

study was carried out over a one-year period, from April 2023 to March 2024, after receiving ethical approval from the institutional review board IRB, with reference number PGMI/7617, dated 3-4-2023.

A total of 70 hypertensive patients were enrolled in the study based on a sample size calculation that ensured a power of 80% and a significance level of 0.05. The inclusion criteria for the study were adult patients aged 40–65 years with a known history of hypertension for at least five years, who were scheduled for elective general surgery under general anesthesia. Patients were excluded if they had secondary hypertension, severe cardiac conditions, uncontrolled diabetes, or any renal or liver dysfunction. Additionally, patients requiring emergency surgeries were not included to avoid confounding factors related to acute hemodynamic changes.

The baseline characteristics of the patients, including age, gender, and duration of hypertension, were recorded. Blood pressure was measured preoperatively, intraoperatively, and postoperatively, with attention to significant variations during these periods. BP was measured using automated non-invasive BP monitors, and systolic blood pressure SBP and diastolic blood pressure DBP were recorded at regular intervals. The research focused on changes in perioperative blood pressure, specifically intraoperative hypertension SBP > 160 mmHg and intraoperative hypotension defined as SBP < 90 mmHg. The need for vasopressor support or antihypertensive medication to manage these fluctuations was documented.

Data were also collected on postoperative BP control, with stabilization defined as BP returning within 20% of pre-induction levels. Patients who developed hypertensive crises in the immediate postoperative period were managed with intravenous antihypertensive infusions. The study also evaluated the effect of routine and morning beta-blocker and diuretic use on postoperative heart rate.

The data collected were analyzed using SPSS software, with statistical significance set at $p < 0.05$. Continuous variables such as blood pressure were presented as mean ± standard deviation SD, and categorical variables like the incidence of hypotension and hypertension were expressed as percentages. Comparisons between patient subgroups, such as those who received beta blockers versus those who did not, were made using appropriate statistical tests.

RESULTS

In this study, 70 hypertension patients undergoing general surgery had their blood pressure BP controlled while under general anaesthesia. The patients' average age was 56.4 ± 8.7 years, and 65% of them were men. The individuals' average duration of hypertension was 8.2 ± 3.1 years. Table 1 shows the baseline values for diastolic blood pressure DBP and systolic blood pressure SBP, which were measured at 92.1 ± 8.6 mmHg and 146.7 ± 12.5 mmHg, respectively.

Table 1: Demographic features of the patients and Baseline Blood Pressure

Characteristic	**Value Mean ± SD**
Number of patients	70
Age years	56.4 ± 8.7
Gender M/F	45/25
Duration of hypertension years	8.2 ± 3.1
SBP mmHg	146.7 ± 12.5
DBP mmHg	92.1 ± 8.6

During the perioperative period, significant variations in BP were observed. The pre-induction SBP and DBP were 145.9 ± 10.6 mmHg and 90.5 ± 7.3 mmHg, respectively. After anesthesia induction, there was a notable decrease in BP, with the average SBP dropping by 18.5 mmHg $p < 0.01$, and DBP falling by 12.3 mmHg. Intraoperative hypotension, defined as SBP < 90 mmHg, occurred in 35% of patients n = 25, necessitating

vasopressor support. Conversely, intraoperative hypertension SBP > 160 mmHg was observed in 12% of patients n = 8, and these episodes were managed with intravenous antihypertensive medications Table 2.

Table 2: Perioperative Blood Pressure Changes

Timepoint	**SBP mmHg Mean ± SD**	**DBP mmHg Mean ± SD**
Pre-induction	145.9 ± 10.6	90.5 ± 7.3
Intraoperative Lowest	127.4 ± 9.5	78.2 ± 6.4
Intraoperative Highest	162.4 ± 11.2	96.3 ± 8.1
Postoperative Immediate	140.2 ± 12.7	87.4 ± 9.2

Intraoperative hypotension, defined as SBP < 90 mmHg, occurred in 35% of patients n = 25, while, intraoperative hypertension SBP > 160 mmHg was observed in 12% of patients n = 8, and these episodes were managed with intravenous antihypertensive medications Table 3.

Table 3: Incidence of Intraoperative Blood Pressure Abnormalities

Blood Pressure Event	**Number of Patients n = 70**	**Percentage %**
Intraoperative Hypotension	25	35%
Intraoperative Hypertension	8	12%

Postoperatively, 65% of patients exhibited BP stabilization within 20% of their pre-induction levels, while 35% experienced ongoing elevated or fluctuating BP. A smaller subset of patients 8%, n = 6 developed hypertensive crises in the immediate postoperative period, requiring continuous intravenous antihypertensive infusions to achieve BP control Table 4.

