

Original Research Article

A Study on Clinical Profile and Etiological Factors of Cerebrovascular Disease in Young Patients**Dasari Kamalakara¹, Terala Krishna Prasad^{2*}**¹*Assistant Professor, Department of General Medicine, RIMS, Adilabad, Telangana, India*²*Professor & HOD, Department of General Medicine, RIMS, Adilabad, Telangana, India***Received: 13-08-2021 / Revised: 05-09-2021 / Accepted: 01-11-2021****Abstract**

Aim & Objectives: To study clinical profile and etiological factors of cerebrovascular disease in young patients. **Methodology:** Stroke is a common disease manifestation in our clinical practice. In hospital cerebrovascular disease manifesting in young is not uncommon, hence we studied various etiological factors contributing stroke under the age of 45 years. 100 patients between 15 - 45 years of age were admitted in tertiary care teaching Hospital. A total of 100 consecutive patients diagnosed with stroke satisfying the inclusion criteria. **Results:** The sex ratio in our study was 1.3:1. The majority of stroke occurred between the ages of 36-40 years at 24%. In males highest incidence was seen in the same age group, whereas in females it was in the ages between 21-25 years at 28.6%. 14% of the study population presented with seizure. Decreased consciousness was seen in 60% of the group. 34% of the patients had speech abnormalities. The most common cranial nerve affected was the facial nerve at 56%. Motor deficit was seen in all the patients. Hemisensory loss was seen in 14% of the study group. Only 2% of the patient had cerebellar deficit. 36% of all the patients were smokers, among these 35.9% were ischemic and 36.4% were hemorrhagic stroke. Alcohol consumption was seen in 30% of patients. Among these 28.2% were ischemic and 36.4% were hemorrhagic stroke. 12% of the study group was overweight. Among ischemic strokes were 15.4% whereas none of the cases of hemorrhagic stroke were overweight. Diabetes mellitus was seen in 24% of the patients. 28.2% of diabetics had ischemic stroke and 9.1% had hemorrhagic stroke. Hypertension and CAD were seen in 32% and 18% of the total number of patients respectively. Among ischemic strokes 15.4% were hypertensive, 20.5% had CAD, whereas hypertension and CAD were seen 90.9% and 9.1% of hemorrhagic strokes respectively. Transient ischemic stroke and family history of stroke were both seen in 2% of the patients. 2.6% of ischemic strokes had this history. None of hemorrhagic stroke had this previous history. 4% of the patients were taking OC pills. Among these 2.6% and 9.1% were ischemic and hemorrhagic strokes respectively. Elevated homocystein levels were seen in 12% of patients. 15.4% had ischemic strokes and none of the hemorrhagic strokes had hyperhomocysteinemia. LDL and HDL were abnormal in 60% and 72% of the patients respectively. Ischemic stroke had abnormal LDL and HDL 61.5% and 74.4% of the patients respectively. Among hemorrhagic stroke LDL and HDL was seen to be abnormal in 54.5% and 63.6% of patients respectively. Atherosclerosis was seen in 32% of patients. Cortical Venous thrombosis was seen in 18% of patients, all of them were women. Tubercular Meningitis, RHD, SLE were seen 12%, 10%, 4% of patients respectively. Out of 100 cases of stroke in young, 78% of the strokes were ischemic whereas 22% of them had hemorrhage. **Conclusion:** Hypertension and Diabetes mellitus were non-modifiable risk factors commonly seen, especially hypertension in cases of intra-cerebral hemorrhage. Rare risk factor like homocystein should be considered during evaluation. Lipid abnormalities such as elevated LDL and decreased HDL were also common. Atherosclerosis was the most common etiology for stroke in young. Cortical Venous Thrombosis should be kept in mind in females.

Keywords: Hypertension, Stroke, Homocystein, HDL, Venous Thrombosis, Cerebral Haemorrhage

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Cerebrovascular disease is the third leading cause of morbidity and mortality throughout the globe after heart disease and cancer. Classically stroke is a disease of elderly population but it is not uncommon in the younger age too. Young strokes pose a major socio-economic challenge in occupational, neuro-rehabilitational programme of stroke survivors and also have varying etiology and prognosis in comparison with stroke in the elderly. Stroke is defined by the World Health Organization as a condition characterized by rapidly developing symptoms and signs of focal brain lesion, with symptoms lasting for more than 24 hours or leading to death, with no apparent cause other than that of vascular origin [1].

