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Comparison between the Efficacy of Amlodipine with Captopril in the Management of Uncontrolled Blood Pressure in the Emergency Department

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ABSTRACT

Objective: To compare the efficacy of Amlodipine with Captopril in the management of patients presenting to the emergency department with uncontrolled blood pressure.

Study Design: Comparative prospective study.

Place and Duration of Study: Emergency Department, Combined Military Hospital, Malir Pakistan, from Jul to Dec 2021.

Methodology: A total of 127 individuals presenting to the Emergency Department with two readings of uncontrolled blood pressure (Systolic blood pressure ≥ 160mmHg and Diastolic blood pressure ≥90mmHg) were included. They were administered a tablet of Captopril 12.5mg per oral and a tablet of Amlodipine 10mg per oral on the turn by turn basis. Patients were observed for 3 hours and monitored for the reduction in blood. The efficacy of medication was judged based on the ability to achieve target blood pressure reduction, which was at least a 20-30% reduction in systolic blood pressure.

Results: Out of 127 individuals, 65(51.2%) patients were given a tablet of Captopril 12.5mg orally, and 62(48.8%) were given a tablet of Amlodipine 10mg orally. The mean reduction in systolic blood pressure was 20.73±5.17 in all patients. In addition, target blood pressure reduction was achieved in 35(53.8%) individuals of the Captopril-Group and 33(53.2%) of the Amlodipine-Group, with a total of 68(53.5%) individuals achieving target blood pressure within 3 hours after medication.

Conclusion: Both medications were efficient in achieving target blood pressure levels. However, no drug was superior to another in reducing blood pressure in an emergency.

Keywords: Amlodipine, Blood pressure, Captopril, Hypertension.

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INTRODUCTION

Hypertension is considered one of the commonest diseases worldwide, with an estimated prevalence of around 31% worldwide, meaning over 1.3 billion people.[1] Among these patients,1–2% will have an episode of hypertensive crisis in their lifetime. Hypertensive crisis, often defined as Systolic Blood Pressure ≥180 mmHg and/or Diastolic Blood Pressure ≥ 120mmHg, can present with various acute, life-threatening complications, in which case it is termed a hypertensive emergency.[2,3] The management of these patients involves introducing or intensifying oral anti-hypertensive therapy rather than using intravenous anti-hypertensive drugs.[4,5] To which extent the blood pressure should be lowered and with what speed is still unclear as there is a lack of evidence from randomized controlled trials for the best therapeutic protocol or drug to adopt.[6] However, it is understood that blood pressure should not be lowered by more than 25-30 % in the first few hours,[7] as rapid blood pressure reduction in minutes to hours may lead to cardiac, neurological or renal complications.[8] A study done in a tertiary care hospital in Pakistan by Almas *et al.* in 2014 showed that 28.6% of patients coming to the Emergency Department had uncontrolled blood pressure,[9] and were managed with various intravenous and oral medications. A study done by Kotruchin *et al.* in 2016 in Thailand compared Amlodipine and Captopril in managing hypertensive urgencies.[10]

In our study, we compared the efficacy of Amlodipine and Captopril in managing uncontrolled blood pressure in emergency setups, as it is one of the most common presentations in the Emergency Department. The main aim of the study was to establish whether there is any difference in response to Captopril and Amlodipine in emergencies or whether both can be used safely and with equal efficacy in emergency settings.

METHODOLOGY

This comparative prospective study was conducted at the Emergency Department of Combined Military Hospital, (CMH) Malir Karachi Pakistan from July to December 2021. Permission was taken from the

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Hospital Ethical Review Committee for the study (Letter number 68/2021/Trg/ERC dated 25th June 2021). The sample size was calculated to be 127 as per the WHO sample size calculator, taking anticipated Prevalence of patients presenting with uncontrolled hypertension to Emergency Department=28.6%,[9] and d=0.08. Informed consent was taken from all the patients.

Inclusion Criteria: Patients of either gender, aged above 18 years, presenting to the Emergency department and having systolic blood pressure (SBP) ≥160 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg were included in the study.

