Subtypes of Acute Ischemic Stroke

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Abstract

Background: To determine the frequency of various subtypes of acute ischemic stroke among patients using the TOAST criteria.

Methods: In this prospective, cross sectional study 156 consecutive stroke patients fulfilling the inclusion criteria were recruited. Information on risk factors like age, gender, diabetes and hypertension was collected. Physical and neurological examination was done and relevant investigations were reviewed, to classify the subtype of stroke according to TOAST criteria. . Risk factors like age, gender, diabetes and hypertension were compared with stroke subtypes after stratification using the chi-square test with significance at p < 0.05.

Results: Out of the 156 patients with acute ischemic stroke, mean age at presentation was 63.51 years. Among them 75% had hypertension and 48.1% were diabetics. The various subtypes of acute ischemic stroke were Large artery atherosclerosis(35.3%)which was the commonest cause. Large artery atherosclerosis was found to be more common in females (47.1% vs 25.6%) whereas cardioembolic strokes were more common in males (29.1% vs 17.1%) (p value 0.02). When hypertension and diabetes was compared with stroke subtypes the results were statistically insignificant (p value. >0.05).

Conclusion: Higher incidence of large artery and cardioembolic disease was found. Preventive efforts against the burden of ischemic stroke should focus on risk factor intervention for each patient according to subtype rather than ischemic stroke as a whole.

Introduction

Stroke is a worldwide disease with high morbidity. The TOAST classification divides patients with ischemic stroke into five different subgroups according to presumed etiological mechanism. This criteria is widely used classification scheme of ischemic stroke subtypes and has a good inter-observer agreement. It helps predict prognosis, outcome and management in acute ischemic stroke patients. [1] Estimated annual incidence of stroke in Pakistan is 250/100,000, translating to 350,000 new cases every year.[2]

Risk factors of ischemic stroke include diabetes mellitus, hypertension, dyslipidemia, smoking, atrial fibrillation, history of coronary artery disease, obesity and use of oral contraceptive pills. [3] Estimated prevalence of diabetes in acute stroke patients is between 8 - 20%.[4] Diabetic patients have an approximately 2 to 4 times higher risk of ischemic stroke than non-diabetic subjects. [5] According to National Health Survey of Pakistan, one out of every 3 persons over the age of 45 years is affected by hypertension. It is estimated that about 30-40% stroke risk reduction can be achieved with lowering of blood pressure only. [3]

Ischemic stroke can be divided into various etiological subtypes, each with variable underlying pathogenesis. The landmark Trial of Org 10172 in Acute Stroke Treatment (TOAST) classification divides patients with ischemic stroke into five subtypes: 1) large artery atherosclerosis, 2) small vessel occlusion (lacunar), 3) cardio embolic, 4) stroke of other etiology and 5) stroke of undetermined etiology. [6,7] The distribution of different etiological subtypes of ischemic stroke according to the TOAST criteria in a recent Norwegian study was reported as; small vessel disease 31.4%, large vessel disease 11.4%, cardio-embolic disease 31.4%, and stroke of undetermined etiology 25.7% .No patient was found to have stroke of unusual etiology.[7-9] Approximately 795,000 people in the United States experience new (610,000 people) or recurrent (185,000 people) stroke[10]. Approximately 87% of all strokes are ischemic strokes.[11-13] The bulk of stroke burden in terms of incident events, deaths, and days lost is borne by low-income to middle-income countries.[14-16]

Pakistan has the world's 6th largest population with a growth rate of about 2% per year.[17] The estimated annual incidence of stroke in Pakistan is 250/100,000, which is projected to an estimate of 350,000 new cases every year.[17]

The definition of stroke sub types is adapted from TOAST criteria (trial of org 10172 in acute stroke treatment). TOAST classification divides patients with ischemic stroke into five subtypes ,e.g., (i)large artery atherosclerosis,(ii)small vessel occlusion (lacunar),(iii)cardio-embolism, (iv)stroke of other etiology and (v)stroke of undetermined etiology

Large artery ischemic stroke is defined as evidence of a significant (>50%) stenosis or occlusion of the internal carotid artery or middle cerebral artery on the symptomatic side confirmed radiologically on Doppler ultrasound. Small artery ischemic stroke (Lacunar

stroke) is defined as ischemic stroke with CT brain or MRI brain showing a small <1.5cm infarct in the basal ganglia, internal capsule or brainstem. Cardio-embolic stroke is defined as ischemic stroke with at least one cardiac risk factor for embolism and absence of any features to suggest other stroke subtypes. Cardiac risk factors for embolism include any one or more of these , e.g., atrial fibrillation , recent myocardial infarction in the preceding 6 weeks,echocardiographic evidence of regional wall motion abnormality,endocarditis and prosthetic heart valves.Stroke of other determined etiology is defined as absence of features suggestive of afore mentioned stroke subtypes and evidence of other risk factors of stroke including hypercoagulable states.

Patients and Methods

This Cross Sectional Study was conducted at Shifa International Hospital Islamabad, from June 2014 to November 2014.All the adult patients who were admitted in the medical and neurology departments of the hospital with the diagnosis of acute stroke were included. Patients with hemorrhagic stroke defined as a hyper-dense area on initial CT brain, with transient ischemic attack because in TIA CT/MRI brain is normal and patients with focal neurological deficit secondary to other causes including tuberculous meningitis, brain tumor, viral or bacterial encephalitis, multiple sclerosis etc,were excluded.