The age group included in studies on stroke varies widely in the reports. The lower limit of the age varies from 0 to 25 years in various reports with majority keeping it at 15 years. The upper age limit also varies from 40 to 55 years, majority being around 45 years. The wide variation compromises comparisons across the studies and confounds communication among experts. The rationale for the choice of age group is not given in the reports [2].

Community based surveys from West and Japan indicate average annual incidence of strokes are 111 to 180 per 100,000 population and 9 to 28 per 100,000 young persons. In India, the prevalence of stroke in younger individuals is 18-32% of all stroke cases. (Dalal et al 2008) [3]. Similarly, data from major Indian hospitals show 24 to 35% of stroke in young of all neurological admissions [4].

The approximate annual age specific incidence of stroke in young is more among 35-44 years, range from 27-34/100,000. (Dalal et al 2008) [3]. The etiology may vary with different age groups, but most of the risk factors are common to all age groups. Still, certain factors are confined to the young. Several studies have analyzed the risk factors of stroke in young. But considering its impact on younger generation, it needs more studies for identification and modification of risk factors.

*Correspondence

Dr. Terala Krishna Prasad

Professor & HOD, Department of General Medicine, RIMS,
Adilabad, Telangana, India

E-mail: daasarikamal@gmail.com

Aims and objectives

- To study clinical profile of cerebrovascular disease in young patients.
- To study etiological factors contributing young stroke.

Materials and methods

Stroke is a common disease manifestation in our clinical practice. In hospital cerebro vascular disease manifesting in young is not uncommon, hence we studied various etiological factors contributing stroke under the age of 45. 100 patients between 15 - 45 years of age were admitted in tertiary care teaching Hospital were studied in detail.

Criteria for selection of cases

All the patients with stroke between the age of 15- 45years admitted to Tertiary care Teaching Hospital. Sudden onset of focal / global neurological deficit lasting more than 24hours (or leading to death) and of presumed vascular origin were taken into the study

Traumatic causes of CVD, patients with space occupying lesions were excluded.

Data Collection

A proforma was prepared and after admission a detailed history regarding the temporal profile of stroke and risk factors like Hypertension, Diabetes mellitus, Smoking, Alcohol, RHD and Previous Strokes were taken. Detailed neurological examination including cardiovascular examination carried out in all patients 2D Echocardiography were carried out where ever necessary. Biochemical parameters like lipid profile, blood sugar, blood urea, serum electrolytes and haemogram were done in all patients. In majority of cases CT scan of brain and skull was performed, follow up all the cases were carried out up to the time of discharge.

Statistical-Analysis

Analysis was performed using spss software version19. Measures obtained included percentages, medians, correlation coefficients and chi square tests. Boxe plots, tables, bar diagrams and pie diagrams were used for data representation.

Exclusion criteria**Results and Observations**

Age in years	Males	Females	Total
15 – 20	2 (3.4%)	8(19.0%)	10 (10.0%)
21 – 25	10 (17.2%)	12 (28.6%)	22 (22.0%)
26 – 30	12 (20.7%)	6 (14.3%)	18 (18.0)%
31 – 35	6 (10.30%)	4 (9.5%)	10 (10.0%)
36 – 40	20 (34.50%)	4 (9.5%)	24 (24.0%)
41 – 45	8 (13.8 %)	8 (19.0%)	16 (16.0%)
Total	58 (58.0%)	42 (42.0%)	100(100%)

A total of 100 patients, 58 (58.0%) males and 42(42.0%) females diagnosed to have stroke in young included in the study. The majority of strokes occurred between the ages of 36-40 at 24.0% .In males highest incidence of stroke was seen in same age group(34.5%), where as in females it was in the ages between 21-25 at (28.6%).

