ORIGINAL ARTICLE

# SEASONAL VARIATIONS IN STROKE: A STUDY IN A TEACHING HOSPITAL OF KHYBER PAKHTUNKHWA

**Wazir Muhammad Khan[1], Majid Khan[1], Faridullah Shah[2]**

[1]Department of Medicine, Khyber Teaching Hospital, Peshawar - Pakistan
[2]Department of Medicine, Peshawar Medical College, Peshawar - Pakistan

## ABSTRACT

**Objective:** To determine variations in incidence of stroke and its subtypes during summer and winter seasons and to determine the risk factors associated with it.

**Material and Methods:** This descriptive study was conducted in the Department of Medicine, Khyber Teaching Hospital Peshawar, Pakistan, from January 2015 to December 2016. Patients whose findings were consistent with stroke were included in the study on the basis of history, clinical examination and radiological evidence.

**Results:** Out of total 210 patients, 117 (55.71%) cases accounted for ischemic stroke and 93 (44.28%) cases accounted for hemorrhagic stroke. Stroke incidence was more prevalent in male than female (60.5% vs 39.5%). In summer season more patients presented with ischemic stroke than hemorrhagic stroke (58.1% vs 31.2%), while in winter season more patients presented with hemorrhagic stroke than ischemic stroke (68.8% vs 41.9%) and the seasonal variation was found to be strongly statistically significant (p value <0.001). Hypertension (42.4%) was found to be major risk factor for stroke followed by diabetes (34.3%).

**Conclusion:** Seasonal variation was found among patients presented with stroke. Stroke was more common in winter season. Hemorrhagic stroke was more than ischemic stroke in winter season and vice versa. Hypertension was the major risk factor among patients.

**Key words:** hemorrhagic stroke, ischemic stroke, seasonal variation, stroke.

**This article may be cited as:** Khan WM, Khan M, Shah F. Seasonal Variations in Stroke: A Study in a Teaching Hospital of Khyber Pakhtunkhwa. J Med Sci 2017; 25: (3) 292-296.

## INTRODUCTION

Stroke is defined as rapid onset of focal neurological deficits lasting for more than 24hours as a result of vascular insult [1]. Stroke is a broad terminology which can be further classified into ischemic and hemorrhagic stroke[2]. Stroke is a major cause of morbidity and mortality and about 5.7 million people die globally[3].

The incidence of Stoke in United States is 200 cases/100,000 populations, while in Pakistan it is approximately 250/100,000 population; therefore, there is risk of 350,000 of new stroke patients every year[4]. Prevalence of Ischemic stroke is 85%, while hemorrhagic stroke is 15%[5]. The severity of morbidity and mortality rates are higher for hemorrhagic than ischemic stroke[6]. Ischemic stroke occurs after cessation of blood circulation to an area of the brain giving rise to focal neurological deficit, while intracerebral hemorrhage occurs secondary to rupture of blood vessels in the brain[7].

The risk factors for stroke include hypertension, diabetes, dyslipidemia, smoking, old age, heart disease, using oral contraceptive pills, excess alcohol consumption, hyper-coagulopathies etc[8]. The major risk factor is uncontrolled hypertension as depicted in local national survey 30% people above 45-years-old suffer from uncontrolled hypertension[4]. Old age is a common risk factor for both genders, as it has showed increased incidence of both ischemic and hemorrhagic strokes with increasing age[9]. The incidence of ischemic and hemorrhagic stroke varies in different seasons. To establish this relationship a number of studies were carried out in different countries in different seasons[10-17]. Some studies favoured the relationship while others negated it[18-22].

**Dr. Majid Khan** (Corresponding Author)
Department of Medicine Khyber Teaching Hospital, Peshawar, Pakistan
Cell: +92-312-5975936
Email: drmajidkhan@ymail.com
**Date Received:** April 16, 2017
**Date Revised:** May 20, 2017
**Date Accepted:** June 10, 2017

Pakistan is a tropical country and has different seasons, but summer and winter are the two main seasons that are extreme and are present for extended period of time. It may influence the incidence of ischemic and hemorrhagic stroke. The aim of this study was to determine the relationship between the seasonal variation and the stroke subtypes. It will help us to strategize and alter our management plans to counteract strokes in different seasons effectively.

