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ORIGINAL RESEARCH

Etiology, Risk Factors and Outcome of Spontaneous Intracerebral Hemorrhage in Young Adults Admitted to Tertiary Care Hospital in Mogadishu, Somalia

Mohamed Sheikh Hassan[1,2], Ahmet Bakir[1], Nor Osman Sidow[1], Umut Erkok[3], Said Abdirahman Ahmed[4], Maryan Dahir Abshir[5], Ayhan Ayhan Köksal[6]

[1]Department of Neurology, Mogadishu Somalia Turkish Training and Research Hospital, Mogadishu, Somalia; [2]Faculty of Medicine and Surgery, Mogadishu University, Mogadishu, Somalia; [3]Department of Gynecology and Obstetrics, Mogadishu Somalia Turkish Training and Research Hospital, Mogadishu, Somalia; [4]Department of Cardiology, Mogadishu Somalia Turkish Training and Research Hospital, Mogadishu, Somalia; [5]Department of Medical Laboratory, Mogadishu Somalia Turkish Training and Research Hospital, Mogadishu, Somalia; [6]University of Health Sciences, Istanbul Başakşehir Cam and Sakura City Hospital, Istanbul, Turkiye

Correspondence: Mohamed Sheikh Hassan, Mogadishu Somalia Turkish Training and Research Hospital, Mogadishu, Somalia, Email dr.m.qalaf@gmail.com

Introduction: Spontaneous Intracerebral hemorrhage (ICH) in young patients is less common and not well studied compared to ICH in older patients. The etiology, risk factors and outcome of ICH in young patients may have regional and ethnic differences. The study aims to investigate the clinical characteristics, risk factors, etiology and outcome of spontaneous intracerebral hemorrhage in young adults in Somalia.

Methods: The study enrolled 168 young patients with ICH (16–50 years) admitted to the neurology department of a tertiary hospital from 2019 to 2022. The information about the demographic details, documented ICH risk factors, etiology and patients' clinical status were retrieved. The etiology of ICH was determined based on clinical, laboratory and radiological findings. Intra-hospital survival status and associated factors were assessed.

Results: The mean age of the patients was 35±8.6 years. 99 (59%) of patients were male while 69 (41%) were females. Hypertension 48 (29%) was the most common risk factor, followed by substance abuse. Hypertensive hemorrhage was the most common etiology of ICH 60 (35.7%), followed by cerebral venous thrombosis (CVT) 5(15%), substance abuse 23 (13.7%) and arteriovenous malformation (AVM) in 10 (6%). AVM, CVT, cavernoma, eclampsia, substance abuse and cryptogenic etiology were more common in the 2nd and 3rd decades whereas hypertension was more common in the 4th and 5th decade. Intrahospital mortality was 28% in this study. Factors predicting intrahospital mortality were hematoma volume of greater than 30mL, thrombolytic etiology, brainstem ICH location, substance abuse related etiology, presence of associated mass effect, low GCS score on admission, high systolic blood pressure on admission, and the presence of chronic renal failure.

Conclusion: In this study, hypertension, substance abuse, CVT and vascular malformation are the leading causes of ICH in young adults. Intracerebral hemorrhage in the young has different spectrum of etiologies and factors associated with short-term mortality compared to older patients.

Keywords: intracerebral hemorrhages, young patients, etiology, outcome

Introduction

Spontaneous intracerebral hemorrhage represents approximately 10–15–% of all stroke types. ICH has a poorer outcome than ischemic stroke, with a high case-fatality rate of about 40% and a significant rate of disability. The incidence of ICH among young patients varies from 0.7% to 40% in different studies.[1–3] ICH in young adults was not studied as much as ICH in older patients. The data on the clinical profile and outcome of ICH in young adults is limited.[4,5]

