

Seasonal Variations in Blood Pressure and Increased Incidence of Intracerebral Hemorrhage in Cold Months of the Year

SAMIULLAH KHAN¹, GOHAR ALI KHAN², NASEEB UR REHMAN SHAH³, SAEED MAQSOOD⁴, RADHIA KHAN⁵, ATTAULLAH⁶

¹Assistant professor department of Medicine MTI Bannu

²Assistant professor Internal medicine, Khalifa Gul Nawaz teaching hospital Bannu

³Associate professor Department of medicine, MTI, Bannu

⁴Assistant Professor Cardiology Bannu Medical College

⁵Associate professor department of Biochemistry MTI BANNU

⁶Professor Department of medicine MTI Bannu

Corresponding author: Radhia Khan, Email: Radhiakhan487@gmail.com

ABSTRACT

Objective: To assess the Seasonal variations in Blood Pressure and increased incidence of Intracerebral Hemorrhage in cold months of the year

Methods: This cross sectional study was conducted at KGN hospital, during the time period of one year. The months of the year was divided as cold months (November-February) and all other months (March-October) of the year. Ischemic stroke and intracerebral hemorrhagic stroke were the two main categories used to categorize individuals with stroke based on non contrast brain CT scan along with clinical characteristics.

Results: In cold months, the incidence of Intracerebral hemorrhage, 98 (65.3%) was significantly greater at $p < 0.05$ as compared to all other months of the year, 52 (34.7%). Both systolic and diastolic blood pressure of intracerebral hemorrhage patients was higher in cold months as compared to all other months of the year

Conclusion: The good reason for increase in both systolic and diastolic blood pressure of intracerebral hemorrhage patients is the peripheral vasoconstriction of the vessels in cold weather.

Keywords: Intracerebral hemorrhage, seasonal variations, Ischemic stroke, cholesterol, blood pressure.

INTRODUCTION

Strokes and other cerebrovascular illnesses are typically divided into two categories: ischemic and hemorrhagic. The incidence of strokes as well as the proportion of people over 65 is expected to rise in tandem with the increasing aging of the general population (1). For a period of time exceeding twenty-four hours or till death, without any clear non-vascular etiology, stroke is defined as the clinical manifestation of a localized or global disruption of brain function (2). Atherosclerosis, an embolism, or a ruptured blood artery are all potential causes of serious brain damage (3).

Stroke is one of the top three causes of mortality in the world, behind cancer and cardiovascular disease, and one of the primary causes of disabilities (4). Strokes can be either ischemic or hemorrhagic, however ischemic accounts for about 80% of all cases. Hemorrhaging stroke occurs when blood arteries to the brain burst, causing hemorrhage in the tissues around them, whereas ischemic stroke (IS) occurs when the blood flow to the brain is intermittent owing to the occlusion of tiny bloodstream vessels by certain types of clots of blood or atherosclerosis (5). Hypertensive alterations along with other abnormalities in the circulatory system are the most common causes of intracerebral hemorrhaging (ICH), which is the bleeding inside the brain. With better arterial pressure regulation, the prevalence of hypertension ICH has declined in affluent nations. Nevertheless, the ICH impact has not lessened in poorer countries. Infarcts of the cerebral hemispheres have varying outcomes depending on a number of criteria such as hematoma dimensions, positioning, and ventricular extension. In spite of that, ICH results in a greater death rate as well as longer-lasting disabilities when compared with IS (6-8).

Ten to twenty percent of all strokes are caused by ICH; in the West, 8 to 15 percent of strokes occur this way. It is estimated that there are 350,000 new instances of stroke every year throughout Pakistan. The rate of ICH varies greatly between regions and ethnic groups (9, 10).

Following cardiovascular disease as well as cancer, strokes remain Pakistan's third-most common cause of death. The importance of seasonal fluctuation in the increased morbidity and higher rate of cerebrovascular diseases (CVA) has been proven by several research from various nations as well as temperate regions, although the data contain many contradictions, making the result uncertain (11, 12).

It is commonly considered that seasonal fluctuation accounts for the higher reported incidence of IS during the winter months in

hospital-based research. Among the elderly, seasonal changes in their blood pressure (BP) are a major contributor to the increased death rate seen in IS during the winter months (13).

The rationale of this study is to approximate the incidence of ICH in cold months and all other months of the year and to evaluate the role of blood pressure and cholesterol level variations in incidence of ICH in a tropical region like Pakistan.

METHODOLOGY

The current cross-sectional study was conducted upon 428 cases of stroke patients admitted at Khalifa Gulnawaz Teaching hospital, KGN, Bannu and District Health Quarter, DHQ, Bannu, Khyber Pakhtoon Khwa, KPK, Pakistan, during the time period of one year, May 2022-May 2023. The months of the year was divided as cold months (November-February) and all other months (March-October). Non-contrast brain CT scans as well as clinical characteristics were used to categorize individuals with stroke into the ischemic stroke (IS) group and the ischaemic stroke (ICH) group, respectively. Each patient's full clinical history was recorded, including their age, the time of year, the length of their symptoms, and any preexisting conditions they might have, such as high blood pressure, heart disease, diabetes, irregular heartbeat, obesity, or smoking. Every participant had a standard blood test run, which included a lipid profile. The current version 23 of the Statistical Package for the Social Sciences was used for the statistical analysis. The t-test was performed to compare the groups, and a significant value of $p < 0.05$ was taken into account.

RESULTS

The incidence of ICH and IS stroke patients in cold and all other months of the year is shown in table 1. Out of total 428 stroke patients admitted to KGN hospital Bannu in the year 2020, 278(64.95%) were suffered with IS and 150 (35.1%) were suffered with ICH stroke type. In cold months, the incidence of ICH, 98 (65.3%) was significantly greater at $p < 0.05$ as compared to all other months of the year, 52 (34.7%).

