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# Impact of Undiagnosed Hypertension in Patients Presenting With Stroke: Comparison With Patients Having Diagnosed Hypertension

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## ABSTRACT

***Objectives:*** To compare morbidity and mortality among stroke patients with undiagnosed Hypertension vs those with pre-existing, diagnosed Hypertension.
***Study Design:*** Comparative cross-sectional study.
***Place and Duration of Study:*** Pak Emirates Military Hospital, Rawalpindi Pakistan from Dec 2022 to May 2023.
***Methodology:*** A total of 86 patients fulfilling the inclusion criteria were included in the study. Detailed history was obtained to assess for Hypertension i.e., undiagnosed Hypertension (Group-A) or pre-existing, diagnosed Hypertension (Group-B). Stroke outcomes including type of stroke, in-hospital mortality and 30-day disability were compared between groups using Chi-square and Mann-Whittney U-test.
***Results:*** Mean age of patients was 55.18±11.31 years. There were 57(66.28%) male and 29(33.72%) female patients. Frequency of "undiagnosed Hypertension (HTN)" was 26(30.23%) while of "pre-existing Hypertension (HTN)" it was 60(69.77%). Patients with "undiagnosed Hypertension" were found to have significantly higher frequency of hemorrhagic stroke ($p$<0.001), in-hospital mortality ($p$=0.001) and 30-days disability score ($p$<0.001).
***Conclusion:*** Frequency of undiagnosed Hypertension in stroke patients was 30.23% and is associated with poor outcomes in term of morbidity and mortality in stroke patients as compared to those having pre-existing, diagnosed Hypertension.

**Keywords:** Hemorrhagic stroke, Hypertension, Ischemia, Undiagnosed.

***How to Cite This Article:*** *Mahmood MA, Saleem s, Tariq SA, Cheema AS, Anwar A, Anwar I. Impact of Undiagnosed Hypertension in Patients Presenting with Stroke: Comparison with Patients Having Diagnosed Hypertension. Pak Armed Forces Med J 2024; 74(SUPPL_2): S147-S150. DOI: https://doi.org/10.51253/pafmj.v74iSUPPL-2.12144*



## INTRODUCTION

Stroke can be defined as "Focal neurological signs or symptoms of vascular origin that persists for more than 24 hours".[1] Globally, stroke is a leading cause of death and neurological disability along with a significant financial burden secondary to extended healthcare.[2] Strokes are classified broadly into ischemic and hemorrhagic, however, their clinical spectrum is quite variable depending upon the severity with the majority of strokes being ischemic.[3,4] There are several factors that either increase the propensity or directly contribute towards the development of cerebrovascular accident (CVA) including non-modifiable (advancing age, gender, and racial or ethnic identity) and modifiable (having unhealthy body weight, lack of physical exercise, sedentary way of living, utilization of unhealthy dietary products and chronic ailments like diabetes and Hypertension) factors.[5,6]

Amongst aforementioned risk factors, Hypertension is one of the most notorious and major contributor to this disabling morbidity.[7,8] Despite the widely known association of Hypertension and stroke, studies have shown that the burden of undiagnosed Hypertension in patients is still very high among patients who present with clinically evident cerebrovascular accident (CVA).[9] In Pakistan, which is a developing country having limited healthcare resources for such a large population, this burden of undiagnosed Hypertension in stroke patients is expected to be even higher.

The present study was, therefore, conducted with the aim of determining the frequency of undiagnosed Hypertension in stroke patients. Additionally, outcomes of stroke (in relation to type of stroke, in-hospital mortality and morbidity) were compared among patients with undiagnosed Hypertension versus those who have previously diagnosed Hypertension to determine the impact of undiagnosed Hypertension on the stroke outcomes.

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*Received: 30 Apr 2024; revision received: 26 Jun 2024; accepted: 26 Jun 2024*

## METHODOLOGY

This comparative cross-sectional study was conducted at Department of Medicine of Pak Emirates Military Hospital, Rawalpindi, Pakistan from Dec 2022 to May 2023 after obtaining approval from the Institutional Ethical Review Board (ERB No. A/28/EC/552/23).

