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Evaluation of Adherence to Prescription Guidelines for Secondary Prevention at Discharge Following Ischemic Stroke

Ola Ali Nassr[1]*, Paul Forsyth[2], Huda Muhammed Muzher[1], Raghad Faris Wadeea[1], Sara Delman Najim[1], Aya Manhal Mustafa[1] and Mustafa Shaalan Tarish[1]

1. Department of clinical pharmacy, College of pharmacy, Mustansiriyah University, Baghdad, Iraq.
2. NHS Greater Glasgow & Clyde, Pharmacy Services, Clarkston Court, 56 Busby Rd, Scotland, United Kingdom

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*Corresponding author
Ola Ali Nassr

Email:
ola.nassr@uomustansiriyah.edu.iq

ABSTRACT

Stroke is a significant public health issue. It represents the second leading cause of death globally and the third of death and disability combined. This study aims to evaluate whether stroke patients receive appropriate secondary prevention therapy at discharge through a retrospective analysis of patients admitted to Al-Yarmouk Teaching Hospital from September 15th, 2023, to January 15th, 2024. The prescription of secondary prevention therapy was evaluated according to American Heart Association/American Stroke Association (AHA/ASA) guidelines, which recommend the prescription of antiplatelet therapy and high-intensity statins to all patients, and antihypertensive treatment to those with hypertension. The researchers reviewed the medical records of 180 patients, of which 164 were eligible, who were aged 33-101 years (mean=65.5). Of those, 93 (56.7%) were male. Overall, 70.1% received appropriate secondary prevention therapy, 92.1% were prescribed antiplatelet therapy and statins, and 78.0% antihypertensive treatment. In contrast, 16.8% were prescribed high-intensity statins and only 11.1% of patients with atrial fibrillation were offered anticoagulants. There was no statistically significant difference between receivers and non-receivers of appropriate secondary prevention therapy, with the exception of systolic blood pressure on admission (P: 0.038). In addition, the male patients (odds ratio [OR]: 0.404; 95% confidence interval [CI]: 0.164, 0.995) were less likely to be prescribed antihypertensive therapy. Our findings highlight the need for education programs to ensure optimal statin dosing and improve the prescribing of antihypertensive medications and anticoagulants at follow-up to reduce stroke-related morbidity and mortality.

Keywords: antihypertensive treatment, guidelines, ischemic stroke, secondary prevention, statins

INTRODUCTION

Stroke is defined as "a group of pathological conditions characterized by sudden, non-convulsive loss of neurological function due to brain ischemia or intracranial hemorrhage" (Shahbandi et al., 2022). It represents the second leading cause of death globally and the third of death and disability combined (Shahbandi et al., 2022). Globally, stroke affects 12.2 million and was responsible for 6.55 million deaths in 2019, with 75% of these deaths occurring in low- and middle-income countries (GBD 2019 Stroke Collaborators, 2021). According to a global burden of disease study, Iraq was ranked as the second-highest country in the Middle East in terms of the prevalence of stroke in 2019, at 196.2-218.3/100000, as well as in regard to mortality rate caused by stroke at 143.3/100000 (Jaberinezhad et al., 2022). This rising trend is a barrier to achieving the Sustainable Development Goal (SDG) 3.4 to reduce the burden of non-communicable disease by a third in 2030 (Shahbandi et al., 2022). Stroke is broadly divided into ischemic and hemorrhagic types which differ in terms of epidemiology, and prognosis (Chen et al., 2020). Ischemic stroke accounts for 87% of cases and hemorrhagic stroke 13% (Chen et al., 2020). Ischemic stroke is caused by the restriction of blood flow to an area of the brain due to the stenosis or occlusion of cerebral blood vessels by a thrombus formed inside cerebral arteries or an embolus mostly originating from the heart (Campbell et al., 2019). The interruption of the oxygen supply to brain cells will ultimately result in cell death (Campbell et al., 2019).

Stroke has a high rate of recurrence: 41% of those who survive the first event may have a recurrence within five years and recurrent stroke carries a poorer prognosis than first-ever stroke (Chen et al., 2020). Thus, the American Heart Association/American Stroke Association (AHA/ASA) guidelines recommend an integrated approach to screen for modifiable risk factors and provide secondary prevention therapy that addresses the etiology of stroke (Kleindorfer et al., 2021). This will typically include medical treatment with antihypertensive medications, as well as statins, antiplatelets, or anticoagulants for atrial fibrillation, and lifestyle modification such as avoiding excessive salt intake, smoking cessation, and exercise. Selected patients may benefit from surgical interventions such as endarterectomy and patent foramen ovale closure (Kleindorfer et al., 2021). The AHA/ASA guidelines for the secondary prevention of ischemic stroke recommend for all patients without contraindications high-intensity statin therapy with atorvastatin 80 mg or rosuvastatin 20 mg, antiplatelet therapy with either aspirin (81-325 mg) daily, clopidogrel 75 mg daily or aspirin/dipyridamole 25/200 twice daily for those with non-cardioembolic stroke, and anticoagulants in preference to antiplatelets in patients with atrial fibrillation or arterial or cardiac thrombosis (Kleindorfer et al., 2021). The AHA/ASA guidelines set a blood pressure target of <130/80 mmHg for patients with ischemic stroke after the acute phase (Kleindorfer et al., 2021). Secondary prevention can effectively prevent ischemic stroke from recurring by 80.0% (Kleindorfer et al., 2021). Evidence suggests that the prescription of secondary prevention therapy at discharge is critical in ensuring the persistence of utilizing these medications long-term to prevent further vascular events (Thrift et al., 2014).

