

ORIGINAL RESEARCH

Pattern of Neurological Disorders among Patients Evaluated in the Emergency Department; Cross-Sectional Study

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Abstract: **Introduction:** Neurologic disorders are common reasons for emergency consultations. Most neurologic disorders seen in the emergency department (ED) are life-threatening and require urgent treatment. The goal of this study is to investigate the pattern of neurological disorders among patients evaluated in the ED. **Methods:** This is a cross-sectional study conducted in the ED of Mogadishu Somali Turkish Training and Research Hospital, from July 2021 to February 2022. The clinical and epidemiological characteristics of adult patients with neurologic manifestations in the ED were evaluated. Age, gender, distribution of neurological disease manifestations, neurological examination findings, and neurological diagnoses made by consultant neurologists were assessed. **Results:** During the study period, 321 patients were assessed (3.7% of all ED admissions). The majority of the patients in the study were above 50 years of age (62.6% male). Hypertension was the most common comorbidity among these patients with 122 (38%) cases, followed by diabetes mellitus with 65 (20.2%), and heart diseases with 26 (8.1%) cases. The main reasons for neurology consultations were altered mental status with 141 (44%) cases, motor weakness with 102 (31.8%), seizures with 33 (10%), headache with 17 (5.3%), and vertigo with 9 (2.8%) cases. 196 (61%) had hemiplegia, 60 (18.7%) had consciousness impairment, and 38 (11.8%) had normal neurological examination. The most frequent neurological diagnoses were ischemic strokes with 125 (39%) cases, hemorrhagic strokes with 65 (20.2%), epileptic seizures with 28 (8.7%), and metabolic encephalopathies with 13 (4%) cases. The median duration of the neurology consultations was 20 minutes. 251 (78%) of the patients were admitted to the hospital, while 70 (22%) were discharged from the emergency department. After neurology consultation, the neurology department made the most admissions with 226 (90%) cases, while 25 (10%) were admitted by other departments. Of those admitted, 186 (74.2%) were admitted to the neurology ward, and 65 (25.8%) were admitted to the intensive care unit. **Conclusion:** In our study, neurologic emergencies accounted for 3.7% of all emergency admissions. Stroke, epileptic seizures, cerebral venous thrombosis, encephalopathies, and acute spinal cord diseases were the most common neurological disorders. The admission rate was very high following neurologic assessment by neurologists.

Keywords: Nervous system diseases; stroke; emergency service, hospital; comorbidity; Somalia

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1. Introduction

Neurological disorders comprise 9% of total emergency department (ED) admissions (1). The majority of neurological emergencies are life-threatening conditions that necessitate immediate diagnosis and treatment. If not recognized and treated early, they can have catastrophic effects, resulting in long-term impairment or death (2). Patients presenting to EDs with neurological diseases should be examined as soon

as possible and managed in a multidisciplinary manner, as some of these disorders are associated with other medical and non-medical conditions (3).

As demonstrated by a study in the United Kingdom, 10% of ED admissions have at least one neurological complaint, 10%–20% of acute hospitalizations are for neurological disorders, and 8–15% of all patients admitted to the ED require a neurologist's evaluation (4). Cerebrovascular diseases, epileptic seizures, central nervous system (CNS) infections, encephalopathies, and myelopathies are the commonest neurological disorders admitted to the ED (5). In one study in Ethiopia, neurological emergencies accounted for 5.27% of the total medical emergencies. Hemiparesis, altered mental status, and seizures were the most common neurological presentations, accounting for 44%, 19.3%, and 13.1% of all cases, respectively. Cerebrovascular disorders (54%), HIV/AIDs related neurologic sequels (9%), meningitis (8.7%), and seizures (7%) were the most common neurologic disorders diagnosed (6).

Somalia is a developing country with limited medical resources. The provision of high-standard healthcare is limited by a lack of human resources, mainly trained health professionals for the management of diseases. Due to the lack of sufficient neurologists in the country, the majority of neurological disease manifestations in EDs are evaluated by non-neurologists, mainly by general practitioners.