Table -2 - Clinical Features Stroke in Young**2a. Seizures**

Seizures	No. (n = 100) %
Present	14 (14.0%)
Absent	86 (86.0%)

2b. Consciousness level

Consciousness level	No. (n = 100) %
Conscious	60 (60%)
Impaired Conscious	40 (40%)

2c. Speech

Speech	No. (n = 100) %
Normal	36 (36%)
Dysphasia	34 (34%)
Could not be examined	30 (30%)

2d. Cranial nerve deficit

Cranial nerve deficit	No. (n = 100) %
Normal	36 (36%)
Oculomotor	6 (6%)
Facial	56 (56%)
Multiple	2 (2%)

2e. Motor Deficit

Motor deficit	No. (n = 100) %
Hemiparesis	86 (86%)
Hemiplegia	12 (12%)
Monoparesis	2 (2%)

2f. Sensory deficit

Sensory deficit	No. (n = 100) %
Normal	86 (86%)
Hemi sensory loss	14 (14%)

2g. Cerebellar deficit

Cerebellar deficit	No. (n = 100) %
Present	2 (2%)
Absent	98 (98%)

Table – 3 Type of Stroke

Type of stroke	Number(n=100)	%
Ischemic	78	78.0%
Intra cerebral Hemorrhage	22	22.0%

Among total number of 100patients,78.0% of patients had ischemic stroke, Where asonly 22.0% of study group had intra cerebral hemorrhage.

Table 4 - Aetiology

Aetiology	Number(n=100)	%
Atherosclerosis	33	33%
Hypertension	21	21%
CVT	18	18%
TBM	12	12%
RHD	12	12%
SLE	4	4%

Aetiologies were varied,Atherosclerosis was seen in33% of the patients. Cortical VenousThrombosis seen in 18% of the patients, all of them were women. Tubercular meningitis, Rheumatic heart disease and Systemic Lupus Erythematosus were seen in 12%,12%and 4% respectively.

Table – 5 Risk Factors Associated with Stoke

Risk factors	Number (n=100)	%
Smoking		
Present	36	36.0%
Absent	64	64.0%
Alcohol		
Present	30	30.0%
Absent	70	70.0%
Hypertension		
Present	68	68.0%
Absent	32	32.0%
CAD		
Present	18	18.0%
Absent	82	82.0%
Diabetes Mellitus		
Present	24	24.0%
Absent	76	76.0%
TIA		
present	2	2.0%
absent	98	98.0%
Family history of stroke		
Present	2	2.0%
Absent	98	98.0%
OCP		
Present	4	4.0%
Absent	96	96.0%
Homocysteinemia		
Present	12	12.0%
Absent	88	88.0%

Table – 6 – Risk Factors Associated with - BMI

BMI		
Under weight	22	22.0%
Normal	66	66.0%
Over weight	12	12.0%

Table – 7 - Risk Factors Associated with type of Stroke

Risk factors	TYPE OF STROKE	
	Ischemic n=78	Hemorrhagic n=22
Smoking		
Present	28(35.9%)	8(36.4%)
Absent	50(64.1%)	14(63.6%)
Alcohol		
Present	22(28.2%)	8(36.4%)
Absent	56 (71.8%)	14(63.6%)

Hypertension		
Present	12(15.4%)	20(90.9%)
Absent	66(84.6%)	2(9.1%)
CAD		
Present	16(20.5%)	2(9.1%)
Absent	62(79.5%)	20(90.9%)
Diabetes Mellitus		
Present	22(28.2%)	2(9.1%)
Absent	56(78.2%)	20(90.9%)
TIA		
Present	2(2.6%)	-
Absent	76(97.4%)	22(100.0%)
Family history of stroke		
Present	2(2.6%)	-
Absent	76(97.4%)	22(100.0%)
OCP		
Present	2(2.6%)	2(9.1%)
Absent	76(97.4%)	20(90.9%)
Homocysteinemia		
Present	12(15.4%)	-
Absent	66(84.6%)	22(100.0%)

Table – 8 - Risk Factors Associated With type of Stroke

BMI		
Under weight	18(23.1%)	4(18.2%)
normal	48(61.5%)	18(81.1%)
over weight	12(15.4%)	-

Multiple risk factors were analyzed in our study. 36% of all the patients were Smokers, and among ischemic and hemorrhagic strokes 35.9% and 36.4% were smokers respectively. Alcohol consumption was seen in 30% Among ischemic stroke 28.2%, and hemorrhagic strokes 36.4%. 12% of study were Overweight. Among ischemic strokes 15.4% where as none of the hemorrhagic stroke were Overweight. Diabetes mellitus was seen in 24% of the patients 28.2% were ischemic where as 9.1% were hemorrhagic strokes had same disease.