Despite being a region with a high prevalence of stroke, studies evaluating discharge prescriptions of secondary prevention therapy in Iraq are lacking. According to an evaluation by Benamer, there is a scarcity of evidence related to this topic in Arabic countries (El-Hajj et al., 2016). Thus, this study aims to evaluate whether patients with stroke receive appropriate secondary prevention therapy at discharge as per AHA/ASA guidelines which would help in research planning and informs policymakers when developing strategies for the prevention and effective management of stroke.

MATERIALS AND METHODS

Ethical approval

The study was approved by Mustansiriyah University and Iraqi Ministry of Health (ethics number 3178; 10-1-2024). Patients' names were removed and assigned a number to protect their confidentiality and the analysis was performed on anonymous data.

Study design and settings

An observational retrospective study of patients with ischemic stroke admitted to the medicine ward at Al-Yarmouk Teaching Hospital in Baghdad, which is one of the largest hospitals in Iraq. The hospital provides government-funded public healthcare. The reporting of the findings is presented in line with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Cuschieri, 2019).

Study population, sample size, and sampling strategy

All patients with a confirmed acute stroke diagnosis from September 15th, 2023, until January 15th, 2024, were eligible for inclusion. Patients who died during admission and those with a transient ischemic attack or unconfirmed diagnosis were excluded.

Stroke diagnosis at the hospital is usually made clinically and for all patients a computed tomography scan is ordered immediately, sometimes with magnetic resonance imaging (MRI), to exclude hemorrhage and guide further management. In order to identify the mechanism of stroke, a certain diagnostic investigation is performed, for example carotid duplex, electrocardiography, and echocardiography, to identify cardiac causes of stroke such as atrial fibrillation, valvular heart disease, heart failure, etc. Routine laboratory tests in the emergency department usually include random blood glucose level, hemoglobin A1C, a coagulation study such as prothrombin time, activated partial thromboplastin time (APTT), complete blood count, and tests for renal function, liver function, and serum electrolytes. Testing for lipid profile and carotid artery atherosclerosis using a carotid duplex was conducted after patients were transferred from the emergency department to the medicine ward. Given the descriptive nature of the study and the commitments of the first author, in addition to the prevalence of stroke at the site, a sample of 164 patients was considered appropriate. Convenience sampling was employed and patients were identified by the administrative staff at the statistics office at the site who screened medical records for stroke diagnosis until 164 cases were reached.

Data collection

Data were collected and entered into Excel by four researchers under the supervision of an experienced clinical pharmacist. Medical records were reviewed to extract routinely collected patient-level data, including age, gender, and the clinical presentation of stroke, including all signs and symptoms experienced by the patient leading to seeking care, such as nausea, left-side weakness, numbness, decreased level of consciousness, etc.

The data collection form also includes information on blood pressure on admission and discharge, past medical history of hypertension, diabetes, atrial fibrillation or flutter, previous stroke, ischemic heart disease, myocardial infarction, heart failure, chronic kidney disease, and lifestyle factors, including smoking and alcohol. All secondary prevention medications that each patient was receiving on the last day of hospitalization, including dose and frequency of dosing, were also extracted. We assumed that secondary prevention medications given on the last day of admission were prescribed at discharge since a copy of the discharge letter is not available in the medical records. To assess the need for antihypertensive therapy, all patients with systolic blood pressure ≥140 mmHg and or diastolic blood pressure ≥90 mmHg at discharge were considered candidates for antihypertensive therapy as per the guidelines (Chobanian et al., 2003). The data were first entered into Excel, cleaned, and then transferred to Statistical Package for the Social Sciences (SPSS).

Statistical analysis

Descriptive statistics were used to describe the patients' characteristics. The mean (standard deviation, SD) was utilized to describe continuous variables and numbers and percentages to report categorical variables. The chi-square test or Fisher's exact test was applied as appropriate to test the association between a range of sociodemographic and clinical characteristics and prescription of secondary prevention therapy. Variables with a P-value < 0.05 in the bivariate analysis were further tested with univariate binary logistic regression to identify predictors associated with secondary prevention therapy prescription. The data were analyzed with SPSS v. 22.0, Chicago, IL, USA, and a P-value < 0.05 was employed to indicate statistical significance. The analysis was performed on anonymized data to protect patients' confidentiality.

