Stroke mortality and its predictors in a Nigerian teaching hospital

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Abstract

Background: Stroke is the third leading cause of death worldwide. Stroke mortality has been noted to be higher in blacks in biracial studies. There have been few studies on stroke mortality and its predictors in Nigeria. This study examines mortality of stroke and its predictors in a Northern Nigerian teaching hospital.

Methods: This was a prospective study that was carried out at Jos University Teaching Hospital in Nigeria. One hundred and twenty stroke patients admitted into the medical wards within one year were assessed. Demographic data was recorded. Patients were examined and ancillary investigations were carried out. The deaths and predictors were recorded. Multivariate logistic regression was used to identify independent predictors of mortality.

Results: There were one hundred and twenty participants. Forty two (35%), patients died. Most (76.2%) deaths occurred within the first week. Predictors of mortality on univariate analysis were age $\geq$ 60 years, male sex, loss of consciousness, high NIHSS score ($\geq$16), the presence of co-morbid conditions and presence of complications. On multivariate analysis, the predictors of mortality were the presence of co-morbid conditions, GCS<10 and high NIHSS score.

Conclusion: Stroke mortality was quite high in this study. Predictors of mortality were the indices of severity and the presence of co-morbid conditions.

Key Words: Co-morbid conditions, Level of consciousness, Mortality, National Institute of Health Stroke Scale (NIHSS score), Predictors, Stroke

Introduction

Stroke is one of the major public health problems in the world today[1]. It is the third leading cause of death worldwide after ischaemic heart disease and cancer[2]. Most of these stroke deaths are found in the developing countries. The deaths in these countries account for as much as 87% of all the stroke deaths[3]. This high death toll is even more in Sub Saharan Africa. Nigeria, the country where this study was carried out is a sub Saharan African country.

Epidemiological studies have identified risk factors for stroke for some years. These are classified into the non-modifiable and the modifiable risk factors. The non-modifiable risk factors are older age, male gender, black race and family history. The commonest modifiable risk factor is hypertension. Other common risk factors are diabetes mellitus, central obesity, dyslipidaemias, cardiac disorders, vasculitis, heavy alcohol consumption and cigarette smoking[4].

Additional well recognized risk factors are Sickle cell disease, oral contraceptives, vasculitic lesions and hypercoagulable states[4]. More recently, HIV and hyperhomocysteinaemia have been noted as novel risk factors for stroke[5]. The commonest risk factor in Nigeria remains hypertension[6-8]. Others notable risk factors in Nigeria are Diabetes mellitus[6,7], central obesity[6] previous stroke , cardiac disease and HIV[6].

Blacks have been shown to have a large burden of stroke. Similarly, there are more severe strokes seen in the blacks than in other races. Mortality is also noted to be higher in blacks than other races. These differences in the burden, severity and mortality of stroke are seen even in biracial studies[9,10]. The case fatality rate of stroke in Africa is about 35% but could be as low as 14.9% or as high as 77% when due to cerebral haemorrhage[11]. In Nigeria, mortality rates are very high with a range of 21%- 45%[7,8,12-14] It is worthy of note that most of the dead patients in the Nigerian studies died within the acute phase[7,12]. Morbidity and mortality after stroke have been shown to arise from complications. Post-stroke complication is a leading cause of death accounting for 23-50% of total deaths in patients with ischaemic stroke. These include both medical and neurological complications[15]. Neurological complications frequently account for the worsening seen during the acute phase[16].

Predictors of stroke mortality have been identified in different studies. Older age (age>60 years) has been shown to be a predictor of mortality[17]. This however was not the case in another study[18]. Likewise, the effect of sex on the outcome of stroke is varied. Some studies have noted that females have increased mortality and a lower one year survival[19]. While another study noted male sex to be a poor predictor[18]. There was yet another study that had an inconclusive result[20].

Stroke mortality is an important outcome measure in stroke epidemiology studies and clinical trials. Data on stroke mortality therefore are critical for monitoring disease trends and planning public health interventions. The knowledge acquired in this study concerning the predictors of mortality will be of use in the management of patients more especially in the emergency services in acute stroke. This will lead to a reduction in stroke mortality and further disability.

