Lifestyle risk factors of stroke in young Indians

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Abstract

Introduction: Stroke is a leading cause of death and claims 6 million lives every year worldwide. Etiology of stroke is extremely diverse in the young, risk factors differ considerably in young adults compared to those in older individuals. Lifestyle related risk factors play significant role in causation of stroke. The most frequent modifiable lifestyle related risk factors are smoking, physical inactivity, arterial hypertension, diabetes, dyslipidemia, and obesity. Prevention of stroke in the young assumes paramount importance as it increases number of quality-adjusted life years (QALY) much more in young than in elderly population.

Objectives: To study the different lifestyle related risk factors in patients of stroke in age group 15-49 years.

Materials and Methods: Patients of stroke between ages 15-49 years, who reported to Outpatient Neurology Services or admitted to a tertiary care service hospital, were evaluated for various potential lifestyle related risk factors which were analysed in detail using SPSS 15.0.

Results: Out of total 144 cases studied alcohol consumption was found in 70 (48.6%) cases, smoking was present in 36 (25%) cases, while 50 (34.7%) cases were hypertensive, 10 (6.9%) cases were diabetic, 15 (10.4%) were obese and dyslipidemia was found in 56 (38.8%); multiple risk factors were found in 22 (15.3%) cases.

Conclusion: Amongst lifestyle related problems alcohol, smoking, hypertension, diabetes and dyslipidemia followed by obesity were important risk factors for strokes in young. Unhealthy life style not only leads to increased chances of stroke, but also carries higher all cause mortality after stroke. The need of immediate vigorous primary and secondary preventive measures targeting the lifestyle modifications and risk factor among young population in developing countries in inevitable.

Keywords: Stroke, Young, Lifestyle risk factors.

Introduction

Stroke is defined by world health organisation (WHO) as an event caused by the interruption of the blood supply to the brain, usually because a blood vessel bursts or is blocked by a clot. This cuts off the supply of oxygen and nutrients, causing damage to the brain tissue.[1] Stroke is a leading cause of death and claims 6 million lives every year worldwide.[2] According to WHO, Stroke and Ischaemic heart disease accounted for a combined 15 million deaths in 2015, more than two third occurring in less developed countries.[3] More than 4% of direct health care expenditure in developed countries is incurred on stroke.[2]Though being one of the leading causes of disability and death worldwide, it gains even more importance because of increasing propensity to affect young people. Up to 10-20% of ischaemic strokes have been reported to occur in young individuals.[4] In India, during the last decade, the crude prevalence rates of stroke was between 136 and 220 per 1,00,000 population.[5-8] It is emphasised that developing countries are facing the main brunt of this disease because of increasing prevalence of hypertension, fast-changing lifestyle and population restructuring.[9]

Etiology of stroke is extremely diverse in the young, risk factors differ considerably in young adults compared to those in older individuals. Lifestyle related risk factors play significant role in causation of stroke.

The most frequent lifestyle related modifiable risk factors are smoking, physical inactivity, arterial hypertension, diabetes, dyslipidemia, and obesity. Besides, alcohol in men and migraine in women are important modifiable risk factors for stroke in young.[10]

Stroke in young causes marked long term socio-economic consequences and has a high public health impact due to associated indirect cost as the young stroke patients are at their most productive age. Prevention of stroke in the young assumes paramount importance as it increases number of quality-weighted life years much more in young than in elderly population. However, despite being so important, stroke in the young has long been understudied and currently available data is still derived mostly from developed countries and from small patient series.[11-13] There is very little knowledge available about preventive impact of low risk lifestyle in the occurrence of disease.[14] A large European cohort of 18 to 55 years patients with acute ischaemic stroke or Transient ischaemic attacks has high prevalence of modifiable risk factors.[10] In a study by Lee et al, vascular risk factors like hypertension, diabetes mellitus, dyslipidemia were seen more commonly in patients with large artery atherosclerotic disease and small vessel occlusive disease.[15] The beneficial impact of low risk lifestyle on prevention of stroke has already been established in Nurses Health Study.[16]

In the light of available literature, it is emphasised that risk factors, particularly related to life style, needs to be studied in detail, stratified and primordial and primary preventive strategies need to be re-evaluated to curb the menace of lifestyle related cerebrovascular events which are definitely preventable.

