

## The burden of stroke in young black population and the role of post mortem evaluation in increasing awareness and prevention

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### ABSTRACT

**Background:** Stroke is the second commonest cause of preventable death and adult disability worldwide. While the risk factors, burden and mortality of stroke are known to a considerable extent in the older populations, the same still remain a big challenge in young population particularly in young black population, Rwanda included. Sometimes, stroke events in children and young adults happening without the existence of any of the known risk factors and as a result, clinicians tend to overlook the diagnosis of stroke in this particular age group. This case report aims to highlight the existing burden of stroke as well as create awareness for prevention, timely recognition and proper diagnosis of stroke in young black subjects.

**Methods:** We review two cases autopsied at the Kacyiru Police Hospital, Kigali-Rwanda, in 2015 in which a definitive diagnosis was not clearly established prior to death. These cases were presented at the 4th Interdisciplinary Forensic Summer School with the leading theme "A holistic approach towards a safer society" held in Kigali-Rwanda from 24th-27th August 2015.

**Results:** Following autopsy, hemorrhagic stroke was confirmed in two cases involving young patients aged 16 and 17 years respectively. Antemortem diagnoses did not include stroke.

**Conclusion:** These case reports clearly highlight the existing burden of stroke in young subjects, and with limited diagnostic modalities evident in low-income countries, emphasis needs to be put on risk-factor screening and prevention. Furthermore, stroke events in children and young adults happen without the existence of any of the known risk factors and so, there is a tendency to overlook the diagnosis of stroke in this particular age

**Keywords:** Stroke - young black population - autopsy - awareness

### INTRODUCTION

Stroke is the second commonest cause of preventable death and adult disability worldwide [1]. An estimated 5.7 million people died in 2005, 87% of these deaths occurring in low and middle-income countries [2]. Without intervention, the number of global deaths was projected to rise to 6.5 million in 2015 and to 7.8 million in 2030 [2]. Despite the availability of treatment of selected patients with stroke, the best approach to reduce its burden remains prevention. Effective preventive strategies necessitate credible epidemiologic data, which are not readily available or highly unreliable in developing countries Rwanda included, compared to developed countries.

Epidemiologic studies of the risk factors for stroke are important for determining its origin and prevention. In the past, many studies have successfully identified non-modifiable risk factors for stroke such as age, gender, race, ethnicity, heredity as well as modifiable risk factors such as hypertension, atrial fibrillation, diabetes mellitus, ischemic heart disease, dyslipidemia, cigarette smoking, alcohol abuse, obesity, physical inactivity and asymptomatic carotid stenosis.

Stroke mortality is increased among black compared to white patients. Population-based studies suggest that this excess mortality is due to an increased stroke incidence [3,4]. Age-adjusted stroke incidence has been estimated to be 2.2 and 2.4 times higher in UK and US black patients respectively, compared with the white population [5,6]. A

number of explanations for these excess incidences have been reported. Risk factor profiles differ between the ethnic groups; with hypertension, diabetes and in some studies, smoking and obesity occurring more frequently in black populations [7-9]. Socio-economic differences appear to account to some extent for the increased risk but do not explain all of it [10]. Differing genetic susceptibility, particularly to hypertension and its effects on the cerebral vasculature has been suggested [11].

Retrospective analysis of patients admitted with stroke in two hospitals of the same locality in Karachi, Pakistan, showed that out of the 12,454 cases admitted in the medical units, 796 (6.4%) had stroke [24]. The prevalence of stroke varies among countries and increases exponentially with age. Stroke not only increases mortality but also puts a great economic burden on the society.

Age and sex are important demographic variables known to the clinicians. Men have a higher incidence of stroke than women at younger but not older ages, with the incidence reversed and higher for women by age 75 years and older [12]. An international study recently reported (in abstract form), found a male predominance for children with arterial ischemic stroke and cerebral sinovenous thrombosis and also found increased risk for strokes due to cardiac disease, hematological malignancies as well as head and neck trauma in males [13].

The presence of risk factors increases the odds that a stroke is due to a particular mechanism, but the clinician cannot make a firm diagnosis simply on the basis of probability. As examples, conditions such as hypertension predispose to more than one type (thrombosis, intracranial hemorrhage) while the presence of a myocardial infarction increases the likelihood of a cardiac-origin embolism. Older patients

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with severe atherosclerosis may also harbor unexpected cerebral aneurysms.

Hypertension is the most common and most important risk factor. Epidemiologic studies show that there is a gradually increasing incidence of both coronary disease and stroke as the blood pressure rises [14]. Both prior and current blood pressures are important risk factors. However, these observations do not prove a causal relationship since increasing blood pressure could be a marker for other risk factors such as increasing body weight which is associated with dyslipidemia, glucose intolerance and the metabolic syndrome. Severe uncontrolled hypertension is a strong risk factor for intracranial hemorrhage. A young person who enters the hospital with the acute onset of focal neurologic deficit and a blood pressure greater than 220/120mmHg has a high likelihood of having an intracranial hemorrhage. In a Korean cohort study, for each higher 20 mm Hg of systolic blood pressure, the relative risk of ischemic and hemorrhagic stroke increased by 2.23 (2.17 to 2.30) and 3.18 (3.06 to 3.30), z test for difference between odds ratios 11.40,  $P < 0.00001$  [15]. For blood pressures greater or equal to 180/110 mmHg, the difference in relative risk was even more pronounced between hemorrhagic and ischemic stroke subtypes (28.83 versus 9.56).

