Prevalence of Stroke in a Rural Population of Bangladesh

Stroke is a leading cause of mortality all over the world. It imposes a considerable burden on individuals, societies, and healthcare systems. It poses a similar health challenge in the South East Asia Region also. As in other South Asian populations, the Bangladeshi population has witnessed a dramatic change in life expectancies during the last few decades, exposing them to increased risk of chronic diseases including stroke. Major risk factors of stroke such as hypertension and diabetes have shown an increasing trend in Bangladesh [1]. Other factors such as tobacco use and salt consumption are also known to be very high. Therefore, stroke prevalence is also considered to be high in Bangladesh. Anecdotal experience in hospitals indicates that stroke is one of the leading causes of death, which has been increasing over the years. However population-based data are not available. We have done this study in a village to determine stroke prevalence in order to develop an appropriate intervention for rural Bangladesh.

The survey was done in a village (Ekhlaspur) of Matlab North subdistrict of Chandpur district, about 60 km southeast of Dhaka City. The background of the village has been reported elsewhere [2]. Briefly, it is an agricultural area, but some of the families supplement their main agricultural income by small business and employment in towns. Recent introduction of paved roads for commutation, employment of some people overseas as labor forces, and wide availability of cell phones and televisions have contributed to sedentary lifestyles and consumption of junk foods. However, until now, most people endured moderate to hard physical activity. Rice, fish, and vegetables are their daily dishes. Alcohol is prohibited and unacceptable to the society. Salt and tobacco consumption is very high. Women do not smoke, but do consume smokeless tobacco.

A voluntary health center, Ekhlaspur Centre of Health has been working in that village for promotion of health since 1999. The field execution of the survey was done mid-2007 by the health assistants and doctors of Ekhlaspur Centre of Health. Therefore the survey team had a high degree of access and rapport with the villagers. Before beginning the survey, a meeting with the investigators with the formal and informal community leaders was held to inform the community about the purposes of the survey. Community consent was obtained first; then verbal consent was cobtained at the individual level prior to the interview.

A list of households (1,088 total as of the 2005 demographic update) and their inhabitants was already available. People aged $\geq$30 years were targeted for this household level survey. A questionnaire adapted from stroke surveillance instrument of the World Health Organization was used to identify probable stroke cases by visiting households by health assistants. Thereafter, the probable cases were examined by the doctor for confirmation of diagnosis. Some of the stroke cases were actually already registered in the stroke registry of Ekhlaspur Centre of Health. Age at occurrence of stroke was recorded.

Of 1,766 eligible people ages $\geq$30 years, screening could be done for 1,709 (96.8%) persons. Their mean age was 48 (men: 49, women: 46) years (standard deviation: 14 years). Among them, 16 cases of stroke (12 men and 4 women) were diagnosed. This gave a prevalence of 9.4 per 1,000 (Table 1). The prevalence was $>3\times$ higher in men (14.5 per 1,000) than in women (4.5 per 1,000). Median age of onset was 58 years (interquartile range: 14 years), but in men it had happened 1 decade earlier (56 vs. 65 years) than in women. Various types of residual disabilities such as quadriplegia, hemiplegia, and facial palsy were present in 13 cases (81.3%); the details of which are given in Table 1. The median modified Rankin scale score was 5, which suggests that one-half of them had severe disabilities such as being bedridden, being incontinent, and/or requiring constant nursing care and attention.

At the time of our survey (2007), there had not been any population-based survey in Bangladesh. Since then, a report [3] was published reporting a prevalence of 3.0 per 1,000. Studies done in neighboring West Bengal, India (which has cultural similarity to Bangladesh) reported prevalence of up to 5.5 per 1,000 population [4]. In both these instances, prevalence is substantially lower than that of ours. The reasons for this higher burden in our sample are not instantly clear to us [5]. However, we suggest that higher rates of dyslipidemia (e.g., 66% have low high-density lipoprotein cholesterol, 33% total to high density lipoprotein cholesterol ratio >5.5), salt intake (17 gm/day), hypertension (19%), and tobacco use (55% smoking in men and 39% smokeless tobacco use in women) in our sample might be possible explanations. Moreover, there is a high tendency of clustering of risk

