Faridpur Med. Coll. J. 2014;9(2):80-83

Original Article

Circadian Variation in Frequency of Stroke in Bangladesh: a Hospital Based Cross Sectional Study

AM Hossain[1], R Saha[2], BK Tarafder[3], MA Salam[4], MR Islam[5], MA Saleh[6], M Rahman[7]

Abstract:

A hospital based cross sectional study was carried out to analyze diurnal variation of stroke and their association to sleep awake cycle. Four hundred and two patients of stroke admitted in different Medicine Units of Faridpur Medical College and Dhaka Medical College Hospitals from July 2012 to June 2013 were chosen using purposive sampling technique. Enrolled patients were with their first stroke, subsequently proved by CT scan of brain. The initial clinical diagnosis of stroke was made from history and examination obtained from the patient himself or from his/her attendant. The time of onset of stroke was recorded by attending doctor at the time of assessment and recorded on a fixed proforma. Patient who could not give history properly or had no responsible attendant and who had history of head injury, intracranial space occupying lesion or bleeding disorder were excluded from the study. Age ranged from 25 years to 98 years with mean age of 62.02 years (±SD 11.75 years). Out of 402 patients 59.7% suffered from ischemic stroke. Highest incidence of stroke (26.9%) occurred between 4:01am to 8:00 am and lowest (7.5%) between 8:01 pm to 12:00 am. Among the subtypes, ischaemic stroke has shown a single peak incidence at 4:01 to 8:00 am and lowest between 8:01 pm to 12:00 am. 50 % of ischaemic stroke cases developed between 0:01 am to 8:00 am. In this study, maximum number of patients developed hemorrhagic stroke between 4:01 am to 8:00 am (25.9%) and lowest number developed hemorrhagic stroke between 12:01 pm to 4:00 pm (9.3%). This study confirms the diurnal variation of both hemorrhagic and ischaemic stroke in Bangladesh and most of them occurs in early morning after wakening.

Key words: stroke, circadian variation, hospitalized patients, Bangladesh.

Introduction:

Stroke is one of the leading causes of morbidity and mortality and third most common cause of death worldwide standing next to coronary artery disease and cancer[1]. World Health Organization defined stroke as a rapidly developing clinical signs of focal disturbance of cerebral function, lasting for more than 24 hours or leading to death with no apparent cause other than vascular origin[2].

1. Dr. Ahmed Manadir Hossain, D Card., FCPS (Medicine); Assistant Professor, Dept. of Medicine, FMC, Faridpur

2. Dr. Radheshyam Saha, FCPS, MD (Neuromedicine), Associate Professor, Dept. of Neuromedicine, FMC, Faridpur

3. Dr. Binoy Krishna Tarafder, FCPS (Medicine), Assistant Professor, Dept. of Medicine, FMC, Faridpur

4. Dr. Md. Abdus Salam, FCPS (Medicine), Assistant Professor, Dept. of Medicine, SZMC, Bogra.

5. Dr. Md. Rafiqul Islam, MPH (DU), Assistant Professor, Dept of Community Medicine, FMC, Faridpur.

6. Dr. Mohammed Abayedeen Saleh, MBBS, Registrar, Dept. of Cardiology, DMCH, Dhaka

7. Dr. Mahbubur Rahman, MPH (Epid), Medical Officer, Dept. of Epidemiology, Institute of Epidemiology, Disease Control & Research (IEDCR), Dhaka

Address of correspondence :
Dr. Ahmed Manadir Hossain, FCPS (Medicine); Assistant Professor, Dept. of Medicine, Faridpur Medical College, Faridpur.
Phone: +88-01711316036, E-mail: dr_manadir@yahoo.com

Several data have indicated that incidence of stroke have chronobiological variation such as circadian variation, circaseptan variation and circannual variation[3,4]. Several studies regarding circadian variation of stroke have produced conflicting results. Some suggested that strokes occur most often during the night[5], and others suggested a morningpeak[6].

No study could be found among Bangladeshi population on circadian variation in frequency of ischaemic and haemorrhagic stroke. The aim of the present study was to investigate whether such type of circadian variation is present among the Bangladeshi population. Proof of a circadian rhythm in the occurrence of stroke might lead to further investigation providing clues for any triggering or risk factors in context of our country which have precipitate these events, which in turn might lead to more rational treatment and reduce the burden of treatment cost.

