"A STUDY OF CLINICAL AND LABORATORY FEATURES
IN STROKE PATIENTS AT THE KENYATTA NATIONAL
HOSPITAL".

By

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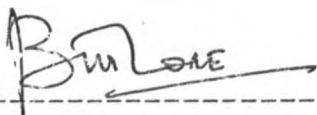## D E C L A R A T I O N

This dissertation is my own original work and has
not been presented for a degree in any other
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(iii)

CONTENTS

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LIST OF TABLES AND FIGURES

LIST OF ABBREVIATIONS

KNH	-	Kenyatta National Hospital
ESR	-	Erythrocyte Sedimentation Rate
$>$	-	More than
$\geq$	-	Equal to or more than
$<$	-	Less than
$\leq$	-	Equal to or less than
B.C.	-	Before Christ
C.N.S.	-	Central Nervous System
mmHg	-	Millimeters of Mercury
VDRL	-	Venereal Disease Research laboratory test
CXR	-	Chest X-ray
E.C.G.	-	Electrocardiogram
mmol/L	-	Millimoles per litre
BUN	-	Blood urea Nitrogen
umol/L	-	Micromoles per litre
g/l	-	grammes per litre
KA Unit	-	King Amstrong Units
SGOT	-	Serum glutamic acid-oxaloacetic acid Trangaminase
SGPT	-	Serum glutamic acid-pyruvic acid transaminase
T_3	-	Triiodothyronine
T_4	-	Tetraiodothyronine (thyroxine)
CVA	-	Cerebrovascular accident
WBC	-	White Blood Cell count
Hb	-	Haemogram
UTI	-	Urinary Tract Infection
Na^+	-	Sodium
K^+	-	Potassium

Great.	-	Creatinine
A.P.	-	Alkaline phosphatase
HDL-chol	-	High Density Lipoprotein cholesterol
LDL-chol	-	Low Density Lipoprotein cholesterol
GIT	-	Gastro-intestinal tract
SOL	-	Space occupying lesion
e.g.	-	for example
etc.	-	and so on
T.P.H.A.	-	Treponema pallidum Haemagglutination test.

SUMMARY

This is both a retrospective as well as a prospective study conducted from January 1986 to January, 1987 at KNH involving 72 stroke patients. Thirty point four per cent of the patients were found to be hypertensive. The majority were found to be from the Central Province. More patients were rural dwellers than urban dwellers. The majority of the hypertensive patients were either first diagnosed at admission for stroke or had had poor control of their hypertension. Most hypertensive patients were old ($>$ 45 years). Laboratory investigations showed hypertriglyceridemia, hyperuricemia, renal insufficiency, and high ESR to be common amongst stroke patients. Syphilis was not found in any of the patients. The young normotensive patients were examined and some possible aetiological factor identified in all except four.

Recommendations are made as to further work and prevention against stroke.

INTRODUCTION

HISTORICAL ASPECTS

The clinical syndrome of stroke has been known to mankined since time immemorial. In fact, it seems to be as old as man himself. The earliest evidence of brain disease is to be found in fossils of the New Stone Age (about 5,000 B.C.). In this period, there is evidence of skulls with marks of trephination (1). It was performed on men, women and children. They used flint-stone knives for this operation. The reasons for the trephination can only be presumed to have been strokes, epilepsy, etc., but these were attributed to demon possession and the trephination must have been to allow the demons to escape. The Bible also indicates man suffered strokes even then (1 Sam. 25: 37).

The Indians seem to have known about stroke as evidenced by tablets found in the Library of Ashurbanipal (2). The Egyptians also seem to have been well aware of the condition as shown by Papyrus Ebers which shows it might have caused the death of Weshptah (2). The Hippocratic school recognized stroke(apoplexy) and ascribed advancing age as the aetiological factor (1,2). Aretaeus of Cappadocia (2nd-3rd Century, A.D.) recognized hemiplegic paresis to be due to contralateral lesions of the brain (2).

The Chinese seem to have known stroke as

early as 400 B.C. and ascribed it to cerebral
haemorrhage (2). One of the first scientific
observations on strokes was done by Johann Jacob
Wepfer (1620-1695) who, in 1658, published a work
showing that apoplexy is due to haemorrhage from
the cerebral vessels and worked up the anatomy of
cerebral vessels (1,3). The modern description of
stroke first appeared in Gower's book "Manual of
Diseases of the Nervous System" (1886-8) (1). He
initiated a new era in the investigation of strokes.
However, the big advances in the understanding of
cerebrovascular accidents have come after the second
world war. New techniques in haematology have led
to new knowledge of clot formation and the role of
triglyceride. Fisher (4) has led the field in
relating the clinical features of stroke to the
anatomical lesion. We have been alerted to the
importance of the carotid vessels and the heart
as sources of emboli. Computerised tomography has
enabled us to further relate the clinical picture
and the actual site of the lesion. Massive epide-
miological studies have emphasized the importance
of hypertension, diabetes mellitus, obesity, and
cigarette smoking as contributing factors in the
production of strokes.

Prophylactic measures have proved to be
effective and life expectancy has increased.
Field (5) in his monograph "Collateral circulation
of the brain", gives the importance that the circle

of Willis plays in the body's attempt to circumvent the effects of occlusion of the various arteries supplying the brain. The more effective the collateral circulation, the more complete the recovery that is noted.

CLINICAL PICTURE

Stroke is a term given to the clinical manifestation of ischaemia to the cerebrum following occlusion or rupture cf any of the cerebral vessels (6,7). It may take any of the following forms:

a) Atherosclerotic thrombosis

b) Lacunar stroke,

c) Embolism

d) Hypertensive haemorrhage

e) Ruptured aneurysms and vascular malformations,

f) Transient ischaemic attacks,

g) Others.

    i) Large vessel stenosis due to extrinsic causes,

    ii) Radiation necrosis

    iii) Post-operative encephalopathy

    iv) Hypertensive encephalopathy

Transient ischaemic attacks are short-lived and are soon followed by full recovery so that many patients do not tend to come to hospital. It is therefore a diagnosis made retrospectively from interrogation of the patients. Hence, it has not been included among the conditions investigated here.

The incidence of stroke in Kenya has not been
worked out yet. Bahemuka (8) in 1985 carried out
a retrospective study of 207 stroke patients at KNH,
Nairobi including the period 1975 through 1979,
and found no history of transient ischaemic attacks,
48% had arterial hypertension , 11% had a prior
history of stroke. There was no history of myocar-
dial infarction, angina pectoris, or peripheral
vascular insufficiency. On angiography, most lesions
were found to be intracranial, usually in the
middle cerebral artery or its branches. This
suggested to him that atherosclerosis was not a
major aetiological factor. In an analysis of all
admissions to adult medical wards at Mulago hospital,
Kampala, Billinghurst (9) in 1970 found neurological
diseases to account for 9.6% of the 6144 admissions
with a male to female ratio of 2.7:1. Of these,
34.0% were due to vascular disorders. Sharper &
Sharper (10) in a similar analysis earlier in
Mulago found in 1957, that CNS diseases constitu-
ted 10.5% of all medical admissions; of these
cerebrovascular diseases constituted 10.1%. Dada
et al (11) reported on the Nigerian neurological
profile from Lagos University Teaching Hospital
for the period 1962 to 1967 and in their litera-
ture review cited some of the following rates in
various parts of Africa for neurological admissions:
Hutton (11) - 13% for Kampala, Kaushik (11) -
16.3% for Ibadan; Haddock (11) - 5.5% for Tanzania;
Ojiambo(11) - 20% for Nairobi.

Dads et al noted in the same paper that cerebro- -
vascular accidents form the second commonest of all
neurological admissions with an incidence of 16.8%.
Osuntokun et al (12) made a similar survey and found
non-embolic ischaemic disease to constitute 57.5%,
cerebral haemorrhage 26.4% and embolic ischaemic
disease to constitute 6.1% of all cerebrovascular
diseases at the University Teaching Hospital in
Ibadan, Nigeria.

