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Evaluation of modifiable risk factors for stroke in Bangladesh: A tertiary level hospital experience

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Abstract
Background: there is limited study describing such stroke in tertiary level hospital experiences from developing countries like Bangladesh Objectives: The aim study is to evaluate the modifiable risk factors stroke in both young and old age group. Methods: A retrospective audit of medical records of all patients presenting between July 2011 to November 2012 with a stroke was conducted. Information about clinical presentation, modifiable risk factors laboratory and radiological investigations was collected. Data was entered and analyzed using SPSS14.0. Results: O f total 183 cases 31 were young adults and 152 old patients between 18 to 100 years. Mean age young adult was 38.76 (± 6.379) and old age was 64.06 (± 11.238). 65.02% were male & 34.97% were female and the ratio was 1.9:1. Among patients majority had the Ischemic stroke in both age groups. In young age group 18 patients were diagnosed with ischemic stroke (58.06%) while 13 patients presented with hemorrhagic stroke (41.94%). In old age group 103 patients were diagnosed with ischemic stroke (67.76%) while 49 patients presented with hemorrhagic stroke (32.24%). Hypertension was the most common modifiable risk factor seen in both in the young (54.8.0%) and in old age group (55.9%), followed by previous history of transient ischemic attack (19.4%) and oral contraceptive pills (16.1%) in young age group and dyslipidaemia (23.7%), previous history of transient ischemic attack (20.4) and diabetes mellitus (DM) (19.7%) in old age group. Conclusion: A high prevalence of modifiable risk factors such as hypertension in both groups in stroke patients was observed in the tertiary level hospital in Bangladesh.

1. Introduction

The word stroke is used to refer to a clinical syndrome, of presumed vascular origin, typified by rapidly developing signs of focal or global disturbance of cerebral functions lasting more than24 hours or leading to death.[1] Stroke is one of the commonest causes of

mortality and sustained disability in the developing world. According to World Health Organization estimates, 85.5% death from stroke in developing countries in the worldwide.[2] At least fifteen million others have non-fatal stroke annually and about a third are disabled as a consequence.[3] As developing countries such as Bangladesh experience socioeconomic transition and population longevity, this burden is bound to increase.[4] A systematic review of population-based studies of stroke conducted in 2008 shows that the overall stroke incidence in developing countries has exceeded that in developed countries by 20%.[5] In addition, stroke patients in developing countries are a decade younger than their western counterparts and consequently Table I. Stroke clinic - Initial assessment formthe burden of sustained disability in survivors is greater.[6]

Stroke is a neurological disorder and the distribution of its subtypes and associated risk factors varies by ethnicity and geographical location.[7, 8]

The commonest modifiable risk factors include hypertension, diabetes mellitus, mitral valvular diseases, dyslipidaemia, smoking; transient ischemic attacks and alcohol abuse [9] .An effective intervention is to prevent cerebrovascular disease and elucidate locally relevant risk factors and address them through pharmacological and public health strategies. However, there are limitations of adequate systematized data on the distribution of stroke types and modifiable risk factors in stroke patients of Bangladesh. Opportunities for primary and secondary prevention are yet to be recognized and hence, no effective programs are in place. So secondary prevention of stroke through dedicated stroke clinics has been shown to improve management of modifiable risk factors in developed countries.[10,11] However, no such reports have been published from the developing world.

This study presents a dedicated stroke clinic experience at a tertiary care hospital in Dhaka, Bangladesh and describes the distribution of modifiable risk factors in this population.2. Methods

2.1. Study Design and Setting

This systematic retrospective was conducted in the multidisciplinary stroke clinic at a tertiary care hospital in Dhaka, Bangladesh. The department neurology of Sir Salimullah Medical College & Mitford Hospital (SSMC& MH) has initiated a specialty stroke clinic run by a certified neurologist for prevention, diagnosis and outpatient management of stroke from July 2011 to November 2012. This initiative is supported by a multidisciplinary team including radiologists, physiotherapists, internist and neurosurgeons. All patients presenting to the stroke clinic undergo standardized history and physical evaluations, laboratory and radiological investigations, functional scores (National Institutes of Health Stroke Scale (NIHSS), modified Rankin Scale (mRS), Barthel Index and relevant interventions.[12-15]

To ensure a standardized work-up for each patient, an initial and follow-up assessment form has been designed (Table I).