RESULTS AND DISCUSSION

Sociodemographic and clinical characteristics of the study population

During the study period, 180 medical records were reviewed; 16 were excluded due to death (n=10), transient ischemic attack (n=3), and unconfirmed diagnosis (n=3). Of the included 164 patients, 93 (56.7%) were male and 71 (43.3%) female, and the mean age was 65.5 years (range=33-101 years). There was a statistically significant association between age and sex: the mean age (SD) was 63.6 years (12.57 years) for males and 68.1 years (12.66 years) for females, P=0.005. The mean systolic blood pressure on admission was 150.5 mmHg (range=70-259 mmHg). The mean (SD) duration of hospital stay was 3.6 days (3.51), (range=1-25 days) (Table I).

With regard to risk factors for stroke, 85.4% (n=140) had hypertension, 54.3% (n=89) diabetes, 41.5% (n=68) stroke, and 34.8% (n=57) had ischemic heart disease or myocardial infarction. Patients with atrial fibrillation represented 11.0% (n=18), and 7.9% (n=13) had chronic kidney disease. Only 2.4% (n=4) used alcohol, and almost one-third of patients were current smokers (n=43, 26.2%), of which 37/43 (86.0%) were male (Table II).

The most common clinical features experienced by patients included hemiparesis (64.6%, n=106) and slurred speech (51.2%, n=84). Slightly less than half experienced a decreased level of consciousness (42.3%, n=69), more than one third had mouth deviation (38.4%, n=63), and 18.3% (n=30) had vomiting. Aphasia/dysphasia, headache, and vertigo/dizziness were experienced by 18.3% (n=30), 14.0% (n=23), and 13.4% (n=22), respectively. Numbness, blurred vision, and nausea were experienced by 9.8% (n=16), 7.9% (n=13), and 6.1% (n=10). Only 3.7% (n=6) had convulsions, 2.4% (n=4) had ataxia, and 1.8% (n=3) had vision or hearing loss. The mean number of symptoms experienced by patients was 3.1 (range= 1-10) (Table III).

Table I. Characteristics of the study population

Variable	N=164 (%)
Age, average (SD), range (years)	65.5 (12.97), (33-101)
Gender	
Male	93 (56.7)
Female	71 (43.3)
SBP on admission, average (SD), range (mmHg)	150.5 (32.87),(70-259)
DBP on admission, average (SD), range (mmHg)	86.8 (21.19), (40-180)
SBP at discharge, average (SD), range (mmHg)	138.7 (24.92), (70-220)
DBP at discharge, average (SD), range (mmHg)	80.6 (15.07), (43-120)
Duration of hospital stay, average (SD) (range) (days)	3.6 (3.51), (1-25)

SD: standard deviation; SBP: systolic blood pressure; DBP: diastolic blood pressure

Table II. Medical history and lifestyle factors of the study population

Medical history	N=164 (%)
Hypertension	140 (85.4)
Diabetes	89 (54.3)
Stroke	68 (41.5)
Ischemic heart disease	49 (29.9)
Heart failure	22 (13.4)
Atrial fibrillation	18 (11)
Chronic kidney disease	13(7.9)
Myocardial infarction	8 (4.9)
Lifestyle factors	
Smoking	
Nonsmoker	115 (70.1)
Current smoker	43 (26.2)
Ex-smoker	6 (3.7)
Alcohol	4 (2.4)

Table III. Clinical presentation of patients with stroke

Clinical presentation	N=164 (%)
Hemiparesis	106 (64.6)
Slurred speech	84 (51.2)
Decreased level of consciousness	69 (42.3)
Mouth deviation	63 (38.4)
Vomiting	30 (18.3)
Aphasia/dysphasia	30 (18.3)
Dysphagia	25 (15.2)
Headache	23 (14.0)
Vertigo/dizziness	22 (13.4)
Numbness	16 (9.8)
Blurred vision	13 (7.9)
Nausea	10 (6.1)
Quadriparesis	7 (4.3)
Convulsion	6 (3.7)
Ataxia	4 (2.4)
Vision or hearing loss	3 (1.8)
Symptoms, mean (S.D), range	3.1 (1.44), (1-10)

Table IV. Secondary prevention medications prescribed at discharge

Medications	N=164 (%)
Antiplatelet therapy for ischemic stroke	151/164(92.1)
Antiplatelet Monotherapy	116/151 (76.8)
Dual antiplatelet therapy	35/151 (23.2)
Aspirin	100/151 (66.2)
Clopidogrel	86/151 (56.9)
Anticoagulants	7 (4.3)
Abixaban	6/7(85.7)
Rivaroxiban	1/7 (14.3)
Antihypertensive medications	103/132(78.0)
One	52/103 (50.5)
Two	32/103 (31.1)
≥three	19/103 (18.4)
Antihypertensive medication classes	103/132 (78.0)
ACEI/ARBs	56/103 (54.4)
Betablockers	48/103 (46.6)
Calcium channel blockers	45/103 (43.7)
Diuretics	22/103 (21.4)
Others	1/103 (0.9)
Statins	151/164 (92.1)
Atorvastatin	131/151 (86.8)
Rosavastatin	20/151 (13.2)

ACEI/ARBs:angiotensin converting enzyme inhibitors/angiotensin receptor blockers

Secondary prevention therapy prescription at discharge

Antiplatelet therapy was administered to the majority of patients (92.1%, n=151), and of those 23.2% (n=35) were given dual antiplatelet therapy. The prescribing rate of aspirin was slightly higher than clopidogrel at 66.2% (n=100) versus 56.9% (n=86). The mean dose of aspirin was 113.5 mg (range =100-300 mg), while clopidogrel was prescribed at a dose of 75 mg in all cases.