## MATERIAL AND METHODS

This descriptive study was conducted in the Department of Medicine, Khyber Teaching Hospital, Peshawar, Pakistan. The time period of the study was from January 2016 to December 2016.

Total number of 210 stroke patients presented to our department in one year. Stroke was confirmed and sub-classified into ischemic and hemorrhagic stroke on the basis of physical examination and Computed Tomography of brain. The whole year was divided into two seasons i.e. winter (October, November, December, January, February and March) and summer (April, May, June, July, August and September), as these are the two main seasons that exist for extended period of time in our country and affect lifestyles of the people.

All age groups patients with ischemic and hemorrhagic strokes regardless of gender were included in the study after formal consent. After approval from the ethical committee those patients who fulfilled the inclusion criteria, a detailed history was taken about the symptoms, especially risk factors like hypertension, diabetes, dyslipidemia, smoking, family history of stroke and contraceptive pills. Stroke was confirmed on neurological examination and neuroimaging (Computed Tomography) of the brain. Finally, data was analysed on SPSS software (SPSS version 16, Inc., Chicago, IL), and chi square test was applied to find out statistically significant association (p value $<0.05$) of stroke types and seasons of a year.

## RESULTS

A total of 210 cases were included in the study. Of 210, males were 127 (60.5%) and females were 83 (39.5). Table 1 illustrates the information that age groups were divided among 6 groups (<40, 40-49, 50-59, 60-69, 70-79 and ≥ 80). The incidence of both ischemic and hemorrhagic stroke was more common in 60-69 age groups in genders, while the lowest incidence was found in age group < 40 in both genders.

Table 2 shows that the incidence of stroke is more common in males as compared to females (60.5% vs 39.5%). Moreover, ischemic stroke was common in both genders than hemorrhagic stroke in both genders (55.7% vs 44.3%).

The incidence of ischemic stroke in summer season was more common than hemorrhagic stroke. As total of 97 cases (46.2%) presented with stroke, of which 68 cases (58.1%) were ischemic stroke and 29 cases (31.2%) were hemorrhagic stroke, while in winter season the incidence of ischemic stroke was more common than hemorrhagic stroke. On the other hand in winter season the incidence of hemorrhagic stroke was more common than ischemic stroke. As total of 113 cases (53.8%) presented with stroke, of which 64 cases (68.8%) were hemorrhagic stroke and 49 cases (41.9%) were ischemic stroke. This seasonal variation of stroke subtypes were analysed on SPSS by applying chi square test. The value of chi square test was 14.147 and it was statistically strongly significant (p value $<0.0001$).

The Figure I show the risk factors associated with stroke. Hypertension (42.4%) was found to be major risk factor followed by diabetes (34.3%) and dyslipidemia (7.6%).

## DISCUSSION

In our study a significant relationship was found between seasonal variation and the type of the stroke. There are many studies reported in the literature which

**Table 1 Distribution of Gender, Season and type of stroke with respect to Age groups**

| | | Age Groups in years | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | <40 | 40-49 | 50-59 | 60-69 | 70-79 | ≥ 80 | |
| Gender | Male | 12(5.7%) | 14(6.7%) | 20(9.8%) | 38(18.1%) | 25(11.9%) | 18(6.6%) | 127(60.5%) |
| | Female | 5(2.4%) | 12(5.7%) | 12(5.7%) | 22(10.5%) | 20(9.5%) | 12(5.7%) | 83(39.5%) |
| Season | Summer | 9(4.3%) | 16(7.6%) | 10(4.8%) | 27(12.9%) | 16(7.6%) | 19(9.0%) | 97(46.2%) |
| | Winter | 8(3.8%) | 10(4.8%) | 22(10.5%) | 33(16.7%) | 29(18.8%) | 11(5.2%) | 113(53.8%) |
| Type of Stroke | Ischemic | 10(4.8%) | 16(7.6%) | 19(9.0%) | 29(13.8%) | 24(11.4%) | 20(9.5%) | 117(55.7%) |
| | Hemorrhagic | 7(3.3%) | 10(4.8%) | 13(6.2%) | 31(14.8%) | 21(10.0%) | 10(4.8%) | 93(44.3%) |