There is no previous data on the epidemiological profile of patients with neurological emergencies in the ED in Somalia. Our objective is to evaluate the demographic characteristics, clinical profile, and neurologic disease pattern among patients evaluated in the ED of a tertiary care hospital in Mogadishu, Somalia.

2. Methods

2.1. Study design and settings

This is a cross-sectional study conducted in the ED of Mogadishu Somali Turkish Training and Research Hospital, Mogadishu, Somali, between July 2021 and February 2022. The study was reviewed and accepted by the ethics committee of Mogadishu Somali Turkish Training and Research Hospital (Ethics Protocol No: MSTH/7128, Decision No: 410). Informed consent was obtained from all eligible patients or their legal representatives. We adhered to all the principles of the Helsinki Declaration.

2.2. Participants

This study included all adult patients who were brought to the ED and required neurological assessment by neurologists in the hospital between July 2021 and February 2022. Children and patients with conversion disorders were excluded from the study.

Table 1: Baseline characteristics of studied patients

Variable	Number (%)
Age (years)	
20-40	78 (24.3)
40-60	92 (28.7)
> 60	150 (46.7)
Gender	
Male	201 (62.6)
Female	120 (37.4)
Comorbidities	
Hypertension	122 (38.0)
Diabetes mellitus	65 (20.2)
Stroke	9 (2.8)
Heart disease	26 (8.1)
Epilepsy	8 (2.5)
Respiratory disease	4 (1.2)
Cancer	4 (1.2)
Metabolic condition	5 (1.6)
Without comorbidity	78 (24.3)
Clinical findings	
Hemiplegia	196 (61.1)
Consciousness Impairment	60 (18.7)
Paraplegia/Quadriplegia	10 (3.1)
Cranial neuropathy	5 (1.6)
Aphasia/Dysarthria	4 (1.2)
Cerebellar dysfunction	4 (1.2)
Hyperkinetic movement disorder	3 (0.9)
Autonomic dysfunction	1 (0.3)
Normal neurologic examination	38 (11.8)

2.3. Data gathering

The data was gathered by a team of neurology specialists and residents in collaboration with emergency physicians. Patients' demographic characteristics, co-morbidities, presentations of neurological diseases in the ED, neurological examination findings, neurological diagnoses made by neurologists, and admission status were evaluated. The neurological diagnosis was made based on clinical, radiological (computed tomography, magnetic resonance imaging, and Electroencephalography/Electromyography) findings, and other laboratory investigations according to the ICD-10 codes. To avoid bias in patient selection, a team of expert physicians, including emergency, neurology, and radiology physicians did collaborative work to ensure correct patient selection and proper diagnosis.

2.4. Statistical analyses

Data was analyzed using SPSS (Statistical Package for Social Sciences, IBM Inc., Chicago, IL, USA) v26.0. Descriptive statistics were used to summarize the data; categorical variables were summarized as counts and percentages. The Pearson chi-square test was used for the evaluation of categorical data, and the Mann–Whitney test was used for the evaluation

of quantitative data. The level of significance was chosen as a p-value < 0.05.

3. Results

3.1. Baseline characteristics of studied patients

Out of 8,500 patients admitted to the ED during the study period, 321 patients had neurological manifestations requiring neurological evaluation, representing 3.7% of total ED admissions. 189 (59%) patients were above 50 years of age (62.6% male). Table 1 shows the baseline characteristics of studied patients. Co-morbidities were present in about 243 (76%) of the cases. Hypertension was the most common comorbidity among these patients with 122 (38%) cases, followed by diabetes mellitus with 65 (20.2%), and heart diseases with 26 (8.1%) cases. Cranial or spinal diagnostic imaging was done in 273 (85%) of the cases. Computed tomography was the most common imaging modality used for evaluating these patients.

3.2. Clinical characteristics of patients

Regarding the main reasons for neurology consultations, 141 (44%) were consulted due to altered mental status, 102 (31.8%) for motor weakness, 33 (10%) for seizures, 17 (5.3%) for headache, 9 (2.8%) for vertigo, 8 (2.5%) for speech impairment, 5 (1.6%) due to acute vision loss, and 4 (1.2%) for involuntary movement, while gait impairment and syncope each led to 1 (0.3%) each consultation. On neurological examination, 196 (61%) had hemiplegia, 60 (18.7%) had consciousness impairment, 4 (1.2%) had aphasia/dysarthria, 5 (1.6%) had cranial nerve palsy, 4 (1.2%) had cerebellar dysfunction, 10 (3.1%) had paraplegia, and 38 (11.8%) had normal neurological examination.