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The causes of spontaneous intracerebral hemorrhages are divided into primary and secondary causes. The primary cause of ICH is the spontaneous rupture of hypertension-related damaged intracranial small arteries and amyloid angiopathy. Secondary ICH is related to underlying coagulopathies, vasculitis, iatrogenic, Substance abuse, malignancies, and vascular abnormalities. Although secondary factors are a significant factor in the pathogenesis of ICH in younger patients, most spontaneous ICH causes are primary.[6–8]

The incidence of ICH is higher in developing countries compared to developed countries. This is possibly caused by variations in diet, social standards, and genetics, as well as differences in the prevalence of stroke risk factors.[9,10] Hypertension, smoking, and substance abuse have been reported as the most frequent risk factors in young patients with ICH. However, the cause of ICH in young patients may vary depending on the region and ethnic group, which could affect the mortality and functional outcome.[11,12] Data on the clinical profile, underlying etiologies, and outcome of ICH in the young will help determine the diagnostic work-up, management, and prognostication of this particular age group. Our study aimed to evaluate the clinical characteristics, etiology, risk factors, and outcome of spontaneous intracerebral hemorrhage and factors associated with intrahospital mortality in young adults admitted to a tertiary hospital in Mogadishu, Somalia.

Methods and Materials

This retrospective observational study was conducted in the neurology department of Mogadishu-Somalia Turkish Training and Research Hospital (Somalia's largest tertiary hospital). We used convenient sampling to retrieve data from patients admitted to neurology department. Since we worked with the available data, our sample size was determined by the number of subjects or cases that meet our inclusion criteria. This study focused on assessing clinical characteristics, risk factors, underlying etiologies, locations and outcomes of spontaneous intracerebral hemorrhage in young adults admitted to the hospital. We retrieved the data from the electronic records of patients admitted to the neurology ward due to spontaneous intracerebral hemorrhage. The study included young adults with ICH (16–50 years) from June 2019 to June 2022. We have chosen this time frame based on the availability of the data of interest. There was limitation regarding access of the required patient information before 2019. We selected 18–50 years as a cut-off point for defining young adults. Majority of previous published studies about young adults with intracerebral hemorrhages had a sample population between 8–296 cases with an arbitrary age range of 15 to 45 years old. Therefore, this age range appeared reasonable as people with less 50 years of age cannot be considered older.

Patient Selection

The patients with CT or MRI evidence of first acute intracerebral hemorrhage between the ages of 16 and 50 years admitted to the neurology department of the hospital, from June 2019 to June 2022, were retrospectively analyzed. Patients with intracranial hemorrhage secondary to head trauma, tumor bleeding, aneurysmal rupture, and patients with cranial extra-axial hemorrhage were excluded from the study. The patients' medical records were retrieved from the hospital FONET system. A total of 188 young patients with intracerebral hemorrhage were admitted to the neurology department during this time interval. Fourteen of them were excluded due to incomplete data records, and six others were excluded due to the presence of subarachnoid hemorrhage. Patients with a hemorrhagic transformation from a cerebral infarction were not considered and therefore were not eligible.

Data Retrieval

A retrospective review was performed, including patient medical records, imaging, and laboratory investigations. Brain CT scans were performed in all patients as an initial diagnostic test. MRI, CTA, and MRA were performed for patients whose underlying etiologies required more investigation; this was decided case by case.

For each patient, the following risk factors were analyzed: hypertension, diabetes mellitus, smoking, coagulation disorder, known liver or renal disease, family history of intracerebral hemorrhage, and substance abuse (including Khat chewing—which is more prevalent in the country).

The etiological determination was based on patients records and doctor notes, imaging evidence, and laboratory findings. Evaluated laboratory investigations include: complete blood count, ESR, INR, prothrombin time, activated

partial thromboplastin time, blood glucose, serum urea/creatinine, electrolytes, bilirubin, and liver enzymes. The CT scan or MRI findings were analyzed, including location, size of the hematoma, associated mass effect, and presence of intraventricular extension. The Mass effect of the hematoma was defined by midline deviation and ventricular compression. The hematoma volume was calculated using the formula "AxBxC/2" and classified as small (<20 mL), medium (20–30 mL), and large (>30 mL).

