

# Stroke Subtypes on Imaging in a Jamaican Population

## A Hospital-based Study

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### ABSTRACT

**Objective:** To examine the pattern of stroke subtypes found on Computed Tomography (CT), Magnetic Resonance Imaging (MRI) at the University Hospital of the West Indies (UHWI), Kingston, Jamaica.

**Method:** A retrospective review was conducted for all patients diagnosed with stroke and who were subjected to CT or MRI evaluation at UHWI between January 2001 and December 2004. Data were collected for patient age and gender and type of stroke.

**Results:** Four hundred and thirty-three patients were identified and classified as having cerebral infarct, intra-parenchymal haemorrhage or subarachnoid haemorrhage. There were 414 patients who had CT scans and 19 had MRI scans. Within and across genders, over 80% suffered infarcts with no significant statistical difference between male and female patients. Subarachnoid haemorrhage was the least frequent subtype and occurred in younger patients.

**Conclusion:** The pattern of stroke subtypes seen in this population was similar to that of Australian and European cohorts of patients but differed from that reported in Asians. Ischaemic infarct was the most frequent stroke subtype followed by intra-parenchymal haemorrhage and subarachnoid haemorrhage. There was no gender predilection for any specific type of stroke.

# Subtipos de Accidente Cerebrovascular en la Imagen Médica en una Población Jamaicana: Estudio en un Hospital

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### RESUMEN

**Objetivo:** Examinar el patrón de los subtipos de accidente cerebrovascular encontrados en las imágenes de TAC y MRI en el Hospital Universitario de West Indies (HUWI), Kingston, Jamaica.

**Método:** Se realizó un examen retrospectivo de todos los pacientes con diagnóstico de accidente cerebrovascular, sometidos a evaluación mediante TAC o MRI, entre enero 2001 y diciembre 2004. Los datos fueron recogidos teniendo en cuenta la edad y el género del paciente, así como el tipo de accidente.

**Resultados:** Cuatrocientos treinta y tres (433) pacientes fueron identificados y clasificados como pacientes con un infarto cerebral, hemorragia intraparenquimal o hemorragia subaracnoidea (HSA). Hubo 414 pacientes examinados con TAC y 19 con MRI. Dentro de ellos, ambos géneros incluidos, más del 80% sufrió infartos sin que hubiese diferencias estadísticas significativas entre hombres y mujeres. La hemorragia subaracnoidea fue el tipo menos frecuente, y se produjo en pacientes jóvenes.

**Conclusión:** El patrón de subtipos de accidente cerebrovascular en esta población fue similar al de cohortes de pacientes australianos y europeos, pero diferente al reportado para los asiáticos. El infarto isquémico fue el subtipo de accidente cerebrovascular más frecuente, seguido por la hemorragia intraparenquimal y la hemorragia subaracnoidea. No hubo preferencia de géneros en relación con ninguno de los tipos específicos de accidente cerebrovascular.

West Indian Med J 2009; 58 (3): 261

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## INTRODUCTION

Stroke is a major public health challenge and was the leading cause of death in Jamaica in 2000 (1). It is the third leading cause of death in the United States of America (USA) after heart disease and cancer. More than 750 000 incident strokes are estimated to occur in the USA every year (2–4). More than half of all stroke patients are left dependent on others (5).

Stroke is not a homogeneous condition but rather a mix of clinically distinct subtypes that have different aetiological and epidemiological characteristics (6–8).

The American Heart Association (AHA) recommends that Computed Tomography (CT) scan should be the first option for imaging patients with stroke because it is not always possible to differentiate stroke subtypes clinically (9). In addition, this modality is relatively accurate, readily available and safe.

