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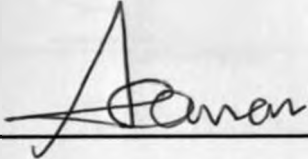
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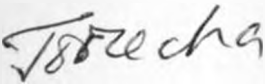
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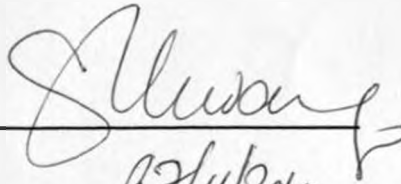
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DEDICATION

A journey of a thousand miles begins with one step.

DEDICATION

I dedicate this work to my son Daniel and wife Beatrice for their support and to all the stroke victims and their families.

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I - ABBREVIATIONS.

ADL	-	Activities of Daily Living
APC	-	Activated protein C
BIS	-	Barthel Index Score
CMV	-	Cytomegalovirus
CNS	-	Central Nervous System
CT	-	Computerized Tomography
ELISA	-	Enzyme Linked Immunosorbent Assay
ESR	-	Erythrocyte Sedimentation Rate
GCS	-	Glasgow Coma Scale
H. Pylori	-	Helicobacter Pylori
HDL	-	High Density Lipoprotein
HIV	-	Human Immunodeficiency Syndrome
ICU	-	Intensive Care Unit
IQR	-	Interquartile Range
KNH	-	Kenyatta National Hospital
LACI	-	Lacunar Infarct
LDL	-	Low Density Lipoprotein
LTFU	-	Loss to Follow-Up
MI	-	Myocardial Infarction
OCSP	-	Oxfordshire Community Stroke Project
PACI	-	Partial Anterior Circulation Infarct
PICH	-	Primary Intracerebral Hemorrhage
POCI	-	Posterior Circulation Infarct
NVAF	-	Non-Valvular Atrial Fibrillation
SICH	-	Spontaneous Intracerebral Hemorrhage.
SSS	-	Scandinavian Stroke Scale
TIA	-	Transient Ischemic Attack
TACI	-	Total Anterior Circulation Infarct
VDRL	-	Venereal Disease Research Laboratory

ACKNOWLEDGMENT

I wish to express my sincere gratitude to my supervisors Prof. Amayo, Dr Mecha and Dr Mwango and my statistician Mr. Mutai who was very patient with me up to the last minute.

Above all I would like to thank God for enabling me to complete this work. My thanks also go out to my parents for their support and encouragement.

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1. ABSTRACT

Background and Purpose- Stroke is the leading neurological cause of long-term disability. The goal of this study was to determine the case fatality, disability at 30days, and factors associated with outcome of stroke in a hospital cohort of stroke patients. The short-term outcome of stroke and factors affecting the outcome had not been adequately studied in our Kenyan population.

Objective- To determine the 30-day outcome of acute stroke of patients admitted to Kenyatta National Hospital medical wards and Intensive Care Unit.

Design -A longitudinal hospital-based study.

Setting - Kenyatta National Hospital Accident and Emergency Department, Medical Wards, and Intensive Care Unit.

Subjects -80 patients were recruited into the study.

Sampling and follow up – the patients were sampled consecutively and the 30-day outcome of death or disability was assessed.

Methods - The admission blood pressure, temperature, initial random blood sugar, HIV status, and level of consciousness were recorded. The stroke subtype was classified according to the Oxfordshire Community Stroke Project criteria. Diagnosis was done clinically and confirmed using Computer Tomography. The volume and location of intracerebral hemorrhage was assessed from the CT scan .The patients were followed up for a period of 30 days at which point the outcome of level of disability or death within 30 days of the stroke was assessed.

Data management and analyses- Statistical analysis was done using statistical package for social scientists (SPSS) version 15.0, chi-square test, student's t-test, Mann Whitney U and logistic regression to determine variables associated with stroke fatality at 30 days.

Results- 109 patients were screened between 5/8/2009 and 26/11/2009. 80 patients were recruited into the study with a CT scan of the brain done in 72 patients to confirm the stroke. This latter group was analyzed as a subgroup. The age range was 14 years to 110 years. The sex distribution was similar and the mean age of males was 56.4 years and females 58.3 years. 54.2% of the patients were admitted within a day of the stroke. The cumulative mortality at 30 days for the whole group was 45% with 60% of the deaths occurring by the ninth day after the stroke. The mean age of those who died was 65 years and for those alive was 53.9 years which was statistically significant with a $p=0.02$. The median duration to death was 9.0 days with a mean survival time of 21.3 days.

There were no differences in mortality between both sexes or stroke subtype but mortality occurred sooner in hemorrhagic stroke (at a mean number of 3 days) than in ischemic stroke (mean number 10 days) ($p=0.027$). The median volume of hemorrhage for those who died was 55.6ml. 83.3% of patients with a total anterior circulation infarct died. 93.5% of the patients died in hospital. Only 14.6% of the patients alive at 30 days were independent when scored against the Barthel stroke score. The most significant predictors of mortality was a raised blood pressure and severe loss of consciousness at the time of the stroke.

Conclusion- Stroke has a high mortality and high degree of dependency 30 days after the event. The most important determinant of mortality in this study was found to be severe loss of consciousness and elevated blood pressure at admission..

2. LITERATURE REVIEW

2.0 INTRODUCTION

2.1 Background

Stroke is defined, according to the World Health Organization (WHO), as "rapidly developing clinical signs of focal (or global) disturbance of cerebral function lasting more than 24 hours (unless interrupted by surgery or death) with no apparent cause other than of vascular origin."¹ It is classified as either hemorrhagic or ischemic. Ischemic strokes have a heterogeneous group of causes, including thrombosis, embolism, and hypoperfusion, whereas hemorrhagic strokes can be either intraparenchymal or subarachnoid.^{2,3}

2.2 Epidemiology

Stroke ranks second after ischemic heart disease as a cause of lost disability-adjusted life-years in high-income countries and as a cause of death worldwide.⁴ It is the third leading cause of death behind heart disease and cancer and the leading neurological cause of long-term disability.⁵ More than half of all stroke survivors are left dependent on others for everyday activities.⁶ The projected increase in the elderly population with improvements in life expectancy is expected to further increase stroke prevalence and the overall population burden of stroke.

Although stroke incidence and subsequent mortality have declined in recent years attributable to improved risk factor management⁵, stroke can be considered to represent a greater healthcare burden than acute coronary disease as a result of the residual disability.

Risk Factors for Stroke

The risk factors for stroke can be broadly grouped into modifiable and non-modifiable⁷ factors as explained below.

Non-modifiable risk factors for stroke.

(a) Age

Two thirds of strokes occur in persons older than 65 years and the chance of having a stroke approximately doubles for each decade of life after age 55.⁷

(b) Heredity and race.

Stroke risk is greater if a first degree relative has had a stroke. African Americans, or blacks, have a much higher risk of death from a stroke than Caucasians.⁷

(c) Sex

Stroke is also more common in men than in women with the male-to-female ratio for stroke estimated to be 1.35:1. In most age groups, more men than women will have a stroke in a given year. However, more than half of total stroke deaths occur in women. At all ages, more women than men die of stroke.⁷

Modifiable Risk Factors

(a) Prior stroke and Transient Ischemic Attack (TIA)

Transient ischemic attacks are strong predictors of stroke such that a person who has had one or more TIAs is almost 10 times more likely to have a stroke than someone of the same age and sex who has not⁷.

(b) High Blood Pressure-High blood pressure is a major risk factor for stroke⁷, and is the most important risk factor for spontaneous intracerebral hemorrhage.⁸

(c) Diabetes- People with diabetes have 2 to 4 times the risk of stroke compared to people without diabetes and is associated with high mortality.^{7,9}

(d) Carotid Artery Stenosis and Peripheral Artery Disease.

Extracranial carotid artery stenosis is one of the leading causes of ischemic stroke.^{10,11} However, in a study conducted in KNH by Mwazo et al (2007) of 126 patients with ischemic stroke, it was shown that significant carotid artery stenosis of 70% or more had a low prevalence of 1.6%.¹²

(e) Acute myocardial infarction and Congestive Cardiac Failure.

Patients with acute myocardial infarction (MI) have a general cardio embolic stroke risk of approximately 2% during the first 4 weeks. This risk is increased to 15% in patients with acute MI and left ventricular thrombus.¹³ For patients with chronic heart failure, risk of stroke increases with decreasing ejection fraction and the risk of mortality increases with the clinical severity of cardiac failure (New York Heart Association classification).¹⁴

(f) Dissections of internal carotid and vertebral arteries

The majority (85-95%) of ischemic symptoms after dissection of brain-supplying arteries are caused by emboli from the site of the dissection, while the remaining ones are due to vessel-narrowing with hemodynamic insufficiency.¹⁵

(g) Atrial Fibrillation

Patients with atrial fibrillation (AF) have a stroke risk of 4.5% per year. Patients with additional risk factors (e.g., age >75 years, recent stroke or TIA, systemic embolism, hypertension, congestive heart failure, or diabetes) have an increased stroke risk of at least 8% per year.¹⁶

(h) Thrombophilia

In patients younger than 40 years of age with cerebral ischemia of unknown origin, a search for hereditary thrombophilia is generally recommended as it can be a cause of stroke.^{17, 18}

(i) Physical inactivity and obesity.

Being inactive, obese or both increases risk of high blood pressure, high blood cholesterol, diabetes, heart disease and stroke.^{7, 19}

(j) Tobacco Use.

Smoking almost doubles a person's risk for ischemic stroke, independently of other risk factors by promoting atherosclerosis and increasing the levels of blood clotting factors, such as fibrinogen.⁷

(k) High Cholesterol Levels.

Excess cholesterol contributes to atherosclerosis. High LDL can lead to atherosclerosis and stroke.^{20, 21}

(l) Alcohol abuse.

Generally, excessive alcohol use can lead to an increase in blood pressure, which increases the risk for stroke. Excessive use of alcohol also increases the risk of intracerebral hemorrhage by impairing coagulation and directly affecting the integrity of cerebral vessels.²⁰⁻²³

(m) Sickle cell disease.

Sickle-cell anemia is the most common cause of stroke in children.²⁴

(n) HIV/AIDS

Data from developed countries confirm HIV infection as a risk factor for stroke. Several possible mechanisms have been hypothesized to account for stroke in association with AIDS, including a prothrombotic state by induction of autoantibodies and protein S deficiency or a covert HIV-induced vasculopathy, either isolated or in the context of meningitis.²⁵⁻³²

2.4 Factors affecting outcome of stroke.

1) Type, Site, and Size of Stroke.

Thirty-day case fatality rates for ischemic stroke in Western societies generally range between 10 and 17%.³³ Mortality in the first month after stroke has been reported to range from 2.5% in patients with lacunar infarcts³⁴ to 78% in patients with space-occupying hemispheric infarction.³⁵ The prognosis of complete middle cerebral artery territory stroke is very poor and can be estimated by early clinical and neuroradiological data within the first few hours after the onset of symptoms. A space-occupying mass effect develops rapidly and predictably over the initial 5 days after presentation.

Although intracerebral hemorrhage is a less frequent cause of stroke than cerebral infarction, it is more often fatal. The mortality rate at six months following a spontaneous intracerebral hemorrhage ranges from 23 to 58 percent. A low score on the Glasgow Coma Scale (Appendix D), a large volume of the hematoma, and the presence of ventricular blood on the initial CT scan are factors that have been consistently identified as predictive of a high mortality rate. Broderick et al. found that the mortality rate at one month was best predicted by determining the initial score on the Glasgow Coma Scale and the initial volume of the hematoma. In their study, patients who initially had a score of less than 9 on the Glasgow Coma Scale and a hematoma volume of more than 60 ml had a mortality rate of 90 percent at one month, whereas patients with a score of 9 or greater and a hematoma volume of less than 30 ml had a mortality rate of 17 percent^{36, 37}

2) Ventricular extension of blood

According to Qureshi et al, hemorrhage volume and ventricular extension are the best predictors of early deterioration and mortality in black Americans with SICH.³⁹ The presence of intraventricular hemorrhage, the number of ventricles containing blood, fourth ventricular blood, and intraventricular hemorrhage volume are each related to 30-day mortality.⁴⁰

3) Level of Consciousness at Time of Stroke.

The loss of consciousness at the time of the stroke and the presence of urinary incontinence within the first 24 hours after a stroke are significantly associated with increased mortality. Findings at the time of admission of impaired gag reflex, dysphagia, impaired consciousness, sensory inattention, visual field defect, expressive and receptive dysphasia, and chest infection are all significantly associated with increased mortality.⁴¹

4) Presence of Atrial Fibrillation

Stroke patients with AF are at high risk of death both at the acute phase of stroke and during the subsequent year after the first acute stroke event Minna M. Kaarisalo et al. showed that stroke patients with AF are at high risk of death both at the acute phase of stroke and during the subsequent year after the first acute stroke event.^{42,43}

5) High blood pressures at hospital admission.

