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Identification of Drug-Related Problems and Associated Factors Among Hospitalized Stroke Patients in Selected Hospitals in Sana'a City, Yemen: A Prospective Study

A graduation research project submitted as partial fulfilment for the
requirement of the Bachelor's degree in Pharm-D

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قال تعالى :

عَلَيْكَ وَعَلَىٰ الْكَلْبِ

وَكَانَ فَضْلُ اللَّهِ عَلَيْكَ عَظِيمًا سورة النساء آية (١١٢)

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Dedication

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Abstract

Background: Stroke is the second leading cause of mortality and disability worldwide, with ischemic stroke being the most common subtype in developing countries. Stroke patients often experience long-term complications, significantly reducing their quality of life. Drug-related problems (DRPs)—events that interfere with optimal therapeutic outcomes are a major concern in stroke management due to comorbidities, and complex treatment regimens. Despite the high burden of stroke in Yemen, there is no data on DRPs among hospitalized stroke patients, particularly in resource-limited settings like Sana'a, where healthcare challenges such as inadequate clinical pharmacy services exacerbate the risk of adverse drug events. **Aim:** This study aimed to assess the prevalence, types, and associated factors of DRPs among stroke patients in selected hospitals in Sana'a, Yemen, and evaluate their impact on clinical outcomes.

Methods: A prospective observational study was conducted across three major tertiary hospitals in Sana'a, Yemen (Al-Gumhori, Al-Thawra, and Al-Kuwait Hospital) from January 2025 to March 2025. A total of 100 adult stroke patients diagnosed with ischemic stroke, hemorrhagic stroke, or transient ischemic attack (TIA) were enrolled using a whole sampling technique. Data on patient demographics, past history, prescribed medications, and drug-related problems (DRPs) were collected through medical record reviews and patient interviews. DRPs were identified and classified using the Cipolle et al [81]. framework, with validation from clinical decision support tools (Lexicomp, Micromedex, Dynamedex). Data were analyzed using IBM SPSS Statistics (version 27.0) and Microsoft Excel (2019).

Results: A total of 100 stroke patients were included in this study. The majority were male (64%), aged 50-65 years (44%), with significant rates of smoking/khat chewing (60%). Most cases (58%) were from Al-Gumhori Hospital. Hypertension (83%), heart failure (52%), diabetes (39%) and were the most common comorbidities. Ischemic stroke accounted for (69%) of cases. During hospitalization, (47%) of patients received 11-20 medications. Drug-related problems were frequent, with need for additional therapy (82%), low dosage (77%), and unnecessary medications (69%) being most common. Patient outcomes at discharge showed partial improvement in (64%) of cases, full recovery in (14%), and mortality in (5%).

Conclusion: Effective stroke management remains a critical challenge in Yemen's healthcare system. This study reveals significant gaps in medication safety, with drug-related problems affecting 37% of stroke patients. These results provide crucial evidence to guide clinical practice reforms and policy decisions to optimize stroke care and medication safety in Yemen's resource-limited settings.

Keywords: Drug-related problems, Associated factors, Stroke patients, Hospitalized, Sana'a, Yemen, Prospective study.

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ABBREVIATION

Abbreviation	Full Term
EIU	Emirate International University
CVA	Cerebrovascular Accident
DRPs	Drug Related Problems
ICU	Intensive Care Unit
CC	Chief Complaints
AIS	Acute Ischemic Stroke
TIA	Transient Ischemic Attack
BID	Twice Daily
TID	Three Times Daily
OD	Once Daily
SC	Subcutaneous
IV	Intravenous
DAPT	Dual Antiplatelets Therapy
PPIs	Proton Pump Inhibitors
ACEIs	Angiotensin Converting Enzyme Inhibitors
ARBs	Angiotensin Receptor Blockers
HCZT	Hydrochlorothiazide
UFH	Unfractionated Heparin
VTE	Venous Thromboembolism
RBS	Random blood Sugar
CNS	Central Nervous System
PCNE	Pharmaceutical Care Network European
CT	Computed Tomography
ICH	Intracerebral Hemorrhage
SAH	Subarachnoid Hemorrhage
MRI	Magnetic Resonance Imaging
MENA	Middle East and North Africa
AF	Atrial Fibrillation
ECG	Electrocardiogram

ATP	Adenosine Triphosphate
GCS	Glasgow Coma Score
BP	Blood Pressure
EVT	Endovascular Therapy
LMICs	Low Middle Income Countries
NIHSS	National Institute of Health Stroke Scale
ASCVD	Atherosclerotic Cardiovascular Diseases
LDL-C	Low Density Lipoprotein Cholesterol
PCSK-9	Proprotein Convertase Subtilisin/Kexin type 9
RCTs	Randomized Controlled Trials
P-value	Probability value
SPARCL	Stroke Prevention by Aggressive Reduction in Cholesterol
TST	Treat Stroke To Target
SBP	Systolic Blood Pressure
AHA/ASA	American Heart Association / American Stroke Association.
WHO	World Health Organization
ICP	Intra-Cranial Pressure
UTI	Urinary Tract Infection
SAP	Stroke Associated Pneumonia
CAP	Community Acquired Pneumonia
HAP	Hospital Acquired Pneumonia
VAP	Ventilator Acquired Pneumonia
DDIs	Drug Drug interaction
pDDIs	Potential Drug Drug interaction
CST	Culture Sensitivity Test
IBM	International Business Machines
NY	New York
USA	United State of America
SPSS	Statistical Package for the Social Sciences
ANIAS	Annapurna Neurological Institute and Allied Sciences
ABCD2	Age >60 years, Blood pressure > 140 Clinical feature diabetes.

Chapter I: Introduction

Introduction

1.1 Background

Stroke: is a neurological disorder and a second leading cause of mortality and mortality worldwide [1]. Strokes mainly consist of two types: hemorrhage and ischemia [2]. The clinical subtype of stroke that is the most common and leading cause of death in developing countries is ischemic stroke. [3]. Poor patient quality of life results from ischemic attack or minor stroke, which may also have long-term negative effects.[4]. Cerebrovascular accident (CVA) is also one of the leading socio-economic issues and causes high morbidity and mortality [5]. There are numerous stroke risk factors, such as hypertension, diabetes, migraines, excessive aging, etc. Women are more likely than males to experience a stroke [6].

Risk factors for stroke can be distributed into modifiable and non-modifiable risks. Modifiable risk factors include hypertension, smoking, diabetes mellitus, hyperlipidemia, heart failure, atrial fibrillation, alcohol consumption, positive family history, oral contraceptives, and polycythemia. Non-modifiable risk factors include age, gender (Males more than females), hereditary, and predisposition to vascular events such as myocardial infarction, stroke, or peripheral embolism [7]. In developed countries, about 85–90% of strokes are due to cerebral infarction, and 10–15% are due to intracranial hemorrhage. Hemorrhagic stroke is more prevalent in Asians [8]. Several studies have shown that patients with stroke are among those at high risk for the development of DRPs due to elderly age, co morbidities and poly pharmacy [9]. Therefore, identifying and resolving DRP's is an important priority for health care professionals for improving the therapeutic benefits and health related quality of life in stroke patients [10-11].

A Drug related problem (DRP): is defined as an any event or circumstance involving drug treatment that interferes or potentially interferes with the patient achieving an optimum outcome of medical care [12]. An actual DRP is an event that has already occurred in a patient, whereas a potential DRP is an event that is likely to develop if pharmacists do not make any appropriate interventions [13]. Drug therapy is getting more complex, thus making it more challenging for physicians to prescribe appropriate drug therapy. Accordingly, in clinical practice, a wide range of drug-related problems (DRPs) may arise they are common in hospitalized patients and can result in patient morbidity and mortality and increased costs [14-15]. Identifying, preventing, and resolving DRPs are an important issue in the pharmaceutical care process [16]. DRP, defined as an event or circumstance that actually or potentially interferes with desired health outcomes, can lead to ineffective pharmacotherapy and may cause drug-related morbidity and mortality [17].

Mainly stroke patients are administered many drugs like anti-platelet agents, statins, low molecular weight heparin, antihypertensives, insulin , oral hypoglycemic agents , also etc. and for treatment of post-stroke infections various antibiotics are prescribed, multiple antibiotics were administered to stroke patients to treat infections, such as ceftriaxone, levofloxacin, penicillin, moxifloxacin ,also for manage post stroke seizures various anti-seizures used such as phenytoin ,levetiracetam also hyperosmolar therapy for elevated intracranial pressure including mannitol, acetazolamide and finally other neuroprotective such as citicoline, cerebrolysin, piracetam.

1.2 Problem Statement

Stroke represents a major healthcare challenge in Yemen, where limited resources and fragile health infrastructure compound the difficulties in managing this life-threatening condition. Drug-related problems (DRPs) among hospitalized stroke patients present a critical but understudied issue in Yemen's healthcare context. Despite the known vulnerability of stroke patients to medication errors and adverse drug reactions, there remains a significant knowledge gap regarding the prevalence, nature, and contributing factors of DRPs in Yemeni stroke patients [18].

The situation in Yemen hospitals is particularly concerning due to several interrelated factors: High-risk patient population: Stroke patients frequently require multiple high-alert medications (e.g., anticoagulants, antihypertensives) and often have comorbidities, making them particularly susceptible to DRPs [19]. Systemic challenges: Yemen's healthcare system faces medication shortages, inconsistent drug supply chains, and limited clinical pharmacy services, all of which may contribute to DRPs [20]. Lack of local data: While international studies have documented DRP prevalence rates of 30-50% in stroke patients , no such comprehensive data exists for Yemeni patients, despite their unique socioeconomic and healthcare context [21]. Clinical consequences: Unidentified DRPs may lead to prolonged hospitalization, increased morbidity, and higher treatment costs - particularly burdensome in Yemen's resource-constrained setting [22]. Quality of care implications: Without understanding the specific DRPs and their risk factors, hospitals cannot develop targeted interventions to improve medication safety for stroke patients [23]. This prospective study aims to systematically identify and characterize DRPs among stroke patients in Sana'a hospitals, while examining associated patient-specific, medication-related, and system-level risk factors. The findings will provide essential evidence to guide clinical practice and policy decisions aimed at reducing medication-

related harm in Yemen's stroke patients.

1.3 Justification of Study

Stroke represents leading cause of mortality and disability in Yemen's fragile healthcare system, also Limited data exists on medication safety for stroke patients in conflict-affected settings, Growing burden of non-communicable diseases amidst ongoing humanitarian crisis. The complex nature of stroke management often involves polypharmacy, long-term hospitalization, and comorbid conditions, all of which increase the risk of drug-related problems (DRPs). DRPs are known to negatively affect clinical outcomes, increase healthcare costs, and prolong the duration of hospital stay. Despite the critical importance of pharmacological care in stroke management, there is a lack of published data on the prevalence, types, and risk factors of DRPs among stroke patients in Yemen. This gap limits the ability of healthcare professionals and policymakers to develop effective strategies to minimize medication-related risks and optimize therapeutic outcomes. The current study is the first in Yemen to assess DRPs in stroke patients. The current study aims to help fill the gap and identifying the most common drug-related problems and associated risk factors among stroke patients in Yemen. Understanding these issues is crucial for improving patient safety, enhancing the quality of pharmaceutical care, and supporting the implementation of clinical pharmacy services in Yemeni hospitals. Given the ongoing healthcare challenges in Yemen, including limited resources, shortage of trained clinical pharmacists, and inadequate medication monitoring systems, this research is both timely and necessary. The findings are expected to contribute to better medication management, informed decision-making, and the development of national guidelines for stroke care in Yemen.

1.4 Research questions

1. What is the prevalence and nature of drug-related problems (DRPs) among stroke patients hospitalized in selected hospitals in Sana'a City, Yemen?
2. What are the most common types of DRPs identified in this patient population?
3. Which patient-specific factors (age, gender, comorbidities, polypharmacy, etc.) are significantly associated with increased risk of DRPs?
4. Which medication-related factors (drug classes, dosing complexity, etc.) contribute most frequently to DRPs?
5. How do hospital/system factors (staffing patterns, medication availability, etc.) influence DRP occurrence?

