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Original Research Article.

Etiologic Pattern of Stroke in Young Patients in a Tertiary Care Hospital

Raseul Kabir[1], Md. Mominul Islam[2]*, Md. Mehadi Hasan[3], Rokeya Nazneen Jarna[2], Md. Majedur Rahman[4]

[1]Department of Neuromedicine, Rajshahi Medical College, Rajshahi, Bangladesh.
[2]Department of Pharmaceutical Sciences, North South University, Dhaka-1229, Bangladesh.
[3]Department of Pharmaceutical Technology, University of Dhaka, Dhaka, Bangladesh.
[4]Shahabuddin Medical College and Hospital, Dhaka, Bangladesh.

ABSTRACT

Introduction: Strokes in young is important for a society, for a nation where most of the risk factors are avoidable and modifiable.

Objective: In this study our main goal is to identify the etiology of stroke in young age.

Method: This cross sectional type of descriptive studywas conducted among the patients reporting to our patients department and patients admitted into Neuromedicine and Medicine Units of Rajshahi Medical College Hospital from 2012 January 1 to 2013 December 31. During the study data was collected by face to face interview, physical examination and investigations in a data collection sheet also evaluated and analyzed by SPSS.

Results: The experiment wheremost of the stroke patients were female gender and hypertension was most common risk factor 76%. Also contraceptive user female with strokes where 32.1% were haemorrhagic and 36.8% were ischemic.

Conclusion: After much analysis we can conclude that rheumatic heart diseases were important factors for female strokes and hypertension were for both male and female strokes. Further community based large sample studies are required to have better outcome.

Keywords: Strokes, Haemorrhagic, Ischemic.

***Correspondence to:**

Md. Mominul Islam (M.Pharm, B.Pharm)
Department of Pharmaceutical Sciences,
North South University, Dhaka-1229, Bangladesh.

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INTRODUCTION

Stroke in young poses a major health problem. World Health Organization (WHO) was used to define acute stroke: rapidly developing clinical signs of focal (or global) disturbances of cerebral function, with symptoms lasting 24 hours or longer or leading to death with no apparent cause other than of vascular origin. There is no clear cut age limit for young adults. But most of the studies in different countries consider young age group limit is 15-45 years.

Strokes account for 5.54 million deaths worldwide being the second commonest cause of mortality. Other data suggest that two-thirds of these deaths occur in less developed countries.

Stroke is the third most common cause of death in the developed countries following ischaemic heart disease and cancer. In many developing countries the incidence has been rising because of the adoption of less healthy life styles. As evident from RMCH that out of 1434 patients admitted in Neuro-medicine unit in 2007, 1,119 were admitted with stroke. About one-fifth of patients with an acute stroke will die within a month of the event and at least half of those who survive will be left with physical disability.[1-3] The most common symptom of a stroke is sudden weakness or numbness of the face, arm, or leg, most often on one side of the body, occurring in 90% of the strokes. Other symptoms include confusion; difficulty speaking or understanding speech; difficulty seeing with one or both eyes; difficulty walking, dizziness, and loss of balance or coordination; severe headache with no known cause; fainting or unconsciousness.

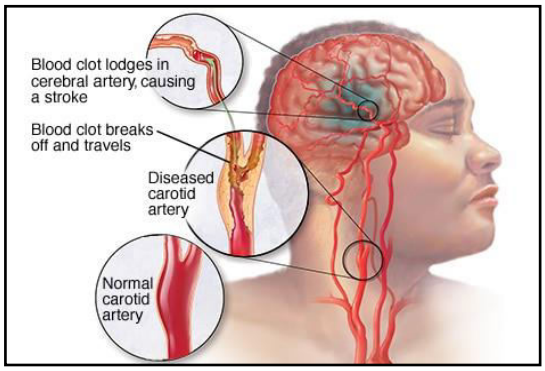
The effects of a stroke depend on which part of the brain is injured and how severely it is affected. A very severe stroke can cause sudden death. Globally, stroke is the third commonest cause of mortality and the fourth leading cause of disease. It makes an important contribution to morbidity, mortality, and disability in developed as well as developing countries.

In recent years, there has been increasing economic and demographic development in developing countries resulting in a shift from diseases caused by poverty toward chronic, non-communicable and lifestyle-related. This happening in the younger age group adds to the social burden, and as such these patients merit special attention in diagnostic, therapeutic, and preventive care.[4] It leaves the patients with residual disabilities like physical dependence, cognitive decline, depression, and seizures. The study discusses the burden of stroke in young and its implications in a developing country like Bangladesh along with approach to

identifying different causes that are known to occur in this age group. Stroke incidence rises steeply with age; therefore, stroke in younger people is less common; however, stroke in a young person can be devastating in terms of productive years lost and impact on a young person's life.