3.3. Neurological diagnoses

The most frequent neurological diagnoses were ischemic strokes with 125 (39%) cases, hemorrhagic strokes with 65 (20.2%), epileptic seizures with 28 (8.7%), and metabolic encephalopathy with 13 (4%) cases (Table 2). Cerebrovascular disorders were more common in older patients compared to young patients (63% vs. 37%; $p = 0.001$). In contrast, seizure disorders were more common in young patients than in older patients (68% vs. 32%; $p = 0.001$). Hospital admission was more common in older patients compared to young patients ($p = 0.032$). One of the most common reasons for neurology consultation was altered mental status. Among subjects evaluated due to consciousness impairment, 86 (42%) had ischemic stroke, 65 (31.7%) had hemorrhagic stroke, and 20 (9.7%) were diagnosed with epilepsy (table 2).

Table 2: Neurologic Diagnoses among the evaluated patients

Variable	Number (%)
Among all cases	
Ischemic stroke	125 (39.0)
Hemorrhagic stroke	65 (20.2)
Epilepsy	28 (8.7)
Metabolic encephalopathy	13 (4.0)
Cerebral venous thrombosis	12 (3.7)
Primary headache	11 (3.4)
Acute spinal cord disease	10 (3.1)
Subarachnoid hemorrhage	8 (2.5)
Benign paroxysmal positional vertigo	7 (2.2)
Hypertensive encephalopathy	6 (1.9)
Delirium	6 (1.9)
Guillain-Barre syndrome	4 (1.3)
Movement disorder	4 (1.3)
Meningitis	3 (0.9)
Demyelinating disease	3 (0.9)
CNS neoplasm	2 (0.6)
Psychiatric disease	1 (0.3)
Unspecified CN palsy	1 (0.3)
Brain abscess	1 (0.3)
Motor neuron disease	1 (0.3)
No definitive diagnosis	6 (1.8)
Among cases with impaired consciousness	
Ischemic stroke	86 (4.2)
Hemorrhagic stroke	65 (31.7)
Epilepsy	20 (9.7)
Metabolic encephalopathy	10 (4.87)
Central venous thrombosis	7 (3.4)
Delirium/Dementia	6 (3.0)
Subarachnoid hemorrhage	3 (1.48)
Drug intoxication	1 (0.48)
Hypertensive encephalopathy	1 (0.48)
Intracranial mass	1 (0.48)
Meningitis	2 (0.97)
Brain abscess	1 (0.48)
Subdural hemorrhage	1 (0.48)
Undiagnosed	1 (0.48)

CNS: central nervous system; CN: cranial nerve.

3.4. Disposition

The median duration of the neurology consultations was 20 minutes. 251 (78%) patients were admitted to the hospital, while 70 (22%) were discharged from the emergency department. After neurology consultation, the neurology department made most of the admissions with 226 (90%) cases, while 25 (10%) were admitted by other departments. Of those admitted, 186 (74.2%) were admitted to the neurology ward, and 65 (25.8%) were admitted to the intensive care unit.

4. Discussion

The findings showed that 3.7% of patients admitted to ED had neurological complaints. Hemorrhagic and ischemic

strokes were the most prevalent neurological presentations, followed by epileptic seizures, cerebral venous thrombosis, encephalopathies, and acute spinal cord diseases. The majority of patients with neurological manifestations were admitted to the neurology department.

Neurological disorders are responsible for more than 20% of the world's burden of disease. Neurological and psychiatric disorders are responsible for up to 28% of all years of life lived with disability. Neurologic emergencies contributed to 92 million disability-adjusted life years in 2005 and were predicted to be 103 million in 2030. The burden of these diseases is higher in developing countries, which constitute about 85% of the world's population (7, 8). Neurological disorders account for nearly a quarter of all the years of life spent disabled. In 2005, neurological emergencies resulted in 92 million disability-adjusted life years, with a potential increase to 103 million by 2030.

