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**RESEARCH ARTICLE**

# Evaluation of Pattern of Lesions Depicted on Brain Computed Tomography (CT) of Patients Presenting with Stroke in a Tertiary Hospital in Northern Nigeria

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## *Abstract*

**OBJECTIVE:** This study was aimed at determining the lesions depicted on brain CT scan of stroke patients with its associated sex and age distribution.

**METHODS:** A retrospective cross sectional study was conducted reviewing brain CT scan reports of patients with stroke that were referred for brain CT scan in radiology department of Federal Teaching Hospital Gombe for a period of 16 months from January 2013 to April 2014. Data was collected using a data capture sheet with columns for; Date of examination, CT number, Age, Sex, Request and Findings. Data were generated using 16 slice Philips Brilliance CT scanner (model 453567023331, serial no 1597: USA), and analyzed using Microsoft excel 2010, where descriptive statistic such as, Mean, Standard deviation, Percentages and Frequencies were generated

**RESULTS:** A total of 121 brain CT scan results of patients were reviewed. About 76 (62.80%) males and 45 (37.20%) females, with age ranged from 14-87 years, mean age of 54 year±15. More males were affected with male to female ratio of 1.7:1, and the most common lesions depicted were cerebral infarction (55.40%) followed by cerebral atrophy (26.40%) and the least were Cerebral edema and Cerebella infarction with 0.8% and 1.70% respectively, normal studies were observed in 3.30%.

**CONCLUSSION:** This study revealed that males are mostly affected than females with male to female ratio of 1.7:1, and cerebral infarction and atrophy are the commonest lesions, while cerebral edema and lacuna infarction were the least, with 61-70 years as the mostly affected age group.



## INTRODUCTION

Stroke is a major public health problem worldwide and it is the third leading cause of death in industrialized countries and ranks among the five most common causes of hospital deaths in adults in Africa[1]

The population of Nigerians that suffer stroke is on the increase, recent hospital statistics suggests that more than 160,000 Nigerians develop stroke yearly[2], but literature regarding the pattern of lesions depicted in CT brain of patients presenting with stroke in this locality are insufficient.

There is need for improved stroke data collection in developing nations like Nigeria, in order to elucidate the relevant factors magnitude and trends in stroke in these nations[1].

Imaging of suspected stroke cases is an important topic to all emergency physicians, neurologists, neurosurgeons, neuroradiologist and radiographers. Computed tomography (CT) has revolutionized the assessment of patients who present with an acute neurologic deficit with the head CT scan now playing an integral role in the screening and treatment of stroke patients (Hacke 1995). Currently in the United States, noncontrast computed tomography (CT) remains the primary imaging modality for the initial evaluation of patients with suspected stroke[3].

Computed tomography (CT) is an imaging modality that uses x-ray and special detectors to produce cross sectional images of the body, through mathematical reconstruction of attenuation measurement taking through a single axis of rotation[4].

Computed tomographic (CT) images of the brain are produced by scanning a collimated beam of x-rays through the brain in thin, sequential slices. The x-ray output is counted, analyzed, and reconstructed for clinical interpretation (South Med J. 2003). Brain CT scans are typically requested for many different symptoms such as headache, weakness, dizziness to exclude a tumor, aneurysm or infarction or as a follow up test for patient with stroke, bleeds, or surgery among others[5].

CT scans are relatively inexpensive compared with MRI and PET scanning; they give accurate, 3-dimensional data including attenuation information, rapid acquisition of data and no need for patients to remain for planning process, 4-dimensional data acquisition is possible using gating technology. However, it is associated with some disadvantages, like high dose of ionizing radiation per scan (increased for 4-D imaging), prone to artifacts due to patient movement, contrast required for certain structures, particularly vessels, and some people may have an anaphylactic response to intravenous contrast, which may occasionally be fatal[6].

The study aims at evaluating the pattern of lesion depicted on CT brain of patients presenting with stroke and their distribution based on gender and age in Federal Teaching Hospital Gombe.

## Materials and Methods

A retrospective cross sectional study was conducted reviewing brain CT scan reports of patients with stroke that were referred for brain CT scan in radiology department of Federal Teaching Hospital Gombe for a period of 16 months from January 2013 to April 2014. Data was collected using a data capture sheet with columns for; Date of examination, CT number, Age, Sex, Request and Findings. Data were generated using 16 slice Philips brilliance CT scanner (model 453567023331, serial no 1597: USA), using 250 Kvp and 300 mAs scanning from 4$^{th}$ cervical spine (C4) to the vertex of the head. Approval for the study was obtained from ethical clearance committee of the hospital. Data was analyzed using Microsoft excel 2010, where descriptive statistic such as, Mean, Standard deviation, Percentages and Frequencies were generated.