Table I. *Stroke clinic - Initial assessment form*

Points	Assessing data
Demographics	Current Age
	Gender
	Modified Rankin Score
Disability Assessment	NIHSS Score
	Barthel Index
	Age of onset
	Duration of symptoms
	Co-morbid
Medical History	Prior Stroke History
	Current Medications
	Alcohol
	Smoking
	Stroke
Family History	Coronary Artery Disease
	Hypertension
	Diabetes
	Weakness(Hemiplegia/hemipaeresis)
	Loss of consciousness
	Headache
	Postural instability
Clinical symptoms	Numbness
	Diplopia/Visual disturbances
	Vertigo
	Memory Loss
	Confusion
	Seizures
Physical examination	Vital signs
	Neurological Examination
	MRA / MRI Brain
Radiological Investigations	CT Head
	ECG
	Echocardiography
	Carotid Doppler
	Hemoglobin / Hematocrit
	C Reactive Protein
Laboratory Investigations	Erythrocyte Sedimentation Rate
	Lipid profile
	Serum glucose level
	HbA1C
	More investigations
Management	Medications
	Lifestyle modifications
	Referrals

2.2. Patient Enrollment and Data Collection

The Medical records of 267patients were reviewed. Young Adult patient includes age range from 15 to 45 years and old age group includes age range above 45 years .Eighty seven patients with diagnoses other than stroke or with incomplete or missing data were excluded from this study. One hundred and eighty three patients met the final inclusion and exclusion criteria. This study was approved by Ethical Review Committee at the SSMC & MH.

2.3. Variable Definitions

Variables of interest included age, gender, date of event and date of admission to a hospital, type of event and major subtype of stroke, vascular risk factors, co-morbid diseases, previous medications, results from radiological examinations

(e.g. Doppler ultrasound), infarct localization, medication for secondary prevention, and severity of the clinical deficit (mRS used at clinic presentation).[16] Risk factors such as hypertension, diabetes mellitus (DM), smoking, dyslipidaemia, oral contraceptive pill (OCP), transient ischemic attack(TIA), ischemic heart diseases(IHD) and Mitral valvular disease(MVD) were specifically documented. The following definitions were used:

Diabetes mellitus : Fasting blood glucose of ≥ 126 mg/dL (7.0 mmol/L), or symptoms of diabetes plus random blood glucose of ≥ 200 mg/dL (11.1 mmol/L), or 2h post load glucose of ≥ 200 mg/dL (11.1 mmol/L) during an Oral Glucose Tolerance Test, or current use of anti-diabetic medications.[17]

Hypertension: Mean of two readings of blood pressure (BP) measurements each at two separate occasions of ≥ 140 mmHg systolic and ≥ 90 mmHg diastolic BP, or current use of antihypertensive medications.[18]

Dyslipidaemia: Total serum cholesterol >200 mg/dL (11.1 mmol/L) or LDL cholesterol > 100 mg/dL (5.6 mmol/L), or HDL cholesterol < 40mg/dL (2.2 mmol/L), or current use of lipid lowering medications.[19]

Transient Ischemic Attack: A transient episode of neurological dysfunction caused by focal brain, spinal cord or retinal ischemia without acute infarction last less than 24 hours.[20]

Smoking: Quantified in packs (20 cigarettes) per day and duration in years. Defined as ex-smoker if smoking was quit ≥ 6 months ago.[21]

2.4. Data Entry and Analysis

Data was entered and analyzed using SPSS 14.0 (SPSS, Chicago, IL, USA). Descriptive statistics including percentages, means and standard deviations have been reported as appropriate. Chi-square ($\chi 2$) test and Fisher exact tests for categorical variables and compare differences between groups. P-values less than 0.05 were considered significant.

3. Results

In the Table II shows that total of 183 patients were included in this audit with 31 were young adult and 152 were old age group. Ages of young adults were mean age ± SD: 38.76 ± 6.38 years and old age group were 64.06 ± 11.24.

Table II. *Distribution of patients by age (n =183)*

	Young	Old Age
Number of Patients (n)	31	152
Mean age (yrs)	38.76	64.06
Std. Error of Mean	1.547	1.219
Std. Deviation	6.379	11.238
Minimum age (yrs)	18	46
Maximum age (yrs)	45	100

*t test was done to measure the level of significance.

Distribution of patients across age groups and gender is shown in Table III. Male in young were 32.26% and female were 67.74%, in old age male were 71.71% and female were 28.29%. Young adult and old age group ratio is 1: 4.9 and Male female ratio is 1.9:1

Table III. *Distribution of patients by Sex (n =183)*

Sex	Young adult	Old Group	Total no	Total Percent
Male	10(32.26%)	109(71.71%)	119	65.03
Female	21(67.74%)	43(28.29 %.)	64	34.97
Total	31	152	183	100.0

Table -IV shows the difference of habitual variables in young and old age stroke patients. Many patients had more than one habits. Among 183 patients maximum 61.29% patients in young adult and 61.18% in old age patients were smoker and only 3.3% patients were alcoholic. Smoking had no significance difference in both age groups for development of stroke.