Exclusion Criteria: Patients having a decrease in blood pressure of 15% to 20% from baseline upon rest of 30 minutes, having known chronic kidney disease, or having known secondary hypertension due to any cause, or pregnant or breastfeeding ladies, or patients with any signs of hypertensive emergency like myocardial infarction with symptoms such as chest pain, pulmonary oedema, altered sensorium suggesting hypertensive encephalopathy, stroke, aortic dissection, haematuria, or patients with the known allergy to Amlodipine or Captopril or those who had received an anti-hypertensive drug within last 60 minutes of coming to the Emergency Department were excluded from the study.

History of previous hypertension or use of anti-hypertensive medications was taken from all patients. Blood pressure was measured with a standard android sphygmomanometer with the patient sitting and arm supported at the heart level, two readings were taken five minutes apart, and an average of these two was considered.[11] The patients were randomly divided into two groups by lottery. One patient was given a tablet of Captopril 12.5mg per oral, and the next patient was given a tablet of Amlodipine 10mg per oral, and so on, and blood pressure readings were measured every 30 minutes for the next 3 hours and readings at the end of 3 hours were recorded. Any patient developing any side effects to medications, new onset symptoms suggesting hypertensive emergency or having more than a 30% decrease in blood pressure after taking the medications were not considered further in the study. The target decrease in blood pressure at the end of 3 hours was a 20-30% reduction in systolic blood pressure.[12]

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Descriptive statistics were applied to calculate mean and standard deviation for age, pre-medication systolic and diastolic blood pressure, post-medication systolic and diastolic blood pressure and percentage decrease in systolic blood pressure. In addition, frequencies and percentages were calculated for variables like gender, previous history of hypertension and achievement of target blood pressure. Change in post-medication blood pressure was assessed using paired sample t-test. Comparison between outcomes (target blood pressure reduction achieved) of the two groups was made using the Chi-square test. The *p*-value lower than or up to 0.05 was considered as significant.

RESULT

A total of 127 patients were included in the study. Among them, 69(54.3%) were males, and 58(45.7%) were females. Of these 127, 65(51.2%) patients were given tablet Captopril and 62(48.8%) tablet Amlodipine. Among these patients, 76(59.8%) had a previous history of hypertension. Patients given the tablet Captopril had a slightly higher percentage (63.1%) of patients with previous hypertension than those given the tablet Amlodipine (56.5%). The mean age of the patients included in the study was 51.06±11.22 years. A comparison of baseline characteristics in both groups was shown in the Table-I.

Table-I : Baseline Characteristics of the Study Groups (n=127)

Baseline Characteristic		Captopril n(%) (n=65)	Amlodipine n(%) (n=62)	*p*-value
Gender	Male	36 (55.4%)	33 (53.2%)	0.919
	Female	29 (44.6%)	29 (46.8%)	
Previous history of Hypertension	Yes	41 (63.1%)	35 (56.5%)	0.835
	No	24 (36.9%)	27 (43.5%)	
Age in years (Mean±SD)		51.54±11.61	51.54±11.61	<0.001

Mean pre-medication systolic blood pressure was 174.13±10.04mmHg and diastolic blood pressure was 96.54±5.69mmHg. Mean post-medication blood pressure was 137.72±9.15mmHg and diastolic blood pressure was 80.04±5.54mmHg. The mean percentage reduction in systolic blood pressure was 20.73±5.17 mmHg. 68(53.5%) patients achieved target blood pressure control. Changes in blood pressure in both study groups were shown in the Table-II.

The reduction in systolic blood pressure post-medication was not significant (*p*-value=0.274). However, there was a significant reduction in diastolic blood pressure post-medication in both study groups (*p*-value 0.020). The percentage of the target of target blood pressure achieved was comparable in both

groups, 53.8% and 53.2%, respectively. There was no significant difference in outcomes and effectiveness in reducing blood pressure in both groups (*p*-value 0.543). A comparison between the two groups was shown in the Table-III.

