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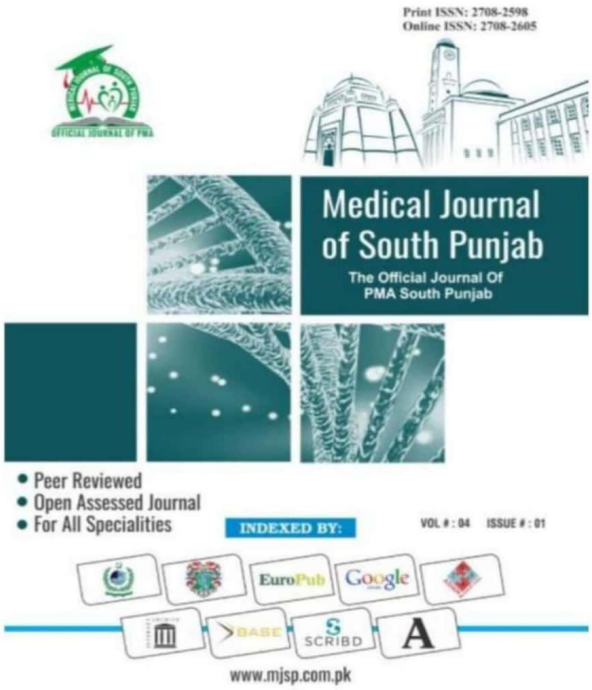

Frequency of Intraoperative Hypotension after the Induction of Anesthesia in Hypertensive Patients with Preoperative Angiotensin Converting Enzyme Inhibitors

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Original Article

Frequency of Intraoperative Hypotension after the Induction of Anesthesia in Hypertensive Patients with Preoperative Angiotensin Converting Enzyme Inhibitors

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ABSTRACT

Objective: *is to evaluate the intraoperative hypotension after anesthesia induction in controlled hypertensive patients who have been taking ACE inhibitors preoperatively.*

Methods: *Prospective study conducted at department of anesthesia and ICU Lady Reading Hospital, Peshawar, Pakistan from 1st march 2021 to 28th February 2022.Before the surgery, the patient's mean arterial pressure and blood pressure (systolic, diastolic) were recorded in the preoperative holding area. During the surgery, the primary anesthesia team maintained an intraoperative monitoring chart. After the surgery, patient was shifted to recovery room, patient was monitored for blood pressure, for at least 10 minutes after the shifting from operation theater.*

Results: *There were 73.1% males and 26.9% females, 57.7% patients had hypotension. The mean age, BMI and duration of anesthesia of the patients was 54.07±6.85 years, 26.52±4.45kg/m^{2}and 82.19±3.16 minutes, respectively. There were 74.7% patients had hypotension and on antihypertensive drugs other than ACE inhibitor and hypotension was occurred in 74.5% of patients who are using ACE inhibitors as antihypertensive drugs (p>0.050).*

Conclusion: *Higher incidence of intraoperative hypotension in patients with controlled hypertension who are taking ACE (Angiotensin-Converting Enzyme) inhibitors. So, controlled hypertension with ACE inhibitors is a significant risk factor for intraoperative hypotension.*

Keywords: Intraoperative hypotension, ACE inhibiotrs, Hypertensive, Anesthesia, Antihypertensive.

1. INTRODUCTION

The renin-angiotensin-aldosterone system (RAAS) is indeed an important regulatory system in the body that plays a significant role in blood pressure regulation and fluid balance[1]. Angiotensin II, one of its key components, is a potent vasoconstrictor and has multiple effects on the cardiovascular system[2]. Angiotensin-converting enzyme (ACE) inhibitors are a class of drugs that are commonly used to target the RAAS and treat conditions such as hypertension, heart failure, and acute myocardial infarction[3].

Ephedrine is an indirect sympathomimetic agent that acts by releasing norepinephrine from sympathetic nerve terminals and stimulating both alpha and beta adrenergic receptors[4]. It has a mixed action, which means it can increase heart rate and cardiac output while also causing vasoconstriction. This makes it particularly useful in cases of hypotension that are associated with both a decrease in blood pressure and a decrease in heart rate, as can sometimes occur during general anesthesia[5].