Finally, where authors have reported incidence rates by age decile, it is apparent that even within the "young stroke" category, incidence increases sharply with age, particularly among the 34 to 44 year old age .No major etiological differences between stroke in young age and stroke in all ranges.[5] So far many common and rare causes of stroke are found.

In as many as 35% of cases, the underlying etiology remains unclear .In this study our main objective is to find out the etiology of stroke in young age.



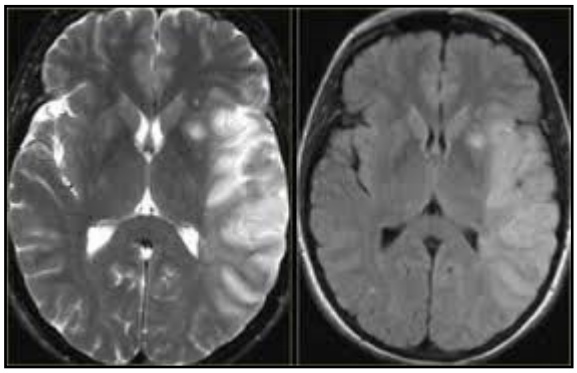


Figure 1a and 1b: Stroke reason and imaging in MRI

OBJECTIVE

General Objective

- To detect the etiology of stroke in young age

Specific Objective

- To find out vascular anomalies in young age group
- To detect vasculitic cause of stroke in young age group
- To identify cardiovascular causes of stroke in young age group
- To find out biochemical causes of stroke in young age group
- To Compare the etiology of stroke in young between male and female
- To discover most common causes in this age group.

METHODOLOGY

Study Type

- This study was a cross sectional type of descriptive study.

Study Place and Period

- The present study was carried out among the patients reporting to out patients department and patients admitted into Neuromedicine and Medicine Units of Rajshahi Medical College Hospital from 2012 January 1 to 2013 December 31.

Sample Size

- The required sample size for the proposed study was calculated by using the following statistical formula.

$$n = \frac{Z^2 pq}{d^2}$$ Here p = 0.2

The prevalence of stroke in young is 20% (The prevalence of stroke in young patients was determined by the consultation with the specialists working in the department of Medicine and Neuromedicine Unit at RMCH). In Australia 10-15% of stroke occurs <40 years of age (S. Razdan, 1989).

q = 1- 0.2 = 0.8; d = 0.0025; z = 1.96 at 95% confidence interval.

So, putting the value into above equation

$$= \frac{1.96^2 x 0.2 x 0.8}{0.0025^2} = 245$$

As the information about the total number of stroke in young patients attending RMCH for a period of one year on an average 500; So, the corrected sample size for finite people was:

$$n_c = \frac{n}{1+\frac{n}{N}} = \frac{245}{1+\frac{245}{500}} = 164$$

We enrolled 164 patients for proposed study.

Sampling Technique

- It was a purposive sampling

Sampling Method

- The researches went through the Neuromedicine and Medicine Unit of RMCH from the register book maintained in the ward.
- Identification of the participant had done by asking duty doctor or nurse in the ward. After identification of the study subject, the researcher explained the aim and objective of the study to prospective study subject in details. If the respondent agreed to participate then informed written consent was obtained and thereby was included in the study. So the selection of the participants indicates that a nonrandom sampling technique was applied in this regard. But the researcher selected each study participant on the basis of predetermined inclusion and exclusion criteria.

Sample Collection

- The patients who fulfill both the inclusion and exclusion criteria had enrolled in this study.

Inclusion Criteria

- Age: 15-45 years.
- Both male and female patients were enrolled.
- Clinical features of stroke.
- Radiological evidence of stroke present.

Exclusion Criteria

- Age <15 years and > 45 years
- Head injury
- Deep coma
- Radiological evidence of stroke absent.

Method of Data Collection

- Data was collected by face to face interview, physical examination and investigations in a data collection sheet. It was collected after taking informed consent of the patient. We went for CT head to confirm clinically found stroke. When it was large, superficial, multiple follows definite vascular territory and haemorrhagic transformation, it was an embolic strokes. Then we went for related investigation step by step. Investigations done to exclude metabolic abnormalities were RBS, Serum creatinine, Serum electrolyte, fasting lipid profile, plasma and urine amino acids level (to exclude homocystinemia), DSA, CTA to search for CNS vascular anomalies like AVM and aneurysm. MRV to detect venous thrombus. Echocardiogram to exclude valvular abnormalities, left atrial thrombus and ECG to exclude coronary artery diseases. Protein C, Protein S to detect thromboembolism. Platelete count and BT, CT to exclude bleeding disorders. Finally for highly suspected cases for vasculities; we did antiphospholipid antibody, ANF, Anti-ds antibody and RA test.