Table-II: Study Outcomes in Both Groups (n=127)

Outcomes	Captopril Mean±SD (n=65)	Amlodipine Mean±SD (n=62)	*p*-value
Mean Pre-Medication Systolic Blood Pressure in mmHg	173.23±10.30	175.00±10.30	0.301
Mean Post-Medication Systolic Blood Pressure in mmHg	136.85±8.82	138.63±9.46	0.274
Mean Pre-Medication Diastolic Blood Pressure in mmHg	97.00±5.36	96.05±6.02	0.348
Mean Post-Medication Diastolic Blood Pressure in mmHg	78.92±5.34	81.21 ± 5.59	0.020
Mean decrease in Systolic Blood Pressure in mmHg	20.82±5.37	20.64 ± 4.99	0.848

Table-III: Comparison between Captopril and Amlodipine Group (n=127)

Parameter		Captopril (n=65)	Amlodipine (n=62)	*p*-value
Target Blood Pressure Achieved n(%)	Yes	35 (53.8%)	33 (53.2%)	0.543
	No	30 (46.2%)	29 (46.8%)	

DISCUSSION

Hypertension is one of the most prevalent diseases worldwide and one of the most common reasons for visits to emergency departments and the use of chronic prescription medications.[13] These patients generally present with mild non-specific symptoms such as headache, dizziness, tiredness and chest tightness. However, it is often asymptomatic and is detected incidentally on the routine visit for some other ailment.[14] Managing such uncontrolled blood pressures without any signs of hypertensive emergencies varies considerably.[15,16] There has been no specific guideline for managing such patients, as no large-scale study has proven the benefit of one therapeutic agent over another.

In one study done by Grassi *et al.*[17] it was found that 30 minutes of rest in a quiet room could reduce blood pressure ≥20/10mmHg in severe asymptomatic patients. However, anti-hypertensive medications should be used if the blood pressure is not reduced following rest. Dihydropyridine Calcium channel blockers and ACE Inhibitors are the most commonly used drugs in such scenarios.[18]

Kotruchin *et al.*[10] found out that oral Captopril, oral Amlodipine and a low-dose combination of Captopril and Amlodipine had similar outcomes in terms of efficacy and safety. Our study also compared the effect of Amlodipine and Captopril on controlling blood pressure in an Emergency setup. Gender distribution in both groups was quite similar, with 55.4% males in the Captopril group and 53.2% patients in the Amlodipine group. Baseline characteristics in the study by Almas *et al.*[9] showed a mean age of 56.7±14.7 in patients with uncontrolled blood pressure, with 45.2% males. Although the population area is similar, the difference in the mean age may be due to the larger sample size in Almas *et al.*[9] study. The percentage of male patients is higher because of the specific entitled clientele of our hospital. The Captopril Group had a slightly higher percentage (63.1%) of patients with a previous history of hypertension compared to 56.5% in the Amlodipine Group. Both medications helped achieve target blood pressures with similar efficacy, i.e., in 53.8% of patients with Captopril and 53.2% with Amlodipine. The percentage decrease in blood pressure after 3 hours was also quite similar, with a 20.82% reduction with Captopril and a 20.64% reduction with Amlodipine. The results are similar to a previous study which also showed >15% reduction of blood pressure in 53.5% in the Captopril Group and 52.2% in the Amlodipine Group.[19]

We used Captopril only via the oral route and achieved similar results to Amlodipine. Although the findings may be significant, a few points need further discussion and investigation. The study did not consider previous to-morbid use of anti-hypertensives and their type, lifestyle habits and family histories. These factors can alter the response of blood pressure to these medications. In addition, risk factors and mitigating scenarios for raised blood pressure were not considered. Long-term follow-up is also required to understand these medications' effects to achieve prolonged blood pressure control. However, our study also shows that a controlled reduction in blood pressure in the emergency scenario is more important than the type of drug used.

LIMITATIONS OF STUDY

The study has been done on a small scale in a single centre. However, the scope of the study can be extended to emergency departments of multiple centres using different approaches to manage hypertensive crises. Furthermore, different centres use different dosing regimens based on

clinician discretion so that the resulting outcome may differ in a large-scale study. Therefore, a larger scale study is required using the multi-centre approach to establish the best management strategy for control of blood pressure in emergencies in our population.

CONCLUSION

The study further complements previous studies that among Captopril and Amlodipine, no drug is superior to another in emergency room treatment for uncontrolled blood pressure. Instead, both have equal efficacy and are similarly effective in achieving target blood pressures.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

KM & HWK: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

MIK & MI: Concept, data acquisition, data analysis, data inter-pretation, critical review, approval of the final version to be published.

HBT & QZ: Critical review, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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