Not much is known about mortality of stroke and its predictors in the northern part of Nigeria. This is because there have not been many studies in this part of the country on stroke mortality hence there is gap in knowledge of the predictors of mortality. Management of stroke therefore is arbitrary at its worst. At best, it is based on studies with conclusions from other localities. Furthermore, the limited studies carried out in Nigeria (mostly the western part) were mostly retrospective and hence were hampered by incomplete data[7,8,13]. We therefore undertook this prospective study to examine the mortality of stroke in a city in Nigeria. The end points are the case fatality and the predictors of mortality. . The knowledge gained from this study will be of immense help in the in hospital care of stroke patients with a consequent reduction in stroke mortality. It will also be of use in health planning and promotion in my country Nigeria.

Methods:

This was a prospective study carried out in the Jos University Teaching Hospital (JUTH) in Nigeria to examine stroke mortality and its predictors. Jos is the capital of Plateau state in located in the North central Nigeria. This hospital serves as the referral centre in the state and also for nearby states in North central Nigeria. Being a teaching hospital, the hospital already had all the major clinical departments at the time of the study. The department of internal medicine where the study was carried out had several sub specialties/units at the time of the study. These are neurology, endocrinology, gastroenterology, cardiology, nephrology, respiratory, infectious disease. There was no stroke unit in the hospital hence all stroke patients were managed in the general medicine wards. Other special services in internal medicine services include dialysis services, HIV services, special tuberculosis care, endoscopy, and special diabetes care. There was a physiotherapy department which catered for patients who had need of rehabilitation like stroke survivors. The radiology department at the period of study had no available neuro imaging services. A Computed Tomography (CT) scan has since been installed. The study was carried out between January and December 2006.

The participants were one hundred and twenty patients who were admitted into the medical wards of the hospital with stroke. Stroke was defined as" rapidly developing signs of focal or global neurological disturbance of function leading to death or lasting longer than 24 hours with no other cause other than vascular"[23].

The sample size was determined by the Beneth's formula [24]:

$$N = \frac{(Zi - a)^2 (p)(1-p)}{d^2}$$

N is the minimum sample size while P is the best estimate of stroke prevalence from literature review as expressed as a fraction of 100.The community prevalence in Nigeria varies, but the earliest prevalence is 58/100,000 11 hence, 0.58 was used. Zi – a is a constant as 95% confidence interval for two -tailed descriptive studies (1.96) while d is the absolute precision that is value (in percentage points) which in actual terms describes the maximum difference between the population rate and the sample rate that can be tolerated. Five

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(5%) translating to 0.1 was adopted for this study. Minimal sample size was ninety three (93). However allowing for attrition a total of one hundred and twenty (120) patients were recruited for the study.

All consecutive patients with acute stroke who were more than 16 years and gave an informed consent were recruited for the study. The diagnosis was made clinically. Patients, who presented later than one week after the stroke, had transient ischaemic attack or head trauma were excluded. The 'WHO (World Health Organization) criteria' was used to sub type the stroke. Few patients, however, who could afford CT scan in the nearby centers, were confirmed by same to validate the diagnosis.

The history was taken from the patient and/or relatives in the language they understand. Components of the history included the demographic variables, history of stroke, past medical history, family and social history. All the patients had their blood pressure measured using the mercury sphygmanometer available in the medical wards. Signs of longstanding hypertension and cardiac disease like displaced heaving apex beat, fourth heart sounds, loud A_2 were noted. The Littman's stethoscope was used for auscultation.

The patients had a full neurological examination and the NIHSS score was recorded. The NIHSS stroke scale is an objective clinical tool used in the evaluation of stroke severity. The scale is designed to be simple and reliable. It comprises 15 items of neurologic examination. Neurological domains assessed are levels of consciousness, language, neglect, visual field loss, extra ocular movement, motor strength, ataxia, dysarthria and sensory loss. The lowest score for each parameter is 0 and the highest may be 2, 3 or 4. Persons with a low score have less severe strokes while those with a high score have more severe strokes. High NIHSS score therefore signifies severe stroke. It has been shown to be the best predictor of outcome. A sum of ≥16 forecasts a high probability or severe disability and a score of <16 forecasts good recovery[22].

