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Research Article

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Determinants of Hypertensive Crisis Among Hypertensive Patients in Emergency Departments: A Systematic Review and Meta-Analysis

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Abstract

Introduction: *Hypertensive crisis can rapidly lead to* ***target organ injury****, including cerebrovascular events, acute renal failure, cardiovascular emergencies, and increased emergency department admissions, necessitating prompt recognition and management. In low-income countries such as Ethiopia, the burden of hypertensive crisis is rapidly growing yet often under-diagnosed and poorly managed, making it a critical public health concern. So, this study is aimed to identify the determinants of hypertensive crisis among hypertensive patients among adults treated in emergency departments in Ethiopia.*

Methods and materials: *Both manual and electronic searches were used to extract studies for this meta-analysis from PubMed, Scopus, Web of Science, and Google databases. The quality of studies was assessed by using the Newcastle-Ottawa Scale. An inverse variance-weighted random-effects model meta-analysis was performed to estimate the pooled odds ratio of determinants with a 95% confidence interval. The I^2 test statistic was used to check between-study heterogeneity. A p-value of less than 0.05 is used to declare Statistical significance.*

Result: *Seven studies comprising of 4, cross-sectional studies, 1 cohort and 2 case control studies with a good methodological quality included. Patients with a history smoking (OR: 1.87, 95% CI: 1.09–3.22), alcohol consumption (OR: 1.91, 95% CI: 1.22–2.99), and comorbid conditions (OR: 1.93, 95% CI: 1.31–2.83) were determinants of hypertensive crisis.*

Conclusion: *This study demonstrates that lifestyle factors and existing health conditions play a significant role in the development of hypertensive crisis. For patients with a history of smoking and alcohol consumption, the presence of comorbid conditions substantially increased the risk. So, targeted risk reduction strategies should be implemented.*

Keywords: *Determinants, hypertensive crisis, adult, Ethiopia.*

Introduction

Hypertension is a major global public health concern, affecting more than 1.4 billion people worldwide and contributing substantially to morbidity and mortality due to cardiovascular complications [1–3]. One of the most serious acute complications of hypertension is hypertensive crisis, defined as a sudden and severe increase in blood pressure (systolic ≥180 mmHg and/or diastolic ≥120 mmHg) with or without evidence of target organ damage [4,5]. Hypertensive crisis can rapidly lead to target organ injury, including cerebrovascular events, acute renal failure, cardiovascular emergencies, and increased emergency department admissions, necessitating prompt recognition and management [6-8].

In low-income countries such as Ethiopia, the burden of hypertensive crisis is rapidly growing yet often under-diagnosed and poorly managed, making it a critical public health concern [9] Though Ethiopia is reported to have a high prevalence of hypertension, estimated at approximately 19.2% to 20.6% [10, 11], among the general adult population, the disease is often poorly controlled [12].

Studies conducted in Ethiopian emergency settings reported varying prevalence estimates of hypertensive crisis and its subtypes, reflecting inconsistent screening practices, patient characteristics, and healthcare access across regions. For example, the prevalence of hypertensive crisis among emergency department patients ranged from approximately 4.9% - 40.7% [13, 14].

Despite this high burden, determinants of hypertensive crisis in Ethiopia are not fully explained and with limited evidence on factors such as comorbid diabetes mellitus, prior history of hypertension, behavioral risk factors, and socio-demographic characteristics [15, 16] with heterogeneity in study design, sample size, and reporting prevents a comprehensive understanding of determinants across the country. Furthermore, these findings have not yet been synthesized systematically to

inform clinical practice and public health strategies in Ethiopia. Identifying the determinants of hypertensive crisis among adult patients treated in emergency settings is critical for adapting preventive and management strategies, optimizing resource allocation, and reducing morbidity and mortality associated with uncontrolled blood pressure complication in Ethiopia.

Objective of the review

- ✓ To identify determinants of hypertensive crisis among hypertensive patients among adults treated in emergency departments in Ethiopia

Methods and materials

Study Design and Reporting

This study is a systematic review and meta-analysis to identify the determinants of hypertensive crisis among adult hypertensive patients treated in emergency departments. The review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [17].

Data Sources and Search Strategy

A comprehensive literature search was performed in electronic databases including PubMed, Scopus, Web of Science, and Google Scholar. Search terms included combinations of keywords and Medical Subject Headings (MeSH) and used Boolean operators 'AND' and 'OR' to refine searching. The utilized keywords are: "hypertensive crisis," "hypertensive emergency," "hypertensive urgency," "determinants," "risk factors," "emergency department," and "hypertension", and "high blood pressure". Reference lists of included studies were also reviewed to identify additional relevant articles.