Statistical Analysis

- The data were analyzed with the help of SPSS (16th version) software program. Descriptive analytical techniques involving frequency distribution, computation of percent.

Table 1: Distribution of stroke in age group

Age group	Frequency	Percentage
(15-25) years	8	5%
(26-35) years	50	33%
(36-45)years	92	62%

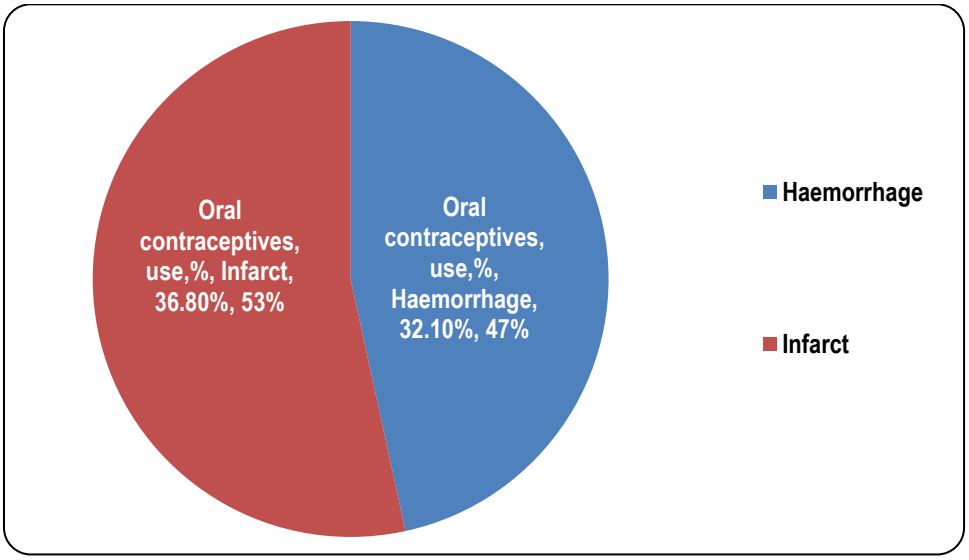


Figure-2: Gender distribution of stroke [n=150]

Table-2: Etiology distribution of the patients

Variables	Number	(%)	Total
Hypertension	76	50.66	150
Diabetes	24	16.0	150
Hyperlipidaemia	8	5.33	150
Cardiac disease – (Mitral valvular disease - 13, IHD – 05, Atrial fibrillation – 02)	20	13.33	150
Vasculities (SLE - 06, Anti phospholipid antibody syndrome - 02)	8	5.33	150
Oral contraceptive use [OCP]	73	48.66	150
Smoking	35	23.33	150
Alcohol consumption	12	8.0	150
Recent history of delivery	6	4.0	150
Past history of stroke	21	14.0	150
Family history of stroke	73	48.66	150
Coagulation abnormality	0	0	150
Meningo-encephalitis	12	8.0	150
Anticoagulant or antithrombotic	16	10.66	150
Bleeding disorder(aplastic anaemia-4, DIC-2)	6	4	150
Blood coagulation disorder	3	2.0	150
Carotid duplex (>50%, bilateral stenosis)	02	1.33	150

SLE-Systemic Lupus erythromatosus

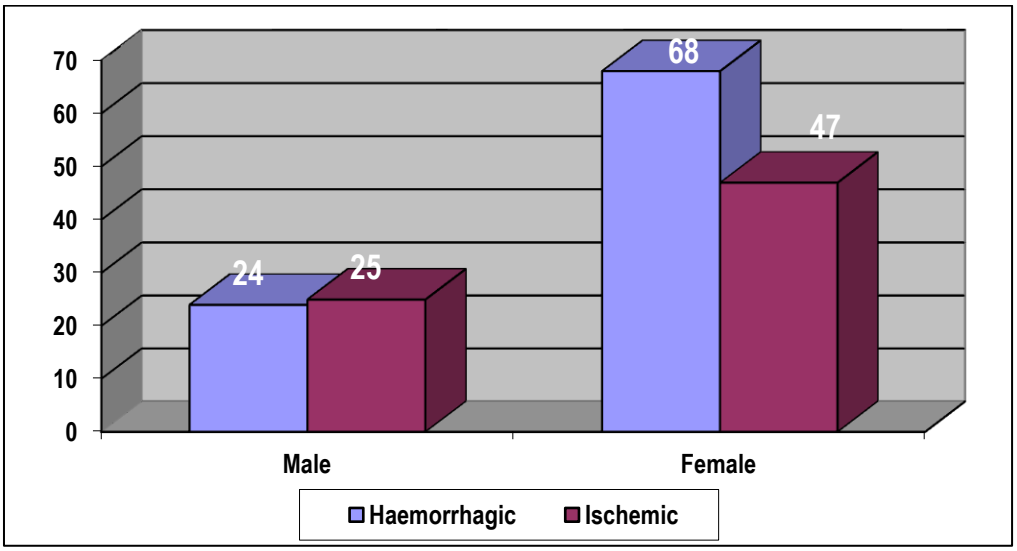


Figure 3: Strokes distribution with gender [n=150]