The risk and aetiological factors associated
with strokes are various and include hypertension
which takes the top spot in most series, diabetes
mellitus (7,9,12-15), rheumatic heart disease
(8,13), pregnancy (8,12,13), thyrotoxicosis (8),
infections (8,9,13), alcohol ingestion (8, 15-18),
cavernous sinus thrombosis (9), sickle cell anaemia
(9,12), chronic myeloid leukemia (12), anaemia (12),
obesity (12), syphilis (12), congestive heart
failure (12), nephrotic syndrome (12), hyperlipi-
demia (14,15,19), subacute bacterial endocarditis ~
(20) non-bacterial thrombotic endocarditis (21),
moyamoya disease (22), migraine (23,14), acute
leukemia (13), metastatic cancer of the brain
from stomach (13), trauma (14), oral contraception
(14), mitral valve prolapse (14), atrial flutter/
fibrillation (14), abnormal platelets (14), cardio-
myopathy (14), hypotension (14), ulcerative colitis
(14) and smoking (15,17,20,24). In all the series,~

there is always a substantial proportion of
stroke patients in whom all the available and exha-
ustive investigations fail to reveal the underlying
cause.

The clinical presentation is variable and
depend on the underlying pathology and the site
affected. Most patients present with hemiparesis
or hemiplegia which may be purely motor, purely
sensory, a mixture of the two, dysarthria, ataxia
and/or signs of brainstem involvement. The features
may be static, amy worsen with time with coma
supervening and in many instances death follows, or
may gradually regress and complete or near complete
recovery may be expected in a minority of patients.

AIMS AND OBJECTIVES OF THE STUDY

The previous two studies of strokes in Kenya referred to (8,13) were the only ones that could be traced in the literature. The first one dealt with a retrospective survey of hospital records and was, of necessity, incomplete in many aspects, especially as far as the clinical presentation and laboratory work up are concerned. The second one only looked at the normotensive young patients who form only a small proportion of patients with stroke seen at KNH. It has been reported in the literature that hypertension is the commonest cause of strokes. Whereas this is true in the western world, there are only few studies in Africa and only two studies in Kenya which gave two different figures of 48% and 20% (8,13) respectively. Hence, there was a need to carry out a prospective study of all stroke patients to see whether the situation at KNH is similar or different from the other places where similar studies have been carried out. The other felt need for the study was the clinical impression that there is a large number of young patients aged 45 years or less who are admitted to our medical wards in whom there is no obvious reason for them to have a stroke. Hence the objectives of this study were as follows:

1. To determine the frequency of stroke in terms of the total admissions and the total neurolo-gical cases admitted over the study period.

2. To determine the associated factors for stroke
    in our patients particularly in terms of
    frequency of hypertension and factors peculiar
    to the young normotensive patients.

3. To identify, where possible, any important
    clinical or biochemical peculiarities of
    stroke patients so as to suggest preventive
    strategies.

MATERIALS AND METHODS

This was both a prospective as well as a retro-
spective study over the period January, 1986 to
January, 1987. The retrospective part of the study
consisted of going over the files of those who were
known to have had hypertension to determine the
level of blood pressure control. The subjects
studied were those patients admitted to the medical
wards at KNH over the period with a clinical diagno-
sis of "stroke" or "cerebrovascular accident". They
were seen by the author personally and examined in
the first instance to establish:

a) that they were indeed suffering from stroke,

b) whether they were hypertensive and

c) other accompanying physical findings.

Stroke was defined as a sudden development of a
focal neurological deficit of at least 24 hours'
duration with or without loss of consciousness.

The working definition excluded transient
ischaemic attacks and subarachnoid haemorrhage. A
patient was considered hypertensive if:

a) there was a history of hypertension prior to
the incidence;

b) he/she had been treated for hypertension (13);
defined as a diastolic pressure of 95mmHg or
greater in adults or 60mmHg or greater in
children (13);

c) repeated blood pressure readings were at least
165/95mmHg on at least two occasions taken for

at least three days after the stroke had been
established (25);

d)   there was evidence of otherwise unexplained
heart failure and raised blood pressure on
admission (8);

e)   there was severe retinopathy (grade III or IV)
and raised blood pressure on admission (8).

The patients had a complete history including age,
race, ethnicity, residence, occupation,
duration of hypertension, whether on regular treat-
ment, adequacy of blood pressure control (for those
who were known hypertensive and whose files could be
traced), whether actually taking the medication,
history of other significant diseases, for example,
diabetes mellitus, acute or chronic renal failure,
phaechromocytoma, Cushing's syndrome, etc. The
presence or absence of neck bruits, fundoscopic
changes, cardiac lesions was also looked for. The
laboratory investigations performed included a
haemogram, blood sugar (2 hours post-prandial),
VDRL, CXR, ECG, blood urea, creatinine, electrolyte
levels, liver function tests, and serum lipids. It
had earlier been intended to perform the catechola-
mine screening tests and urinary keto and hydroxy-
steroid levels but these had to be abandoned due to
technician and organisational difficulties. A few
patients had carotid/vertebral angiography done, and
one had a computerised tomographic scan done. The
serum lipid parameters looked at were:

a)   cholesterol – using Boehringer/Mannheim (BM)
      Monotest Cholesterol chod–Pap method
      (cat. No. 29031);

b)   high density lipoprotein cholesterol – using
      BM HDL. Cholesterol precipitant reagent
      (catalogue number 543004);

c)   low density lipoprotein cholesterol – using
      BM LDL – cholesterol reagent catalogue number
      726290;

d)   triglycerides – using BM reagents catalogue
      number 701882.

The results were then subjected to statistical
analysis to determine means and standard deviations.
As this was not a comparative study, no attempts
were made at a comparable analysis of the results.

The blood pressure control was classified
arbitrary as follows:-

Good control – average diastolic ≤ 95 mmHg
Fair control – average diastolic $> 95 \leq 110$ mmHg
Poor control – average diastolic > 110 mmHg.

RESULTS

Seventy two consecutive patients were recruited
into the study. There were 22 (30.6%) hypertensives
and 50 (69.4%) normotensives. Twenty five (34.7%)
were 45 years of age and below, the age range being
from 15 years to 88 years, mean 52 years. Twenty
one (29.2%) patients were from an urban setting
while 47 (65.3%) were from the rural areas. In 4
patients the residence was not known. The various
provinces are represented on Table 1.

In terms of occupation, 33 (45.8%) were farmers,
13 (18.1%) were housewives, 5 (6.9%) were students,
3 (4.2%) were drivers, 4 (5.6%) were businessmen,
2 (3.8%) were watchmen or guards. There was 1
(1.4%) each of a general worker, secretary, machine
operator, waiter, fitter and housemaid. Four (5.6%)
were unemployed and the occupation of 4 others was
unknown.

On questioning the following diseases, conditions
and habits were elicited: hypertension in 11 (15.3%),
previous stroke in 7 (9.7%), cigarette smoking in
12 (16.7%), alcohol drinking in i4 (19.4%), diabetes
mellitus in 5 (6.9%), probably trauma in 4 (5.6%),
congestive cardiac failure in 3 (4.2%), duodenal
ulcers in 2 (2.8%), bronchial asthma in 3 (4.2%), _
"heart disease" in 3 (4.2%), pneumonia in 2 (2.8%).
One case each of the following was also found:
sickle cell disease, chest pain, cold ischaemia of
the foot with gangrene, use of the oral contra-

ceptive pill, delivery one week before; chronic headaches probably migraine, dementia and mental depression, ulcerative colitis, cough with haemoptysis, gouty arthritis, deep vein thrombosis of leg, connective tissue disease (probably systemic lupus erythematosus), upper gastrointestinal bleeding, focal fits, pulmonary oedema, and malaria.

The patients with hypertension were further analysed. Fourteen had hypertension for less than one year, 5 had a history of 1 to 2 years, 1 had had it for 3 years while 4 had it for more than 5 years. For those who had had hypertension for one year or more, 1 (10%) had had good control, 7 (70%) had fair control, while 2 (20%) had had poor control of their hypertension.

Other findings on physical examination releaved the following: signs of atherosclerosis in 10 (45.5%), grade I and II retinopathy in 19 (86.4%) grades III and IV retinopathy in 11 (50.0%), cardiomegaly in 13 (59.1%), obesity in 4 (18.2%), valvular heart disease in 1 and cataracts in 1. Figure 1 shows the pattern of Hb, WBC and ESR of the hypertensive patients.