Objectives

To study the different lifestyle related risk factors in patients of stroke in age group 15-49 years.

Materials and Methods

1. **Study design:** Prospective observational study
2. **Study population:** Patients of stroke between ages 15-49 years, who reported to Outpatient Neurology Services or admitted to a tertiary care service hospital in a metropolitan city in Eastern India.
3. **Sample size:** The proposed sample size to be studied was based on average incidence of 16% of stroke in young adults in India[17] Considering alpha error of 5% and error value of 8% on either side, a sample size of 81 was computed. It was proposed to study 100 patients of young stroke meeting eligibility criteria mentioned below. However, 144 patients presented to study hospital during 31 May 2010 to 30 June 2013 were included in the study. While all the patients were treated for stroke as per standard protocol, the detailed examination and investigations revealed various potential modifiable and non-modifiable risk factors which were analysed in detail.
4. **Study period:** 31 May 2010 to 30 June 2013
5. **Inclusion criteria:** Patients with first ever stroke (ischemic/ hemorrhagic/cerebral venous thrombosis) in age group 15-49 years.
6. **Exclusion criteria:** Stroke patients < 15 years and > 49 years of age, recurrent strokes, and Transient Ischemic Attack (TIA)
7. **Study protocol:** All cases diagnosed as Stroke during the study period at the hospital, underwent detailed history taking, clinical examination, basic and specific investigations. While all the patients were treated for stroke as per standard protocol, the detailed history recorded on a structured Proforma, examination and investigations revealed various potential modifiable and non-modifiable risk factors which were analysed in detail.
8. **Analysis of data:** All raw data collected on proforma entered into a Microsoft Excel Spreadsheet and analysed using standard statistical software, Statistical Programme for Social Sciences (SPSS) 15.0 for Microsoft Windows (SPSS Inc. Chicago, IL, USA), Continuous numerical data was described as means, standard deviations, medians, minimum, maximum and standard error of mean. Further, mean was compared across 3 groups by ANNOVA test, distributions were compared using Pearson's Chi Square Test. Two-sided values of $P < 0.05$ were considered statistically significant.
9. **Parameters studied:** Following lifestyle related risk factors in a patient of stroke in age group 15-49 years were studied:-
   a. **Alcohol:** Alcohol consumption was taken as significant when an individual consumed more than 70 gm of alcohol in females and 140 gm in males per week.[18]
   b. **Smoking:** Smoker was defined as an individual who had smoked greater than 100 cigarettes in their life time and currently smoking prior to event.[19]
   c. **Blood pressure:** Upper level of normal blood pressure was taken as 140/90 mm of Hg.[20]
   d. **Obesity:** As per WHO BMI greater than or equal to 30.[21]
   e. **Diabetes:** As per WHO definition Fasting Blood sugar level >126 mg/dl, RBS > 200 mg/dl in presence of osmotic symptoms.[22]
   f. **Dyslipidemia:** Serum Cholesterol >200mg/dl, LDL > 100mg/dl, Triglycerides > 150mg/dl.[21]
   g. **Haemoglobin level:** Anaemia: <12.0 g/dL in women and <13.0 g/dL in men and Polycythemia.[23,24]
10. **Study format:** Patient's name, address, other personal details were noted and detailed history taking and examination were done at initial presentation Baseline investigations like hemoglobin level (Hb), total leukocyte count (TLC), lipid profile, random blood sugar level (RBS), platelets, prothrombin time (PT), international normalized ratio (INR), chest X ray, electrocardiogram (ECG) were done in all patients and specific investigations were carried out on basis of initial presentation and findings of baseline investigations.

