

## Estimated Burden and Risk Factors of Ischemic and Hemorrhagic Stroke in a Tertiary Hospital, Mogadishu-Somalia: A Cross-Sectional Study

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**Abstract** **Introduction:** In Somalia, a country in East Africa, no data is available about key features of stroke, such as incidence, prevalence, mortality, or stroke subtypes. The objective of this study is to show the burden of stroke, both ischemic and hemorrhagic stroke, and its risk factors in Somalia. **Materials and Methods:** We conducted a hospital-based retrospective study. Patients were recruited from January 1, 2019, to December 31, 2019, at the Mogadishu Somali Turkey Recep Tayyip Erdogan Training and Research Hospital. **Results:** A total of 292 participants with stroke (65.4% male and 34.6% women) were analyzed; the prevalence of ischemic and hemorrhagic strokes was 66.8% and 33.2%, respectively. A system for categorization of subtypes of ischemic stroke mainly base on etiology has been developed for the Trial of Org 10172 in Acute Stroke Treatment (TOAST). The most prevalent was a stroke of other determined etiology (28.7%), while the least common was lacunar stroke (11.3%), and cardio-embolic (13.3%). The most prevalent hemorrhagic stroke was in the basal ganglia. **Conclusions:** In Somalia, there is no previous data on the prevalence and risk factors of stroke. We concluded that the prevalence of hemorrhagic stroke in Somalia is higher compared to other countries in the region.

**Keywords** Cardio-embolic; Basal ganglia; Computed tomography; Lacunar; Thalamus

### Introduction

The prevalence of stroke remains a noteworthy concern in the global public health domain (1, 2). It is anticipated that the significance of this issue will escalate in the future due to persistent demographic changes, including the aging of the population and the health-related transformations observed in developing nations (3, 4). As per the definition provided by the World Health Organization (WHO), a stroke is characterized by the swift onset of clinical

indications of localized or widespread disruption of cerebral function that persists for a minimum of 24 hours or results in mortality. The aforementioned symptoms can arise due to either ischemic or hemorrhagic disruptions of cerebral blood flow (5). A cerebrovascular accident has the potential to result in mortality. Around 80% of all strokes in Caucasian populations are attributed to ischemic strokes, whereas approximately 20% of all strokes are caused by intracerebral and subarachnoid hemorrhage, known as hemorrhagic strokes (6). The Global Burden of Disease study conducted in 2013 revealed that cerebrovascular diseases were the second most prevalent cause of mortality, with ischemic heart disease ranking first (7, 8). According to the World Health Organization (WHO), stroke is responsible for the demise of 15 million individuals annually, with African nations contributing to 86% of all stroke fatalities (9, 10). Currently, there exists a dearth of information regarding crucial facets of stroke within the East African country of Somalia. The aforementioned factors encompass the frequency of occurrence, overall occurrence rate, and fatality rate, along with varying classifications of cerebrovascular accidents. Consequently, it was deemed imperative to conduct this investigation to determine the prevalence of stroke in our population and establish a foundation for future research.

### **Materials and Methods**

A retrospective analysis was performed on data pertaining to stroke patients who sought medical attention or were referred to the neurology department at Mogadishu, Somalia Turkiye Training and Research Hospital between January 2019 and December 2019. The type of stroke, whether hemorrhagic or ischemic, is ascertained through the utilization of CT or MRI. The study will encompass all stroke patients, both hemorrhagic and ischemic, who were admitted to the neurology department from January 2019 to December 2019. Exclusion criteria encompassed patients who presented at the outpatient department, emergency room patients who declined admission, and patients in the intensive care unit.

