Research Article

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Determinants of hypertension crisis and stroke among hypertensive patients in South Wollo and Oromia special zones public hospitals

Abstract

Background: Uncontrolled hypertension results in hypertension crisis, and it is an important public health concern around the world. The incidence of complicating hospitalizations with hypertension continues to grow and is associated with increased mortality and adverse discharge. Hypertension crisis and stroke are caused by numerous factors; however, there is a paucity of studies to identify determinants of hypertension crisis and stroke in Ethiopia, particularly the study area.

Objective: To identify determinants of hypertension crisis and stroke among hypertensive patients in South Wollo zone and Oromia special zone public hospitals, 2022.

Methods: An institution based cross-sectional study was conducted among 416 participants in South Wollo and Oromia special zones public hospitals. Systematic random sampling technique was used to select study participants. Data were entered into Epidata version 3.1 and analyzed using Statistical package for social sciences version 23. Variables having P<0.25 in binary logistic regression was retained in the multivariable analysis to control the effect of confounding. Finally, determinants were identified based on adjusted odds ratio along with 95% confidence level at p-value less than 0.05. Model fitness was checked using Hosmer-Lemshow test.

Results: In this study, the magnitude of hypertensive crisis was 35.6%(95%CI:31.1,40.4). Age(41-60years)(AOR=0.76,95%CI:0.42,0.98), Social support(AOR=0.82,95%CI:0.41,0.93), living in urban(AOR=0.56,95%CI:0.24,0.86) and good medication adherence(AOR=0.48,95%CI:0.29,0.83) were determinants of hypertensive crisis. Another, the magnitude of stroke was 5.0%(95%CI:3.1,7.8). Rural residence (AOR=3.4,95%CI:1.23,9.44), Systolic blood pressure (AOR=9.6,95%CI:2.71,34.06), family history of stroke (AOR=0.26,95%CI:0.07,0.79) were determinants of stroke.

Conclusion and recommendation: The magnitude of hypertensive crisis was high, whereas the magnitude of stroke was relatively low. Age 41-60 years, urban residence, having social support and good medication adherence were determinants of hypertensive crisis, while rural residence, systolic blood pressure and family history of stroke were determinants of stroke. Thus, health care providers should screen aged patients and patients with family history of stoke.

Keywords: determinants, Ethiopia, hypertension crisis, stroke, blood pressure

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Abbreviations: HE, hypertension emergency; HU, hypertension urgency; AOR, adjusted odds ratio; COR, crude odds ratio; SBP, systolic blood pressure; DBP, diastolic blood pressure; SPSS, statistical package for social sciences; WHO, world health organizations

Background

Hypertension crisis is a sudden and severe increase in blood pressure. It is classified into two categories: hypertensive urgency and hypertension emergency. Hypertensive urgency is blood pressure reading ≥ 180/120mm Hg without target organ damage while Hypertensive emergency is Blood Pressure(BP)≥180/120mmHg with organ damage.[1] According to the World Health Organization (WHO), stroke is defined as rapidly developing clinical signs of focal or global disturbance of cerebral function, with symptoms lasting 24hours or longer or leading to death which may be either ischemic or hemorrhagic disturbances of the cerebral blood circulation.[2] The two major types of stroke are ischemic and hemorrhagic stroke. Ischemic stroke is the most common type that results in reduced blood supply to the brain tissues, whereas hemorrhagic stroke occurs due to the rupture of blood vessels within the brain.[3]

In developed countries, ischemic stroke is high whereas hemorrhagic stroke is high in sub-Saharan Africa countries, as such in Kenya (15%),[4] Ethiopia (41%).[5] The high prevalence of hypertension among Africans maybe attributed to decreased production and increased degradation of nitric oxide resulting in endothelial dysfunction.[6] WHO points out that cardiovascular diseases account for approximately 17million deaths per year, and complications from hypertension accounts for 9.4 million of these deaths, hypertensive crisis is one of the major acute complications of hypertension, resulting in an emergency admission to hospitals.[2,7]

