SEASONAL VARIATION IN STROKE IN A TEACHING HOSPITAL OF KHYBER PAKHTUNKHWA

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ABSTRACT

Objective: To determine seasonal variation in the occurrence of stroke and its subtypes (ischemic stroke and hemorrhagic stroke) during summer and winter and to observe the frequency of common risk factors for stroke.

Methodology: The present descriptive study was conducted in the Department of Medicine, MTI Lady Reading Hospital Peshawar, Khyber Pakhtunkhwa, Pakistan, over a period of one year from 1st January 2014 to 31st December 2014. A total of 321 patients of any age and either gender were included. The diagnosis was established based on history, clinical examination and supplemented by CT scan of brain.

Results: In winter 58.56% of patients and in summer 41.48% of patients were presented. Ischemic stroke was present in 66.04% patients while hemorrhagic stroke in 33.95% patients. Males had more strokes as compared to females (60.75% Vs. 39.25%). In males highest number of strokes was found in 60-69 age groups whereas in females it was in 50-59 age groups. In winter the strokes increased in all age groups comparative to summer. Hypertension (34.26%) was the highest risk factor for stroke.

Conclusion: Stroke showed seasonal variation. Winter season was associated with increased frequency of stroke and its subtype of hemorrhagic stroke. There was variation of gender, season and stroke types in different age groups. Hypertension was found to be the highest risk factor.

Key words: Stroke, Ischemic Stroke, hem¬orrhagic Stroke, Stroke risk factors, Seasonal variation.

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INTRODUCTION

Stroke is a major cause of social disability and death. It accounts for about 5.7 million deaths globally; 87% of which occur in developing countries[1]. Ischemic strokes comprise 85% while hemorrhagic strokes (intra-cerebral and sub-arachnoid) comprise 15%[2].

Ischemic stroke is characterized by the sudden loss of blood circulation to an area of the brain, resulting in a corresponding loss of neurologic functions. Intra-cerebral hemorrhage (ICH) occurs when an already damaged or diseased blood vessel in the brain bursts that leaks blood inside the brain. This leakage of blood causes increase in the pressure upon the brain tissues and cells surrounding the blood. Increased pressure and blood accumulations may cause unconsciousness and ultimately death[3].

Basal ganglia are considered the most frequent sites of bleed (55%) followed by thalamus (26%), cerebral hemispheres (11%), brain stem (8%) and cerebellum (7%)[4].

Hypertension is found to be the most important risk factor for stroke (ICH and ischemic strokes). Other risk factors of ICH include trauma, infections, tumors, blood clotting deficiencies and abnormalities in blood vessels such as arterio-venous malformations[5].

Stroke is also related to many other factors including smoking, gender, high intake of alcohols and seasonal variation[6,7]. Current smokers have increased risk as compared to ex-smokers. Men and women both are reported to have similar proneness toward ICH and ischemic strokes due to smoking[8].

Similarly age is also a common factor that has increased impact on the occurrence of ICH in both males and females. Elderly persons have more tendencies to sustain ICH stroke presumably due to high blood pressure[9].

Seasonal variations are common in ICH and ischemic strokes occurrence. A number of studies were carried out in several countries and different climatic regions[10-17]. However, the results varied according to

study design, geography and climate leading to some discrepancy in results[18-20].

Pakistan, being a tropical country, has different seasons. Exposure to extremes of temperature during summer and winter can influence stroke causation in a large population. The present study was aimed to determine if there is any evidence of seasonal variation in the occurrence of stroke and its subtypes, along with causal factors of stroke, the effect of age and gender on the occurrence of ICH and ischemic strokes in a teaching hospital of Khyber Pakhtunkhwa Pakistan. This may help clinical decision making in stroke prevention[21].

METHODOLOGY

The present study was conducted in the Department of Medicine at Medical Teaching Institute (MTI) Lady Reading Hospital, (LRH) Peshawar, Khyber Pakhtunkhwa, Pakistan. Data were obtained from the admission book of Medical units of LRH. The annual records were examined and analyzed for the estimation of ICH and ischemic stroke occurrence.

Total number of patients with stroke (hemorrhagic and ischemic) confirmed through CT scan, was 321. Khyber Pakhtunkhwa province has diverse weather conditions, but due to climate changes, two season i.e. spring and autumn are not specific to the environment that used to be in the past. So accordingly the year was sub divided in two season, the summer (April, May, June, July, August and September) and Winter (October, November, December, January, February and March). The seasonal stroke variation in one year time period was studied, from 1st January 2014 to 31st December 2014.