Table IV. *Distribution of habitual variables*

Parameters	Young adults (%)n=31	Old age group (%) n=152	P value
Smoking	19(61.29)	93(61.18)	<0.05
Alcohol	0	5(3.3)	<0.05

Chi square test and Fisher exact tests were done to measure the level of significant

In the distribution of types of stroke Table V shows that among young age group 58.8% had ischemic and 41.2% had hemorrhagic stroke. In old age group 68.2% had ischemic and 31.8% had hemorrhagic stroke. Between two groups ischemic stroke is more than that of hemorrhagic stroke in both age groups

Table V. *Types of stroke*

Parameters	Young adults (%)	Old age group (%)
Type of stroke		
Ischemic	18(58.06)	103(67.76)
Hemorrhagic	13(41.94)	49(32.24)

In the distribution of the Table VI Hypertension was the most prevalent modifiable risk factor seen in both in the young (54.8.0%) and in old age group (55.9%), followed by previous history of TIA (19.4%) and OCP (16.1%) in young age group and dyslipidaemia (23.7%), previous history of TIA (20.4) and DM (19.7%) in old age group. In young female 16.1% and in old female age group 10.5 % had history of OCP use. OCP showed statistically significant role in developing stroke in young age group. Both dyslipidaemia and diabetes had significant role in developing stroke in old age group. Moreover MVD n is the less common risk factor both the group (young adult 6.5%, old group 3.3%) especially in young adult.

Table VI. *Distribution of risk factors*

Parameters	Young adults (%)	Old age group (%)	P value
History of TIA or stroke	6(19.4)	31(20.4)	<0.001
Hypertension	17(54.8)	85(55.9)	<0.05
IHD	0	10(6.6)	<0.05
MVD	3(6.5)	5(3.3)	<0.001
DM	0	30(19.7)	<0.001
OCP	5(16.1)	16(10.5)	<0.001
Dyslipidaemia	1(3.2)	36(23.7)	<0.001

Chi square test and Fisher exact tests were done to measure the level of significant

4. Discussion

This study reports the distribution of stroke types and modifiable risk factors both young adult and old age group in a dedicated stroke clinic in a developing country. Patients in this clinical sample have a younger mean age as compared to their counterparts in the developed world. The mean age of young adults was 38.76 ± 6.38 years and old patients mean age was 65.06 ± 11.238 years in Table I. The number of patients in old age group is five times more than that of young age group. The incidence increased with age.[22] In our study about 65% of our patients was males. In contrast to the Framingham Heart Study reports a mean age of 75.1 years for women and 71.1 years for men presenting with first incident stroke which is similar to our study. [23]

The ratio of stroke in male and female patients was 1.9:1.Community based studies indicate that stroke is more common in men than in women globally.[24] In the absence of local epidemiological evidence, we may speculate that gender disparity in our sample is due to under reporting of female patients or an actual lower prevalence of stroke in women. However, community based studies are required to evaluate the average age and gender distribution of stroke adequately.

Among patients majority had the Ischemic stroke in both age groups. In young age group 18 patients were diagnosed with ischemic stroke (58.06%) while 13 patients presented with hemorrhagic stroke (41.94%). In old age group 103 patients were diagnosed with ischemic stroke (67.76%) while 49 patients presented with hemorrhagic stroke (32.24%). Between two groups ischemic stroke is more than that of hemorrhagic stroke. This study found to be similar that ischaemic stroke is more than that of haemorrhagic stroke.[25]

Many patients had more than one habit. Among 183 patients maximum around 61%patients were smoker in both age groups. Smoking was found to be a significant risk factor in majority of patient between the two age groups but alcohol was found to be responsible in older age group. This study is similar to that a meta-analysis of relation between cigarette smoking and stroke mentioned that cigarette smoking increases risk (RR) of ischemic stroke nearly two times, with a clear dose-response relation .[26] About 19.4% in young adult and 20.4% old age groups had the history of TIA or stroke. Previous history of TIA or stroke is significant for development of stroke in both age groups. Our study is similar to that a prospective study on reevaluation of transient ischemic attacks as a risk factor for death and described the average risk of stroke in patients with TIA is about 4%. After adjustment for major cardiovascular risk factors predisposing a patient to stroke, a TIA remains a significant independent risk factor for both stroke and myocardial infarction .[27]