A significant portion of patients in the ED may have life-threatening neurological diseases that would quickly deteriorate if not diagnosed and treated rapidly. However, the vast majority of these patients are not evaluated by neurologists (9). Neurological emergencies are defined by certain features, including rapid onset, the need for immediate assessment, diagnosis, and intervention, and the propensity to cause immediate life-threatening situations or long-term disability (10). Because of the shortage of neurology specialists in our country, the majority of patients with neurological emergencies do not have access to neurological evaluation by neurologists. As a result, these patients are assessed by generalists or internists in the ED. In addition, the proportion of neurologic patients in the ED and their diagnosis and disease patterns had never been studied in the country before.

As demonstrated by a cross-sectional study conducted in Turkey, the mean age of neurologic patients evaluated in the ED was 63.14 ± 18.61 years. Male patients comprised 50.7% of the subjects, while female subjects comprised 49.3% (11). According to Marcos C. Lange, Vera L. Braatz, and Carolina Tomiyo et al., the mean age of neurologic patients in the ED was 58 years. 60% of the subjects were female, while 40% were male (12). In our study, most patients were 50 years of age or older (59%). The gender distribution of the study population showed no significant differences, which is consistent with previous studies.

Comorbidities are common in patients with neurological presentations because of the fact that common neurological disorders become more prevalent with increase in age (13). Our study showed that 76% of subjects had associated comorbidities. Hypertension was the most common associated comorbidity seen in 38% of the patients, followed by diabetes mellitus, previous history of stroke, heart disease, epilepsy, cancer, respiratory disease, and other metabolic conditions.

The findings were similar to those of a study by Ufuk Emre and his colleagues, which showed that hypertension, previous stroke, diabetes mellitus, chronic obstructive pulmonary disease, epilepsy, and cancer were the most common comorbidities (11).

As shown by previous studies, neurological complaints were observed in 2% to 10% of patients admitted to the ED. In one study conducted in Brazil, 10% of cases admitted to the ED had neurological presentations [10](14). Another study in Turkey found that 6% of emergency admissions were due to neurological disorders (15). As per a study in Ethiopia, 10.8% of ED admissions had neurological emergencies (16). In our study, 3.7% of emergency admissions had neurological presentations. 78% of these patients with neurological disorders were admitted to the hospital. This high proportion should be taken into account during emergency medicine and neurology training programs, with the goal of increasing hospital staff's capacity to diagnose and treat these common neurological disorders. Our study also showed that 85% of the cases had at least one cranial or spinal diagnostic imaging. Tomography was the most common imaging modality used for evaluating these patients. This indicates the importance of imaging in the diagnosis of neurological diseases.

A study in the UK performed by Carroll and Zajicek demonstrated that the main neurological presentations in the ED requiring neurology consultation were weakness (40%), headache (24%), and seizures (15%). Stroke, headaches, and seizures were the three most common ED admissions and accounted for 53% of cases (14). Another study conducted in a referral hospital in Bangladesh showed that stroke was the most common condition (47.5%), followed by seizure (9.3%), disease of the spinal cord (7.8%), and encephalopathy (6.3%) (17). In our study, the main reason for neurology consultations was impaired consciousness 141 (43.9%), followed by motor weakness 102 (31.8%), seizure 33 (10.3%), and headache 17 (5.3%). This is consistent with the findings that the most common neurological disorders diagnosed in the ED are strokes, seizures, and headache disorders.

In the present study, the most common neurological examination findings were motor deficit, consciousness impairment, speech impairment, cranial nerve palsy, cerebellar system dysfunction, abnormal movement disorder, and autonomic dysfunction. These findings are consistent with the fact that cerebrovascular diseases are the most common reason for neurology consultation. This is similar to the findings of another study by Sevilyay Vural and her colleagues, which also showed that motor deficit, speech disorder, consciousness impairment, facial asymmetry, and sensory system dysfunction were the major neurological findings on examination in those subjects (18).

