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Profile of stroke mimics in a tertiary medical center in the Philippines

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Abstract

Background & Objectives: Stroke mimics are conditions that simulate the signs and symptoms of a stroke. These conditions pose a clinical challenge as they need to be distinguished from actual strokes based on neurologic findings, laboratory tests, and imaging studies in order to minimize the adverse effects of acute stroke therapies as well as hospital costs. The study aims to determine the rate and the most common etiologies of stroke mimics in a private tertiary care hospital in the Philippines and calculate the average cost incurred for diagnostics. *Methods:* We conducted a retrospective review of medical records of adult patients assessed by the hospital's Brain Attack Team from 1 January 2014 to 31 December 2017. The diagnosis of stroke mimic was based on negative neuroimaging findings and laboratory results that showed an alternate diagnosis, in consultation with the stroke neurologist on call. *Results:* A total of 1,485 patient records were analyzed; 448 patients (30.2%) were diagnosed as stroke mimics. The most common etiologies were encephalopathy (83 cases, 18.5%), seizures (77 cases, 17.2%), headache (31 cases, 6.9%), hypertensive emergency (31 cases, 6.9%), and radiculopathy (27 cases, 6.0%). The average cost for diagnostics for each patient diagnosed as a stroke mimic was PHP 24,629.53 (approximately US$500).
Conclusion: Stroke mimics are often encountered in the emergency setting. Due to the wide range of medical conditions that mimic stroke, early recognition is important in order to avoid the potential adverse effects of acute stroke therapies and minimize diagnostic costs, particularly in countries with limited resources.

Keywords: Stroke mimics, stroke, brain attack, diagnostic costs, cost burden

INTRODUCTION

In the Philippines, cerebrovascular disease is the second leading cause of mortality, with an overall prevalence of 0.9%.[1] Rapid and accurate diagnosis of stroke is critical, particularly in patients who are eligible for intravenous thrombolysis or mechanical thrombectomy. A stroke mimic is a condition that manifests with a stroke-like clinical picture due to symptoms caused by a disease other than cerebrovascular disorders.[2] In various studies, the most common medical conditions that mimic stroke include seizure, syncope, encephalopathy, primary headache disorders, space-occupying lesions, functional disorders, and metabolic imbalances.[3] The incidence of stroke mimics across different hospitals worldwide ranged from 1% to 30%.[4-8] However, in the Philippines, there are no published data on the incidence and most common etiologies of stroke mimics among healthcare institutions. Moreover, published costing studies on the estimated total and mean diagnostic costs incurred by patients who presented with stroke mimics are lacking. Our study aims to determine the frequency and most common etiologies of stroke mimics in our hospital and calculate the average costs for diagnostic tests for these patients.

METHODS

Patient selection and study site

We conducted a retrospective review of hospital's medical records and stroke database. All adult patients (age > 18 years old), who presented with signs and symptoms of stroke (focal neurological symptoms with sudden onset) in the emergency room, medical wards or the intensive care units, and were assessed by the hospital's Brain Attack

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Team (BAT) from January 1, 2014 to December 31, 2017 were included in the study.

The study site is at St. Luke's Medical Center (Quezon City, Philippines), a 650-bed tertiary hospital accredited by the Joint Commission International (JCI) as a Primary Stroke Center. It is equipped with all the necessary laboratory, neuroradiological, and neurosurgical facilities, as well as critical care units capable of managing acute stroke patients. The hospital's Brain Attack Team is composed of stroke neurologists, stroke fellow, neurology residents, nursing associates, and paramedical staff. When a Brain Attack code is activated within the hospital, the team proceeds to assess the patient at bedside, obtain the pertinent neurologic history, and perform a complete neurologic examination to determine whether the symptoms are consistent with a possible cerebrovascular event and if the patient is a candidate for acute stroke interventions such as intravenous thrombolysis or mechanical thrombectomy. The case is discussed with the stroke neurologist on-call and subsequently, the appropriate neuroimaging modality and laboratory tests are requested. A diagnosis of stroke mimic was determined after neuroimaging studies did not show radiographic findings consistent with stroke and laboratory test results showed an alternate diagnosis other than stroke, in consensus with the stroke neurologist assigned to the patient.

Data Collection and analysis

The following data were retrieved from the patient's clinical records: hospital patient identification number, age, sex, date and time of ictus, time of brain attack code activation, initial diagnosis, laboratory test results, imaging results, final diagnosis, etiology of stroke mimic, and final disposition (admission or discharge). The costs for the laboratory tests and imaging procedure for each patient was calculated using the price of each laboratory test or imaging modality during the four-year period. Descriptive statistics were used to determine the incidence rate, most common etiologies of stroke mimics, total diagnostic costs and average costs of diagnostics per patient.