The blood sugar in hypertensives ranged from 3.8 to 20.5 mmol/l with a mean of 7.6 ± 4.2 mmol/l, six (27.3%) patients had blood sugar above 8 mmol/l. The serum sodium ranged from 122 mmol/l to 153 mmol/l with a mean of 136 ± 8 mmol/l. There were 5 subjects (23.8%) with levels below 130 mmol/l and 1 with a level above 150 mmol/l. The serum potassium levels ranged from 2.8 to 5.3 mmol/l with a mean of 4.0 ± 0.7 mmol/l. There were 7 (31.8%) subjects with serum potassium levels below 3.8 mmol/l and none with levels above 5.5 mmol/l. BUN levels ranged from 4.1 to 65 mmol/l with a mean of 14.4 ± 22.1 mmol/l. 13 (59.1%) patients had BUN above 6.6 mmol/l.

The serum creatinine ranged from 67 µmol/l to 315 µmol/l with a mean of 132 ± 63 µmol/l. Six (35.3%) had levels above 133 µmol/l and it was not determined in 5 paitents.

Serum uric acid levels ranged from 110 µmol/l to 1,395 µmol/l with a mean of 417±321 µmol/l. Five

(29.4%) patients had levels above 420 µmol/1. Five
patients did not have their uric acid levels
determined.

The total serum proteins ranged from 55 g/1 to
86 g/1 with a mean of 70±10 g/1. Six (22.7%) had
serum alkaline phosphatase levels which were higher
than 15KA unit. Only one patient had a significantly
raised SGOT level.

The triglycerides were markedly raised in all
the patients with a mean of 582±127 mg%. The total
serum cholesterol ranged from 108 mg% to 237 mg%
with a mean of 189 ± 36 mg%. No patient had levels
above 250 mg%. The serum high density lipoprotein
levels ranged from 13 mg% to 48 mg% with a mean of
36 ± 9 mg%. No patient had levels above 55 mg%
while 6 (28.6%) had levels below 35 mg%.

The serum low density lipoprotein levels ranged
from 37 to 138 mg% with a mean of 96 ± 18 mg%. No
patient had levels above 150 mg%.

In the hypertensive patients, the chest xray
showed cardiomegaly in 16 (72.7%) and was normal in
2 (9.1%). It was not done in one patient. The
electrocardiogram was abnormal in 15 (68.2%) and
normal in 3 (13.6%). It was not done in 4 patients.
The abnormalities noted were: tachycardia, left
ventricular hypertrophy, left axis deviation, right
ventricular hypertrophy and low voltage QRS complexes.
Urine examination was abnormal in 6 (27.3%) patients
with hypertension. It was normal in 5 (40.1%)

patients and was not done in 7 (31.8%) patients.
The abnormalities of the urine included glycosuria,
and bacteruria (culturing Klebsiella, proteus,
citrobacter, and salmonella typhimurium). Serolo-
gical test for syphilis was not positive in any
of the hypertensive patients. Blood cultures
revealed septicaemia in one patient where a heavy
growth of staphylococcus albus was obtained.
Carotid angiogram was done in only one patient with
hypertensive stroke and it was normal. Computerised
axial tomography done in one patient showed
infarction in the left cerebellar hemisphere and
brainstem. In one patient ultrasonography showed
enlarged kidneys with bilateral hydronephrosis.
Three patients with hypertension were aged 45 years
or younger.

The haemoglobin level ranged from 6.3g/dl to
20.5g/dl with a mean of 14.0$\pm$2.0 g/dl. The white
blood cell count in normotensive patients ranged
from 4,1 x 10^9/1 to 1066 x 10^9/1 with a mean of
28.9$\pm$49.7x10^9/1. This was due to a few of the
patients who had extremely high WBC counts. No
patient had a reading below 3.5 x 10^9/1 while 5
(10%) had readings above 11.0 x 10^9/1, one of these
had a reading of 32.0 x 10^9/1 while the other one
had the incredible figure of 1066.0 x 10^9/1.

The erythrocyte sedimentation rate of the
normotensive patients ranged from 1 mm/h to 60 mm/h
with a mean of 29$\pm$20 mm/h. Five (15.2%) of the

patients had an ESR of 1 or 2, while 20 (60.6.%) had an ESR above 20. ESR's were not determined in 17 patients.

The blood sugar levels in normotensives ranged from 2.1 mmol/l to 22.2 mmol/l with a mean of 4.9+3.1 mmol/l. One patient had a blood sugar level of 22.2 mmol/l, while the rest had blood sugar levels <11 mmol/l. Four patients had hypoglycaemia with blood sugar levels below 2.6 mmol/l.

The serum sodium levels in normotensives ranged from 130 mmol/l to 160 mmol/l with a mean of 135+21 mmol/l. Three patients (6.4%) had levels above 150 mmol/l while none had levels below 130 mmol/l.

The potassium levels in normotensive patients ranged from 2.8 mmol/l to 5.6 mmol/l with a mean of 4.4+0.7 mmol/l. One (2%) had a reading above 5.5 mmol/l while another 1 (2%) had a level below 3.5 mmol/l. The blood urea nitrogen levels for normotensives ranged from 2.4 mmol/l to 16.3 mmol/l with a mean of 5.4+2.5 mmol/l. Ten (20%) had BUN levels above 6.7 mmol/l.

The uric acid levels in serum of normotensives ranged from 160 μmol/l to 608 μmol/l with a mean of 376+36 μmol/l. Ten patients (31.2%) had uric acid levels above 420 μmol/l. The serum creatinine levels ranged from 45 μmol/l to 144 μmol/l with a mean of 97+23 μmol/l. Twelve (34.3%) of patients had a serum creatinine level over 106 μmol/l.

The liver function tests done included total

serum proteins, albumin, glutamate-oxalo-acetate
transaminase (SGOT), glutamic-pyruvic acid trans-
aminase (SGPT), and alkaline phosphatase.   The
total serum protein in normotensive patients ranged
from 38 g/1 with a mean of 70+19 g/1.   Five (10%)
patients had levels above 85 g/1 while 7 (14%) had
levels below 60 g/1.   The albumin levels ranged
from 15 g/1 to 52 g/1 with a mean of 34+8 g/1.   The
SGOT levels ranged from 2 units/1 to 192 units/1
with a mean of 46+40 units/1.   The range of SGPT
was from 10 units/1 to 197 units/1 with a mean of
45+37 units/1.   The serum alkaline phosphatase
levels ranged from 3.0 - 37.1 K.A.   units with a
mean of 15.4+6.3 K.A. units.

The lipid profile in normotensives showed that
there was markedly raised triglyceridemia with a
range from 450 mg% to 686 mg% with a mean of
595+116 mg%.   None of the patients had normal
serum triglycerides.   The total serum cholesterol
ranged from 112 mg% to 293 mg% with a mean of
195+51 mg%.

The high density lipoprotein cholesterol level
ranged from 10mg% to 72mg% with a mean of 31+10mg%
while the low density lipoprotein cholesterol levels
ranged from 22mg% to 158 mg% with a mean of
94+30 mg%.

The young normotensive patients were then
analysed.   The cut off age was arbitrarily taken
as 45 years.   There were 10 males and 12 females

in this group. The youngest patient was 15 years
of age. Six (27.3%) were students: six (27.3%)
were farmers, 2 (9.1%) were unemployed and there
was 1 (4.5%) each of a secretary, waiter, housemaid,
watchman and unknown occupation. Six (27.3%) were
urban dwellers while 16 (72.7%) were rural dwellers.
Examination, history and laboratory work up indicated
the following associated factors in these young
normotensive patients: high ESR in 8 (36.4%),
mitral valve stenosis and regurgitation in 7 (31.8%),
anaemia in 4 (18.2%), polycythemia in 3 (13.6%),
atrial fibrillation in 3 (13.6%), heart palpitation
in 2 (9.1%). There was 1 (4.5%) each of the
following conditions: pneumonia, deep vein thrombo-
sis, connective tissue disease, mitral valve
prolapse, postpartum septicaemia, alcohol intake,
cigarette smoking, VDRL-positivity, sickle cell
disease, arterio-venous malformation, hepatitis,
malaria, an intracranial space occupying lesion
and ulcerative colitis.