Investigations done included fasting blood glucose which was assessed with the Neurology unit's Acucheck© glucometer. Patients had (Electrocardiogram) ECG either on their bed or taken to the ECG room. Computed tomography scan was not available in JUTH as at the time of the study. Patients however were sent to nearby centers. Most could still not go because of cost and distance.

The data collected was recorded onto a spreadsheet of Microsoft excel and analyzed using SSPS version 20 statistical package. Descriptive statistics was used for demographic variables. Chi square (x2) statistics was used to analyse the categorical variables. Fisher's exact test was used when there were cells less than five (<5). The p value of <0.02 was considered significant. Logistic regression was used to analyze the predictors of mortality. Univariate analysis was used for each of the individual variables that were identified as possible predictors of mortality. The identified predictors on univariate analysis were subjected to multivariate logistic regression. Ethical approval was obtained from the ethical committee of the hospital. An informed consent was obtained from the patients and where not possible, from a responsible caregiver.

Results

The results of the study are as hereby reported. There were one hundred and twenty patients who completed the study. These included 74(61.7%) males and 46(38.3%) females (Table 1).

Table 1:   Age and Sex Distribution of Patients with Stroke

AGE (Years)	MALE (%)	FEMALE (%)	TOTAL
<40	11(57.9%)	8(42.1%)	19
40-49	11(55%)	9(45%)	20
50-59	18(62.1%)	11(37.9%)	29
60-69	15(57.7%)	11(42.3%)	26
>70	19(73.1%)	7(26.9%)	26
TOTAL	74(61.7%)	46(38.3%)	120

The age range was 18-85 years with a mean of 55±15.2 years. The commonest risk factor was hypertension with as many as 70% having a prior diagnosis of hypertension while 78.3% had elevated blood pressure on admission. Other common risk factors noted were central obesity and diabetes mellitus (Table 2).

Table 2: All identified risk factors

Risk Factor	Male	Female	Total
Hypertension	58(61.7%)	36(38.3%)	94(78.3%)
Obesity	43(58.9%)	30(41.1%)	73(60.8%)
Diabetes Mellitus	24(63.2%)	14(36.8%)	38(36.7%)
Previous stroke	20(76.9%)	6(23.1%)	26(21.7%)
Cardiac disease	2(40%)	3(60%)	5(4.2%)
HIV/AIDS	2(50%)	2(50%)	4 (3.3%)
Sickle cell disease	2(100%)	0(0%)	2(1.7%)
Malignancy	1(100%)	0(0%)	1(0.85%)

Forty two (35%) patients out of the one hundred and twenty died. Thirty two (76.1% of the dead and 26.7% of all the stroke patients) died within the first seven days. Eight more patients died by the end of 30 days taking the death toll to forty persons (95.2% of the dead and 33.3% of all the stroke patients). The last two died by the end of the three months of observation.

Predictors of mortality on univariate analysis were age ≥ 60 years, male sex, level of consciousness <10 and NIHSS score ≥ 16. There were fifty two patients who were more than 60 years. Twenty four (46.2%) of these patients died and twenty eight (53.8%) survived. Sixty eight patients were less than 60years. Eighteen (26.5%) of these patients died while fifty (73.5%) of them survived. (p=0.001).

Thirty one (41.9%) out of the seventy four men died while forty three (58.1%) survived. Eleven (23.9%) of the forty six women died while thirty five (76.1%) survived (p=0.047).

The level of consciousness was assessed with the Glasgow coma scale. The Glasgow coma score was <10 in twenty nine (24.2%) patients and ≥ 10 in ninety one (75.8%) patients. As much as twenty (69%) of the twenty nine patients with a GCS <10 died while only nine (31%) survived.