For patients with atrial fibrillation (n=18), only 2/18 (11.1%) of them received anticoagulants with apixaban; the remaining 15/18 (83.3) were prescribed antiplatelet monotherapy and 1/18 (5.6%) dual antiplatelet therapy. Other patients (n=5) were given apixaban or rivaroxaban for indications that were not documented in the medical notes. Of the surviving 132/164 (80.5%) who had hypertension as per the study definition, 78.0% (n=103) were prescribed antihypertensive therapy at discharge.

Of the 29/132 (22.0%) who did not receive antihypertensive therapy, 21/132 (15.9%) were male. Of those taking antihypertensive medication(s), slightly more than half (50.5%, n=52/103) received monotherapy, 31.1% (n=32/103) dual therapy, and 18.4% (19/103) ≥3 medications. The angiotensin-converting enzyme inhibitors/angiotensin receptor blockers (ACEIs/ARBs) were the most prescribed antihypertensive medication class (54.4%, n=56/103), followed by beta blockers (46.6%, n=48/103) and calcium channel blockers (43.7%, n=45/103), with diuretics being the least (21.4%, n=22/103). The most prescribed ACEI/ARBs was candesartan 22/56 (39.3%), followed by valsartan 11/56 (19.6%), and lisinopril 7/56 (12.5%). Bisoprolol was the most common beta blocker 23/48 (47.9%), followed by metoprolol 13/48 (27.1%) and carvedilol 7/48 (14.6). Amlodipine was the most frequently prescribed calcium channel blocker n=45/45 (100.0%). Hydrochlorothiazide was the most prescribed diuretic 14/22 (63.6%), followed by spironolactone 6/22 (27.3%) (Table IV).

Most patients were prescribed statins at the time of discharge. (151/164, 92.1%). Atorvastatin was the most prescribed statin at 131/151 (86.8%), and only 20/151 (13.2%) were given rosuvastatin. The mean prescribed dose of atorvastatin was 37.2 mg (range=10-40 mg) and for rosuvastatin it was 26.8 mg (range=10-40 mg).

Table V. Differences between recipients and non-recipients of secondary prevention therapy

Characteristics	Receiving appropriate secondary prevention N=115 (70.1%)	Not receiving appropriate secondary prevention N=49 (29.9%)	Total N=164 (100.0)	P-value
Age, mean (S.D)	65.8 (12.2)	64.9 (14.07)	65.5 (12.76)	0.779
Gender				0.676
Male	51 (31.1)	20 (12.2)	71 (43.3)	
Female	64 (39.0)	29 (17.7)	93 (56.7)	
Medical history				
Hypertension	99 (60.4)	41 (25.0)	140 (85.4)	0.689
Diabetes	65 (39.6)	24 (14.6)	89 (54.3)	0.375
Stroke	53 (32.3)	15 (9.1)	68 (41.5)	0.066
Number of comorbidities, mean (S.D)	2.5 (1.28)	2.4 (1.30)	2.5 (1.29)	0.548
Number of stroke symptoms on admission, mean (S.D)	3.3 (1.52)	2.8 (1.16)	3.2 (1.44)	0.080
SBP on admission, mean (S.D)	153.9 (32.9)	142.3 (31.58)	150.5 (32.87)	0.038
DBP on admission, mean (S.D)	88.6 (21.8)	82.7 (19.26)	86.8 (12.19)	0.063
Hospital stay, mean (S.D)	3.6 (3.42)	3.6 (3.86)	3.6 (3.55)	0.626

SBP: systolic blood pressure; DBP: diastolic blood pressure

Table VI. Association between patients' characteristics and receiving secondary prevention medications at discharge

Parameters	P value		
	Antihypertensive therapy	Statins	Antiplatelet therapy
Sex	0.045	0.424	0.424
Hospital stay ≤ 2 days	0.058	0.043	0.773
History of ischemic stroke	0.046	0.721	0.819
History of ischemic heart disease	0.174	0.757	0.061
Stroke symptoms >3	0.058	0.468	0.651

Only 16.8% (22/131) were prescribed high-intensity stations as per the guidelines. Most patients (95%, n=19/20) who received rosuvastatin were prescribed a high dose (20-40 mg), while only 2.3% of atorvastatin users (n=3/131) received high-dose atorvastatin (80 mg), 79.4% (n=104) a medium dose (40 mg), and 18.3% (n=24) a low dose (10-20 mg).