Hypertension and CAD were seen in 32% and 18% of the study group respectively. Among ischemic strokes 15.4% were Hypertension and 20.5% had CAD, whereas hemorrhagic stroke 90.9% were Hypertensive, 9.1% had CAD.

Transient ischemic attack and previous family history of stroke were both seen in 2% of the study group. 2.6% of same had ischemic stroke where as none of the hemorrhagic stroke had this history. 4% of the patients were taking Oral contraceptive pills. 2.6% and 9.1% ischemic and hemorrhagic patients were taking the same.

Elevated Homocystein levels were seen in 12% of the patients. 15.4% patients were ischemic and none of the hemorrhagic strokes were this risk factor.

Table– 9 – Lipid Profile Associated with Stroke

	Number(n=100)	%
Total cholesterol(<200)		
Normal	70	70.0%
Abnormal	30	30.0%
Triglycerides(<150)		
Normal	88	88.0%
Abnormal	12	12.0%
HDL cholesterol(m:<35,f:<38)		
Normal	28	28.0%
Abnormal	72	72.0%
LDL cholesterol(<100)		
Normal	40	40.0%
Abnormal	60	60.0%

Table –10 – Lipid Profile Associated with type of Stroke

Lipid profile	Type of stroke	
	Ischemic (n=78)	Hemorrhagic (n=22)
Total cholesterol(<200)		
Normal	54(69.2%)	16(72.7%)
Abnormal	24(30.8%)	6(27.3%)
Triglycerides(<150)		
Normal	68(87.2%)	20(90.9%)
Abnormal	10(12.8%)	2(9.1%)
HDL cholesterol, (m:<35,f:<38)		

Nnormal	20(25.6%)	8(36.4%)
Abnormal	58(74.4%)	14(63.6%)
LDL cholesterol(<100)		
Normal	30(38.5%)	10(45.5%)
Abnormal	48(61.5%)	12(54.5%)

Abnormalities in lipid profile were also investigated. HDL and LDL were abnormal 72% and 60% of the patients respectively. 74.4% ischemic and 63.6% hemorrhagic had abnormal HDL, whereas 61.5% ischemic and 54.5% hemorrhagic stroke was seen in LDL abnormal patients respectively.

Table – 11 – CT Scan Findings

CT scan finding	Number of patients (n=100)	%
Infarct	60	60.0%
Venous thrombosis	18	18.0%
Hemorrhage	22	22.0%

CT scan finding showing 60% of patients having arterial infarction. Cortical venous thrombosis was seen in 18% of the patients and intra cerebral hemorrhage was seen in 22%.

Discussion

In the present study of 100 patients of stroke in young, there was male preponderance. 58% were males and 42% were females. Sex ratio in our study was 1.3 : 1 (males : females), similar findings were seen in Mehndiratta MM et al [4] in north India and Zunni et al [5] in Africa, showed 1 : 0.8 and 1.2 : 1 respectively. In the present study, maximum number of patients were seen in the age group of 36-

40, where as similar findings were seen in Mehndiratta et al [4].

Among clinical features hemiparesis was prominent feature, of 100 cases 86 patients had hemiparesis. In the Bansal et al [6] study also showed hemiparesis in 79.2%. and seizures, decreased level of consciousness and speech abnormalities were 28.6%, 57.2%, 30.45% respectively. These are concurred with present study.

Table 12: Comparison of Clinical Features

S.NO	CLINICAL FEATURE	PRESENT STUDY	BANSAL et al ⁶
1	Seizures	14.0%	28.6%
2	Consciousness level	60.0%	57.2%
3	Speech abnormalities	34.0%	30.4%
4	Cranial nerve deficit	56.0%	-
5	Motor deficit(hemiparesis)	86.0%	79.2%
6	Sensory deficit	14.0%	-
7	Cerebellar deficit	2.0%	-

Nagaraja et al [7] had showed an incidence of smoking associated with stroke to be 15%, Dalal et al [8] 40%, Bogousslavsky et al [9] 36.6% and Alvarez et al [10] 56.7%. In meta analysis 32 separate studies of relation between smoking and stroke analyzed by Roger Shunton and Beevers there was a strong association between smoker and incidence of stroke. In our study it was showed 36%. In study of Nagaraja et al [7] the frequency of alcohol consumption was 15%, Alvarez et al [10] 37.8% and Dalal et al [8] 40%, the present study had 30%. The incidence of Diabetes in our study was 24% which was correlated with Nagaraja et al [7] (11%), Dalal et al [8] (20%), Grindal et al [11] (5.2%), Zunni et al [5] (14.8%) and Alvarez et al [9] (10.9%). In the present study 32% had Hypertension, similar to Dalal et al, [8] Alvarez et al, [10] Nagaraja et al, [7] Grindal et al [11]. In our study 18% of the study groups had CAD, which is strongly correlated with Grindal et al [11] and Alvarez et al [9] studies.