Africa is particularly worst hit, owing to population growth, unchecked industrialization and increased consumption of western diets, leading to a rise in many modifiable vascular disease risk factors including smoking, excessive use of alcohol, physical inactivity and unhealthy diets, and invariably resulting in increased prevalence of hypertension, diabetes and obesity.[8,9] Even with this increasing burden, the public health response, accesses to health services and treatment options in many African countries have been poor. This facilitates the fatality rates of hypertension crisis.[10]

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Currently in Ethiopia, stroke is one of the greatest public health problems, accounts for 7% of total deaths.[11] As studies showed that stroke was the third most common cause of medical intensive care unit admissions (15.2%) and the first cause of death, which accounts for 17% of all deaths in the medical intensive care unit.[12] Similarly, hypertension is responsible for 66.2% of all stroke admission and 38% of all strokes were on anti-hypertensive treatment.[13]

Uncontrolled hypertension results in a hypertension crisis and it is an important public health concern in the world. The incidence of complicating hospitalizations with hypertension continues to grow and is associated with increased mortality and adverse discharge. Hypertension crisis and stroke are caused by numerous factors. However, there is a paucity of studies to identify determinants of hypertension crisis and stroke in Ethiopia, particularly in the study area. Thus, this study was aimed at identifying determinants of hypertension crisis and stroke among hypertension patients in south Wollo and Oromia special zone public hospitals.

Methods and materials

Study design and Study area description

The study was conducted in South Wollo and Oromia special zone public hospitals. There are 13 public hospitals in the South Wollo zone and 2 hospitals in the Oromia special zones. From a total of 15 public hospitals, 5 hospitals were selected randomly.

Study design and period

A five year retrospective institution-based cross-sectional study design was implemented from 21 January 2017 to 20 January 2022.

Study participants

The study populations were all hypertensive patients who had visited selected public hospitals found in South Wollo and Oromia special zones from January 20, 2017 to January 21, 2022.

Eligible criteria

Hypertensive patients aged equal or greater than 18years were included in the study, whereas patient charts with incomplete data were excluded from the study.

Sample size determination

The sample size was calculated using a single population proportion formula by considering the following assumptions: 95% CI (1.96), 5% margin of error, and estimated proportion of hypertension crisis (50%) due to lack of prior research

$$n = \frac{(z \, a/2)^2 \, p \, (1-q)}{d^2}$$

Where, n=is sample size

z=the value of the standard normal curve score corresponding to the given confidence interval=1.96

p=estimated proportion of hypertension crisis (50%) as there is no previous study in Ethiopia as our knowledge.

d=the permissible margin of error (the required precision)=5%

$$n = \frac{(1.96^2)(0.5(1-0.5)}{0.05^2} = 384$$

After adding 10 % non-response rate, the final sample size was 422.

Sampling technique and procedure

Out of 15 hospitals found in South Wollo and Oromia special zones, 5 hospitals were selected by a simple random sampling technique (the lottery method). A proportional allocation of sample size was done for each selected hospital based on the number of patient flows. A systematically random sampling technique was used to select the records of the study subjects. The records of the study subjects were selected based on constant interval K, where K was calculated from total hypertension cases attended in public hospitals from January 21, 2017 to January 20, 2022 in chronological order divided by the sample size of the study (422). The first patient's medical record was selected by a lottery method and all patients' charts in the K interval were included in the study until the calculated sample size was obtained.

Study variables

i. Outcome variable

Magnitude of hypertension crisis

Magnitude of stoke

ii. Independent variables

a) **Scio-demographic** (age, sex, marital status, occupation, residence, educational status, and monthly income).

b) **Behavioral factors** (Physical exercise, Smoking, alcohol consumption, excessive salt in diet, fatty food use, medication adherence).

c) **Physical exercise**

i. Physically active - if patients make regular physical activities ≥ 30minutes

ii. for 5 days and above per week

iii. Physically inactive - if patient is made physical exercise less than 30minutes per week or less than 5 days per week.

d) **Medication adherence** was assessed using Morisky medication adherence score to anti-hypertensive medications having eight questions with Yes =1 and No=0

i. Good adherence - if participants score mean and above the mean.