6. What is the association between DRPs and clinical outcomes (length of stay, mortality, functional recovery)?

1.5 Research objectives

1.5.1 General objectives:

To identify and characterize drug-related problems (DRPs) and their associated risk factors among hospitalized stroke patients in Sana'a, Yemen, in accordance with evidence-based stroke management guidelines (AHA/ASA and Canadian Best Practice Recommendations for Stroke Care).

1.5.2 Specific objectives:

- To describe the demographic and clinical data of stroke patients admitted to selected hospitals.
- To identify the common types of drug-related problems (DRPs) encountered during the management of stroke patients.
- To assess the risk factors associated with the occurrence of DRPs, including polypharmacy, presence of comorbidities, patient age, length of hospital stay, and clinical outcomes.
- To determine the most frequently used medications associated with the occurrence of DRPs among hospitalized stroke patients.
- To evaluate the extent of patient adherence to prescribed medications throughout the hospitalization period.

Chapter II: literature review

Literature review

2.1 Stroke:

2.1.1 Stroke definitions:

The concept of "Stroke" Historically, was recognized as early as ancient Egypt and Greece, where physicians like Hippocrates (460-370 BCE) described sudden paralysis and loss of speech, calling it "apoplexy" (Greek: apoplexia, meaning "struck down violently")[24].

Stroke is currently defined as an acute neurological deficit caused by vascular injury to the central nervous system (CNS), which includes infarction (ischemic stroke), hemorrhage (intracerebral or subarachnoid), or venous thrombosis [25]. The definition now encompasses even short-duration symptoms when accompanied by neuroimaging evidence of injury [26].

Ischemic Stroke: it occurs due to obstruction of cerebral blood flow, commonly resulting from atherothrombosis, cardioembolic, or small vessel disease. It accounts for approximately 75-80% of all strokes globally, making it the most common subtype [26-27].

Transient Ischemic Attack (TIA): is defined as a brief episode of neurological dysfunction resulting from temporary cerebral ischemia without evidence of acute infarction on neuroimaging (CT or MRI) [28]. Traditionally, TIA was defined as symptoms lasting less than 24 hours, but modern imaging-based definitions now focus on absence of tissue injury [29]. TIAs are clinically important because they serve as a strong predictor of future stroke, with up to 15-20% of patients experiencing a full stroke within 90 days, especially within the first 48 hours [30].

Intracerebral Hemorrhage (ICH): is caused by rupture of small penetrating arteries, often due to hypertension, cerebral amyloid angiopathy, or anticoagulant therapy. It results in bleeding directly into the brain tissue and accounts for approximately 10-15% of strokes in high-income countries and up to 28% in low- and middle-income regions [31-32]. ICH is associated with a high mortality rate and significant long-term disability. Early management focuses on blood pressure control, reversal of anticoagulation, and neurosurgical intervention in select cases [32].

Subarachnoid Hemorrhage (SAH) involves bleeding into the subarachnoid space, most commonly due to ruptured cerebral aneurysms. Although it accounts for only 3-5% of all strokes, it carries a high early mortality (up to 40-50%) and long-term neurocognitive impairments among survivors [33]. Delayed complications such as vasospasm and delayed

cerebral ischemia occur in about 30% of cases and significantly affect outcomes. Timely aneurysm securing via clipping or coiling and management of complications are critical [33-34].

2.1.2 Global and Local Prevalence

In 2021, approximately 12.2 million incident strokes and 101 million prevalent cases were reported worldwide. Stroke is the second-leading cause of death globally, contributing to 6.6 million deaths annually [35]. In the Middle East and North Africa (MENA) region, stroke incidence has increased by 52% since 1990 [36]. In Yemen, limited data exist; however, recent hospital-based studies in Sana'a report ischemic stroke as the most common type, primarily affecting males over 60 years [37].

2.1.3 Etiology

Etiology depend on type of stroke:

- A.** Cardioembolic stroke caused by emboli originating from the heart, commonly due to: atrial fibrillation, left ventricular thrombus, rheumatic mitral valve disease, prosthetic heart valves, patent foramen ovale, often results in large cortical infarcts and sudden onset symptoms [38-39].
- B.** Non cardioembolic stroke includes small and large vessel disease: large artery atherosclerosis (e.g., carotid stenosis), small vessel occlusion (lacunar infarcts), arterial dissection, hypercoagulable states, vasculitis or inflammatory arteritis, tends to present with more localized or stepwise deficits [40-41].
 - Intracerebral Hemorrhage (ICH): include chronic hypertension, cerebral amyloid, angiopathy vascular malformations, coagulopathy or anticoagulant use [42]. Subarachnoid Hemorrhage (SAH): bleeding into the subarachnoid space, often due to: ruptured cerebral aneurysm, trauma [43].

2.1.4 Risk Factors

2.1.4.1 Non-modifiable risk factors

The primary non-modifiable risk factors for stroke include:

Age: Risk increases substantially after age 60 due to vascular changes and comorbidities [44].

Sex: Males are more affected in younger age groups; however, females over 80 have higher incidence due to longevity [44].

Genetics: Family history of stroke or inherited cardiac arrhythmias (e.g., atrial fibrillation) predispose individuals to higher stroke risk [45].

2.1.4.2 Modifiable risk factors

Hypertension: is the most common and significant modifiable risk factor. In a 2023 study conducted in Shabwah, Yemen, 71% of hospitalized stroke patients had hypertension. It was significantly associated with poor in-hospital outcomes and death ($p = 0.015$) [46].

Diabetes contributes to stroke via mechanisms including atherosclerosis and endothelial dysfunction. In the same Shabwah cohort, diabetes mellitus was an independent predictor of mortality among stroke patients (adjusted OR = 5.8; 95% CI: 1.79–18.85) [46].

Hyperlipidemia increases stroke risk by accelerating atherosclerosis. In Shabwah, dyslipidemia was commonly reported among stroke patients, although not always quantified [46].

Atrial Fibrillation (AF) is a key risk factor for ischemic stroke, particularly embolic stroke. It contributes to around 20–25% of ischemic strokes worldwide [47]. While underreported in Yemeni datasets, its prevalence is likely underestimated due to lack of routine ECG in emergency stroke evaluation [48].

Smoking and use of “shamma” are strongly linked to stroke in Yemen. A 2021 study from Dhamar reported high usage among cardioembolic stroke patients [49]. Tobacco toxins promote blood clotting and vascular inflammation [50].

Obesity and Physical Inactivity: Though less frequently reported in Yemeni hospital studies, global data shows that obesity contributes to stroke through hypertension, insulin resistance, and dyslipidemia. Physical inactivity further exacerbates these risks [51].

2.1.5 Pathophysiology

Ischemic stroke is the manifestation of neurologic deficit due to occlusion of a cerebral artery, causing reduction in cerebral blood flow and neuronal ischemia. The pathophysiologic mechanisms of ischemic arterial occlusions are most commonly due to artery-to-artery emboli, cardiac sources of emboli, or by vascular changes leading to occlusion of the cerebral artery itself. Cerebral blood flow is maintained at an average rate of 50 mL/100 g per minute over a wide range of blood pressure (mean arterial pressures of 50-150 mm Hg) by a process

called cerebral autoregulation. Cerebral blood vessels dilate and constrict in response to changes in blood pressure, but this process can be impaired by atherosclerosis, chronic hypertension, and acute injury, such as stroke. Decreased cerebral blood flow due to arterial occlusion can lead to infarction of cerebral tissue. Surrounding a core area of infarct is tissue that is ischemic but may maintain membrane integrity and is referred to as the ischemic penumbra [52]. This penumbra is the area of brain tissue that is potentially salvageable with urgent pharmacologic and endovascular interventions in acute ischemic stroke. Insufficient oxygen supply in ischemic tissue leads to adenosine triphosphate (ATP) depletion and anaerobic metabolism. This results in an accumulation of intracellular lactate, sodium, and water, which may cause cytotoxic edema and eventual cell lysis. There is also an influx of intracellular calcium leading to activation of lipases and proteases that degrade proteins and release free fatty acids from cellular membranes. Additionally, excitatory amino acids, such as glutamate and aspartate, are released in ischemic tissue that perpetuate neuronal damage and production of damaging prostaglandins, leukotrienes, and reactive oxygen species. These processes occur within 2 to 3 hours from the onset of ischemia and, ultimately, lead to cellular apoptosis and necrosis [52].

Hemorrhagic stroke causes neuronal damage by a variety of mechanisms and timelines. In patients with ICH, the hematoma causes primary injury and mechanical compression of the brain parenchyma itself. Early hematoma expansion, which may occur in up to 38% of patients within 3 hours of ICH onset, is associated with worsened functional outcome and increased mortality. The highest rates of mortality are associated with a low Glasgow Coma Score (GCS) on presentation (GCS 3-4), ICH volume greater than 30 cc (mL), intraventricular extension, brain stem location, and age greater than 80 [53]. Secondary mechanisms of injury in ICH patients are mediated by subsequent inflammatory response, cerebral edema, and damage from blood product degradation [54].

2.1.6 Management of stroke:

A. Management of ischemic stroke:

Elevated blood pressure in acute Phase (first 24–48 hours) is common and often permissively tolerated to maintain cerebral perfusion, unless excessively high. Routine rapid BP lowering is discouraged unless $\geq 220/110$ mmHg in non-thrombolysis candidates. Once thrombolysis or thrombectomy is planned: BP must be $\leq 185/110$ mmHg before treatment, and maintained $\leq 180/105$ mmHg for 24 hours post–reperfusion [55]. Preferred agents (based on consensus):

IV labetalol, nicardipine, or enalaprilat/urapidil for titratable rapid BP control [55]. Secondary Prevention after stabilization (typically 3–7 days post-stroke), initiate antihypertensive therapy aiming for a target BP <130/80 mmHg, especially in non-cardioembolic ischemic stroke patients [56].

- Antiplatelet therapy

The safety and benefit of aspirin in the treatment of patients with AIS were established by 2 large clinical trials administering doses between 160 and 300 mg [57-58]. This has recently been confirmed by a large Cochrane review of aspirin trials [59]. In patients unsafe or unable to swallow, rectal or nasogastric administration is appropriate. Limited data exist on the use of alternative antiplatelet agents in the treatment of AIS. However, in patients with a contraindication to aspirin, administering alternative antiplatelet agents may be reasonable. A retrospective analysis of consecutive ischemic stroke patients admitted to a single center in Seoul, South Korea, found no increased risk of hemorrhage with early initiation of antiplatelet or anticoagulant therapy (<24 hours) after IV alteplase or EVT compared with initiation >24 hours [60]. However, this study may have been subject to selection bias, and the timing of initiation of antiplatelet therapy or anticoagulation should be made on an individual level, balancing risk and benefit. The recommendation was modified from the previous guideline to remove the specific dosing recommendation “initial dose is 325 mg” because previous clinical trials supporting its use for AIS included doses of 160 to 300 mg.

Dual Antiplatelet Therapy (DAPT): minor stroke & high risk TIA guideline-based indications: Minor ischemic stroke: NIHSS ≤ 3, high-risk TIA: ABCD² score ≥ 4 Initiate DAPT (usually within 24 hours of symptom onset) with aspirin + clopidogrel for 21 days, then switch to monotherapy — Class I, Level A [61-56]. In select cases (e.g. NIHSS ≤5 or ABCD² ≥6 with ipsilateral large-artery stenosis), aspirin + ticagrelor for 30 days may be considered (Class IIb) [61]. Aspirin/clopidogrel typical regimen: aspirin ~75–100 mg daily + clopidogrel (loading dose 300 mg, then 75 mg daily) [62]. Ticagrelor dose: 90 mg twice daily + aspirin [61].