Results

Stroke types and subtypes

In our study, out of 144 patients included in study, 99 (68.7%) patients were of ischemic strokes, 19 (13.2%) patients were of hemorrhagic strokes and 26 (18.1%) patients were of cerebral venous thrombosis (CVT).(Fig. 1)
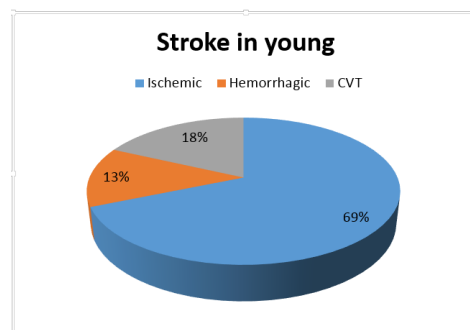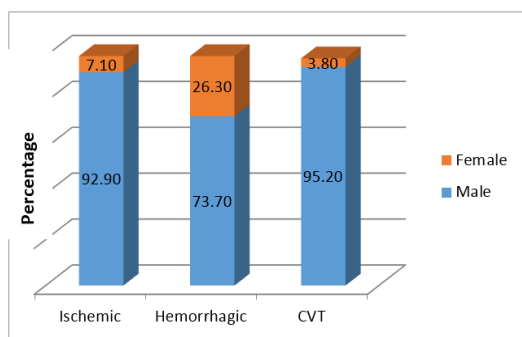

Fig 1: Distribution of Stroke in Young

Sex: Hemorrhagic stroke was seen in 26.3% females whereas 7.1% females were in ischemic stroke group and 3.8% females were in CVT group. (Fig. 2)

**Fig. 2: Distribution of Strokes in Different Sexes**

Risk factors

Alcohol consumption was found in 70 (48.6%) cases, smoking was present in 36 (25%) cases, while 50 (34.7%) cases were hypertensive, 10 (6.9%) cases were diabetic, 15 (10.4%) were obese and dyslipidemia was found in 56 (38.8%); multiple risk factors were found in 22 (15.3%) cases. (Fig. 3)

Alcohol consumption was found in 11 (42.3%) cases of CVT, 10 (52.6%) cases of hemorrhagic strokes and 49 (49.5%) cases of ischemic strokes. (Fig. 4)
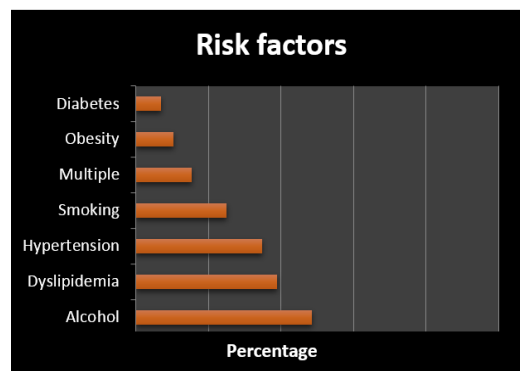
Fig. 3: Distribution of Modifiable Risk Factors Observed among Study Subjects

Smoking was found in 2 (7.7%) cases of CVT, 3 (15.8%) cases of hemorrhagic strokes and 31 (31.3%) cases of ischemic strokes. However it was not an important risk factor in respect of any type of stroke whether CVT, hemorrhagic or ischemic strokes (p value > 0.555) (Table 1) (Fig. 4).

