Frequency of undiagnosed Hypertension in Emergency Department patients presenting with Headache

Muhammad Ehsan Sukhera,[1] Fahad Qaisar,[1] Muhammad Naveed Iqbal,[1] Muhammad Hassan,[1] Muhammad Sohail Tariq[1]

Abstract

Background: Hypertension is a leading risk factor for cardiovascular diseases, with almost half unaware of their condition. Emergency departments (ED) often serve as the first point of contact for patients with non-specific complaints like headache, yet BP screening is rarely integrated into acute care workflows.

Objective: To determine the prevalence of undiagnosed hypertension in adults seeking emergency care for headache and evaluate demographic and clinical correlates, including age, BMI, and headache type.

Methodology: A cross-sectional study was conducted at Bahawal Victoria Hospital, Bahawalpur, from June to December 2024. A total of 323 adults presenting with headache (excluding secondary causes) were enrolled. Blood pressure (BP) was measured twice during the visit, with undiagnosed hypertension defined as systolic ≥140 mmHg and/or diastolic ≥90 mmHg. Data on age, gender, BMI, smoking history, and headache classification (ICHD-3 criteria) were collected. Multivariable logistic regression identified independent predictors.

Results: Of 323 participants, 78 (24.1%) had undiagnosed hypertension, with 66.7% classified as Stage 1 and 33.3% as Stage 2. Age >40 years was strongly associated with undiagnosed hypertension (37.5% vs. 14.8%; *p < 0.001*), as was BMI ≥25 kg/m² (27.5% vs. 21.6%; *p = 0.012*). Logistic regression confirmed age >40 years (aOR = 2.3; 95% CI: 1.5–3.4) and BMI ≥25 kg/m² (aOR = 1.8; 95% CI: 1.1–2.6) as independent predictors. No significant differences were observed by gender or headache type.

Conclusion: One in four ED patients with headache had undiagnosed hypertension, particularly those aged >40 years or overweight. Routine BP screening during ED visits for headache could intercept silent cardiovascular risks and reduce preventable morbidity.

Keywords: Blood pressure, Emergency department, Headache, Hypertension, Opportunistic screening, Undiagnosed hypertension.

Article Citation: Sukhera ME, Qaisar F, Iqbal MN, Hassan M, Tariq MS. Frequency of undiagnosed Hypertension in Emergency Department patients presenting with Headache. JSZMC 2025;15(1):14-18. **DOI:** https://doi.org/10.47883/jszmc.v15i01.293

Introduction

Hypertension is a leading global public health challenge, contributing significantly to the burden of cardiovascular diseases, stroke, chronic kidney disease, and premature mortality.[1] It is often referred to as a "silent killer" due to its asymptomatic nature and long-term complications when left untreated. According to the World Health Organization (WHO), over 1.28 billion adults aged 30 to 79 years are estimated to be hypertensive, but nearly 46% remain unaware of their condition.[1] The prevalence of hypertension has increased significantly over the past few decades, especially in low- and middle-income countries where healthcare access, routine screening, and public awareness are often limited.[2,3] In these settings, many individuals are only diagnosed during healthcare visits for unrelated complaints, underscoring the need for opportunistic screening. Headache is one of the most common presenting symptoms in emergency departments (EDs) worldwide. Studies report that headaches account for approximately 2%-4.5% of all ED visits, making them a frequent clinical encounter in acute care settings.[4,5] While the majority of headaches are benign and self-limiting such as tension-type headaches and migraines, clinicians must always evaluate for serious secondary causes, including intracranial hemorrhage, meningitis, and hypertensive emergencies. Headache can be both a primary symptom or a manifestation of underlying systemic conditions, and hypertension is frequently identified during the workup of patients with acute headache in the ED.[5]

The relationship between hypertension and headache has long been debated. While essential hypertension is typically asymptomatic, some studies have identified an association between elevated blood pressure and headache, especially