**Table 2 Gender wise distribution of Type of Stroke**

| | | Ischemic | Hemorrhagic | Total |
|---|---|---|---|---|
| Gender | Male | 75(64.1%) | 52(55.9%) | 127(60.5%) |
| | Female | 42(35.9%) | 41(44.1%) | 83(39.5%) |
| Total | | 117(100%) | 93(100%) | 210(100%) |

**Table 3 Season wise Distribution of Type of Stroke**

| | | Ischemic | Hemorrhagic | Total | Chi Square Value | p Value |
|---|---|---|---|---|---|---|
| Season | Summer | 68(58.1%) | 29(31.2%) | 97(46.2%) | 14.174 | 0.0001 |
| | Winter | 49(41.9%) | 64(68.8%) | 113(53.8%) | | |
| Total | | 117(100%) | 93(100%) | 210(100%) | | |

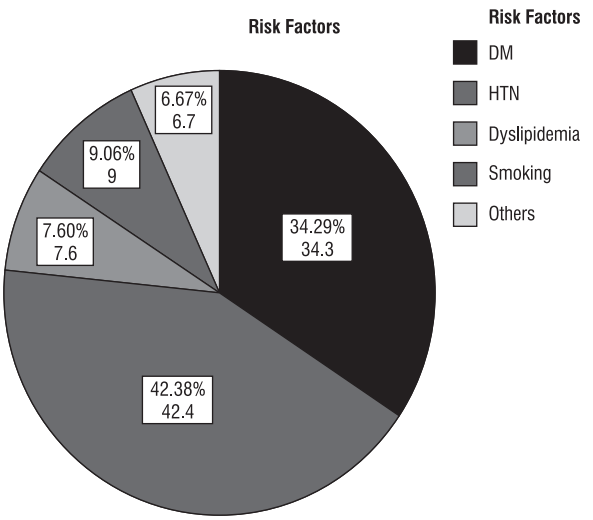


Figure 1: Percentages of Risk Factors associated with Stroke

advocates this significance[12,16,23-26].

In our study it was found that the incidence of stroke was more common in males than females (60.5% vs 39.5%), this observation was in correlation with the studies conducted by Ziauddin et al[7] (60.7% vs 39.3%), Soomro MA et al[27] (58% vs 42%), Syed NA et al[28] (58% vs 42%) and Vohra EA et al[29] respectively.

The highest incidence of stroke was found in the age group 60-69, which correlates with other various studies[22-27]. The incidence was found to be 8.1% in age group <40 years, which was in accordance with previous studies[27,28] (11%), but the incidence was reported high in studies conducted in Western society[29,30].

The study illustrated that the incidence of stroke, ischemic and hemorrhagic, was more common in winter season than the summer (53.8% vs 46.2%). Other studies conducted by Capon et al[15], 23% in November and December, while 10% in July and August and Ziauddin et al[7] (58.6% vs 41.4%) showed the same results. The main finding of the study was that hemorrhagic stroke was more common in winter season (68.8% vs 31.2%). Miah et al[13] conducted a study which showed the incidence of hemorrhagic stroke was 62.2% in winter, while 37.6% in summer. Fang CW et al[17] also found significant association of winter season and hemorrhagic stroke ($p = 0.002$). On the other hand, study also revealed that ischemic stroke was more common in summer season than winter (58.1% vs 41.9%). This finding was in accordance by study conducted by Kumar P et al while it contradicted the findings of the study conducted by Jakovljević D[32].

The increase risk of stroke in winter season may be due to increase in the blood pressure levels as compared to the summer seasons. The factors responsible for the high blood pressure levels may be vasoconstriction secondary to low temperature, additionally; increase in blood viscosity may account for it as well[34-36].