NORMOTENSIVE PATIENTS:

Twenty two (44%) normotensive patients were
aged 45 years or below while 28 (36%) were older
than 45 years. Twenty three (46%0 were males while
twenty seven (54%) were females, 21 (42%) were
farmers, 9 (18%) housewives, 5 (10%) students, 2
(4%) watchmen, 2 (4%0 drivers, and 2 (4%) were
unemployed. There was one each of a businessmen,
secretary, waiter and housemaid. In 5 (10%) the

occupation was unknown. Seven (14%) had history of
alcohol consumption and cigarette smoking; 5 (10%)
had previous history of stroke, 4 (8%) had history
of heart disease, 3 (6%) had history of chronic
chest pain, cough and hemoptysis, 2 (4%) had used
contraceptive pills while 2 (4%) had used intra-
uterine contraceptive devices, 2 (4%) had pneumonia.
The following occurred in one patient each: cold
ischaemia of the foot, chronic headaches, recent
parturition, trauma, ulcerative colitis, bronchial
asthma, congestive cardiac failure, deep vein
thrombosis, connective tissue disease, duodenal
ulcer, dementia and mental depression. Physical
examination in the normotensive patients showed
that 20 (40%) had left-sided stroke while 30 (60%)
had right-sided stroke and in one the stroke was
bilateral. Signs of atherosclerosis was found in
11 (22%) patients. Twenty two (44%) had grade I
or II retinopathy. 3 (6%) had grade III or IV
retinopathy, 6 (12%) had atrial fibrillation, 10
(20%) had cardiomegaly, 13 (26%) had heart murmurs,
and there was 1 each of tachycardia, and abdominal
malignancy. On laboratory work up, chest x-ray
showed cardiomegaly in 14 (28%), the electrocardio-
gram was abnormal in 14 (28%), urine examination was
abnormal in 5 (10%). VDRL test was positive in
2 (4%), though both were negative for the more
specific test of TPHA. Blood culture was positive
in one patient; carotid angiogram was abnormal in

4 cases, the two dimensional echocardiogram was
abnormal in two, the antinuclear factor and
rheumatoid factor in one, the widal test was
positive in one and T_3/T_4 levels were significantly
raised in one.

The pattern of Hb, WBC and ESR in normotensive
patients is shown in Figure II.

DISCUSSION

As stated at the outset, the aim of the study was to document the occurrence of stroke in terms of clinical presentation and laboratory workup at Kenyatta National Hospital, i.e., it was a descriptive study and no attempt was made at a comparative analysis of any of the findings. Seventy two consequtive patients were enrolled in the study all coming from the medical wards. Only those who survived long enough to have the various clinical and laboratory parameters studied were included. Hence, a number of stroke patients were excluded on the account of early demise following admissions. Other patients presenting to KNH with stroke but who got admitted to other wards, e.g., surgical, paediatric and gynaecological wards for other reasons were also excluded. In that period, January, 1986 to January, 1987, there were 4704 patients admitted to the adult medical wards. Of these, 1084 had neurological problems constituting 23% of all medical admissions and of those, 193 were recorded as having had CVA as described in the introduction. This was 18% of all neurological admissions. In 1957, Shaper and Shaper found that neurological admissions constituted 10.5% of total medical admissions in Mulago Hospital (10). This was lower than in this present study. They found that CVA constituted 11.4% of all neurological admissions. This is also a lower figure compared

with the findings in this study of 18%. Dada et al
(11) in a similar study at the University of Lagos,
found CVA's to constitute 16.8% of all the neurolo-
gical admissions. It is important to note that in
this particular study, subarachnoid haemorrhage was
included amongst the CVA's; and accounted for 13.6%
of all CVA's. Billinghurst (9), about two decades
ago, studied the pattern of neurological admissions
to Mulago Hospital, Kampala and found that out of
all 6144 medical admissions, neurological cases
accounted for 9.6%. This again is lower than the
findings of the current sudy. In that study,
CVA's constituted 34.0% of neurological cases. This
is rather high compared to findings of the current
study, but that is probably because no attempts were
made by Billinghurst to subdivide the vascular
problems further; and the study included such
entities as subdural haematoma, diffuse athero-
scleoris, extradural haemorrhage and venous sinus
thrombosis. These differences suggest that there
is a higher incidence of neurological admissions and
CVA's. The aetiological factors to stroke were
analysed and the patients were divided into two
broad groups, namely: hypertensive and normotensive
patients. The patients were examined in terms of
the history, physical examination and laboratory
findings including other investigative techniques
from all these modalities of evaluation, it was
noted that hypertension occurred in 22 patients

constituting 30.6% of all stroke patients. This
is slightly lower than found by Bahemuka (8) at
KNH (47.8%) in a retrospective study of 207 cases
in 1985. Billinghurst (9) found hypertension to
constitute 45% of his cases. Osuntokun et al (12)
found an even higher frequency of hypertension
amongst cerebrovascular accident patients. They
reported 53.6% at University College Hospital,
Ibadan in 1969. The age distribution of the
patients was from 15 years to 88 years with a mean
of 52 years. The highest incidents were found in
the sixth and seventh decades, both accounting for
44.4% of the patients. Of necessity there were no
patients included below 12 years of age which is
the operational dividing line between paediatric and
adult admissions to KNH. No patients were seen
older than 88 years. These findings are in keeping
with those of Bahemuka (9) who found a higher
incidence in the fifth, sixth and seventh decades,
the three totalling 59.3% of all his cases.
Osuntokun (12) found a similar age distribution in
Nigeria. Majority of the patients (65.3%) in the
current study were from a rural setting. This is
a most interesting finding considering that hyper-
tension has hitherto been thought of as an urban
problem largely attributed to westernization, among
other things. It is not clear whether this may be
related to the other equally interesting finding
that the majority of the/(58.3%) came from the
patients

central province of Kenya. Could this be a reflec-
tion of the level of "westernization" of the life
style and foods and so on with its accompanying
high level of "stress" etc? This calls for further
scrutiny. It should be noted though that KNH is
a National Referral hospital situated within the
central province, so that the figures may only
reflect ease with which patients get referred from
the immediate environs. There was no literature
available with which to compare these last two
observations.

In terms of occupation, farmers occupied the
first spot (45.8%). This is, again, an interesting
observation though it may probably be tied together
with the preponderance of rural dwellers in the
series. Housewives were second at 18.1%. The
group one would have expected to feature prominently,
businessmen, only had 2 representatives constituting
2.8%. This is again, an interesting observation as
this group is usually thought to have risk factors
such as stress. May be most of the businessmen
with stroke would go to the private (paying) hospitals
rather than to KNH. Of the hypertensive patients,
50% had a positive history. History of smoking was
elicited in 12 (16.7%). This is a very low
incidence compared to the findings of a rate of
63.3% by Lederman et al (15) in the U.K. in 1985.
The relationship between smoking and stroke has now
been well established. Abbot et al (26) studied

this phenomen conclusively and found that cigarette smoking on a long term basis adversely affected the occurrence of stroke and probably had implications in prevention. A case control study was conducted by Bonita, et al (24) in which they looked at a total of 132 cases of stroke and found that cigarette smokers had a three-fold increase in the risk of stroke compared to current non-smokers. This risk remained significant after adjusting for the risk from concurrent hypertension. Smoking and hypertension increased the risk to 20-fold compared to those who neither smoked nor had hypertension. Others have also noted the important contribution of smoking to stroke development (20,27).

A history of alcohol consumption was elicited in 14 (19.4%) of the patients. This is a recognised risk factor to the development of stroke as reported in several papers: (15-18). The study by Gill et al (18) indicates that the risk of stroke from alcohol consumption is dependent on the sex and the amount of alcohol consumed. Among men, the relative risk of stroke (adjusted for hypertension, cigarette smoking and medication) was lower in light drinkers (those consuming 10 to 90 g of alcohol weekly) than in non drinkers, but four times higher in heavy drinkers (consuming $>$ 300g weekly) than in non-drinkers. There was not enough data to comment on the effect on women.