Sudlow and Walrow have sought to define “ideal” criteria for conducting research on the incidence of stroke subtypes. They recommend prospective community-based studies with brain imaging in at least 70% of cases (10). Precise data are important for effective implementation of preventative strategies and evolving therapeutic options in the management of stroke. Studies suggest that the epidemiological pattern of existing subtypes is similar among Western nations but the pattern among Western nations is different from that of Asian and Latin American countries. Kitamura *et al* compared their findings of stroke subtypes in a Japanese city to the reported data for both hospital and community-based studies of Koreans, Japanese, Chinese, Chileans, Americans and Western Europeans. They found that Asians and Chileans had relatively higher proportions of haemorrhagic stroke, approximately 30%, compared to 14% for Americans and Western Europeans (11).

Data on stroke in Black populations are sparse. In the Caribbean, published data on community-based studies of stroke incidence have only been done in Barbados and Martinique. In Martinique, with a 94% Black population, the main subtype was cerebral infarction, which accounted for 80% of all strokes, whereas intracerebral haemorrhage accounted for approximately 14% (12). In Barbados with a 95.6% Black population, cerebral infarction, intracerebral haemorrhage and subarachnoid haemorrhage were detected in 82%, 12% and 2.0% respectively with 4% of strokes being unclassified (13). The Jamaican population is 94% Black and should have a similar profile, however to our knowledge the distribution of stroke subtypes seen on imaging in this population has not been previously documented.

The University Hospital of the West Indies (UHWI) is located within the capital, Kingston, which has a population of approximately 579 137. During the period under review, it was the only public institution with CT and MR scanners and provided both routine and 24-hour emergency imaging services to all Government hospitals and clinics on the island.

This study was undertaken to provide an analysis of the age and gender of patients confirmed to have strokes by imaging and to determine the relative frequency of the three main subtypes in the population under review.

## SUBJECTS AND METHODS

A retrospective analysis was done on patients with stroke who had CT and MRI evaluation during the period January 1, 2002 to December 31, 2004. Patients were identified by search of MRI and CT registers of the Radiology section of the University Hospital of the West Indies for the period under review. Multinomial logistic regression analyses and a chi-square test were used to identify any association of age or gender with stroke outcome.

Computed tomography examinations were performed with a GE Synergy plus System (GE, Wisconsin, USA). Patients had unenhanced brain scans, and – when indicated – contrast or interval studies for clarification. MRI examinations were performed with a 1.5T GE Signa (GE, Wisconsin, USA). T1 and T2-weighted spin-echo sequences, diffusion weighted and FLAIR sequences were routinely done.

All scans were interpreted by consultant radiologists and the reports were stored on compact discs in Microsoft Word format. Reports containing the words cerebrovascular, stroke, haemorrhage, haematoma, infarction, ischaemic, subarachnoid and brain were reviewed.

## RESULTS

There were 433 patients comprising 241 females and 192 males, with ages ranging from 4 to 96 years who were classified as having either cerebral infarct, intra-parenchymal haemorrhage or subarachnoid haemorrhage on brain imaging. There were 414 patients who had CT scans and 19 had MRI scans. The results indicate that 362 patients had cerebral infarcts, 157 males and 205 females; 48 patients had intracerebral bleeds, 27 males and 21 females. There were 23 subarachnoid haemorrhages in 8 males and 15 females. Tables 1 and 2 illustrate the distributions of stroke subtypes by gender and age respectively.

Table 1: Stroke subtype and gender

Sex	Intra-parenchymal haemorrhage		Ischaemic infarcts		Subarachnoid haemorrhage	
	%	No	%	No	%	No
Males	14.1	27	81.7	157	4.2	8
Females	8.7	21	85.1	205	6.2	15
Males and Females	11.1	48	83.6	362	5.3	23

More than 80% of the patients had infarcts. No statistically significant gender difference in stroke type was found. Within and across genders, the mean age of persons who developed subarachnoid haemorrhage were lowest of the three stroke subtypes. Compared with males in the infarct group, males who suffer subarachnoid haemorrhage