All patients who had ICH and ischemic stroke of either gender and any age were included in the study. We excluded sub-arachnoid hemorrhage, arterio-venous malformation, and venous stroke. Age, gender, type of stroke, date of admission and stroke onset were recorded of all patients.

After formal consent, patients fulfilling the inclusion criteria were further assessed through a detailed history of hypertension, diabetes mellitus, previous stroke, atrial fibrillation, smoking, coronary artery disease and dyslipidemia. Relevant investigations were carried out. The diagnosis of stroke was established based on history, clinical examination and supplemented by CT scan of brain.

Seasons were categorized into summer and winter. The data were recorded in the proforma and statistically analyzed through MS Excel 2013.

RESULTS

A total of 321 patients with stroke were included in the study.

Table 1 showed that there was variation of gender, season and stroke types in different age groups. Males had more strokes (195) as compared to females (126). In males highest numbers of strokes were found in 60-69 age groups whereas in females they were in 50-59 age groups. In winter the strokes increased in all age groups (<40, 6; 40-49, 22; 50-59, 47; 60-69,52; 70-79, 43; >80, 18) compared to summer (<40,7; 40-49, 15; 50-59, 26; 60-69, 36; 70-79, 30; >80, 19). Ischemic strokes patients were less than hemorrhagic stroke in 60-69 age group, while in all other age groups it was found high.

It was observed that the highest number of hemorrhage and ischemic strokes occurred in December and February, and least strokes were noticed in April. Highest hemorrhage stroke occurred in December (28), followed by August and November (10), respectively. The least hemorrhage stokes were observed in April (4). Ischemic strokes in patients were highest in January whereas least was observed in April (6).

In table 2 it was observed that the data of patients, ischemic and hemorrhage stroke related to seasonal variation was significant. The patients admitted in summer and winter had person chi-square value of 9.4 and is significant at 95 percent level. Similarly, the chi-square value of ischemic and hemorrhage stroke were 5.4 and 4.04, and were found significance at 95 percent level.

Various risk factors and their relative frequency for hemorrhagic/ ischemic stroke are shown in Figure 1.

Figure 2 showed that patients with hemorrhagic or ischemic stroke due to hypertension were 110, due to combination of hypertension and diabetes mellitus were 61 and due to combination of other risk factors (AF, smoking, dyslipidemia, CAD) were 8. Patients had high number of ischemic strokes in all 3 types of risk factors i.e. HTI (64), HDI (46), and MXI (6) compared to hemorrhage (46, 15 and 2).

DISCUSSION

Seasonal variation of stroke is a debatable issue. Several researchers looked into the possible association between the occurrence of stroke and various seasons of the year. A number of these studies carried out in various countries of the world showed an association[12,16,18,19,22-25].

Statistically significant seasonal variation was observed regarding incidence of all strokes ($p < 0.01$)[18] and sub-types of strokes like hemorrhagic stroke ($p < 0.05$)[18] and ischemic stroke ($p < 0.01$)[12,18]. Such variation in seasonality was not reported regarding sub-arachnoid hemorrhage[18,26].

Besides variation in seasonality, a number of meteorological factors were also studied by various researchers. These included changes in ambient temperature, diurnal temperature changes and difference in atmo-

