# COMPUTERIZED TOMOGRAPHIC PATTERN OF STROKE SEEN IN UNIVERSITY OF PORTHARCOURT TEACHING HOSPITAL.

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## ABSTRACT

BACKGROUND: Data on Computed tomographic (CT) pattern of stroke abound in literature but they are predominantly from studies done in the Western world.Though most of the reports agree that ischaemic rather than haemorrhagic stroke is prevalent in most climes, no strictly radiology based study can be quoted in the Port Harcourt area.Thus there is the need for accurate data on stroke pattern in Nigerians of the South-South region.

AIMS: This study was done to establish the CT pattern of stroke seen in University of Port Harcourt Teaching Hospital (UPTH) and to determine the relationship between the different stroke patterns and age, sex, including time of presentation.

METHODOLOGY: A prospective study of 203 subjects with clinical diagnosis of stroke who had CT of the brain performed during a 12month period (November 2012 to November 2013).A 2-slice helical CT was used to obtain images in the axial plane. Images were classified as normal or abnormal scans. Abnormal scans were analyzed as ischaemic infarcts, intracerebral haemorrhage, subarachnoid haemorrhage (SAH), subdural haematoma, abscess, neoplasm, meningitis, and cerebral atrophy.The clinical diagnosis, age, sex and time of presentation of the patients were recorded.

Statistical analysis was done with the Statistical Package for the Social Sciences (SPSS) software version 20.0. Means were compared using Student's t test. Pearson's correlation coefficient was used to correlate CT findings with clinical diagnosis, age, and sex. P values < 0.05 were considered significant.

RESULTS: The age distribution of the study population ranged from 6-90 years with a mean of 58.3+14.9years. The over 70 age group was most frequent with 24.1% of the subjects. Males were predominant at 51.7% of the sample size. Findings of ischaemic cerebrovascular disease (CVD) were more common than haemorrhagic CVD at 63.2%.

CONCLUSION: This study revealed a higher incidence of ischaemic stroke compared to haemorrhagic stroke.

KEY WORDS: Computed tomography; Cerebrovascular disease; Ischaemic stroke; Haemorrhagic stroke.

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## INTRODUCTION

With increasing incidence and prevalence of stroke especially in sub-Saharan Africa,[1] the pattern of stroke has become an important aspect of stroke management. Studies have varied in their findings in different geographical locations hence the need for peculiar local studies.

Stroke is defined by the World Health Organisation (WHO) as "neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours".[2] Stroke is of two types; ischaemic and haemorrhagic. Haemorrhagic stroke has two subtypes; intra-cerebral haemorrhage and subarachnoid haemorrhage.

Radiological confirmation of stroke diagnosis is essential as clinical assessment alone may be inadequate in classifying a stroke as either ischaemic or hemorrhagic.[3] Imaging hence is important in the management of a stroke patient.

Computed tomography (CT), is able to demonstrate if a stroke has occurred as well as the type of stroke which occurred. Stroke mimics[4] which may impair stroke diagnosis, are also detected on CT. With increasing availability of CT in our environment, there is significant improvement in making stroke diagnosis, its pattern characterization and enhancing its manangement.

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The British National Health Service[5] noted that CT scans 'were the most available and cost effective' in diagnosing stroke. Non-enhanced CT scan is recommended by the American Heart Association as the initial modality of choice for stroke investigation.[6] Time is of essence in management of strokes and determining the subtype greatly contributes to improved prognosis. Magnetic Resonance Imaging, angiography and ultrasonography are all quite useful in stroke imaging. CT however is fast, thus very useful in emergencies.

The literature is replete with reports of higher incidence of ischaemic stroke compared to haemorrhagic stroke, however local study on imaging-based stroke pattern is scanty and mainly retrospective.[7]

Therapy for both ischaemic and haemorrhagic stroke differ and may be detrimental if treatment for one is given for another. It is therefore important that diagnosis and stroke subtype are confirmed as this influences the course of management.

The burden of stroke is high. This burden comprises the mortality, prevalence, incidence and long-term outcome of patients.[8] Stroke is the 3rd leading cause of death in the western world[9] and has a high prevalence in Nigeria.[1] This has its financial/economic implications on both relatives and the health delivery system.[10,11].