It has been recommended that antihypertensives should be continued until the day of a surgical procedure[6]. The reason for this recommendation is that discontinuing these medications before surgery may result in more harm than benefit. The use of ACE inhibitors (Angiotensin-Converting Enzyme inhibitors) preoperatively has indeed been the subject of several studies, and the findings in the literature have shown conflicting results[7].

The maintenance of appropriate tissue perfusion during anesthesia requires a combination of these monitoring tools, clinical judgment, and interventions as needed[8]. Anesthesiologists continuously assess and adjust parameters to ensure that patients receive optimal care while under anesthesia and during the perioperative period[9].Monitoring cardiac output helps anesthesiologists ensure that the heart is pumping an adequate amount of blood to maintain tissue perfusion. Similarly, pulmonary capillary wedge pressure, provides information about the filling pressures of the left side of the heart[10].

Previous studies were conducted on limited number of patients that were not large enough to strengthen the significance of this topic.This study will provide sufficient data to strengthen the conclusion and implementation of recommendations made on study finding.

2. METHODOLOGY

Descriptive case series study conducted at department of anesthesia and ICU Lady Reading Hospital, Peshawar, Pakistan from 1st march 2021 to 28th February 2022. The study was conducted after obtaining approval from the Ethics Review Committee [1402-21]. The sample size for the study was determined from statistics of previous study by Khan MA et al[16]., which reported hypotension in 59.8% of cases with a margin of error of 9%. Continence sampling technique was used for sampling. The study includes individuals who were undergoing elective surgery, having controlled hypertension, meaning their high blood pressure is managed and controlled with medication from 6 months, no cardiac history and prescribed medicine taken on day of surgery. Patients with a systolic blood pressure below 90 mm Hg, uncontrolled Hypertension (Systolic Blood Pressure > 150 or Diastolic Blood Pressure > 95), require surgery for conditions involving vasoactive substances like carcinoid tumors or pheochromocytoma, ejection fraction of left heart below 40% shows left heart decompensation on clinical basis, renal disease with end stage investigations were excluded from the study.

Before the surgery, the patient's mean arterial pressure along with systolic and diastolic blood pressure measurements were

recorded in the preoperative holding area. During the surgery, the primary anesthesia team maintained an intraoperative monitoring chart. After the surgery, the patient was shifted to recovery room, patient was monitored for blood pressure, for at least 10 minutes after the patient's arrival in the recovery room.

Monitoring is conducted during the surgery. This includes tracking various vital signs, such as heart rate, temperature of body, blood pressure (noninvasive) and saturation (oxygen level). If the patient experiences hypotension during surgery, the decision to correct it with interventions such as fluid administration or vasopressor support is left to the primary anesthesia team's discretion. Vital signs are recorded at regular intervals of 10 minutes during the surgery.

Collected data was analyzed by using SPSS version 27. Numerical data was computed for mean and SD and categorical data for frequencies and percentages. Chi square test and t-test was applied to see association among variables. P values less than or equal to 0.05 was taken as significant.

3. RESULTS

Overall, 130 patients were included in this study with mean age 54.07±6.85 years. There were 95 (73.1%) males and 35 (26.9%) females. 75 (57.7%) patients had hypotension. The mean age, BMI and duration of anesthesia of the patients was 54.07±6.85 years, 26.52±4.45kg/m^{2}and 82.19±3.16 minutes, respectively. Whereas, 37 (28.5%) patients had diabetic. According to ASA status, 71 (54.6%) patients had II grade and 59 (45.4%) patients had ASA III. Further, there were 97 (74.6%) patients had antihypertensive medication other than ACE Inhibitor. (Table. I).

The distribution of age, BMI, duration of anesthesia, gender, diabetes status, ASA status and use of other antihypertensive drugs were almost equal in hypotensive and non-hypotensive patients, there were 74.7% patients had hypotension and on antihypertensive drugs other than ACE inhibitor and hypotension was occurred in 74.5% of patients who are using ACE inhibitors as antihypertensive drugs (p>0.050). (Table. II).