Patients with acute stroke are often found to have high blood pressures at hospital admission. In a population-based sample of patients with acute stroke, eighty-five patients with intracerebral hemorrhage and 831 with ischemic disease were studied. It was found that high blood pressure in patients with impaired consciousness on hospital admission was significantly related to 30-day mortality in patients with intracerebral hemorrhage ($P = .037$) and in patients with ischemic disease ($P < .0001$).⁴⁴

6) High First-Day Mean Arterial Pressure (MAP).

According to reports by Rainer Fogelholm et al, the most important predictor of the 28-day survival was the level of consciousness on admission, followed by first-day MAP (Appendix E). Hypertension was the most important predictor of the first-day MAP, followed by age, which had an inverse effect on the MAP level.^{45, 46}

7) Presence of Hyperthermia

Reith J, Jorgensen HS et al. have showed that an association exists between body temperature and initial stroke severity, infarct size, mortality, and outcome. Mortality was lower and outcome better in patients with mild hypothermia on admission; both were worse in patients with hyperthermia. Body temperature was independently related to initial stroke severity ($p < 0.009$), infarct size ($p < 0.0001$), mortality ($p < 0.02$), and outcome in survivors (SSS at discharge) ($p < 0.003$). For each 1 degrees C increase in body temperature the relative risk of poor outcome (death or SSS score on discharge < 30 points) rose by 2.2 (95% CI 1.4-3.5) ($p < 0.002$).^{47, 48, 49}

8) Post-Stroke Hyperglycemia

Acute hyperglycemia predicts increased risk of in-hospital mortality after ischemic stroke in nondiabetic patients and increased risk of poor functional recovery in nondiabetic stroke survivors. Although confounded by other factors, such as severity of the infarct, hyperglycemia in the face of acute stroke worsens clinical outcome. Nondiabetic

hyperglycemic ischemic stroke patients have a 3-fold higher 30-day mortality rate and diabetic patients have a 2-fold 30-day mortality rate.⁵⁰

9) Age.

Stroke outcome features have been shown to be poorer in older patients, as reported by S. Olindo, P. Cabre, et al. The 30-day case fatality rate was twice as high in patients aged 85 years and above (31% versus 16.7%). Among survivors, patients aged 85 years were more dependent at 30 days than patients aged <85 years (78% versus 48%), and the disability (Rankin Scale score ≥ 3) in survivors was markedly higher (78% versus 48%; $P < 0.0001$).⁵¹

Stroke Mortality Studies in Africa

The figures from Pretoria⁵² reflect the poorer prognosis in patients with cerebral hemorrhage, as has been found in studies in developed countries; however, these findings self-fulfilling because those who died before CT were predominantly classified as having a hemorrhagic stroke. A 1-month mortality of 33% for 304 stroke patients was reported from Medunsa, South Africa,⁵³ but no breakdown into hemorrhage and infarction or follow-up details were given. In relation to studies without CT scanning, in a Harare incidence study, 96 (35%; 44 men) of the 273 patients (142 men) died within the first week, with a higher case fatality rate for women (40%) than men (31%).⁵⁴

Worldwide, comparisons are generally based on first-in-a-lifetime stroke. Depending on the age structure and health status of the population studied, 1-month case fatality varies between 17% and 34%, with an average of 24%.⁵⁵

Stroke outcome studies in Kenya.

Kwasa et al in a one-year/thirteen month prospective study of 72 patients carried out between January 1986 and January 1987 found that 46% of the patients died during the period of study while the remainder had residual neurological deficits.⁵⁶

Bahemuka et al in a 5-year retrospective study of 207 stroke patients between 1975 through 1979 found a case-fatality rate of 17% at 30 days after the stroke, with 69% of the deaths occurring in the first 10 days.⁵⁷

3- STUDY JUSTIFICATION

Stroke affects a significant proportion of our population and is responsible for a significant amount of morbidity and mortality. With the adaptation of a more Western diet and way of life, it is expected that the incidence of stroke and other adverse cardiovascular outcomes will increase. Currently, no structured prospective studies have been carried out in this region. In addition, more studies are needed on the short-term outcome of stroke and the factors affecting the outcome.

Newer risk factors of stroke have emerged such as HIV disease and studies are needed to find out if this disease has an influence on outcome. The study will also sensitize clinicians on the factors affecting stroke outcome. Data generated in this study will encourage policy makers and concerned parties in improving the management of stroke patients, and possibly set up stroke management units.

4- STUDY OBJECTIVES

a) Broad objective

1. To determine the outcome at 30 days after an acute stroke event.

b) Specific objectives

1. To determine the prevalence of infarctive and hemorrhagic stroke in the study group.
2. To determine the 30-day mortality and compare the mortality in both infarct and hemorrhagic stroke.
3. To determine the disability at 30 day using the Barthel Index Score and compare the degree of disability between infarctive and hemorrhagic stroke.
4. To determine the blood pressure, mean arterial pressure, HIV status, post-stroke hyperglycemia, initial hyperthermia, initial Glasgow Coma Scale(Appendix E), type of stroke (i.e. infarct or hemorrhage) , site and size of hemorrhage, and infarct type (according to the OCSP Classification) and outcome of stroke.

c) Secondary objective

To determine the utility of the Siriraj Stroke Score ⁶⁴ in assessing the type of stroke in our patient population.

5- METHODOLOGY

a) Study Sites.

Patients were recruited from KNH Accident and Emergency Department, medical wards and the Intensive Care Unit.

b) Study Design.

It was a prospective hospital-based study to determine the outcome at 30 days of patients with stroke in KNH.

c) Study Population.

All patients with rapidly developing clinical signs of focal (or global) disturbance of cerebral function with no apparent cause other than of vascular origin and patients with sudden alteration in consciousness.

d) Sample Size Determination.

The sample size was determined by the following formula by Fisher et al (1998);

$$n = \frac{z^2 p (1-p)}{d^2}$$

Where n = desired minimum sample size;

z = standard normal distribution value (1.96)

p = known prevalence rate for the factor of interest under study ($p = 27\%$ according to the Mortality and Recovery After Stroke in The Gambia study, Stroke 2003;34:1604-1609, Richard W. Walker et al⁴⁰)

d = the level of desired precision (0.1).

When this formula is applied at $d = 0.05$, $z = 1.96$, $p = 0.27$, $1-p = 1-0.27 = 0.73$

$$n = \frac{1.96^2 * 0.27 * 0.73}{0.05^2}$$

$$(0.1)^2$$

$$n = 75.7$$

$$= 76 \text{ patients}$$

Applying a $\pm 5\%$ LTFU (loss to follow-up) rate, a minimum sample size of 80 patients was derived. Assuming about 80% of the patients with a stroke were able to do a CT scan of the brain to confirm the lesion, a minimum of 100 patients were screened.

e) Sampling Method.

Patients were sampled serially on a daily basis for a period of four months.

f) Inclusion Criteria

1. A signed informed consent form by the patient or guardian.
2. Clinical diagnosis of a first-ever stroke.
3. Age of 13 years and above.
4. The stroke event must have occurred within 3 days prior to presentation to the hospital.

g) Exclusion Criteria.

Patients with other causes of neurological deficits such as TIAs, cerebral tumors (primary or metastatic), the presence of subdural hematoma, post-traumatic lesions, sub-arachnoid hemorrhage, post-seizure palsies or states, or traumatic lesions.

h) Case Definitions.

- i. **Stroke** was defined according to the World Health Organization (WHO) definition as "rapidly developing clinical signs of focal (or global) disturbance of cerebral function lasting more than 24 hours (unless interrupted by surgery or death) with no apparent cause other than of vascular origin." The definition excluded cases of primary cerebral tumor,

cerebral metastasis, subdural hematoma, post seizure palsy, brain trauma, and TIA.

- ii. **Cerebral infarction** was defined as a stroke for which a CT scan performed within 28 days of the onset of symptoms showed an area of low attenuation or a normal appearance in the vascular territory that corresponded to the recent symptoms and signs; or a Siriraj Stroke Score of <1.
- iii. **Intracerebral hemorrhage (ICH)** was defined as a stroke in which a CT scan demonstrated an area of hyperdensity within the brain parenchyma with or without extension into the ventricles or subarachnoid space or, for scans performed beyond 1 week, an area of attenuation with ring enhancement after injection of contrast; or a Siriraj Stroke Score of >1.
- iv. **Recurrent stroke-** This was defined as a stroke in which (1) there was clinical evidence of the sudden onset of a new focal neurological deficit with no apparent cause other than that of vascular origin (i.e., the deficit could not be ascribed to an intercurrent acute illness, epileptic seizure, or toxic effect) occurring at any time after the index stroke or (2) there was clinical evidence of the sudden onset of an exacerbation of a previous focal neurological deficit with no apparent cause other than that of vascular origin occurring >21 days after the index stroke.^{128,129,130}
- v. **"First-ever strokes"** were defined as strokes that occurred in patients without any prior stroke event. Past history of stroke was determined using all available information from hospital records and a verified past history. The presence of a clinically silent past cerebral infarction or hemorrhage found on CT scanning was not considered to constitute a stroke¹⁴⁷.
- vi. **An "undetermined stroke"** was defined as a stroke in which a patient had not undergone a CT scan within 30 days of the onset of symptoms.

- vii. A “possible stroke” was defined in a patient in whom a stroke was suspected but initial CT scan brain failed to reveal a lesion.

g) Patient Selection and Follow up

All patients who presented suddenly in a coma, or a rapid onset of altered consciousness, or rapidly developing clinical signs of focal (or global) disturbance of cerebral function with no apparent cause other than of vascular origin were screened and entered into a study log; all the suspected stroke patients will had their blood pressure, temperature, Random blood sugar, Glasgow Coma Scale, Barthel Index Score, and the Siriraj Stroke Score⁶⁴ taken at admission. A CT Scan Brain was requested to confirm the stroke and the type. The patients were then followed up from the medical wards or ICU daily until the time of discharge or death, and thereafter for a period of 30 days from the onset of the stroke. Discharged patients were followed up from the neurology clinic and medical outpatient clinics and by telephone call for up to a period of 30 days from the time of stroke.

For outpatients and for those patients who were discharged, communication by mobile phone with the patient or close relative or close friend or caretaker was done on a weekly basis up to 30 days after the event and asked how the patient was able to perform according to the Barthel Index Score. Mobile phone contacts of the patient, relatives and close friends were taken at admission, with an aim of having at least two close contact persons.

Day 0 (zero) was defined as the day of stroke onset. If the patient woke up with a stroke it was assumed the onset was at the time of going to sleep.

h) Outcomes

The outcome at 30 days was death, if alive, the degree of disability at 30 days after the stroke.

i) Materials.

Demographic, medical history, pre-morbid states and potential risk factors according to details were collected on a study proforma and questionnaire. The CT scan was done using the 16-slice high resolution Philips scanner available at the radiology department. Image reconstruction was done in the sagittal and coronal planes to determine the size of the bleed in a hemorrhagic stroke. The infarct type of stroke was classified according to the Oxfordshire Community Stroke Project classification.

The axillary temperature was recorded with a digital automatic reader from NEOMED, which was left in place for at least a full minute and cleaned with antiseptic after usage. The fasting blood sugar was recorded using the ACUCHECK glucometer using capillary blood. The blood pressure was taken with a mercury sphygmomanometer machine in the recumbent position on any arm after a five minute rest and the average of two readings 5 minutes apart was recorded. The mean arterial pressure was then be derived from the blood pressure average reading.

j) Laboratory Investigations.

Basic investigations were carried out as appropriate and as part of standard risk profile assessment for stroke and included serial blood sugars (fasting and random), fasting lipid profile, HIV test, urea, electrolytes, urinalysis, full haemogram and ESR, coagulation profile. These were done by the primary clinicians as part of standard diagnostic and follow up investigations .Other tests were done if deemed necessary e.g. connective tissue disease screening, electrocardiogram, echocardiogram, VDRL, etc. These investigations were undertaken by the primary physicians as part of the standard stroke care and information extracted from the files of the patients. The HIV status was retrieved from the file and was not a study driven activity.

k)-Data Management and Analysis

All data was collected on the study proforma and questionnaire and was entered into MS access computer data base. The data was cleaned and verified. Statistical analysis was done using statistical package for social scientists (SPSS) version 17.0.

The types of stroke and outcome were analyzed and presented using Student's t-test. The Barthel Index Score, blood sugar and size of haemorrhage was presented as medians and the Mann Whitney U test was used to compare between outcomes. The HIV status, level of consciousness, type of stroke, infarct type and blood pressure were associated with mortality using the chi-square test. Independent predictors of 30-day mortality were determined using logistic regression. 30-day survival rates of stroke patients were estimated using the Kaplan–Meier method and survival between the types of stroke was compared using log rank test. The Cox regression model was applied to derive independent relative risks of mortality. All statistical tests were considered significant at a p value of 0.05 (with a 95% confidence).