The study received ethical clearance from the Ethical Review Board of the Mogadishu-Somali-Turkey Recep Tayyip Erdogan Training and Research Hospital with the reference number MSTH/12/3792. The management of Referral Hospital granted us permission to access the patient's medical records, as evidenced by the presentation of a letter of permission. In order to

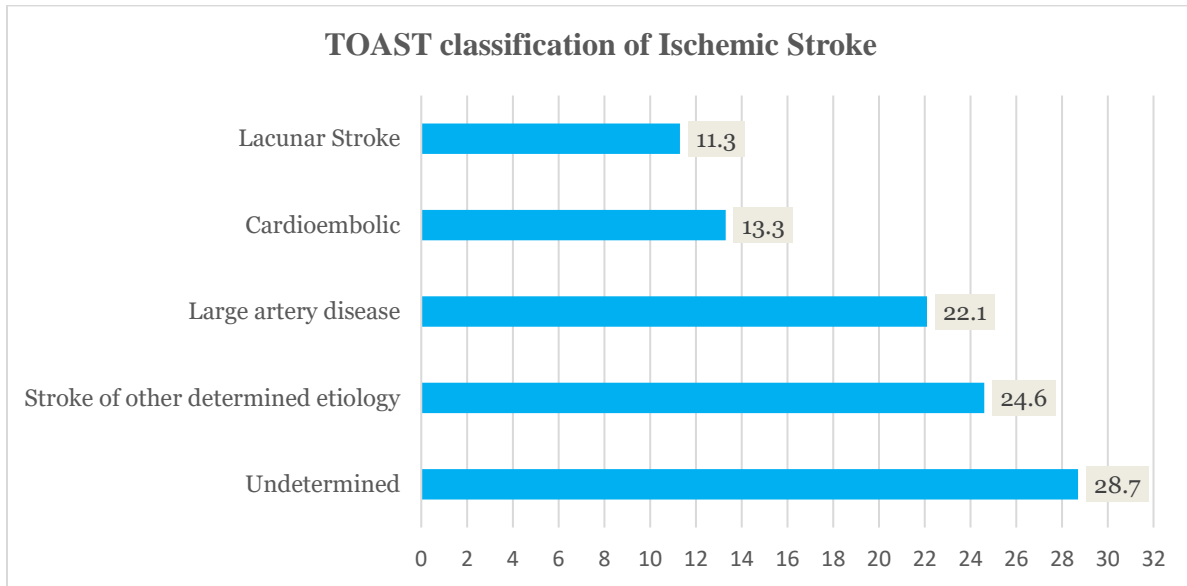
maintain the confidentiality of patient data, identifying information such as names and addresses was omitted from the data collection process. The study comprised 292 stroke patients who were admitted to the hospital between January 2019 and December 2019. The study conducted a review of the medical records of patients to examine their demographic characteristics, risk factors, and types of stroke. The statistical software package, SPSS version 20.0, was utilized for data entry and analysis. The patients' characteristics were summarized using descriptive statistics, specifically percent, and frequency.

### Results

A total of 292 participants (65.4 male and 34.6 female) were analyzed. The prevalence of ischemic and hemorrhagic strokes was 66.8% and 33.2%, respectively (Table 1).

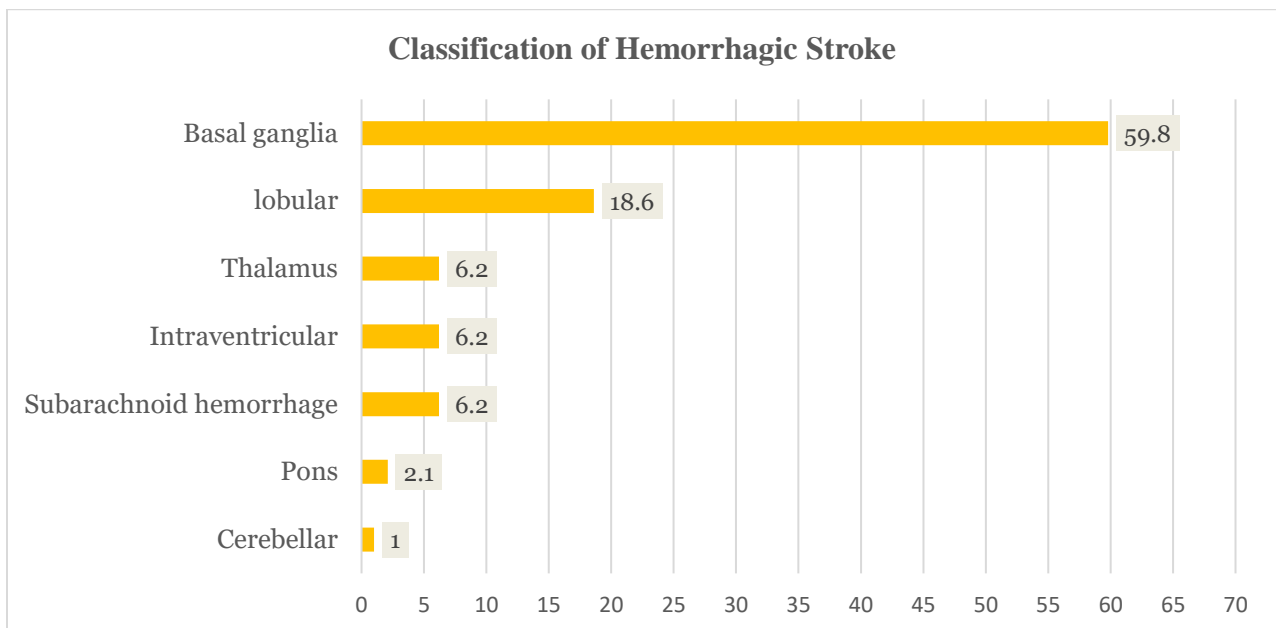
**Table 1.** The risk factors for the participants and distribution of their age and gender.