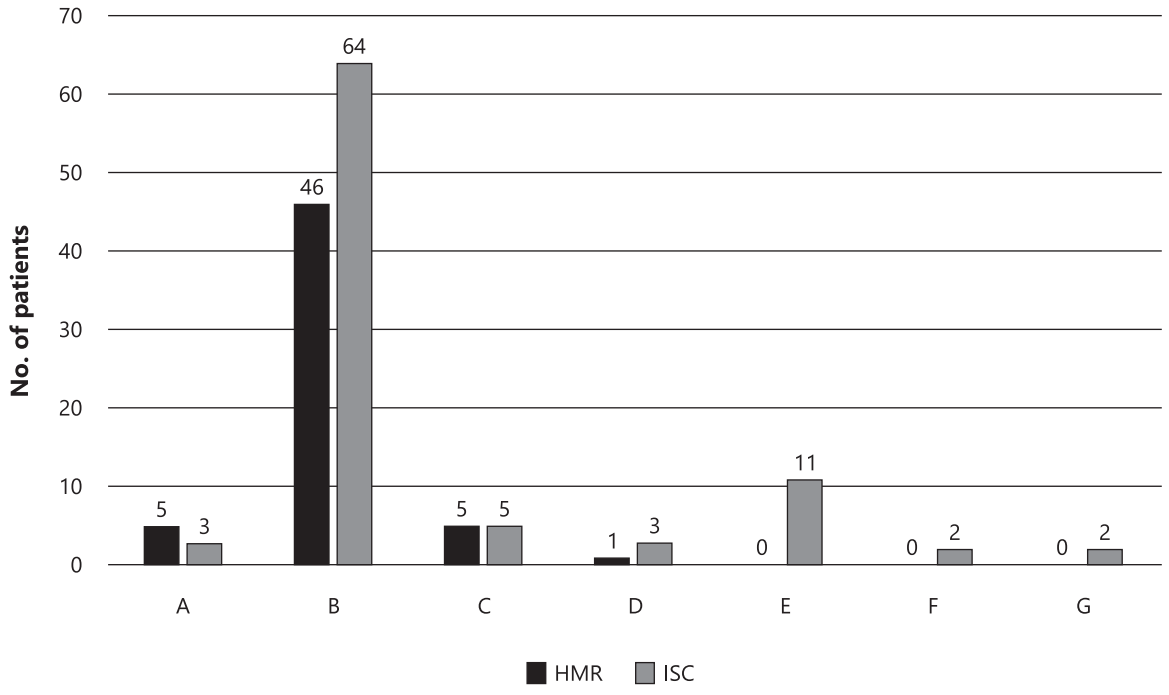
Table 1: Gender, season and stroke type with respect to age distribution (n=321)

	Age groups						
	<40	40-49	50-59	60-69	70-79	>80	
Male	9	20	41	58	43	24	195
Female	4	17	32	30	30	13	126
Summer	7	15	26	36	30	19	133
Winter	6	22	47	52	43	18	188
Hemorrhage	6	15	21	45	14	8	109
Ischemic	7	22	52	43	59	29	212

Table 2: Distribution of patients, hemorrhage and ischemic stroke related to seasonal variation

	Summer	Winter	Total	Chi square	P-value
Patients	133	188	321	9.4	0.00
Ischemic Stroke	89	123	212	5.4	0.01
Heomrrhage	44	65	109	4.04	0.04

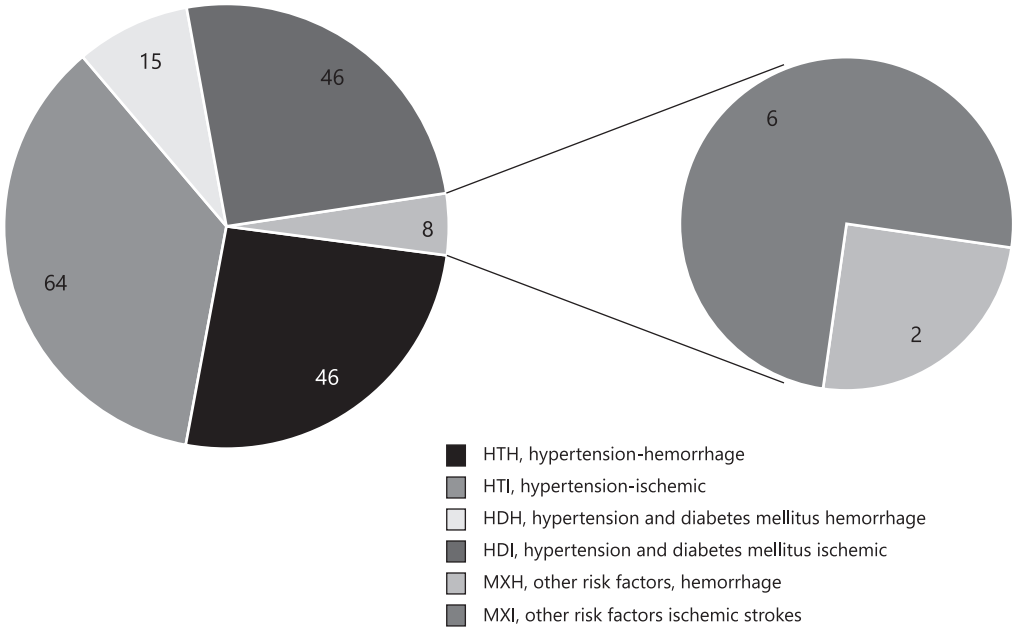
Figure 1: Number of patients having hemorrhage/ ischemic stroke with respect to no risk factor (A) and single factors such as hypertension (B), diabetes mellitus (C), smoking (D), atrial filiation (E), CAD (F) and dyslipidemia (G).



spheric pressures. These were found to be associated with the occurrence of stroke[17,27,28].