ii. Poor adherence- if participants score less than the mean value.

e) **Alcohol drinker:** a person who drinks 10.5 units of alcohol and above per week.

f) **Physical measurements and clinical factors:** Fasting blood glucose (FBG), cholesterol

level, blood pressure control, body mass index (BMI) and comorbidities, normal FBG <126 mg/dl, raised FBG > =126 mg/dl.

g) **Cholesterol level:** normal if less than 200 and high cholesterol level 200 and above

h) **BMI:** Underweight (<18.5), normal (18.5–24.9), overweight (25–29.9) and obese (≥30).

i) **Systolic blood pressure:** controlled (<140mm Hg) and uncontrolled (≥140mmHg),

j) **diastolic blood pressure:** controlled (<90mmHg) and uncontrolled (≥ 90mmHg).

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Operational definitions

i.   **Stroke:** It is clinically defined as per WHO criteria, as rapidly developing clinical signs of focal or global disturbance of cerebral function, with symptoms lasting 24hours or longer or leading to death, with no apparent cause other than vascular origin.[14]

ii. **Ischemic Stroke:** It is the evidence of a recent infarct in the clinically relevant area of the brain/confirmed cerebral infarction.[15]

iii. **Hemorrhagic stroke:** It occurs due to the weakening of blood vessels which would rupture and bleed into the surrounding brain tissues.[16]

Data collection tools and procedure

The data source for the study was hospital medical record review (history & summary of patient card). Data was collected by using a data collection format prepared to include all the necessary variables on the patient card. First, all hypertension patient cases were counted from the log book. Then, by using these card numbers, charts of the patients were retrieved from the card room. Five data collectors and five supervisors from each hospital were recruited.

Data quality assurance

Training was given for data collectors and supervisors for one day on the objective of the study and the contents of the questionnaire. Continuous supervision was held by supervisors and principal investigators, and communication by phone was done on a daily basis. Prior to actual data collection, the questionnaire was pretested on 5% at Woldia hospital. After reviewing the results of the pretest, modification of the questionnaire was performed for applicability of the questionnaire.

Data processing and analysis

The collected data was numerically coded, checked, cleaned, and entered into Epidata version 3.1 and then exported to SPSS version 23.0 for analysis. Descriptive statistics were calculated. Bivariable and multivariable logistic regression were used to see the associations between dependent and independent variables. Variables with a p-value ≤ 0.25 in bivariable analysis were candidates for multivariable analysis to control the possible effect of confounding. The AOR and 95% confidence intervals were used to determine the presence and strength of the association, and $p < 0.05$ was declared statistically significant. Model fitness was checked by the Hosmer-Lemeshow test.

Results

Sociodemographic characteristics of participants

More than half (60.6%) of patients were females, 51.2% of patients were categorized as aged 40–60 years, and most (42.8%) of these patients could not read and write (Table 1).

Table 1 Socio demographic characteristics of participants to identify determinants of hypertension crisis and stroke among hypertensive patients (N=416).

Variables	Variable category	Frequency	Percentage
Sex	Male	164	39.4
	Female	252	60.6
Age(years)	20-40	83	20.0
	40-60	213	51.2
	>60	120	28.8
Marital status	Single	7	1.7
	Married	326	78.4
	Widowed	59	14.2
	Divorced	24	5.8
Educational status	Unable to read and write	178	42.8
	Able to read and write	171	41.1
	Primary (Grade 1-8)	25	6.0
	Secondary (Grade 9-12)	16	3.8
	Higher education	26	6.3
Residence	Urban	271	65.1
	Rural	145	34.9
Occupation	Government employee	29	7.0
	Private	4	1.0
	Merchant	82	19.7
	Daily laborer	8	1.9
	Housewife	181	43.5
	Farmer	90	21.6
	Retirement	18	4.3
	Others*	4	1.0
Monthly income(ETB)	<3000	113	44.7
	3000-6000	109	43.1
	>6000	31	12.1

ETB: Ethiopian birr, * students

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Clinical and anthropometric measurements

Most (96.2%) of patients had normal cholesterol levels, but 78.1% of patients had uncontrolled blood glucose levels. More than one-third (37.3%) of patients had comorbidities, and peripheral neuropathy accounted for 36.7% of the total comorbidities (Table 2).