Diabetes mellitus was noted in 5 (6.9%) of the

patients. This is a well recognised risk factor to development of stroke all over the world. The incidence compared well with other studies. Bahemuka (8) found an incidence of 5.3%, Billing-hurst (9) found 3%, Osuntokun et al (12) found 8.5%, Bahemuka (13) found an incidence of 4.2% in young normotensive patients. Hilton-Jones and Warlow (14) found an incidence of 3.3%, Schneider et al (20) found an incidence of 25%. probably the highest incidence reported so far. Lederman et al (15) found an incidence of 9.5%, Matenga et al (27) found an incidence of 3.2% in Harare; and many others have shown this correlation between diabetes and stroke.

Trauma to the head is an interesting association to stroke. The direct injury caused to the brain with subsequent bleeding is obvious enough, but often patients who have had trauma to the head will present with stroke several weeks later and investigations may not reveal any blood clot to account for the ischaemia. In the current study, the only factor that could be found in 4 (5.6%) patients was a history of trauma to the head several weeks before. In these 4 patients, carotid angiograms and skull x-rays were done and these did not show any abnormality. It was not clear how trauma led to stroke in these patients. Bahemuka (13) found this phenomenon in 11 (30.6%) of 36 patients he studied with stroke. These 11 included those

in whom no possible cause for the stroke had been
determined. Hilton-Jones and Warlow (14) found
trauma to be the most common cause of stroke in the
young at the Radcliff Infirmary in the U.K. They
took patients below 45 years. They noted that the
"trauma" may consist, as did in one of their
patients, of being grabbed around the neck in a
scuffle. The stroke developed the following day.
There were no neck bruits to suggest dislodging of
an atheromatous material.

Congestive cardiac failure was noted in 3
(4.2%) of the patients. Bahemuka (8) found an
unspecified number of his patients had cardiomyo-
pathy with congestive cardiac failure, Billinghurst
(9) did not find any, and in the other works, heart
disease was reported in terms of the specific
underlying cause other than as congestive cardiac
failure. It would appear that the sluggishness of
circulation may encourage thrombus formation in the
heart chambers which may form source of the emboli.
On the other hand, the failing heart's inability to
pump enough oxygenated blood to the brain may be the
underlying factor. No clear explanation can be
offered for the association between stroke and
duodenal ulcer disease found in 2 patients. The
finding of an infective process (pneumonia),
bronchial asthma, sickle cell disease, use of
contraceptive pill, and

stroke occurring in the immediate post-partum is
in conformity with other studies (8,9,10,12,13).
Bahemuka (13) found infections to be the most common
of the associated factors in his series on the young
normotensive patients. These included conditions
like upper respiratory tract infection, cavernous
sinus thrombosis, intracranial tuberculosis, malaria,
typhoid fever, neurosyphilis, pyogenic meningitis.
In this study, only one case could be ascribed to
malaria. Three other cases had urinary tract infec-
tion. One had pneumonia, one had septicaemia, two
had positive VDRL but these were non-reactive to
the more specific treponemal serological tests, one
patient had hepatitis.

Chronic headaches thought to be secondary to
migraine was elicited in one young normotensive
patient. Migraine is a well recognized association
with stroke. In the series by Hilton-Jones and
Warlow (14) migraine was the second commonest
association with stroke in the young normotensive
patients accounting for 10% of the cases. Henrich
et al (23) studied this association in some detail
and found that migraine most often was associated
with cerebral infarction type of stroke (244
patients) as opposed to cerebral haemorrhage (28
patients) or subarachnoid haemorrhage. This tended
to suggest that migraine might be a direct causa-
tive factor via the vasospasm/vasodilatation
phenomenon.

Hypertensive patients as a group tended to be older, only 3 being under 45 years. This is in contrast to elsewhere where the tendency has been for hypertensive complications to occur in the younger male black patients. One of the postulates had been that probably if blood pressure control had been good then the risk of complications, including strokes might be lowered. This, however, may not be tenable in our local set up as 50% of the patients had not given previous history of hypertension prior to the event and were found to be hypertensive for the first time after admission for stroke. Matenga and colleagues (27) found that 44.9% of their patients presenting with stroke in Harare had no previous history. A further 44.9% had previously been diagnosed but had then "absconded" from treatment. Bahemuka (25) found that only 6(13.3) had previous history of hypertension. In the present study of the patients who had hypertension for one year or more, 10% had good control as defined earlier, 70% had fair control, while 20% had either absconded from treatment and follow-up or had poor control of their blood pressure. From this, it would appear that a very strict control of blood pressure is the only acceptable aim of treatment in terms of preventing strokes. But considering the average age of the patients presenting with hypertensive stroke, it is

not clear whether this is feasible as most elderly
people would have diastolic pressure levels above
95mmHg and yet not constitute a need for anti-
hypertensive therapy. This opinion, namely, that
the level of the blood pressure may not be the whole
story in terms of neurological complications, is
shared by many including Bahemuka (28) who in a
study of 34 consecutive patients admitted to KNH
from 1975 to 1979 with malignant hypertension and
followed up upto 1982, only 2 patients presented
with stroke, and neuro-psychiatric syndromes were
not observed in any of them. Against this is the
fact that many reviewers think otherwise (13,29).
The most common associated finding amongst hyper-
tensives was an elevated uric acid level (54.5%).
This was followed by renal insufficiency (25.4%)
and a high ESR (31.8%). It was difficult to trace
any literature discussing hypertensive stroke,
high uric acid and ESR. The other findings were
the expected ones, e.g., diabetes mellitus (18.2%),
history of cigarette smoking (18.2%), family
history of hypertension (18.2%) and alcohol
consumption (13.6%).

Physical examination of the hypertensive
patients revealed signs of atherosclerosis (palpa-
ble radial artery, serpentigeous brachial artery,
etc) in 10 (45.5%). This is in contrast to
previous studies which have tended to find no
signs of atherosclerosis in the African hypertens-

ive patient (8,13). Grade I and grade II retino-
pathy was noted in 86.4% of the patients. The
significance of this is not clear as in a concurrent
study by Ngumuta (30) a large majority of normoten-
sive elderly people have Grade I & II retinopathy.
Fifty per cent of the patients had Grade III and
IV retinopathy. This was thought to be related to
the hypertension rather than to the development
of stroke per se. Cardiomegaly, by clinical
examination, chest x-ray and ECG studies, was noted
in 59.1% of the hypertensive patients. Again, this
is explainable by the expected end-organ damage.

The haemoglobin in hypertensives ranged from
8.7 g/dl to 18.8 g/dl with a mean of 14.3+2.3 g/dl.
This is in agreement with the local figures (31).
Hence anaemia does not seem to have played an
important part. Only 3 patients had a haemoglobin
value below 12 g/dl. Six (27.3%) had a haemoglo-
bin above 15 g/dl and in fact 2 had a haemoglobin
level above 18 g/dl. These may have had a part to
play in the causation of stroke. Osuntokun (12)
had 3 patients in his series with haemoglobin
levels above 18g/dl but they all had normal WBC's.
The WBC's in this series ranged from $3.9 \times 10^9/1$
to $15.1 \times 10^9/1$ with a mean $\pm$ Standard Deviation of
$8.8 \pm 3.5 \times 10^9/1$. Kyobe et al (32) in a study of
normal subjects at Makerere College, Kampala, found
the WBC to have a mean of $5.5 \times 10^9/L$. But this
was a much younger population.

Kasili et al (33), reviewing blood from donors
found the WBC's to range from 2.0 - 10.7 x 10^9/l
with a mean of 5.0 x 10^9/l. Allen et al. (34) had
done a similar study in Kenyan Africans in 1959 and
found the WBC to range from 3.0 to 9.1 x 10^9/l.
with a mean of 5.5 x 10^9/l. Hence the current
study indicates that the WBC counts were probably
elevated. However it is not easy to compare this
with the other studies quoted as the age range is
not comparable. The ESR range was from 1 mm/hr to
55 mm/hr with a mean of 22 $\pm$ 14 mm/hr. This tends
to show that the majority of these patients had a
raised ESR. Fifteen (68.2%) had an ESR above 15mm/
nr. Whether this is a general response to the
stroke event itself or a reflection of some under-
lying problem which also led to the stroke is not
clear. Whether the ESR was high before the stroke
occurred is not clear either. If it could be
shown that the ESR goes up just before the stroke
occurs, then it might be a good screening test in
those who are at risk of developing stroke. Kyobe,
et al. (32) found the ESR in his series of healthy
young adults to be 6 $\pm$ 8 mm/hr. A study to show
the effect of age on ESR and a controlled trial on
ESR and stroke development might be interesting.
The renal function tests showed most parameters to
be within normal limits except the BUN which
showed an elevation with a range from 4.1 to 65
mmol/l with a mean of 14.4 $\pm$ 22.1mmol/l.

