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Study the Prevalence of Sleep Disordered Breathing in Patients With Acute Stroke in Western Rajasthan

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ABSTRACT

Objectives: Aim of our study is to determine the prevalence of sleep disordered breathing in patients with acute stroke in Western Rajasthan and its correlation to age, sex, BMI, Neck Circumference and stroke subtype.
Method: A cross sectional hospital based study done on 35 to 90 years of both sexes admitted to the department of medicine were analyzed within 2 weeks after onset of stroke.60 patients were included. Detailed history, clinical examination, biochemical indices were recorded. Overnight monitoring of electroencephalography, eye movements, muscle tone, respiratory efforts, airflow and O2 saturation (Polysomnography)was also done.
Results: Prevalence of SDB in acute stroke patients was 73.3% which was significantly higher. Study included 32(53.3%) male subjects and 28(46.6%) female subjects. SDB was more prevalent in male population (81.2%) though association was not significant. Prevalence of SDB is higher (76.9%) in older age group (≥65 years). Prevalence of SDB as well as severity of SDB was more in higher BMI group and this difference was statistically significant (p-value <0.05). Increased NC was associated with increased prevalence of SDB and also increased severity of SDB. Severity of SDB was also higher in lacunar infarct as compared to anterior circulation and posterior circulation infarct and this difference is statistically significant (p-value <0.05).

KEYWORDS sleep disordered breathing, acute stroke, lacunar infarct, apnoea hypopnea index

INRODUCTION

World Health Organization defines the clinical syndrome of "stroke" as 'rapidly developing clinical signs of focal (or global) disturbance of cerebral function with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than vascular origin.[1] Cerebrovascular accidents (CVA) are leading cause of death worldwide, after coronary artery disease and cancer. The identification and management of modifiable risk factors are crucial for the development of primary and secondary preventive strategies [2].

Sleep disordered breathing (SDB) is well known disorder characterized by recurrent episodes of nocturnal hypoxemia and resultant sympathetic activation and cardiovascular distress. SDB has also been independently associated to specific cardiovascular risk factors such as Hypertension, myocardial ischemia, fatal or nonfatal cardiovascular events, and arrhythmias such as atrial fibrillation, diabetes and stroke. Therefore, the early diagnosis and optimal treatment of SDB is critical among patients with stroke during the acute and chronic phase of neurorehabilitation.

The mechanism linking SDB with stroke is complex and include hemodynamic, neural, metabolic, endothelial, coagulatory and inflammatory changes secondary to respiratory events and recurrent hypoxemia [3]. Several changes occurring with respiratory events including hypoxemia, reduction of cerebral blood flow, decreased cardiac output, cardiac arrhythmias, blood pressure swings, increased sympathetic activity, baroreceptor dysfunction, endothelial dysfunction, inflammatory changes, decreased fibrinolytic activity, and increased platelet aggregability may be responsible for onset or rapid progression of stroke during sleep in patients with SDB [3,4].

In a recent published meta-analysis by Johnson KG and Johnson DC, of 2343 patients of ischaemic or haemorrhagic stroke and TIA, the frequency of SDB with AHI >5 was 72% and with AHI >20 was 38%[6]. A cross sectional study of >6000 subjects in general population reported a modest but significant association of SDB with stroke [7]. The present study would look into the prevalence of SDB in acute stroke patients and further study the correlation of severity of SDB with various risk factors and stroke subtypes.

AIMS AND OBJECTIVES

To determine the prevalence of sleep disordered breathing in patients with acute stroke in Western Rajasthan.

Its correlation to various clinical parameters like age, sex, BMI, Neck Circumference and stroke subtype.

For early detection and introduction of management to halt progression and prevent complications.

MATERIAL AND METHODS

The present study was conducted in Department of Medicine at MDM Hospital attached to Dr. S.N. medical college, Jodhpur. Participants after understanding the study protocol and procedure was asked to give their written consents for the study.

Study Area: Present study was carried out in group of patients belonging to western Rajasthan.

Study design: A cross sectional hospital based study.

Study population: INCLUSION CRITERIA
Randomly selected subjects of age 35 to 90 years of both sexes admitted to the department of medicine, MDM Hospital, Jodhpur with acute stroke. Patients with acute stroke were analyzed within 2 weeks after onset of stroke.