**Inclusion Criteria:** Adult patients over 18 years of age, of either gender who presented with clinically evident stroke (defined as "syndrome of acute, focal neurological deficit attributed to altered circulation in the cerebral vessels" 11) and a raised blood pressure (≥130/80 mmHg) were included in this study.

**Exclusion Criteria:** Patients who had normal blood pressure (<130/80 mmHg) at presentation, pre-existing vascular conditions, those with traumatic vascular injury to CNS vasculature and those with secondary Hypertension due to chronic kidney disease.

Sample size was calculated using WHO sample size calculator by using anticipated frequency of undiagnosed Hypertension in patients presenting with stroke = 33.7%.[10] This gave a sample size of 86. Data was collected using non-probability consecutive sampling technique. Written consent signed by the study participants was made an essential pre-requisite. Definition of Hypertension was set as per "American College of Cardiology (ACC) and American Heart Association (AHA)" which define Hypertension as "blood pressure reading of ≥ 130/80 mmHg".[12]

Baseline characteristics of all the included study participants, including age, gender, body mass index (in kg/m$^2$) and type of stroke were documented. In all these patients, as part of initial clinical evaluation, a detailed history was taken and blood pressure was recorded and documented. Based on history, it was identified that whether patient had previously "undiagnosed Hypertension" (Group-A) or had "previously diagnosed/pre-existing Hypertension" (Group-B). Once assorted in the groups, outcomes were compared in patients with undiagnosed versus previously diagnosed Hypertension. Outcomes included type of stroke, in-hospital mortality (defined as "death while being admitted at the hospital") and 30-days disability which was assessed by using modified Rankin scale (mRS) given in Table-I.

Data was analyzed by using Statistical Package for Social Sciences (SPSS) version 22.00. Normality of data was checked by Kolmogorov-Smirnov test. Age was normally distributed while BMI and mRS score were non-normal data. Quantitative data (age) was represented using mean ± standard deviation while BMI and mRS score was presented as median (IQR). Qualitative data (gender, type of stroke, presence of undiagnosed Hypertension and stage of Hypertension) was represented by using percentage and frequency. Chi square test (for qualitative variables), Student t-test (for normally distributed quantitative variables) and Mann-Whittney U-test (for non-normal data) were applied and *p*-value of ≤0.05 was considered as statistically significant.

**Table-I: "Modified Rankin Scale (mRS)"[13]**

| Score | Clinical Characteristics |
|---|---|
| 0 | No symptoms |
| 1 | No significant disability despite symptoms; able to carry out all usual duties and activities |
| 2 | Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance |
| 3 | Moderate disability; requiring some help, but able to walk without assistance |
| 4 | Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance |
| 5 | Severe disability; bedridden, incontinent and requiring constant nursing care and attention |
| 6 | Dead |

## RESULTS

Mean age of study population was 55.18± 11.31 years. There were 57(66.28%) male participants while remaining 29(33.72%) participants were female. Median BMI was 31.00(19.00-44.00) kg/m$^2$. Frequency of "ischemic stroke" was 64(74.42%) while of "hemorrhagic stroke" was 22(25.58%). These are summarized below in Table-II

**Table-II: Baseline characteristics of patients (n=86)**

| | |
|---|---|
| **Age** | |
| Mean ± SD | 55.18 ± 11.31 years |
| **Gender** | **n(%)** |
| Male | 57(66.28%) |
| Female | 29(33.72%) |
| **Body Mass Index (BMI)** | |
| Median inter-quartile range (IQR) | 31.00(44.00 – 19.00) kg/m$^2$ |
| **Type of Stroke** | **n(%)** |
| Ischemic stroke | 64(74.42%) |
| Hemorrhagic stroke | 22(25.58%) |