The patients were grouped as shown below at 30 days from the time of the stroke:

- 1- Without a CT scan but stroke highly suspected (UNDETERMINED STROKE ⁵⁷).
- 2- With a CT scan but no evidence of stroke seen (NO STROKE).
- 3- Stroke not confirmed on CT scan but probably present; follow up scan was recommended (POSSIBLE STROKE ⁵⁸).
- 4- Evidence of stroke seen (STROKE CONFIRMED).

m) Ethical Considerations.

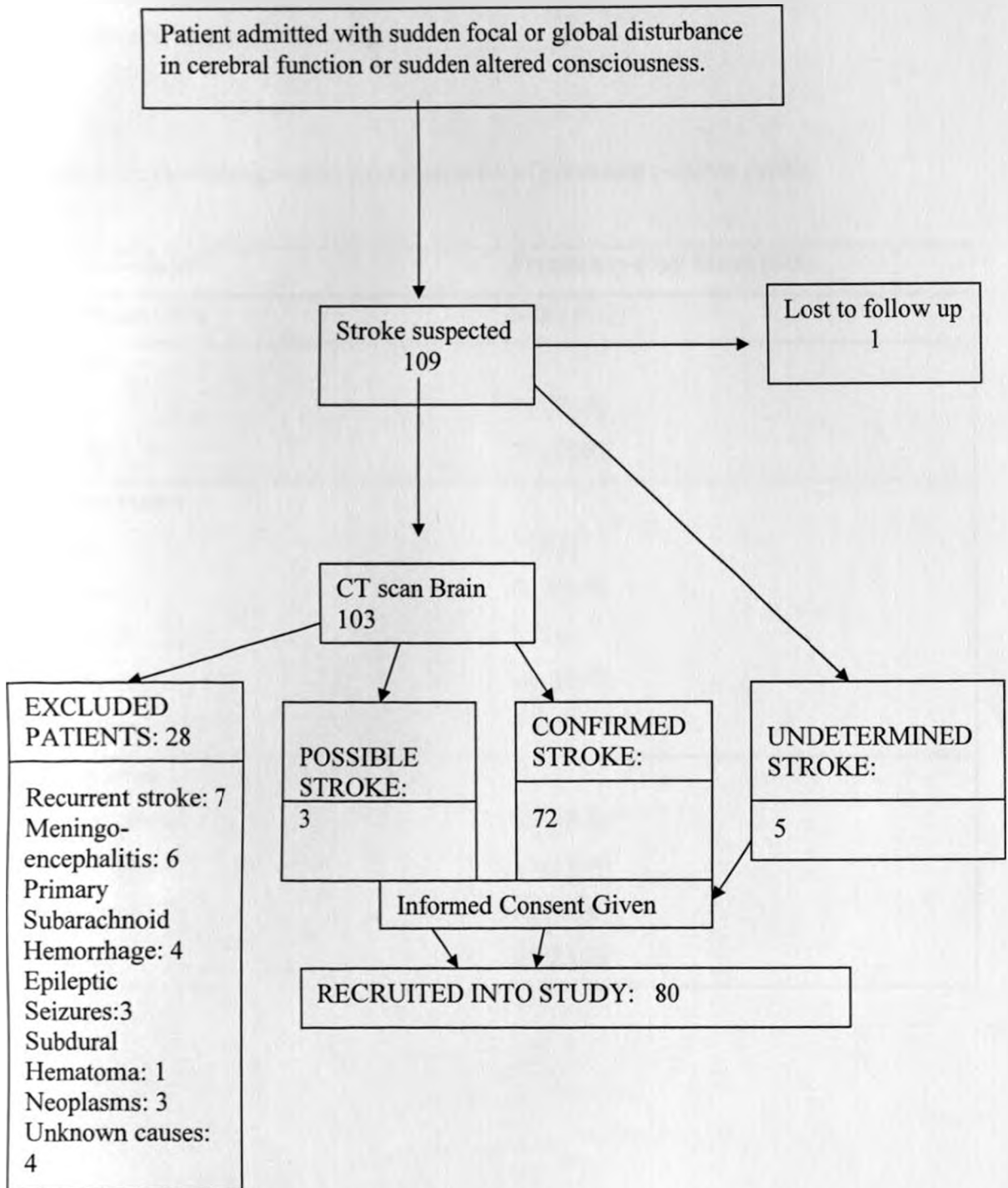
Patients' names were not recorded during the study to maintain confidentiality. Patients were recruited into the study after signing an informed consent..Only after approval by the Department of Clinical Medicine and Therapeutics on 2801102008 and obtaining permission from the KNH Ethics and Research Committee on did this study commence. In working with ionizing radiation, the As Low as Reasonably Achievable, economic and other factors being taken into account (ALARA) dose minimization principle was used to ensure that exposures to staff, students, contractors, visitors, the public and the environment was minimized.

6-RESULTS

CLINICAL CHARACTERISTICS OF PATIENTS ON ADMISSION.

109 patients were screened between 5/08/2009 and 26/11/2009. One patient was lost to follow up. This is also shown in the flow chart below.

Patients' flow chart



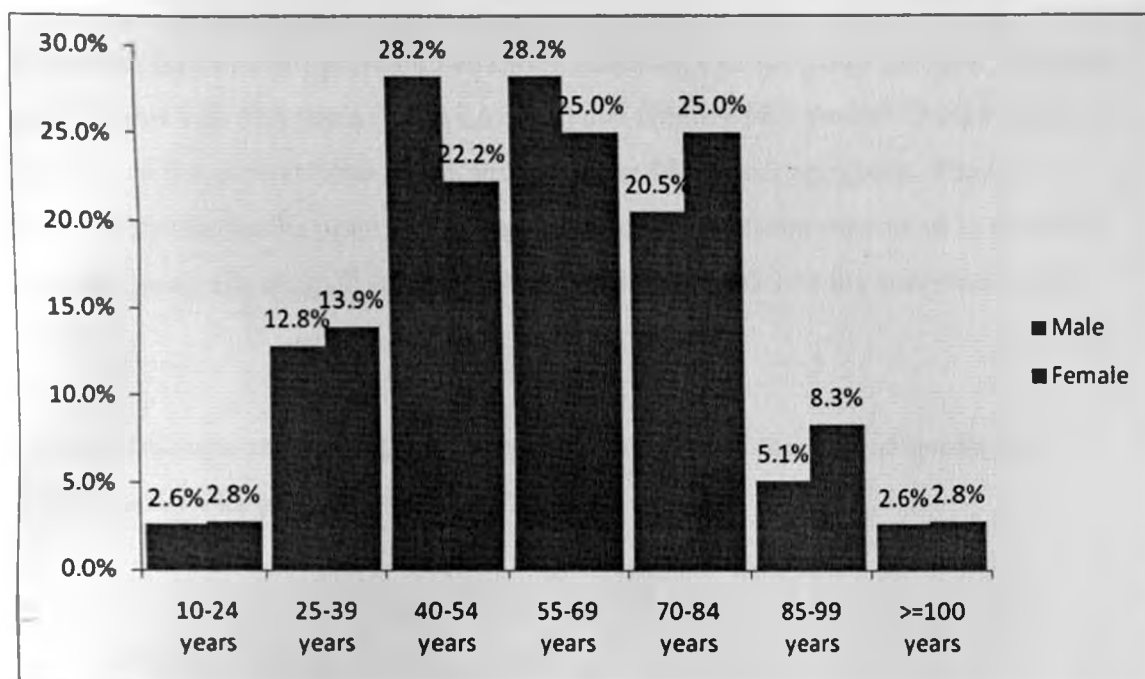
80 patients were recruited into the study. The socio-demographic characteristics are shown in table 1. Forty one (51.3%) of the patients were males and 39 (48.8%) were female. The overall mean age was 57.6 years with a standard deviation of 19.7 years. Seventy percent were married while 17.5% were widowed. 35 (43.8%) of the 80 patients were self employed and 25 (31.3%) were retired.

The youngest patient was 14 years while the oldest was 110 years. The age and sex distribution is demonstrated in figure 1.

Table 1: Socio-demographic characteristics of recruited patients (n=80)

Characteristics	Frequency (%) / Mean (SD)
Age, Mean (SD)	57.6 (19.7)
Gender	
Male	41 (51.3)
Female	39 (48.8)
Marital status	
Single	7 (8.8)
Married	56 (70.0)
Divorced	1 (1.3)
Widowed	14 (17.5)
Widower	2 (2.5)
Occupation	
Self employed	35 (43.8)
Unemployed	11 (13.8)
Employed	9 (11.3)
Retired	25 (31.3)

Figure 1: Age and sex distribution of recruited patients (n=80, P=0.992)



54.2% of the patients recruited into the study were admitted within a day (24 hours) of the stroke, as shown in table 2. 13.9% of the patients were admitted on the third day after the stroke. The earliest presentation to the hospital Accident and Emergency department was six hours from the onset of the stroke.

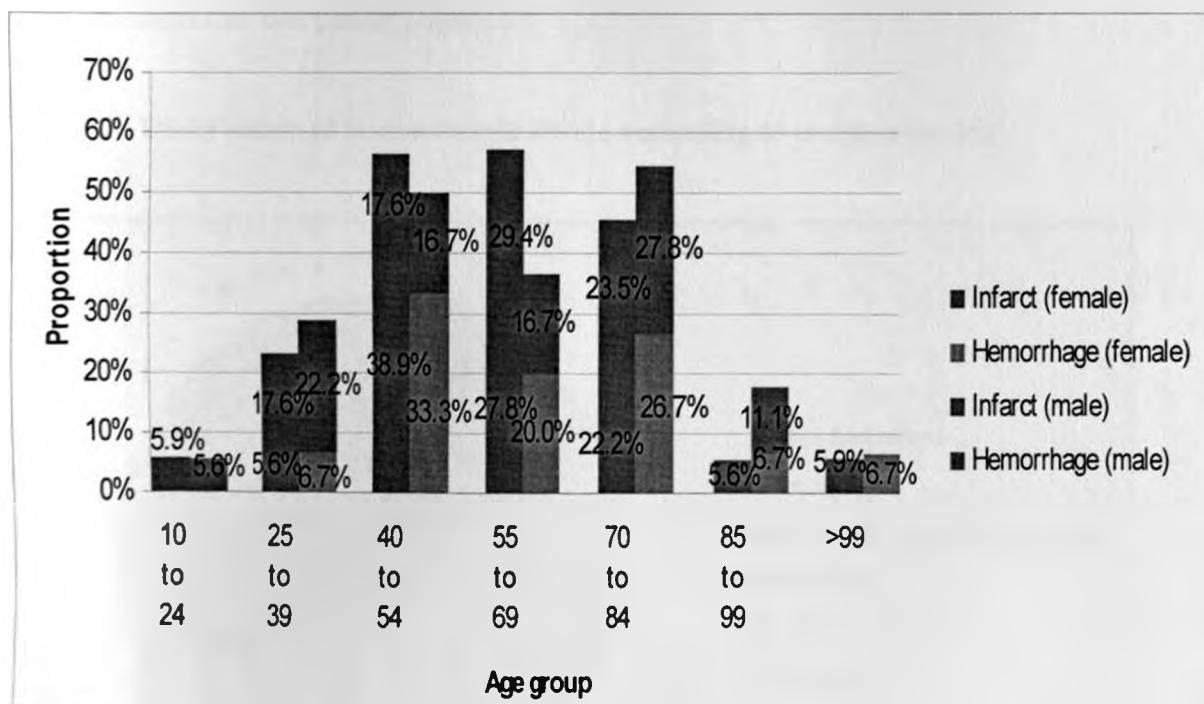
Table 2: Time in days from Day of stroke to time of admission (n=80)

Days from onset of stroke	Frequency (%)
0	39 (54.2)
1	12 (16.7)
2	11 (15.3)
3.00	10 (13.9)

Confirmed stroke category

72 patients had a confirmed stroke and were subjected to a subgroup analysis. The mean age of males was 56.4 years (S.D 19.6 years) and females 58.3 years(S.D 20.5 years). Majority of the patients were adults and fell in the 40-85 year age group. The sex distribution was similar across all the age groups, though males were more in the 40-69 year age group (figure 2). The male to female ratio was 1.05:1 for the confirmed stroke group.