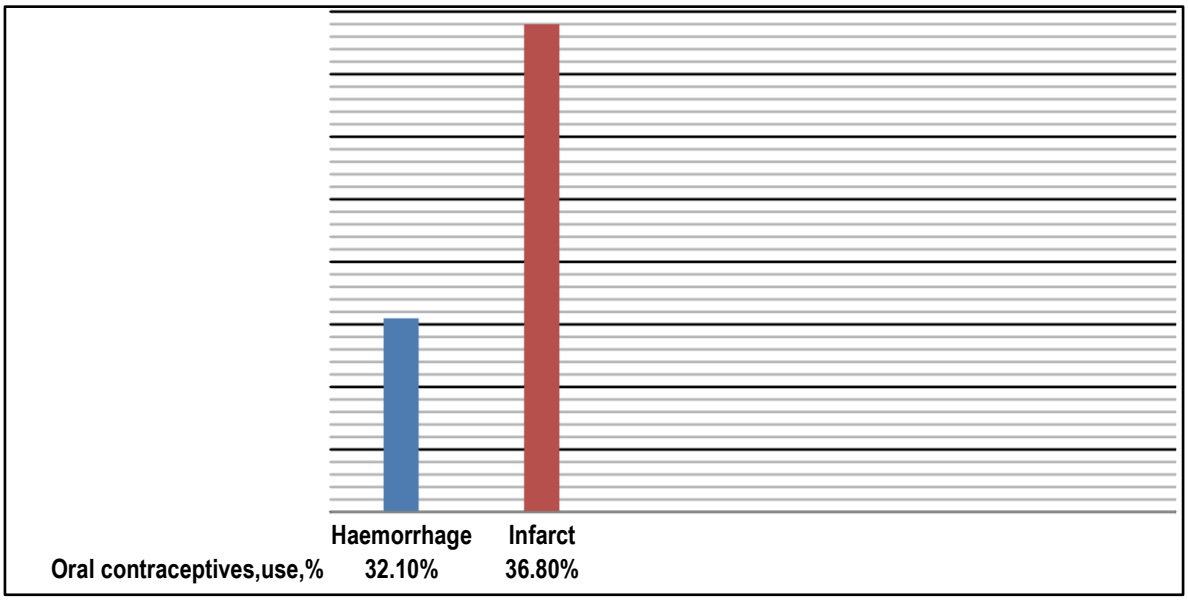


Figure 4: Distribution of all hemorrhagic stroke revealed by neuroimaging eg- CT scan, MRI, MRV, CTA, DSA and bleeding / coagulation factor analysis. [n =78]

Table 2: Distribution of all infarction revealed by neuroimaging [n=72 Embolic stroke 12, Thrombotic stroke 48.

Site	Number	%
Basal ganglia	32	44.44
Cerebral cortex – [parietal 05, parieto-temporal 07, fronto-parietal 05, frontal 02, fronto-temporo-parietal 05, parieto-occipital 03, Embolic stroke-9]	24	33.33
Bilateral multiple site (3 were embolic)	04	5.55
Brainstem	05	6.94
Thalamic	03	4.16
Cerebellum	02	2.77
Venous thrombosis (all superior sagittal sinus thrombosis)	02	2.77

Table 3: Association of hypertension with strokes [n=150]

Strokes	Hypertension Grade1-mild (140-159 sys,90-99 diast), Gr2-moderate (160-179 syst, 100-109 diast), Gr3-severe (>_180 syst, >_110 diast).					P-value
	Present	Percent	Absent	Percent	Total	0.033
Haemorrhage (Hypertensive's -60)	49	32.7	29	19.3	78	
Infarct	32	21.3	40	26.7	72	
Total	81	54.0	69	46.0	150	

Table 4: Association of hypertension with sex [n=150]

Sex	Hypertension Grade1-mild (140-159 sys,90-99 diast), Gr2-moderate (160-179 syst, 100-109 diast), Gr3-severe (>_180 syst, >_110 diast).					P-value
	Present	Percent	Absent	Percent	Total	0.283
Male	27	18.0	17	11.3	44	
Female	54	36.0	54	34.7	106	
Total	81	54.0	69	46.0	150	