All the patients were managed according to the stroke pathway developed by a multidisciplinary team of hospital. Initial assessment included several investigations as per stroke pathway including CT and/or MRI. Further investigation as carotid ultrasound Doppler and echocardiography were also done as per stroke pathway, and patients were managed according to the parameters defined in the pathway. The pathway followed the current guidelines of acute stroke care. Effect modifiers like age, gender, diabetes mellitus and hypertension were controlled by stratification. Post stratification, Chi square test was applied. P value < 0.05 was considered significant.

Results

Out of the 156 patients who were selected for the study 86 (55.1%) were males and 70 (44.9%) were females. The mean age of the patients was 63.51 years with a standard deviation of 13.81 . Of all patients admitted with an ischemic stroke, 117 (75%) had hypertension and 75(48.1%) were diabetics. According to TOAST criteria large artery atherosclerosis was the commonest(Table 1). In other determined etiology

strokes, one patient had vasculitic infarcts and two patients had raised homocysteine levels.

Table 1. Stroke subtypes in hypertensive vs normotensive patients

	Subtype of stroke					Total
	Large artery athero-sclerosis	Small vessel occlusion	Cardio-embolic	Stroke of other etiology	Stroke of un-deter-ined etiology	
Hyper-tensive No(%)	44, (37.6%)	20, (17.1%)	27, (23.1%)	1, (0.9%)	25, (21.4%)	117 (100 %)
Normo-tensive No (%)	11, (28.2%)	3, (7.7%)	10, (25.6%)	2, (5.1%)	13, (33.3%)	39, (100 %)

p = 0.13

Table 2. Comparing frequency of stroke subtypes in Diabetics vs non Diabetics

	Subtype of stroke					Total
	Large artery atheroscler-osis	Small vessel occlusion	Cardio-embolic	Stroke of other etiology	Stroke of undetermined etiology	
Diabetics No (%)	24 (32.0%)	14 (18.7%)	21 (28.0%)	1 (1.3%)	15 (20.0%)	75 (100%)
Non-Diabetics No (%)	31 (38.3%)	9 (11.1%)	16 (19.8%)	2 (2.5%)	23 (28.4%)	81 (100%)

p = 0.34

Table 3. Comparing frequency of stroke subtypes in age groups: younger (<50years) vs older patients (>50years)

	Subtype of stroke					Total
	Large artery atheros-clerosis	Small vessel occlusion	Cardio-embolic	Stroke of other etiology	Stroke of undetermi-ned etiology	
Age ≤50yrs No (%)	6 (30.0%)	1 (5.0%)	1 (5.0%)	3 (15.0%)	9 (45.0%)	20 (100%)
Age >50yrs No(%)	49 (36.0%)	22 (16.2%)	36 (26.5%)	0 (0.0%)	29 (21.3%)	136 (100%)

p = 0.00

Table 4: Comparing gender differences in subtypes of acute ischemic stroke (p=0.02)

	Subtype of stroke					Total
	Large artery atherosc-lerosis	Small vessel occlusion	Cardio-embolic	Stroke of other etiology	Stroke of undetermined etiology	
Male	25.6%	19.8%	29.1%	1.2%	24.4%	100%
Female	47.1%	8.6%	17.1%	2.9%	24.3%	100%

Large artery stroke was more common in diabetics (Table 2).Large artery atherosclerosis, lacunar and cardioembolic strokes were more common in patients aged more than 50 years, whereas stroke of other etiology and undetermined etiology was more

commonly found in patients 50 years or younger (p value 0.00) (Table 3). Large artery atherosclerosis was found to be more common in females as compared with males (47.1% vs 25.6%) whereas cardioembolic strokes were more common in males as compared with females (29.1 vs 17.1%) (p- 0.02 (Table 4). When hypertension and diabetes was compared with stroke subtypes the results were statistically insignificant (p value. >0.05).

Discussion

In the present study , large artery strokes were the most common subtype found in 35.3% of the patients. This is higher than (23.4%) reported from the West but comparable with that reported by Khealani et al (31.7%) in a recently published local multicenter study.[18,19] Cardioembolic strokes were found in 23.7% of our patients which is also higher than (10.4%) reported by Khealani et al and (8.1 to 19.7%) reported by a recent study comparing the overall race/ethnicity effect in the incidences of various stroke types.[18,19] A Norwegian study has reported a higher proportion of cardioembolic strokes (31.4%) in their sample of 253 patients.[7] Lacunar strokes were 14.7% in our study which is lower than that 25.7% reported by Khealani et al and 23.0% reported from the West.[18, 19] Stroke of undetermined etiology was found in 24.4% of our population which is slightly lower than (32%) reported in a recent study.[18] Stroke of other determined etiology was found in 1.9% which is comparable to 2.9% reported by above mentioned multiethnic study.[19]

In the current study the mean age of the patients was 63.51 years which is slightly higher than 59.1 years reported by a local multicenter study but lower than 65years reported in South Asian population in a recent study from United States.[18, 19]

Gender distribution of acute stroke has been found to be highly variable. Studies from the West report an even higher proportion of females (49.8 to 60%) among acute stoke patients.[20, 21]

Conclusion

1. A higher incidence of large artery and cardioembolic disease and a lower incidence of small vessel disease was observed
2. With increasing risk and twice high prevalence of stroke in our setup, preventive strategies should take into account the differences in ischemic stroke subtypes in our local population and risk factor intervention should be optimized for each individual patient.

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