Figure 2: Graph showing age and sex distribution with the type of stroke for confirmed stroke patients (n=72) ;(P=0.839)

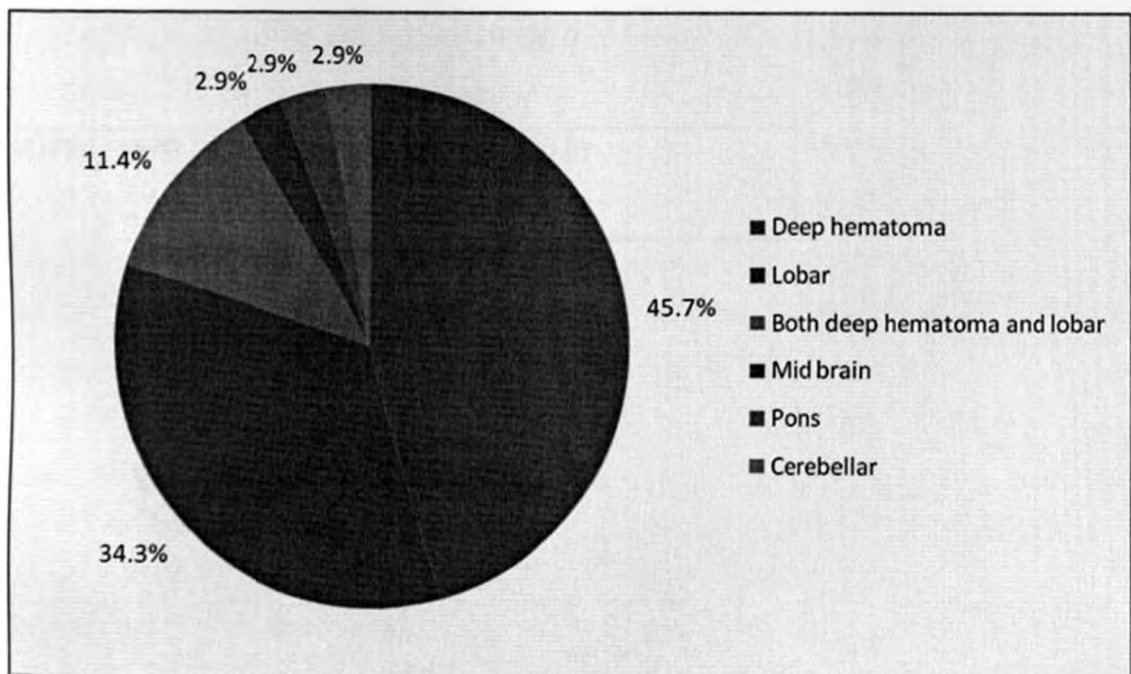


Types of stroke in confirmed stroke patients.

Thirty-seven (51.4%) patients had an infarct while thirty-five (48.6%) patients had a hemorrhagic stroke. Nine-teen males (54.3%) suffered a hemorrhagic stroke while females had a higher proportion of ischemic stroke (51.4%). Male to female ratio in patients with hemorrhagic stroke was 1:1.19, while in ischemic stroke it was 1: 0.95 respectively. The mean age for males with a hemorrhagic stroke was 57.8 years while it was 62.9 years for females and this was not statistically significant ($p=0.409$). Males with an ischemic stroke had a mean age of 57.5 years while for females it was 56.5 years, but this was also not statistically significant ($p=0.897$).

Sixteen (45.7%) patients with a hemorrhagic stroke had a deep hematoma; lobar hemorrhages accounted for 34.3% of hemorrhagic strokes, while the mid-brain, pons and the cerebellum had one patient (figure 3).

Figure 3: Distribution of Hemorrhagic stroke according to location (n=35).



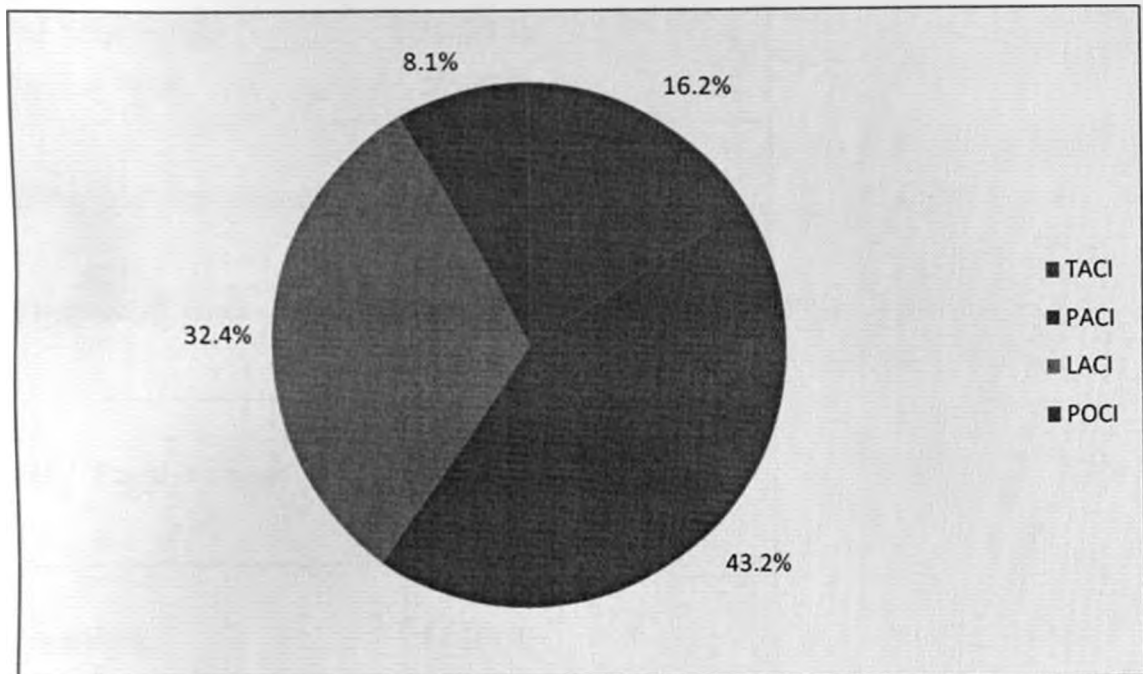
Amongst the patients who had a hemorrhagic stroke, fifteen (42.9%) had ventricular involvement (extension), with 4th ventricular involvement in seven (46.6%) patients. Eight (22.9%) patients had sub-arachnoid extension of the bleed. Seven patients had midline shift due to mass effect (Table 3).

Table 3: Characteristic features of Hemorrhagic stroke (n=35).

Feature	Frequency (%)
Median size of hemorrhage (ml)	37.5 (IQR :10.4-70.5)
Ventricular involvement	15 (42.9)
Sub-arachnoid space involvement.	8 (22.9)
Fourth ventricle involvement.	7 (20.0)
Midline shift	7 (20.0)

Thirty-seven patients had ischemic strokes; sixteen patients (43.2%) had PACI-type infarcts as shown in figure 4. POCI-type infarcts were the least, making up 8.1% of the confirmed stroke subgroup (figure 4).

Figure 4: Distribution of ischemic stroke according to OCSP classification (n=37).



Clinical presentation and characteristics of confirmed stroke patients (n=72).

Forty-two (58.3%) patients presented with blood pressure in stage 2 levels; only seven patients (9.7%) had a normal blood pressure. Eleven patients were febrile.

27.8% of the patients presented in severe coma and 29.2% in moderate coma. Five patients (6.9%) had convulsions at the time of the stroke. Four (5.6%) were HIV positive, Fourteen 19.4%) had a history of vomiting, while nineteen (26.4%) had complained of headache around the onset of stroke (table 4).

Table 4: Clinical features on admission

Consciousness	
Normal	17 (23.6)
Mild coma	14 (19.4)
Moderate comas	21 (29.2)
Severe coma	20 (27.8)
History of convulsions	5 (6.9)
Presence of fever	11 (15.3)
HIV Positive status	4 (5.6)
Vomiting	14 (19.4)
Headache	19 (26.4)

RESULTS SHOWING THE OUTCOME AT 30 DAYS

Thirty-one patients (43.1%) died within the 30 day follow-up period in the confirmed stroke category. The mortality was 46.7% at 7 days while it was 60.0% at 9 days.

DEMOGRAPHIC CHARACTERISTICS OF PATIENTS WHO WERE FOLLOWED UP.

The demographic characteristics compared to the outcome for patients with a confirmed stroke is shown in table 8. The mean age of those who died was 65 years and those who were alive at day 30 of follow up was 53.9 years (table 5).

Table 5: Demographic characteristics and outcome of stroke (n=72)

Variable	Death	Alive	P value
Age, mean (SD)	65.0 (19.6)	53.9 (18.3)	0.020
Gender			
Male	16 (51.6%)	21 (51.2%)	0.974
Female	15 (48.4%)	20 (48.8%)	
Marital status			
Single	3 (9.7%)	4 (10.3%)	0.974
Married	23(74.2%)	28(71.8%)	
Divorced/Widowed	5 (16.1%)	7 (17.9%)	
Occupation			
Self employed	12 (38.7%)	20 (48.8%)	0.625
Unemployed	5 (16.1%)	4 (9.8%)	
Employed	3 (9.7%)	6 (14.6%)	
Retired	11 (35.5%)	11 (26.8%)	

Of the patients who died, 23.1% and 38.5% of patients in the 55-69 years and 70-84 year age groups respectively were females (figure 5). Figure 6 shows the age and sex distribution of the patients alive at 30 days of follow up. 66.6% of those who were alive were in the age group of 40 to 69 years.

Figure 5: Age and sex distribution of patients who died.

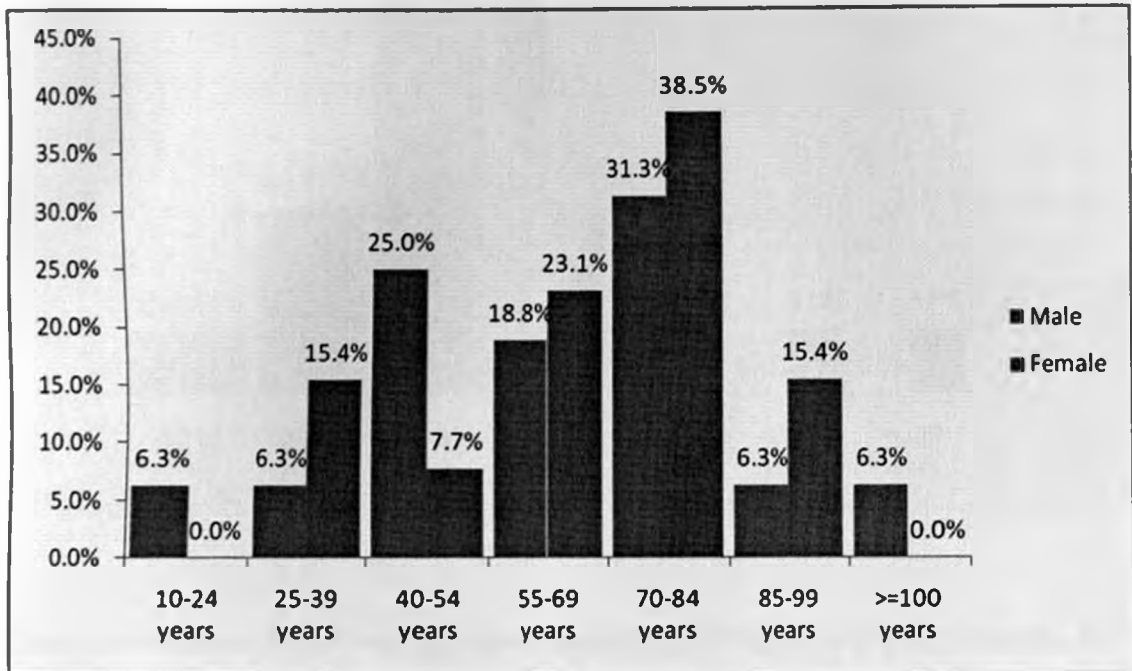
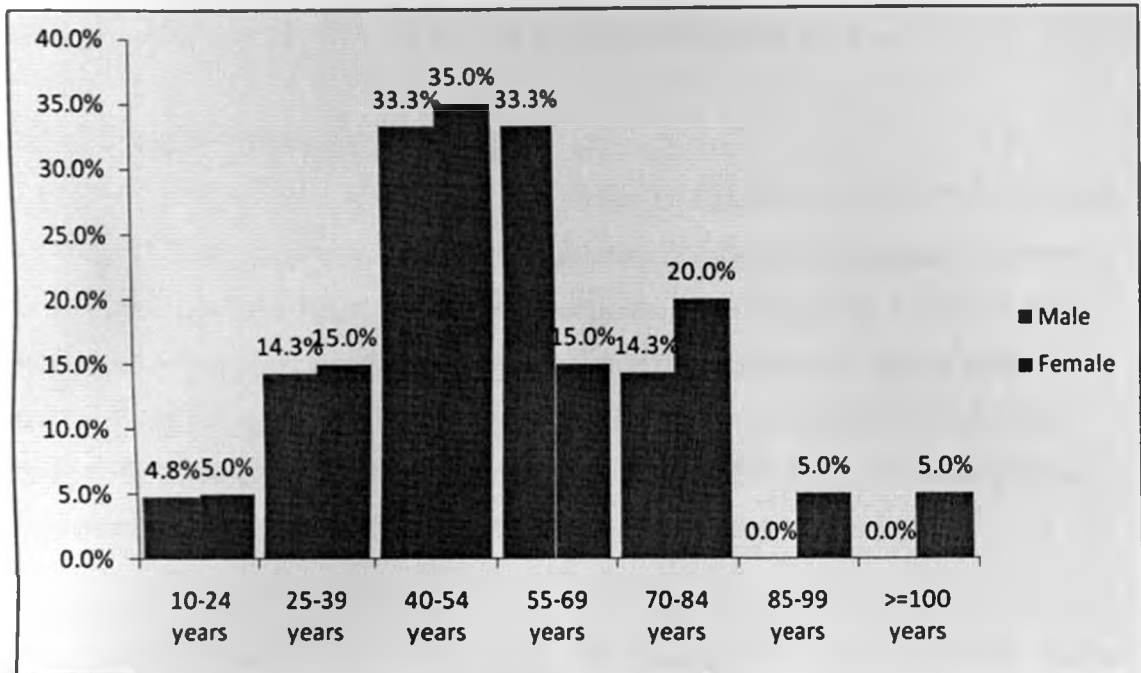


Figure 6: Age and sex distribution among patients who were alive at day 30 of follow up (n=72) (P=0.714).