- Statin therapy

In patients with ischemic stroke who are very high risk (defined as stroke plus another major ASCVD or stroke plus multiple high-risk conditions), are taking maximally tolerated statin and ezetimibe therapy and still have an LDL-C >70 mg/dL, it is reasonable to treat with PCSK9 (proprotein convertase subtilisin/kexin type 9) inhibitor therapy to prevent ASCVD events [63-64]. In patients with ischemic stroke or TIA and atherosclerotic disease (intracranial, carotid,

aortic, or coronary), lipid-lowering therapy with a statin and also ezetimibe, if needed, to a goal LDL-C of <70 mg/dL is recommended to reduce the risk of major cardiovascular events.[65] In patients with ischemic stroke with no known coronary heart disease, no major cardiac sources of embolism, and LDL cholesterol (LDL-C) >100 mg/dL, atorvastatin 80 mg daily is indicated to reduce risk of stroke recurrence [66]. Two RCTs, SPARCL (Stroke Prevention by Aggressive Reduction in Cholesterol Levels) and TST (Treat Stroke to Target).[67] evaluated lipid-lowering therapy in patients after ischemic stroke. Both trials found significant benefit from cholesterol-lowering therapy in preventing vascular events, including stroke. SPARCL found that atorvastatin 80 mg daily reduced stroke recurrence in patients without another indication for statin therapy. TST confirmed that target LDL-C <70 mg/dL was superior to a target of 90 to 110 mg/dL for preventing major cardiovascular events. These 2 trials do not pertain to patients with cardioembolic stroke and no atherosclerotic disease [67]. These 2 stroke-specific trials are further supported by numerous RCTs of lipid-lowering drugs that indicate that high risk patients with ASCVD should receive high-intensity statin therapy and that if LDL-C remains ≥ 70 mg/dL (≥ 1.8 mmol/L) on maximally tolerated statin therapy, it may be reasonable to add ezetimibe and then a PCSK-9 inhibitor if necessary and if patients are deemed to be at very high risk [67] .

B. Management of Hemorrhagic stroke:

- Intracerebral hemorrhagic:

Spontaneous, nontraumatic ICH is a significant global cause of morbidity and mortality. Elevated highly prevalent in the setting of acute ICH and is linked to greater hematoma expansion, neurological worsening, and death and dependency after ICH [68] .In patients with spontaneous ICH of mild to moderate severity presenting with SBP between 150- and 220-mm Hg, acute lowering of SBP to a target of 140 mm Hg with the goal of maintaining in the range of 130 to 150 mm Hg is safe and may be reasonable for improving functional outcomes [69,70,71]. In patients with spontaneous ICH presenting with large or severe ICH or those requiring surgical decompression, the safety and efficacy of intensive BP lowering are not well established [72]. In patients with spontaneous ICH of mild to moderate severity presenting with SBP >150 mm Hg, acute lowering of SBP to <130 mm Hg is potentially harmful [73,74,75].

Mannitol is commonly used to manage elevated intracranial pressure (ICP) in patients with intracerebral hemorrhage (ICH). It acts as an osmotic diuretic, reducing brain edema by

drawing fluid from cerebral tissue into the intravascular space. In acute ICH, mannitol is typically administered intravenously in doses of 0.25–1.0 g/kg, often as 20% solution. Repeated doses may be used, depending on clinical response and monitoring of serum osmolality and renal function. However, routine use of mannitol is controversial due to limited evidence on improving long-term outcomes, and potential side effects including rebound cerebral edema, dehydration, and electrolyte disturbances. Recent clinical trials are evaluating the safety and feasibility of early mannitol use in ICH, particularly in patients at high risk of cerebral edema [76,77,78,79].

2.2 Drug-Related Problems (DRPs):

2.2.1 Concept of DRPs:

It's an events or circumstances involving drug therapy that actually or potentially interfere with desired health outcomes. DRPs can result in prolonged hospitalization, increased healthcare costs, and higher morbidity and mortality—especially among vulnerable populations such as the elderly or those with chronic conditions [80].

2.2.2 Types of DRPs:

According Cipolle et al. categorize DRPs into nine main types: Unnecessary drug therapy, needs additional drug therapy, wrong drug selection, ineffective drug, dosage too low, dosage too high, drug-drug interaction, adverse drug reaction, non-adherence. Each type has distinct clinical implications and may require different interventions by pharmacists and healthcare teams [81]. DRPs in hospitalized patients are particularly susceptible to DRPs due to polypharmacy, complex therapeutic regimens, comorbidities, and transitional care challenges. Studies conducted globally indicate that 15–50% of hospitalized patients experience at least one DRP during their stay [82]. DRPs frequently occur in internal medicine wards and intensive care units, where stroke patients are often managed [82].

2.2.3 Prevalence of DRPs:

The World Health Organization (WHO) published a comprehensive evidence synthesis in 2024 assessing the global burden of preventable medication-related problem in healthcare. Their key findings include:

A pooled analysis of 81 observational studies covering 285,687 patient records showed that approximately 3% of patients experience preventable medication-related harm during their care. Of these preventable problems, around 25% were classified as severe or potentially life-threatening. Medication-related harm is estimated to account for about 50% of all

preventable patient harm in healthcare settings globally, making it the single largest contributor to avoidable patient injury [83]. The WHO report highlighted that in England alone, there are an estimated 237 million medication errors annually, of which 66 million are potentially clinically significant. In the United States, medication-related harm affects approximately 1.3 million people each year, contributing to an estimated 7,000 to 9,000 deaths annually. The global economic burden of medication errors is estimated at United States of America \$42 billion per year in direct healthcare costs, not including additional indirect costs from lost productivity and extended hospital stays. The report emphasizes that these figures likely underestimate the true burden in low- and middle-income countries (LMICs) due to limited data and greater challenges in medication safety [83].

2.3 A review of studies involved DRPs among stroke patients

In 2024, a cross-sectional observational study was carried out at the Annapurna Neurological Institute & Allied Sciences (ANIAS) in Nepal to evaluate drug-related problems (DRPs) and their risk factors among stroke patients. A total of 111 patients aged 18 years and above who had been admitted for stroke during the study period were included, excluding those with transient ischemic attacks. The majority of strokes were ischemic (68.5%), predominantly affecting males (76.6%), with hypertension (61.3%) being the most prevalent comorbidity. The study revealed that (91.9%) of stroke patients experienced DRPs, with potential drug-drug interactions (pDDIs) being the most common type (91.09%). Most pDDIs were of the "monitor closely" severity category (73.2%), while only a small portion were classified as serious (6.29%) or contraindicated (0.52%). The most frequently prescribed medications included calcium channel blockers (29.7%) and ARBs (29.7%) for hypertension, and antiplatelet monotherapy (60.5%) for ischemic stroke patients. Polypharmacy, particularly the use of more than 10 medications, was significantly associated with higher severity pDDIs (OR = 6.9, p = 0.036). These findings underscore the critical need for active clinical pharmacist involvement in the management of stroke patients to mitigate DRPs and improve therapeutic outcomes [84].

A multicenter, prospective cross-sectional observational study was conducted from October 2021 to December 2022 in tertiary care hospitals in Karachi, Pakistan, to assess drug-related problems (DRPs) and clinical end outcomes among 250 hospitalized stroke patients. The study included various clinical subtypes such as ischemic stroke, hemorrhagic stroke, cerebrovascular accident (CVA), and transient ischemic attack (TIA), with patients admitted

to medical, neurology, ICU, and isolation wards. Informed consent was obtained from all participants. The study population consisted of 46% males and 54% females, including both adult (120) and geriatric (130) patients. Most hospital stays ranged from 1–10 days. Hospital-acquired infections (HAIs) were reported in 70% of cases, including stroke-associated pneumonia (SAP), community-acquired pneumonia (CAP), urinary tract infection (UTI), sepsis, and ventilator-associated pneumonia (VAP). Commonly used antibiotics were ceftriaxone (79%), piperacillin-tazobactam (52%), cefixime (48%), meropenem (42%), and vancomycin (39%). A high mortality rate was noted among patients infected with *Klebsiella pneumoniae* and *Staphylococcus aureus* (78%) and *Streptococcus pneumoniae* (61%). The study highlighted multiple contributing factors to poor clinical outcomes, including DRPs, drug–drug interactions (DDIs), comorbidities, HAIs, use of nephrotoxic medications, and antibiotic administration without culture sensitivity testing (CST). The findings underscored the need for pharmacist-led drug therapy reviews at the bedside to minimize DRPs and improve patient outcomes [85].

A prospective observational study conducted by Aravinda Swami in a neurological ward in India included 210 stroke patients and followed them over six months, from August 2018 to January 2019. The study identified a total of 163 DRPs, translating to a frequency of 0.8 DRPs per patient. The most frequently observed problem was drug-drug interactions, accounting for (42.2%) of the cases, followed by untreated conditions and issues related to patient compliance. This study highlights the significant burden of DRPs in hospitalized neurological patients, particularly in settings where comprehensive medication review systems may be lacking [86].

Delina Hasan et al. (2019) conducted a retrospective cross-sectional study at RS X Hospital, East Jakarta, to evaluate the prevalence of drug-related problems (DRPs) and their impact on clinical outcomes among 120 ischemic stroke patients admitted during 2018. The authors found a high incidence of DRPs, with the most frequent types being drug interactions (36.07%), indication without drug (29.51%), and drug without indication (9.29%). Other DRPs observed included inappropriate frequency or dose, duplication of therapy, and use of drugs not aligned with clinical guidelines. Despite the considerable number of DRPs, the study reported that the association between DRPs and poor clinical outcomes was not statistically significant. The study emphasized the complexity of managing ischemic stroke patients,

particularly those with comorbid conditions such as hypertension and hyperlipidemia, which increase the risk of polypharmacy and subsequent DRPs. The authors recommended strengthening collaboration between pharmacists, physicians, and other healthcare professionals to reduce DRPs and improve patient safety and therapeutic outcomes[87].

A prospective observational study was conducted by Celin A.T, Seuma J ,Ramesh in the general medicine and neurology wards of a 1,200-bed tertiary care teaching hospital in South India over a six-month period from November 2011 to April 2012 to assess drug-related problems (DRPs) among stroke patients. A total of 108 stroke patients were monitored, during which 80 DRPs were identified, with a frequency of 1.4 DRPs per patient. The most common DRPs reported were drug interactions (25%), drug use without indication (15%), and adverse drug reactions (15%). Polypharmacy was found to be a significant contributing factor, with 95% of DRPs observed in patients taking more than six medications. Ischemic stroke was more prevalent (86.1%) than hemorrhagic stroke (13.9%), and the majority of DRPs (77.5%) occurred in male patients. The most implicated drugs included enoxaparin, diclofenac, aspirin, and clopidogrel. All adverse drug reactions were classified as 'probable' in causality, mostly mild (83.3%) in severity, and none were preventable. Clinical pharmacists intervened in most cases, and their recommendations were accepted in 97% of DRPs. The study concluded that clinical pharmacists play a crucial role in identifying and managing DRPs in stroke patients, especially in elderly patients with multiple comorbidities and polypharmacy. This study further emphasizes the significant burden of drug-related problems among hospitalized stroke patients and the vital role of clinical pharmacists in minimizing these issues. The high frequency of DRPs—particularly drug interactions, drug use without indication, and adverse drug reactions—demonstrates the complexity of pharmacotherapy in stroke patients, especially those of advanced age and with multiple comorbidities. The study's structured identification, categorization, and management of DRPs, coupled with a high acceptance rate of pharmacist interventions (97%), reinforce the value of clinical pharmacy services in inpatient care. It also highlights the importance of routine medication review, prescriber education, and collaborative care models in improving patient outcomes. These findings support the need for implementing similar clinical pharmacy practices in resource-limited settings and strengthen the rationale for the present study in Sana'a to evaluate DRPs prospectively among stroke patients [88].

In other retrospective cross-sectional study conducted in a district hospital in Indonesia, researchers assessed the prevalence and types of drug-related problems (DRPs) among ischemic stroke inpatients aged ≥ 18 years. Medical records of 101 patients hospitalized between February and April 2019 were analyzed, revealing a total of 204 DRPs and 175 associated causes. The mean age was 57.85 ± 10.54 years, with males comprising 51.3% of the study population. Common comorbidities included hypertension (62.6%), dyslipidemia (45.2%), and diabetes mellitus (20.9%). The DRPs were categorized mainly under the domain of treatment effectiveness (65.2%), followed by adverse effects (32.8%) and medical expenses (1.96%). Most DRPs were associated with antihypertensive and antiplatelet agents. The primary causes included the need for a new indication for drug therapy (29.14%), drug interactions (27.43%), and inappropriate dosage regimens (13.71%). Notably, multivariate analysis indicated a significant association between polypharmacy and DRPs; patients taking more than eight medications were significantly more likely to experience multiple DRPs compared to those on fewer medications (OR 5.593; 95% CI 1.015–30.812; $p = 0.009$) [89].