EXCLUSION CRITERIA:
1. A decreased level of consciousness on admission.
2. A baseline oxygen saturation value of <90%.
3. Any acute or chronic cardiopulmonary diseases that disturb pulmonary function.
4. A neuromuscular-junction disorder (e.g., myasthenia gravis).
5. A neurodegenerative disorder, such as Parkinson's disease, spinocerebellar degeneration, Alzheimer's disease, or motor neuron disease.

Patients who refused to give informed consent to perform the necessary polysomnography study.

Laboratory Investigations
Haemogram, CRP, Blood sugar, renal function test, Liver function test, Lipid profile, and Arterial blood gases analysis, ECG, Chest x-ray, Polysomnography study, CT Head/MRI Brain.

NUMBER OF CASES TO BE STUDIED: Sixty Cases

METHODOLOGY:
Comprehensive clinical evolution, anthropometric measures, relevant laboratory investigation and nocturnal Polysomnography, CT Head/MRI Brain performed at MDM Hospital Jodhpur. Polysomnography is a noninvasive technique that involves overnight monitoring of electroencephalography, eye movements, muscle tone, respiratory efforts, airflow and O_2 saturation. SDB is diagnosed when apnoea hypopnea index (AHI) is greater than five. Three different degrees of severity was outlined: Mild SDB: AHI value 5-15; Moderate SDB: AHI value 16-30; Severe SDB: AHI value >30.

DATA EVALUATION:
In Cross-sectional study, the data was analyzed by Epi Info statistical and multivariate analysis method used.

OBSERVATION AND RESULTS
Sleep disordered breathing is an umbrella term that covers many conditions all of which involve impaired airflow, resulting in reduced oxygen saturation levels, during sleep [9]. All of these disorders are manifest exclusively during or are significantly worsened during the sleep state; hence the necessity of sleep testing procedures [10].

Severity criteria: Severity of OSA syndrome has two components; severity of daytime sleepiness and based overnight monitoring. [11]

Severity according to daytime Sleepiness
1. Mild: Unwanted sleepiness or involuntary sleep episodes occur during activities that require little attention.
2. Moderate: Unwanted sleepiness or involuntary sleep episodes occur, during an activity that requires some attention.
3. Severe: Unwanted sleepiness or involuntary sleep episodes occur during activities that require more attention.

In clinical history Epworth score and Berlin questionnaires are used to assess severity of daytime sleepiness.

Overnight polysomnography is the reference diagnostic procedure. Based on overnight polysomnography the severity of SDB is graded as [11]

Mild: AHI (Apnoea – hypopnea index) >5 but ≤ 15

Moderate: AHI > 15 but ≤ 30

Severe: AHI > 30

Standard Nocturnal Polysomnography (NPSG)
Standard polysomnography (also known as a Type I sleep test) is performed in a sleep center or laboratory, hospital, or other dedicated unit and is attended by a sleep technologist. The study simultaneously records multiple physiological parameters to identify sleep architecture, number and degree of arousals, number and type of abnormal breathing events, episodes of oxygen desaturation and severity, cardiac arrhythmias, number, type and periodicity of limb movements, disorders associated with REM sleep, and seizure activity.

In present study total 8 subjects were observed with SDB in 35-49 years age group. Out of which 4 (50%) were observed with mild SDB and 4(50%) were observed with moderate SDB. In 50-64 years age group total 16 subjects were observed with SDB. Out of which 6(37.5%) were observed with mild SDB, 6(37.5%) were observed with moderate SDB and 4(25%) were observed with severe SDB. In ≥65 years age group total 20 subjects were observed with SDB. Out of which 3(15%) were observed with mild SDB, 6(30%) were observed with moderate SDB and 11(55%) were observed with severe SDB. (P value <0.05) (Table 1) .

In present study total 26 male subjects were observed with SDB out of which 12(46.1%) had mild SDB, 8(30.7%) had moderate SDB and 6(23%) had severe SDB. Total 18 female subjects were observed with SDB out of which 1(5.5%) had mild SDB, 8(44.4%) had moderate SDB and 9(50%) had severe SDB. (P value <0.05) (Figure 1) .