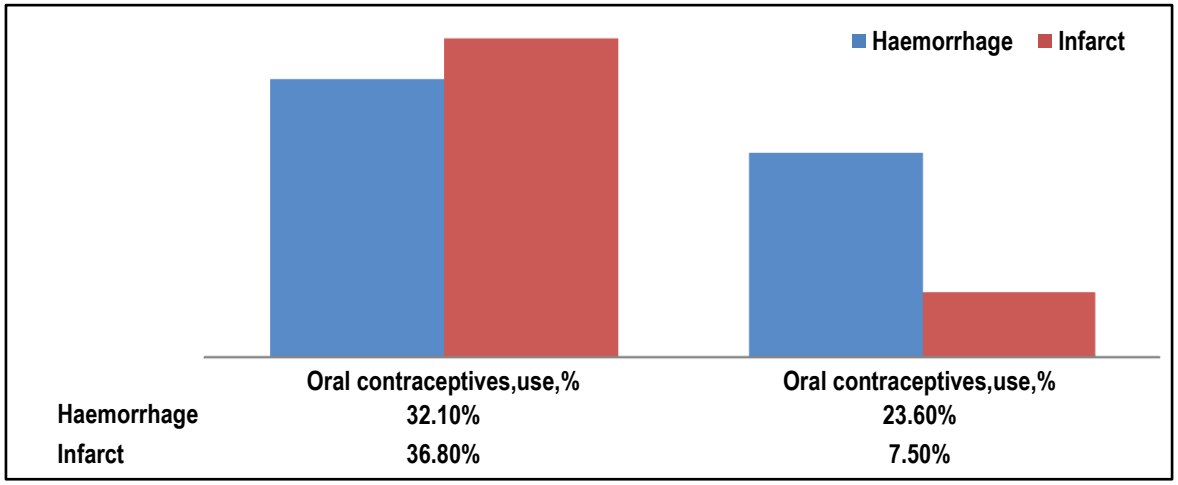


Figure 5: Association of heart disease with strokes [n=150]