Kanagala et al. (2016) conducted a prospective observational study over six months, from January to June 2014, to assess medication-related problems among stroke patients admitted to the general medicine ward of a tertiary care teaching hospital in Andhra Pradesh, India. A total of 133 patients aged over 18 years who met the inclusion criteria were enrolled. Patient data—including demographics, medical history, and medication records—were collected using a structured data form and assessed daily during hospital stay. Drug-related problems (DRPs) were evaluated using the Pharmaceutical Care Network Europe (PCNE) classification system version 6.2 and standard drug information resources such as Micromedex® and Lexicomp®. Among the 133 patients, 120 (90.2%) experienced at least one DRP, yielding a total of 254 DRPs and an average of 2.015 DRPs per patient. The most commonly identified problems were "wrong effect of drug treatment" (35.03%) and "suboptimal effect of drug treatment" (32.28%). The most frequent causes of DRPs were the need for prophylactic drugs (27.66%) and inappropriate drug combinations (16.6%). The highest incidence of DRPs was reported among patients aged 51–60 years and those taking 6–10 medications. The authors emphasized the clinical significance of these findings and advocated for integrating clinical pharmacists into hospital care teams to address and reduce

DRPs in stroke management settings [90].

Farrah Bilal conducted a prospective observational study in a neurology ward of a tertiary care hospital in Pakistan. The study aimed to identify the types, patterns, and clinical consequences of drug-related problems (DRPs) in stroke patients. Over a six-month period from April to November 2019, data were collected from 100 stroke patients using 100 prescriptions and case records. A total of 71 DRPs were identified, resulting in an average of 1.5 DRPs per patient. The most affected age group was 51–70 years (28.1%). The most frequent DRPs were drug-drug interactions (26.1%), followed by adverse drug reactions (14.0%) and drug use without indication (14.5%). Common adverse reactions included Amlodipine-induced constipation (23.3%) and Atorvastatin-induced myopathy (17.6%). Most ADRs (81.3%) were mild in severity. The acceptance rate of pharmacist interventions was high (98.2%), although only 71% resulted in changes to therapy. The study concluded that early identification of DRPs can improve therapeutic outcomes, and emphasized the importance of standard guidelines in reducing medication-related issues in stroke care [91].

Chapter III: Methodology

Methodology

3.1 Study Design

This study adopts a prospective observational design, which is appropriate for assessing the incidence and predictors of drug-related problems (DRPs) over time. In this design, a defined group of stroke patients is followed from the point of hospital admission until discharge to detect the occurrence and types of DRPs. This approach enables the establishment of a temporal relationship between potential risk factors (e.g., polypharmacy, comorbidities, prescriber behavior etc) and the development of DRPs during of study period .

3.2 Study Setting and duration

The research was conducted in three major tertiary care hospitals in Sana'a, Yemen: Al-Gumhori Teaching Hospital, Al-Thwara Modern General Hospital and Al-Kuwait Hospital. These hospitals were chosen due to their high patient turnover, comprehensive stroke care services, and inclusion of both general and specialized care units. Data will be collected from medical wards, neurological wards, and intensive care units (ICUs) where stroke patients are routinely admitted and treated. Study Duration was carried out over a 3-month period, (from 1 January to March 31, 2025).

3.3 Study Population

The target population includes adult patients (≥ 18 years) diagnosed with any type of stroke (ischemic, hemorrhagic, or TIA) and admitted to any one of the targeted hospitals during the study period.

3.4 Eligibility Criteria

3.4.1 Inclusion Criteria:

- Patients with a confirmed diagnosed with any type of stroke based on clinical and/or radiological findings.
- Patients admitted to the medical, neurological, or intensive care units of the selected hospitals.
- Patients hospitalized for at least 48 hours during the study period.
- Patients whose medical records were available and complete, regardless of their level of consciousness or ability to respond.

3.4.2 Exclusion Criteria:

- Patients younger than 18 years.

- Patients with incomplete or missing medical records.
- Patients not admitted to the medical, neurological, or ICU wards of the selected hospitals like (patients treated only in outpatient clinics).
- Patients admitted outside the study period before January or after March 2025.
- Pregnant women due to potential differences in drug therapy and risk factors.

3.5 Sample size

A whole sampling technique was employed, whereby all eligible stroke patients admitted during the study period were included until the target sample size of 100 was reached. This approach ensured comprehensive inclusion and minimized selection bias in this hospital-based prospective study.

3.6 Data Collection

Data were collected prospectively from the time of admission until discharge using the following sources: Patient medical records were reviewed to extract demographic data such as age, sex, marital status, and life habits (e.g., smoking, and physical activity), as well as clinical features of stroke such as unilateral body weakness, dysarthria, facial droop, visual disturbances, loss of consciousness, headache, dizziness, and other neurological deficits. Additional information included diagnoses, prescribed medications, laboratory results, and imaging. Medication details covered the name of the drug, dosage, route of administration, frequency, duration of therapy, and adherence (compliance). Patient interviews (when feasible) and, when necessary, interviews with patient attendants were conducted to obtain medication history, social history, family history, adherence, and patient-reported symptoms or side effects. Observation and assessment of medical staff adherence to standard treatment protocols were also performed.

3.7 Assessment of Drug-Related Problems

Drug-related problems was identified and classified using an established classification system Cipolle et al. model [81], which includes categories like:

- | | |
|---------------------------------|-------------------------|
| • Unnecessary drug therapy | • Dosage too high |
| • Needs additional drug therapy | • Drug-drug interaction |
| • Wrong drugs selection | • Adverse drug reaction |
| • Dosage too low | • Non-adherence |
| • Duration too low | |

Each case will be assessed by reviewing patient files and discussing findings with the care team when needed.

To ensure the accurate identification and assessment of drug-related problems (DRPs) in stroke patients, a variety of digital tools and clinical reference applications were utilized during the data collection process. Lexicomp Drug Interactions was used primarily to detect and evaluate potential drug-drug interactions. Additionally, Lexicomp also served as a reference for information related to certain neuroprotective medications, such as cerebrolysin and citicoline.

For accessing evidence-based clinical guidelines and recommendations, UpToDate, DynaMed, and DynaMedex were employed, particularly for guideline-directed stroke management, including those published by the American Heart Association/American Stroke Association (AHA/ ASA) and the Canadian Stroke Best Practice Recommendations. Furthermore, Micromedex was used for cross-checking drug doses, adverse effects, and specific pharmacological properties to ensure safe and appropriate use of medications.

These tools were accessed regularly throughout the data collection phase to support clinical judgment, ensure consistency with current best practices, and validate the classification of identified DRPs.

3.8 Statistical analysis

After data collection, the information recorded on the six-page structured data collection form was thoroughly reviewed, organized, and transferred into a digital format using Microsoft Excel 2019. The Excel spreadsheet was used for data cleaning, variable coding, and preliminary tabulation. After validation, the dataset was imported into IBM SPSS Statistics version 27.0 for Windows® (IBM Corp., Armonk, NY, USA) for comprehensive statistical analysis.

- **Descriptive statistics:** were used to summarize the characteristics of the study population. Categorical variables such as: gender, age group, hospital of admission, social history, family history medication history also used past medical history (e.g., hypertension, diabetes, heart failure, valvular heart disease, dyslipidemia, ischemic heart disease, previous stroke),stroke type (AIS, TIA, ICH, SAH), outcomes (fully recovered, partially improved, death), types of drug-related problems (DRPs), medications used (e.g.,

antiplatelets, anticoagulants, statins, antibiotics).

These variables were presented as frequencies and percentages.

- Continuous variables such as: number of medications received during hospitalization; duration of hospital stay. Continuous variables that were not normally distributed were categorized into discrete groups (e.g., length of stay: ≤ 5 days, 6–10 days, >10 days).
- Inferential statistics: the relationships between independent and dependent variables were evaluated using Chi-square (χ^2) tests, which are appropriate for categorical data. Specific associations tested included: stroke type and use of drug classes (e.g., antiplatelets, statins, anticoagulants), stroke type and frequency of drug-related problems (DRPs), number of medications and occurrence of DRPs, Stroke outcome and presence of complications and type of stroke. A p-value of < 0.05 was considered to indicate statistical significance.
- Data integrity and ethics: data were double-checked in Excel before importing into SPSS to ensure completeness and accuracy. All patient data were anonymized, and only relevant clinical and pharmacological variables were included in the analysis. The study followed ethical standards for data confidentiality and handling.

3.9 Ethical approval

The study was reviewed and approved by the ethical review board of the Emirates International University (EUI), Al-Gumhori Teaching Hospital, Al-Thawra Modern General Hospital, and Al-Kuwait Hospital in Sana'a, Yemen. Patient data confidentiality was taken after his personal consent or from one of his relative. Also safeguarded through the use of unique identification codes and storage in password-protected computers accessible only by the principal investigators.

Chapter IV: Results

4 Results

4.1 Patients' Characteristics

Out of one hundred total samples size, more than one half (58%) of cases were collected from Al-Gumhori hospital followed by Al-Thawra hospital (24%) during the total follow up duration period. On the other hand, only eighteen cases were found in Al-Kuwait hospital that's could be explained by the free medical care service supported with government for Al-Gumhori hospital.

See **figure 4.1**

The majority of cases were males (64%) and the larger groups of the total patients ages (44%, 39%) lie between either 50 to 65 years or more than 65 years respectively. Regarding social history, around 60% of patients were smoker & khat chewer and only 12% of total were using nonsmoking tobacco (shama). Other patient characters manifested in **table 4.1**

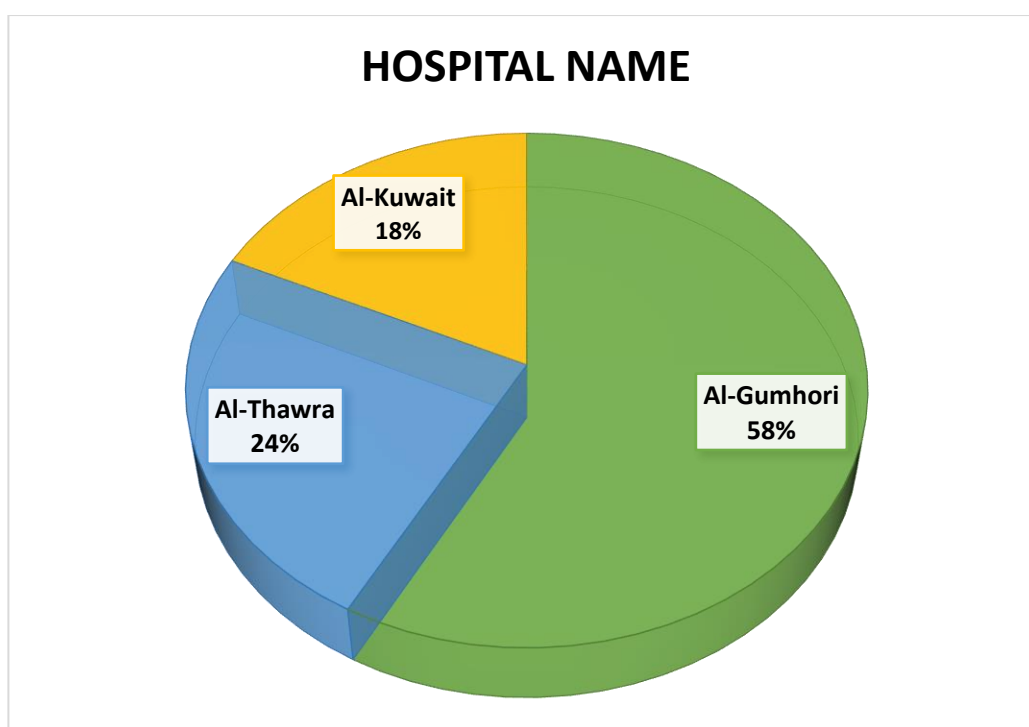


Figure 4.1: distribution of cases according to hospitals

Table 4.1: Distribution of Patients' characteristics

Patients' characteristics			
Variable		Frequency	Percentage%
Age (years)	< 50	17	17
	50 - 65	44	44
	> 65	39	39
	Total	100	100
Sex	Male	64	64
	Female	36	36
	Total	100	100
Family History	Relevant	9	9
	Irrelevant	91	91
	Total	100.	100
Smoker	No	62	62
	Yes	38	38
	Total	100	100
Khat chewer	No	40	40
	Yes	60	60
	Total	100	100
Shama user	No	88	88
	Yes	12	12
	Total	100	100
Poor income	No	45	45
	Yes	55	55
	Total	100	100

4.2 Past medical history of participants before admission

Table 4.2 shows patients' comorbidities before admission which consist of hypertension (83%), diabetes mellitus (39%), dyslipidemia (29%), heart failure (52%), valvular heart diseases (30%), prior stroke (31%), ischemic heart disease (25%) and 7% for each of atrial fibrillation and venous thrombosis.