Table 2: Stroke subtypes and age

Sex	Intra-parenchymal haemorrhage		Ischaemic Infarct		Subarachnoid haemorrhage	
	Age	CI	Age	CI	Age	CI
Males	65.6	(59.5 – 71.7)	65.1	(62.5 – 67.8)	43.0	(23.9 – 62.1)
Females	64.4	(57.0 – 71.8)	68.3	(65.9 – 70.8)	63.3	(55.8 – 70.8)
Males and Female	65.1	(60.5 – 69.6)	67.0	(65.2 – 68.8)	56.2	(47.7 – 64.7)

were significantly younger ( $p < 0.05$ ). The odds ratio for occurrence of SAH *versus* infarct was 0.97 (95% CI 0.95, 0.99). Older patients were less likely to have subarachnoid haemorrhage compared to younger patients ( $p = 0.005$ ). This association remained statistically significant even after adjusting for gender.

## DISCUSSION

The distribution of stroke subtypes among Jamaicans of predominant African or mixed African descent in this hospital-based study is similar to that described among patients in community-based studies undertaken in the predominantly Caucasian populations of France, Australia, Italy, England, Denmark and Sweden (3), and to that of the predominantly Black populations of Martinique, French West Indies (12) and Barbados (13). The distribution of stroke subtypes differed from that of Japanese, Chinese and Korean populations in the relatively lower frequency of intracerebral haemorrhage. Some researchers have suggested that the difference in pattern of stroke subtypes between Asian and Western populations is due to dietary and lifestyle factors rather than genetics (14, 15). It is therefore possible that these factors also account for the similarity in the pattern of stroke subtypes seen in Blacks in Caribbean islands and the populations of major Western nations. Lin-Feng *et al* reviewed stroke subtypes in ten populations of the Han people of China and found that the average incidence of haemorrhagic stroke was higher in the Han people than in Western nations. In their study, an average 29.6% of strokes were haemorrhagic compared to 9–18% in Western populations. However, the incidence of haemorrhagic stroke varied from 19.4% to 42.2% between the ten Han populations. They concluded that the variation in incidence across Han populations suggested that the relatively higher incidence of haemorrhagic strokes in the Han people may be a feature of lifestyle rather than genetics. This is further borne out by research done by Bin Jiang *et al* who reviewed the pattern and trends of stroke subtypes in three Chinese cities over a ten-year period. They also found that there was a higher incidence of haemorrhagic stroke in the Chinese populations but found that the pattern was changing to that of the Western nations as the diet and lifestyle became more western. Jamaica's population in 2001 was reported to be 2 607 632 comprising 1 324 085 females and 1 283 547 males (1). In the years 1999 and 2000, 1924 and 1954 deaths respectively were

attributed to stroke, this being the largest single cause for both years, an indication of the size of the burden on the population.

The large percentage of ischaemic infarcts in the population imaged at the University Hospital of the West Indies suggests that guidelines for early therapeutic interventions for ischaemic infarcts should be established at the institution. It has been documented in the Oxford Vascular Study (OXVASC) and the Oxfordshire Community Stroke Project (OSCP), that stroke subtypes differ in hospitalized and non-hospitalized patients (5).

This study is hospital-based and does not include acute stroke patients who did not have imaging or those in whom the diagnosis was made at autopsy. It does not therefore attempt to address the incidence of stroke subtypes; however the central role played by the Radiology Department of the UHWI in the imaging of patients seen at the major hospitals across the island allows it to provide useful data on imaging of stroke in patients islandwide. Conventional CT scans are not sensitive in the diagnosis of infarct in the first six hours, but more sensitive techniques such as CT perfusion scanning and xenon cerebral blood flow studies are not available at the study institution.

In summary, using conventional CT techniques and MRI, the hospitalized patients, predominantly of African descent, imaged at the UHWI Jamaica, showed a similar pattern of stroke subtypes to studies done in Australian and European cohorts with ischaemic infarcts being the most common. The pattern differed from Asian cohorts in having relatively fewer intracerebral haemorrhages.

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