TABLE 1. Prevalence of stroke in a rural population of Bangladesh ages $\geq$30 years

Results	Male	Female	Total
Subjects	827	882	1,709
Stroke cases	12	4	16
Median age at onset of stroke, yrs	56	65	58
Prevalence per 1,000 (95% confidence interval)	14.5 (6.3—22.7)	4.5 (0.1—9.0)	9.4 (4.8—13.9)
Median modified Rankin scale score	5	5	5
No residual disability	2 (16.7)	1 (25.0)	3 (18.8)
Quadriplegia	3 (25.0)	0 (0)	3 (18.8)
Hemiplegia	5 (41.7)	3 (75.0)	8 (50.0)
Facial palsy	2 (16.7)	0 (0)	2 (12.5)

Values are n or n (%) unless otherwise indicated.

factors leading to metabolic syndrome in this population. These assumptions, however, need verification through further studies. Our study suffers from a limitation that the results are based on a survey done 7 years ago.

Stroke is relatively common in this rural sample of Bangladesh. Severe residual disabilities are also very common. Stroke prevention in this population should address highly prevalent major risk factors, such as tobacco and salt consumption, and early detection and treatment of hypertension and diabetes. Early rehabilitation should also be integral part of the stroke control program to prevent disability.

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Low 25-Hydroxyvitamin D Concentrations May Explain Atherosclerosis in Ancient and Modern Humans

A recent issue of *Global Heart* contained a set of articles on the prevalence of atherosclerosis in ancient and modern people. An article by Thomas et al. [1] suggested that chronic inflammation might be an important contributing factor. It noted that in ancient times, inflammation could be due to microbes and parasites, whereas in modern times, it could be due to chronic systemic inflammatory diseases.

I would like to propose that low 25-hydroxyvitamin D (25(OH)D) concentrations may explain the high prevalence of atherosclerosis in mummies as well as in modern people in countries such as Egypt, and that the mummies as well as modern people likely exhibit additional features that could be used to evaluate this hypothesis. First, low 25(OH)D concentrations are a risk factor for both atherosclerosis and osteoporosis [2]. The classic role of vitamin D is to facilitate absorption of calcium from the intestines and regulate calcium metabolism. When 25(OH)D concentrations are too low, calcium stores are reduced in bones and increased in soft tissues, including the arteries. Evidently osteoporosis was common in Egyptian mummies [3]. It is also likely that other diseases linked to low 25(OH)D concentrations such as dental caries, periodontal disease, rheumatoid arthritis, and tuberculosis could be found in a number of mummies or modern people with atherosclerosis. The evidence for the role of vitamin D in reducing risk of many types of disease is given in a recent review by Pludowski et al. [4]. Although much of the evidence comes from observational studies, similar results are often found in different populations, and the mechanisms whereby vitamin D reduces the risk of many types of disease are well known. Vitamin D has been found to reduce biomarkers of inflammation in a number of randomized controlled trials, especially when baseline 25(OH)D concentrations were below 50 nmol/l [5].

Why might ancient and modern Egyptians have low 25(OH)D concentrations? For modern Egyptians, it is probably that they wear clothing that covers much of the body surface area and do not spend much time in the sun during the summer when it is hot. In some of the Middle Eastern countries, 25(OH)D concentrations are highest in spring rather than summer due to avoiding the sun during the oppressive heat in summer. Those Egyptians who were mummified were mostly from the highest social levels. As such, they would not be working in the fields but would rather be found indoors most of the time. For ancient and modern Egyptians, diet is also a cause of low 25(OH)D concentrations. Ancient Egyptians likely got much of their food from wheat and other grains. Modern Egyptians derive >10% of their energy from animal products according to the Food and Agriculture Organization of the United Nations. A study in the United Kingdom found that vegans have 25(OH)D concentrations 20 nmol/l lower than meat eaters do independent of season [6].

Thus, the low 25(OH)D concentration hypothesis could be evaluated by looking at the computed tomography scans of ancient mummies for evidence of any diseases or pathologies related to low 25(OH)D concentrations and correlating the findings with the extent of vascular calcification. Confirming this hypothesis could have important implications for modern humans.