Of the ninety one patients who had a GCS score ≥ 10, twenty two (24.1%) died while as many as sixty nine (75.9%) survived (p<0.001).

The NIHSS score was < 16 (low) in sixty four (53.3%) patients and ≥16 (high) in fifty six (46.7%) patients. Eight (12.5%) of the sixty four patients with a low NIHSS score died while fifty six (87.5%) survived. Meanwhile, thirty four (60.7%) of the fifty six patients with high NIHSS score died while twenty two (39.3%) survived (p<0.000).

There were twenty patients who had other comorbid conditions (Table 3).

Fourteen (70%) of them died and only six (30%) sur-

Table 3: Co morbid factors that were predictors of mortality on univariate analysis

	Alive	Dead	Total
NKHS	0(0%)	4(100%)	4
CKD	0(0%)	4(100%)	4
HIV	2(50%)	2(50%)	4
MI	1(50%)	1(50%)	2
CHEST	1(50%)	1(50%)	2
CCF	0(0%)	1(100%)	1
DEPRESSION	0(0%)	1(100%)	1
RHEU	1(100%)	0(0%)	1
SCHIZOPHRENI	1(100%)	0(0%)	1
TOTAL	6	14	20
P<0.01			

vived. All the four (100%) patients with non-ketotic hyperglycaemic state died. All the four (100%) patients with chronic kidney disease died. Two patients (50%) out of the four patients with HIV/AIDS died. One (50%) of the two patients with myocardial infarction died. One (50%) of the two patients with a chest in-fection died. The patient with congestive cardiac failure and the patient with depression also died. One hundred others had no comorbidities. Twenty eight (28%) died while the remaining seventy two (72%) survived (p=0.001). Sixteen patients had different complications (Table 4).

Table 4: Complications that were predictors of mortality on univariate analysis

	Alive	Dead	Total
Decubitus ulcer	1(20%)	4(80%)	5
Pulmonary embolism	0(0%)	2(100%)	2
Asp Pneumonitis	0(0%)	2(100%)	2
UTI	3(100%)	0(0%)	3
DVT	1(100%)	0(0%)	1
Hypocalcaemia	0(0%)	1(100%)	1
Dysphagia	0(0%)	1 (100%)	1
Burns	0(0%)	1(100%)	1
Total	5	11	16

P = 0.003

Eleven of these patients (68.8%) died, while the remaining five (31.2%) patients survived. Four (80%) of the five patients who had decubitus ulcers died. The two (100%) who had pulmonary embolism and two (100%) others with aspiration pneumonitis also died. Other patients who died were the patients who had dysphagia, burns, and hypocalcaemia. None of the three patients who had urinary tract infection died. One hundred and four patients did not develop any complications. Thirty one (29.8%) of these patients died and seventy three (70.2%) survived (P=0.005). Fever, fasting plasma glucose ≥ 10mmols/L, type of stroke, educational status and previous stroke were not predictors of mortality on univariate analysis. On multivariate analysis, the predictors of mortality were presence of comorbid factor, GCS < 10 and high NIHSS score (Table 5).

Table 5: Multivariate regression showing independent predictors of mortality in logistic stroke patients

	Univariate analysis Odds ratio (95% CI) p – value	Multivariate analysis Odds ratio (95% CI) p – value
Age ≥60 years	2.38 (1.11 – 5.12) 0.03	0.86 (0.20 – 3.66) 0.84
Male sex	2.29 (1.01 – 5.21) 0.047	1.43 (0.29 – 7.10) 0.66
GCS <10	18.75 (5.08 – 69.20) <0.001	10.37 (1.23 – 87.57) 0.03
NIHSS score ≥16	7.98 (3.13 – 20.28) <0.001	6.22 (1.08 – 35.82) 0.04
FPG≥10mmols/L	2.32 (0.79 -- 6.74) 0.12	2.58 (0.42—16.08) 0.31
Presence of comorbidity	6.00 (2.10 – 17.17) 0.001	7.44 (1.29 – 42.71) 0.02
Presence of complications	5.18 (1.66 – 16.15) 0.005	3.35 (0.59 – 2.98) 0.17