Table 2 Clinical and anthropometric measurements of patients to identify determinants of hypertensive crisis and stroke in South Wollo zone and Oromia special zone public hospitals

Items	Category	N (%)
Duration of hypertension	<5 years 5-10 years >10 years	296(71.2) 89(21.4) 31(7.5)
Cholesterol level	<200mg/dl ≥200mg/dl	400(96.2) 16(3.8)
Blood glucose level(FBS)	<126mg/dl ≥126mg/dl	91(21.9) 325(78.1)
Creatinine level	<1mg/dl ≥1mg/dl	371(89.2) 45(10.8)
Urine albumin level	<30mg/g ≥ 30mg/g	398(95.7) 18(4.3)
BMI	18.5-24.9 25-29.9 ≥30	388(93.3) 12(2.9) 16(3.8)
Systolic blood pressure	<140mmHg ≥140mmHg	274(65.9) 142(34.1)
Diastolic blood pressure	<90mmHg ≥90mmHg	291(70.0) 125(30.0)
Presence of comorbidities	Yes No	155(37.3) 261(62.7)
If yes, type of comorbidities	Diabetes Mellitus Chronic kidney disease Peripheral Neuropathy cardiac disease others	43(27.2) 6(3.8) 58(36.7) 18(11.4) 33(20.9)
Presence of family history of stroke	Yes No	36(8.7) 380(91.3)
Drugs given for the treatment of hypertension	ACEIs Diuretics CCBs Beta blockers	177(42.5) 72(17.4) 106(25.4) 61(14.7)
Do you ever taken lipid regulating drugs	Atorvastatin Lovastatin Simvastatin Others*	79(19.1) 15(3.6) 6(1.5) 313(75.8)
Attending hypertension education	Yes regularly Yes sometimes No never	86(20.8) 308(74.6) 19(4.6)
Having social support	Yes No	399(95.9) 17(4.1)

* Eye disorders, ACEI: angiotensin converting enzyme inhibitors, CCB: Calcium channel blockers

Anti-hypertension medication adherence

The mean (±SD) of antihypertensive adherence was 12.76(±1.83). This mean was used to classify participants into two categories. Thus, 228(54.8%, 95%CI: 50.0-58.9) patients had good adherence and 188(45.2%, 95%CI: 41.1-50.0) had poor adherence (Table 3).

Table 3 Anti-hypertension medication adherence among hypertensive patients

MMAS Adherence questions	Responses Yes, n(%)	Responses No, n(%)
Do you sometimes forget to take your prescribed medications?	208(50)	208(50)
Over the past two weeks, were there any days you did not take any prescribed medications?	87(20.9)	329(79.1)
Have you stopped taking medications because you feel worse when you when took it?	155(37.3)	261(62.7)
When you travel or leave home, do you sometimes forget to bring along your medications?	223(53.6)	193(46.4)
Did you take your medication yesterday?	354(85.1)	62(14.9)
When you feel like your health is under control, do you sometimes stop to take medications?	91(21.9)	325(78.1)
Do you feel hassled about sticking to your prescribing treatment plan?	106(25.5)	310(74.5)
How often do you have difficulty, to take your medications?	122(29.3)	294(70.7)

Adherence to dietary modifications

Dietary modification for hypertension patients is crucial to control different complications. In this study, more than three-fourths (78.4%) of patients rarely ate fruits and vegetables (Table 4).