Hypertension was the most prevalent modifiable risk factor in our sample. More than 50% of total patients had hypertension. We were seen in both in the young (54.8.0%) and in old age group (55.9%). The large decline in mortality in age adjusted stroke and coronary artery disease in Western countries has been attributed to widespread and improved control of hypertension.[28]

Out of 183 patients 6.6% had IHD in old age group which is statistically significant risk factor for development of stroke in old age group. In the Framingham Study, using multivariate analysis found that risk of stroke was increased twofold by coronary heart disease, threefold by electrocardiographic left ventricular hypertrophy, and threefold to fourfold by cardiac failure.[29]

In our observation 6.5% of young adult and 3.3% old age patients had mitral valvular heart disease. Mitral valvular heart disease is statistically significant for development of stroke in young age group patients. A prospective study shows that lower risk of stroke in patients with uncomplicated mitral valve prolapse (MVP) like endocarditis or AF. Another valvular risk factor for stroke is mitral annular calcification. In the Framingham Study mitral annular calcification was associated with a doubled rate of stroke. As with mitral stenosis, the presence of AF and mitral annular calcification resulted in an amplification of risk for stroke. The presence of both AF and annular calcification, the increases risk of stroke was fivefold, compared with a doubling in stroke risk with either factor present alone.[30]

In this study 20% patients of old age group were diabetic and young adult patients were free from diabetes mellitus. Diabetes has significant role in developing stroke in old age group. Among Hawaiian Japanese men in the Honolulu Heart Program, the patients those with diabetes had twice the risk of thromboembolic stroke than that of without diabetes. In this same study shows that the patients with diabetes have an increased susceptibility to atherosclerosis and an increased prevalence of atherogenic risk factors, notably hypertension, obesity, and abnormal blood lipids. This prospective epidemiological study have confirmed an independent effect of diabetes with a relative risk of ischemic stroke in persons with diabetes from 1.8 to 3.0.[31]

In our study 20% young adult female and 10.3% old female stroke patients' had history using oral contraceptive pill (OCP). The OCP has statistically significant role in developing stroke in young age group. In a relevant study on OCP mentioned that the OCP which contain with an estrogen content >50 µg, the preparations used in the 1960s and 1970s, were strongly associated with risk for stroke. Recently a study of low-dose oral contraceptives (<50 µg estrogen) disclosed no increased risk of stroke in more than 3.6 million

woman-years of observation .[32]

In our study young adult 5.9% and in old age group 24.7% were dyslipidaemic. Dyslipidaemia is statistically significant to develop stroke in old age group. There is a similar study stated that the association between dyslipidaemia and the risk of ischaemic stroke, especially cortical type. In this case control study among other risk factors total serum cholesterol and LDL-cholesterol levels were raised in both cortical and lacunar infarct. The level of HDL-cholesterol were significantly low in cases (70%) compared to control subjects (26.7%) and serum triglyceride (TG) levels were raised in of case group (60%) in comparison of control subjects (26.7%).[33]

This study therefore reveals that ischaemic stoke is more common in the both group of patients. Hypertension the major modifiable risk factors of stroke in both groups of patient .As a developing country like Bangladesh majority patient are priorly unnoticed or uncared of hypertension. Incidentally they are diagnosed after stroke attack. Pharmacological interventions of Hypertension make at this stroke clinic will reduce the incidence of stroke in Bangladesh. The other important risk factor in young patients like History of TIA or stroke, OCP and dyslipidaemia and History of TIA or stroke and DM in older age group patients.

5. Limitations

Limitations of our study include its reliance on clinical data from a single urban tertiary care center in a free service system. As government hospital like SSMS& MH we are in financial and facilities constraints. The non-affording patients are regularly accommodated through patient welfare or other funds. Our samples may not be entirely representative of stroke patients in Bangladesh. Hence, distribution of types of stroke or risk factors cannot be generalized to the entire Bangladeshi population. A standardized algorithm was used for each patient and detailed investigations were sought whenever possible and this approach helped identify inadequate secondary interventions.

6. Conclusions

A wide prevalence of potentially modifiable risk factors such as hypertension amongst stroke patients has been observed in our study. Pragmatic entry points for primary and secondary prevention of stroke in Bangladesh have been identified. The further strategy of specialty services dealing with stroke in such developing countries may benefit from adaptation of a similar evidence-based algorithmic approach to investigations and treatment in order to maximize secondary prevention. In primary care, similar systematic screening for prevalent and amenable risk factors will help decrease the burden of stroke in community.

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