Regarding past medication history, antihypertensive (49%) followed by antiplatelets (33%) were the commonly used drug classes among patients before their admission as it is shown in **figure 4.2**.

Table 4.2: Comorbidities distribution among patients

Chronic diseases	
Variable	Percentage%
Hypertension	83
Diabetes mellitus	39
Venous thromboembolism	7
Atrial Fibrillation	7
Heart failure	52
Previous stroke	31
Dyslipidemia	29
Valvular heart disease	30
Ischemic heart disease	25

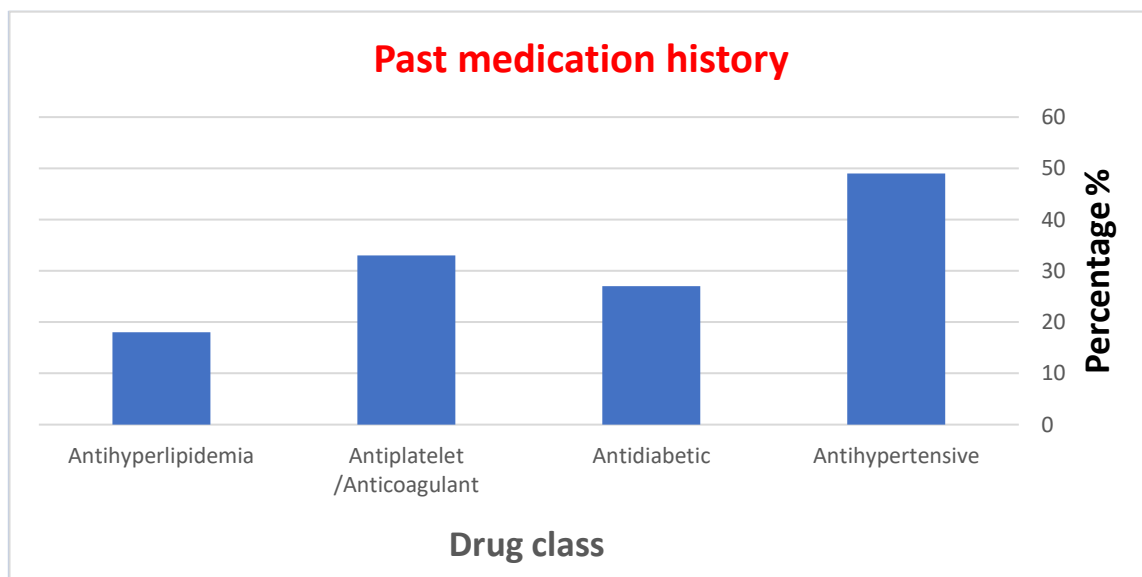


Figure 4.2: Percentages of commonly used drugs by patients before admission

Table 4.3: Current medical information related to the acute management phase of stroke

Variable		Frequency	Percent %
Blood pressure on admission (mmHg)	≤ 140/90	59	59
	141/91-160/100	27	27
	> 160/100	14	14
	Total	100	100
Variable		Frequency	Percent %
Random blood glucose (mg/dl)	≤140	52	52
	141-180	20	20
	> 180	28	28
	Total	100	100
Variable		Frequency	Percent %
Number of Medications received	1-10	43	43
	11-20	47	47
	> 20	10	10
	Total	100	100
Variable		Frequency	Percent %
Chief Complaints (CC)	Unilateral body weakness	92	92
	Loss of consciousness	44	44
	Headache	44	44
	Dizziness	35	35
	Dysphagia	34	34
	Blurred vision	35	35
	Dysarthria (aphasia) & Facial drooping	75	75
Variable		Frequency	Percent %
Length of hospital stay (in days)	-	-	-
	2-5	29	29
	6-10	42	42
	> 10	29	29
	Total	100	100

4.3 Current medical information on regarding the acute management phase of stroke

It is clear that from table 4.3, most of the enrolled patients were admitted with blood pressure of $\leq 140/90$ mmHg (59%) and ≤ 140 mg/dl random blood sugar (52%).

Considering the number of medications received during the acute treatment of stroke, (47%) of patients received from 11 to 12 drugs and less than 11 drugs were received by (43%) of patients. The most frequently stroke symptoms detected were unilateral weakness and dysarthria/facial drooping which noted among (92%) and (75%) of patients respectively. Forty two percent of patients were hospitalized for a period ranged from 6 to 10 days, while the other (58%) divided between either 2 to 5 days or more than 10 days.

Figure 4.3 shows the different stroke types diagnosed during the study period, where ischemic stroke represents the majority of patients' stroke types detected (AIS 69% & 12% TIA) and rest of patient were diagnosed with hemorrhagic stroke (19%) mainly intracerebral hemorrhage. Out of (19%) there was a single case (5%) of subarachnoid hemorrhage due to head trauma.

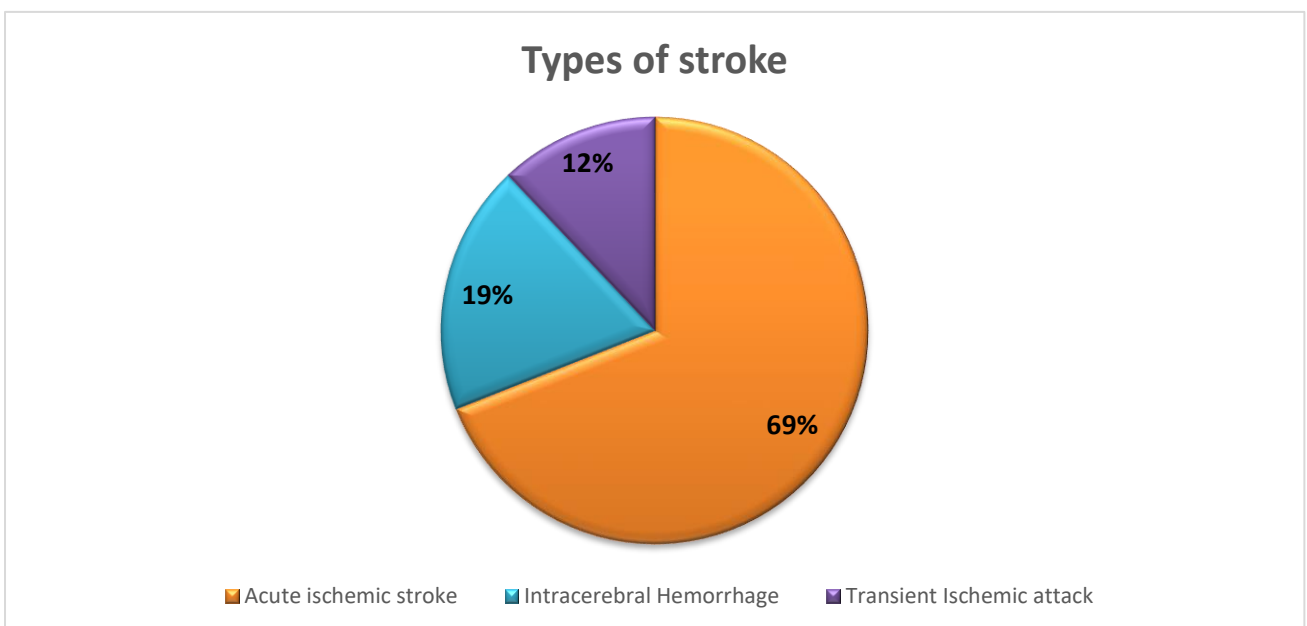


Figure 4.3 Types of strokes diagnosed among participants

4.4 Outcome of stroke management

Assessing patient's outcome at discharge found out that, major group of cases were partially improved (64%) and only fourteen patients were fully recovered. Out of total enrolled patients, death was occurred for (5%).

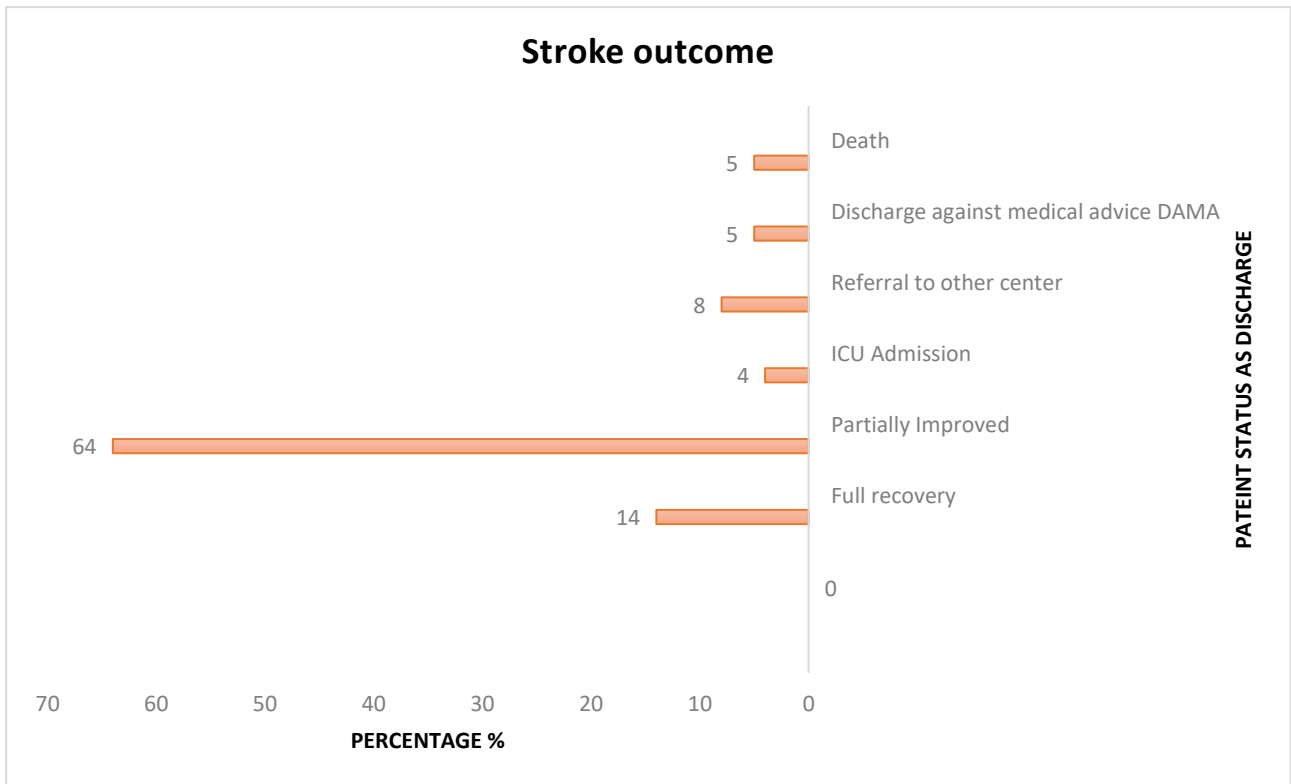


Figure 4.4: Outcome of patients at discharge

Based on the data presented on the **table 4.4**, different complications happened to patients either due to stroke like aspiration pneumonia, seizures or due to hospitalization and medications that were used for the patient such as infection, electrolyte imbalance, coagulopathy, anemia ...etc. aspiration pneumonia (48%) and electrolyte imbalance (49%) represent the highest frequency. The second most common group of conditions occurring to patients during the hospitalization were anemia (28%), urinary tract infection (22%), and acute kidney injury (20%). The last group if complications associated with stroke management were seizures (15%) bedsore (13%). Seizure may be related to electrolyte imbalances and bedsore can be explained by lack of infection control and low patient care and in part to the unilateral paralysis related to stroke.