Factors associated with receiving appropriate secondary prevention therapy at discharge

Overall, 70.1% (n=114) received appropriate secondary prevention therapy of antiplatelet therapy and statins, as well as antihypertensive therapy if indicated at discharge. In the bivariate analysis, there was no statistically significant difference between receivers and non-receivers of appropriate secondary prevention therapy, with the exception of systolic blood pressure on admission (P: 0.038) (Table V). There was a statistically significant relationship between sex (P: 0.045), history of ischemic stroke (P: 0.046), and prescription of antihypertensive therapy. In addition, there was a marginally significant association between having a hospital stay ≤ 2 days (P: 0.058), stroke symptoms >3 (P: 0.058), and receiving antihypertensive therapy. The prescription of statins was associated with a hospital stay ≤ 2 days (P: 0.043). There was a marginally significant association between antiplatelet therapy and history of ischemic heart disease (P: 0.061) (Table VI). Binary logistic regression analysis revealed that male patients (odds ratio (OR): 0.404; 95% confidence interval [CI]: 0.164, 0.995), were less likely to receive antihypertensive therapy.

This study evaluated stroke secondary prevention therapy prescribing at discharge. Overall, 70.1% received appropriate secondary prevention therapy, 92.1% were prescribed antiplatelet therapy and statins, and 78.0% antihypertensive treatment. There was an association between receiving appropriate secondary prevention therapy at discharge and systolic blood pressure on admission. In addition, male sex was associated with a lower likelihood of receiving antihypertensive therapy.

The rate of antiplatelet prescription for ischemic stroke was 92.1%, which is comparable to the rate reported in Palestine (98.0%), Bahrain (83.0%), and Malaysia (88.9%) (Al Banna et al., 2015; Hwong et al., 2017; Sawalha, 2009). Platelet activation results in platelet aggregation and thrombus formation leading to cardiovascular events including stroke and myocardial infarction (Shah et al., 2022). Thus, antiplatelet therapy is an essential part of secondary prevention therapy recommended for all patients without contraindications (Kleindorfer et al., 2021). The guidelines recommend either aspirin, clopidogrel once daily, or a combination of aspirin and extended-release dipyridamole twice daily (Kleindorfer et al., 2021). Aspirin reduces the risk of recurrent stroke by 22.0%, which is considered a clinically significant effect (Bangad et al., 2023).

Dual antiplatelet therapy was received by 23.2%. The initiation of dual antiplatelet therapy is recommended during the first 24-48 hours for patients with non-cardioembolic minor stroke and to be continued for three weeks after the index event (Wang et al., 2013). This intervention reduces the risk of recurrent stroke by 30% at 90 days compared with aspirin alone (Wang et al., 2013). After that, antiplatelet monotherapy is continued indefinitely. The other indication of dual antiplatelet therapy is symptomatic cerebral stenosis (70%-99%) to be used for three months (Bangad et al., 2023; Kleindorfer et al., 2021).

The guidelines recommend oral anticoagulation for all patients with atrial fibrillation to reduce the risk of stroke (Kleindorfer et al., 2021). Oral anticoagulants, including vitamin K antagonists and novel new oral anticoagulants (NOACs), reduce the risk of cardioembolic stroke by 70.0% (Kamel & Healey, 2017). The choice is based on the patient's factors, comorbidities, and clinical circumstances. NOACs are appealing as they reduce the risk of intracranial bleeding compared to warfarin (Kamel & Healey, 2017). Of the 18 patients with atrial fibrillation, only two patients received apixaban (NOAC), because anticoagulation should be delayed until four to 14 days after the index event to avoid hemorrhagic transformation of the infarct and the mean duration of hospital stay was 3.7 days, which may explain the underutilization of anticoagulants for patients with atrial fibrillation (Kamel & Healey, 2017).

A recent study in the United Kingdom reported the underutilization of anticoagulants in patients with cardioembolic stroke (Lee et al., 2011). Another investigation in the United States of America showed that only 33% of patients with atrial fibrillation receive anticoagulants (Ko et al., 2022). This pattern may be driven by miscalculation of the risk-benefit ratio of anticoagulants by the prescriber (Ko et al., 2022).

In our study, only 78.0% of patients with hypertension were given antihypertensive medications at discharge. This rate is higher than a study conducted in Malaysia where 48.0% of patients with ischemic stroke receive antihypertensive therapy, yet lower than what was reported in Bahrain (92.5%) and comparable to that in Palestine (79%) (Al Banna et al., 2015; Hwong et al., 2017; Sawalha, 2009). This may be due to the short duration of hospital stay for most patients. Intensive lowering of blood pressure during the acute phase of stroke is strongly discouraged due to concerns about adequate perfusion to ischemic cerebral tissue (Liu et al., 2023; Sandset et al., 2011). However, achieving adequate blood pressure control is critical long-term because it not only reduces the recurrence of stroke but also ameliorates the progression of small vessel disease that contributes to cognitive decline and dementia (Kleindorfer et al., 2021). Reducing systolic and diastolic blood pressure by 10 mmHg and 5 mmHg diminishes the risk of recurrent stroke by 41.0% (Law et al., 2009). Therefore, AHA/ASA stroke secondary prevention guidelines set a blood pressure target of <130/80 mmHg for patients with a history of stroke (Kleindorfer et al., 2021). Previous evidence in Iraq indicates that only 38.7% of patients with hypertension had controlled blood pressure (Nassr & Forsyth, 2019).