The mean duration of time of admission to discharge for those who were alive at day 30 in patients with a confirmed stroke was 10.0 days (with an interquartile range of 6.0 – 17.5 days). Twenty one patients were still alive in the hospital at the end of 30 days follow up. The median duration to death was 9.0 days (3.0-12.8) days.

SURVIVAL TREND OVER 30 DAYS OF FOLLOW UP.

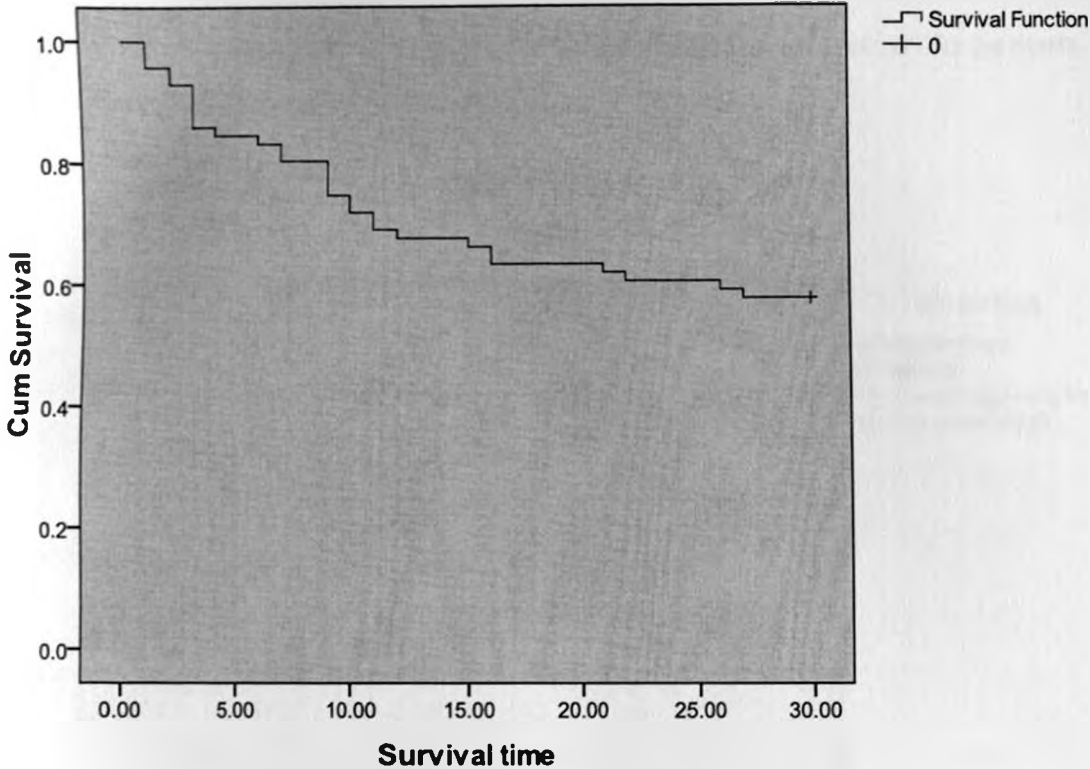
Overall group

The overall mortality (n=80) was 45% during the 30-day follow up period. The mean survival time was 20.8 (95% C.I 18.3-23.4) days for the whole group.

CONFIRMED STROKE CATEGORY

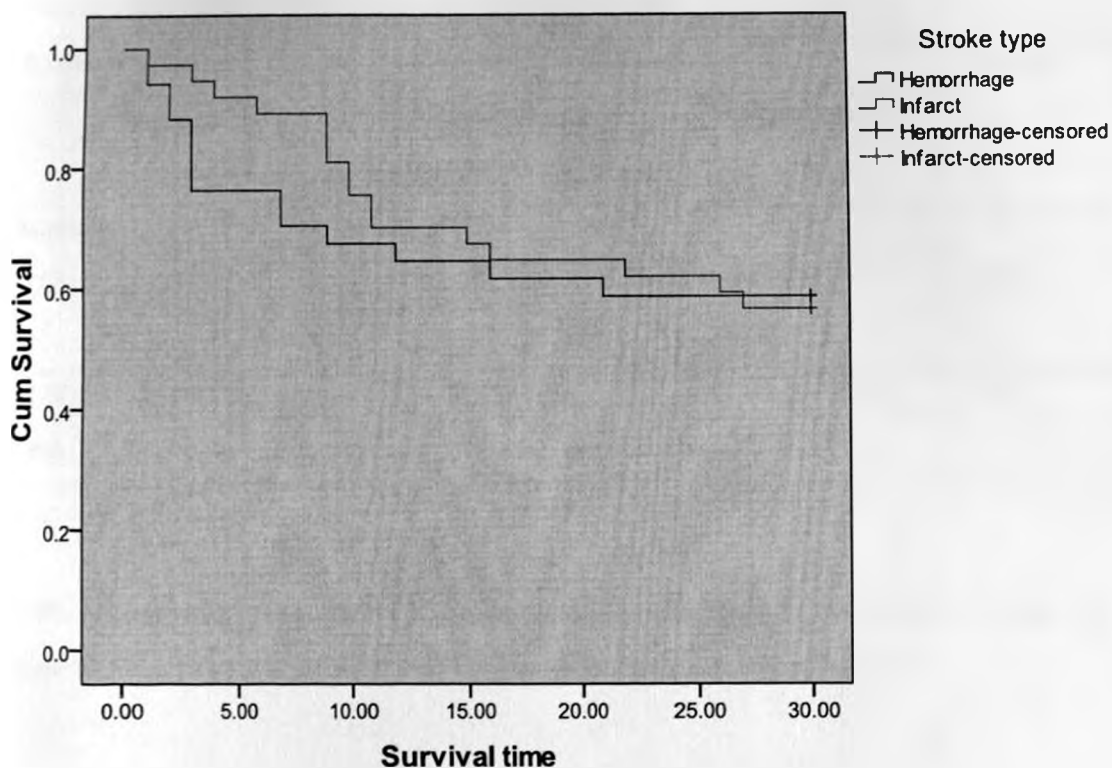
In the category of patients with a confirmed stroke (n=72), thirty-one (43.1%) died within the 30 day follow-up period. Twenty-nine patients (93.5%) died in hospital while two died at home after discharge. Out of the patients who were alive at the end of 30 days of follow up, twenty had been discharged home while twenty-one were still in hospital at the end of follow up. Figure 7 shows the survival curve for patients with a confirmed stroke. The mean survival time was 21.3 (95% C.I 18.6-23.9) days. . The mortality for confirmed stroke patients was 46.7% at 7 days while it was 60.0% at 9 days.

Figure 7: Kaplan Meier curve showing survival for confirmed stroke patients observed over 30 days.



For patients with an infarct, the mean survival time was 22.1 (18.8-25.4) days, while for hemorrhage it was 20.3 (95% C.I 16.2-24.4) days. This is shown in the survival curve below (figure 8).

Figure 8: Kaplan Meier survival curve for hemorrhage and infarct stroke patients observed over 30 days. (Log rank test). (P value = 0.873)



TYPE OF STROKE AND OUTCOME

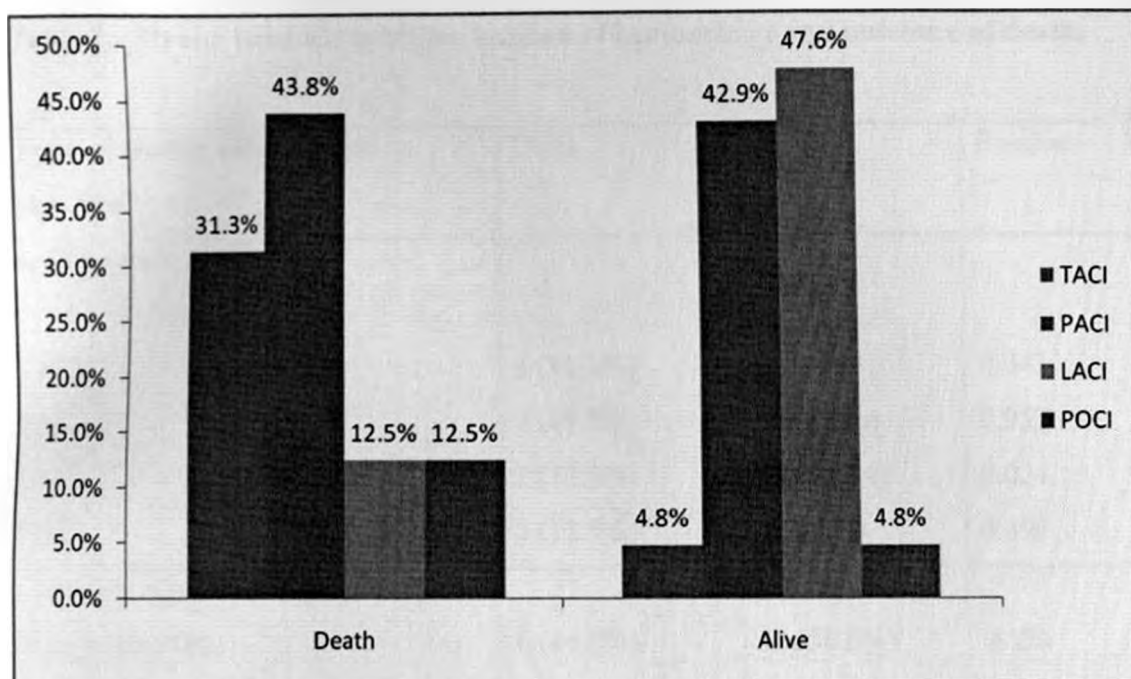
Fifteen (42.9%) patients with hemorrhagic strokes died while 16 (43.2%) patients with ischemic strokes died. The mean number of days from time of stroke to death was sooner at three days (2-9 days) for hemorrhagic stroke, while it was ten days (7.5-15.5 days) for ischemic strokes; this is shown in table 6. This was statistically significant with a P value of 0.027.

Table 6: Association of the type of stroke and death

Characteristics	Type of stroke		P value
	Hemorrhage (n=35)	Infarct (n=37)	
Outcome Death	15 (42.9%)	16(43.2%)	0.974
Mean number of days to death	3.0 (2.0-9.0)	10.0 (7.5-15.5)	0.027

43.8% of the patients that died with ischemic strokes had PACI type of stroke (figure 9), while 47.6% of those who were alive with an ischemic stroke had a LACI .

Figure 9: OCSP classification of stroke and outcome of stroke



40% of those who died with hemorrhagic strokes had deep hematomas. The median hemorrhage volume was 55.6ml (IQR 36.3-73.6) (table 7).

Table 7: Stroke ischemic subtype, location of hemorrhage and outcome of death.

Type of stroke, subtype and outcome	Dead	Alive	P value
OCSP stroke (n=37)			
TACI	5 (31.3%)	1 (4.8%)	0.043
PACI	7 (43.8%)	9 (42.9%)	0.957
LACI	2 (12.5%)	10(47.6%)	0.024
POCI	2 (12.5%)	1 (4.8%)	0.396
Location of hemorrhage (n=35)			
Deep hematoma	6 (40.0%)	10 (50.0%)	0.520
Lobar	5 (33.3%)	7 (35.0%)	
Both deep hematoma and lobar	3 (20.0%)	1 (5.0%)	
Mid brain	0 (0.0%)	1 (5.0%)	
Pons	1 (5.0%)	0 (0.0%)	
Cerebellar	0 (0.0%)	1 (5.0%)	
Size of hemorrhage (ml) median	55.6(IQR:36.3-73.6)	19.3 (IQR:9.0-43.0)	0.036

83.3% of the patients with TACI died while a similar proportion with LACI were alive at 30 days (table 8).

Table 8: Comparison of subtype of stroke, location of hemorrhage between the dead and alive at 30 days.

Type of stroke, subtype and outcome	Dead	Alive	P value
OCSP stroke (n=37)			
TACI	5 (83.3%)	1 (16.7%)	0.043
PACI	7 (43.7%)	9 (56.3%)	0.957
LACI	2 (16.7%)	10(83.3%)	0.024
POCI	2 (66.7%)	1 (33.3%)	0.396
Location of hemorrhage (n=35)			
Deep hematoma	6 (37.5%)	10 (62.5%)	0.520
Lobar	5 (41.7%)	7 (58.3%)	
Both deep hematoma and lobar	3 (75.0%)	1 (25.0%)	
Mid brain	0 (0.0%)	1 (100.0%)	
Pons	1 (100.0%)	0 (0.0%)	
Cerebellar	0 (0.0%)	1 (100.0%)	
Size of hemorrhage (ml) median	55.6(IQR:36.3-73.6)	19.3 (IQR:9.0-43.0)	0.036

As shown in figure 13, 60% of those with a bleed 30ml or less were alive at the end of follow up; however, only 5% with volume of hemorrhage above 90ml were alive at day 30 of follow up. 80% of the patients who had a bleed of 30ml or more died within 30 days of the stroke (figure 10 and 11 respectively).