The serum creatinine was also elevated with a range from 67 μmol/l to 215 μmol/l with a mean of 132 ± 63 μmol/l. The local laboratory range for normal serum creatinine is from 62 to 106 μmol/l (31). The elevation of BUN and creatinine was expected from the effect of hypertension on the kidneys.

The total serum proteins in hypertensives was within normal limits and hyperproteinaemia did not seem to be an important factor in the aetiopatho- genesis of stroke in the hypertensive patients. None was clinically jaundiced and none showed features of compromised liver function.

The total serum triglyceride levels were extremely elevated in all the patients. This was most surprising though several studies have shown that patients with hyperlipidaemia have a high risk to development of stroke yet the figures were extremely high. There was really no reference material with which to compare these readings as the method used was the new fully enzymatic method, but the manufacturers recommend 200 mg/dl as the cut off point for definite hypertriglyceridaemia (35). Most of the readings obtained were three times higher than this. Further tests will need to be done using this method in order to establish appropriate normal levels for our local population hence, it would probably not be appropriate to make a categorical statement that triglyceride levels are, an average, three times higher than normal

in all stroke patients at least not at this stage.
The total serum cholesterol ranged from 100mg/dl to
237mg/dl with a mean of 189+36mg/dl. This was within
normal limits according to the recommendation of the
manufacturers of the test kit who give an upper cut-
off point of 260mg/dl (35). There were no patients
with readings above this level. Okelo, Kanja and
Kyobe (36) looked at the serum lipid profile in
diabetics and non-diabetic controls at the Universi-
ty of Nairobi and found the serum triglycerides and
cholesterol to be significantly elevated in compari-
son to controls. Ojwang, et al (37) worked out a
reference level for serum lipids in Africans aged
between 20 years and 40 years. They found that the
levels for serum cholesterol was 4.73+0.7 mmol/l,
for men and 4.46+0.76 for women while that for
serum triglyceride was 0.83+0.36 mmol/l for men and
0.66 + 0.39mmol/l for women. The HDL-cholesterol
in men was 1.04+0.34 mmol/l while that in women was
1.18+0.25mmol/l. These are closely similar to those
found by Okelo et al and slightly lower than those
in the current study except for the levels for
serum triglycerides already referred to earlier.

The normotensive patient with stroke is always
a diagnostic problem especially if that patient is
young and especially in the developing world where
the diagnostic options are limited. Sixty nine
per cent of the patients in this series

were normotensive and of these 22 (44%) were aged
45 years or below.   There was a slight preponderance
of males over females (54%:46%).   Lederman et al
(15) found males to be more (88:46) in his study of
young stroke patients also.   Bahemuka (13) also
found a male preponderance of 2:1.   There has been
no attempt to explain this male preponderance of
stroke, especially in the normotensive patients.
The occupation distribution was similar to that of
hypertensives.   There were more right-sided hemi-
plegics than left-sided (60%:40%).   This was only
significant in that all the patients were right
handed and a large proportion of these patients were
aphasic.   Whereas 44% had grade I or II retinopathy,
only 6% had grade III or IV retinopathy.

The haemogram in normotensive patients showed
the Hb to range from 6.3g/dl to 20.6g/dl with a
mean of 14.0+2.6g/dl.   The majority had a range from
12g/dl to 18g/dl.   Four (8%) had a Hb above 18g/dl
and in these, the polycythemia was thought to have
played some role in the causation of stroke.
Anaemia might also be an important factor because
upto 9 (18%) had a Hb below 12g/dl.   Bahemuka (13)
did not find anaemia or polycythemia to be an
important factor in his series.   Hilton-Jones and
Warlow (14) reported anaemia in 3 (21.4%) of the
patients with ischaemic strokes.   He did not find
any patient with polycythemia. Lederman et al (15)
reported no cases of anaemia but had 13% of his

normotensive patients with a high packed cell volume.
The white blood cell count in normotensive patients
ranged from $4.1x10^9/1$ to $1066x10^9/1$ with a mean of
$26.9 \pm 149.7x10^9/1$. The high mean was due to 3
patients who had extremely high WBC levels. One
had a level of $1066x10^9/1$ and diagnosed to have a
myeloproliferative disorder on bone marrow examina-
tion most probably granulocytic leukemia. The other
one had a count of $19.4x10^9/1$, an infective process
being considered the culprit, while the third one
had a count of $32.0x10^9/1$. This was a 58 year old
female who had a stroke six months before, she had
atrial fibrillation with mitral stenosis and
mitral regurgitation, she was on therapy with
warfarin and she also had biochemically confirmed
hyperthyroidism. The ESR in normotensive patients
was raised in 22 (44%) of cases. The range was
1 mm/hr to 60 mm/hr, with a mean of 22 ± 20 mm/hr.
Hilton-Jones and Warlow (14) found a high ESR in 2
of 14 (14%) of his patients.

The renal function tests showed that uremia
occurred in 20% of the cases. It was not immediately
apparent what caused this uremia and it was not easy
to find any reference to uremia as a cause of stroke.
The other interesting finding was that 31.2% of the
normotensive patients had an elevated uric acid
level (>420 umol/l). Whether this was related
to the uremia or whetther it had a direct causative
effect on stroke was not clear either and may need

further study. Ten per cent of normotensive stroke patients had total protein levels above 85g/1. This may have the effect of making blood hyperviscous and this might in turn lead to stroke in patients who are predisposed.

The lipid profile of normotensive patients showed a similarly high levels of triglycerides as in hypertensives and similar comments apply. Eight (16%) of the patients had significantly elevated serum total cholesterol. These were not necessarily those with renal insufficiency as only 2 of these 8 had elevated BUN or serum creatinine. Again the same problems as noted for hypertensive patients in terms of interpreting serum cholesterol results apply.

The young normotensive patients constituted 22 of the patients. There was an equal distribution of the sexes. Here there were more students. The diagnostic work-up was limited as has been indicated, but with what was available, not all the patients had a recognisable factor causing the stroke. Here again rural dwellers out-numbered urban dwellers (72.7%:27.3%). A· high ESR was noted in 8 (36.4%). The other associated findings are similar to those noted in other studies. In one patient, echocardiography showed anterior myocardial infarction. This has not been reported before in the local literature.

CONCLUSION AND RECOMMENDATIONS

The study carried out over about twelve months incorporated 72 patients. It was found that at KNH, stroke (cerebrovascular accident) constituted 18% of all neurological admissions. This is higher than in most other series. Hypertension constituted 30.6% of all stroke cases. The majority of the patients (58.3%) originated from the central province. Sixty five point three per cent of the patients lived in the rural areas. Forty five point eight per cent were farmers, followed by housewives (10.1%).

Fifteen point three per cent had a previous history of hypertension. Cigarette smoking and alcohol consumption were found to be important associated factors. This is in keeping with data now emerging from other parts of the world indicating that these two habits, especially in the setting of hypertension are serious risk factors. Other co-existing conditions were noted but their weighting in terms of aetiology was not clear.

Good control of hypertension was seen to be possibly useful in preventing strokes by extra-polation though it was noted that there are reports throwing doubt on this assertation. It was noted that only about 50% of hypertensive stroke patients had a previous history of hypertension. Signs of atherosclerosis was noted in 45.5% of hypertensive patients. This has not been previously reported

from this part of the world.

Triglycerides were estimated using a new enzymatic technique and found to be elevated in all the patients. It was difficult to interpret this considering the method had not been previously used in Kenya and there was no data to compare it with.

No patient was found to have syphilis and the importance of this disease as a cause of stroke may be truly diminishing.