Table 4.4: Concurrent conditions during hospitalization period

Associated complications	Percentage%
Seizure	15
Electrolyte imbalance	49
Urinary tract infection	22
Bedsore	13
Anemia	28
Aspiration pneumonia	48
Coagulopathy	14
Acute kidney injury	20

4.5 Medication used for the stroke management

Table 4.5 shows the common drug classes and specific drug agents that had been used in hospitals for the management of stroke. Aspirin either alone or in combination with clopidogrel was the commonly used antiplatelet drug in (75%) of total patients. Among anticoagulants, unfractionated heparin (19%) was the most commonly used drug in this class followed by enoxaparin (11%). Most of the enrolled patients had been used antihypertensive drugs either as a single agent or in combination; however, (28%) of patients did not receive any antihypertensive. Among those treated, ramipril was the most frequently used single agent (9%), followed by lisinopril (6%) and amlodipine (5%). Notably more than two-drug combinations were the most commonly employed regimen, accounting for (39%) of patients. Nearly more than three-quarters of patients had been used statins and one half of the total cases used atorvastatin 40mg (49%) followed by 20 mg of the same drug (23%). Neuroprotective such as citicoline was used by (24%) of patients and mannitol was noted to be used among (30%) of patients to lower intracerebral edema that's related to hemorrhagic stroke. Additionally, there was a place for diuretics, where furosemide was on the top (23%). Finally, Levetiracetam 500 mg orally (15%) and insulin (22%) use were detected for seizures and hyperglycemia respectively.

Table 4.5: Medications used in the treatment of strokes

Drug class	Specific drug	Dosage	Percent %
Antiplatelets	None	-	18
	Aspirin	75mg	37
	Clopidogrel	75mg	7
	Aspirin & Clopidogrel	75mg, 75mg	19
	Aspirin	100mg	19
	Total		100
Anticoagulants	Specific drug	Dosage	Percent %
	None	-	63
	Heparin SC	5000IU (BID /TID)	19
	Enoxaparin SC	40mg OD	11
	Warfarin	5mg	3
	Rivaroxaban	10mg	3
	Apixaban	2.5mg BID	1
	Total		100
Antihypertensives	Specific drug		Percent %
	Not used		28
	Amlodipine orally		5
	Ramipril orally		9
	Lisinopril orally		6
	Bisoprolol		2
	Other		4
	Losartan/HCTZ orally		7
	More than two combination		39
Total		100	
Diuretics	Specific drug		Percent %
	Not used		71
	Torseamide orally		2
	Furosemide IV		19
	Spiroinolactone orally		5
	Furosemide/Spiroinolactone		3
	Total		100
Statins	Specific drug/ Dosage		Percent %
	None		19
	Atorvastatin 10 mg orally		3
	Atorvastatin 20 mg orally		23
	Atorvastatin 40mg orally		49
	Rosuvastatin 20 mg orally		6
Total		100	
Antiseizures	Specific drug/ Dosage		Percent %
	None		78
	Phenytoin 100mg IV		3
	Levetiracetam 500 mg orally		15
	Levetiracetam orally/Phenytoin IV		4
Total		100	
	Specific drug/ Dosage		Percent %
	None		76

Neuroprotective	Citicoline orally	17
	Cerebrolysin IV infusion	2
	Citicoline orally & Cerebrolysin IV	5
	Total	100
Hypertonic agents	Specific drug/ Dosage	Percent %
	Not used	68
	Mannitol IV infusion	30
	Acetazolamide orally	2
	Total	100
Antidiabetic	Specific drug/ Dosage	Percent %
	None	65
	Regular insulin	9
	Mixed insulin	14
	dapagliflozin orally 10mg	9
	Empagliflozin orally 10mg	2
	Metformin Orally 500mg	1
	Total	100

4.6 Drug related problems

Indication drug related problems were the most commonly identified one. Need additional drug therapy (82%), un-necessary drug used (69%) were reported, nonadherence was reported among (50%) of patients. Regarding effectiveness, the most frequently DRP detected was too low dosage (77%) and wrong drug selection (20%). DRPs associated with safety were also there which include, duplication therapy (25%), adverse drug reactions (17%), dosage too high (9%) and drug interaction (5%).

Table 4.6: Common detected drug related problems among patient in the study

Drug related problem	Percentage%
Unnecessary drugs therapy	69
Duplication therapy	25
Needs additional drug therapy	82
Duration too low	12
Wrong drug selection	20
Dosage too low	77
Adverse drug reaction	17
Drug-drug interaction	5
Dosage too high	9

Antibiotics were the most frequently associated drugs with different types of drug related problems. As it is presented on **table 4.7**, ceftriaxone represented (19%) of unnecessary drugs used as antibiotic prophylaxis in the absence of clear evidence for its indication. Metronidazole was the second most commonly implicated drug (10%) for unnecessary drug therapy among study participants. These two points reflect the irrational use of an antibiotics and malpractice of our clinical staff. Surprisingly, the same drug class (antibiotics) was also involved as part of drug duplication therapy problem, but the difference here new agents were used. Using of ceftriaxone plus either cefepime or piperacillin/tazobactam was responsible for (5%) of this category of DRPs. Additionally, levofloxacin plus moxifloxacin use was reported among (9%) of total patients enrolled this study. Finally, there was some drugs contributed to nonadherence which include; atorvastatin (8%), aspirin (4%), citicoline (8%), insulin (3%) and heparin (8%).

Table 4.7: Common drugs associated with drug related problem

Common drugs related to DRPs		
	Drug/class	Percentage%
Unnecessary drugs therapy	Ceftriaxone	19
	Metronidazole	10
	Moxifloxacin	9
	Phenytoin	5
	Mannitol	6
Duplication therapy	Two beta lactam antibiotics	5
	Two fluoroquinolones antibiotics	5
	Amlodipine	4
	Two PPIs	3
	ACEIs with ARBs	3
	Two beta blockers	4
	UFH with enoxaparin	3
Need additional drug therapy	Dapagliflozin	29
	DAPT	16
	Anticoagulant as prophylaxis	14
	ACEIs	9
Too short duration	Citicoline	6
	Antiplatelet	6
Wrong drug selection	Aspirin	6
	Amlodipine	3
Adverse effects	Salbutamol induced hypokalemia	5
	Antibiotic associated diarrhea	7
	Anticoagulants -bleeding	4
Nonadherence	Atorvastatin	8
	Aspirin	4
	Citicoline	8
	Heparin	8
	Insulin	3

Table 4.8: Association between final diagnosis and the commonly used drugs for treatment

Variable	Type of stroke			Chi- square	P-Value
	Transient Ischemic attack	Intracerebral Hemorrhage	Ischemic stroke		
Medications used					
Antiplatelets				82.62	0.001
Aspirin	4	3	49		
Clopidogrel	1	0	6		
DAPT	7	0	12		
Not used	0	16	2		
Anticoagulants				9.88	0.825
Yes	1	5	31		
No	11	14	38		
Antihypertensives				40.17	0.17
Yes	7	17	47		
No	5	2	22		
Statins				65.1	<0.001
Yes	12	4	65		
No	0	15	4		
Mannitol infusion				8.3	0.2
Yes	2	10	20		
No	10	9	49		

Table 4.8 figure out the association between commonly drugs used in the management of different types of strokes, where it shows a strong statistically significant association between the stroke type in one part & each of statins (P value, **0.001**) and antiplatelet agents in the other side. In contrast, there was no association among the other medications used for stroke since P-value is greater than the alpha value (5%). Although antiplatelets are contraindicated in case of hemorrhagic stroke, their use was noted among (15%) of cases diagnosed with hemorrhagic strokes.

Table 4.9: Association between DRPs and number of medications

Variable	Number of medications				Chi-square	P- value
		1-10	11-20	>20		
Unnecessary drug therapy	No	18	13	0	8.12	0.06
	Yes	25	34	10		
Need additional drug	No	6	8	4	5.9	0.119
	Yes	37	39	6		
Duration too low	No	41	39	8	4.64	0.199
	Yes	2	8	2		
Wrong drug selection	No	38	36	6	4.84	0.184
	Yes	5	11	4		
Dosage too low	No	6	15	2	4.6	0.206
	Yes	37	32	8		
Adverse drug reaction	No	38	40	5	9.6	0.022
	Yes	5	7	5		
Drug-drug interaction	No	43	45	7	27.6	0.001
	Yes	0	2	3		
Dosage too low	No	6	15	2	4.577	0.206
	Yes	37	32	8		
Nonadherence	No	26	22	2	6.361	0.095
	Yes	17	25	8		

Table 4.9 shows the association between DRPs and number of medications used during the stroke management. Depending on the information presented on table above, there was a strong significant statistical association between the number of medications used & adverse drug reactions and drug interaction where p values are 0.022 and 0.001 respectively. On the other hand, there was no association among the other DRPs and number of medications received as P value told in the **table 4.9**.

Table 4.10: Association between patients' characters and type of strokes

Variable		Final diagnosis			Chi-square	P- value
		Ischemic stroke	Intracerebral Hemorrhage	Transient Ischemic attack		
Hospital Name	Al-Kuwait	13	3	2	3.739	0.750
	Al-Thawra	17	5	2		
	Al-Gumhori	39	11	8		
Age (years)	>65	29	6	4	2.698	0.712
	50-65	30	9	6		
	<50	10	4	3		
Gender	Females	25	8	3	1.751	0.626
	Males	44	11	9		
Hypertension	Yes	56	16	11	1.03	0.799
	No	13	3	1		
Diabetes mellitus	Yes	28	4	7	4.727	0.193
	No	41	15	5		
VTE	Yes	7	0	0	3.382	0.336
	No	62	19	12		
Dyslipidemia	Yes	20	3	6	4.3	0.23
	No	49	16	6		
Shama user	Yes	7	4	1	8.08	0.04
	No	62	15	11		
RBS on admission	>180	22	0	6	19.60	0.02
	141-180	12	7	1		
	120-140	12	4	0		
	<120	23	8	5		
Anemia	Yes	19	9	0	9.384	0.025
	No	50	10	12		
Aspiration pneumonia	Yes	36	12	0	13.38	0.003
	No	33	7	12		
Electrolyte imbalance	Yes	38	10	1	10.007	0.019
	No	31	9	11		

When examining the association between different types of strokes and the characteristics of patients, we found that, there a significant association between stroke types and random blood sugar on admission as **table 4.10** showed p value (0.02). similarly, there was an association between anemia as complication and hemorrhagic stroke at p value (0.025). Additionally, aspiration pneumonia and electrolyte disturbances were also significantly associated with different types of strokes where p values were (0.003) and (0.019) respectively. Finally the presented data on **table 4.10** revealed that there was no significant association among other patients demographic/ characters with types of strokes as p values was greater than 5%.

Chapter V: Discussion

5 Discussion

Stroke is the second leading cause of death and disability worldwide. Effective management of modifiable risk factors plays a crucial role in reducing stroke incidence. This study is the first multicenter, prospective study to identify DRPs specifically in stroke patients and associated factors in Yemen.

This study was conducted in three tertiary referral educational hospitals in Sana'a, Yemen and revealed a notably high burden of drug-related problems (DRPs) among hospitalized stroke patients. In the present study, the majority of stroke patients were in the age group of 50–65 years (44%) followed by those aged above 65 years (39%) consistent with the studies done in Nepal. (84) and India (86,88).

Unexpectedly 17% of patients affected were below 50 years. This finding may change our thought from considering a stroke as a disease of the older people mainly. At the same time these shocked results may indicate the presence of different risk factors that are not checked or taken seriously.

Males were commonly affected by strokes (64%) compared to females (36%), which may be attributed to a higher prevalence of risk factors such as hypertension, diabetes mellitus, smoking, and poor socioeconomic status in men. This is in accordance with other studies [89,88].

However, our findings differed with the study of Farrah Bilal, at Pakistan where females made up a higher proportion (57.7%) of stroke cases, and patients above 70 years formed a significant portion [91].

In our prospective study, ischemic stroke was the predominant type, accounting for 81% of cases, followed by hemorrhagic strokes (19%), mainly intracerebral hemorrhage with a single traumatic subarachnoid hemorrhage (1%). These findings aligned closely with other studies [86,84]. Our findings regarding stroke types were also inconsistent with Indonesian study [87].