Materials and Method:

This cross sectional study was carried out among inpatients of stroke admitted in different Medicine Units of Faridpur Medical College Hospital and Dhaka Medical college Hospital from July 2012 to June 2013. Patients with their first stroke, subsequently proved by CT scan of brain were included in the study. The initial clinical diagnosis of stroke was made from

history obtained from the patient him/her self or from his/her attendant(s). Detail clinical examination, thorough general physical examination (specially cardiovascular and neurological examination) were carried out and recorded.

Following patients were excluded from the study:

1. Patients who could not give history properly or no responsible attendant was found.
2. Patients with history of head injury, intracranial space occupying lesion (ICSOL) or bleeding disorder.

After having informed verbal consent, a total of 402 patients were recruited for the current study.

The data were collected in a standardized pretested questionnaire and checklist and analyzed and presented in simple statistical percentage. Stroke type was classified as cerebral infarction and primary intracerebral haemorrhage.

The time of onset of stroke was recorded by attending doctor at the time of assessment. Exact time was noted for patients who were awake at the time of onset of stroke. Information about onset of stroke in patients, who were asleep, was collected from their attendants.

Some patients were able to state that onset was first noted on waking from sleep but could not recall the exact time of waking. For patients who first noted symptoms on waking from sleep, the time of waking was initially used as the time of onset of stroke. Details of whether the patient was at sleep, rest or active when the stroke occurred were also recorded.

Each day was divided into six sections of four hours duration each. Time calculation was started from 0001 hrs (12:01 am midnight). Time of stroke onset was noted and each patient was bracketed in a particular four hour time period.

Result:

Among 402 enrolled patients, most of them were male (61.9%). Age of the enrolled patients ranged from 25 years to 98 years with mean age of 62.02 years (± SD 11.75 years). More than sixty percent (61.2%) of them were within the age group of 51 to 70 years.

Table I: Socio-demographic characteristics of the respondents (n=402)

Characteristics		No. of Respondents	Percentage
Sex	Male	249	61.9
	Female	153	38.1
Age (in years)	≤ 40	18	4.5
	41-50	66	16.4
	51-60	114	28.4
	61-70	132	32.8
	> 70	72	17.9

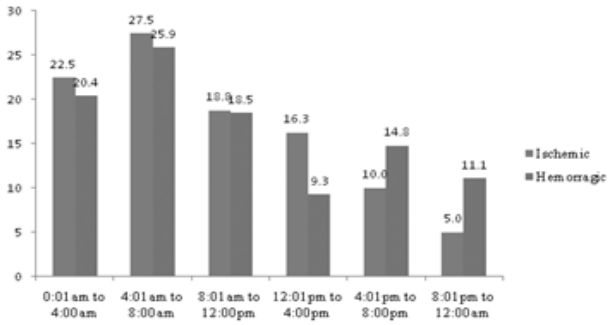
Most of the respondents suffered from ischemic stroke (59.7%). Among all the stroke patients, the highest incidence occurred between 4:01 am to 8:00 am (26.9%), which was followed by between 0:01 am to 4:00 am (21.65%) and least incidence occurred between 8:01 pm to 12:00 pm (7.5%).

Table II: Clinical characteristics of the stroke patients (n=402)

Characteristics		No. of respondents	Percentage
Type of stroke	Ischemic	240	59.7
	Hemorrhagic	162	40.2
Time of occurrence	0:01am to 4:00 am	87	21.6
	4:01am to 8:00 am	108	26.9
	8:01am to 12:00 pm	75	18.7
	12:01pm to 4:00 pm	54	13.4
	4:01pm to 8:00 pm	48	11.9
	8:01pm to 12:00 am	30	7.5

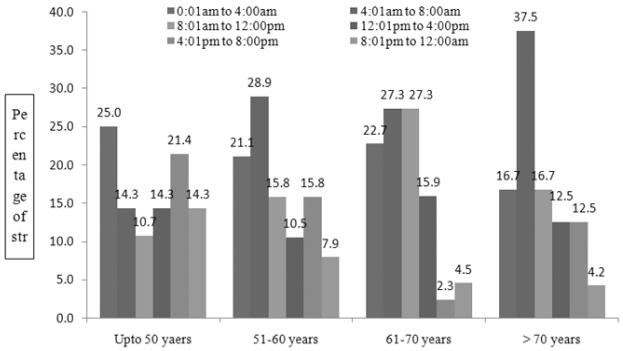
Among types of stroke, highest number of ischemic stroke (27.5%) and hemorrhagic stroke (25.9%) occurred between 4:01 am to 8:00 am. On contrary, lowest number of ischemic stroke (5.0%) occurred between 8:01 pm to 12:00 am and lowest number of hemorrhagic stroke (9.3%) occurred between 12:01 pm to 4:00 pm.