Variable	Ischemic Stroke	Hemorrhagic Stroke	$\chi^2$ ( <i>p</i> -value)
	N (%)	N (%)	
<b>Age</b>			
18-39 years	15 (45.5)	18 (54.5)	36.674 (0.001)
40-64 years	72(56.7)	55 (43.3)	
≥65 years	108 (81.8)	24 (18.2)	
<b>Sex</b>			
Male	116 (60.7)	75 (39.3)	9.104 (0.003)
Female	79 (78.2)	22 (21.8)	
<b>Hypertension</b>			
Yes	121 (61.4)	76 (38.6)	7.840 (0.005)
No	74 (77.9)	21 (22.1)	
<b>Diabetes mellitus</b>			
Yes	37 (80.4)	9 (19.6)	4.589 (0.032)
No	158 (64.2)	89 (35.8)	
<b>Previous Stroke</b>			
Yes	32 (80.0)	8 (20.0)	3.651 (0.056)
No	163 (64.7)	89 (35.3)	
<b>Total Cholesterol (mg/dl)</b>			
<200	68 (98.6)	1 (1.4)	0.381 (0.537)
>200	26 (100.0)	0 (0.0)	
KEY: AOR (Adjusted Odd Ration), CI (Confidence Interval=95%), P-value <0.05 is significant			



**Figure 1.** Classification of Ischemic Stroke

The data presented in Figure 1 Indicates that the ischemic strikes with the highest prevalence were those of other determined etiologies (28.7%), undetermined (24.6%), and large arterial disease (22.1%), and cardio-embolic (13.3%). Figure 2 illustrated that the basal ganglia (59.8%) and lobular stroke (18.6%) were the most frequently occurring hemorrhagic stroke, whereas cerebellar (1.0%) and pons 2.1%) were the least prevalent.



**Figure 2.** Classification of Hemorrhagic Stroke

Age group ( $X^2=36.674$ ,  $p\text{-value}=0.001$ ), Sex ( $X^2=9.104$ ,  $p\text{-value}=0.003$ ), History of diabetes ( $X^2=4.589$ ,  $p\text{-value}=0.032$ ), and History of hypertension ( $X^2=7.840$ ,  $p\text{-value}=0.005$ ) were found to be associated risk factors of stroke (Table 1).

The Trial of ORG 10172 in Acute Stroke Treatment (TOAST) has devised a system for the classification of subtypes of ischemic stroke primarily centered on etiology. The study found that the highest proportion of ischemic strokes was attributed to other determined etiologies (28,7%), followed by undetermined (24,6%) and large artery disease (22,1%). Conversely, the least frequent types of ischemic stroke were lunar stroke (11,3%) and cardio-embolic (13,3%). In contrast, the basal ganglia (59,8%) and lobular stroke (18,6%) were found to be the most frequently occurring hemorrhagic strokes, whereas the cerebellar (1,0%) and pons (2,1%) were identified as the least prevalent types.