Eligibility Criteria

- ✓ Studies conducted among adult (≥18 years) hypertensive patients
- ✓ Studies reporting determinants or risk factors of hypertensive crisis
- ✓ Studies conducted in emergency department settings
- ✓ Observational study designs (cross-sectional, case–control, cohort)
- ✓ Articles published in English, whereas Case reports, reviews, editorials, and conference abstracts, studies conducted in pediatric populations, Studies with insufficient data for extraction, and duplicate publications were extracted from this study.

Study Selection and data Extraction

All retrieved articles were imported into reference management software, and duplicates were removed. Two independent reviewers screened titles and abstracts for eligibility. Full-text articles were then assessed for inclusion. Disagreements were resolved through discussion. Data were extracted using a standardized data extraction form; which includes: Author name, year of publication, study setting, Study design, sample size, and determinants with their odd ration.

Quality Assessment

The methodological quality of included studies was assessed independently by two reviewers using the Newcastle–Ottawa Scale (NOS) for observational studies. Studies that scored five or higher on the NOS were included in the analysis [18]. The quality assessment was independently conducted by the authors, and any discrepancy in the result was resolved through careful examination of the studies by all authors together.

Data Synthesis and Statistical Analysis

Meta-analysis was performed using STATA software. Pooled effect estimates were calculated using a random-effects model due to expected heterogeneity among studies. Statistical heterogeneity was assessed using the I^2 statistic and Cochran's Q test. An I^2 test statistics of < 50 was declared as low heterogeneity, 50–75% was moderate, and $> 75\%$ was high heterogeneity [19]. Subgroup and sensitivity analyses were conducted. Publication bias was assessed using funnel plots and Egger's test.

Results

Selection of the studies

The search strategy retrieved a total of 747 published articles: 472 from PubMed, 110 from Scopus, 147 from Web of Science, and 18 from Google Scholar. After removing duplicates using reference management software, 593 articles remained. Then 317 articles were removed by their title and abstract. Following further screening, 168 articles were assessed for eligibility. Out of these, 161 articles were excluded because they didn't meet the inclusion criteria and doesn't report the cross-tabulation result. In the end, seven studies were included in the analysis (Fig. 1).

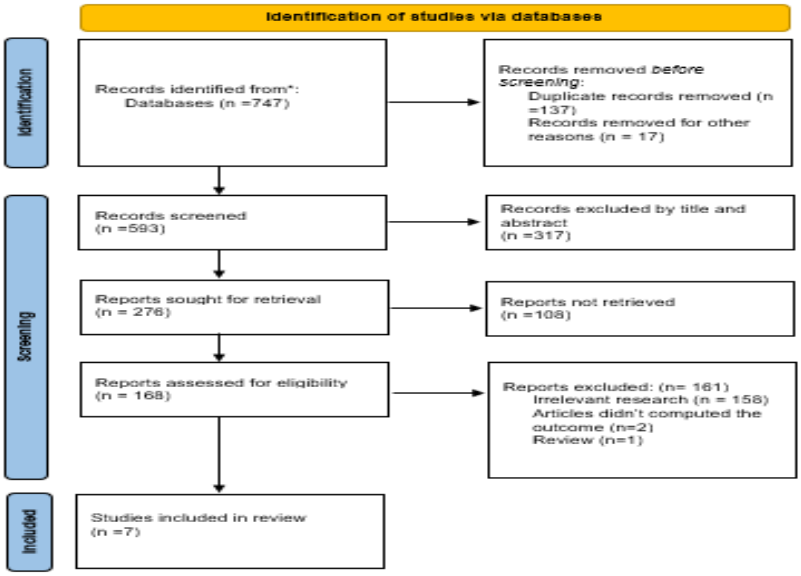

Fig. 1: PRISMA flowchart diagram of the study selection process.

Characteristics of included studies

Seven studies [13, 14, 20-24] comprising of 4, cross-sectional studies, 1 cohort and 2 case control studies with actual sample size ranging from 141[20]-582[24] with a good methodological quality. Most studies were conducted in Amhara and Oromia region and published from 2020 onwards (Table 1).

Table 1: Characteristics of the included studies in the systematic review and meta-analysis.

Authors Name	Publication Year	Study area	Study design	Sample size
Desta DM,	2020	Mekelle	Cross-sectional	141
Shanko T	2025	Hawassa	Cross-sectional	369
Gezie H,	2023	Addis Ababa	Case-control	255
Wondimneh F	2025	Eastern Ethiopia (Harar, Diredawa and Somali)	Case-control	357
Ambachew K.	unpublished	Amhara region	Cohort	582
Adugna T,	2025	Asella	Cross-sectional	317
Tegegne B	2023	South Wollo	Cross-sectional	416

Determinants of hypertensive crisis

Nine variables were analyzed to identify the determinants of hypertensive crisis. These variables included gender, place of residence, age, previous history of severe hypertension, smoking history, alcohol consumption, occupation, diabetes mellitus, and the comorbidity. Among those smoking history, Alcohol consumption, and comorbidity were identified as significant determinants of hypertension crisis.