Table 1: Smoking as a risk factor in different types of stroke

		Smoking		Total
		Present	**Absent**	
Group	CVT	2	24	26
	Hemorrhagic strokes	3	16	19
	Ischemic strokes	31	68	99
	Total	36	108	144
Statistical test used	**Value**	**Degree of freedom**		**Significance (2-sided)**
Pearson Chi-Square	36.147	38		.555
Likelihood Ratio	39.890	38		.386
N of Valid Cases	144			
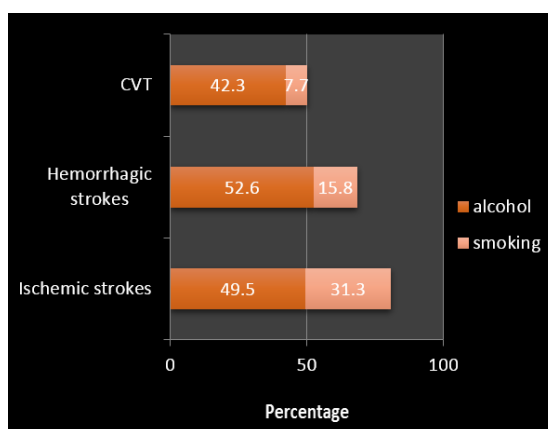
Fig. 4: Alcohol and Smoking in Stroke

Hypertension was present in 12 (63.2%) cases of hemorrhagic strokes, 38 (38.4%) cases of ischemic strokes, whereas none was hypertensive in case of CVT. Past history of hypertension was not found in 7 (36.8%) cases of hemorrhagic strokes amongst whom 4 (21.1%) cases were alcoholic, 2 (10.5%) cases had subarachnoid hemorrhage

and one (5.2%) had tumor bleed (choriocarcinoma). One (5.2%) patient had multiple risk factors. Hypertension was statistically significant as a risk factor in cases of hemorrhagic strokes and ischemic strokes as compare to CVT (p value<0.001 (Table 2)

Table 2: Hypertension in stroke

		Strokes			Total	P Value between Ischemic & Haemorrhagic strokes	P Value between CVT & Ischemic strokes	P Value between CVT & Haemorrhagic strokes
		Ischemic	Hemorrhagic	CVT				
HTN	No	61	7	26	94	0.045	<0.001	<0.001
		61.6%	36.8%	100.0%	65.3%			
	Yes	38	12	0	50			
		38.4%	63.2%	.0%	34.7%			
Total		99	19	26	144			
		100.0%	100.0%	100.0%	100.0%			

Diabetes was present in 10 (10.1%) cases of ischemic strokes, none was found diabetic in cases of CVT and hemorrhagic strokes. However it is not statistically significant when compared with CVT and hemorrhagic strokes (p values 0.091 and 0.148 respectively). (Table 3)

Table 3: Diabetes mellitus in ischaemic stroke, haemorrhagic stroke and DVT

		Strokes			Total
		Ischemic	Hemorrhagic	CVT	
DM	No	89	19	26	134
		89.9%	100.0%	100.0%	93.1%
	Yes	10	0	0	10
		10.1%	.0%	.0%	6.9%
Total		99	19	26	144
		100.0%	100.0%	100.0%	100.0%

Higher values of triglycerides were found in case of CVT (170.69±71.73 mg/dl) as compared to ischemic (140.23±54.36 mg/dl) (p value 0.034) and hemorrhagic strokes (133.37±54.72 mg/dl) (p value 0.018) (Table1) (Table 3). Higher values of triglycerides were associated more with CVT as compared to ischemic and hemorrhagic groups (p value 0.040) (Table 3) (Table2). Statistically significant higher values were found in ischemic strokes as compared to hemorrhagic strokes (p value 0.018) (Table 4).

Table 4: Mean, SD, SE, 95% confidence interval for risk factors

		N	Mean	SD	95% Confidence Interval for Mean		Min	Max		
					Lower Bound	Upper Bound			F statistic	p value
Age	CVT	26	32.54	7.112	29.67	35.41	22	45		
	Hemorrhagic	19	41.00	6.725	37.76	44.24	24	48	14.792	.000
	Ischemic	99	40.08	6.382	38.81	41.35	22	49		
Hb (gm/dl)	CVT	26	14.254	1.6226	13.598	14.909	8.4	17.0		
	Hemorrhagic	19	12.863	1.9394	11.928	13.798	8.2	16.0	3.428	.035
	Ischemic	99	13.743	1.7697	13.390	14.096	8.0	18.2		
CHOL (mg/dl)	CVT	26	183.96	71.733	154.99	212.94	132	481		
	Hemorrhagic	19	164.16	37.993	145.85	182.47	109	285	1.414	.246
	Ischemic	99	168.23	38.287	160.60	175.87	72	280		
TG (mg/dl)	CVT	26	170.69	71.768	141.70	199.68	85	435		
	Hemorrhagic	19	133.37	54.722	106.99	159.74	53	279	3.281	.040