This study aims at determining the pattern of stroke in UPTH by means of computed tomography and correlating it with age, sex and time of presentation of the patients. Comparisons will be made with similar studies, both local and international.

## MATERIALS AND METHODS

### Study site

This study was carried out in the radiology department of University of Port Harcourt Teaching Hospital (UPTH) in the South South geo-political zone of Nigeria over a period of 12 months; from November 2012 to November 2013. This hospital is a 500 bed facility that serves as a referral centre for Rivers State, south-south Nigeria.

### Study Design

The study was a cross-sectional, prospective and descriptive study which utilized subjects referred to the department of radiology, UPTH for brain CT on clinical diagnosis or suspicion of stroke. Utilized patients were recruited into the study after meeting the set criteria. Consent was sought with signatures on a form after counseling and confidentiality was assured. Subject's relatives appended their signatures in cases where the subjects were not able to do so.

Demographic data such as age and sex, clinical diagnosis, time of onset of symptoms and time of presentation to the hospital, as well as time between presentation to the hospital and CT were obtained from subjects' relatives and case notes using a structured interview form.

### Imaging Technique

All the brain scans were done using a General Electric NX/1 Dual Slice Helical CT scanner. The patients were counseled where possible, their vital signs were obtained. They were then laid supine with head first into the gantry. Patient's head was steadied in the head holder. Scanogram was obtained, and then contiguous axial slices of 5mm thickness and interval of non-enhanced scans were taken from the skull base to the vertex. This was followed by contrast-enhanced scans for those in whom native scans were normal or showed infarcts or mass lesions except haemorrhage.

### Data Analysis

Data analysis was done using Statistical Package for Social Sciences (SPSS) software (version 20.0) for windows. Results were presented as mean ± standard deviation, percentages, tables and graphs as appropriate. Means were compared using Student's t test. Pearson's correlation was used to assess the association between CT findings, sociodemographic factors and clinical diagnosis. P values less than or equal to 0.05 were considered statistically significant.

### Results

A total of 203 subjects were recruited into the study. The age range was 6-90 years with a mean of 58.3 + 14.9years. The age group of above70years had the highest frequency with 49 (24.1%) subjects and age group of less than 20 having the lowest with 1 subject(0.5%).

Of the total number of subjects, 105 (51.7%) were males and 98 (48.3%) were females with a male to female ratio of 1.1:1. This is not statistically significant; p=0.624. There were more male subjects, 25% in the 51-60 age group while females were more, 26.5% in the 61-70 age group.

All patients had clinical diagnosis of stroke. On computed tomography scan, 11.8% had normal CT diagnosis while 88.2% had abnormal diagnosis.

Out of 203 patients, 152 (74.9%) of the clinical diagnosis were confirmed as CVD on CT (p=0.010) while fifty one (25.1%) were non-CVD cases (p=0.544).

Of the 152 confirmed cases of CVD on CT, ischaemic CVD was predominant with a frequency of 96 (63.2%). Intraparenchymal hemorrhage, 52 (34.2%) and subarachnoid hemorrhage, 4(2.6%) together had a frequency of 56 giving hemorrhagic CVD 36.8%.

Table 1 – CT findings of patients

| CT Findings | Frequency(n) | Percent(%) |
|---|---|---|
| Normal | 24 | 11.8 |
| Infarcts | 96 | 47.3 |
| Intraparenchymal bleed | 52 | 25.6 |
| Subarachnoid hemorrhage | 4 | 2.0 |
| Abscess | 6 | 3.0 |
| Neoplasm | 1 | 0.5 |
| Meningitis | 1 | 0.5 |
| Atrophy | 16 | 7.9 |
| subdural hematoma | 3 | 1.5 |
| Total | 203 | 100.0 |

Sex was a notable factor on the subtype of CVD that occurred as more females (52) had ischaemic CVD compared to males (44) but more males had hemorrhagic CVD (35; intraparenchymal bleed 33, SAH 2) compared to females (21; 19 intraparenchymal bleed, 2 SAH). See figure 10. There was however no significant statistical correlation between sex and ischaemic CVD ($p = 0.112$) as well as between sex and hemorrhagic CVD ($p = 0.058$).