Discussion:

We showed that stroke mortality was high in this study. There were a total of one hundred and twenty patients. Forty two of these patients died. This gave a case fatality rate of 35% which is quite high. It is important to note that most of these dead patients 32 (26.7%) died within the first week. The first two weeks after the stroke comprise the acute phase. We therefore showed that the acute period is the critical period for patients with stroke. Interventions to reduce stroke mortality would be best targeted at the acute phase. Morbidity and mortality after stroke usually arise from complications. These include both medical and neurological complications. The neurological complications that have been described include brain edema, haemorrhagic transformation, seizures, delirium and recurrent stroke[15] .

These complications are said to be less frequent than the medical complications. They however occur earlier (within 48-72 hours after the stroke) than the medical complications and are known to affect outcomes with potential short-term and long-term consequences[15]. In our study however, it was unfortunate that the cause of death was not recorded in our dead patients. Thus the cause of death in our patients could not be determined but in some cases was presumed to be the complicating illness. Further studies will attempt to bridge this gap in knowledge. The prevention of these acute neurological complications will be paramount in reducing this high mortality. When this is not possible, early detection and proper management could be effective in reducing an adverse outcome.

The death toll in this study continued after the first week getting to forty (95.2% of the dead and 33.3% of all the participants) by the end of thirty days. The corollary is that even after the acute period, the mortality continues albeit at a lower rate. The first factor contributing to the overall high mortality seen in our study will be that of absence of first rate and effective care. All the patients in this study had only supportive care which was not optimal. Stroke was an untreatable disease until recently. The vital intervention needed was made possible in 1995 when the National Institute of Neurological Disorders and stroke (NINDS) recombinant tissue plasminogen activator (rt-PA) stroke study group first reported that the early administration of rt-PA benefited some carefully selected patients with acute ischaemic stroke[25].Owing to this breakthrough study and the successful use of rt-PA, stroke has become a treatable disease. Thrombolytic drugs are commenced within three hours in acute ischemic stroke. Patients with haemorrhagic stroke may require neurosurgical interventions. These medications (thrombolytic agents) and neurosurgical procedures are not available in not just in the study center but generally in our practice in Nigeria. These accounted immensely for sub optimal care to a large extent. The fear then is that this high mortality will continue if measures are not taken to provide optimal care for stroke patients. This high mortality we found in our study is comparable to what has been found in similar studies all over Africa where case fatality averages 35%[11] and in Nigeria[8, 12,13]

Another factor that contributed to the high mortality is the cost of care. The majority of the patients who participated in this study catered for all their own health bills. The per capita income in Nigeria is low. This makes even the available services and medications exorbitant for the common man. Only few of these patients (civil servants) have health insurance which took care of some of their bills. Widespread use of health insurance to lift the financial burden of care off our patients will be of great benefit to our patients. The absence of a dedicated stroke unit with the paucity of trained stroke experts in the study center and other centers in the country generally are other factors that further influenced the care received by the patients and eventual outcome.

Furthermore, stroke is generally believed to be a spiritual disease in the study city and in Nigeria as a whole. It therefore follows that some persons with stroke seek care elsewhere initially and if they subsequently present to the hospital, will come late. Some of these late presenters already have complications which will lead to a further rise in mortality. There are also some cases where the patient is withdrawn from the hospital against medical advice. Some of these patients are taken to churches or traditional healers for treatment and are eventually lost to follow up.[7] The high mortality recorded in this study may therefore just be the tip of the iceberg since. This ignorance has another facet apart from poor health seeking behaviour of our patients. Some of these patients were ignorant of the possible risk factors as they were unaware of their blood pressure measurement. What more, some patients with modifiable risk factors like hypertension and Diabetes mellitus are not compliant with their medications. Again the lack of necessary funds is a contributing factor to the poor compliance.