## CONCLUSION

Winter season was associated with increased risk of stroke, ischemic and hemorrhagic, as compared to the summer season. Moreover, incidence of hemorrhagic stroke was much higher than ischemic stroke in winter season and vice versa. The study observed hypertension to be the biggest risk factor for stroke.

## REFERENCES

1. Davenport R, Dennis M. Neurological Emergencies: Acute stroke. J Neurol Neurosurgery psychiatry 2000; 68: 277-88.
2. Allen CMC, Lueck CJ, Dennis M. Neurological disease, Davidson's Principles & Practice of Medicine 20th edn 2006. 1200-10.

3. Feigin VL, Forouzanfar MH, Krishnamurthi R, Mensah GA, Connor M, Bennett DA, et al. Global Burden of Diseases, Injuries, and Risk Factors Study 2010 (GBD 2010) and the GBD Stroke Experts Group. Global and regional burden of stroke during 1990-2010: findings from the Global Bur¬den of Disease Study 2010. Lancet 2014; 383:245-54.
4. Pakistan stroke society 14th annual meeting, Pakistan society of Neurology, March 24-25, 2007. Avari Hotel Lahore Organizer: proff Nasrl.
5. Shiber JR, Fontane E, Adewale A. Stroke registry: hemor¬rhagic vs ischemic strokes. Am J Emerg Med 2010; 28:331-3.
6. National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. Tissue plasminogen activator for acute ischemic stroke. The National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. N Engl J Med. Dec 14 1995; 333(24):1581-87.
7. Ziauddin, Iqbal N, Shah IA, Ali Z, Rehman H, Mehmood K. Seasonal variation in stroke in a teaching hospital of Khyber Pakhtunkhwa. J Postgrad Med Inst 2015; 29(3): 193-98.
8. Tintinalli J, Kellen G, Stapczynski J. Emergency Medicine: A Comprehensive Study Guide. 6th ed. New York: American College of Emergency Physicians. McGraw Hill; 2004:1382-90.
9. Russo T, Felzani G, Marini C. Stroke in the very old: a systematic review of studies on incidence, outcome, and resource use. J Aging Res 2011; 2011:1087-88.
10. Raj K, Bhatia R, Prasad K, Srivastava MV, Vishnebhatla S, Singh MB. Seasonal differences and circadian variation in stroke oc¬currence and stroke subtypes. J Stroke Cerebrovasc Dis 2015; 24:10-16.
11. Giua A, Abbas MA, Murgia N, Corea F. Climate and stroke: a controversial association. Int J Biometeorol 2010; 54:1-3.
12. Ogata T, Kimura K, Minematsu K, Kazui S, Yamaguchi T. Japan Multicenter Stroke Investigators' Collaboration. Variation in ischemic stroke frequency in Japan by season and by other variables. J Neurol Sci 2004; 225:85-89.
13. Miah AH, Sutradhar SR, Ahmed S, Bhattacharjee M, Alam MK, Bari MA, et al. Seasonal variation in types of stroke and its common risk factors. Mymensingh Med J 2012; 21:13-20.
14. Hannan MA, Rahman MM, Haque A, Ahmed HU. Stroke: seasonal variation and association with hypertension. Bangladesh Med Res Counc Bull 2001; 27:69-78.
15. Capon A, Demeurisse G, Zheng L. Seasonal variation of cerebral hemorrhage in 236 consecutive cases in Brussels. Stroke 1992; 23:24-27.
16. Oberg AL, Ferguson JA, McIntyre LM, Horner RD. Incidence of stroke and season of the year: evidence of an association. Am J Epidemiol 2000; 152:558-64.
17. Fang CW, Ma MC, Lin HJ, Chen CH. Ambient temperature and spontaneous intracerebral haemorrhage: a cross-sectional analysis in Tainan, Taiwan. Br Med J Open 2012; 8:2.
18. Biller J, Jones MP, Bruno A, Adams Jr HP, Banwart K, Seasonal variation of stroke – does it exist? Neuroepidemiology, 1988; 7: 89-98.
19. Kelly-Hayes M, Wolf PA, Kase CS. Temporal patterns of stroke onset: The Framingham study. Stroke 1995;26:1343-47.
20. Schievink WI, Wijdicks EFM, Meyer FB, et al. Seasons, snow, and subarachnoid hemorrhage: lack of association in Rochester, Miinnesota. J Neurosurg 1995; 82:912-13.
21. Wang H, Sekine M, Chen X, Kagamimori S, A study of weekly and seasonal variation of stroke onset. Int J Biometeorol. 2002;47(1):13-20.
22. Wang H, Levi CR, Attia JR, D'Este CA, Spratt N, Fisher J. Seasonal variation in stroke in the Hunter Region, Australia: a 5 years hospital based study. Stroke 2003;34(5):1144-50.
23. Shinkawa A, Ueda K, Hasuo Y, Kiyohara Y, Fujishima M. Seasonal variation in stroke incidence in Hisayama, Japan. Stroke 1990; 21:1262-7.
24. Gallerani M, Trappella G, Manfredini R, Pasin M, Napolitano M, Migliore A. Acute intracerebral haemorrhage: circadian and circannual patterns of onset. Acta Neurol Scand 1994; 89:280-86.
25. Turin TC, Kita Y, Rumana N, Murakami Y, Ichikawa M, Sugihara H, et al. Stroke case fatality shows seasonal variation regardless of risk factor status in a Japanese population: 15-year results from the Takashima Stroke Registry. Neuroepidemiol 2009; 32:53-60.
26. McDonald RJ, McDonald JS, Bida JP, Kallmes DF, Cloft HJ. Subarachnoid hemorrhage incidence in the United States does not vary with season or temperature. AJNR Am J Neuroradiol 2012; 33:1663-68.
27. Soomro MA, Solangi GA, Shaikh BA, Gurbakhshni K, Mahesar AH. Stroke Types In Relation To Seasonal Variation And Months Of A Year. Medical Channel 2011;17:57-62.
28. Syed NA, Khealani BA, Ali S, Hassan A, Akhtar N, Brohi H et al. Ishemic stroke subtypes in Pakistan: the Aga Khan University stroke data bank.J Pak Med Assoc. 2003: 53: 584 – 88
29. Vohra EA, Ahmed WU, Ali M. Aetiology and prognostic factors of patients admitted for stroke. J Pak Med Assoc. 2000:50:234-36.
30. Khan JA, Shah MA. Young stroke: clinical aspects. J coll physicians surgpak 2000; 10:461- 66.
31. Kumar P, Kumar A, Pandit AK, Pathak A, Prasad K. Seasonal Variations in Stroke: A Study in a Hospital in North India. Journal of Stroke 2015;17(2):219-220