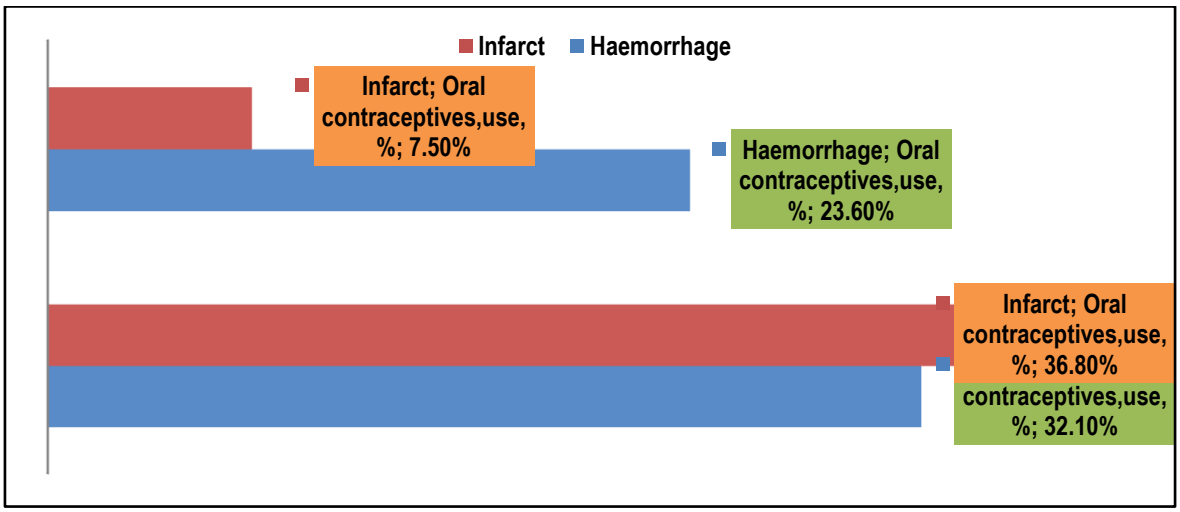


Figure 6: Association of DM (diabetes mellitus) with stroke

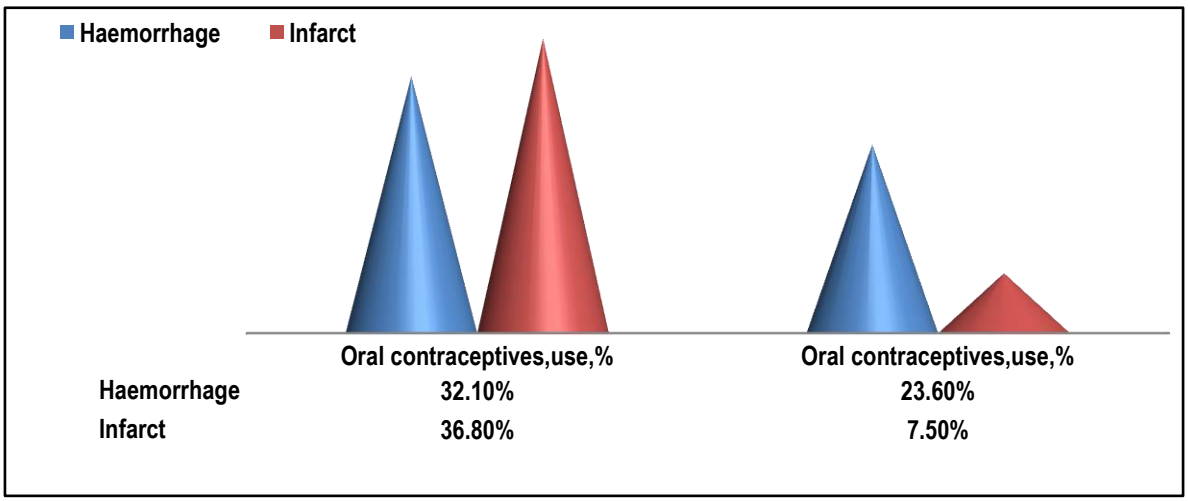


Figure 7: Relation of contraceptive user female with strokes

RESULTS

In table-1 shows distribution of stroke in age group where majority of stroke patients lies in 36-45 years age groups which was 62%. In figure-2 shows gender distribution of stroke [n=150] where most of the stroke patients were female gender which was 71%. Female: male ratio was 2.40:1.

In table-2 shows etiology distribution of the patients where hypertension was most common risk factor 76%, OCP (Oral contraceptive) use was present in 48.66%; smoking was present in 23.33%.

In figure-3 shows strokes distribution with gender [n=150] where young stroke is predominantly present in female patients. Out of 150 patients 68 was hemorrhagic and 47 was ischemic among female.

In table-2 shows distribution of all infarction revealed by neuro imaging where among all infarctions basal ganglia infarction was highest in number [44.44%] and next to it was cerebral cortical infarction which was 33.33%. In figure-4 shows distribution of all haemorrhagic strokes revealed by neuro imaging eg- CT scan, MRI, MRV, CTA, DSA and bleeding / coagulation factor analysis where most of the haemorrhagic strokes were basal ganglia distribution 32.05%. Next to it was lober 25.64 % and thalamic haemorrhage which was 16.66%.

Table-3 shows association of hypertension with strokes [n=150] where out of 150 patients hypertension was 81 (54%). Out of 81 (54%), haemorrhage was 49 (32.7%) and Ischemic stroke was 32 (21.3%). (χ^2=5.090 with df=1, p<0.05). So test is statistically significant.

In table-4 shows association of hypertension with gender [n=150] where out of 81 (54.0%) hypertensive patients male was 27 (18.0%) and female was 54 (36.0%). (χ^2=1.359 with df=1, p>0.05). So the test is not significant. In figure-5 shows association of heart disease with strokes [n=150] where out of 150 total patients haemorrhagic patient were 2.0% and infarct patient were 11.3% which was statistically highly significant. (p value 0.001)

In figure-6 shows association of DM (diabetes mellitus) with stroke [n=150] where haemorrhagic were 5.3% and 8.0% were ischemic which was statistically insignificant (P>0.05). In figure-7 shows relation of contraceptive user female with strokes where 32.1% were haemorrhagic and 36.8% were ischemic which was statistically highly significant (P<0.05).

In table-5 shows association of male smoker with strokes where out of 35 (79.5%) smoker patients Haemorrhagic strokes were 12 (27.3%) and infarct patients were 23 (52.3%).χ^2=5.519 with df=1, p<0.05. So test is statistically significant.

In table-7 shows Distribution of strokes revealed by angiography [CTA, DSA, MRA, MRV] [n=150] where Embolic ischemic strokes and SAH strakes faced 12 patients also ICH) – Non hypertensive faced 20 patients.

Table 6: Association of male smoker with strokes [n=44]

Strokes	Smoking			P-value
	Smoker	Non-smoker	Total	
Haemorrhage	12(27.3%)	7(15.9%)	19	0.027
Infarct	23(52.3%)	2(4.5%)	25	
Total	35(79.5%)	9(20.5%)	44	

Table 7: Distribution of strokes revealed by angiography [CTA, DSA, MRA, MRV] [n=150]