The incidence of TIA in our study was 2%, correlated with Mehndiratta et al [4] and Bogousslavsky et al [9] studies. OCP associated with stroke was seen in only 4% of the study group, where as in Grindal et al [11] it was 17.1% possibly because of rural population.

Elevated Homocystein levels were seen in 12% of the patients, where as Mehndiratta et al [4] was showed only 0.9%. probably there was no correlation because of elevation of Homocystein temporarily occurred after stroke, In the present study Homocystein levels were measured during presentation of stroke.

In the present study smoking was present in 35.9% of ischemic stroke where as hemorrhagic strokes were seen in 36.4% of the patients where as it was 18.11% and 4.72% in ischemic and hemorrhagic strokes respectively in Mehndiratta et al [4]. In the study by Alvarez et al [10] it was present in 56.74% of ischemic strokes.

Alcohol consumption in our study was 28.2% ischemic stroke and

36.4% hemorrhagic stroke where as it is in Bevan et al [12] study in ischemic and hemorrhagic stroke were 16.7% and 28.26% respectively. Diabetes was present in 28.2% of ischemic and 9.2% hemorrhagic strokes in our study where as Mehndiratta et al [4] showed 3.96% and 2.36% in ischemic and hemorrhagic respectively.

In our study Hyper tension was seen in 15.4% of ischemic and 90.9% of hemorrhagic stroke where as in Mehndiratta et al [4] study 16.5% and 3.14% ischemic and hemorrhagic stroke respectively. This did not concur with the present study probably because there were no. of risk factors present in the same patients diluting the effect of simple risk factor.

In the present study CAD was seen in 20.5% of ischemic and 9.1% of hemorrhagic stroke similarly seen with Mehndiratta et al [4] study.

History of TIA was seen in 2.6% of ischemic stroke and none in hemorrhagic stroke, it is strongly correlated with Mehndiratta et al [4] study. 2.6% of ischemic and 9.1% of hemorrhagic strokes patients had History of OCP consumption where as it was 18.75% and none in Bevan et al [12] study. Our study showed a high occurrence of Dyslipidemia in the form of elevated LDL and decreased HDL, Mehndiratta et al [4] showed abnormal Cholesterol and Triglycerides levels as a risk factor.

Albucher JF et al [13] showed by multivariate analysis that HDL was the only one to be highly associated with stroke.

Atherosclerosis had emerged as the main etiological factor responsible for 33% of the patients in our study. Atherosclerosis was considered based on criteria similar to Adams et al when the patient had 2 or more risk factors for atherosclerosis in the absence of identifiable causes. Bevan et al [12] showed 31%.

Hypertension is the etiological factor in 21% of the patients, maximum of which present in 90.9% of cerebral hemorrhage. Dalal et al [8] showed an incidence of 40%.

CVT was seen in 18 patients (18%), this does not concur with the

study by Venkataraman et al [15] where incidence was 43%. Tubercular meningitis comprised of 12% of cases which is higher in comparison to Mehndiratta MM et al [4]. RHD leading to cardio embolic stroke comprised 12% of the cases. In a study by Mehndiratta et al [4] showed 30%, Bansal et al [6] showed incidence of 16%. In the present study 4 patients (4%) were diagnosed to have SLE. In the study by Mehndiratta et al [4] the incidence was 1.8%. Ischemic infarcts were noted in 60% of the patients. 30(50%) patients had MCA infarct. 4(4.0%) had lacunar infarct, 4(4.0%) had Cerebellar infarct and 2(2.0%) had anterior cerebral infarct. Intra cerebral hemorrhage was seen in 22(22.0%) patients. 6(6.0%) patients had hemorrhage involving MCA territory. 8(8.0%) patients had hemorrhage in putamen, 4(4.0%) in globus pallidus, 2(2.0%) in thalamus. Rajeh SA et al [14] in their study had found ischemic infarction in CT 76.2 and hemorrhage 23.8% of stroke in young stroke. Cortical venous thrombosis was seen 18% of the patients who all were females. In a study by Venkataraman et al [15] who evaluated 69% patients less than 40 years with stroke, the incidence of cortical venous thrombosis was 4.3%.

