

Stroke in SSA: Review of current literature concerning the incidence, risk factors and mortality in this demographic

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Prevention of stroke has been a key target for health care interventions in developed countries for decades, with recent WHO statistics demonstrating a 42% decrease in stroke incidence since 1970 [1]. This trend is not observed uniformly worldwide, with the same review demonstrating a 100% increase in stroke incidence in developing countries over a similar time period. Economic changes in these countries are anticipated to amplify this problem, with key risk factors for stroke also increasing in prevalence [2, 3]. Furthermore, more effective treatment of childhood diseases will likely increase the proportion of elderly people in these countries, further increasing the burden of chronic disease. A large hospital based study in Tanzania estimated the incidence of stroke to be between 108-316 per 100,000 [4] with significant differences between rural and urban populations. However considerable variation in this estimate has been observed in several smaller studies [5, 6]. Information concerning the community incidence of stroke is scarce with only one large study demonstrating a significantly lower incidence of stroke than hospital based studies [7]. Reliable information on stroke in sub-Saharan Africa (SSA) is therefore poor and it is difficult to accurately estimate stroke incidence in its population. Nevertheless, the aforementioned studies demonstrate a steady, yet substantial increase in the burden of stroke, hence necessitating further research and implementation of appropriate prevention strategies.

The rising incidence of stroke and stroke associated morbidity is especially problematic in SSA. Financial constraints and delayed presentation [8] contribute to a high case fatality rate. Two studies in Tanzania and Gambia recently demonstrated 1-month fatality rates of 24% and 27% respectively [9,10]. Comparison with fatality rates of <20% in developed countries [2] demonstrates a significant area of healthcare deficit with important implications in the context of a rising stroke incidence. A large study conducted in Mozambique suggested that in-hospital complications had the strongest influence on case fatality [11]. Greater prioritisation to acute stroke

management therefore could have a large impact on case fatality in these countries. Other studies demonstrate significant variation in mortality rates throughout SSA, with some studies revealing 28-day mortality rates of >40% [12]. This emphasises the need for more rigorous studies detailing key factors affecting mortality throughout SSA populations. In addition to acute stroke mortality, the burden of stroke morbidity is especially high. One study recently estimated a seven times greater number of disability-adjusted life years lost in developing countries in comparison with their developed counterparts [13]. Long term care of patients following a stroke is healthcare intensive and often unavailable in sub-Saharan countries.

Table 1. Relative contribution of cardiovascular risk factors to stroke

| Study Location | Risk Factor | Risk Factor Present (%) |
|--------------------------------------|----------------------|-------------------------|
| Agincourt, South Africa[20] (n= 103) | Hypertension | 73 (71) |
| | Diabetes | 12 (11.7) |
| | Smoking | 9 (8.7) |
| Ibadan, Nigeria[21] (n= 66) | Hypertension | 66 (100) |
| | Obesity | 12 (18) |
| | Alcohol / Drug Abuse | 11 (16.6) |
| | Diabetes | 9 (13.6) |
| Nairobi, Kenya[22] (n= 80) | Hypertension | 64 (80) |
| | Diabetes | 27 (33.7) |
| Blantyre, Malawi[23] (n= 147) | Hypertension | 81 (55) |
| | Diabetes | 31 (21) |
| | Hyper-cholesteremia | 22 (15) |
| | Smoking | 26 (18) |
| | Alcohol Abuse | 22(15) |

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Table 2. Contribution of risk factors for stroke: a comparison between ethnicities [24]

| Risk Factors | White | | Black | |
|-------------------------|------------|-------------------------|------------|-------------------------|
| | Odds Ratio | Etiological Fraction(%) | Odds Ratio | Etiological Fraction(%) |
| Hypertension | 1.8 | 25 | 2.0 | 37 |
| Diabetes | 1.0 | 0 | 1.8 | 14 |
| Atrial Fibrillation | 4.4 | 20* | 1.7 | 3* |
| Coronary Artery Disease | 1.3 | 16 | 1.1 | 6 |

*Significant difference in causative fraction in comparison between white and black populations ($p < 0.04$)

Such substantial morbidity rates, combined with an increasing incidence of stroke in these populations, will have profound economic effects at a national level.