Table 4 Dietary modifications among hypertension patients

Items	Never n(%)	Rarely n(%)	Usually n(%)	Always n(%)
Do you include fruits, vegetable, grains, and beans in your diet after you diagnosis with hypertension?	33(7.9)	326(78.4)	53(12.7)	4(1%)
How often do you consume foods that contain high saturated fat (e.g., cheese, coconut oil, cottonseed oil, mutton fat etc.) since being diagnosed?	126(30.3)	274(65.9)	16(3.8)	0
Do you consume spicy foods since being diagnosed	113(27.2)	270(64.9)	33(7.9)	0
Do you consume salt in your food?	206(49.5)	191(45.9)	4(1.0)	15(3.6)
Do you read nutritional facts on food labels to compare the amount of sodium in products	328(78.8)	65(15.6)	15(3.6)	8(1.9)

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Adherence to exercise

As non-pharmacological management, exercise is recommended for hypertension patient. In this finding, one –fourths (25.2%) patients perform exercise. (Table 5)

Table 5 Adherence to exercise among hypertension patients

Items	Variable categories	n(%)
Do you perform physical exercise at all?	Yes	105(25.2)
	No	311(74.8)
How often do you exercise?	< Three times per week	34(8.2)
	≥Three times per week	75(18.0)
What type of exercise do you perform?	Walking	95(22.8)
	Jogging	3(0.7)
	Cycling	7(1.7)
For how long do you exercise per session?	< 30 minutes	33(7.9)
	≥ 30 minutes	72(17.3)

Cessation of smoking

Cigarette smoking is a risk factor for hypertension patients. For hypertension patients, stopping cigarette smoking is recommended. As shown from the table, 11.8% of patients were smokers. (Table 6)

Table 6 Cessation of smoking among hypertension patients

Items	Category	N(%)
Have you ever used tobacco?	Yes	49(11.8)
	No	367(88.2)
Do you still smoke cigarettes?	Yes	6(1.4)
	No	362(87.0)
Have you tried to quit smoking?	Yes	21(5.0)
	No	341(82.0)

Alcohol consumption

Moderate alcohol consumption is good for hypertension patients to control further complications. In the current study, majority (92.1%) of hypertension patients had never drank alcohol. (Table 7)

Table 7 Alcohol consumption among hypertension patients

s.n	Items	Coding	n(%)
1	How often do you have a drink containing alcohol?	(0) Never (1) Monthly or less	383(92.1)
		(2) 2 to 4 times a month	21(5.0)
			12(2.9)
		(3) 2 to 3 times a week	0
		(4) 4 or more times a week	0
2	How many drinks containing alcohol do you have on a typical day when you are drinking?	(0) 1 or 2	30(7.2)
		(1) 3 or 4	3(0.7)
		(2) 5 or 6	4(1.0)
		(3) 7, 8, or 9	0
		(4) 10 or more	0
3	How often do you have six or more drinks on one occasion?	(0) Never (1) Less than monthly	27(6.5) 6(1.4)
		(2) Monthly	0
		(3) Weekly	0
		(4) Daily or almost daily	0
4	How often during the last year have you found that you were not able to stop drinking once you had started?	(0) Never (1) Less than monthly	3(0.7) 24(5.8)
		(2) Monthly	3(0.7)
		(3) Weekly	3(0.7)
		(4) Daily or almost daily	0
5	How often during the last year have you failed to do what was normally expected from you because of drinking?	(0) Never (1) Less than monthly	24(5.8) 6(1.4)
		(2) Monthly	3(0.7)
		(3) Weekly	0
		(4) Daily or almost daily	0
6	How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	(0) Never (1) Less than monthly	33(7.9) 0
		(2) Monthly	0
		(3) Weekly	0
		(4) Daily or almost daily	0
7	How often during the last year have you had a feeling of guilt or remorse after drinking?	(0) Never 1) Less than monthly	6(1.4) 12(2.9)
		(2) Monthly	15(3.6)
		(3) Weekly	0
		(4) Daily or almost daily	0
8	How often during the last year have you been unable to remember what happened the night before because you had been drinking?	(0) Never (1) Less than monthly	27(6.5) 6(1.4)
		(2) Monthly	0
		(3) Weekly	0
		(4) Daily or almost daily	0
9	Have you or someone else been injured as a result of your drinking?	(0) No (2) Yes, but not in the last year	18(4.3) 15(3.6)
		(4) Yes, during the last year	0
10	Has a relative or friend or a doctor or another health worker been concerned about your drinking or suggested you cut down?	(0) No (2) Yes, but not in the last year	3(0.7) 24(5.8)
		(4) Yes, during the last year	6(1.4)

Magnitude of hypertension crisis

In this study, 34.1% of patients had greater than 140 mmHg (uncontrolled hypertension) and 30% of patients had greater than 90 mmHg. The magnitude of the hypertensive crisis was 35.6 %(95% CI: 31.1, 40.4).