RESULTS

A total of 1,485 patients were seen by the Brain Attack Team, both in the emergency department and in-hospital, over the four-year period. Among these, 448 patients (30.17%) were diagnosed as stroke mimics, with mean age of 59.4 years (SD 16.5) and majority (54%) were females (Table 1). Among the 448 patients, 317 (79%) were initially assessed in the emergency department while 131 (21%) were already admitted for another medical condition in the medical wards and in the intensive care units (ICUs). The proportion of stroke mimics among inpatients was higher compared to those seen in the emergency department (55.5% vs. 25.4%) (Table 2).

The most common etiologies of stroke mimics are: (1) encephalopathy (n=83, 18.5%), which comprise of septic, metabolic, uremic, and hepatic encephalopathy; (2) seizures, focal or generalized (n=77, 12.2%); (3) headache (n=31, 6.9%); (4) hypertensive emergency (n=31, 6.9%), and; (5) radiculopathies (n=27, 6.0%) (Table 3). In the emergency department, seizures, encephalopathy, and headache are the most common conditions mimicking stroke (Table 4). Among inpatients, encephalopathy, seizures, sepsis, and syncope are the most common stroke mimics (Table 5). The total costs of diagnostics (comprising of laboratory tests and imaging studies) for patients diagnosed as stroke mimics were calculated to be PHP 11,034,031.58 (USD 220,680.63) or roughly PHP 24,629.53 (USD 492.59) for each patient (Table 6).

DISCUSSION

Over the four-year study period, there were 1,485 patients assessed by the hospital's Brain Attack Team and 448 were eventually diagnosed as stroke mimics (30.2%). The incidence rate of stroke mimic in our hospital is consistent with

Table 1: Baseline characteristics of patients diagnosed as stroke mimics from 2014-2017

Brain Attack Codes	1,485
Stroke mimics	448
Sex (Male:Female)	204:244 (46%:54%)
Age, yr (Mean ± SD)	59.4 ± 16.5
Emergency department	317 (71%)
In-Hospital (Medical wards & ICU)	131 (29%)

Table 2: Stroke mimics seen in the emergency department vs. in-hospital

Year	Emergency Department			In-Hospital		
	Brain Attack Codes	Stroke Mimics	%	Brain Attack Codes	Stroke Mimics	%
2014	313	88	28.11	58	31	53.44
2015	348	79	22.70	55	22	40.0
2016	281	75	26.69	52	31	59.61
2017	307	75	19.81	71	47	66.20
Total	1,249	317	25.38%	236	131	55.50%

Table 3: Most common etiologies of stroke mimics from 2014 – 2017

Categories	2014	2015	2016	2017	Total (%)
Encephalopathy	21	16	21	25	83 (18.5)
Seizures	26	16	20	15	77 (17.2)
Headache	17	6	3	5	31 (6.9)
Hypertensive emergency	13	1	8	9	31 (6.9)
Radiculopathy	0	8	9	10	27 (6.0)
Peripheral vertigo	9	5	4	6	24 (5.4)
Syncope	7	4	3	7	21 (4.7)
Bell's palsy	3	3	3	7	16 (3.6)
Anxiety	3	7	2	2	14 (3.1)
Brain metastases	2	5	5	1	13 (2.9)
Transient global amnesia	0	5	2	5	12 (2.7)
Others	18	25	26	30	99 (22.1)
	119	101	106	122	448 (100%)

Table 4: Top 10 most common stroke mimics in the emergency department from 2014 – 2017

Categories	2014	2015	2016	2017	Total %
Seizures	20	12	8	3	43 (13.6%)
Encephalopathy	6	7	12	7	32 (10.1%)
Headache	17	6	3	5	31 (9.8%)
Hypertensive emergency	10	1	8	8	27 (8.5%)
Radiculopathy	0	8	6	9	23 (7.3%)
Peripheral vertigo	8	5	4	6	23 (7.3%)
Bell's palsy	3	3	3	7	16 (5.0%)
Syncope	6	4	2	3	15 (4.6%)
Anxiety	3	6	2	2	13 (4.1%)
Transient global amnesia	0	5	2	4	11 (3.5%)
Brain metastases	1	5	3	1	10 (3.2%)
Others	14	17	22	20	73 (23%)

the results of a published study on a 10-year data from the National Institute of Health Stroke Program[5] comprising of 8187 patients, which showed that stroke mimics account for 30% of patients examined by the stroke team in both the emergency department and in the wards. However, the incidence of stroke mimics in our institution was relatively higher in comparison to Japan,

Table 5: Top 10 most common stroke mimics in hospitalized patients from 2014 – 2017