## Discussion

Stroke is a non-communicable disease experiencing a notable rise in prevalence within sub-Saharan Africa, despite being frequently overlooked. This has been documented in various studies (11, 12). Currently, there is a dearth of recorded epidemiological data pertaining to stroke in Somalia, and correspondingly, there is a lack of information regarding its associated burden. The study's outcomes furnish a robust basis for forthcoming publications on stroke within the nation.

The prevalent type of stroke was identified as ischemic stroke, which constituted 66.2% of the total cases, whereas hemorrhagic stroke accounted for 33.2% of the total cases. The study was carried out on a cohort of 292 individuals who had suffered a stroke and were admitted to a tertiary medical facility located in Mogadishu, Somalia, over a period of one year. The data suggest that the prevalence of hemorrhagic stroke in Somalia surpasses that of other nations, with a rate of 33.2% compared to the global average of 20%. The prevalent risk factors for ischemic stroke were hypertension, which accounted for 61.4% of cases, and diabetes, which accounted for 80.4% of cases. On the other hand, high blood pressure was the most common risk factor for hemorrhagic stroke, accounting for 38.6% of cases, followed by diabetes mellitus, which accounted for 19.6% of cases. The study findings indicate that a medical history of diabetes and hypertension is significantly linked to factors that heighten the probability of

experiencing a stroke. According to the study, 10% of the participants exhibited total cholesterol levels exceeding 200 mg/dl. A prevalence rate of 13.6% was observed among the population with a history of stroke. Furthermore, the potential impact of smoking and khat consumption on arterial blood pressure, as indicated by previous research (9, 10), was examined. However, the available data was deemed inadequate for conclusive analysis. According to the Trial of Org 10172 in Acute Stroke Treatment (TOAST) (13, 14), the predominant form of ischemic stroke was determined to be of other etiology (28.7%), trailed by undetermined (24.6%) and large artery disease (22.1%). Conversely, the types of strokes that exhibited the lowest frequency were lunar stroke (11.3%) and cardioembolic stroke (13.3%).

Basal ganglia strokes were found to be the predominant form of hemorrhagic stroke, accounting for 59.8% of cases, while lobular strokes were the second most frequent type, comprising 18.6% of cases. The incidence of cerebellar and pons strokes was found to be relatively low, with rates of 1.0% and 2.1%, respectively, among cases of hemorrhagic strokes. This study exclusively utilized the Mogadishu-Somalia Turkey Training and Research Hospital as the sole tertiary healthcare facility. One of the study's limitations is that it pertains solely to the center that possesses the necessary resources to provide treatment for individuals who have experienced a stroke. Secondly, due to the absence of comprehensive healthcare coverage in the nation, certain patients lacked the necessary financial resources to meet the financial responsibilities linked to MRI or tomography procedures as well as hospitalization charges. The present article has been reported in accordance with the PROCESS criteria (14). The medical records of certain patients lacked crucial particulars, such as their cigar-smoking or khat-chewing habits. The country of Somalia lacks pre-existing data on critical facets of stroke, such as its incidence, prevalence, mortality rates, and stroke subtypes. Consequently, we refrained from comparing the prevalence outcomes and the results of prior local studies. This research endeavor will serve as the sole source of information regarding the frequency of strokes and the corresponding risk factors in Somalia.

## **Conclusion**

Stroke is a significant contributor to the incidence of disability. The prevalence and risk factors of stroke in Somalia have not been previously documented. The findings of our study indicate that the incidence of hemorrhagic stroke in Somalia is comparatively greater than that of other

nations, with a global prevalence ranging from 20% to 33.2% in Somalia. The preeminent risk factors for ischemic stroke were identified as hypertension, accounting for 61.4% of cases, and diabetes, accounting for 80.4% of cases. In contrast, for hemorrhagic stroke, the primary risk factors were hypertension, accounting for 38.6% of cases, and diabetes mellitus, accounting for 19.6% of cases.

### **Conflict of interest**

The authors declare no conflict of interest.

### **Ethical approval**

Ethical clearance was obtained from the Ethical Review Board of Mogadishu-Somalia Turkey Training and Research Hospital with the reference number of MSTH/12/3792.

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