In present study total 6 subjects were smoker out of which 5 subjects were observed with SDB, 54 subjects were nonsmoker, out of which 39 were observed with SDB. Total 20 subjects were alcoholic out of which 17 subjects were observed with SDB, 40 subjects were nonalcoholic, out of which 27 were observed with SDB. According to above data, prevalence of SDB in smokers was 83% while in nonsmokers was 72.2%. Prevalence of SDB in alcoholic subjects was 85% while 67.5% in nonalcoholic. (P value >0.05) (Table 2).

Table 3 shows prevalence of SDB in different BMI groups in this study total 29 subjects were in 20-24.99 kg/mt2 BMI group, out of which 17 were observed with SDB, total 16 subjects were in 25-29.99 kg/mt2 BMI group, out of which 14 were observed with SDB and total 15 subjects were in ≥30 kg/mt2 BMI group, out of which 13 observed with SDB. According to above data prevalence of SDB was 58.6% in 20-24.99 kg/mt2 BMI group, 87.5% in 25-29.99 kg/mt2 BMI group and 86.6% in ≥30 kg/mt2 BMI group. In this study the mean BMI in total subjects was 26.93±4.3 and 27.74±4.4 in subjects with SDB & 24.72±3.13 in subjects without SDB. (P value <0.05)

Table 4 shows prevalence of SDB in study subjects based on their neck circumference. In present study, total 28 subjects had NC in between 30-35 cm, out of which 18 subjects were observed with SDB. Total 16 subjects had NC in between 36-40 cm, out of which 12 were observed with SDB and total 16 subjects had NC >40cm, out of which 14 were observed with SDB. According to above data prevalence of SDB in subjects with NC 30-35cm was 64.2%, with NC 36-40cm was 75% and with NC >40cm was 87.5%. In this study the mean NC in total subjects was 36.46±4.42 and 37.22±4.33 in subjects with SDB & 34.37±4.11 in subjects without SDB (P value <0.05).

Table 5 illustrates prevalence of IHD in different SDB severity groups. In this study total 44 subjects were observed with SDB out of which 10(22.7%) subjects presented with IHD. According to above data, 13 subjects were observed with mild SDB, out of which 0(0%) subjects presented with IHD 16 subjects

were observed with moderate SDB, out of which 6(37.5%) subjects presented with IHD and 15 subjects were observed with severe SDB, out of which 4 (26.6%) subjects presented with IHD. (P value >0.05)

Graph 2 shows prevalence of SDB based on acute stroke subtype. In present study total 16 subjects with acute on set stroke were analyzed, out of which 44 subjects were observed with SDB. Total 44 subjects had acute infarct, out of which 33 subjects were observed with SDB and total 16 subjects had acute ICH, out of which 11 subjects were observed with SDB. According to above data prevalence of SDB in acute onset stroke was 73.3%. Among them prevalence of SDB in acute infarct was 75% and in acute ICH was 68.7%. (P value >0.05)

Graph 3 shows distribution of SDB severity based on acute infarct subtype. In present study total 16 subjects had anterior circulation infarct, out of which 3(18.7%) subjects were observed with mild SDB, 8(50%) subjects were observed with moderate SDB and 5(31.2%) subjects were observed with severe SDB. Total 6 subjects had posterior circulation infarct, out of which 4(66.6%) subjects were observed with mild SDB, 2(33.3%) subjects were observed with moderate SDB. Total 11 subjects had lacunar infarct, out of which 1(9%) subjects were observed with mild SDB, 2(18.1%) subjects were observed with moderate SDB and 8(72.7%) subjects were observed with severe SDB. (P value <0.05).

TABLE 1: Distribution of SDB severity in different age group

SDB Severity	Age (in yrs)		
	35-49 (n=8)	50-64 (n=16)	≥65 (n=20)
AHI 5-15 (Mild n=13)	4 (50)*	6 (37.5)	3 (15)
AHI 16-30 (Moderate n=16)	4 (50)	6 (37.5)	6(30)
AHI >30 (Severe n=15)	0(0)	4 (25)	11 (55)

(*Percentage in parenthesis)

TABLE 2: Prevalence of SDB in study subjects according to their Addiction

Addiction	Total	SDB Subjects	Prevalence %
Smoker	6	5	83.3
Non Smoker	54	39	72.2
Alcoholic	20	17	85
Non Alcoholic	40	27	67.5

TABLE 3: Prevalence of SDB in different BMI groups

BMI (kg/mt^2)	Total (n=60)	SDB Subjects (n=44)	Prevalence %
20-24.99	29	17	58.62
25-29.99	16	14	87.50
≥30	15	13	86.67