The location of hematoma was categorized into the caudate, putaminal, internal capsule, thalamic, lobar, brainstem, cerebellar, or multiple. The underlying causes of hematoma were divided into hypertensive, vascular malformation, cerebral venous sinus thrombosis (CVST), substance abuse, coagulopathy, vasculitis, end stage renal failure (glomerular filtration rate (GFR) of 15 milliliters per minute or less) and cryptogenic. Hypertension etiology was considered after excluding other possible causes. In the meantime, hypertension was defined as history of arterial hypertension, previous antihypertensive treatment, elevated blood pressure levels on admission, characteristic hypertensive location of ICH (deep or brainstem), elevated blood pressure levels during hospitalization and other cardiological findings. Patients with high systolic blood pressure was defined as individuals with stage 3 hypertension, which is characterized by a blood pressure reading of 180 mmHg or higher. If there was no risk factor, predisposing disorder, or structural or vascular abnormalities on neuroimaging for ICH, the diagnosis of cryptogenic ICH was made. The patients were treated conservatively as per ICH management guidelines. Outcome was measured by way of Intrahospital survival status (Intrahospital mortality) and factors associated with Intrahospital mortality were assessed.

Statistical Analysis

Data was analyzed via the SPSS program (version 26; SPSS Inc., Chicago, IL, USA). Descriptive statistics, frequencies, and percentages were calculated for variables such as demographic data, comorbidities, risk factors, admission status, and clinical characteristics of patients. To assess the univariate relationship between variables of interest, the Persons' chi-square test was used. Binary logistic regression analysis was applied to variables that were statistically significant ($p < 0.05$) in univariate analysis. Odd ratios and 95% confidence intervals were calculated for potential predictors of Intrahospital mortality.

Ethical Consideration

The research was carried out in accordance with the Helsinki Declaration's fundamental principles. Due to the fact that our hospital is a research hospital a general informed consent is obtained from every patient admitted to obtain their data for retrospective research purposes from the hospital medical records, and this study did not disclose any personal information. This study was reviewed and approved by the ethics committee of Mogadishu Somalia Turkish Training and Research Hospital (Ethics Protocol No: MSTH/10260).

Findings

One hundred sixty-eight young patients with spontaneous ICH admitted to the neurology department of the hospital from June 2019 to June 2022) were retrospectively analyzed. The mean age was 35 ± 8.6 years, and there were 69 (41%) females and 99(59%) males in this study.

Comorbidities/Risk Factors

Hypertension was the most common comorbidity, affecting 51 patients (29.7%). The majority of these patients were not regularly using their medications. Hypertension was more common in the 4th and 5th decades of life, with 45 patients (93%) falling within this age range, and was also more prevalent among male patients. Out of 48 hypertensive patients, 16 did not know they had hypertension. Four patients (2.4%) had diabetes mellitus, 8 (4.8%) had chronic renal failure, 9 (5.4%) had eclampsia. Among other comorbidities/risk factors, 8 patients (4.8%) had concomitant heart disease, 7 (4.1%) were on anticoagulants (3 on non–vitamin K antagonist oral anticoagulants (NOACs) for atrial fibrillation and 4 on warfarin for prosthetic mechanical valve), 33 (20%) were regular Khat chewers, 29 (17%) were regular smokers, 12 (7%) were regular tobacco chewers, 6 patients (3.5%) were using cannabis regularly, while 30 (18%) had a family history of

hemorrhagic stroke. Substance abuse was more prevalent in male patients than female patients (26% vs 4.7%), (P = 0.001), whereas anticoagulation, diabetes mellitus, and renal failure were evenly distributed among patients.