Frequency of undiagnosed Hypertension in stroke patients was 26(30.23%) while of those who had "pre-existing Hypertension (HTN)" it was 60(69.77%). Upon comparison of outcomes of stroke in two groups formed based on status of Hypertension it was found that among patients with "undiagnosed Hypertension" (n=26), frequency of hemorrhagic stroke was 16(61.54%) and of ischemic stroke it was 10 (38.46%) while in patients with "pre-existing Hypertension" (n=60), frequency of ischemic stroke was 54 (90.00%) and of hemorrhagic stroke it was 6(10.00%), ($p$<0.001). Among patients with "undiagnosed Hypertension" (n=26), frequency of in-hospital mortality was 11(42.31%) while in patients with "pre-existing Hypertension" (n=60), it was 6(10.00%), ($p$=0.001). Upon assessment of 30-day disability it was found that median mRS score in group-A was 5(3-6) while in group-B it was 3(2-6), ($p$<0.001). All this data is given below in Table-III.

**Table-III: Comparison of Stroke outcomes between groups (n=86)**

| Outcome | Groups based on Hypertension status | | *p*-value |
|---|---|---|---|
| | Undiagnosed HTN (n=26) | Pre-existing HTN (n=60) | |
| Type of stroke<br>Hemorrhagic<br>Ischemic | 16(61.54%)<br>10(38.46%) | 6(10.00%)<br>54(90.00%) | <0.001 |
| In-hospital mortality | 11(42.31%) | 6(10.00%) | 0.001 |
| Median mRS score | 5(3-6) | 3(2 – 6) | <0.001 |

## DISCUSSION

Stroke is a prevalent condition in Pakistan with an approximated incidence of 0.25% every year.[10] Increased awareness among general public regarding the risk factors and methods of prevention of stroke, especially in developing nations like Pakistan can help reduce mortality.[14] Hypertension serves as a major precipitator of a clinical event of stroke and it is also highly prevalent condition both in the developed and the developing world and is wreaking financial havoc on the healthcare systems in terms of higher number of patients being catered who develop complications of these conditions.[15]

Several studies have demonstrated that frequency of "undiagnosed Hypertension" among apparently healthy people is very high.[16,17] In our study, most of our population who suffered from stroke were males. This supports the previously presented evidence that stroke is a morbidity effects men much more as compared to women.[18] The present study, based on median BMI value, it was found that majority of patients had a very unhealthy body mass index. This may be due to the fact that in patients who are obese, chances of developing Hypertension are far more as compared to those with normal BMI ranges and subsequently have higher chances to develop stroke.[19,20]

Our study reported that most patients who presented with stroke had "ischemic CVA" which is consistent with the findings of multiple previous studies.[3,4] In present study, the number of stroke patients who had "undiagnosed Hypertension" was significantly high, however, it was much lower as compared to what has been reported in previous studies conducted by Khan *et al*.[10] and Fatima *et al*.[21] both of which reported much higher frequency. When it comes to the outcome of stroke based on status of Hypertension, it was found that patients who had previously "undiagnosed Hypertension" had significantly poorer outcome as compared to those with pre-existing Hypertension. These patients were found to have higher frequency of hemorrhagic stroke and in-hospital mortality. Additionally, 30-days disability score was also significantly higher in these patients. These findings were congruent with the studies conducted by Woo *et al*.[22] and Han *et al*.[23]

Based on findings of present study, it is evident that still a large number of cases of Hypertension go undetected and patients end up developing serious complications of this uncontrolled persistently high blood pressure.

## CONCLUSION

In conclusion, undiagnosed Hypertension is highly common in patients presenting with stroke in our community and is associated with poorer outcomes in terms of morbidity and mortality in stroke patients as compared to pre-existing, diagnosed Hypertension.

**Conflict of Interest:** None.

**Authors' Contribution**

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

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

SAT & ASC: Data acquisition, data analysis, approval of the final version to be published.

AA & IA: Critical review, concept, 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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