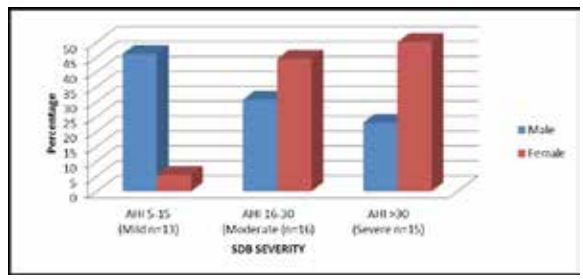
TABLE 4: Prevalence of SDB in study subjects based on Neck Circumference

Neck Circumference (in cm)	Total (n=60)	SDB Subjects (n=44)	Prevalence %
30-35	28	18	64.2
36-40	16	12	75
>40	16	14	87.5

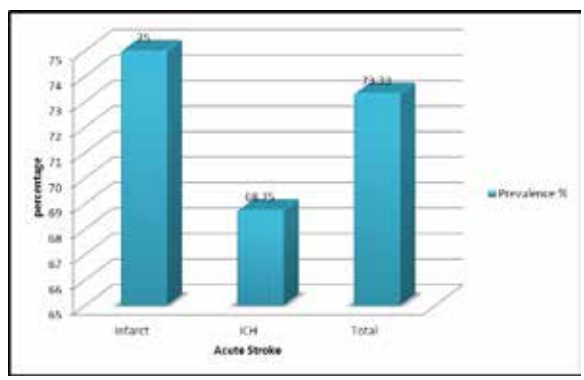
TABLE 5: Prevalence of IHD in different SDB severity groups

SDB SEVERITY	SDB Subjects (n=44)	With IHD (n=10)	Prevalence %
AHI 5-15 (Mild)	13	0	0.00
AHI 16-30 (Moderate)	16	6	37.5
AHI >30 (Severe)	15	4	26.6

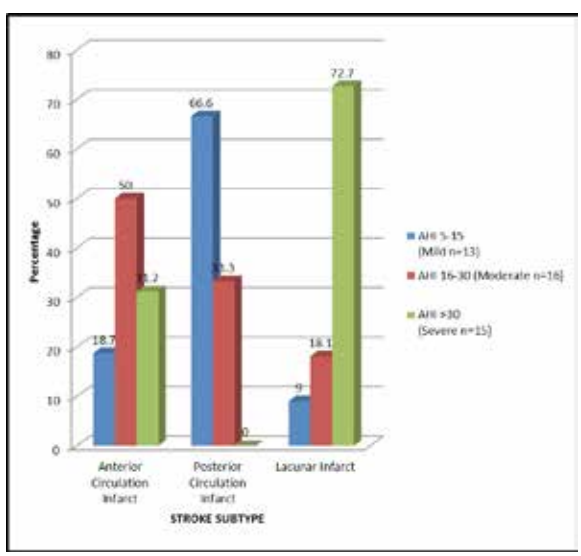
Graph 1: Sex wise distribution of SDB severity based on AHI



Graph 2: Prevalence of SDB based on Acute Stroke subtype



Graph 3: Distribution of SDB severity based on acute infarct subtype



Discussion

The present study was a hospital based observational cross sectional study in Western Rajasthan assessing the prevalence of SDB in acute stroke patients. We used standard full night time polysomnography as a diagnostic tool. Polysomnography was done within 2 week of onset of stroke after confirming CT or MRI finding suggestive of acute stroke (Infarct or ICH).

The number of subjects studied were 60, out of these 32 (53.3%) were male and 28 (46.6%) were female. The mean age of study population was 63.58±13.5 years, for male was 59.28±13.25 years and for female was 68.5±11.38 years The mean BMI (Body Mass Index) of study subjects was 26.93±4.3 kg/m^2 and mean neck circumference was 36.46±4.42cm.

In present study overall prevalence of SDB in acute stroke patients was 73.3%. In males it was 81.2% and in females it was 64.2%. The result demonstrates that prevalence of SDB was more in males as compared to female subjects.

In male subjects 46.1% had mild SDB, 30.7% subjects had moderate SDB and 23% had severe SDB while in female subjects, 5.5% had mild SDB 44.4% had moderate SDB and 50% had severe SDB. Severity of SDB was more in female subjects as compare to male subjects. This difference may be due to higher mean age (68.5±11.38) in female subjects as compare to male subjects (59.28±13.25) in our study.