The young normotensive patients were found to have a raised ESR, mitral valve disease, anaemia polycythemia, urinary tract infection, atrial fibrillation, heart disease with palpitations, pneumonia, deep vein thrombosis, connective tissue disease, mitral valve prolapse, post-partum period, septicaemia, alcohol consumption, smoking, sickle cell disease, arterio-venous malformation, hepatitis, malaria, ulcerative colitis, and contraceptive pill use, as associated conditions. In four young normotensive patients, no cause or associated conditions could be found to explain the occurrence of stroke. It is recommended that:-

1. Treatment of hypertension, with follow-up and good control is still probably the single most important method of preventing strokes in patients attending K.N.H. The control would seem to be effective only when diastolic level is kept below 95 mm Hg.

2. The reason for the high incidence of strokes in patients from central province of Kenya should be studied to ascertain its statistical significance and to look for the possible reasons for its occurrence.

3. More attention should/paid to the study and _ documentation of hypertension and stroke incidences in the rural areas of Kenya as it would seem from this study that they form the majority of our patients.

4. Cigarette smoking, alcohol consumption and hypertriglyceridaemia are important states which constitute risk factors to the occurrence of stroke and that the control of these may be an important step in preventing strokes. The first two may be achieved through intensive health education while the third may be achieved through both health education and drug therapy.

5. A further controlled trial should be undertaken to establish the status of serum lipids especial- ly using the enzymatic method which is reported by the manufacturers to be highly sensitive, so local norms can be established particularly for the age range which suffers strokes and also to establish what levels require therapy.

6. The young normotensive stroke patient should be fully investigated as in the majority of cases, a treatable underlying cause

for the stroke can be demonstrated. In this
regard, it is hoped that computerized tomographic
scanner will soon be available so that more accurate
and safer evaluation can be made.

TABLE I: REGION OF ORIGIN OF STROKE PATIENTS

(REGION)	NUMBER	(%)
Central	42	(58.3)
Nyanza	9	(12.5)
Western	8	(11.1)
Eastern	7	(9.7)
Coast	2	(2.8)
Rift Valley	1	(1.4)
North Eastern	1	(1.4)
Nairobi	1	(1.4)
Not known	3	(4.2)

TABLE II: <u>AGE DISTRIBUTION IN STROKE PATIENTS</u>

AGE (YEARS)	NUMBER OF PATIENTS
11 - 20	4
21 - 30	9
31 - 40	8
41 - 50	6
51 - 60	17
61 - 70	15
71 - 80	8
81 - 90	3
91 - 100	0
Not known	2 Both elderly

TABLE III: OCCUPATIONS OF STROKE PATIENTS

OCCUPATION	NUMBER	(%)
Farmer	33	(45.8%)
Housewife	13	(18.1%)
Student	5	(6.9)
Businessman	4	(5.6)
Driver	3	(4.2)
Watchman/guard	2	(2.8)
General worker	1	(1.4)
Secretary	1	(1.4)
Machine operator	1	(1.4)
Waiter	1	(1.4)
Fitter	1	(1.4)
Housemaid	1	(1.4)
Unemployed	4	(5.6)
Not known	4	(5.6)

TABLE IV: ASSOCIATED CONDITIONS IN STROKE PATIENTS

CONDITION	PERCENTAGE FREQUENCY IN HYPER-TENSIVES	PERCENTAGE FREQUENCY IN NORMO-TENSIVES
Diabetes Mellitus	18.2	2.0
Alcohol ingestion	13.6	14.0
Cigarette smoking	18.2	14.0
Urinary tract infection	18.2	0
Vulvular heart disease	9.2	26.0
Bronchial asthma	13.6	2.0
Signs of atherosclerosis	45.4	22.0
Previous stroke	4.5	10.0
GIT Bleeding	4.5	2.0
Atrial fibrillation	0	12.0
Chronic chest pain with hemoptysis	0	6.0
Pneumonia	4.5	4.0
Trauma	4.5	2.0
Congestive cardiac failure	4.5	2.0
Epilepsy	4.5	0
Intra-uterine contraceptive device	0	4.0
Dementia with depression	0	2.0
Deep vein thrombosis	0	2.0
Abdominal malignancy	0	2.0
Myocardial infarction	0	2.0
Ulcerative colitis	0	2.0
Gangrene (ischemic) foot	0	2.0
Migraine	0	2.0
Following child birth	0	2.0
Connective tissue disease	0	2.0

TABLE V: BIOCHEMICAL PARAMETERS IN STROKE PATIENTS

PARAMETER	RANGE		MEAN ± SD	
	Hypertensive	Normotensive	Hypertensive	Normotensive
Haemoglobin (g/dl)	8.7–18.8	6.3–20.6	14.3±2.3	14.0±2.8
WBC (x10^9/L.)	3.9–15.1	4.1–10.66	8.8±3.5	28.9±149.7
ESR (mm/hr)	1 – 55	1 – 60	22 ± 14	29 ± 20
BUN (mmol/l)	4.1 – 65.0	2.4 – 16.3	14.4±22.1	5.4±2.5
Na$^+$(mmol/l)	122 – 153	130 – 160	136 ± 89	135 ± 21
K$^+$ (mmol/l)	2.8 – 5.3	2.8 – 5.6	4.0±0.7	4.4±0.7
Creatinine (µmol/l)	67 – 315	46 – 144	132 ±63	97 ± 23
Urate (µmol/l)	110 – 1,395	160 – 608	417 ± 321	378 ± 36
Total Protein (g/l)	55 – 86	38 – 96	70 ± 10	70 ± 19
Albumin (g/l)	15 – 42	15 – 52	31 ± 7	34 ±8
SGPT (u/l)	18 – 95	10 – 197	32 ± 19	45 ± 37
SGOT (u/l)	11 – 113	2 – 192	36 ± 28	46 ±40
A.P. (K.A. u/l)	4.7 – 34.8	3 – 37.1	18.8 ±10.5	15.4±6.3
Triglycerides (mg/dl)	174 – 697	333 – 686	582±127	595±116
Total cholesterol (mg/dl)	108 – 232	112 – 293	189±36	195 ± 51
HDL-chol. (mg/dl)	13 – 48	10 – 72	36 ± 9	31 ±10.
LDH-chol. (mg/dl)	37 – 138	22 – 158	96±18	94 ±30
Blood sugar (mmol/l)	3.0 – 20.5	2.1 22.2	7.6±4.2	4.9 ± 3.1

TABLE VI: FEATURES OF THE YOUNG NORMOTENSIVE
STROKE PATIENTS

CLINICAL FINDINGS	LAB FINDINGS	OCCUPATION
Mitral valve disease 7	ESR---------8	Farmer-----6
UTI----------------- 3	Anaemia-----4	Student----6
Atrial fibrillation--3	High Hb---- 3	Housewife --3
Heart disease------- 2	VDRL+VE---- 1	Secretary --1
Pneumonia------------1	A-V malfor- mation------1	Waiter -----1
Connective tissue disease---------------1	Malaria-----1	Maid -------1
Mitral valve prolapse-------------1	SOL ---------1	Guard ------1
Post-partum --------1		Unemployed-2
Septicemia-----------1		Not known---1
Smoking--------------1		
Smoking----------- --1		
Sickle cell disease--------------1		
Hepatitis------------1 ulcerative colitis--------------1		
The "Pill"----------1		
DVT-----------------1		
Alcohol consumption--1		

Footnote: (1) 22 patients M - 10, F - 12

        (2) Urban dwellers - 6, rural dwellers - 16

        (3) Numbers refer to number of patients with

           each variable.

FIGURE I: SHOWING PATTERN OF Hb, WBC & ESR
IN HYPERTENSIVE STROKE PATIENTS.