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Determinants of hypertensive crisis

From bivariable analysis, age, marital status, occupation, blood glucose level, type of comorbidity, type of antihypertensive drugs, attending hypertensive education, having social support, and good adherence were significantly associated with hypertensive crisis. From multivariable analysis; age (41-60years), residence, having social support, and good adherence were determinants of hypertensive crisis.

Accordingly, participants aged 41–60years were 24% less likely to develop hypertensive crises as compared to participants aged >60 years (AOR=0.76, 95%CI: 0.42, 0.98). Those participants living in urban areas were 44% less likely to develop hypertensive crises as compared to rural residents (AOR=0.56, 95%CI: 0.24, 0.86). Participants who received social support were 18% less likely than their counterparts to develop hypertensive crises (AOR= 0.82, 95% CI: 0.41, 0.93). Lastly, participants who had good adherence were 52% less likely to develop hypertensive crisis as compared to their counterparts (AOR=0.48, 95%CI: 0.29, 0.83) (Table 8).

Table 8 Determinants of hypertensive crisis among hypertensive patients in south Wollo zone and oromia special zone public hospitals

Variables	Variables categories	Hypertensive crisis		COR(95%CI)	AOR(95%CI)
		Yes	No		
Sex	Male	18	46	0.72(0.55,1.25)	
	Female	33	61	1	
Age(years)	20-40	30	53	1.3(0.7,2.3)	1.1(0.87,2.36)
	41-60	81	132	1.4(0.86,2.22)*	0.76(0.42,0.98)**
	>60	37	83	1	1
Marital status	Single	1	2	1.2(0.18,7.88)	
	Married	37	72	1.8(0.71,4.77)*	
	Widowed	11	23	1.1(0.38,3.31)	
	Divorced	2	10	1	
Educational status	Unable to read and write	34	65	0.8(0.34,1.86)	
	Able to read and write	11	31	1.0(0.43,2.35)	
	Primary (Grade 1-8)	2	5	0.8(0.24,2.39)	
	Secondary (Grade 9-12)	1	3	0.7(0.19,2.72)	
	Higher education	3	3	1	
Residence	Urban	30	60	0.98(0.64,1.50)*	0.56(0.24,0.86)**
	Rural	24	47	1	1
Occupation	Government employee	13	16	1	
	Private/NGO	2	2	1.2(0.15,9.97)	
	Merchant	25	57	0.54(0.23,1.29)*	
	Daily laborer	2	6	0.41(0.07,2.38)*	
	Housewife	71	110	0.79(0.36,1.75)	
	Farmer	31	59	0.65(0.28,1.52)	
	Retirement	3	15	0.25(0.06,1.04)*	
	Others	1	3	0.41(0.04,4.43)	
Monthly income(birr)	<3000	41	72	1	
	3000-6000	41	68	1.1(0.61,1.83)	
	>6000	66	128	0.91(0.56,1.47)	
Duration of hypertension	<5 years	36	82	1	
	5-10 years	10	18	1.1(0.61,1.83)	
	>10 years	5	7	0.91(0.56,1.47)	
Blood glucose level	<120mg/dl	5	14	1	
	≥120mg/dl	46	93	0.71(1.15)*	
Creatinine level	<1mg/dl	41	88	1	
	≥1mg/dl	10	19	1.1(0.59,2.11)	
Urine albumin level	<30mg/g	46	100	1	
	≥ 30mg/g	5	7	1.55(0.44,3.06)	
BMI	18.5-24.9	49	105	0.53(0.19,1.44)	
	25-29.9	2	2	1.00(0.22,4.47)	
	≥30	51	107	1	
Systolic BP	<160mmHg	26	54	1	
	>160mmHg	25	53	0.85(0.55,1.30)	
Diastolic BP	<110mmHg	34	73	1	
	>110mmHg	17	34	0.98(0.63,1.51)	

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Table Continued...