Type of strokes	Causes	Lesion Site	Revealed by
ICH (20) – Non hypertensive	Ruptured AVM (2) Bleeding diathesis (6) – Aplastic anemia (3), Leukemia (1), DIC (2), drugs - 12	MCA (Rt) - 2 Lt Parietal (3) - RtParietofrontal (6), Lt frontal (5), temporal – Lt – 4, Rt - 2	DSA MRA
Embolic ischemic strokes (12)	NVD with Lt atrial thrombus (5), Others (7)	MCA - Rt – 6, Lt - 3 , Multiple sites – 3	Echocardiography – Lt atrial thrombus with Rheumatic heart disease, ECG – IHD and AF, DSA – Embolic in Rt and Lt MCA
SAH (12)	Ruptured aneurysm (7)	A Com A – 5, MCA - Lt -2, Rt - 1	CTA
	AVM (3)	MCA - Lt – 1, Rt - 2	DSA
	Hypertension (2)	MCA - 2	CTA
Venous sinus thrombosis (2)	Antiphospholipid antibody syndrome (1), Others (1)	Superior sagittal sinus -2	MRV
Carotid arterial stenosis (2)	Atherosclerotic (2)	Rt – 72%, Lt – 65%	Carotid doppler
Vasculitides (8)	SLE (6), Antiphospholipid antibody syndrome (1), Primary vasculitidis -1	Multiple sites -1, Basal ganglia – 3, Parietal – 2, Parietofrontal -2	ANA (+ve), C- ANCA (+ve), P-ANCA (+ve), Antiphospholipid antibody (+ve)

DISCUSSION

In this current study it was observed that out of 150 stroke patients haemorrhagic was 52% and ishemic was 48%. While in other study observed a greater proportion of strokes were due to subarachnoid haemorrhage and intracranial haemorrhage in young adults (40–55%) compared to the general stroke population (15–20%).[6] This issue was different among young Asians, apart from a study in North India that only 14% of cases were haemorrhagic of total strokes[7] compared to Western countries with reported proportions in the range of 40–55% of all young strokes.[8]

Whereas ischemic stroke were found by one study that study to Western countries 60-45 %.[8] An increased risk of cerebral infarction among young adults with conventional vascular risk factors is observed, particularly in developing countries due to increasing smoking rates and urbanization.

Mean age of young stroke were 29.7± 14 years with a range from 15- 45 years. Majority of patients (61.3%) were in the 36± 13.4 years age group. Female sex was 70.7% more than male 29.3% sex. Female: Male was 2.40: 1.

Female sex is higher in proportion probably due to, sedentary life style, oral contraceptive use, family history of stroke, obesity, hypertension pregnancy associated diseases 12% which need to be evaluated further study. About 54% of total hypertensive patients in this study male were 18% and female was 36%. In a study of stroke in the young from Southeast Asia, the most common risk factors observed were hypertension (45.8%).[9]

Hypertension was more commonly seen in patients with small vessel occlusion, large artery atherosclerosis and stroke due to unknown etiology.

Most of the hypertensive patients in my study were female and above 36 years. Female hypertensives were more in number than male because of sedentary life style, oral contraceptive using, obesity and pregnancy associated complication.

Stroke in young in India study pregnancy related causes (including Pregnancy-induced hypertension and puerperal sepsis) were 12%. From above findings strongly support the current study.

In one study the prevalence of hypertension increased with increasing age and was seen in 28.3% of patients in 15-44 year age group, whereas it was prevalent in 51.7% of patients in 45-49 year age group in other study.[10] Analysis of prevalence of risk factors in studies of stroke in young from the west reveals prevalence of hypertension from 20 to 60% in one study. [10]

In this study, hypertensive haemorrhagic strokes were 32.7% and ischemic strokes were 21.3%. Hypertension was important etiology for all strokes particularly of hemorrhagic stroke it was 54%. It was similarly to other studies which was statistically significant (P< 0.05).

Another study found that the incidence of stroke appears greater in women than men under the age of 30.[11] Oral contraceptive drugs using history in my study were 68.9%. Which were statistically highly significant (p < 0.05). In Iran oral contraceptive use has been implicated in up to 8% of cases of young stroke in some populations.

With regard to stroke in women, one study found that oral contraceptive use were associated with a 2- to 5-fold increased risk of all sub types of particularly ischemic stroke.[12]

In that series of study all types of cardiac diseases were found 13.3%. Among them 40% were valvular diseases and 60% were other cardiac diseases.

In another study found that 177 patients with first ever ischemic stroke (age group 15-45 years) were included retrospectively based on hospital data diabetes mellitus were present in 7% only. In this study diabetes was 13.3%. Among them ischemic strokes were 8%. So it supports by the studies done by others. It is not statistically significant (P>0. 05).[13]

Smoking or tobacco consumption was found in 79.5% of male strokes.

In this series, haemorrhagic patients were 27.3% and ischemic stroke consumed smoke 52.3%. Which was statistically significant (p < 0.05). In a study of stroke in the young from Southeast Asia, smoking (49.8%), where Smoking was observed in 42.6% of White and 56.7% of Black men and 37.0% of White and 47.5% of Black women.