Moreover, other risk factors that have been identified include heart disease, smoking, diabetes, elevated total cholesterol and decreased high density lipoprotein (HDL), elevated serum lipoprotein A, the use of amphetamines/cocaine, the presence of a known bleeding disorder or prescription of anticoagulants and HIV-infection.

### Case presentation

The cases discussed below were presented during the 4th Interdisciplinary Forensic Summer School with the leading theme "A holistic approach towards a safer society" held in Kigali-Rwanda from 24th-27th August 2015.

Case 1: A 17-year-old male reported sudden onset of headache, dizziness and loss of vision. The symptoms started while he was watching a football game. No prior illnesses were reported and no familial disease conditions were reported. The patient was confirmed dead on arrival at the health facility and no further investigations were done. The family requested an autopsy to determine the cause of death and rule out any possibility of poisoning. The autopsy report indicated the presence of massive bleeding in the third ventricle with inability to identify the source of bleeding. The thoracic and abdominal viscera were intact with no gross finding and no sign of trauma was objectivated.

Conclusion was hemorrhagic stroke. No post-mortem imaging or further investigation was done because the tests were expensive and the family could not afford.

Case 2: A 16-year-old male, previously healthy, consulted the nearest health facility complaining of sudden headache, dizziness and loss of vision. The symptoms had started the night before following a self-study session. No prior symptoms were reported and no existing familial medical conditions were reported. Upon arrival at the health center, the patient was immediately transferred to a higher-level hospital for further investigation and management. The patient was managed at the hospital during the first 24 hours but with progressive deterioration

and subsequently died. No conclusive investigation had been made yet. The family requested an autopsy to determine the cause of death. The autopsy report indicated that there was no sign of trauma on external examination, presence of petechiae on lung surface, petechiae noted on brain parenchyma with supratentorial hemorrhage of the basal ganglia, limited clot and bleeding objectivated. The abdominal viscera were intact with no gross finding. Conclusion was hemorrhagic stroke. No post-mortem imaging or further investigation was done because the tests were expensive and the family could not afford.

### Discussion

A stroke is the acute neurologic injury that occurs as a result of these pathologic processes including brain ischemia due to thrombosis, embolism or systemic hypoperfusion or brain hemorrhage due to intra-cerebral or subarachnoid hemorrhage. Another cause of stroke that is difficult to classify is the occlusion of veins that drain the brain. Venous occlusion causes a back-up of fluid resulting in brain edema, and in addition, it may cause both cerebral ischemia and hemorrhage.

Approximately 80-87% of strokes result from ischemic infarction due to thrombotic or embolic cerebrovascular occlusion. Hemorrhagic infarctions comprise most of the remainder of strokes with a smaller number due to aneurysmal subarachnoid hemorrhage [16-19]. Physicians must initially consider whether the patient with suspected cerebrovascular disease is experiencing symptoms and signs of ischemia or hemorrhage.

While the risk factors, burden and mortality of stroke are known to a considerable extent in the older populations, the same still remain a big challenge in young populations - particularly in young black populations. One large population-based study in California analyzed stroke subtypes and potential risk factors in 2278 children [20] and identified race and gender as important risk factors for ischemic and hemorrhagic stroke. In that study, congenital heart disease, arrhythmias and infections were the 3 most common risk factors identified.

Our case reports indicate that both patients died of hemorrhagic stroke confirmed on autopsy, but we have not been able to find enough supporting literature comparing the incidences of ischemic versus hemorrhagic stroke particularly in young black children and adolescents: hence there is a need for further large population-based studies.

Another study done by Chen and colleagues examining an administrative database of hospital discharges throughout Taiwan [21] also indicated that the incidence of all pediatric cases was highest in children aged less than 4 years, followed by children aged 15 to 19 years.

As evidenced in our case reports, sometimes stroke events in children and young adults happen without the existence of any of the known risk factors and so, there is a tendency to overlook the diagnosis of stroke in this particular age group.

Even though, we were not able to establish the existence

of sickle cell disease in all the cases that were autopsied (due to limited diagnostic abilities), stroke has been reported to occur in approximately 10% of children with sickle cell disease by 20 years of age if not prevented [22-24]. This calls for clinicians to rule out, adequately treat and prevent sickle cell disease in young patients - particularly black populations - in whom stroke is suspected.

## Conclusion

In conclusion, the cases reported above highlight the need for an emphasis in timely recognition of signs and symptoms as well as correct diagnosis of a possible stroke event in young populations. It is also a clear

manifestation of the existing stroke burden in children and adolescents and hence the need for improved screening for stroke risk factors in this particular age group. The role of genetic compositions leading to stroke events regarding patients of African descent needs to be understood further, hence the need for further large population-based studies. Finally, neuropathology and eventually post mortem angiography should be considered as desirable standard diagnostic pathways of a stroke resulting especially from thrombosis or embolism in the smaller vasculature of the brain. However, these modalities still remain a big challenge in developing countries, Rwanda included, compared to developing countries thus resulting into missed diagnoses or underreporting of stroke and eventually improper management.

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