Probability of CVD occurring was shown to be higher with increasing age. This was demonstrated by a positive correlation between age group and incidence of CVD ($p = 0.000$; $r = 0.655$).

Infarcts were most seen in the 61 – 70 age group with a frequency of 28 while hemorrhagic CVD was most incident in the 41 – 50 age group with a frequency of 17.

Ischaemic CVD showed positive correlation with increasing age ($p = 0.034$; $r = 0.259$) but no significant correlation was noted between hemorrhagic CVD and age ($p = 0.076$).

Table 2 : Age group distribution of CVD findings on CT

| CT Finding | Years | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | <20 | 21-30 | 31-40 | 41-50 | 51-60 | 61-70 | >70 | total |
| Ischaemic CVD | 1 | 0 | 6 | 18 | 19 | 28 | 24 | 96 |
| Intraparenchymal hemorrhage | 0 | 3 | 3 | 17 | 14 | 8 | 7 | 52 |
| SAH | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 4 |
| total | 1 | 3 | 11 | 35 | 33 | 37 | 32 | 152 |

Only one (1) patient (0.5%) had brain CT done in less than 6 hours after the incident. This patient had a normal CT. No evidence of early ischaemic stoke was seen in this patient however follow-up was advised. 202 (99.5%) of the subjects had CT scan after 6 hours with 25 (12.3%) being done in 24 hours and 177 (87.2%) in more than 24 hours.

Table 3. CT outcome of patients based on time of presentation

| CT Finding | Time of presentation | | | Total |
|---|---|---|---|---|
| | <6hours | 6-24hours | >24hour | |
| No CVD | 1 | 8 | 42 | 51 |
| Infarcts | 0 | 6 | 90 | 96 |
| Hemorrhage | 0 | 11 | 45 | 56 |
| Total | 1 | 25 | 177 | 203 |

## DISCUSSION

For decades, stroke has and is still taking a big dip in the public health purse. Reliable data on stroke pattern thus has a role in proper inter-specialty approach to management of stroke cases with a possible positive influence on the morbidity and mortality associated with stroke. Accurate stroke diagnosis and subtype confirmation is therefore important in its prognosis. This is greatly enhanced by CT as observed by Lee.[12] CT has become essential in management of stroke and is advocated as a first line investigation[5,6] in a patient suspected of having had a stroke. This study emanated to evaluate the CT pattern of stroke in UPTH, Port Harcourt, South-South, Nigeria.

A total of 203 subjects who were clinically diagnosed of having had a stroke were analyzed in this study. The mean age of the subjects was 58.3years. Obajimi et al[13] in a CT stroke study of 1,172 patients in Ghana, had a mean age of 55.7years while a prospective study of 128 patients on stroke diagnosis with CT in Sudan by El Zein et al[14] had a lower mean age at 53years. The mean ages of the aforementioned studies are not much different from this study. Naik et al[15] in their prospective study of CT stroke profile of 150 patients in Eastern Nepal, had a mean age of 58.3years. This is much similar to the mean age of this study.

In this study there was marginal male predominance as males accounted for 51.7% of the study population while females were 48.3% with a male to female ratio of 1?1:1. This was not statistically significant. Sex distribution in the Naik et al15 study showed a male predominance with a male to female ratio of 2.3 : 1. The study of "sex difference in stroke" in United States by Turtzo et al[16] as well as the El Zein et al[14] study collaborated male predominance. The possible reason for the concordance in male predominance may be that the predisposing factors such as lifestyle, hypertension, diabetes mellitus, etcetera, affected males more. It may also be that males sought hospital treatment more. A retrospective Nigerian study on pattern of CT findings in stroke patients in Enugu[7] even showed higher male predominance.