Figure 10: Graph showing size of hemorrhage and outcome (P=0.102).

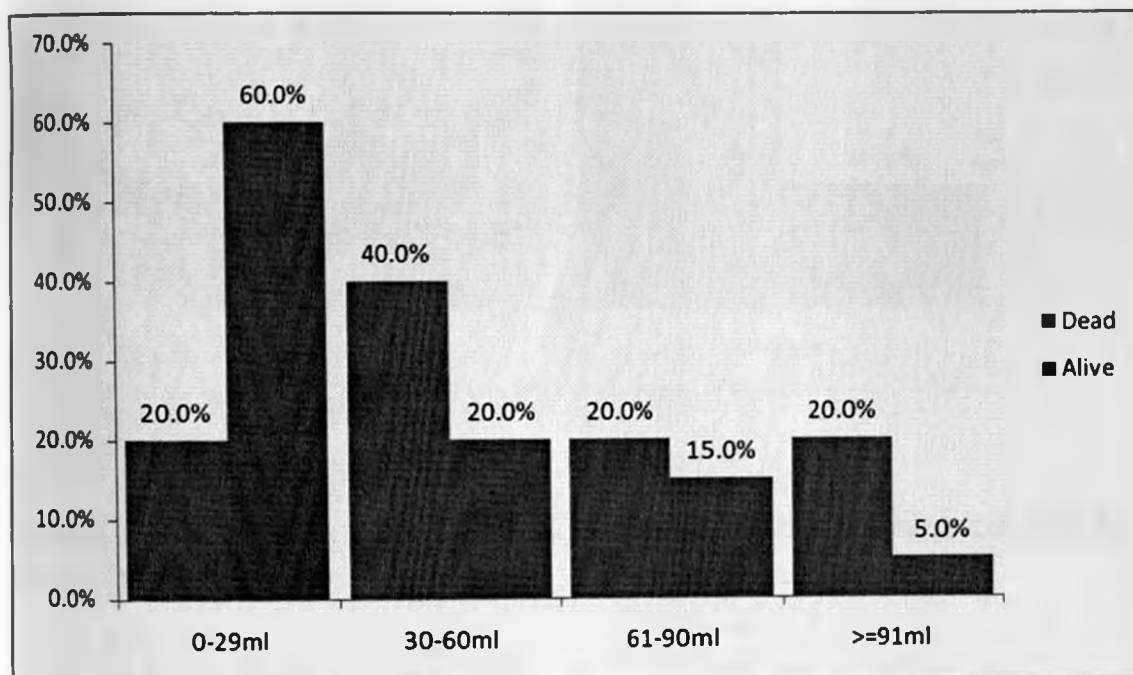
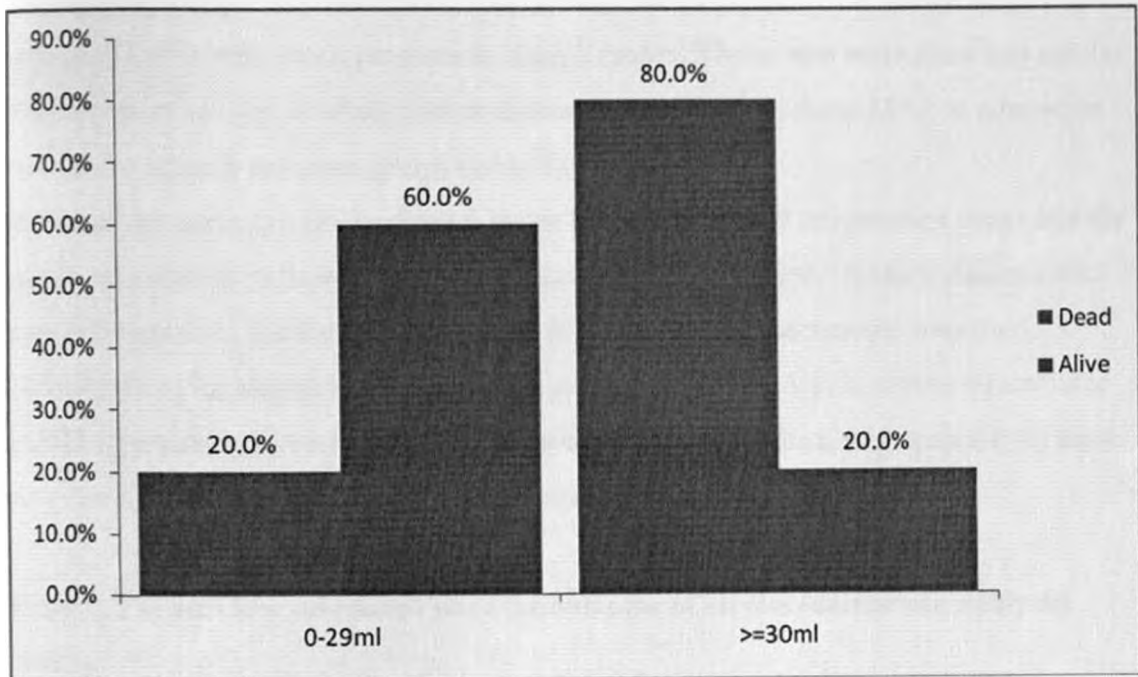


Figure 11: Death amongst patients with hemorrhage less than and more than 30ml (P=0.018)



BARTHEL STROKE SCORE CHARACTERISTICS FOR PATIENTS ALIVE AT DAY 30 OF FOLLOW UP

Nineteen patients (46.3%) who were alive at 30 days of follow up had a poor Barthel score (<15) while 53.7 % had a good score (>15). Only one patient with a TACI stroke type was alive at 30 days and had a poor Barthel score of 2. The patients with a LACI had a good Barthel (>15/20) of 18 (table 14).

For the patients who were alive patients at 30 days of follow up, only 6 (14.6%) had a maximum Barthel score of 20/20. The median Barthel Score in hemorrhagic stroke was 14, while in ischemic it was 16 (p=0.628).

Results showing factors associated with outcome of stroke.

Twenty two patients that died (71%) had elevated blood pressure, i.e. above stage 1 level, with 16 (51.6%) with blood pressure in stage 2 ranges. Those who were alive had similar blood pressure ranges on admission as shown in Table 14. The mean MAP at admission was similar in both outcome groups (table 9).

49.7 % of the patients with confirmed stroke had a sub-normal temperature range and the pattern was similar in those who were alive as in those who died. Of the 4 patients who were HIV positive, 2 were alive at the end of follow up. Of the patients who died, 28(90.4%) had an altered level of consciousness, with 16 (51.6%) in severe coma (table 14). This pattern was reversed in those who were alive at 30 days, with majority of those alive having been admitted in full consciousness (table 10).

**Table 9: Parameters associated with the outcome of stroke (univariate analysis)
(n=72)**

Characteristics	Outcome		P value
	Death	Alive	
BP			
Normal	3 (9.7%)	4 (9.8%)	0.655
Pre-hypertension	6 (19.4%)	8 (19.5%)	0.987
Stage 1	6 (19.4%)	3 (7.3%)	0.122
Stage 2	16(51.6%)	26(63.4%)	0.315
Temperature			
Normal	11 (35.5%)	11 (26.8%)	0.624
Subnormal	13 (41.9%)	26 (63.4%)	0.113
Febrile	7 (22.6%)	4 (9.8%)	0.115
Mean arterial pressure	110. (22.5)	114. (21.7)	0.438

Table 10: Clinical features associated with outcome (univariate analysis) (n=72)

Characteristics	Outcome		P value
	Death	Alive	
HIV status			
Positive	2 (6.7%)	2 (5.1%)	0.786
Consciousness			
Normal	3 (9.7%)	14(34.1%)	0.015
Mild coma	2 (6.5%)	12 (29.3%)	0.015
Moderate coma	10(32.3%)	11 (26.8%)	0.616
Severe coma	16 (51.6%)	4 (9.8%)	<0.001
Barthel Index Score pre-stroke	20.0	20.0	0.099

The blood pressure was elevated in 60% of the patients who died from a hemorrhagic stroke and in 43.8% of the patients with an ischemic stroke. Both these distributions were not significant in terms of outcome when compared to patients who were alive at 30 days. The median random blood sugar was 7.1.mmol/l for those who died, while it was 6.2mmol/l for those alive at 30 days (Tables 11).

Table 11: Comparison of blood pressure, random blood sugar and outcome.

Variable	Death	Alive	P value
BP in hemorrhagic stroke			
Normal Blood Pressure	2 (13.3%)	1 (5.0%)	0.582
Pre-hypertension	2 (13.3%)	2 (10.0%)	
Stage 1	2 (13.3%)	1 (5.0%)	
Stage 2	9 (60.0%)	16 (80.0%)	
BP in ischemic stroke			
Normal Blood Pressure	1 (6.3%)	3 (14.3%)	0.582
Pre-hypertension	4 (25.0%)	6 (28.6%)	
Stage 1	4 (25.0%)	2 (9.5%)	
Stage 2	7 (43.8%)	10 (47.6%)	
Random Blood sugar, median (IQR) (n=72)	7.1 (5.2-9.0)	6.2 (5.4-7.5)	0.215

After multivariate analysis, the presence of elevated blood pressure (above 140/90mmHg) and presence of moderate and severe coma were predictive of a poor outcome in terms of death. An elevated blood sugar was to a much smaller extent associated with a poor outcome (table 12).

Table 12: Multivariate analysis of independent determinants of death

	OR (95% CI)	P VALUE.
BP		
Pre-hypertension	0.3 (0.0-54.2)	0.666
Stage 1	6.2 (0.1-462.6)	0.408
Stage 2	12.8 (0.1-2472.0)	0.342
Temperature		
Subnormal	0.1 (0.0-1.2)	0.065
Febrile	0.1 (0.0-3.4)	0.182
Consciousness		
Mild coma	0.0	0.999
Moderate coma	10.6 (0.4-293.2)	0.163
Severe coma	265.6 (3.4-20974.1)	0.012
Blood sugar	1.5 (1.0-2.4)	0.041
Mean arterial pressure	0.9 (0.9-1.0)	0.073

Similarly after Cox regression analysis, the most significant determinant of mortality was the presence of moderate and severe coma at the time of stroke (table 13). However, the confidence interval is wide. This could be due to the small sample size.

Table 13: Cox regression analysis for the outcome of death

Variable	RR (95% CI)	P value
Age	1.0 (0.99-1.02)	0.290
Consciousness		
Normal	Reference	
Mild	0.6 (0.1-4.0)	0.601
Moderate	2.4 (0.5-11.2)	0.250
Severe	5.8 (1.2-28.4)	0.029

The Siriraj Stroke Score

Each of the patients who were recruited was scored according to the Siriraj Stroke Scale to determine the stroke type as explained in the study protocol. 30 patients had a score of one or more, suggesting a hemorrhagic stroke, while 42 patients had a score of less than one, suggesting an ischemic stroke. The Siriraj Stroke Score had a sensitivity of 57% and specificity of 73 % in predicting the type of stroke with an accuracy of 65.3% (table14).

Table 14: Comparison of Siriraj stroke score and CT-Scan findings.

	CT Scan		Total
	Hemorrhage	Infarct	
SIRIRAJ Scale Hemorrhage	20	10	30
Infarct	15	27	42
Total	35	37	72

Kappa = 0.3, P=0.010

Sensitivity = 57%, Specificity = 73%

Positive predictive value (PPV) = 67%

Negative predictive value (NPV) = 64%

Observed agreement (accuracy) = 65.3%

7-DISCUSSION

Stroke ranks second after ischemic heart disease as a cause of lost disability-adjusted life years in high income cultures and as a cause of death worldwide. The incidence of stroke varies among countries and increases with age. In western societies, about 80% of strokes are caused by focal cerebral ischemia while 20% are caused by hemorrhage.

In this study, we recruited 80 patients with suspected stroke and confirmed the stroke in 72 patients. There were no significant differences in terms of age or sex distribution of the patients recruited into the study. The males and females were equally distributed with a ratio of 1.05:1 which contrasts to other studies which have found a higher occurrence of stroke in men^{1,74}. The mean age was 58.6 years, with a standard deviation of 19.5 years. This is similar to what other workers have found in African studies^{41, 62}. Walker et al, in a hospital-based study in Gambia involving 106 patients, found a mean age of 58 years with a standard deviation of 16 years.