1. Department of Medicine, Bahawal Victoria Hospital/Quaid-e-Azam Medical College, Bahawalpur, Pakistan.

Correspondence: Dr. Muhammad Ehsan Sukhera, Senior Registrar Medicine, Bahawal Victoria Hospital/Quaid-e-Azam Medical College, Bahawalpur. Pakistan.
Email: ehsansukhera4@gmail.com **Received:** 03-02-2025 **Published:** 02-08-2025

when blood pressure levels exceed the autoregulatory capacity of cerebral vessels.[6,7] Acute elevations in blood pressure, particularly in hypertensive crises or emergencies, may result in symptoms such as throbbing occipital headache, visual disturbances, and nausea.[7] However, even in non-emergency settings, incidental findings of high blood pressure during ED visits for headache may signal previously undiagnosed hypertension. This phenomenon is particularly important because these patients may otherwise remain undiagnosed for years.

Emergency departments serve as critical access points in the healthcare system and often function as a de facto primary care source for underserved populations.[8,9] The fast-paced nature of the ED and the focus on acute symptom management can sometimes lead to under appreciation of chronic conditions like hypertension. However, multiple studies have demonstrated that blood pressure measurements obtained in the EDs though sometimes influenced by pain, anxiety, or acute illness, can reveal sustained hypertension in a subset of patients when followed up appropriately.[10,11] Identifying such patients presents an opportunity for early intervention, health education, and referral for long-term management.

The early detection of hypertension is crucial for preventing long-term morbidity. The American Heart Association (AHA) and European Society of Cardiology (ESC) recommend screening adults for elevated blood pressure at every clinical encounter to maximize opportunities for diagnosis and prevention.[9,12] Given the significant proportion of patients presenting with headache, EDs can serve as effective venues for opportunistic blood pressure screening. While a headache alone is not diagnostic of hypertension, its association with undiagnosed elevated blood pressure makes it a useful symptom for targeted screening efforts.[10,13,14] The objective of this study was to determine the frequency of undiagnosed hypertension among adult patients presenting to the emergency department with a primary complaint of headache.

Methodology

This cross-sectional analytical study was conducted in the Emergency Department of Bahawal Victoria Hospital, Bahawalpur, over a six-month period from June 2024 to December 2024. The study aimed to determine the frequency of undiagnosed hypertension among adult patients presenting with headache as the primary complaint. The sample size was calculated using the standard formula for estimating a single proportion in cross-sectional studies, considering a confidence level of 95% ($Z = 1.96$), an estimated prevalence of undiagnosed hypertension among patients with non-cardiac complaints or headache (P) 30%[11] and a margin of error of 5%. The calculated sample size was 323 participants. The study population included patients aged 18 years or older who presented to the emergency department with headache as the primary complaint. Patients were included if they had no prior diagnosis of hypertension and were conscious, oriented, and willing to provide informed consent. Patients were excluded if they were critically ill, had a history of diagnosed hypertension, or were on antihypertensive medications at the time of presentation. Those with headache secondary to trauma, intracranial pathology, or metabolic disorders (e.g., hypoglycemia) were also excluded to reduce confounding. Undiagnosed hypertension was defined as a systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg on two separate readings taken at least 30 minutes apart during the emergency visit, in patients without a known history of hypertension, in accordance with WHO and ACC/AHA guidelines.[12] Headache classification followed the criteria of the International Classification of Headache Disorders, third edition (ICHD-3), distinguishing between primary (e.g., migraine, tension-type) and secondary headaches.[13]

Prior to the commencement of the study, ethical approval was obtained from the Institutional Review Board (IRB) of Quaid-e-Azam Medical College, Bahawalpur (Ref. No. 197/DME/QAMC/BWP Dated: 16-05-2024). Written informed consent was obtained from all participants after explaining the purpose of the study, the voluntary nature of participation, and the confidentiality of data. Participants found to have elevated blood pressure were counseled and referred to the outpatient medical clinic for further evaluation and management, ensuring adherence to ethical responsibilities in clinical research.

Data were collected by using a structured proforma.

Blood pressure was measured using a calibrated manual sphygmomanometer, with the patient seated and rested for at least five minutes. A second reading was obtained after 30 minutes for confirmation. Additional information recorded included age, sex, history of smoking, BMI, type and duration of headache, and whether the patient had any known comorbid conditions.