## Results

A total of 121 brain CT scan results of patients presenting with stroke were reviewed. The study group consisted of 76 (62.80%) males and 45 (37.20%) females, with age ranged from 14-87years, with mean age of 54 years±15. The age group most affected was 61-70 years with 33 (27.30%), with 22 (18.20%) males and 11 (9.10%) females, while the least were within the age group of 81-90 years having 3 (2.50%) with 2 (1.70%) males and 1 (0.80%) female (Table 1).

The most frequently observed clinical history were left side body weakness in 40 (33.10%) and right side body weakness in 31 (25.60%) while the least were haemorrhagic head injury and cortical blindness accounting for 2 (1.70%) and 1 (0.80%) respectively (table 2).

The pattern of lesions depicted on brain CT scan were; cerebral infarction and cerebral atrophy were the most occurring lesions with 67(55.40%) and 32 (26.40%) respectively, while Lacuna infarction and Cerebral edema were least with 2 (1. 70%) and 1 (0.80%) respectively and Normal studies were 4 (3.30%) (Table 3).

Pattern of findings and their corresponding age ranges shows that only cerebral infarction and cerebral atrophy were lesions found in all the age groups. Patients between the age group of 61-70 years having frequency of 20 and 10 each as the highest in cerebral infarction and cerebral atrophy respectively. Other lesions were not seen in some age groups. Lacuna infarction and cerebral edema were seen only among age groups of 61 to 70 years and 31 to 40 years only (Table 4).

Pattern of findings in relation to sex, shows that Males with 76 (62.80) were more commonly affected than Females with 45 (37.20%), normal studies had 2 (1.70%) in both sexes and cerebral edema was found in females only with 1 (0.80%) (Table 5).

**Table 1: Age and Sex distribution of participants**

| Age range | Male | % | Female | % |
|---|---|---|---|---|
| 11-20 | 2 | 1.70 % | 2 | 1.70 % |
| 21-30 | 6 | 5.00 % | 3 | 2.50 % |
| 31-40 | 6 | 5.00 % | 9 | 7.40 % |
| 41-51 | 11 | 9.10 % | 8 | 6.60 % |
| 51-60 | 16 | 13.20 % | 9 | 7.40 % |
| 61-70 | 22 | 18.20 % | 11 | 9.10 % |
| 71-80 | 11 | 9.10 % | 2 | 1.70 % |
| 81-90 | 2 | 1.70 % | 1 | 0.80 % |
| Total | 76 | 62.80 % | 45 | 37.20 % |

**Table 2: Distribution of patient's clinical history/information**

| **Clinical history** | **Frequency** | **Percentage (%)** |
|---|---|---|
| Generalized body weakness | 12 | 9.90 |
| Right side body weakness | 31 | 25.60 |
| Left side body weakness | 40 | 33.10 |
| Inability to use the right side of the body/paralyses | 10 | 8.30 |
| Loss of /slowed speech or inability to talk | 8 | 6.60 |

| | | |
|---|---|---|
| Unconsciousness/ Convulsion/seizure | 12 | 9.90 |
| Dementia/mental retardation | 5 | 4.10 |
| Head injury? haemorrhagic stroke | 2 | 1.70 |
| Cortical blindness | 1 | 0.80 |
| **Total** | **121** | **100.00** |

**Table 3: Pattern of lesions depicted on Head CT scan of patients presenting with stroke**

| Lesions | Frequency | Percentage (%) |
|---|---|---|
| Cerebral infarction | 67 | 55.40 |
| Cerebral atrophy | 32 | 26.40 |
| Lacuna infarction | 2 | 1.70 |
| Cerebral edema | 1 | 0.80 |
| Cerebella infarction | 3 | 2.50 |
| Intracerebral haemorrhage | 9 | 7.40 |
| Intraventricular haemorrhage | 3 | 2. 50 |
| Normal studies | 4 | 3.30 |
| **Total** | **121** | **100.00** |

**Table 4: Pattern of lesions depicted in relation to age.**

| Age range | Cerebral infarct | Cerebral atrophy | Lacuna infarct | Cerebral edema | Cerebella infarction | Intracerebral haem. | Intraventricular haem. | Normal |
|---|---|---|---|---|---|---|---|---|
| 11-20 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| 21-30 | 4 | 1 | 0 | 0 | 1 | 2 | 0 | 1 |
| 31-40 | 9 | 1 | 0 | 1 | 0 | 3 | 0 | 1 |
| 41-50 | 14 | 3 | 0 | 0 | 0 | 0 | 2 | 0 |
| 51-60 | 15 | 5 | 0 | 0 | 1 | 4 | 0 | 0 |
| 61-70 | 20 | 10 | 2 | 0 | 1 | 0 | 0 | 0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 71-80 | 3 | 9 | 0 | 0 | 0 | 0 | 1 | 0 |
| 81-90 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 67 | 32 | 2 | 1 | 3 | 9 | 3 | 4 |