The most common age group for admission with stroke was 40 to 54 years, and the highest death rate was seen in the 70 to 84 year age group. Ischemic stroke was the most common pathological stroke subtype seen in 51.4% of confirmed strokes. This distribution is contrary to most quoted literature.^{1, 2, 37, 39, 66} In western societies, community-based studies have shown that about 80% of strokes are caused by focal cerebral ischemia while 20% are caused by hemorrhage. This was a hospital based study carried out over a period of four months and hence our patient population was highly selective. However, in a retrospective hospital based study in Tanzania by Matuja et al⁶³, 60% of patients studied had a hemorrhagic stroke while 39.9% had an ischemic stroke. In another study done in Siriraj Hospital in Thailand, cerebral hemorrhage accounted for 40-50% of cases of stroke⁶⁵. A possible explanation could be that patients with hemorrhagic stroke tend to be sicker and will therefore be preferentially admitted to hospital or referred to facilities such as Kenyatta National Hospital for more specialized care.

59.4% of the patients with an ischemic stroke had an anterior circulation infarct according to the OCSP stroke classification. The minority, 8.1%, had POI-type ischemic stroke. Lacunar ischemic strokes were 32.4 % in this study. In Mwazo et al's study¹², 37.3% of patients in his study group had a lacunar type of infarct (LACI), while 3.2 % had POI type of infarct. Those with anterior circulation infarct were 59.5% in Mwazo's study as compared to 59.4% in this study. Jowi et al in a retrospective hospital-based study of 68 patients with ischemic stroke had 63% involvement of the anterior circulation and 5.9% had posterior circulation involvement⁶². However, his study population was from high income class and varied races. Our patient population was from low and middle income background and all were Africans of the same race.

45% of the recruited patients (n=80) died during the 30 day follow-up period. The mean survival time was 21.3 days. However, for those with a confirmed stroke, the 1-month case fatality was 43.1%. Worldwide; the 1-month case fatality varies between 17% and 34% with an average of approximately 24%. Kwasa et al in a one-year prospective study of 72 patients carried out between January 1986 and January 1987 found that 46% of the patients died during the period of study.⁵⁶ This study had a similar mortality rate but was carried out over a one year period and did not have the advantage of ct-scan imaging. In a hospital based study in the Gambia⁴¹, mortality was 27% at one month. A 1-month mortality of 33% for 304 stroke patients was reported from Medunsa in South Africa⁵³, but no breakdown into hemorrhagic and infarction was given. This high mortality can be explained by the fact that being a referral hospital, the patients tend to be sicker and even some had multiple co-illnesses.

In this study the mean age of those who died was 63 years and those alive was 53.9 years (P=0.02). There was no significant sex differences in terms of outcome. This was also the case irrespective of the marital status or occupation. There was no significant difference in survival time or outcome of death between infarcts and hemorrhagic stroke. However, the mean number of days to death was significantly shorter (three days) in hemorrhagic stroke as compared to ischemic stroke (10 days), (P=0.027). An explanation to this could be that pressure effects from the hemorrhage itself and early onset of edema could predict an early mortality in hemorrhagic strokes while in ischemic strokes the edema tends to

occur later and delay in interventions that could have led to a favorable outcome.⁷⁵ In addition, we had patients who had ventricular spill and sub-arachnoid extension of the hemorrhage and this impacts negatively on survival. However, the number of patients was too small to analyse if this had a significant influence on mortality in our study group. We were also not able to do follow-up scans in patients with hemorrhagic stroke to monitor the bleed as it has been shown that intracerebral hemorrhage is dynamic and the bleed does actually expand.^{76,77} It would have important to repeat the ct scan to rule out complications such as acute hydrocephalus which is amenable to management and hence avoid increased mortality.

Furthermore, it is highly that the patients had other co-morbidities that could have influenced mortality, e.g. sepsis, aspiration pneumonia, pulmonary embolism, etc. In Western literature, however, hemorrhagic strokes are quoted to have a higher fatality than ischemic stroke⁶⁶. Other studies have also found earlier mortality in hemorrhagic stroke as compared to ischemic stroke.⁷⁰ In this study, 42.9% of patients with hemorrhagic stroke died; this is similar to what other workers have found. One study by Donna et al found a mortality of 44% after 30 days.⁷¹

The mortality rate for ischemic stroke was also high at 43.2%. This much higher than that found in the western population where it ranges from 5% to 17% depending on the studies quoted^{72,73}.

There was no significant difference in terms of degree of independence at day 30 whatever the stroke type. However, the degree of dependence according to the Barthel score was high with only 14.6% being independent at 30 days. In the Gambia stroke study, seventeen (65%) patients had a maximum Barthel score of 20, suggesting full independence; in the Tanzanian Hai study 21% were bedbound.⁶⁷ For ischemic strokes, the less severe the pathological stroke subtype, the less was the dependency.

In terms of the patients' clinical characteristics at admission, 71% (the majority), of those who died had blood pressures above 140/90 mmHg, ie stage 1 and 2 levels. However, the initial blood pressure and mean arterial pressure did not significantly influence the

outcome in terms of those who died or were alive at day 30. An altered level of consciousness significantly affected the outcome in terms of death -66.7% of the patients who died were in severe coma on admission.

Stroke sub-type and outcome

The ischemic sub-type of stroke significantly affected the outcome; 83.3% of patients with a TACI died and were more likely to die ($P=0.043$) and LACI -type were more likely to be alive ($P=0.004$) at day 30 of follow up. This is because LACI type of stroke does not have cortical involvement and is not associated with oedema as much as a TACI (malignant ischemic stroke)³⁵.

The location of the bleed did not significantly influence the type of outcome. 80% of the patients who had a bleed of 30ml or more died within 30 days of the stroke ($P=0.018$) and the mortality increased as the volume of the bleed increased. The median hemorrhage volume for those who died and had a hemorrhagic stroke was 55.6ml and this was significantly different from those who were alive (median hemorrhage volume 19.3ml) ($P=0.036$). 66.7% of patients that died with a hemorrhagic stroke were admitted in severe coma. This was highly significant compared to those who were alive and admitted in full consciousness. This was similar to what Broderick et al^{36,39,40} found, i.e. that a low score on the Glasgow Coma Scale, a large volume of the hematoma and presence of ventricular blood on the initial CT Scan were factors that predicted a high mortality rate.

The Siriraj Stroke Score

The Siriraj Stroke Scale⁶⁴ was developed in Thailand as a simple, reliable and safe diagnostic tool for acute stroke syndromes in a setting where CT scan is not readily available; 174 patients studied between 1984-5 and score validated against 206 patients. We tried to validate it in our patients and we found a sensitivity of 57% and specificity of 73 % in predicting the type of stroke in this and this was significant ($P=0.010$). This was in contrast to what Niphon Pongvarin et al found in their study in Siriraj Hospital, Thailand, whereby the diagnostic sensitivities of the score for cerebral hemorrhage and

cerebral infarction were 89.3% and 93.2% respectively, with an overall predictive accuracy of 90.3%. This could be due to the smaller sample size and different populations studied and that they have a higher prevalence of hemorrhagic stroke than quoted in other studies worldwide. However, in resource-poor settings, this scoring system can be of some use in predicting the stroke type, but all efforts should be made to confirm the stroke and stroke subtype on C.T or M.R.I scan.

CONCLUSION

The overall mortality of stroke was high at 45%, with no significant difference in mortality rate between ischemic and hemorrhagic strokes, with the mortality significantly occurring earlier in hemorrhagic strokes than ischemic stroke. The level of dependency was high with only 14.6% fully independent at 30 days, and the most significant factor that influenced mortality was presence of moderate and severe loss of consciousness and elevated blood pressure.

RECOMMENDATIONS

1. Larger and longer follow-up hospital and community-based studies are needed. Most of the deaths occurred in hospital and early. This has implications on management. An audit on patient management is important to carry out and to look for areas of improvement.
2. Appropriate vigilant, multidisciplinary approach to patient care needs to be accorded to stroke patients, preferably in a stroke unit, especially in the first week when mortality is the highest. Management of stroke patients in stroke units has been shown to reduce morbidity and mortality^{68, 69}.
3. A study on the causes of death in stroke victims needs to be carried out, including aspects of patient management.

LIMITATIONS OF THE STUDY

Nearly half of the patients were admitted more than a day after the stroke and patients' characteristics could have changed within this time, for example the blood pressure and level of consciousness.

Not all patients (undetermined stroke group) were able to do a CT-Scan while those who had a possible stroke were unable to repeat a scan or do an MRI scan to confirm the stroke; this was largely due to financial constraints. We were also not able to carry out postmortem examination to look for other co-morbid illness that could have attributed to mortality.

Co-morbid illness, for example sepsis or dementia, could have influenced the outcome.

Many of the prognostic indicator analyses were hampered by the small sample size, which is further restricted by the inclusion of only those patients admitted to hospital within three days of the stroke.

Management of the patients was not taken into consideration and this could have affected the outcome.

The cause of the stroke was not being looked for in this study.

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9-APPENDICES-APPENDIX A

THE OXFORD COMMUNITY STROKE PROJECT STROKE CLASSIFICATION

TYPE	FEATURES
OCI	Cranial nerve deficit with contralateral hemiparesis or sensory deficit, or bilateral stroke, or disorders of conjugate eye movement, or isolated cerebellar stroke, or isolated homonymous hemianopia.
LACI	Pure motor or pure sensory deficit affecting one of three of face, arm, or leg, or sensorimotor stroke (basal ganglia and internal capsule), or ataxic hemiparesis (cerebellar type ataxia with ipsilateral pyramidal signs-internal capsule or pons); or dysarthria plus clumsy hand, or acute onset movement disorders (hemi-chorea, hemi-ballismus-basal ganglia)
TACI	<ol style="list-style-type: none">1. New higher cerebral function dysfunction: dysphagia, dyscalculia, apraxia, neglect, visuospatial problems plus2. Homonymous visual field defect, plus3. Ipsilateral motor/or sensory deficit of at least two areas of face, arm or leg. In the presence of impaired consciousness, higher cerebral function and visual fields deficits are assumed.
PACI	Two of the three deficits of TACI, or isolated dysphasia or other cortical dysfunction, or motor/sensory loss more limited than for a LACI.

OCSF KEY:

TAC — Total Anterior Circulation Stroke. **LAC** — Lacunar Stroke.

PAC — Partial Anterior Circulation Stroke. **POC** — Posterior Circulation Stroke.

Code last letter as follows:

(S) — Syndrome: Indeterminate pathogenesis, prior to imaging (e.g., TACS).

(I) — Infarct (e.g., TACI). **FINAL CLASSIFICATION:** _____

APPENDIX B

SIRIRAJ STROKE SCALE

Simplified version:

$$\text{Siriraj stroke score} = (2.5 \times \text{consciousness}) + (2 \times \text{vomiting}) + (2 \times \text{headache}) + (0.1 \times \text{diastolic pressure}) - (3 \times \text{atheroma}) - 12$$

Score:

- Consciousness-Alert: 0
 - Drowsy, Stupor: 1
 - Semicoma, coma: 2
- Vomiting - No: 0
 - Yes: 1
- Headache within two hours: No: 0
 - Yes; 1

- Atheroma markers (Diabetes, Angina, and Intermittent Claudication),

No; 0

Yes: 1

Sensitivity for Hemorrhage (score above 1):89.3% (C.I 83.8%-94.8%)

Sensitivity for Infarct (score below -1):93.2% (C.I 85.8%-100.6%)

Accuracy: 90.3%

Final score: _____

Probable Type of Stroke:

Infarct _____

Hemorrhage _____

APPENDIX C

Barthel's index of activities of daily living (BAI)

1. Bowel status

0-Incontinent (or needs to be given enema)

1-Occasional accident (once a week)

2-Fully continent

2. Bladder status:

0-Incontinent or catheterized and unable to manage

1-Occasional accident (max once per 24 hours)

2-Continent (for more than 7 days)

3. Grooming:

0-Needs help with personal care: face/hair/teeth/shaving

1-Independent (implements provided)

4. Toilet use:

0-Dependent

1-Needs help but can do something alone

2-Independent (on and off/wiping/dressing)

5. Feeding:

0-Unable

1-Needs help in cutting/spreading butter etc

2-Independent (food provided within reach)

6. Transfer

0-Unable (as no sitting balance)

1-Major help (physical/one or two people)

2-Can sit with minor help (verbal or physical)

3-Independent

7. Mobility:

0-Immobile

1-Wheelchair-Independent (including corners etc)

2-Walks with help of one person (verbal or physical)

3-Independent

8. Dressing

0- Dependent

1-Needs help but can do about half unaided

2-Independent (including buttons/zips/laces/etc)

- Moderate is 9 to 12 points
- Severe 3 through 8 points
- Patients with score less than 8 are in Coma

PPENDIX E

INDEPENDENT VARIABLES

1. **Age and Gender** :> 13years for both men and women will be included in this study.
2. **Hypertension:**
 - Those currently on antihypertensive medication.
 - Those with a SBP >140mmHg and DBP >90mmHg. For diabetics and chronic kidney disease patients, the cut off will be SBP \geq 130mmHg and DBP \geq 80mmHg. This will be measured using an automated blood pressure machine.
 - Those previously diagnosed to be hypertensive not meeting criteria 1 and 2 above. The severity of hypertension will be assessed using the JNC VII Criteria, as shown below:

BP CLASSIFICATION	SYSTOLIC BP (mmHg)	DIASTOLIC BP(mmHg)
Normal	<120	<80
Pre-hypertension	120-139	80-90
Stage 1 Hypertension	140-159	90-99
Stage 2 Hypertension	>160	>100

If the diastolic and systolic blood pressures fall into different categories, then the higher of the two will determine the grade of hypertension. The Mean Arterial Blood Pressure (MAP)⁶⁰ will be estimated from the formula shown below:

$$\text{MAP} = \text{DP} + 1/3 (\text{SBP}-\text{DBP})$$

3. Diabetes mellitus.

- Self reported
- Use of hypoglycemic medication or insulin.
- Fasting blood sugar of 7.0mmol/l or more.
- Impaired fasting glucose will be defined as FPG ranging from 5.6 mmol/l to 6.9mmol/l.