Clinical Characteristics of the Patients

The main presenting feature among the patients on admission was conscious impairment 70 (42%) followed by hemiplegia 60 (36%), headache 23 (14%), seizure 10 (6%), and speech impairment 5(3%) (See Table 1). On the other hand, clinical findings depend more on the location and volume of the hematoma than the etiology. The mean systolic and diastolic blood pressure at the emergency presentations were 165/95mmHg. Conscious impairment was more prevalent among hypertensive patients, patients with anticoagulation ICHs, and patients with substance-induced ICHs. The majority of the patients 116 (69%) were admitted to the neurology ward, while 52 (31%) were admitted to the intensive care unit. The mean duration of hospitalization was seven days (3–12 days). The majority of the patients 63

Table 1 Characteristics of Patients

	N%
Age, years	
16–30	45(26.8%)
31–40	71(42.3%)
41–50	52(31%)
Gender	
Male	99(59%)
Female	69(41%)
Known Comorbidities/risk factors	
Hypertension	50(29.7%)
Substance Abuse	52(31%)
Eclampsia	9(5.4%)
Heart Disease	8(4.8%)
Renal Failure	8(4.8%)
Anticoagulation	7(4.1%)
Diabetes	4(2.4%)
No Comorbidity/risk factor	30(18%)
Family history of hemorrhagic stroke	
Yes	30(18%)
No	138(82%)
Substance Abuse	
Chewing Khat	33(19.6%)
Smoking	13(7.7)%
Cannabis	3(1.8%)
Tobacco Chewing	3(1.8%)
None	116(69%)
Main Presenting symptoms	
Conscious Impairment	70(41.7%)
Hemiplegia	60(35.7%)
Headache	23(13.7%)
Seizure	10(6%)
Dysarthria/Aphasia	5(3%)
Hemorrhagic pattern	
Left Hemisphere	92(54.8%)
Right Hemisphere	60(35.7%)
Non-Hemispheric	16(9.5%)
Outcome of patients admitted	9(4.2%)
Survived	120(71.4%)
Dead	47(28%)

(52.5%) had a GCS of less than 10 on admission. The mean Glasgow coma scale of patients on admission was 8/15. The majority of the patients 121 (72%) were discharged from the hospital after clinical improvement, while 47 (28%) of the patients died during hospitalization.

Etiology of ICH

Hypertension was responsible for the ICH in 60 (35%), cerebral venous thrombosis in 25 (15%), substance abuse in 23 (13.7%). AVM in 10 (6%), anticoagulation in 7 (4.2%), thrombolytic treatment in 4 (2.4%), eclampsia in 7 (4.2%), cavernoma in 3 (1.8%), chronic renal failure in 6 (3.6%), and cryptogenic in 23 (13.7%) of the patients. Vascular malformation (AVM), cerebral venous thrombosis, cavernoma, eclampsia, substance abuse, and cryptogenic etiology were more common in the 2nd and 3rd decades, whereas hypertension was more common in the 4th and 5th decades. Table 2 illustrates the etiology of ICH and the age groups.

Radiological Findings

The majority of the patients 150 (89%) had supratentorial hemorrhage. Ninety-two (54.8%) of the hematomas were in the left hemisphere, 60 (35.7%) were in the right hemisphere, while 16 (9.5%) were non-hemispheric. Hematoma location was lobar in 59 (35%) of the patients, 40 (23.8%) had putaminal hemorrhage, 19 (11.3) had caudate hemorrhage, 15 (8.9%) had internal capsule hemorrhage, 8 (4.8%) had brainstem hemorrhage, 5 (3%) had cerebellar hemorrhage, 3 (1.8%) had primary intraventricular hemorrhage, while 2 (1.2%) had multiple hemorrhages, (see Table 3). Regarding ventricular extension, 29 (17%) had associated intraventricular extension. Regarding hematoma size, 49 (29%) had a hematoma volume of less than 20 mL, 84 (50%) had a hematoma volume of 20–30 mL, and 35 (21%) had a hematoma volume of more than 30 mL. Mass affect was associated in 109 (65%) of the hematomas. The mean hematoma volume was 27 mL. The hypertensive hemorrhages were in the typical sites (putamen, caudate, and thalamus), whereas cerebral venous thrombosis, vascular malformations, and substance abuse related ICHs were lobar in location. Table 3 illustrates the distribution of hematoma locations with respect to ICH etiologies.