The mean age of IS patients, 70.53 ± 9.83 , is significantly higher at 0.014 as compared to mean age of ICH patients, 65.19 ± 9.35 , as shown in table 2. 221(51.6%) were male and 207(48.4%) were females. Among the medical history frequency of hypertension was significantly higher at $P=0.001$ in ICH patients as compared to IS patients. However, frequency of atrial fibrillation

and cardiovascular diseases were significantly higher in IS patients at $p < 0.05$.

Table 1: Incidence of ICH and IS in Cold Months and All Other Months of the Year

Type of Months	Count % within Groups		Total	p-value
	ICH	IS		
Cold Months (Nov-Feb)	98 (65.3%)	149 (53.6%)	247 (57.7%)	0.021*
All other Months (March-Oct)	52 (34.7%)	129 (46.4%)	181 (42.3%)	
Total	150 (35.1%)	278 (64.9%)	428 (100%)	

P is significant at <0.05

Table 2: Comparison of Age, Gender and Medical History of ICH and IS Patients

Variables	ICH	IS	p value
Age, Year, Mean \pm SD	65.19 \pm 9.35	70.53 \pm 9.83	0.014*
Gender			
Men	80 (53.3%)	141 (50.7%)	0.339
Women	70 (46.7%)	137 (49.3%)	
Medical history			
Hypertension	103 (68.7%)	147 (52.9%)	0.001*
Diabetes	49 (32.7%)	114 (41.0%)	0.051
Obesity	52 (34.7%)	113 (40.6%)	0.134
Atrial fibrillation	43 (28.7%)	107 (38.5%)	0.026*
Cardiovascular disease	44 (29.3%)	107 (38.5%)	0.036*
Current smoking	16 (10.7%)	26 (9.4%)	0.39

P is significant at <0.05 .

Table 3: Seasonal Variation in Blood Pressure and Serum Cholesterol of ICH Patients

Parametres	Cold Months (Nov-Feb)	All Other Months (Mar-Oct)	p-value
Blood Pressure, mmHg, Mean \pm SD			
SBP	166.74 \pm 10.38	153.61 \pm 10.72	0.000*
DBP	100.75 \pm 3.55	94.85 \pm 4.42	0.000*
Serum Cholesterol, mg/dL, Mean \pm SD			
Total Cholesterol	254.76 \pm 24.38	253.90 \pm 22.96	0.843
Triglyceride	209.11 \pm 41.17	192.26 \pm 26.21	0.021*
Low Density Lipoprotein Cholesterol (LDL-C)	138.86 \pm 30	133.35 \pm 36.21	0.072
High Density Lipoprotein Cholesterol (HDL-C)	36.95 \pm 9.92	37.95 \pm 12.20	0.227

P is significant at >0.05

Both systolic and diastolic blood pressure of ICH patients was higher in cold months as compared to all other months of the year, 166.74 \pm 10.38 vs 153.61 \pm 10.72 and 100.75 \pm 3.55 vs 94.85 \pm 4.42 respectively. The level of significance was at $p < 0.001$. Similarly triglycerides values of ICH patients were comparably high in winter season as compared to all other months of the year. However, seasonal variation in total cholesterol, LDL-C and HDL-C of ICH patients remain non significant across the year.

DISCUSSION

Results from the current investigation confirmed that seasonal fluctuation plays a clear effect in the prevalence of ICH as well as IS stroke subtypes. Stroke was more common in the winter months for both sexes than in any other time of year. Invasive cerebral hypertension (ICH) was the primary contributor to this shift. Our findings are in line with those of prospective research conducted in India, which found that the incidence of stroke in both sexes varies with the seasons (14). Another population-based study, this one from China, reveals that the overall incidence of strokes, ICH, and cerebral infarctions varies significantly over the year (15). However, a recent Israeli study suggested that extreme heat or cold may both increase the likelihood of stroke. In our study ICH patients were less aged than IS patients (mean age 65.19 \pm 9.35 vs. 70.53 \pm 9.83 years, $p < 0.05$), but there was no significant difference in gender (males 53.3% vs. 50.7%, and females 46.7% vs 49.3%, $p = 0.34$). Stroke burden is greater among women than men, according to previous research, because of a higher incidence of prior to and following stroke morbidity among women (16). Nonetheless, the study's premise and length of follow-up could account for sex-related disparities in stroke outcomes (17). Similarly hypertension had significantly stronger associations with ICH than IS, whereas diabetes, obesity, atrial fibrillation and cardiovascular diseases were less associated with ICH than IS.

The primary risk factor for ICH that occurs on its own is high blood pressure, and this condition contributes more to severe ICH compared to lobar ICH (18).

The good reason for increase in both systolic and diastolic blood pressure of ICH patients is the peripheral vasoconstriction in cold weather which ends in increased blood pressure (19). Moreover, triglycerides levels seems to be higher in cold months than in all other months of the year (20). The higher levels of triglycerides as reported in this study is thought to be linked to a greater mortality rate following ICH (21). However, having hypercholesterolemia in the past is associated with a lower risk of ICH. has been observed in some past studies, and thus TC has been declared as negatively responsible for hemorrhagic and total stroke death (22-24). Some other factors such as pollution, radiations, diet and viruses may also add but variation in temperature plays the key role for increased incidence of ICH (25).

CONCLUSION

The seasonal variations in blood pressure are the main reason for increased incidence of ICH in winter season. More research is needed to determine whether or not hypertension is a causal factor in the development of ICH.

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