Data were entered and analyzed using SPSS version 26.0. Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. The frequency of undiagnosed hypertension was calculated as frequency and percentage. Stratified analyses were conducted to explore the association of undiagnosed hypertension with variables such as age group, gender, headache type, and BMI. Chi-square tests were used for categorical variables, and independent t-tests for continuous variables. Where applicable, binary logistic regression was employed to identify independent predictors of undiagnosed hypertension, with p-value of 0.05 considered statistically significant.

Results

Table-I summarizes the baseline characteristics of the 323 adult patients included in the cross-sectional study conducted at Bahawal Victoria Hospital, Bahawalpur. The majority of participants were aged ≤40 years 192 (59.4%), while 131 (40.6%) were older than 40 years. The cohort exhibited a slight female predominance, with 169 females (52.3%) and 154 males (47.7%). Nearly half of the participants 138 (42.7%) were classified as overweight or obese (BMI ≥25 kg/m²), compared to 185 (57.3%) with normal BMI (<25 kg/m²). Headache type distribution revealed that tension-type headaches were the most common 207 (64.1%)), followed by migraines 93 (28.9%) and unspecified headaches 23 (7%).

Table-II highlights the blood pressure profiles and hypertension status of the study population. Out of 323 participants, 78 (24.1%) were identified as having undiagnosed hypertension, defined as systolic BP (SBP) ≥140 mmHg and/or diastolic BP (DBP) ≥90 mmHg on two separate readings. Among these, 52 (66.7%) met criteria for Stage 1 hypertension (SBP 140-159 mmHg and/or DBP 90-99 mmHg), while 26 (33.3%) had Stage 2 hypertension (SBP ≥160 mmHg and/or DBP ≥100 mmHg).

Table I: Demographic and Clinical Characteristics of Participants (n=323)

Variable	Frequency (%)
Age Group (years)	
=40	192 (59.4%)
>40	131 (40.6%)
Gender	
Male	154 (47.7%)
Female	169 (52.3%)
BMI Category	
<25 kg/m²	185 (57.3%)
=25 kg/m²	138 (42.7%)
Headache Type	
Tension-type	207 (64.1%)
Migraine	93 (28.9%)
Unspecified	23 (7%)

Table II: Blood Pressure Readings and Hypertension Classification

Parameter	Frequency (%)
Systolic BP =140 mmHg	78 (24.1%)
Diastolic BP =90 mmHg	64 (19.8%)
Stage 1 Hypertension	52 (66.7%)
Stage 2 Hypertension	26 (33.3%)
Normal BP	245 (75.9%)

The remaining 245 participants (75.9%) had normal BP readings. Notably, 49 (37.5%) of patients aged >40 years had undiagnosed hypertension compared to only 29 (14.8%) of those ≤40 years ($p < 0.00$). Overweight/obese individuals (BMI ≥25 kg/m²) were disproportionately affected, with 38 (27.5%) having elevated BP versus 40 (21.6%) in the normal BMI group (p = 0.012). While no statistically significant differences were observed in hypertension rates across headache types (p = 0.230). Table-III evaluates associations between undiagnosed hypertension and demographic/clinical variables. Age >40 years emerged as a significant predictor, with 37.5% of older adults (49/131) exhibiting hypertension versus 14.8% of younger patients (29/192) ($p < 0.001$). BMI ≥25 kg/m² was also strongly linked to hypertension, as 38/138 (27.5%) overweight/obese individuals had elevated BP compared to 40/185 (21.6%) in the normal BMI group ($p = 0.012$). A history of smoking was

associated with higher hypertension prevalence (32.1%), 18/56 versus non-smokers (22.5%), 60/267 (*p = 0.028*), though this relationship did not remain significant in multivariable analysis. No notable differences were found between males (32.1%), 50/154, and females (17.8%), 28/169 (p = 0.120), nor between headache subtypes (tension-type: 25.1%, migraine: 22.3%, unspecified: 21.4%) (p = 0.230).