Predictors of Outcome

Of the 168 patients admitted, 47 (28%) patients died, while 121 (72%) were held from the hospital after clinical improvement. The outcome was related to the underlying ICH etiology. Patients with hypertension induced ICH patients had higher deaths (P = 0.034). ICH related to anticoagulation, thrombolytic treatment, chronic renal failure, and substance abuse were also significantly associated with higher mortality, whereas ICH due to AVM (P = 0.007), CVT (P = 0.02) and eclampsia (P = 0.001) had a better outcome. Deep seated ICH was significantly associated with higher mortality relative to lobar hemorrhage (P = 0.031). On univariate analysis, hematoma volume greater than 30mL was

Table 2 Etiology of ICH Among Different Age Groups

Etiology	16–30yrs (n=45)	31–40 (n=71)	41–50 (n=52)
Hypertension	4(8.9%)	25(35.2%)	31(59.6%)
Substance Abuse	6(13.3%)	10(14.1%)	7(13.5%)
CVT	18(40%)	7(9.9%)	0(0.0%)
AVM	3(6.7%)	4(5.6%)	3(5.8%)
Eclampsia	5(11.1%)	2(2.8%)	0(0.0%)
Anticoagulation	2(4.4%)	1(1.4%)	4(7.7%)
Cavernoma	0(0.0%)	3(4.2%)	0(0.0%)
Chronic renal Failure	0(0.0%)	4(5.6%)	2(3.8%)
Post-thrombolytic	0(0.0%)	4(5.6%)	0(0.0%)
Unknown	7(15.6%)	11(15.5%)	5(9.6%)

Abbreviations: AVM, arteriovenous malformation; CVT, cerebral venous thrombosis.

Table 3 Etiology of ICH VS Hematoma Location

		Hematoma Location								
		Putamen (n=40)	**Thalamus (n=17)**	**Caudate (n=19)**	**Internal Capsule (n=15)**	**Lobar (n=59)**	**Brainstem (n=8)**	**Primary IVH (n=3)**	**Cerebellum (n=5)**	**Multiple (n=2)**
Etiology of ICH	Hypertension	25(62.5%)	9(52.9%)	9(47.4%)	7(46.7%)	4(6.8%)	3(37.5%)	2(66.7%)	1(20.0%)	0(0.0%)
	AVM	1(2.5%)	2(11.8%)	0(0.0%)	0(0.0%)	6(10.2%)	1(12.5%)	0(0.0%	0(0.0%)	0(0.0%)
	CVT	1(2.5%)	0(0.0%)	0(0.0%)	0(0.0%)	23(39%)	0(0.0%)	0(0.0%)	0(0.0%)	1(50%)
	Eclampsia	1(2.5%)	0(0.0%)	0(0.0%)	0(0.0%)	6(10.2%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.%)
	Anticoagulation	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	5(8.5%)	1(12.5%)	0(0.0%)	1(20.0%)	0(0.0%)
	Cavernoma	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	1(1.7%)	1(12.5%)	0(0.0%)	1(20.0%)	0(0.0%)
	Chronic renal Failure	1(2.5%)	0(0.0%)	0(0.0%)	3(20.0%)	1(1.7%)	0(0.0%)	0(0.0%)	1(20.0%)	0(0.0%)
	Unknown	4(10.0%)	3(17.6%)	6(31.6%)	1(6.7%)	5(8.5%)	2(25.0%)	1(33.3%)	0(0.0%)	1(50%)
	Post-thrombolytic	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	4(6.8%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0)%
	Substance Abuse	7(17.5%)	3(17.6%)	4(21.1%)	4(26.7%)	4(6.8%)	0(0.0%)	0(0.0%)	1(20.0%)	0(0.0%)

Abbreviations: AVM, arteriovenous malformation; CVT, cerebral venous thrombosis; IVH, intraventricular hemorrhage.