Ischaemic CVD is said to result from cerebral arterial occlusion leading to ischaemia and if sustained, to infarction. Ischaemic infarcts were the most observed in this study in 63.2% of subjects. Haemorrhagic CVD is said to result from rupture of small cerebral vessels mostly due to hypertension. It was seen in 36.8% of subjects. This findings is in agreement with previous studies which have shown ischaemic CVD predominance compared to haemorrhagic CVD with no gender differential. Ng et al[17] in retrospectively comparing stroke subtypes between Asians and Caucasians, observed that ischaemic stroke is more prevalent in both groups. Sotaniemi et al[18] in Japan and Vila et al[11] in United States all collaborated this finding. Obajimi et al[13] in Ghana and Matuja et al[19] in Tanzania however differed with prevalence of haemorrhagic stroke over ischaemic stroke. The reason for this variation may be due to aetiologic factors like hypertension, diabetes mellitus, sickle cell disease, etcetera which may differ in these locations.

Ischaemic CVD predominance as found in this study and others has been criticised by Keir at al[20] who posited that the low incidence of haemorrhagic CVD reported in most studies may be due to delay in performing a CT scan. This study is not free of that criticism. Though more than 87% of the patients in this study presented after 24hours of onset of symptoms, some even presented weeks after the incident. A possible reason for predominance of ischaemic CVD is that MRI which is more sensitive in detecting small haemorrhage was not employed in most of the studies. Some of the patients in this study had their investigation done many days / weeks after the CT request was made, due to financial and / or religious constraints. Those that presented earlier (between 6 and 24hours) had predominance of haemorrhage (44%) over infarcts (24%) while later presentation (greater than 24hours) had predominance of infarcts (50.8%) over haemorrhage (25.5%). Hence incidence of haemorrhagic CVDs may actually be higher than established by this study.

This study also agrees with Ng et al[17], Sotaniemi et al[18] and Vila et al[11] that ischaemic CVD was more predominant in both sexes but it was discovered that haemorrhagic CVD had a much higher predominance in men. This implies that gender variation has relatively no role in incidence of ischaemic stroke, or that males tend to suffer more from factors that predispose to haemorrhage.

Stroke in the young was found to be uncommon and the risk of stroke occurrence increases with advancing age. Only one (1) patient in this study population was under the age of 20years. This was a patient who was predisposed to stroke by leukaemia. He had an infarct. Previous studies on stroke in the young have demonstrated that infarcts are more predominant. Ogunseyinde et al[21] in a CT study of 14 young sickle cell disease patients with stroke in Ibadan, reported a prevalence of infarcts over haemorrhage with a rate of 57% for infarcts and 21% for intracerebral bleed. This may not be affirmed in this study as a result of the inadequate number of subjects in this age category.

A positive correlation was seen in this study between increasing age and incidence of stroke. Previous studies have demonstrated this. Sacco et al[22] reported that age is the single most important risk factor for stroke. Njoku et al[23] in Sokoto, collaborated this, observing that stroke is most commonly seen in those above 40years. Brown et al[24] in a United States study also collaborated this and went further to report that incidence of stroke more than doubles for each successive 10 years after age 55.

## CONCLUSION

This study found ischaemic stroke to be more prevalent than haemorrhagic stroke accounting for 63.2%. Its incidence correlates with increasing age of patients.