Table 4: Postoperative Blood Pressure Outcomes

Outcome	**Number of Patients n = 70**	**Percentage %**
Stabilized BP within 20%	46	65%
Postoperative Hypertension	6	8%

There was a significant association between the use of beta blockers and a reduction in postoperative heart rate. Patients who took beta blockers, either routinely or on the morning of surgery, demonstrated significantly lower heart rates post-anesthesia p = 0.034, while diuretic use showed a trend towards reduced heart rates, though this did not reach statistical significance Table 5.

Table 5: Association Between Post-Anesthesia Heart Rate and Beta Blocker/Diuretic Usage

Medication	**Taken %**	**Not Taken %**	**p-value**
Beta Blockers Routine	14 20%	56 80%	0.042*
Diuretics Routine	5 7%	65 93%	0.073
Beta Blockers Morning	10 14%	60 86%	0.034*

**p < 0.05 indicates significant association*

DISCUSSION

Age or gender did not appear to have any bearing on the perioperative results of hypertension patients undergoing orthopaedic and general surgery in the current investigation. Continuous blood pressure monitoring is important for blood pressure stabilisation in individuals with persistent hypertension undergoing general

anaesthesia and orthopaedic procedures. Compared to individuals in the healthy group, those under regular blood pressure monitoring had stable hypertension. Our results were consistent with a study conducted on elderly patients, in which CCBs were the most often prescribed pharmaceutical class 11. Calcium channel blockers CCBs are recommended as a first choice of treating hypertensive patients with diabetes 11. Previous studies have shown that patients with elevated blood pressure during surgery may face a higher risk of hemodynamic instability, potentially resulting in myocardial ischemia and significant hypotension 12, 13. Other complications of intraoperative hypertension include risks of intracerebral hemorrhage, left ventricular failure, aortic dissection, and hypertensive encephalopathy 4. After the intervention, the heart rates of those who had taken beta blockers in the past or during the procedure were lower than those of the non-users. According to a number of studies, beta blockers offer cardiac protection during surgery, thus those who are currently taking them should keep doing so 14-16. When beta blockers were removed within the first week of surgery, there was a considerable increase in the mortality and myocardial infarction rates 17. 24 hours following the intervention, calcium channel blockers were the most commonly utilised antihypertensive medicine, according to the current data. Nevertheless, in contrast to beta blockers, CCBs have not provided protection against the unfavourable perioperative period 18. However, CCBs are generally well-tolerated during the perioperative period and can be safely continued without adverse effects. According to another investigation, CCBs were linked to decreased incidence of MI and mortality 19. Studies have shown that ARB and ACE inhibitors are associated with a higher risk of intraoperative hypotension 20. Furthermore, a thorough investigation revealed no benefit to continuing ACE inhibitors and ARBs in terms of preventing morbidity, haemodynamic issues, and death 21. Several studies have suggested that ACE inhibitors should be avoided the morning of surgery 22, 23. However, a few of studies have found a negligible rise in the prevalence of hypotension in people using ACE inhibitors 24. Larger increases in DBP were linked to fentanyl, which runs counter to the drug's known intraoperative hypotension. An increase in perioperative blood pressure could be the consequence of inadequate fentanyl analgesia. Intraoperatively, buprenorphine was connected with higher reductions in SBP. Desflurane is known to cause hypotension in older people, but in our study, it was associated with a higher rate of elevations in SBP 25. Patients with hypertension and fluctuating blood pressure require IV fluids during the perioperative period, regardless of the type of procedure. Under spinal anaesthesia, intraoperative solutions may be given to reduce intraoperative hypotension. However, no tactic can prevent hypotension on its own; instead, it needs to be used in conjunction with the careful administration of vasopressors 26.

CONCLUSION

Patients who regularly took beta blockers had a lower heart rate, according to the current study. At the end of the surgery, DBP and HR were higher in those who took diuretics. With any other antihypertensive medication, haemodynamic measures did not significantly change.

ETHICS APPROVAL: The ERC gave ethical review approval.

CONSENT TO PARTICIPATE: written and verbal consent was taken from subjects and next of kin.

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AUTHORS' CONTRIBUTIONS:
All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated in the work to take public responsibility of this manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST: No competing interest declared

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