Table 4 Predictors of Intrahospital Mortality on Binary Logistic Regression Analysis in Young Patients with Intracerebral Hemorrhage

Variable	Survived	Dead	Odd Ratio (95% CI)	P value
Anticoagulation	2(1.7%)	5(10.4%)	0.46 (0.3 to 1.38)	0.007
Post-thrombolytic	1(0.8%)	3(6.3%)	0.39 (0.52 to 1.02)	0.004
Substance Abuse	13(10.8%)	10(20.8%)	0.64 (1.23 to 2.34)	0.043
Brainstem ICH	1(0.8%)	7(14.9%)	1.23 (2.41 to 4.61)	0.019
Hematoma>30mL	11(9.1%)	24(51.1%)	2.65 (3.45 to 5.23)	0.001
Presence of mass effect	69(57.5%)	40(83.3%)	0.62 (0.83 to 1.02)	0.002
Low GCS score	63(52.5%)	41(85.4%)	0.84 (0.64 to 1.23)	0.001
Very high systolic BP on admission	12(32.4%)	22(58.6%)	1.34 (1.75 to 2.81)	0.018
Associated chronic renal failure	1(1.5%)	5(8.3%)	0.89 (0.92 to 1.65)	0.012

significantly associated with higher mortality (P = 0.012). Patients with hematoma with mass effect also had higher mortality compared to those without mass effect (P = 0.002). Other factors associated with higher mortality were low GCS score and high systolic blood pressure on admission, elevated creatinine levels, hyperglycemia, and leukocytosis.

In binary logistic regression analysis, factors predicting with intrahospital mortality were hematoma volume of greater than 30mL (OR 2.65, 95% CI 3.45 −5.23, P = 0.001), thrombolytic etiology (OR 0.39, 95% CI 0.52–1.02, P = 0.004), brainstem ICH location (OR 1.23, 95% CI 2.41–4.61, P = 0.019), anticoagulation etiology (OR 0.46, 95% CI 0.31–1.38, P = 0.007), substance abuse related etiology (OR 0.64, 95% CI 1.23–2.34, P = 0.043), presence of associated mass effect (OR 0.62, 95% CI 0.83–1.02, P = 0.002), low GCS score on admission (OR 0.84, 95% CI 0.64–1.23, P = 0.001)), high systolic blood pressure on admission (OR 1.34, 95% CI 1.75 to 2.81, *P = 0.023*), and the presence of chronic renal failure (OR 0.89, 95% CI 0.92–1.65, P = 0.012) (See Table 4).

Discussion

In this study, we retrospectively analyzed the clinical data of 168 young adults with intracerebral hemorrhage admitted to the neurology department of our hospital from June 2019 to June 2022. We assessed the clinical characteristics, etiologies, risk factors, their outcomes, and the predictors of intrahospital mortality.

Some previously published studies about young adults with intracerebral hemorrhages had a sample population between 8 and 296 cases with an arbitrary age limit of 35 to 45 years old.[13–17] One of these studies also contained patients with subarachnoid hemorrhages.[18] All of these prior studies followed a similar approach, evaluating risk factors, causes, and mortality retrospectively using the records of patients. We selected 18–50 years as a cut-off point for defining young adults. We excluded patients with subarachnoid hemorrhage, trauma-related intracranial bleeding and patients with hemorrhagic transformations from cerebral infarction. The most common risk factor for ICH in this study was hypertension, followed by substance abuse. Among these, Khat chewing (which is common practice in the country) and tobacco chewing were both more prevalent among patients, especially male patients. Other associated substance abuses were the use of cannabis and smoking.