In this study, prevalence of SDB in older age group (≥65 years) was 76.9% followed by 72.7% in 50-64 years age group and 66.6% in 35-49 years age group. Among them in older age group (≥65 years), 55% had severe SDB while in 50-64 years age group, 25% subjects had severe SDB and none of subject had severe SDB in 35-49 years age group. The results show that prevalence of SDB as well as severity of SDB was higher in older age group. More severe SDB in ≥65 years age group as compare to younger subjects was statistically significant (p-value <0.05).

J Harbison et al (2002 [5] observed in their study that SDB was more common in older patients with acute stroke (≥65 years) v/s younger patients and mean AHI was higher in subjects aged ≥65 years.

Seong Hawn Ahn et al (2013 [12] demonstrated similar findings. They found that overall prevalence of SDB in acute ischemic stroke was 63.1% and patients with SDB were older and tended to be male as compare to patients without SDB.

A. Wierzbicka et al (2006 [13] observed that overall sleep apneas were present in 62.8% patients with stroke and there is significant difference between the mean age of patients with increased AHI and those with normal AHI.

In our study prevalence of SDB was higher in alcoholics (85%) and in smokers (83.3%) as compare to non alcoholics (67.5%) and non smokers (72.2%). *Seong Hawn Ahn et al (2013* [149] observed that history of alcohol consumption and smoking was significantly higher in patients with SDB as compare to patients without SDB. Association of smoking and SDB in acute stroke patients was also supported by *Claudio L. Bassetti et al (2006).*[151]

Claudio L. Basseti et al (2006)[157] concluded that "significant differences between patients with AHI <10 and AHI ≥30 were found in Age, male gender, BMI, Diabetes, Hypertension, Coronary Artery Disease, Hypercholesterolemia, Smoking and Macroangiopathic etiology of stroke. *Seong Hawn Ahn et al (2013* [12] observed in their study that there was no difference in BMI, Hypertension, Diabetes or Hyperlipidemia in patients with SDB and without SDB.

In present study mean BMI of subjects with SDB was 27.74±4.4 kg/m^2 while mean BMI of subjects without SDB was 24.72±3.13 kg/m^2. Prevalence of SDB in BMI group <25 kg/m^2 was 58.6% while in higher BMI group >25 kg/m^2 prevalence of SDB was 87.1%. In BMI group <25 kg/m^2, 17.6% had severe SDB while in BMI group >25 kg/m^2, 44.4% had severe SDB. Above results show that SDB seems to be associated with higher BMI in acute stroke patients. Prevalence of SDB as well as severity of SDB was more in higher BMI group and this difference was statistically significant (p-value <0.05). *Claudio Bassetti and Michael S. Aldrich (1999)* [14] revealed similar observations in their study.

In this study mean NC in SDB subjects was 37.22±4.33 cm while in subjects without SDB was 34.37±4.11 cm and this difference was statistically significant (p-value <0.05). Prevalence of SDB in subjects with NC in between 30-35 cm was 64.2%, 75% in subjects with NC in between 36-40 cm and 87.50% in subjects with NC >40cm. Subjects with NC >40cm had more severe SDB (42.8% had AHI >30). In our study it was observed that increased NC was associated with increased prevalence of SDB and also increased severity of SDB. These findings were supported by study done by *J Harbison et al (2002).* [15]

In present study prevalence of SDB in patients with acute stroke was 73.3%, among them 29.5% had mild SDB, 36.6% had moderate SDB and 34% had severe SDB. We divided acute stroke into two sub groups acute infarct and acute ICH. Prevalence of SDB in acute infarct was 75%, among them 24.4% had mild SDB, 36.6% had moderate SDB and 39.6% had severe SDB. Prevalence of SDB in patients with acute ICH was 68.7%, among them 45.4% had mild SDB, 36.6% had moderate SDB and 18.1% had severe SDB.

Parra O et al (2000) [8] reported that prevalence of SDB was 71% in patients with acute stroke. *MA Martinez Garcia et al (2004)*[15] & *M.L. Sacchetti et al (2012)*[23] had similar observations. In recent published meta analysis by *Johnson KG & Johnson DC (2010)*[6], of 2343 patients of ischemic or hemorrhagic stroke and TIA, the frequency of SDB with AHI >5 was 72% and with AHI >20 was 38%.