In our study, among the evaluated patients, ischemic and hemorrhagic strokes were the most common neurologic di-

agnoses, with 38.9% and 20.2%, respectively. Other common diagnoses among these patients included epilepsy (8.7%), cerebral venous thrombosis (3.7%), metabolic encephalopathy (4%), and acute spinal cord disease (3.1%). The distribution of diagnoses among the patients in the ED requiring neurology consultation varies from one study to another. In one study in Ethiopia, cerebrovascular diseases, meningitis, and seizure disorders were the most common neurological disorders in the ER (16).

In another study in Nigeria, the main neurologic diagnoses were stroke, central nervous system (CNS) infections, and myelopathies (19). In another study conducted in Cameroon, Malaria and other related central nervous system infections, which are endemic to sub-Saharan African countries, were the most common non-traumatic neurological causes in the ED (20). Nevertheless, CNS infections account for a smaller number of patients in emergency admissions in developed countries (18). Although Somalia is a sub-Saharan African nation, CNS infections made up only 0.6% of the cases in our study.

According to our study, stroke, movement disorders, CNS neoplasm, hypertensive and metabolic encephalopathies, delirium, subarachnoid hemorrhage, and motor neuron diseases were more common in patients over 60 years old. In patients under 60 years old, epilepsy, benign paroxysmal positional vertigo (BPPV), headache disorders, demyelinating disorders, Cerebral venous thrombosis (CVT), CNS infections, and psychogenic disorders were the most common diseases. Our study also showed that the most common neurological findings in patients evaluated due to consciousness impairment were ischemic stroke, hemorrhagic stroke, epilepsy, metabolic encephalopathy, cerebral venous thrombosis, delirium, and drug intoxication. These groups of patients usually receive consultations from the neurology department in the ED. This is almost similar to a study by Ufuk Emre and his colleagues, which demonstrated that ischemic stroke, hemorrhagic stroke, hypoxic and metabolic encephalopathy were the most common neurologic diagnoses in patients evaluated due to consciousness impairment (11).

5. Limitation

Even though our sample was modest, we only investigated patients admitted to the ED of our hospital. Patients in the outpatient clinic were not included in this study; therefore, the neurological disease pattern in outpatient was not studied here. Another limitation is the absence of assessment of the outcome and related factors, the short duration of the study, and the fact that it is a single-center cross-sectional study that does not necessarily cover the country's epidemiology. To avoid bias in patient selection, a team of expert

physicians, including emergency, neurology, and radiology physicians, did collaborative work to ensure correct patient selection and proper diagnosis. Multi-center studies, including outpatient neurological disease patterns and outcomes, as well as other study designs should be considered. One major strength of this study is it provides an overview assessment of common neurological emergencies in the country (which was missing data), which is why we consider it to be a valuable study.

6. Conclusions

In our study, neurological emergencies accounted for 3.7% of all emergency admissions. Stroke, epileptic seizures, cerebral venous thrombosis, encephalopathies, and acute spinal cord diseases were the most common neurological disorders. The admission rate was very high following neurological assessment by neurologists.

7. Declarations

7.1. Acknowledgments

We thank all the medical team members at the departments of emergency medicine and neurology of our hospital, including doctors, nurses, the health care experts, and other staff for their assistance in conducting this research. We also thank the patients and their families for their cooperation. In addition, we thank the education and research section of the hospital for their support and encouragement throughout the process of this study.

7.2. Conflict of interest

The authors declare no conflict of interest

7.3. Fundings and supports

We did not receive any funding to perform this study. This was completely voluntary research work conducted by the authors of this research paper.

7.4. Authors' contribution

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

7.5. Data Sharing Statement

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

request.

7.6. Ethical approval

This study was performed in line with the principles of the Declaration of Helsinki. The study was reviewed and accepted by the ethics committee of Mogadishu Somali Turkish Training and Research Hospital (Ethics Protocol No: MSTH/7128, Decision No: 410). All patients/caregivers were informed about the purpose of this study. Written informed consent was obtained from the patient/relatives during data collection and they signed the consent form. We declare that we have followed the protocols of our work center. Patients' data confidentiality was respected.

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