Finally, the inaccessibility to the health care facility especially in the rural areas was another factor in our study since a good number of our patients were not resident

in Jos(the study center). This is mainly as a result of bad roads or unavailable means of transportation. Even having after a stroke, there are no available emergency ambulance services for urgent transportation to the health care facility. There is therefore a continuum of poverty, poor health seeking behavior, poor and underdeveloped resources, noncompliance with medication, more severe strokes, lack of adequate hospital care with ensuing high mortality. In essence, proper and effective stroke care is very challenging in our practice. In the presence of these dire challenges, this high mortality rate may continue.

We also showed some independent predictors of mortality in our study. Factors found to be predictors on univariate analysis were age ≥60 years, male sex, loss of consciousness, high NIHSS score (≥16), presence of co-morbid factors and complications. Further analysis on multivariate analysis however established that high NIHSS score, the presence of comorbidity and GCS< 10 were the predictors of mortality.

NIHSS score is a measure of stroke severity. It means that 'the higher the score, the more severe the stroke'. The inference is that in this study, our more severely affected patients were the ones that died. Reducing then severity of stroke will therefore be paramount in curtailing this high mortality. High NIHSS score has been shown to be the best predictor of outcome in stroke patients. High NIHSS score as a predictor of mortality, is consistent with what has been shown in another Nigerian study[14].

Another predictor of mortality on multivariate analysis was the presence of comorbid conditions. The impact of these co-existing medical conditions on mortality was enormous. The common co morbid factors noted in this study were Non Ketotic hyperglycaemic state (NKHS), chronic kidney disease, HIV infection and myocardial infarction. All the patients who had either NKHS or CKD died. It is also noted that 50% of the patients who had either HIV, myocardial infarction or chest infection died. Comorbid conditions have been found to be predictors in some other studies[26].

The level of consciousness was the final predictor of mortality. Patients who had a lower GCS were more likely to die. These were unarguably the more ill patients. Similar finding was noted in a previous Nigerian study[14]. It is important to note that the GCS is a component of the NIHSS score whose significance has

been discussed earlier.it therefore contributed remarkably to the severity of the stroke.

The post stroke medical complications also contributed to the death toll seen in our study. It is interesting to note that 80% of those with decubitus ulcers all died. All the patients who developed pulmonary embolism and aspiration pneumonitis also died. Complications surprisingly were not predictors on multivariate analysis. This is mostly because there were milder complications like urinary tract infections where all the patients survived. The contribution however of the complications on the overall morbidity cannot be over emphasized.

Investigating the patients was the greatest challenge in this study. Computed tomography scan was not available in JUTH as at the time of the study. Patients however were sent to nearby centers namely Ahmadu Bello University Teaching Hospital, Zaria, Aminu Kano Teaching Hospital, Kano and the National Hospital, Abuja. This again was hampered by the funds and distance. Further more, two of the CT scan machines broke down in the course of the study. Recently, most teaching hospitals in Nigeria have a CT scan. Stroke patients are better classified. Further studies will therefore examine the relationship between the type of stroke (CT diagnosed) and stroke mortality. Emphasis will be placed on the cause of death. The knowledge of the immediate cause of death and other contributory factors will greatly enhance our effective management of acute stroke patients.

Conclusion
Stroke mortality is very high in this study just like in most African studies. This high mortality is especially so during the acute phase. This high death toll is common in other Nigerian studies. The important predictors of mortality found in our study are the presence of comorbid conditions, NIHSS score and loss of consciousness. These are indices of severity of the disease.

Recommendations
Primary prevention measures with emphasis mainly on more aggressive control of risk factors should be of utmost importance. There should be public awareness campaigns to educate the public on the risk factors for stroke and their modifiable nature. The media, religious and community leaders could be used. This will reduce both the prevalence of stroke and the severity. There is a dire need for improved stroke care. This will include acute assessment, monitoring and investigation. Health workers that care for stroke patients need further train-

ing especially in the prevention of complications. There is a burning need to establish stroke units in tertiary hospitals across the country for proper stroke care. Better funding of the health care system will go a long way to improve the quality of care. In the absence of these, this high mortality will regrettably continue.

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