The rate of antihypertensive therapy prescribing is suboptimal since hypertension spans every mechanism leading to stroke and therefore controlling blood pressure is ubiquitously important to enhance clinical outcomes (Liu et al., 2023). According to a recent paper, it may be reasonable to prescribe antihypertensive medication at discharge even for those with a hospital stay of fewer than seven days (Liu et al., 2023). The Perindopril Protection Against Recurrent Stroke Study (PROGRESS) indicates that patients with the lowest blood pressure levels had the lowest risk of stroke (Arima et al., 2006). Antihypertensive medications including ACEIs/ARBs, diuretics, and calcium channel blockers are all effective treatment options, with beta blockers reserved for patients with compelling indications, for example ischemic heart disease due to blood pressure variability (Arima et al., 2006; Bangad et al., 2023). The current evidence suggests that both hypertensive and normotensive stroke patients may benefit from antihypertensive therapy (PROGRESS Collaborative Group, 2001). Indeed, follow-up evaluations show that blood pressure control among stroke patients is inadequate and that more than half of survivors fail to achieve optimal control (Campbell et al., 2019).

There was a correlation between the prescription of antihypertensive medication and sex. Male patients were less likely to be given antihypertensive therapy. A previous study in Iraq reported that male sex is a predictor of uncontrolled blood pressure (Nassr & Forsyth, 2019). With regard to the prescription of antihypertensive medications, evidence from developed countries reported a contrasting sex bias, with women less likely to receive antihypertensive therapy (Connelly et al., 2022). This may be due to differences in culture, practice pattern, and healthcare system delivery.

For every 1 mmol/L reduction in low-density lipoprotein (LDL) cholesterol, the risk of recurrent ischemic stroke is reduced by 12%, with further risk reduction with more intensive lowering (Kleindorfer et al., 2021). The goal is to reduce the LDL level to 70 mg/dl; if patients fail to achieve that despite using the maximum tolerated dose of statin, guidelines recommend adding ezetimibe (Kleindorfer et al., 2021). In addition to LDL-lowering, statins possess anti-inflammatory and antioxidant effects which make them valuable for secondary stroke prevention (Bangad et al., 2023). Thus, the guidelines recommend atorvastatin 80 mg for all patients with ischemic stroke irrespective of baseline LDL level (Kleindorfer et al., 2021). The majority (90.5%) of patients with ischemic stroke receive statins, which is comparable to a study conducted in Malaysia (88.7%) (Hwong et al., 2017). The rate is higher than that reported in Finland where 27.1% were not given statins at discharge (Åivo et al., 2023). However, the prescribed average dose was less than that recommended by the guidelines, with only 16.8% prescribed high-intensity statins as per the guidelines. The reason for this observation is unknown.

This study is the first in Iraq that addresses stroke secondary prevention therapy prescription at discharge, thus overcoming the limitation of the previous research conducted in Anbar, Iraq (Awad et al., 2010). However, this paper has certain limitations. The small sample size collected from a single hospital in Baghdad may limit the generalizability of the findings. In addition, secondary prevention medication prescription at discharge was based on last day of admission. The rate of receiving appropriate secondary prevention therapy may thus be underestimated. Finally, data on mortality, readmission, and care post-discharge were not available and would need to be addressed in future research.

Lastly, a recent study in Iraq indicates that only 21.0% of participants had adequate overall knowledge with regard to stroke symptoms, risk factors, and long-term consequences (Al-Obaidi et al., 2023). Thus, raising public awareness using culturally appropriate educational campaigns would reduce mortality through early recognition and seeking care and may allow high-risk patients to practice risk factor reduction, which is an essential part of stroke prevention.

CONCLUSION

The study shed light on secondary prevention therapy prescription at discharge after acute stroke. Overall, 70.1% received appropriate secondary prevention therapy according to AHA/ASA guidelines including antiplatelet and antihypertensive therapy, as well as statins. While the majority were prescribed antiplatelet therapy and statins, only 78.0% of patients with hypertension received antihypertensive therapy. In addition, a minority of patients with atrial fibrillation were given anticoagulants and only a few patients were offered high-intensity statins as per the guidelines.

There is a need to improve the prescribing of antihypertensive medications and anticoagulants on follow-up visits to reduce stroke-related morbidity and mortality. Moreover, education programs should be implemented to enhance the optimal dosing of statins.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

Åivo, J., Ruuskanen, J. O., Tornio, A., Rautava, P., & Kytö, V. (2023). Lack of statin therapy and outcomes after ischemic stroke: A population-based study. *Stroke*, *54*(3), 781–790. https://doi.org/10.1161/strokeaha.122.040536

Al Banna, M., Baldawi, H., Kadhim, A., Humaidan, H., & Whitford, D. L. (2015). Stroke in Bahrain: Rising incidence, multiple risk factors, and suboptimal care. *International Journal of Stroke*, *10*(4), 615–618. https://doi.org/10.1111/ijs.12513