Overall, our results were consistent with global and regional data showing ischemic strokes as the most frequent type, highlighting the need for effective prevention and timely intervention strategies and also reflect the need for strict control of hypertension and DM which are very prevalent.

In this current study, comorbidity was highly prevalent among stroke patients, with hypertension (83%) being the most dominant, followed by heart failure (52%), diabetes mellitus (39%), valvular heart disease (30%), prior stroke (31%), and dyslipidemia (29%). These findings reflect a complex cerebrovascular risk profiles in the Yemeni stroke population.

When compared to the study observed in Nepal [84]. The pattern is partly consistent—hypertension (68.5%), diabetes (39.3%), and dyslipidemia (34.8%) were also the most commonly reported comorbidities, confirming the global importance of these conditions in stroke pathophysiology. However, our study reported notably higher rates of heart failure (52%) and valvular heart disease (30%), which were not emphasized in the Nepalese studied [84]. Similarly, study observed in India reported hypertension in 65.2%, diabetes in 48.4%, and ischemic heart disease in 12.9% of patients [90], again supporting the central role of vascular risk factors in stroke.

The increased burden of heart failure and valvular heart disease in our study may be linked to the local prevalence of untreated or poorly managed hypertension, rheumatic heart disease, and the influence of unique cultural factors like khat chewing and shamma use, which are known to exacerbate cardiovascular stress.

In the present study, when we assessed the pharmacotherapy outcomes of stroke patients, the majority of patients (64%) were partially improved at discharge. Only 14% achieved full recovery, and 5% died during hospitalization. These outcomes suggest a moderate level of recovery among stroke patients, highlighting opportunities for improvement in clinical care, rehabilitation access, and early intervention strategies. Similarly, 55.7% of patients showed clinical improvement, while 7.1% had poor outcomes, and 5.7% died during the hospital stay [88]. These results are comparable to ours in terms of mortality, but they showed slightly better recovery outcomes. Comparatively, study conducted by (Manohar Babu et al, 2019) who reported that 46% of stroke patients were discharged with moderate improvement, while 30% experienced complete recovery, and 8% died during hospitalization [86]. This also indicates a relatively higher recovery rate and slightly higher mortality compared to our study.

In Pakistani tertiary care setting study, they found that over 50% of stroke patients had delayed recovery, and clinical outcomes were significantly impacted by DRPs and poor follow-up care [91]. This aligns with our study's findings, where full recovery was limited, suggesting systemic challenges in achieving optimal outcomes in similar resource-constrained settings.

In our prospective study, stroke patients experienced multiple concurrent conditions during hospitalization, with electrolyte imbalance (49%) and aspiration pneumonia (48%) being the most common. Other complications included anemia (28%), urinary tract infection (22%), acute kidney injury (20%), seizures (15%), and bedsores (13%). These complications arose from stroke pathology, prolonged immobility, infection risk, and adverse drug effects. When compared to previous studies, some complications were consistent, while others varied. For example, aspiration pneumonia, anemia, seizures, and UTIs were commonly reported in Indian study [90]. Electrolyte imbalance (49%): This was not reported or emphasized in earlier studies [84–91], suggesting either under-recognition in those settings or enhanced monitoring in our hospitals and in the other hand this finding may reflect malpractice. Justification for high rate of electrolyte imbalances in our population may reflect frequent use of diuretics, insulin, B2 agonist inhalers, poor nutritional status, or inadequate fluid and electrolyte management.

In the present study, aspirin alone or with clopidogrel were the most frequently used as antiplatelet (75%), that is consistent to findings from studies [88,90], where antiplatelets were also commonly prescribed. However, unlike the Indian study by Manohar Babu et al.[86], which reported higher use of enoxaparin, our study found unfractionated heparin (19%) more frequently used likely due to cost and local hospital practices. Antihypertensive use was high, with 30% of patients on combination therapy, reflecting the high prevalence of hypertension and comparable to Indian data. Statin use, particularly atorvastatin 40 mg (49%) was aligned with findings from south India [86], indicating good adherence to secondary prevention guidelines. Neuroprotective agents like citicoline (24%) and mannitol (30%) were also used, similar to usage in Indian studies, although the benefit of citicoline remains controversial. Supportive medications such as frusemide (23%), levetiracetam (15%), and insulin (22%) were prescribed for managing complications, consistent with other regional findings.

While the overall drug use pattern in Yemen is largely in line with those reported in India, differences in anticoagulants and neuroprotective preferences highlight variations in clinical protocols and resource availability between countries.

Our study identified indication-related DRPs as the most common type of DRPs, with 82% needing additional drug therapy and 69% receiving unnecessary drugs, which agrees with other studies in south India, Indonesia, also other India study [86,88,89,90]. However, compared to the Pakistani study [91], our rate of unnecessary medications was higher.

Nonadherence was observed among 50% of our patients, consistent with findings from Pakistan and Indonesia studies, though slightly higher than reports from India and Indonesia [91,87,86].

For effectiveness-related problems, our study reported 77% low dosage and 20% wrong drug selection, in agreement with Indian and Indonesian studies [86,87], though the percentage of low dosing was higher in our prospective.

Regarding safety related DRPs, we found duplication therapy (25%), ADRs (17%), and high dosage (9%), which is consistent to previous studies [84,90]. However, our rate of drug interactions (5%) was lower than that reported by Celin et al. [88].

In general, our findings align with most studies from India, Indonesia, Pakistan, and Nepal, especially in indication and effectiveness DRPs categories, but some differences in safety-related DRPs suggest variability in prescribing pattern, monitoring, and healthcare systems [90,89,91,84].

In this current study, antibiotics were the most frequently implicated drugs in DRPs, particularly due to unnecessary use and duplication. Ceftriaxone accounted for 19% of unnecessary prophylactic use, often without a clear indication, followed by metronidazole (10%). Similar concerns were highlighted in Indian study where antibiotics were commonly associated with inappropriate use, reflecting irrational prescribing patterns in stroke care [86]. Moreover, antibiotic duplication—such as the combined use of ceftriaxone with cefepime or piperacillin/tazobactam (5%), and levofloxacin with moxifloxacin (9%)—aligns with findings from other reports, which reported polypharmacy and therapeutic duplication as a significant DRP category in stroke units [88]. This underscores a lack of coordinated antimicrobial stewardship across institutions. Additionally, nonadherence involving atorvastatin (8%), citicoline (8%), heparin (8%), and aspirin (4%) was noted which is in agreement with other study which also reported nonadherence among stroke patients as a frequent issue, especially for chronic preventive therapies [90]. These findings indicate gaps in patient education and follow-up.

In our current study, a significant association was found between stroke type and the use of statins and antiplatelets ($P = 0.001$), with 15% of hemorrhagic stroke patients inappropriately receiving antiplatelets, despite their known contraindication. Similar trends were observed in a study conducted in Nepal [84]. Where atorvastatin was among the most prescribed drugs regardless of stroke type, and guideline deviation was reported in 9.4% of prescriptions, indicating irrational practices [84].

Likewise, Celin et al. and Retnosari et al. identified frequent DRPs related to antiplatelets, including inappropriate combinations and drug use without clear indication, particularly in settings of polypharmacy and comorbidities [88-89]. In Indonesia, dual antiplatelet therapy increased bleeding risk, especially when used without proper justification [89], supporting our concern about misuse in hemorrhagic strokes.

These findings reinforce the need for strict adherence to stroke-specific treatment guidelines and continuous pharmacological review to minimize harm from inappropriate medication use.

Our observational study revealed a significant association between the number of medications used during stroke management and the occurrence of adverse drug reactions ($p = 0.022$) and drug interactions ($p = 0.001$). This aligns with the findings of Indian study who reported that polypharmacy increased the likelihood of drug-related problems, particularly interactions and adverse events, among stroke inpatients [90]. In contrast, Celin et al. study did not find a statistically significant association between the number of prescribed medications and DRPs, suggesting that quality of prescribing may be as important as the quantity [88]. Regarding patient-related factors, our study showed a statistically significant association between stroke type and random blood sugar at admission ($p = 0.02$), as well as complications such as anemia ($p = 0.025$), aspiration pneumonia ($p = 0.003$), and electrolyte disturbances ($p = 0.019$). This is in agreement with other study who reported that comorbid conditions like uncontrolled diabetes and in-hospital complications significantly influenced stroke outcomes and complications [86].

5.1 Strengths:

This study is among the first prospective investigations in Yemen that systematically evaluated DRPs among stroke patients. It was conducted across multiple tertiary care hospitals, enhancing its representation.

Multicenter Approach: the inclusion of three major public hospitals in Sana'a Al-Gumhori, Al-

Thawra, and Al-Kuwait—improves the representativeness of the sample and enhances the generalizability of the findings within the local healthcare context.

Focus on Acute Stroke Care: by targeting the acute phase of stroke management, the study captured critical prescribing patterns and DRPs during the most vulnerable period, providing important insights into clinical practices.

Comprehensive DRP Classification: a wide range of DRPs were identified and categorized, including the need for additional drug therapy, unnecessary drug use, low dosage, and therapeutic duplication—reflecting a thorough analysis of pharmacotherapy issues.

Identification of a Service Gap: the study highlighted the absence of clinical pharmacy services in stroke units, emphasizing the urgent need for pharmacist-led interventions to optimize drug therapy and reduce medication-related harm.

5.2 Limitations:

Limited Sample Size: the sample of 100 patients, while valuable, may be insufficient to detect more nuanced relationships, particularly in subgroup analyses or multivariable models.

Short Study Duration: the study was conducted over a limited time frame, potentially missing seasonal variations or shifts in prescribing behavior over longer periods. Also, outcomes after hospital discharge were not assessed, limiting the ability to evaluate the long-term clinical impact of DRPs on patient morbidity, mortality, or hospital readmission rates. DRPs were identified without intervention, meaning the actual clinical impact or avoidability of each DRP was not validated in practice.

Chapter VI: Conclusions & Recommendations

Conclusions & Recommendations

6.1 Conclusions

Out of total 100 patients enrolled in this prospective observational study, 81% are diagnosed with ischemic stroke while the hemorrhagic stroke is contributed to the other 19% of cases. Majority of population attacked with strokes are males and most of the affected cases are above 50 years old.

Mortality rate of stroke is 5% and the case fatality rate is 2:3 for hemorrhagic versus ischemic stroke. Majority of dead patients (80%) are aged over than 65 years.

Family history is strongly related to females while males were more significantly associated with smoking and khat chewing.

Antiplatelets either alone or in combination as DAPT are observed among 82% of included patients in the current study.

The most commonly used drug class is statins (84%) whereas antihypertensive agents use is observed in 71% of total population.

The prevalence rate of drug related problems among participants is 37%. The most frequently detected DRP is indications without medications (82%) followed by too low dosage (77%) and medications without indications (69%).

The most frequently observed drugs contributed to whole DRPs are dapagliflozin, ceftriaxone antiplatelet agents, and anticoagulants.

The number of medications received is strongly associated with DRPs particularly with (adverse drug reaction and drug-drug interaction). Therefore, polypharmacy is a highly predictor factor for DRPs prevalence and severity.

6.2 Recommendations

Although the sample size is not large enough, it highlights the stroke and related factors as well as DRPs. However further studies in different centers with a larger sample size is required to confirm our findings.

Neurologists and neurosurgeon should treat each patient individually even if the diagnosis is similar among large group of patients.

Health care providers should continuously update their knowledge and practice regarding medications prescribing and associated DRPs by adhering to the international guidelines.

Clinical pharmacy department should be established in each hospital and clinical pharmacist should play an active role in minimizing the DRPs and reducing the physician work load.

All hospitalized patients should be evaluated more frequently and taking appropriate actions as required to avoid ADRs and to reduce the unnecessary medications.

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Appendices

Appendix A: Data Collection Sheets

Identification of Drug-Related Problems and Associated Risk Factors Among Stroke Patients Hospitalized in Selected Hospitals in Sana'a City, Yemen: A Prospective Study

Hospital Name: Al-Thawra Ward: Internal Medicine

No. of case () Room and bed No. () File NO. ()

Section 1: Demographic Information:

Pt code. /..... Age:

Gender: M / F Race :..... . Weight :.....Kg Other

Pt Attendant :..... Phone NO. +967.....