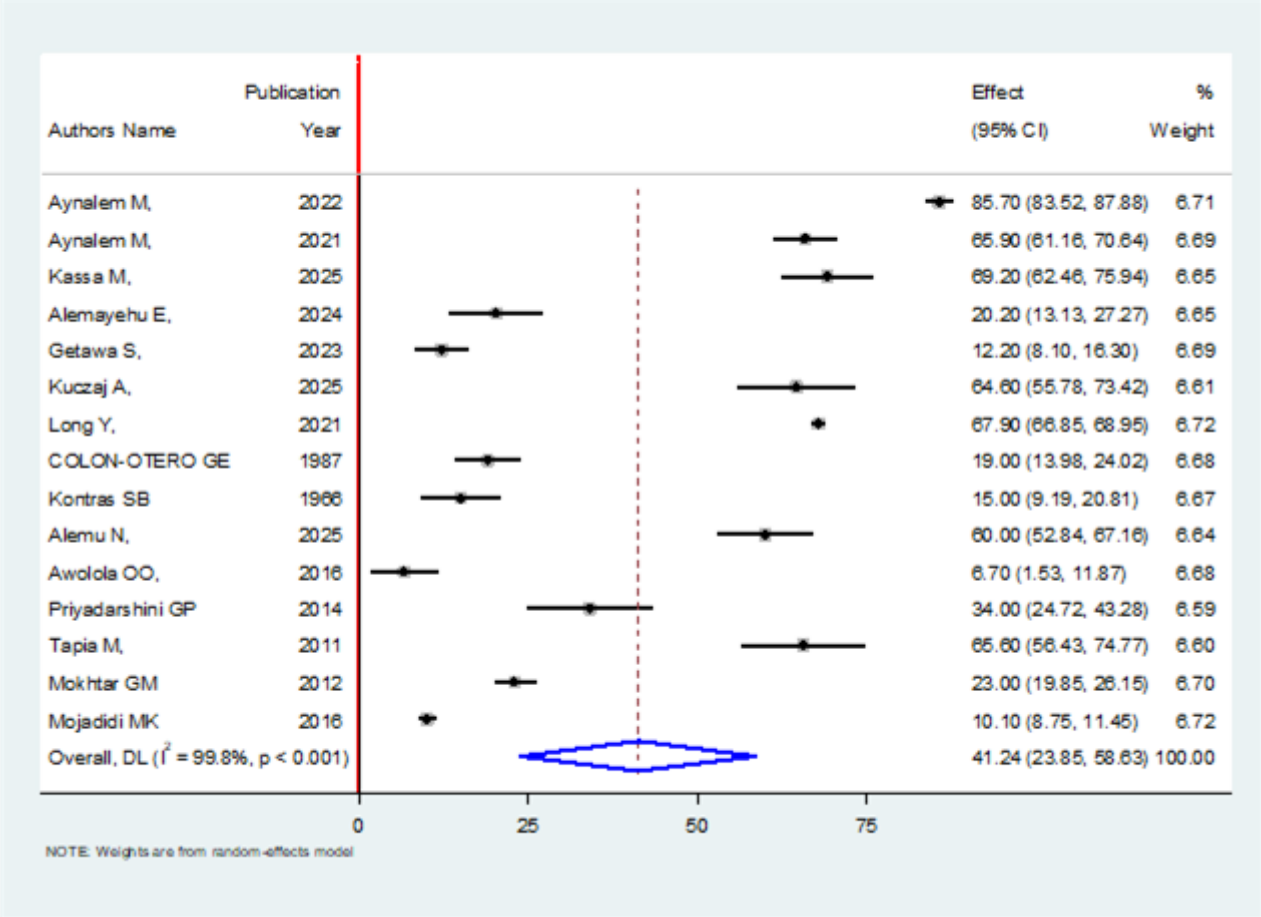

Fig 2: Forest plot showing the global pooled Prevalence of Haemostatic Disorders in Patients with Cardiovascular Diseases.

Patients with a history smoking had nearly twice the odds of developing the hypertensive crisis compared with non-smokers (OR: 1.87, 95% CI: 1.09–3.22). Those patients who were alcohol consumers had approximately two fold increased odds of hypertensive crisis compared with non-drinkers (OR: 1.91, 95% CI: 1.22–2.99). Those patients with comorbid conditions had nearly double the odds of the hypertensive crisis compared with those without comorbidities (OR: 1.93, 95% CI: 1.31–2.83) (Table 2).