On the contrary, other investigators did not find evidence regarding seasonal variation in stroke[20,29] or stroke subtype (i.e. ischemic stroke)[15]. These disagreements to the above mentioned studies may be due to differences in the study design, methodology, statistics and regional differences. Moreover, the sample size diversity and lack of statistical power for consistent results

Figure 2: Hypertension, diabetes mellitus and others risk factors of patients



may also be considered responsible[18-20].

The present study demonstrated that winter season had the highest number (58.56%) of patients with strokes. Hemorrhagic stroke occurred more frequently in winter than in summer. These findings were in line with Fang CW et al[17], who showed that spontaneous ICH significantly occurred more in winter in Taiwan-(p=0.002). Changes in temperature and lower ambient temperature were shown to be the likely reasons for more cases of ICH in Taiwan[17].

Capon et al[15], found increased frequency of stroke (23%) in November-December and decreased (10%) in July-August. These seasonal differences in frequency of stroke were statistically significant (p<0.05). Hemorrhagic stroke was also reported to be associated with ambient humidity and the decreased number of hours of sunshine.

Miah et al[13], showed that hemorrhagic stroke was more frequent during winter (62.2%) than in summer (37.6%). Other studies observed similar findings[6,15,18,30].

Winter and chilly weathers are reported to have more cases of ICH as compare to the warmer and hot climatic conditions. Several studies hypothesize an increase in blood pressure in winters than summers. These fluctuations in BP are considered to be important factor for increased frequency of ICH in winters[30,31].

Similarly, in the waking hours of morning, there is increased in frequency of ICH[19]. The likely explanation for this may be that on awakening there is an increase in the sympathetic tone with resultant increase in blood pressure[31].

Although the exact causes for increased frequency of strokes during the winter are not known, but several mechanisms may be suggested[10].

First, the seasonal variation of blood pressure is well known, with blood pressure being higher in winter[6,18,19]. There is an increase in platelet count, blood viscosity and arterial pressure on exposure to low temperature. Due to cold-induced constriction of peripheral blood vessel, blood pressure is higher in colder months even within the same person. Raised blood pressure during the winter may be a possible trigger for ICH and IS[27,31,32].

Second, total cholesterol and triglycerides tend to be higher in winter than in summer[33]. A significant seasonal pattern for the occurrence of hemorrhagic stroke was noted among persons with a high serum cholesterol level ($p < 0.05$)[18].

Moreover, there are significant seasonal variations in plasma fibrinogen concentration and viscosity. Fibrinogen is considered a significant predictor of stroke[34,35].

Risk factors for stroke are also influenced by age and

gender. In our study hemorrhagic and ischemic strokes were high in patients of 60-69 years of age (88 out of 321). These results were supported by Wang et al[36], who examined 5 year case study in Australia. Frequency of stroke was found to be higher in >65years of age.

Previous literature has reported that seasonal differences in stroke are greater in older than in younger age groups. Klimaszewska et al[37], noted increased incidence of ischemic stroke in older patients during winter months than in summer months. In another study older females were found to be more prone to spontaneous ICH as a result of lower ambient temperature[38]. About17% of strokes are reported in elderly population. Stroke related mortality, morbidity and hospital stay in is increased in elderly population[5,9,39,40].

Blood pressure is shown to be the most powerful risk factor for stroke. It has seasonal and diurnal variations which are responsible for variations in stroke onset[32]. In the current study, the major risk factor for stroke was hypertension (34.26%). In a meta-analysis by Boutayeb et al, it was shown that the frequency of hypertension in stroke patients is about 50 to 82% from different studies of Pakistan. Similarly was found to be greater than 25% in 36 studies, smoking greater than 15% in 26 studies and dyslipidemia greater than 25% in19 studies[41]. Mouradian et al showed that frequency of hypertension was 66% while dyslipidemia and diabetes were around 25%[42].

CONCLUSION

There was seasonal variation noted in the occurrence of Strokes. Winter season was associated with increased frequency of stroke and its subtype of hemorrhagic stroke. There was variation of gender, season and stroke types in different age groups. Hypertension was found to be the highest risk factor.

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CONTRIBUTORS

Z conceived the idea, did data collection and wrote the manuscript. NI, HR and IAS helped in data collection. ZA helped in the writing up of manuscript and did the data analysis. KM supervised the study. All authors contributed significantly to the final manuscript.