In this study, hypertension was the most common etiology of ICH in young adults, followed by cerebral venous thrombosis, substance abuse, and AVM. In 13% of the patients, the etiology was unknown. According to a study by Lai SL et al,[13] hypertension is the major cause of spontaneous ICH in contrast to western countries where vascular malformation remains the major cause. The inclusion of patients up to the age of 50 and the fact that hypertension increases with increasing age, the exclusion of SAH, and the increased prevalence of hypertension in the country compared to the West[19] may have contributed to the study's higher incidence of hypertension. Hypertensive micro-angiopathy was more common in the 4th and 5th decades and was also more prevalent among males than female patients. The majority of these patients were not regularly using their medications. Sixteen out of the 48 hypertensive patients did not know they had hypertension. This should be public health concern. Public education prompting health-seeking behavior and improving antihypertensive drug compliance should be implemented to reduce these consequences.

According to study by Ruiz-Sandoval et al,[16] AVM was the underlying etiology in 33% of ICH patients, cavernoma was responsible in 16% of patients, and hypertension was the cause in 11% of cases. Another study by Rutten-Jacobs et al in Netherlands found that 21% of young ICH cases were due to AVM and 5% were due to bleeding from cavernous angioma.[20] In our study, vascular malformations including AVM and cavernous angioma were less common. AVM was the underlying etiology in 6% of the cases, while cavernoma was in 1.8% of patients. Vascular malformation (AVM), cerebral venous thrombosis, and cavernoma were more common in the 2nd and 3rd decades. According to A. Arboix et al, an acute intraparenchymal hematoma in young patients can be the initial presentation of a hematological disorder.[21] Therefore, it is important to emphasize the need to differentiate hematologic illnesses from other stroke causes, as they require different treatment approaches and have varying outcomes.

Cerebral venous thrombosis was one of the most common etiologies of ICH in young adults, accounting for 15% of ICH cases in this study. The majority of these cases were female patients in their second and third decades of life. Majority of these female patients were either in the third trimester or were in the postpartum period. Despite this significant proportion, most of the CVT-related ICH patients had good outcome. According to a study by Kalita J, et al, CVT was the underlying etiology in 2.2% of the young adults with ICH.[22] Another cohort study in Finland by Koivunen RJ et al, 3% of young ICH cases were due to cerebral venous thrombosis and the majority were female patients.[23]

Substance abuse was one of the major causes of ICH in young adults in this study. 13.7% of cases were due to substance abuse, notably Khat chewing, tobacco chewing, and cannabis abuse. Khat chewing is popular in the Horn of Africa and the Arabian Peninsula. Chewing Khat has been linked to an increased risk of cardiovascular and neurological diseases.[24] Khat acts as a euphoriant, having amphetamine-like characteristics.[25] This may lead to unsteadiness and fluctuations in blood pressure, increasing the risk of intracerebral hemorrhages. Khat chewing has also been linked to an increased risk of stroke and death.[26]

In our study, intrahospital mortality was 28%. The median length of stay was 9 days. As shown by previously published studies on this subject, which have found different mortality rates ranging from 7.4% to 35%.[27–30] The outcome was related to the underlying ICH etiology. Patients with ICH who were hypertensive showed significant mortality and disabilities. Anticoagulation and thrombolytic treatment-related ICHs, renal failure, and substance abuse were all strongly related to higher mortality and disability rates. In contrast, ICHs related to AVM, CVT, cavernous angioma, and eclampsia, in which the majority of the hematomas were lobar in location, had a better outcome. Deep seated ICH was significantly associated with higher mortality relative to lobar hemorrhage. This contrasts with a study by Mendiola JM et al, which found that acute spontaneous lobar cerebral hemorrhages have a different clinical profile and a more severe early prognosis than deep subcortical intracerebral hemorrhages.[31] In this study, deep seated ICH, brainstem and putaminal locations were associated significantly with increased mortality. Hematoma size greater than 30 mL, hematoma-related mass effect, low GCS score, high systolic blood pressure on admission, and elevated creatinine levels were all predictors of intrahospital mortality. According to previously published studies, larger hematoma volume, intraventricular extension, infratentorial localization, and lower GCS score on admission were all independently associated with an increased risk of short-term death in ICH patients.[32–34]