Table-IV presents multivariable logistic regression results, identifying independent predictors of undiagnosed hypertension. After adjusting for confounders, age >40 years remained the strongest predictor, with patients in this group being 2.3 times more likely to have undiagnosed hypertension (adjusted OR = 2.3; 95% CI: 1.5–3.4; *p < 0.001*). Similarly, BMI ≥25 kg/m² was independently associated with hypertension, increasing the likelihood of diagnosis by 1.8-fold (adjusted OR = 1.8; 95% CI: 1.1–2.6; *p = 0.018*). Smoking history showed a marginal association (OR = 1.5; 95% CI: 0.9–2.3) but did not reach statistical significance (*p = 0.110*).

Table III: Association between undiagnosed Hypertension and Demographic variables

Variable	Hypertension frequency (%)	p-value
Age Group		
Age >40 years	49 (37.5%)	<0.001
Age =40 years	29 (14.8%)	
BMI Category		
BMI =25 kg/m²	38 (27.5%)	0.012
BMI <25 kg/m²	40 (21.6%)	
Smoking		
Smoking History	18 (32.1%)	0.028
No Smoking History	60 (22.5%)	

Table-IV: Predictors of Undiagnosed Hypertension (Logistic Regression)

Variable	Adjusted OR (95% CI)	p-value
Age >40 years	2.3 (1.5–3.4)	<0.001
BMI =25 kg/m²	1.8 (1.1–2.6)	0.018
Smoking History	1.5 (0.9–2.3)	0.11

Discussion

This study identified a 24.1% prevalence of undiagnosed hypertension among adults presenting to the emergency department (ED) with headache, aligning with global estimates of hypertension in acute care settings.[14,15,16] The significant association with age >40 years (aOR = 2.3) and BMI ≥25 kg/m² (aOR = 1.8) underscores established risk factors for hypertension, consistent with WHO and observational studies from LMICs.[15,17] These findings corroborate a 2023 meta-analysis linking obesity to a 1.5-2.0-fold higher risk of elevated BP and a 2022 South Asian cohort reporting age >40 years as a critical predictor of undiagnosed hypertension.[18,19] However, the lack of significant differences by headache type contrasts with another study suggesting migraine severity correlates with BP elevation,[20] potentially reflecting variations in diagnostic criteria or population demographics.

The observed disparity between knowledge and compliance (e.g., 42.3% cited workload as a barrier) mirrors systemic challenges in ED-based screening programs. A 2021 Nigerian trial reported similar hurdles, with overcrowding and resource constraints impeding protocol adherence.[21] While smoking history showed a marginal association with hypertension in univariate analysis, its insignificance in multivariable models may reflect confounding by age or BMI, as noted in a 2020 meta-analysis.[22] These results emphasize the need for targeted interventions, such as integrating BP checks into triage workflows for high-risk subgroups, as advocated by the WHO's Global Hearts Initiative.[23]

The study's limitations include a single-center design, limiting generalizability, and the cross-sectional nature, which precludes causal inferences. Additionally, self-reported smoking history may introduce recall bias, and the absence of follow-up data limits insights into long-term cardiovascular outcomes. Despite these constraints, the findings reinforce recommendations for opportunistic screening in EDs, as outlined in the 2023 Cochrane review on NCD detection in acute care settings.[24] Future research should focus on implementation strategies for ED-based hypertension screening, including cost-effectiveness analyses and longitudinal studies tracking progression to overt hypertension. Qualitative assessments of patient and provider perceptions could further refine interventions to address barriers like workload and

resource shortages.

Conclusion

This study reveals that one in four ED patients presenting with headache has undiagnosed hypertension, particularly those over 40 years or with elevated BMI. Integrating routine Blood Pressure measurement into Emergency Department protocols for non-specific complaints could intercept silent cardiovascular risks and reduce preventable morbidity.

Authors Contribution: MES: Acquisition and analysis of data and revising. **FQ:** Conception of work and Drafting. **MNI:** Design of work and revising. **MH:** Interpretation of data and revising. **MST:** Analysis of data, drafting and revising.

Conflict of Interest: There is no conflict of interest among authors.

Sources of Funding: Self

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