Special hematological investigations like anti thrombin III, protein C, protein S, deficiencies could not be done in the present study.

Evaluation of various risk factors of stroke in young are important as they may play a major role in predisposing an individual to a disease which has terrible impact on the family and society.

Stroke in young deserves an extensive evaluation that includes hematological, biochemical, and angiographic studies. By these approaches a large number of potential causes can be detected and the treatment of these patients can be tailored according to the outcome.

Conclusion

- The majority of the age distribution of stroke in this study was between the ages of 36-40 years.
- The peak age of occurrence of stroke among males 36-40 years, where as in females it was seen between the ages of 21-25 years.
- Infarction was observed as most common form of stroke than Hemorrhagic.
- Among clinical features decrease in consciousness and motor deficit were prominent.
- Smoking and Alcohol consumption were important risk factors for stroke among young.
- Hypertension and Diabetes mellitus were non modifiable risk factors commonly seen. especially hypertension in cases of Intra cerebral hemorrhage.
- Rare risk factor like Homocystein should be considered during evaluation.
- Lipid abnormalities such as elevated LDL and decreased HDL were also common.

- Atherosclerosis was the most common etiology for stroke in young. Cortical Venous Thrombosis should be kept in mind in females.

References

1. Aho K, Harmen P, Hatano S, Marquardsen J, Smirnov VE, Strasser T. Cerebro vascular disease in the community. Results of WHO collaborative study. Bull WHO 1980; 58: 113-30.
2. Kameshwar Prasad, Kapil K Singhal, Indian Perspective Study, Stroke in young 2010;58,(3):343-350.
3. Dalal P et al, Population-based Stroke survey in Mumbai, India; Incidence and 28 day case fatality Neuro epidemiology 2008;31:254-61.
4. Mehndiratta MM, Agarwal P, Sen K, Sharma B, Stroke in young Adults. A study from a University Hospital in North India. Med Sci Monit 2004;10(9):CR 535-541.
5. Zunni FS, Ahmed M, Hassan KM, Prakash PS. Stroke: Incidence and pattern in Benghazi Libiya Ann. Saudi Med 1995;15(4):32-37.
6. Bansal BC, Prakash C, Jain AC, Brahmanandan, Cerebro vascular disease in young individuals below the age 40 years. Neurology (India) 1973;21:11-18.
7. Nagaraj D, Murthy SG, Taly AB, Subbakrishna K, Rao BSS. Risk factors for stroke: Relative risk in young and elderly. Neurology India 1998;46:183-184.
8. Dalal PM. strokes in young and elderly: Risk factors and strategies for stroke prevention; J Assoc Physicians India 1997;45(2):125-130.
9. Bogousslavsky J, Pierce P. Ischemic stroke in patients under age 45 Cerebral ischemia: Treatment and prevention. Barnett HJM et al neurologic clinics 2000;10:113-124.
10. Alvarez J, Guiu JM, Somall J, Molins M, Insa R, Molto JM et al ischemic stroke in young adults. Analysis of etiological subgroups. Acta Neurol Scand Jul 1989;80(1):28-34.
11. Grindal AB, Choen RJ, Saul RF, Taylor JR. Cerebral infarction in the young adults. stroke 1978; 9:39-92.
12. Bevan H, Sharma K, Bradley W, Stroke in young adults. stroke 1990;21:382-386.
13. Albucher JF, Ferriere SJ, Ruidavetes JB, Chaumeil G, Perret BP, Chollet F. Serum lipids in young patients with ischemic stroke. A case control study. J Neurol Neurosurg Psychiatry 2000;69:29-33.
14. Rajeh SA, Awada A, Niazi G, Larbi E. Stroke in a Saudi Arabian National guard community. Analysis of 500 consecutive cases from a population based hospital. Stroke 1993;24:1635-1639.
15. Venkataraman S, Bhargava S, Virmani V. Cerebro vascular Accidents. Clinical and Radiological features. J Assoc Physicians India 1977;25:525-529

Conflict of Interest: Nil Source of support: Nil