Categories	2014	2015	2016	2017	Total
Encephalopathy	15	9	9	18	51 (38.9%)
Seizures	6	4	12	12	34 (25.9%)
Infection	0	1	1	6	8 (6.1%)
Syncope	1	0	1	4	6 (4.6%)
Radiculopathy	0	0	3	1	4 (3.1%)
Hypertensive emergency	3	0	0	1	4 (3.1%)
Brain metastases	1	0	2	0	3 (2.3%)
Subdural hemorrhage	1	0	1	1	3 (2.3%)
Cardiac (MI, arrhythmia)	1	1	0	1	3 (2.3%)
Electrolyte imbalance	2	0	0	0	2 (1.5%)
Others	1	7	2	3	13 (9.9%)

wherein the incidence of stroke mimics ranged from 7% - 8.8%[5,6] and Tanzania (6.6%).[7] Our study also showed that the incidence of stroke mimics was higher among hospitalized inpatients (either at the medical wards or in the intensive care units), compared to patients who sought consult in the emergency department (55.5% vs. 25.3%). Similar findings were seen in a previous study wherein stroke mimics accounted for 63.4% of in-hospital stroke codes compared to 31.3% of stroke codes activated in the emergency department.[9]

The most common etiologies of stroke mimics in our hospital were encephalopathy, seizures, headache, and hypertensive emergencies and radiculopathy. The most common etiology of stroke mimic among inpatients in our hospital is encephalopathy, which is characterized by functional alteration of mental status due to systemic disease. Metabolic (hypoglycemia, hepatic, uremic) or electrolyte derangements (hyponatremia) may present with decreased sensorium, or focal neurologic deficits such as aphasia, hemisensory deficits, hemiparesis and presence of a toe-extensor signs.[10,11] Moreover, the frequency of this diagnosis in our hospital is much higher among inpatients compared to patients seen at the emergency room (38.9% vs 10.1%). These can be attributed to other comorbidities, such as electrolyte imbalances and infections, of the patients who are already admitted in the hospital for causes other than stroke.

Another common stroke mimic is seizure. A seizure episode is one of the most common stroke mimics encountered in the emergency department and in the wards.[12] In our hospital, seizures accounted for 17% of all stroke mimics while in a study done at a tertiary university hospital in Spain, seizures comprise more than one-fourth (26%) of all stroke mimics.[8] After a seizure attack, Todd's paralysis occurs, which can persist for several hours. Hence, it was postulated that the persistence of hemiparesis and other post-

Table 6: Total and average cost of diagnostics for stroke mimics from 2014 – 2017

Year	Total Costs, PHP (USD*)	Average cost per patient, PHP (USD*)
2014	3,079,093.76 (61,581.87)	25,874.74 (517.50)
2015	2,449,746.42 (48,994.93)	24,254.92 (485.09)
2016	2,520,569.74 (50,411.39)	23,778.96 (475.58)
2017	2,984,621.66 (59,692.43)	24,464.11 (489.28)
Total	11,034,031.58 (220,680.63)	24,629.53 (492.59)

*Exchange rate: PHP 50 = 1 USD

ictal symptoms such as drowsiness or confusion is usually misidentified as a stroke symptom.

It is critical to distinguish stroke mimics from actual strokes in order to avoid the potentially harmful effects of intravenous thrombolysis as well as to minimize the hospital costs (direct and indirect) of diagnostics, medications, and admission to critical care or acute stroke units. Our study showed that each patient spent PHP24,629.53 (approximately US$500) for laboratory tests and imaging procedures. In a low middle-income country (LMIC) such as the Philippines, with an estimated GDP per capita of US$3500 (World Bank 2019), the average cost per patient for the diagnostics (laboratory tests and imaging) alone is significant because in terms of health financing sources, majority is still via household out-of-pocket payment (57%) and national health insurance system (12%).[13] In comparison, a study done in the United States calculated the direct hospital costs incurred by patients who were given intravenous recombinant tissue plasminogen activator but were eventually diagnosed as stroke mimics, showed that each patient incurred costs amounting to approximately US$5400.[14]

Our study has limitations. We only included patients who were examined and diagnosed as stroke mimics by the Brain Attack Team. Hence, stroke mimics in patients who sought consult and were examined > 6 hours from ictus were not included in the analysis. The study did not analyze the risk factors that would predict the probability that a patient is a stroke mimic rather than an actual stroke. Lastly, indirect healthcare costs on the part of the hospital (e.g. manpower hours and constraints on nursing and healthcare staff), as well as on the part of the patient (e.g. loss of productivity and lost wages), were not calculated in this study.

This is the first study to describe the profile of stroke mimics in terms of incidence, most common etiologies and diagnostic costs in the Philippines and in Southeast Asia. The differentiation of stroke mimics from actual stroke pose a common clinical challenge in the emergency setting and inpatient, as shown by the high incidence of stroke mimics in our institution and the wide range of medical and neurological conditions that mimic the symptoms of stroke. The substantial costs incurred for diagnostics highlight the need for frontline healthcare personnel (physicians and nurses) to be highly cognizant of the symptoms of stroke vis-à-vis stroke mimics. Early recognition of stroke mimics can reduce hospitalization and diagnostic costs and minimize the potential adverse effects of intravenous thrombolysis.

DISCLOSURE

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