Table 2: Determinants of hypertension crisis among hypertensive patient in Ethiopia.

Determinants	Comparison	No of studies	Sample size	OR (95%CI)	P –value	I^2 (%)	Heterogeneity test (p value)
Age	<45 years Vs >45 years	6	1488	0.473 (0.196-1.140)	0.095	92.9	< 0.001
Gender	Male Vs female	7	2113	0.996(0.464-2.140)	0.992	91.6	< 0.001
Residence	Urban Vs rural	5	1660	0.850 (0.526 -1.373)	0.506	76.2	0.002
Occupation	Employed Vs unemployed	3	984	1.394(0.649-2.993)	0.394	73.4	0.023
Previous history of severe hypertension	Yes Vs no	4	1516	2.288(0.724 -7.235)	0.159	92.5	< 0.001
Smoking	Yes Vs No	3	898	1.873(1.091-3.216)	0.023	63.9	0.063
Alcohol	Yes Vs No	3	969	1.909(1.221-2.986)	0.005	55.1	0.108
Comorbidity	Yes Vs No	2	600	1.925(1.309-2.832)	0.001	0.0	0.661
Diabetes mellitus	Yes Vs No	3	969	2.128(0.955- 4.743)	0.065	84.8	< 0.001

Discussion

Hypertensive crisis remains a critical clinical condition characterized by a sudden and severe elevation in blood pressure in patients with known essential or secondary hypertension, or it may develop spontaneously that may lead to acute target-organ damage and life-threatening complications. Despite advances in antihypertensive therapy, hypertensive crises continue to contribute substantially to emergency department admissions, particularly in low- and middle-income countries and associated with high morbidity and mortality due to complications such as stroke, acute heart failure, myocardial infarction, and renal failure [25-29].

In this systematic review and meta-analysis history of smoking has an association with hypertensive crisis. Patients with a history smoking had nearly twice the odds of developing the hypertensive crisis compared with non-smokers (OR: 1.87, 95% CI: 1.09–3.22). This finding is consistent other studies that identify cigarette smoking as an important modifiable cardiovascular risk factor contributing to acute blood pressure elevation and vascular complications [30-32]. Similarly, studies conducted in different settings reported that rates of hypertensive crisis and other acute cardiovascular events among smokers are high [33, 34]. Evidence shows that cigarette smoking increases inflammation, thrombosis, and oxidation of low-density lipoprotein cholesterol [35].

Also, alcohol consumption was identified as determinant of hypertensive crisis. Those patients who were alcohol consumers had approximately two fold increased odds of hypertensive crisis compared with non-drinkers (OR: 1.91, 95% CI: 1.22–2.99). This finding is similar with systematic review and meta-analysis conducted in Africa [36]. Study showed that Alcohol consumption has been associated with higher blood pressure and an increased risk of hypertension [37, 38].

Furthermore, the existence of comorbid health condition increases the occurrence of hypertensive crisis. Accordingly, those patients with comorbid conditions had nearly double the odds of the hypertensive crisis compared with those without comorbidities (OR: 1.93, 95% CI: 1.31–2.83). This finding is similar with systematic review and meta-analysis conducted in Africa [36]. Evidences

Patients with comorbid conditions are at higher risk of hypertensive crisis because these disorders promote endothelial dysfunction, arterial stiffness, impaired renal sodium and fluid regulation, and over activation of the sympathetic and renin–angiotensin systems. As a result it will cause reduction in vascular adaptability and blood pressure control, making sudden severe elevations. Study show that the presence of comorbidity nearly doubles the odds of hypertensive crisis compared with patients without additional illnesses, supporting comorbidity as an important aggravating factor in acute hypertensive complications [39-41].

Limitation of the study

This systematic review and meta-analysis faced several limitations. First, the presence of significant heterogeneity and publication bias means that the results should be interpreted with caution. Secondly, the lack of studies in certain regions of Ethiopia makes it challenging to generalize the findings. Finally, we encountered difficulties in comparing our results due to the absence of regional and worldwide systematic reviews and meta-analyses

Conclusion

This study demonstrates that lifestyle factors and existing health conditions play a significant role in the development of hypertensive crisis. Patients with a history of smoking and alcohol consumption were nearly twice as likely to experience a hypertensive crisis compared with non-users. Similarly, the presence of comorbid conditions substantially increased the risk. These findings highlight the importance of targeted risk reduction strategies, including smoking cessation, moderation of alcohol use, and optimal management of comorbidities, to prevent hypertensive crises and improve patient outcomes.

Declarations

Ethics approval and consent to participant
Not applicable

Consent for publication
Not applicable

Availability of data and materials
The data analyzed during the current systematic review and meta-analysis is fully available with reasonable request.

Competing interests
all the authors declare that they have no competing interests

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