Table. I

Demographic and clinical variables of the study patients

Variable	Mean±S.D	Frequency	Percentage
Age (years)	54.07±6.85		
BMI (kg/m^2)	26.52±4.45		
Anesthesia duration (min)	82.19±3.16		
Gender			
Male		95	73.1
Female		35	26.9
Hypotension		75	57.7
Diabetes status		37	28.5
ASA status			
II		71	54.6
III		59	45.4
On antihypertensive medication other than ACE Inhibitor			
Yes		97	74.6
No		33	25.4

Table. II

Association of diabetes with demographic and clinical variables

Variable	Hypotension		P-value
	Yes 37 (28.5%)	No 93 (71.5%)	
Age (years)	54.18±7.48	53.92±5.95	0.832
BMI (kg/m^2)	26.24±3.98	26.89±5.01	0.412

Anesthesia duration (min)	82.18±3.22	82.20±3.11	0.981
Gender			
Male	57 (76.0)	38 (69.1)	0.380
Female	18 (24.0)	17 (30.9)	
Diabetes status	20 (26.7)	17 (30.9)	0.596
ASA status			
II	37 (49.3)	34 (61.8)	0.158
III	38 (50.7)	21 (38.2)	
On antihypertensive medication other than ACE Inhibitor			
Yes	56 (74.7)	41 (74.5)	0.987
No	19 (25.3)	14 (25.5)	

4. DISCUSSION

The use of angiotensin-converting enzyme (ACE) inhibitors in the perioperative period is a topic of ongoing debate and research within the medical community. The main concern regarding the use of ACE inhibitors in the perioperative period is their potential to cause hypotension (low blood pressure) during and after surgery[11]. Hypotension can lead to various complications, including reduced blood flow to vital organs, which is undesirable during surgery. Some authors recommend that temporarily discontinuing ACE inhibitors prior to surgery to reduce the risk of hypotension during the procedure. If the medication is held before surgery, it is often recommended to restart it as soon as it is clinically feasible after the surgical procedure[12].

Behnia et al[13] concluded that chronic ACE inhibitor therapy can lead to an increase in intraoperative hypotension is consistent with some findings in the medical literature. ACE inhibitors can cause vasodilation and a decrease in blood pressure, which can be problematic during surgery. The study byPigot et al[14] highlights an important consideration in the management of patients undergoing surgery who are on ACE (Angiotensin-Converting Enzyme) inhibitor therapy. ACE inhibitors are commonly prescribed medications for various cardiovascular conditions, and they can have an impact on blood pressure regulation.

It was also recommended that alternative medications do not affect blood pressure as profoundly, such as angiotensin II receptor blockers (ARBs), may be considered as a substitute during the perioperative period[15].There were 74.6% patients had hypotension and on antihypertensive drugs other than ACE Inhibitor and hypotension was occurred in 74.7% of patients who are using ACE inhibitors and in 74.7% who are using antihypertensive of ACE inhibitors. The results of study conducted by Khan et al[16] reported that 59.8% of the 92 patients had hypotension at 30 minutes, and 40.2% had hypotension at 60 minutes following the induction of anesthesia.

A study was conducted by Comfere et al[17]investigated the impact of continuing ACE inhibitor therapy in patients undergoing non-cardiac surgery with general anesthesia. there is a correlation between patients taking ACE (Angiotensin-Converting Enzyme) inhibitors within 10 hours before surgery and an increased likelihood of experiencing intraoperative hypotension during the first 30 minutes of the surgery. A study compiled by Rajgopal et al[18] in 2014 aimed at determining the effect of discontinuing ACE inhibitor therapy and found that there was a significant occurrence of hypotension after the anesthesia induction.

Another study conducted by Salim et al[19]in 2020 reported that intraoperative hypotension may be more frequent in patients with controlled hypertension who are taking ACE inhibitors. However, the results are not definitive, and more research is needed to establish a clear and consistent association. In our study 50.7% patients having ASA III status develop hypotension and ASA II

patients have 49.3% hypotension. A study by Reich et al[20] suggests that perioperative hypotension is more common in patients with ASA III.

5. CONCLUSION

Findings of this study reveal higher incidence of intraoperative hypotension in patients with controlled hypertension who are taking ACE (Angiotensin-Converting Enzyme) inhibitors. So, controlled hypertension with ACE inhibitors is a significant risk factor for intraoperative hypotension.

Practical Implications: Study's results provide valuable insights that can enhance patient safety and the quality of care for hypertensive individuals taking ACE inhibitors who require surgery. Medical professionals should use this information to make informed decisions and tailor their approach to each patient's unique circumstances.

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