Whereas ischemic stroke were found by one study that study to western countries 60-45 %. An increased risk of cerebral infarction among young adults with conventional vascular risk factors is observed, particularly in developing countries due to increasing smoking rates and urbanization.[8]

Six percent (6%) of female patients found Systemic lupus erythematous (SLE) and other form of collagen vascular diseases. No male was found. Systemic lupus erythematous was 4% in a recent study from Pakistan.[14]

Stroke in young in India study pregnancy related causes (including Pregnancy-induced hypertension and puerperal sepsis) were 12%. In this study it was 8%. It was less than that of other studies probably improving pregnancy related care and management.

Eight (8%) of total 150 patients were meningoencephalitis**.** A recent study from Pakistan found in 50 young stroke patients also found infective meningitis including tuberculosis meningitis and bacterial meningitis as the leading cause of stroke (34%).[14]

One study evaluated that 170 patients aged 15–45 years who had non-traumatic hemorrhagic stroke and they found that the main causes of spontaneous intracerebral hemorrhage were hypertension 42%, ruptured arteriovenous malformation 10% arterial aneurism rupture 20% and blood dyscrasia 5%, drugs 15%, not known 20%. A cause was not found in 42 Romanian.[11]

In this study, 10% was drugs (like antithrombotic) history of rupture aneurism and vascular malformation which were main causes of subarachnoid hemorrhage were less significant number 8%. Blood dyscrasia 3%. Hypertension was most significant number 56%, not known 30%.

In this study it was 45%. So this study is supported by the above references. Study also supports past history of stroke also has a great influences on recurrences of in young**.**

LIMITATION

- Sample size was small so the findings may not represent overall population of the country.
- Lake of facilities and rapid removal of the patients and shortages of time.

CONCLUSION

After many analysis and examinations we can conclude that smoking were the main culprit for male strokes; OCP and rheumatic heart disease were important factors for female strokes and hypertension were for both male and female strokes. Further community based large sample studies are required to have unbiased observation.

REFERENCES

1. A. Awada and S. Al Rajeh M. D. Valade (1999). The Saudi Stroke Data Bank.Analysis of the first 1000 cases, Acta Neurologica Scandinavica, vol. 100, no. 4, pp. 265–269.
2. A. C. Onwuchekwa, R. C.Onwuchekwa, and E. G. Asekomeh (2009).“Stroke in young Nigerian adults,” Journal of Vascular Nursing, vol. 27, no. 4, pp. 98–102.
3. A. Carolei, C. Marini, L. Macdonell , et al., (1993). “A prospective study of cerebral ischemia in the young: analysis of pathogenic determinants,” Stroke, vol. 24, no. 3, pp. 362–367.
4. World Health Organization [WHO] (1989). Report of the WHO Task Force on Stroke and other Cerebrovascular Disorders.Recommendations on stroke prevention, diagnosis and therapy. Stroke; 20:1407-10.
5. World Health Organization [WHO]. Geneva: WHO; (2004). World health report 2004: Changing history [online]. Accessed on April 24, 2007.
6. C. Marini, R. Totaro, F Ciancarelli et al. (2001). “Stroke in young adults in the community-based L’Aquila registry: incidence and prognosis,” Stroke, vol. 32, no. 1, pp. 52–56.
7. M. M. Mehndiratta,Sylaja PN, SarmaPS,et al. (2004). “Stroke in young adults: a study from a university hospital in north India,” Medical Science Monitor, vol. 10, no. 9, pp.CR535–CR541.
8. H. Bevan, K. Sharma, and W. Bradley (1990). “Stroke in young adults,” Stroke, vol. 21, no. 3, pp. 382–386.
9. J. L. Ru´ız-Sandoval, C. Cant ´u and F (1999). Barinagarrementeria, “Intracerebral hemorrhage in young people: analysis of risk factors, location, causes, and prognosis,” Stroke, vol. 30, no. 3, pp. 537–541.
10. Putaala J, Inzitari, M. C. Baruffi,Metso AJ et al. (2009). Analysis of 1008 consecutive patients aged 15 to 49 with first-ever ischemic stroke: The Helsinki young stroke registry. Stroke;40:1195-203.
11. Feigin VL, Lawes CM, Bennett DA et al. (2003) Stroke epidemiology: A review of population-based studies of incidence, prevalence, and case-fatality in the late 20 th century. Lancet Neurol;2:43-53.
12. W. S. Chan, J. Ray,E. K. Wai et al., (2004). “Risk of stroke in women exposed to low-dose oral contraceptives: a critical evaluation of the evidence,” Archives of Internal Medicine, vol. 164, no. 7, pp. 741–747.
13. Nayak SD, Nair M, Sarma PS et al. (1997). Ischaemic stroke in the young adult: Clinical features, risk factors and outcome. Natl Med J India;10:107-12.
14. S. K. Das, T. K. Banerjee, A. Biswas et al., (2007). “A prospective community-based study of stroke in Kolkata, India,” Stroke, vol. 38, no. 3, pp. 906–910.

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