Variables	Variables categories	Hypertensive crisis		COR(95%CI)	AOR(95%CI)
		Yes	No		
Type of comorbidities	diabetes mellitus	17	26	1	
	CKD	2	4	0.77(0.13,4.65)	
	peripheral neuropathy	18	40	0.69(0.30,1.57)	
	cardiac disease	6	12	0.77(0.24,2.43)	
	others	8	25	0.49(0.18,1.34)*	
Family history of stroke	Yes	5	7	1.55(0.59,2.39)	
	No	46	100	1	
Drugs given for treatment of hypertension	ACEIs	20	38	1	
	Diuretics	12	25	0.9(0.51,1.6)	
	CCBs	11	34	0.72(0.43,1.21)*	
	Beta blockers	8	10	0.78(0.42,1.44)	
Do you ever taken lipid regulating drugs	Atorvastatin	6	13	1	
	Lovastatin	2	5	1.03(0.33,3.19)	
	Simvastatin	1	2	1.5(0.29,8.17)	
	Others	42	87	0.79(0.48,1.34)	
Attending hypertension education	Yes, regularly	19	29	1.6(0.6,4.4)	
	Yes, sometimes	31	76	0.7(0.44,1.2)*	
	No, never	1	2	1	
Having social support	Yes	143	256	1.34(0.26,1.35)*	0.82(0.41,0.93)**
	No	5	12	1	
Antihypertensive drug adherence	Good	77	151	0.84(0.61,0.98)*	0.48(0.29,0.83)**
	Poor	71	117	1	1

*p<0.25, **p<0.05, 1-reference category

Magnitude of stroke

Out of 416 patients, 21 patients had stroke. Thus, the magnitude of stroke was 5.0% (95%CI: 3.1-7.8).

Determinants of stroke

From bivariable analysis, sex, age, residence, systolic blood pressure (SBP), diastolic blood pressure, and family history of stroke were significantly associated with the magnitude of stroke. From multivariable analysis, residence, SBP, and having a family history of stroke were determinants of stroke.

Accordingly, rural participants were 3.4 times more likely to develop a stroke as compared to urban residents (AOR=3.4, 95%CI: 1.23, 9.44). Participants with uncontrolled systolic blood pressure were 9.6 times more likely to develop stroke as compared to control SBP (AOR=9.6, 95%CI: 2.71, 34.06). Participants without a family history of stroke were 74% less likely to develop a stroke as compared to their counterparts (AOR=0.26, 0.07, 0.79).(Table 9)

Table 9 Determinants of stroke among hypertensive patients in south Wollo and oromia special zone public hospitals

Variables	Variables categories	Stroke		COR(95%CI)	AOR(95%CI)
		Yes	No		
Sex	Male	12	152	1	
	Female	9	243	0.47(0.19,1.14)*	
Age(years)	20-40	3	80	2.16(0.57,8.24)	
	40-60	9	204	1.84(0.71,4.76)*	
	>60	9	111	1	
Residence	Urban	6	265	1	1
	Rural	15	130	5.1(1.93,13.4)*	3.4(1.23,9.44)**
Blood glucose level	<120mg/dl	3	88	1.72(0.49,5.97)	
	≥120mg/dl	18	307	1	
Creatinine level	<1mg/dl	18	353	1.4(0.4,4.96)	
	≥1mg/dl	3	42	1	
Systolic BP	<160mmHg	3	271	1	1
	>160mmHg	18	124	13.1(3.79,45.3)*	9.6(2.71,34.06)***
Diastolic BP	<110mmHg	9	282	3.3(1.37,8.1)*	
	>110mmHg	12	113	1	
Presence of comorbidities	Yes	6	149	1.5(0.58,4.04)	
	No	15	243	1	
Family history of stroke	Yes	6	30	1	1
	No	15	362	0.21(0.08,0.57)*	0.26(0.07,0.79)**
Hypertensive drug Adherence	Good	12	216	1.11(0.46,2.68)	
	Poor	9	179	1	