Al-Obaidi, H., Khidhair, Z., Jirjees, F., Barakat, M., AlSalamat, H., Kharaba, Z., Alfoteih, Y., Haddad, C., Mansour, S., Hallit, S., Malaeb, D., & Hosseini, H. (2023). Factors associated with knowledge and awareness of stroke in the Iraqi population: A cross-sectional study. *Frontiers in Neurology*, *14*, 1144481. https://doi.org/10.3389/fneur.2023.1144481

Arima, H., Chalmers, J., Woodward, M., Anderson, C., Rodgers, A., Davis, S., Macmahon, S., Neal, B., & PROGRESS Collaborative Group. (2006). Lower target blood pressures are safe and effective for the prevention of recurrent stroke: The PROGRESS trial. *Journal of Hypertension*, *24*(6), 1201–1208. https://doi.org/10.1097/01.hjh.0000226212.34055.86

Awad, S. M., Al-Jumaily, H. F., Al-Dulaimi, K. M., & Abdulghafoor, R. H. (2010). Assessment of major risk factors among stroke patients. *Saudi Medical Journal*, *31*(9), 1028–1031.

Bangad, A., Abbasi, M., & de Havenon, A. (2023). Secondary ischemic stroke prevention. *Neurotherapeutics*, *20*(3), 721–731. https://doi.org/10.1007/s13311-023-01352-w

Campbell, B. C. V., De Silva, D. A., Macleod, M. R., Coutts, S. B., Schwamm, L. H., Davis, S. M., & Donnan, G. A. (2019). Ischaemic stroke. *Nature Reviews. Disease Primers*, *5*(1), 70. https://doi.org/10.1038/s41572-019-0118-8

Chen, Y., Wright, N., Guo, Y., Turnbull, I., Kartsonaki, C., Yang, L., Bian, Z., Pei, P., Pan, D., Zhang, Y., Qin, H., Wang, Y., Lv, J., Liu, M., Hao, Z., Wang, Y., Yu, C., Peto, R., Collins, R., Li, L., … China Kadoorie Biobank Collaborative Group (2020). Mortality and recurrent vascular events after first incident stroke: a 9-year community-based study of 0·5 million Chinese adults. The Lancet. Global health, 8(4), e580–e590. https://doi.org/10.1016/S2214-109X(20)30069-3

Chobanian, A. V., Bakris, G. L., Black, H. R., Cushman, W. C., Green, L. A., Izzo, J. L., Jones, D. W., Materson, B. J., Oparil, S., Wright, J. T., Roccella, E. J. (2023) Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure. National Heart, Lung, and Blood Institute, & National High Blood Pressure Education Program Coordinating Committee. Seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure. *Hypertension (Dallas, Tex.: 1979)*, *42*(6), 1206–1252.https://doi.org/10.1161/01.HYP.0000107251.49515.c2

Connelly, P. J., Currie, G., & Delles, C. (2022). Sex Differences in the prevalence, outcomes and management of hypertension. *Current Hypertension Reports*, *24*(6), 185–192. https://doi.org/10.1007/s11906-022-01183-8

Cuschieri, S. (2019). The STROBE guidelines. *Saudi Journal of Anaesthesia*, *13*(Suppl 1), S31–S34. https://doi.org/10.4103/sja.SJA_543_18

El-Hajj, M., Salameh, P., Rachidi, S., & Hosseini, H. (2016). The epidemiology of stroke in the Middle East. *European Stroke Journal*, *1*(3), 180–198. https://doi.org/10.1177/2396987316654338

GBD 2019 Stroke Collaborators. (2021). Global, regional, and national burden of stroke and its risk factors, 1990-2019: A systematic analysis for the global burden of disease study 2019. *The Lancet. Neurology*, *20*(10), 795–820. https://doi.org/10.1016/S1474-4422(21)00252-0

Hwong, W. Y., Abdul Aziz, Z., Sidek, N. N., Bots, M. L., Selvarajah, S., Kappelle, L. J., Sivasampu, S., & Vaartjes, I. (2017). Prescription of secondary preventive drugs after ischemic stroke: Results from the Malaysian National Stroke Registry. *BMC Neurology*, *17*, 203.

https://doi.org/10.1186/s12883-017-0984-1

Jaberinezhad, M., Farhoudi, M., Nejadghaderi, S. A., Alizadeh, M., Sullman, M. J. M., Carson-Chahhoud, K., Collins, G. S., & Safiri, S. (2022). The burden of stroke and its attributable risk factors in the Middle East and North Africa region, 1990-2019. *Scientific Reports*, *12*(1), 2700. https://doi.org/10.1038/s41598-022-06418-x

Kamel, H., & Healey, J. S. (2017). Cardioembolic stroke. *Circulation Research*, *120*(3), 514–526. https://doi.org/10.1161/circresaha.116.308407