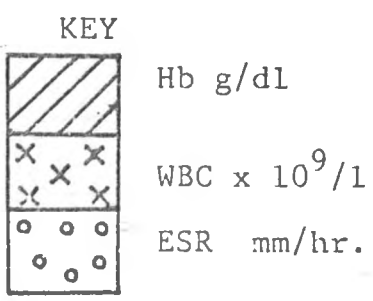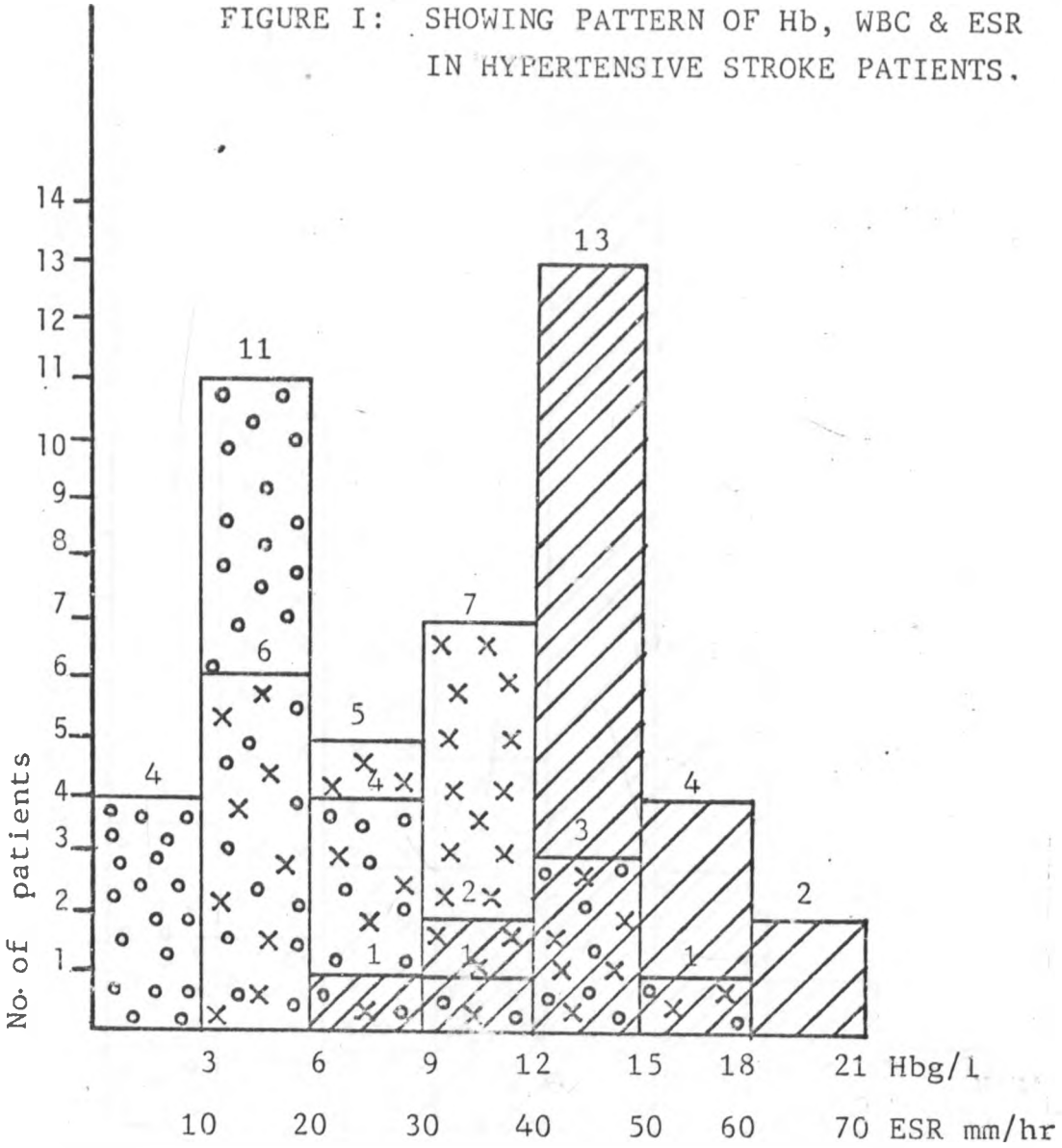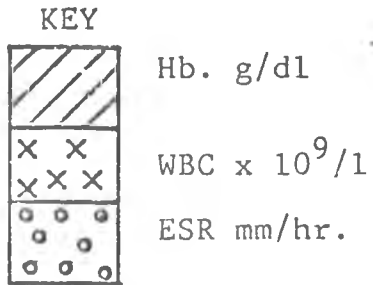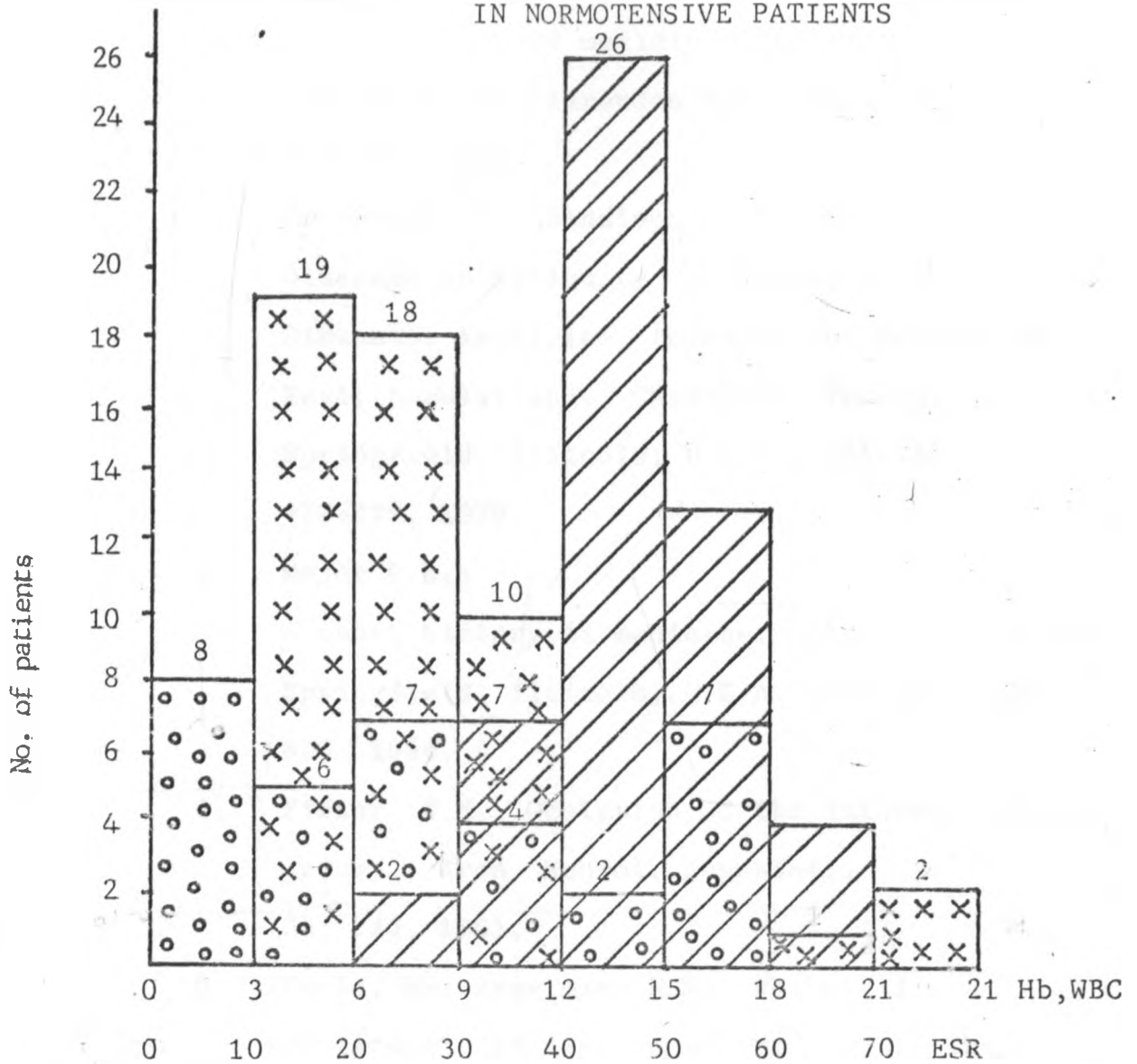KEY

Hb g/dl

WBC x 10^9/l

ESR mm/hr.

FIGURE II: SHOWING PATTERN OF Hb, WBC AND ESR IN NORMOTENSIVE PATIENTS

KEY

Hb. g/dl

WBC x 10^9/1

ESR mm/hr.

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