*p<0.25, **p<0.05, *** p<0.001, 1- reference category

Determinants of hypertension crisis and stroke among hypertensive patients in South Wollo and Oromia special zones public hospitals

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Discussion

Ethiopian morbidity and mortality rates rise from time to time as a result of hypertension crises. In this study, the magnitude of hypertensive crisis was 35.6%(95% CI: 31.1, 40.4). This finding is higher than a study conducted in Ayder comprehensive specialized hospital and Debre Markos, Ethiopia.[17,18] However, this finding is lower than a study conducted in Karachi, Pakista(56.3%)[19] and Gondar(59.2%),Ethiopia.[20]

Being old was a risk factor for a hypertension crisis. Accordingly, participants aged 41–60years were 24% less likely to develop hypertensive crises as compared to participants aged >60years (AOR=0.76, 95%CI: 0.42, 0.98). This is supported by studies in Shashemene, Ethiopia[21] and Luanda, Angola.[22]

The living environment was a factor in hypertensive crisis. Those participants living in urban areas were 44% less likely to develop hypertensive crises as compared to rural residents (AOR= 0.56, 95%CI: 0.24, 0.86). This finding is supported by other studies; Kenya,[4] Bahirdar, Ethiopia,[5] and Nigeria.[23]

Another found that having social support was significantly associated with a hypertension crisis. Participants who received social support were 18% less likely to develop hypertensive crisis than their counterparts(AOR=0.82, 95%CI: 0.41, 0.93).This is congruent with different studies.[8,24]

The determinant of the hypertension crisis was drug adherence. Participants who had good adherence were 52% less likely to develop hypertensive crises as compared to their counterparts. This finding was supported by other studies: Nigeria,[25] Ethiopia[17] and India.[15]

In the present study, the magnitude of stroke was 5.0%(95: CI: 3.1-7.8). This is in line with a study conducted in Debre Markos,7.7%[3] and JUMC,[26] Felege Hiwot hospital,[27] Ethiopia. However, this finding is lower studies conducted in Addis Ababa, Ethiopia,[28] India,[15] and Nigeria.[29]

Concerning determinants of stroke, rural residence, uncontrolled systolic blood pressure, and having a family history of stroke were determinants of stroke. Accordingly, rural participants were 3.4 times more likely to develop a stroke as compared to urban residents (AOR= 3.4, 95%CI: 1.23, 9.44). This result is congruent with studies conducted in different settings: Debre Markos,[3] Ethiopia, USA,[30] and Kenya.[4]

Participants with uncontrolled systolic blood pressure were 9.6 times more likely to develop stroke as compared to controlled systolic blood pressure (AOR=9.6, 95%CI: 2.71, 34.06). This is supported by previous studies.[6,29,31]

Having family history of stroke was significantly associated with stroke. Participants without family history of stroke were 74% less likely to develop stroke as compared to their counter parts (AOR=0.26, 0.07, 0.79). This is similar with previous studies.[5,24,27,32,33]

Conclusion and recommendation

The magnitude of the hypertensive crisis was high, whereas the magnitude of the stroke was relatively low. Age (41–60years), urban residence, having social support and good medication adherence were determinants of hypertensive crisis, while rural residence, uncontrolled systolic blood pressure and family history of stroke were determinants of stroke. Thus, healthcare providers should screen aged patients and patients with a family history of stroke, and the minister of health should prepare guidelines on how to manage hypertensive patients and increase imaging facilities for early screening of stroke.

Data sharing statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent for publication

Not applicable. No individual personal details, images or videos are being used in this study

Conflicts of interest

The authors declare that they have no competing interests.

Author's contribution

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted, and agree to be accountable for all aspects of the work.

Ethical consideration

An ethical letter was obtained from the institutional review board (IRB) of Wollo University, and a letter of permission was obtained from the chief executive officers of the study hospitals. To ensure confidentiality, data were collected anonymously, and all data collection was done in accordance with the Helsinki Declaration.

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