Kleindorfer, D. O., Towfighi, A., Chaturvedi, S., Cockroft, K. M., Gutierrez, J., Lombardi-Hill, D., Kamel, H., Kernan, W. N., Kittner, S. J., Leira, E. C., Lennon, O., Meschia, J. F., Nguyen, T. N., Pollak, P. M., Santangeli, P., Sharrief, A. Z., Smith, S. C., Turan, T. N., & Williams, L. S. (2021). 2021 Guideline for the prevention of stroke in patients with stroke and transient ischemic attack: A guideline from the American Heart Association/American Stroke Association. *Stroke*, *52*(7), e364–e467. https://doi.org/10.1161/STR.0000000000000375

Ko, D., Lin, K. J., Bessette, L. G., Lee, S. B., Walkey, A. J., Cheng, S., Kim, E., Glynn, R. J., & Kim, D. H. (2022). Trends in use of oral anticoagulants in older adults with newly diagnosed atrial fibrillation, 2010-2020. *JAMA Network Open*, *5*(11), e2242964. https://doi.org/10.1001/jamanetworkopen.2022.42964

Law, M. R., Morris, J. K., & Wald, N. J. (2009). Use of blood pressure lowering drugs in the prevention of cardiovascular disease: Meta-analysis of 147 randomised trials in the context of expectations from prospective epidemiological studies. *BMJ*, *338*, b1665. https://doi.org/10.1136/bmj.b1665

Lee, S., Shafe, A. C. E., & Cowie, M. R. (2011). UK stroke incidence, mortality and cardiovascular risk management 1999-2008: Time-trend analysis from the general practice research database. *BMJ Open*, *1*(2), e000269. https://doi.org/10.1136/bmjopen-2011-000269

Liu, L., Xie, X., Pan, Y., Wang, A., Wei, Y., Liu, J., Nie, X., Liu, D., Zhao, Z., Wang, P., Shen, S., Zhong, C., Xu, T., Wang, D., Wang, G.-C., Song, D., Ma, Y., Zhao, J., Jiang, Y., Jing, J., … CATIS-2 Investigators. (2023). Early versus delayed antihypertensive treatment in patients with acute ischaemic stroke: Multicentre, open label, randomised, controlled trial. *BMJ*, *383*, e076448. https://doi.org/10.1136/bmj-2023-076448

Nassr, O. A., & Forsyth, P. (2019). Evaluation of blood pressure control and associated factors among patients with hypertension in Iraq: A prospective cross-sectional study. *Journal of Pharmacy & Bioallied Sciences*, *11*(3), 232–239. https://doi.org/10.4103/jpbs.JPBS_82_19

PROGRESS Collaborative Group. (2001). Randomised trial of a perindopril-based blood-pressure-lowering regimen among 6,105 individuals with previous stroke or transient ischaemic attack. *Lancet*, *358*(9287), 1033–1041. https://doi.org/10.1016/S0140-6736(01)06178-5

Sandset, E. C., Bath, P. M. W., Boysen, G., Jatuzis, D., Kõrv, J., Lüders, S., Murray, G. D., Richter, P. S., Roine, R. O., Terént, A., Thijs, V., Berge, E., & SCAST Study Group. (2011). The angiotensin-receptor blocker candesartan for treatment of acute stroke (SCAST): A randomised, placebo-controlled, double-blind trial. *Lancet*, *377*(9767), 741–750. https://doi.org/10.1016/S0140-6736(11)60104-9

Sawalha, A. (2009). Characterization of hospitalized ischemic stroke patients in palestine. *The Libyan Journal of Medicine*, *4*(1), 37–40. https://doi.org/10.4176/080920

Shah, J., Liu, S., & Yu, W. (2022). Contemporary antiplatelet therapy for secondary stroke prevention: A narrative review of current literature and guidelines. *Stroke and Vascular Neurology*, *7*(5), 406–414. https://doi.org/10.1136/svn-2021-001166

Shahbandi, A., Shobeiri, P., Azadnajafabad, S., Saeedi Moghaddam, S., Sharifnejad Tehrani, Y., Ebrahimi, N., Rezaei, N., Rashidi, M.-M., Ghamari, S.-H., Abbasi-Kangevari, M., Koolaji, S., Haghshenas, R., Rezaei, N., Larijani, B., & Farzadfar, F. (2022). Burden of stroke in North Africa and Middle East, 1990 to 2019: A systematic analysis for the global burden of disease study 2019. *BMC Neurology*, *22*(1), 279. https://doi.org/10.1186/s12883-022-02793-0

Thrift, A. G., Kim, J., Douzmanian, V., Gall, S. L., Arabshahi, S., Loh, M., & Evans, R. G. (2014). Discharge is a critical time to influence 10-year use of secondary prevention therapies for stroke. *Stroke*, *45*(2), 539–544. https://doi.org/10.1161/strokeaha.113.003368

Wang, Y., Wang, Y., Zhao, X., Liu, L., Wang, D., Wang, C., Wang, C., Li, H., Meng, X., Cui, L., Jia, J., Dong, Q., Xu, A., Zeng, J., Li, Y., Wang, Z., Xia, H., Johnston, S. C., & CHANCE Investigators. (2013). Clopidogrel with aspirin in acute minor stroke or transient ischemic attack. *The New England Journal of Medicine*, *369*(1), 11–19. https://doi.org/10.1056/NEJMoa1215340