32. Jakovljević D, Salomaa V, Sivenius J, Tamminen M, Sarti C, Salmi K, et al. Seasonal variation in the occurrence of stroke in a Finnish adult population. The FINMONICA Stroke Register. Finnish Monitoring Trends and Determinants in Cardiovascular Disease. Stroke 1996; 27:1774-79.

33. Shah RS, Cole JW. Smoking and stroke: the more you smoke the more you stroke. Expert Rev Cardiovasc Ther 2010; 8:917-32.

34. Keatinge WR, Coleshaw SR, Cotter F, Mattock M, Murphy M, Chelliah R. Increases in platelet and red cell counts, blood viscosity, and arterial pressure during mild surface cooling: factors in mortality from coronary and cerebral thrombosis in winter. Br Med J 1984; 289:1405-08.

35. Passero S, Reale F, Ciacci G, Zei E. Differing temporal patterns of onset in subgroups of patients with intracerebral hemorrhage. Stroke 2000; 31:1538-44.

36. Woodhouse PR, Khaw KT, Plummer M. Seasonal variation of blood pressure and its relationship to ambient temperature in an elderly population. J Hypertens 1993; 11:1267-74.

**CONFLICT OF INTEREST:** Authors declare no conflict of interest

**GRANT SUPPORT AND FINANCIAL DISCLOSURE** NIL

## AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

| | |
|---|---|
| **Khan WM:** | Concept & design, literature |
| **Khan M:** | Data analysis manuscript & data collection data revise |
| **Shah F:** | Compilation, critical appraisal & proof reading |

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.