Fig.1: Circadian variation of stroke according to type of stroke (n=402)



When considered age group of the patients, highest percentage of patients aged up to 50 years had their incidence of stroke between 0:01 am to 4:00 am (25.0%), among age group 51-60 years highest incidence was between 4:01 am to 8:00 am (28.9%), among age group 61-70 years highest incidence was either between 4:01 am to 8:00 am or 8:01 am to 12:00 pm (27.3%) and among patients aged above 70 years highest incidence of stroke was between 4:01 am to 8:00 am (37.5%).

Fig.2: Circadian variation of stroke according to age of the patients (n=402)



Discussion:

The aim of this hospital based study was to determine diurnal variation of stroke in Bangladeshi population. Though most of the study done previously focused on ischemic stroke, this study involved both ischemic and hemorrhagic stroke. Our study showed that stroke onset is not random in 24 hour period but has a characteristic pattern of the circadian variation of both ischemic and haemorrhagic stroke. Elliot[7] and Omama et al[8] found that all classes of stroke showed diurnal variation. In this study maximum patients developed stroke between 4:01 am and 8:00 am, followed by between 00:01 am to 4:00 am.

Among the subtypes, ischemic stroke had shown a single peak incidence at 4;01 to 8;00 am and lowest between 8:01 pm to 12:00 pm. Argentino et al[9] in their study of 426 patients with ischemic stroke had found a single peak incidence in the morning which correlates with our study. But Similar study done in Pakistan among 800 patients by Butt et al[10] found that maximum patient developed stroke between 4:00 am and 8:00 am followed by another small peak between 4:00 to 8:00 pm. Similar observations had been made by others Omama et al[8], Spengos K et al[11], and Manfredini R et al[12].

Omama et al[8] found that 20% of all ischemic stroke occurred during sleep. In our study, 50 % of ischemic stroke cases developed during sleep or at the time of awakening that is in between 0;01 to 8;00 am and highest incidence was between 4;01 am to 8;00 am. Only 17.5% patients were at sleep. Gupta A et al[13] and Khawar S et al[14] noted that over 50% of ischemic stroke were either present on awakening or developed during early hours of morning. There are multiple observations regarding this issue. Lower blood pressure reduces the incidence of stroke, but nocturnal low blood pressure is a risk factor for ischemic stroke[15]. Several studies have indicated that there is increases in the levels of haematocrit, platelet aggregability and hypercoagulability in the morning[16,17]. These factors promote ischemic events and prevent haemorrhagic events.

Several studies had reported that ICB have double peaks with respect to time of onset[8,18-19]. In this study, maximum number of patients developed hemorrhagic stroke between 4:01 am to 8:00 am (25.9%). The number gradually declined till 9 pm to 10 pm where it shows another small peak between 04:01 pm to 08:00 pm. A study among the Japanes population by Omama et al[8] among 12957 cases, peak was observed in the morning in patients less than 65 years of age. Whereas in late afternoon another peak was seen in all age groups. Arterial blood pressure has been noted to be the trigger for hemorrhagic and ischemic stroke[8]. Physical activity, low external temperature and other triggerers of sympathetic tone raises the arterial blood pressure which has been strongly correlated with hemorrhagic stroke[20,21,22]. In this study 248 (74.3%) cases of hemorrhagic stroke occurred during the day time when blood pressure is high following its circadian variation. Increase incidence of haemorragic stroke during early morning hours in waken state could be explained by rise of blood pressure due to increase sympathetic tone which is parallel to pulse rate and physical activity. On the other hand lower blood pressure in night could explain the lower incidence of haemorragic stroke at night[15].

Conclusion:

This study confirms the diurnal variation both in hemorrhagic and ischemic stroke in Bangladesh. But the exact precipitating cause yet to be determined in the context of our country due different cultural, religious and food habit. Further study to identify this or theses causes and by taking appropriate measure may reduce the incidence of stroke in our community where coast of health care is a burden among the people of our country. This study is only concerned with hospitalized patient, not including those who never reached the hospital.