One of the main determinants of the outcomes after intracerebral hemorrhage (ICH) is the quality of care. The quality of care has several key aspects on the outcome of these patients. For example, prompt recognition of ICH symptoms and early diagnosis are essential for initiating timely treatment. Immediate medical management is crucial in reducing the extent of brain injury and improving outcomes.[35] Availability of specialized stroke units are important this time. Patients with ICH often benefit from specialized stroke units where they can receive intensive monitoring and specialized care from multidisciplinary teams that include neurologists, neurosurgeons, nurses, and rehabilitation specialists. In some cases, surgical intervention such as evacuation of hematoma or placement of a ventricular drain may be necessary. The availability of skilled neurosurgeons and access to surgical facilities are critical factors in determining the quality of care and subsequent outcomes.[36] Additionally, post-acute care and rehabilitation plays a significant role in helping patients recover function and regain independence after ICH. The quality of rehabilitation services, including physical therapy, occupational therapy, and speech therapy, influences long-term outcomes. In summary, the quality of care provided during the acute phase and throughout the continuum of care significantly influences the prognosis and outcomes for patients who have experienced intracerebral hemorrhage.[37]

Stroke care in Somalia faces significant challenges due to the country's ongoing political unrest, insufficient healthcare infrastructure, and resource shortages. The healthcare system in Somalia has been severely disrupted by decades of conflict, resulting in a shortage of trained healthcare professionals, a lack of medical supplies and equipment, and inadequate funding for healthcare services. There are limited hospitals that provide appropriate management for patients with acute stroke. Currently, there are no dedicated stroke units in the country. The availability of surgical management for stroke patients, when necessary, is also limited due to a lack of resources and inadequate skilled professionals capable of performing these duties. Only a few hospitals are able to apply stroke management guidelines. The emergency ambulance service is not well-organized, and patients must rely on other transportation options to get to the hospital. Additionally, the emergency medical services are not readily available, which may contribute to prehospital delays.[38] All of these challenges have a significant negative impact on stroke care outcomes.

Strength and Limitations of This Study

Intracerebral hemorrhage in young adults is a topic not well studies in Africa. This research is the first to be conducted in the east Africa that addresses the etiology, risk factors, and outcome of spontaneous intracerebral hemorrhage in young adults. The study has a modest sample size when compared to previous studies with respect to the duration of the study. Our findings point to some modifiable risk factors, such as hypertension and substance abuse that, if managed properly, could contribute to a significant reduction in the ICH burden in young adults. The study was retrospective and was conducted at a single center. Hospital-based data is subject to referral bias and might not accurately reflect the public's spectrum. The study focus was limited to assessing short-term outcome (intrahospital) and therefore does not evaluate the long-term mortality and risk of recurrent ICH in young adults.

Conclusion

The present study showed that hypertension and substance abuse are the most common modifiable risk factors among young adults with ICH. Hematoma volume, location, associated mass effect, low GCS score, high systolic blood pressure, raised creatinine level, and hypertensive etiology were the most important predictors of intrahospital mortality. Attention should be given to diagnosing and treating hypertension in young patients, and substance abuse should be controlled to reduce the incidence of spontaneous intracerebral hemorrhages in young adults. This study paves the way as the base for further studies in this aspect. Future long-term study might concentrate on specific etiologies of ICH and related mortality and disability.

Data Sharing Statement

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

Ethical Consideration

The research was carried out in accordance with the Helsinki Declaration's fundamental principles. Due to the fact that our hospital is a research hospital a general informed consent is obtained from every patient admitted to obtain their data for retrospective research purposes from the hospital medical records, and this study did not disclose any personal information. This study was reviewed and approved by the ethics committee of Mogadishu Somali Turkish Training and Research Hospital (Ethics Protocol No: MSTH/10260).

Author Contributions

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

Disclosure

The authors declare no competing interests in this work.

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