4. Hyperthermia

Normal temperature range will be taken as 36.6 -37.2 °C. Other temperature parameters will be defined as shown below⁶¹:

Temperature variable	Value(°C)
Normal	36.6-37.2
Febrile	>37.2
Hyperthermia	>41.6
Hypothermia	<35

DEMOGRAPHICS

1. Gender

Male- 1 Female-2

2. Marital Status:

a) Single-1

b) Married-2

Length of Time of Marriage-

c) Divorced-3

Period of Divorce-

d) Separated- 4

Period of Separation-

e) Widowed-5

Date of Death of Spouse-

f) Widower- 6

Date of Death of Spouse-

3. Usual Residence-

4. Usual Occupation:

a) Self employed-1

b)Employed-4

c)Unemployed- 2

d)Retired-5

e)Training/Student-3

CT SCAN FINDINGS

A) Hemorrhagic Stroke (Kretschman and Weinrich Classification)

Classification	Site	
Deep Hematoma	Thalamus	
	Putamen	
	Internal Capsule	
	Caudate Nucleus	
Lobar	Temporal	
	Frontal	
	Parietal	
	Occipital	

Size of Hemorrhage (ml):

Extension of Bleed:

a) Ventricles- 1

c) No. of Ventricles involved-

b) Subarachnoid Space-2

d) 4th Ventricle Involved: Yes-1 No- 2

B) Ischemic Stroke:

OCSP Stroke Type:

- Total Anterior Circulation Infarct(TACI)- 1
- Partial Anterior Circulation Infarct(PACI)-2
- Lacunar Infarct(LACI)- 3
- Posterior Circulation Infarct(POCI)-4

C) Presence of midline shift: Yes-1 No-2

Shift in mm:

KNOWN CHRONIC ILLNESS (PREMORBID STATE)

ILLNESS	YES- specify as appropriate. 1	NO- specify as appropriate. 2	DURATION OF ILLNESS(y ears)	FAMILY HISTORY OF ILLNESS-Specify as appropriate(Yes:1; No:2)		ON TREATMENT-HOW LONG?
				Yes	No	
DIABETES						
HYPERTENSION						
HIV/AIDS						
SICKLE CELL DISEASE						

ATRIAL FIBRILLATIO N						
CHRONIC CONGESTIVE CARDIAC FAILURE						
COAGULOPA THY						
STRUCTURA L HEART DISEASE						
HISTORY OF STROKE						
OTHER- Specify						

CLINICAL PRESENTATION ON ADMISSION

Clinical presentation	Present	
	Yes(1)	No(2)
Vomiting		
Ataxia		
Convulsions		
Hemianopia		
Hemiparesis	Right(1)	Left(2)
Hemisensory Loss	Right(1)	Left(2)
Headache		

PHYSICAL EXAMINATION

1. Initial Blood Pressure Reading (Recumbent)-

Second Blood Pressure Reading 5min later(Recumbent)-

- Average of the two Blood Pressure readings(Recumbent)-
- Mean Arterial Pressure-

2. Pulse Rate-

3. Pulse Rhythm:

Regular- 1

Irregular-2

4. Temperature:

- On Admission-
- At first Contact-

5. Barthel Index Score:

- Pre-stroke -
- At admission -
- At 30 days After the Stroke event-

6. Glasgow Coma Scale:

- At admission: At first contact:
- At 30 days After the Stroke event-

7. History of Convulsions.

Present: 1

Absent: 2

Day of Onset of Convulsions After Stroke:

8. Handedness: Right-1

Left-2

LABORATORY INVESTIGATIONS

1. Random Blood Sugar:

- On First contact-

- At admission-
- 5

2. HIV status(Routine Diagnostic Testing):

Positive: 1

Negative: 2

2-SIRIRAJ STROKE SCALE. (Simplified version)

Siriraj stroke score= $(2.5 \times \text{consciousness}) + (2 \times \text{vomiting}) + (2 \times \text{headache}) + (0.1 \times \text{diastolic pressure}) - (3 \times \text{atheroma}) - 12$

Score: Consciousness-Alert:0;Drowsy, Stupor:1;semicoma,coma:2

Vomitting -No: 0; Yes:1 Headache within two hours: No: 0 ; Yes:1

Atheroma markers (Diabetes, Angina, Intermittent Claudication); No: 0 Yes: 1

Score below -1: infarct Score above +1: Hemorrhage

Final score: _____ Probable Type of Stroke: Infarct__1__

Hemorrhage__2__

BARTHEL ACTIVITIES OF DAILY LIVING

1. Bowel status

- 0-Incontinent (or needs to be given enema)
- 1-Occasional accident (once a week)
- 2-Fully continent

2. Bladder status:

- 0-Incontinent or catheterized and unable to manage
- 1-Occasional accident (max once per 24 hours)
- 2-Continent (for more than 7 days)

3. Grooming:

- 0-Needs help with personal care: face/hair/teeth/shaving
- 1-Independent (implements provided)

4. Toilet use:

- 0-Dependent
- 1-Needs help but can do something alone
- 2-Independent (on and off/wiping/dressing)

5. Feeding:

- 0-Unable
- 1-Needs help in cutting/spreading butter etc
- 2-Independent (food provided within reach)

6. Transfer

- 0-Unable (as no sitting balance)
- 1-Major help (physical/one or two people)
- 2-Can sit with minor help (verbal or physical)
- 3-Independent

7. Mobility:

- 0-Immobile
- 1-Wheelchair-Independent (including corners etc)
- 2-Walks with help of one person (verbal or physical)
- 3-Independent

8. Dressing

- 0- Dependent
- 1-Needs help but can do about half unaided
- 2-Independent (including buttons/zips/laces/etc

9. Stairs:

- 0-Unable;
- 1-Needs help (verbal/physical/carrying aid);
- 2-Independent, up and down; OR Ability to reach household facilities in separate rooms/building

10. Bathing:

- 0-Dependent
- 1-Independent bathing or showering

MAXIMUM SCORE: 20

2- No evidence of stroke seen (**NO STROKE**).

3- Stroke not confirmed on CT Scan but probably present; follow up scan recommended (**POSSIBLE STROKE**).

4- Evidence of stroke seen (**STROKE CONFIRMED**)

10-CONSENT EXPLANATION.

My name is Dr Kamau Ndara, a postgraduate student in Internal medicine, University of Nairobi. I am conducting a study on the 30-day outcome of stroke in patients admitted in KNH and what factors influence the outcome, such initial high blood pressure and temperature, level of consciousness, HIV status, etc.

The results will help doctors understand the management of stroke better and thus prevent early death and reduce disability. The information from you shall remain confidential.

You are free to accept or decline to participate in the study since it is voluntary. If you choose not to participate in the study, your care will not be compromised in any way. If you accept, I shall conduct a full medical examination on you. Any other ailment that shall be discovered in the course of the examination shall be reported to your attending doctors for proper management.

Some blood, about 5ml, will be drawn from your forearm under hygienic precautions. This blood will ascertain your blood sugar levels and will be used to determine your HIV status. I shall then request that you have a CT Scan of your brain to be performed at the Radiology Department in KNH to check if you have a stroke, and if so, of what type.

I shall personally explain all the results from these investigations to you and copies availed in your file. Appropriate treatment shall be offered after liaison with my supervisors and as per the accepted standard of care in the ward or clinic you are attending.

In case you have questions related to this study, you can contact the following:

1. Dr Kamau Ndara, Principal Investigator.
2. Prof. E. Amayo-Supervisor, Department of Clinical Medicine and Therapeutics, University of Nairobi, KNH.
3. DR Mecha- Supervisor, Department of Clinical Medicine and Therapeutics, University of Nairobi, KNH.
4. Dr Mwangi- Supervisor, Department of Diagnostic Radiology, University of Nairobi, KNH.

Maelezo

Jina langu ni Dr Kamau Ndara, mwanafunzi katika somo la internal medicine, katika chuo kikuu cha Nairobi. Nafanya utafiti juu ya matokeo ya matibabu kati ya wagonjwa wanaolazwa spitali kwasababu ya stroke na mambo ambayo yanachangia matokeo ya matibabu kama vile presha ya damu iliyo juu, joto jingi, hali ya HIV na kadhalika.

Matokeo ya utafiti huu yatasaidia daktari kuelewa jinsi ya kutibu stroke vyema zaidi na hivyo kupunguza vifo na ulemavu. ujumbe utakaopeana hautatumika pengine.

Huna huru wa kukubali au kukataa kuchangia katika utafiti huu. ukichagua kutochangia, matibabu unayopata hayataathiriwa. ukikubali, nitakufanyia utafiti kamili wa mwili. ugonjwa mwingine wowote nitakaoupata ninapo kufanyia utafiti nitamjulisha daktari wako kwa matibabu zaidi.

Damu ya kiwango yapata mililita tano itatolewa kutoka mkono wako katika hali ya usafi. damu hii itatujulisha kiwango cha sukari kwa damu na hali yako ya HIV. kisha nitakuomba ufanyiwe CT scan ya akili hapa KNH kunijulisha kama una stroke au la, na kama ipo ni ya aina gani.

Mimi mwenyewe nitakueleza matokeo ya uchunguzi huu na kuutia kwenye faili yako. matibabu yanayofaa utayapata baada ya wakuu wangu kuidhinisha na kulingana na matibabu wapatao wagonjwa kwenye kliniki au wodi uendayo.

Ikiwa unayo maswali kuhusu utafiti huu, waweza ukawauliza wafuatao;

1. Dr Kamau Ndara, mtafiti mkuu.
2. Prof. E. Amayo-msimamizi, Department of Clinical Medicine and Therapeutics, chuo kikuu cha Nairobi, KNH.
3. DR Mecha-msimamizi, Department of Clinical Medicine and Therapeutics, chuo kikuu cha Nairobi, KNH.
4. Dr Mwangi-msimamizi, Department of Diagnostic Radiology, chuo kikuu cha Nairobi, KNH.

CONSENT FORM (Patient)

I _____

from _____

After reading the consent explanation form and having been explained to me by Dr Kamau Ndara (The Principal Investigator) do voluntarily agree to take part in this research study on the 'The 30-day outcome of Stroke in Patients Admitted in Kenyatta National Hospital'.

I am also aware that I can withdraw from this study without quality of management of my medical problem being affected.

Signature/Thumbprint: _____

Witness: _____

Date: _____

FOMU YA KUKUBALI

Mimi _____

Kutoka _____

Baada ya kusoma fomu ya maelezo na kuelezewa na Dr. Kamau Ndara(mtafiti mkuu) najitolea kushiriki katika utafiti huu 'The 30-day outcome of Stroke in Patients Admitted in Kenyatta National Hospital'.

Nafahamu ya kwamba naweza nikajiondoa kutoka utafiti huu na hali ya matibabu ninayapata isiathiriwe.

Sahihi/kidole _____

Shahidi _____

Tarehe _____

CONSENT FORM (Relative or close friend to the patient)

I _____

relative/friend (tick as appropriate)

to _____

(patient) after reading the consent explanation form and having been explained to me by Dr Kamau Ndara (The Principal Investigator) do voluntarily agree to take part in this research study on the 'The 30-day outcome of Stroke in Patients Admitted in Kenyatta National Hospital'.

I am also aware that I/we can withdraw from this study without quality of management of my medical problem being affected.

Signature/Thumbprint: _____

Witness 1: _____

Date: _____

Witness 2: _____

Date: _____

FOMU YA KUKUBALI (JAMAA AU RAFIKI)

Mimi,jamaa/rafiki(onyesha ifaayo)_____

Kwa _____(mgonjwa)

Baada ya kusoma fomu ya maelezo na kuelezewa na Dr. Kamau Ndara(mtafiti mkuu) najitolea kushiriki katika utafiti huu 'The 30-day outcome of Stroke in Patients Admitted in Kenyatta National Hospital'.

Nafahamu ya kwamba naweza nikajiondoa kutoka utafiti huu na hali ya matibabu ninayapata isiathiriwe.

Sahihi/kidole _____

Shahidi _____

Tarehe _____

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