## REFERENCES


1. Danesi M, Okubadejo N, Ojini F. Prevalence of stroke in an urban mixed income community in Lagos, Nigeria. Neuroepidemiology 2007; 204:1-8.
2. Stroke: Definition. http://en.wikipedia.org/wiki/Stroke Accessed on 20 November, 2014.
3. Runchey S, McGee S. Does This Patient Have a Hemorrhagic Stroke? Clinical Findings Distinguishing Hemorrhagic Stroke From Ischaemic Stroke. JAMA 2010;303(22):2280-2286.
4. Onwukeme IO, Ezeala-Adikaibe BA, Ohaegbulam SC, Chikani MC, Amuta J, Uloh HN. Stroke Mimics – A Study of CT Images In Nigerian African Stroke Patients. J Neurol Sci (Turk) 2008; 25(3): 148-154.
5. Wardlaw JM, Keir Sl, Seymour J, Lewis S, Sandercock PA, Dennis MS, et al. What Is The Best Imaging Strategy For Acute Stroke? Health Technol Assess 2004; 8: 1-180.
6. Adams HP Jr, del Zoppo G, Alberts MJ, Bhatt DL, Brass L,Furlan A, et al. Guidelines for the early management of adults with ischemic stroke: a guideline from the American Heart Association/American Stroke Association Stroke Council, Clinical Cardiology Council, Cardiovascular Radiology and Intervention Council, and the Atherosclerotic Peripheral Vascular Disease and Quality of Care Outcomes in Research Interdisciplinary Working Groups. Stroke 2007;38(5):1655–1711.
7. Eze CU, Okaro AO, Ohagwu CC. Pattern of CT Findings in CVA Patients in South-Eastern Nigeria: A Retrospective Study of 480 Patients. Eur J Sci Res 2009;34(1):104-109.
8. Warlow CP. Epidemiology of Stroke. Lancet 1998; 352: 1-4.
9. Cotran SR, Kumar V, Collins T. Cerebrovascular disease. In: Cotran SR (ed) Robbins Pathologic Basis of Disease. 6th Edition, W.B.Saunders. Philadelphia 1999; 1306-10.
10. Palmer AJ, Valentine WJ, Roze S, Lammert M, Spiesser J, Gabriel S. Overview of costs of stroke from published, incidence-based studies spanning 16 industrialised countries. Curr Med Res Opin 2005;21(1) : 19-26.
11. Vila EM, Irimia P. The cost of stroke. Cerebrovasc Dis 2004; 17: 124-9.
12. Lee DH. Brain Imaging In Stroke. AJNR 1996; 17: 1265-1266.
13. Obajimi MO, Nyame PK, Jumah KB, Wiredu EK. Spontaneous Intracranial Hemorrhage : Computed Tomographic Pattern In Accra. West Afr J Med 2002; 21(1): 60-62.
14. El Zein AME, Bukhari EA, Homeida S, Adam I. Stroke In CT Scan Department Of Khartoum Hospital, Sudan. Trop Doct 2007; 37(4): 244-245.
15. Naik M, Rauniyar RK, Sharma UK, Dwivedi S, Karki DB, Samuel JR. Clinico-radiological Profile Of Stroke In Eastern Nepal: A Computed Tomography Study. Kathmandu Univ Med J 2006; 4(2): 161-166.
16. Turtzo LC, McCullough LD. Sex Differences In stroke. Cerebrovasc Dis 2008; 26: 462-474.
17. Ng WK, Goh KJ, George J, Tan CT, Biard A, Donnan GA. A Comparative Study Of Stroke Subtypes Between Asians And Caucasians In Two Hospital-based Stroke Registries. Neurol J SEA 1998; 3: 19-26.
18. Sotaniemi KA, Pyktinen J, Myllyia VV. Correlation Of Clinical And Computed Tomographic Findings In Stroke Patients. Stroke 1990; 21: 1562-1566.
19. Matuja W, Janabi M, Kazema R, Mashuke D. Stroke Subtypes In Black Tanzanians: A Retrospective Study Of Computed Tomography Scan Diagnosis At Muhimbili National Hospital, Dares Salam. Trop Doct 2004; 34(3): 144-146.
20. Keir S, Wardlow JM, Warlow CP. Stroke Epidemiological Studies Have Underestimated The Frequency Of Intracerebral Hemorrhage: Systematic Review Of Imaging In Epidemiological Studies. J Neurol 2002; 249: 1226-1231.
21. Ogunseyinde AO, Obajimi MO, Fatunde OJ. Computed Tomographic Pattern Of Stroke In Children With Sickle Cell Anaemia In Ibadan. Afr J Med Sci 2005; 34(2): 115-8.
22. Sacco RL, Benjamin EJ, Broderick JP, Dyken M, Easto D, Feinberg WM, et al. Public Health Burden Of Stroke. Stroke 1997; 28: 1507-1517.
23. Njoku CH, Aduloju AB. Stroke In Sokoto, Nigeria: A Five-year Retrospective Study. Ann Afr Medicine 2004; 3(2): 73-76.
24. Brown RD Jr, Whisnant J, Sicks J, O'Fallon W, Wiebers D. Stroke Incidence, Prevalence And Survival. Secular Trends In Rochester, Minnesota Through 1989. Stroke1996; 27: 373-380.