Section 2: Clinical information : NIHSS Score ABCD2 Score

1. Date of Admission:(...../...../.....) Date of discharge :(...../...../.....)
2. CC & First appearance of symptom time/ date
.....
.....
3. Past medical history.....
.....
.....
.....
4. Medication Hx:
.....
.....
.....
.....
.....
.....
5. Family history:.....
6. Social history: Khat Smoking Other.....
7. Provisional diagnosis:

8. Primary Symptoms : Headache Falling Vision abnormalities
One side body weakness Facial drooping Aphasia Dysphagia
• Lab investigation :

Head CT Scan(...../...../.....).....
.....
.....
.....
.....
.....
.....

MRI:(...../...../.....)
.....
.....
.....
.....
.....
.....

ECG:.....
ECHO:(...../...../.....).....
.....
.....
..... EF=.....%

Carotid color Coded & Doppler U/S :.....
.....
.....
.....
.....
.....
.....

Culture Yielded Type
.....
.....
.....
.....
.....

Other:.....
.....
.....

Section 4: Drug related problem : (Cipolle et al Classification)

1. Were there any Drug related problem ? (Yes / No).If yes what type ?

i. Unnecessary drug therapy.	()
ii. Needs Additional drug therapy.	()
iii. Ineffective drug.	()
iv. Dosage too low.	()
v. Adverse drug reaction.	()
vi. Dosage too high.	()
vii. Non-adherence(Non-compliance)	()
viii. Other (Miscellaneous Issues)	()

2. Suspected cause of DRPs: Physician
 Nurse administration
 Patient

Section 5: Other data :

- Length of hospital stay :.....
- Comorbidity: Disability Respiratory failure Cerebral edema
 seizures VTE Aspiration Pneumonia ARDS Infections
 (UTI , Sepsis) Bedsores Coagulopathy Anemia AKI
 Electrolyte imbalance other
- Patient discharge status: Fully recovered Partially recovered
 ICU Admission Referral to Other center death DAMA
- Discharge hospital medication :

Appendix B: letter of support for research and ethics approval

Republic of Yemen
 Emirates International University
 College of Medicine & Health Sciences

الجمهورية اليمنية
 الجامعة الإماراتية الدولية
 كلية الطب والعلوم الصحية

EMIRATES INTERNATIONAL UNIVERSITY

المحترم
 الاستاذ الدكتور / اكرم يحيى الحاج - مدير هيئة مستشفى الكويت
 تحية طيبة وبعد،

الموضوع / السماح لطلاب الصيدلة السريرية (Pharm-D) المستوى السادس بتجميع المادة العلمية لاستكمال بحث التخرج

تهديكم الجامعة الإماراتية الدولية اطيب تحياتها متمنية لكم دوام التوفيق والنجاح في اعمالكم.
 بالإشارة الى الموضوع اعلاه فأننا نرجو من سيادتكم التكرم بالتوجيه لمن يلزم بالسماح لطلاب المستوى السادس - الصيدلة السريرية (Pharm-D) - للدخول لمشفاكم حتى يتسنى للطلاب أخذ البيانات المطلوبة لخدمة بحث تخرجهم والذي سيحمل عنوان
Drug related problems in stroke patient admitted to certain sanaa hospital
 شاكرين تعاونكم سلفاً، مع فائق التقدير والاحترام،

عميد كلية الطب والعلوم الصحية
 د. ايمن صالح الظاهري

مرفق لكم أسماء الطلاب
 ابلغ عدد التبريرات
 للمانع من إجراء البحث
 ولله درامات
 ٢٢٠٥٠٠٠٠ / ٢٠١٨
 ٢٢٠٥٠٠٠٠ / ٢٠١٨

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2025/1/21م

المحترم الاستاذ الدكتور/ محمد جحاف - مدير هيئة مستشفى الجمهوري
تحية طيبة وبعد ..

الموضوع/ السماح لطلاب الصيدلة السريرية (Pharm-D) المستوى السادس بتجميع المادة العلمية لاستكمال بحث التخرج

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بالإشارة الى الموضوع اعلاه فأتنا نرجو من سيادتكم التكرم بالتوجيه لمن يلزم بالسماح لطلاب
المستوى السادس - الصيدلة السريرية (Pharm-D) - للدخول لمشفاكم حتى يتسنى للطلاب أخذ
البيانات المطلوبة لخدمة بحث تخرجهم والذي سيحمل عنوان

Drug related Problems in stroke patient admitted to certain Sanaa hospital

شاكرين تعاونكم سلفاً، مع فائق التقدير والاحترام،

لجنايب
البايج

عميد كلية الطب والعلوم الصحية
أ.د. صالح الظاهري



الديماج
لا ديفية طلاب
ماطيه

مرفق لكم أسماء الطلاب



2025/1/21م

المحترم الاستاذ الدكتور/ همدان باجري - مديرة مستشفى الثورة
تحية طيبة وبعد ،،

الموضوع/ السماح لطلاب الصيدلة السريرية (Pharm-D) المستوى السادس بتجميع المادة العلمية لاستكمال بحث التخرج

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بالإشارة الى الموضوع أعلاه فأتنا نرجو من سيادتكم التكرم بالتوجيه لمن يلزم بالسماح لطلاب
المستوى السادس - الصيدلة السريرية (Pharm-D) - للدخول لمشفاكم حتى يتسنى للطلاب أخذ
البيانات المطلوبة لخدمة بحث تخرجهم والذي سيحمل عنوان

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شاكرين تعاونكم سلفاً، مع فائق التقدير والاحترام،

عميد كلية الطب والعلوم الصحية
أ.د. صالح الظاهري



مرفق لكم أسماء الطلاب

E
Col

التاريخ: ٢٠ / /



الجمهورية اليمنية
وزارة الصحة العامة والسكان
هيئة المستشفى الجمهوري التعليمي بالأمانة
مكتب النائب للشئون الأكاديمية

الأخ / عبد الله السعيد المحترم

بعد التحية :-

قادم اليكم الأخ / الطالب / محمد (٤) كلو قندا

للتدريب داخل القسم للفترة من ١٩ / ٠٩ / ٢٠٢٥ إلى الفترة ١٩ / ٠٢ / ٢٠٢٥
والقادم من ع. السعيد

يرجى تمكينه وافادتنا عن تقييمكم له.
مدير مكتب النائب للشئون الأكاديمية

شكرنا
نائب رئيس الهيئة للشئون الأكاديمية

Drug related Problems in stroke patient admitted to certain Sanaa hospital

شاكرين تعاونكم سلفاً، مع فائق التقدير والاحترام،

إعناير

الباحث

عميد كلية الطب والعلوم الصحية

أ.د. صالح الظاهري



مرفق لكم أسماء الطلاب
لادوية صلاب
ماطيه

Republic of Yemen
Ministry of Education and Scientific
Research
Emirates International University



جمهورية اليمن
وزارة التربية والتعليم والبحث العلمي
الجامعة الإماراتية الدولية

كشف بأسماء الطلاب :

اسامه نجيب الحاج

بلال جعوان

عمران الويناتي

حافظ جبل

منير الاخرم

مجدي الاخرم

علي محسن الشرامي

زياب الطلي

نرمين الخليدي

امجد منصر

اصيل الضلاع

منسقة القسم

د/ نسيم عامر

المستخلص

المقدمة: السكتة الدماغية هي ثاني سبب رئيسي للوفاة والاعاقة على مستوى العالم، مع كون السكتة الدماغية الإقفارية هي النوع الأكثر شيوعاً في الدول النامية. غالباً ما يعاني مرضى السكتة الدماغية من مضاعفات طويلة الأمد تؤثر بشكل كبير على جودة حياتهم. تعتبر المشاكل المتعلقة بالأدوية من التحديات الكبرى في إدارة السكتة الدماغية بسبب الأمراض المصاحبة وتعقيد أنظمة العلاج. بالرغم من ارتفاع عبء السكتة الدماغية في اليمن، لا تتوفر بيانات حول المشاكل المتعلقة بالأدوية بين مرضى السكتة الدماغية في المستشفيات، خصوصاً في بيئات الموارد المحدودة مثل صنعاء، حيث تتفاقم تحديات الرعاية الصحية مثل نقص خدمات الصيدلة السريرية، مما يزيد من خطر الأحداث الدوائية الضارة. **الهدف:** تهدف هذه الدراسة إلى تقييم انتشار وأنواع وعوامل خطر المشاكل المتعلقة بالأدوية بين مرضى السكتة الدماغية في المستشفيات المختارة في صنعاء، اليمن، وتقييم تأثيرها على النتائج السريرية.

المنهجية: أجريت دراسة تقديمية عبر ثلاثة مستشفيات تعليمية كبرى في صنعاء باليمن (المستشفى الجمهوري، مستشفى الثورة، ومستشفى الكويت) خلال الفترة من يناير 2025 إلى مارس 2025. تم تسجيل 100 مريض بالغ مصاب بالسكتة الدماغية الإقفارية، النزفية، أو النوبة الإقفارية العابرة باستخدام تقنية المسح الشامل. جُمعت بيانات حول الخصائص الديموغرافية للمريض، التاريخ المرضي، الأدوية الموصوفة، والمشاكل المتعلقة بالأدوية من خلال مراجعة السجلات الطبية والمقابلات المباشرة. تم تحديد وتصنيف المشاكل المتعلقة بالأدوية باستخدام نظام عمل Cipolle وآخرون، مع التحقق باستخدام أدوات دعم القرار السريري (Lexicomp، Micromedex، Dynamedex). تم تحليل البيانات باستخدام برنامج IBM SPSS Statistics (الإصدار 27.0) ومايكروسوفت إكسل (2019).

النتائج: شملت الدراسة 100 مريض سكتة دماغية. كان الغالبية من الذكور 64 %، وتراوح عمرهم بين 50-65 عاماً 44 %، مع معدلات عالية من التدخين ومضغ القات 60 %. تم تسجيل معظم الحالات من مستشفى الجمهوري بنسبة 58 %. كانت الأمراض المصاحبة الأكثر شيوعاً هي ارتفاع ضغط الدم 83 %، فشل القلب 52 %، والسكري 39 %. شكّلت السكتة الدماغية الإقفارية 69 % من الحالات. خلال فترة الاستشفاء، تلقى 47 % من المرضى ما بين 11 إلى 20 دواءً. كانت المشاكل المتعلقة بالأدوية شائعة، حيث كان الحاجة إلى علاج إضافي 82 %، الجرعة المنخفضة 77 %، واستخدام أدوية غير الضرورية 69 % من بين الأكثر حدوثاً. أظهرت نتائج المرضى عند الخروج تحسناً جزئياً بنسبة 64 %، شفاءً كاملاً بنسبة 14 %، والوفاة بنسبة 5 % من الحالات.

الخلاصة: لا تزال إدارة السكتة الدماغية تحدياً حيوياً في نظام الرعاية الصحية في اليمن. تكشف هذه الدراسة عن وجود فجوات كبيرة في سلامة الأدوية، حيث تؤثر المشاكل المتعلقة بالأدوية على 37 % من مرضى السكتة الدماغية. تقدم هذه النتائج أدلة هامة لتوجيه إصلاحات الممارسة السريرية وصنع السياسات لتطوير رعاية السكتة الدماغية وسلامة العلاج الدوائي في بيئات الموارد المحدودة في اليمن.

الكلمات المفتاحية: المشاكل المتعلقة بالأدوية، العوامل المتعلقة بها، مرضى السكتة الدماغية، المرقدون في المستشفى، صنعاء، اليمن، دراسة تقديمية.



الجمهورية اليمنية
وزارة التربية والتعليم والبحث العلمي
الجامعة الإماراتية الدولية
كلية الطب والعلوم الصحية
قسم الصيدلة السريرية (فارم-د)

تحديد المشاكل المتعلقة بالدواء والعوامل المرتبطة بها بين مرضى السكتة الدماغية في المستشفيات المختارة في مدينة صنعاء، اليمن: دراسة تقديمية

بحث تخرج مقدم كمتتم جزئي للحصول على درجة البكالوريوس في الصيدلة السريرية

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محاضر في الصيدلة السريرية

أغسطس (2025) م