Preventative strategies aimed at reducing stroke incidence and mortality need first to identify key risk factors for stroke in sub-Saharan populations. Studies specifically in this demographic however, with the exception of hypertension, are rare.

Multiple studies have identified hypertension as the leading risk factor for stroke in SSAs [14] with a Nigerian study demonstrating >80% prevalence of hypertension in stroke patients [15]. Sub-Saharan populations appear to be more at-risk of developing hypertension and subsequent stroke. Current literature demonstrates higher mean systolic and diastolic blood pressures (BP) in people of African descent in comparison with their Caucasian counterparts [16]. Furthermore a recently published multi-centred study demonstrated a 2 to 5 fold increase in stroke incidence in a population of black Americans [17]. This difference could be accounted for by a combination of factors, including hypertension. A large study conducted in South Africa suggested that up to 45% of strokes in SSAs could be prevented by simple blood pressure control measures [18]. Inadequate funding and lack of infrastructure however often impair diagnosis and screening of hypertension. With an increase in stroke incidence, detection and management of hypertension must become a greater priority. The contribution of eclampsia to stroke incidence should also not be underestimated. Of those patients who progress to eclampsia, approximately 4.9% will develop a stroke [19]. This represents a small but not insignificant portion of stroke burden in this population. Better access to maternal health care services could play an important role in reducing pregnancy related stroke.

Additional cardiovascular risk factors for stroke in this population have a less obvious contribution to stroke aetiology. Several studies have investigated the incidence of these risk factors in patients from sub-Saharan countries

and these are documented in table 1.

These risk factors appear to have variable effects on stroke risk in accordance with racial group. The large population-based NOMASS study [24] recently demonstrated an increased risk of stroke in black populations and made comparisons of the relative contributions of risk factors by ethnicity. Hypertension and diabetes had a substantially higher aetiological fraction in black populations, whereas atrial fibrillation (AF) and the presence of coronary artery disease were stronger predictors of stroke in white populations. These results are summarised in Table 2.

Despite non-significance, this study demonstrates the substantial contribution of hypertension to stroke in Black populations and emphasises the potential benefit of BP control. Furthermore the increased etiological fraction for stroke in black diabetic patients highlights the importance of good glycaemic control in stroke prevention. Interestingly, the risk of stroke resulting from AF appears to be much reduced in comparison to the white study population. This could have important implications when considering the risks surrounding anti-coagulant treatment in SSA.

WHO data indicates a high estimated prevalence of 4.8% of HIV in SSA populations [25] with considerable variation throughout different regions. Research has investigated the link between HIV and risk of stroke with substantial evidence suggesting an increased risk of ischaemic stroke in HIV-positive patients [26,27,28,29]. In particular, HIV appears to disproportionately increase ischaemic stroke risk in young patients, with one study demonstrating an Odds Ratio of >4 in patients aged 18-30 years [26]. This finding is further supported by a Malawian study which demonstrated that HIV-positive stroke patients were on average 24 years younger than their HIV-negative counterparts [27]. In the same study HIV-positive patients had a lower incidence of common cardiovascular risk factors, further suggesting the causal link between HIV and ischemic stroke. The

reasons for this relationship are uncertain but the role of opportunistic infection, hypercoagulability and accelerated atherosclerosis are hypothesised [28]. The affect of HIV on risk of haemorrhagic stroke is less certain. One study suggested an odds ratio of >7 for intra-cerebral haemorrhage in patients with AIDS defining symptoms compared with a HIV-negative cohort, with no significant increase for asymptomatic HIV-positive patients [29]. This compliments the results of an aforementioned study [26] suggesting that risk of both haemorrhagic and ischaemic stroke is strongly predicted by disease severity and viral loads.

More effective and comprehensive treatment of childhood and infectious diseases in SSA will lead to an older population, with higher chronic disease burden. Increasing prevalence of cardiovascular risk factors will further increase the mortality and morbidity caused by stroke in these countries. Risk factors for stroke are well known but an uncertainty surrounding each factor's contribution to stroke risk in this population must first be determined. Further research specifically in sub-Saharan countries is required to help guide potentially simple, yet effective interventions to curb the trend of a potential stroke epidemic.

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