References :

1. Allen CMC, Lueck CJ, Dennis M. Cerebrovascular Disease. In: Colledge NR, Walker BR, Ralston SH, editors. Davidson's Principle & Practice of Medicine. 21st edition. London: Churchhill Livingstone; 2010. p.1180-1191.

2. Aho K, Harmsen P, Hatano S. Cerebrovascular disease in the community. Results of WHO collaborative study. Bull WHO 1980; 5:113-30.

3. Manfredini R, Gallerani M, Portaluppi F, et al. Chronobiological patterns of onset of acute cerebrovascular diseases. Thromb Res 1997; 88:451-63.

4. Casetta I, Granieri E, Fallica E, la Cecilia O, Paolino E, Manfredini R. Patient demographic and clinical features and circadian variation in onset of ischemic stroke. Arch Neurol. 2002; 59:48-53.

5. Marshall J. Diurnal variation in occurrence of strokes. Stroke 1977; 8:230-1.

6. Agnoli A. Manfredi M, Mossuto l, Piccinelli A. Relationship between Nurohormonal rhythms of arterial pressure and pathogenesis of cerebral vascular insufficiency. Rev Neurol. 1975; 131:597-606.

7. Elliot WJ. Circadian variation in the timing of stroke onset: a meta-analysis. Stroke 1998; 29:992-6

8. Omama S, Yoshida Y, Ogawa A, Onoda T, Okayama A. Differences in circadian variation of cerebral infarction, intracerebral hemorrhage and subarachnoid hemorrhage by situation at onset. J Neurol Neurosurg Psychiatry 2006; 77:1345-9.

9. Argentino C, Toni D, Rasura M, Violi F, Sacchetti ML, Allegretta A, et al. Cicadian variation in the frequency of ischemic stroke. Stroke 1990; 21:387-9.

10. Butt M. Zakaria M, Hussain H. Circadian pattern of onset of ischaemic and haemorrhagic strokes, and their relation to sleep and wake cycle. J Pak Med Assoc. 2009; 59:129-132.

11. Spengos K, Vemmos K, Tsivgoulis G, Manios E, Zakopoulos N, Mavrikakis M, et al. Diurnal and seasonal variation of stroke incidence in patients with cardioembolic stroke due to atrial fibrillation. Neuroepidemiology 2003; 22:204-10.

12. Manfredini R, Boari B, Smolensky MH, Salmi R, la Cecilia O, Maria Malagoni A, et al. Circadian variation in stroke onset: identical temporal pattern in ischemic and hemorrhagic events. Chronobiol Int. 2005; 22:417-53.

13. Gupta A, Shetty H. Circadian variation in stroke - a prospective hospital-basedstudy. Int J Clin Pract 2005; 59:1272-5.

14. Khawar S, Rafiq S. Circadian Fluctuation in timing of onset of acute Ischemic Stroke. Biomedica 1996; 12:37-8.

15. Stergiou GS, Vemmos KN, Pliarchopoulou KM, et al. Parallel morning and evening surge in stroke onset, blood pressure, and physical activity. Stroke 2002; 33:1480-6.

16. Andrews NP, Gralnick HR, Merryman P, et al. Mechanisms underlying the morning increase in platelet aggregation: a flow cytometry study. J Am Coll Cardiol. 1996; 28:1789-95.

17. Jafri SM, VanRollins M, Ozawa T, et al. Circadian variation in platelet function in healthy volunteers. Am J Cardiol. 1992; 69:951-4.

18. Stergiou GS, Vemmos KN, Pliarchopoulou KM, Synetos AG, Roussias LG, Mountokalakis TD. Parallel morning and evening surge in stroke onset, blood pressure, and physical activity. Stroke 2002; 33:1480-6.

19. Inagawa T. Diurnal and seasonal variations in the onset of primary intracerebral hemorrhage in individuals living in Izumo City, Japan. J Neurosurg. 2003; 98:326-36.15.

20. Kamei I, Obayashi S, Nakagawa M, Nishibayashi H, Kuwata T, Hyotani G, et al. [When do strokes occur?-analysis of diurnal variation and activity during theonset]. No Shinkei Geka 1998; 26:991-8.

21. Ohwaki K, Yano E, Murakami H, Nagashima H, Nakagami T. Materiological factors and the onset of hypertensive intracerebral hemorrhage. Int J Biometrol. 2004; 49:86-90.

22. Jerrard-Dunne P, Mahmud A, Feely J. Circadian blood pressure variation: relationship between dipper status and measures of arterial stiffness. J Hypertens. 2007; 25:1233-9.