Acute infarct subjects were further divided into three subtypes a) anterior circulation infarct, b) posterior circulation infarct and c) lacunar infarct. In this study prevalence of SDB in anterior circulation infarct was 76.1% among them 18.7% had mild SDB, 50% had moderate SDB and 31.25% subjects had severe SDB. In posterior circulation infarct prevalence of SDB was 60% among them 66.6% had mild SDB, 33.3% had moderate SDB and none of the subject has severe SDB. In lacunar infarct prevalence of SDB was 84.6% among them 9% had mild SDB, 18.1% had moderate SDB and 72.7% subjects had severe SDB. According to above data prevalence of SDB was higher in lacunar infarct. Severity of SDB was also higher in lacunar infarct as compared to anterior circulation and posterior circulation infarct and this difference is statistically significant (p-value <0.05).

J Harbison et al (2002)[5] observed that patients with lacunar stroke had worse SDB than those with anterior circulation cortical strokes.

Early detection of SDB in acute stroke patients is relevant not only because of high prevalence of SDB in stroke population but also because of poorer outcomes after stroke, including prolonged hospitalization, increased functional disabilities and higher mortality in comparison to those patients without SDB. [8,9] CPAP is currently the first line treatment option for SDB as it is non invasive, safe for the patients and usually well tolerated. It should be stressed that making diagnosis of SDB in stroke patient is worthwhile even if adherence to CPAP would be poor or surgical intervention is unfeasible. Diagnosis of SDB also may be important for pharmacologic treatment, for some medicines commonly used in stroke patients such as Benzodiazepine hypnotics or analgesics with muscle relaxing properties are strongly contraindicated in SDB.

This study shows that SDB has a high prevalence in subjects with acute stroke and identify several factors that may be associated with its presence in stroke population. Once diagnosed patient should be encouraged to introduced management in order to halt progression and prevent complications.

Summary and conclusion

The study included 60 patients with acute stroke (Infarct or ICH) who fulfilled the inclusion criteria. Overall prevalence of SDB in acute stroke patients was 73.3% which was significantly higher. Study more prevalent in male population (81.2%) though association was not significant. included 32(53.3%) male subjects and 28(46.6%) female subjects. SDB was Mean age of study population was 63.58±13.5 years and patients with SDB was 64.18±13.46 years. Prevalence of SDB is higher (76.9%) in older age group (≥65 years). Severe SDB was significantly higher in older age group (p value <0.05). Mean BMI of total study population was 26.93±4.3 kg/m2.

Mean BMI of subjects with SDB was 27.74±4.4 kg/m^2 while mean BMI of subjects without SDB was 24.72±3.13 kg/m^2. Prevalence of SDB was more in higher BMI group and this difference was statistically significant (p-value <0.05).

Mean NC of study population was 36.46±4.42 cm. Mean NC in SDB subjects was 37.22±4.33 cm while in subjects without SDB was 34.37±4.11 cm and this difference was statistically significant (p-value <0.05). Increased NC was associated with increased prevalence of SDB. In our study prevalence of SDB is higher in alcoholics (85%) and in smokers (83.3%) as compare to non alcoholics (67.5%) and non smokers (72.2%). However, this association was not statistically significant.

In present study prevalence of SDB in patients with acute stroke was 73.3% among them 29.5% had mild SDB 36.6% had moderated SDB and 34% had severe SDB. Prevalence of SDB in acute infarct is 75% while prevalence of SDB in patients with acute ICH is 68.7%. There was no significant difference found in prevalence of SDB as well as severity of SDB in between patients with acute infarct and acute ICH. In this study prevalence of SDB in anterior circulation infarct was 76.1%. In posterior circulation infarct prevalence of SDB was 60% and in lacunar infarct prevalence of SDB was 84.6%. Prevalence of SDB was higher in lacunar infarct. Severity of SDB was also higher in lacunar infarct as compared to anterior circulation and posterior circulation infarct and this difference is statistically significant (p-value <0.05).

To determine whether SDB represent as an independent risk factor for stroke, a large number of cases as well as controls matched not only for age, gender and BMI but also for other cardiovascular risk factors would be needed. We submit that overnight screening for SDB should be routinely performed in every patient after stroke and it should become diagnostic tool.

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