**Table 5: Pattern of lesions depicted in relation to sex**

| Lesions | Sex | | | |
|---|---|---|---|---|
| | Male | (%) | Female | (%) |
| Cerebral infarction | 42 | 34.70 % | 25 | 20.70 % |
| Cerebral atrophy | 18 | 14.90 % | 14 | 11.60 % |
| Lacuna infarction | 2 | 1.70 % | 0 | 0.00 % |
| Cerebral edema | 0 | 0.00 % | 1 | 0.80 % |
| Cerebella infarction | 2 | 1.70 % | 1 | 0.80 % |
| Intracerebral haemorrhage | 8 | 6.60 % | 1 | 0.80 % |
| Intraventricular haemorrhage | 2 | 1.70 % | 1 | 0.80 % |
| Normal studies | 2 | 1.70 % | 2 | 1.70 % |
| Total | 76 | 62.80 % | 45 | 37.20 % |

## DISCUSSION

Medical imaging plays an important role in the evaluation of brain abnormalities. CT represents one of the most important and commonly used imaging modality[7], as seen in this study with only 4 (2.4%) negative findings and 117 (96.70%) positive findings.

Out of about 121 brain CT scan results were evaluated, 76 (62.80%) were males and 45 (37.20%) females with male to female ratio of 1.7:1. This is similar to the findings of Eze et al.[8], where 66.70% of subjects were males and 33.30% were females, and Nwosu[1] who reported that for every 3 female stroke patients there are approximately 5 to 4 males. This may be due to the high risk behaviors like smoking and alcoholism among others that may predispose them to conditions like hypertension, and post traumatic stroke, although, the female folks may not be completely exonerated from some of this risky behaviors as well.

The most commonly affected age groups were 61-70 years and 51-60 years in both sexes. This agrees with the National Stroke Association (2014), who stated that, most stroke cases occur in people aged over 65 years, and also agrees with the findings of Nwosu[1] who reported that in industrialized countries of Europe and North America, half of stroke cases occurs before the age of 75 years, while in developing countries like Southeast Asia and Africa, the peak age is 1 to 2 decades earlier than in the industrialized countries. This may be due to preventable circumstances such as ignorance, undetected and poorly-managed conditions like hypertension, diabetes, inadequate health care facilities, poor socio-economic factors, racial factor, and poor health-seeking behavior among others.

Cerebral infarction and cerebral atrophy were the most common lesions found, this is similar with the findings of Kahn et al.[9] in two teaching hospitals one in US and one in Canada to determine the result of CT examination of the

head in patients with non traumatic headache where they find out that chronic abnormalities such as infarction and cerebral atrophy were the most significant findings. However, cerebral atrophy was most frequent in the elderly patients whose age ranges between 51 to 80 years, this tally with a statement by Khalil[10] that the generalized cerebral atrophy is routine concomitant of the aging process and is a normal finding in elderly, increasing with age, as found in this study. Also, Petrovitch[11] reported even though stroke is common among the aged over the sixth decade of life, it also occurs in babies as well. This implies that cerebral infarction and atrophy were the major causes of stroke in the location of study and were more predominant among the elderly over the fifth decade of life.

Intracerebral haemorrhage was found in 9 (7.40%), and 4 (3.30%) cases were reported normal this may be due to limited ability of CT to identify primary intracerebral haemorrhage and haemorrhagic transformation which is in accordance with a research by Wardlaw et al.[12] to determine the proportion of haemorrhagic strokes misdiagnose as infarcts on CT in patients with mild stroke, 228 were recruited prospectively and underwent detailed clinical examination and brain imaging using CT and MRI, primary intracerebral haemorrhage was identified by CT in two patients (0.9%) and MRI in eight (3.5%). Haemorrhagic transformation was identified by CT in three patients (1.3%) and MRI in fifteen (6.6%). CT failed to identify 75% of primary intracerebral haemorrhage, equivalent to 24 patients per 1000 with mild strokes.

Cerebella infarction and interventricular haemorrhage were observe in three (2.50%) each, while lacuna infarction and cerebral oedema were two (1.70%) and one (0.80%) respectively. These findings are similar to what most literature reviewed reported Chiewvit et al.[13] The heterogeneity in stroke is related to variations in the prevalence of risk factors in different populations and populations segments. Age, sex, racial/ethnic, and genetic factors are largely unmodifiable and account for persistence of differences in stroke incidence after adjusting for the modifiable factors.

In the passing decade there was a progressive decline in stroke incidence in industrialized nations largely attributable to multifaceted intervention strategies directed at hypertension, diabetes mellitus hyperlipi-deamia, dietary, alcohol and hard drug habits, cigarette smoking, and level of physical activity. The overall health status of various communities and the level of infections control are probable significant contributors to stroke occurrence whose roles require better definition Nwosu[1]. Hence, there is need for improved stroke data collection in developing nations like Nigeria in order to elucidate the relevant factors, magnitude and trends in stroke in developing nations.

## CONCLUSION

Findings from this study revealed that males are mostly affected than females with male to female ratio of 1.7:1, and cerebral infarction and atrophy are the commonest lesions, while cerebral edema and lacuna infarction were the least, with 61-70 years were the age group most affected by stroke in our study.

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