	Ischemic	99	140.23	54.356	129.39	151.07	48	345		
HDL (mg/dl)	CVT	26	43.15	13.266	37.80	48.51	30	100		
	Hemorrhagic	19	42.47	5.274	39.93	45.02	38	60	1.528	.221
	Ischemic	99	40.34	6.718	39.00	41.68	20	68		
LDL (mg/dl)	CVT	26	110.77	52.582	89.53	132.01	45	306		
	Hemorrhagic	19	97.32	27.968	83.84	110.80	48	168	1.040	.356
	Ischemic	99	99.56	34.347	92.71	106.41	22	195		

Cholesterol levels were higher in case of CVT with mean value of 183.96±71.3 mg/dl as compared to ischemic strokes (mean value 168.23±38.2 mg/dl) and hemorrhagic strokes (mean value 164.16±37.9 mg/dl), however these were not statistically significant (p value 0.246) (Table 5) (Table 2). Similarly, differences in HDL and LDL levels amongst different types of strokes were not statistically significant (p values 0.221 and 0.356 respectively) (Table 4)

Lower level of hemoglobin was found in cases of hemorrhagic strokes with mean Hb level being 12.8±1.92 gm/dl as compared to ischemic strokes (mean Hb level 13.7±1.77 gm/dl) and CVT (mean Hb level 14.3± 1.62 gm/dl). Lower values are associated with hemorrhagic strokes (p value 0.010). Also higher values of Hb are associated with CVT as compared to ischemic strokes (p value0.035). (Tables 4, 5) There were 6 cases of migraine observed in our study.

Table 5: Multiple Comparisons

Dependent Variable	(I) group cat	(J) group cat	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Age	1.00	hemorrhagic	-8.462*	1.980	.000	-12.38	-4.55
		ischemic	-7.542*	1.446	.000	-10.40	-4.68
	2.00	CVT	8.462*	1.980	.000	4.55	12.38
		ischemic	.919	1.643	.577	-2.33	4.17
	3.00	CVT	7.542*	1.446	.000	4.68	10.40
		hemorrhagic	-.919	1.643	.577	-4.17	2.33
Hb(gm/dl)	1.00	hemorrhagic	1.3907*	.5334	.010	.336	2.445
		ischemic	.5104	.3895	.192	-.260	1.280
	2.00	CVT	-1.3907*	.5334	.010	-2.445	-.336
		ischemic	-.8803*	.4427	.049	-1.755	-.005
	3.00	CVT	-.5104	.3895	.192	-1.280	.260
		hemorrhagic	.8803*	.4427	.049	.005	1.755
CHOL(mg/dl)	1.00	Hemorrhagic	19.804	13.882	.156	-7.64	47.25
		ischemic	15.729	10.136	.123	-4.31	35.77
	2.00	CVT	-19.804	13.882	.156	-47.25	7.64
		ischemic	-4.074	11.520	.724	-26.85	18.70
	3.00	CVT	-15.729	10.136	.123	-35.77	4.31
		hemorrhagic	4.074	11.520	.724	-18.70	26.85
TG(mg/dl)	1.00	hemorrhagic	37.324*	17.466	.034	2.79	71.85
		ischemic	30.460*	12.753	.018	5.25	55.67
	2.00	CVT	-37.324*	17.466	.034	-71.85	-2.79
		ischemic	-6.864	14.495	.637	-35.52	21.79
	3.00	CVT	-30.460*	12.753	.018	-55.67	-5.25
		hemorrhagic	6.864	14.495	.637	-21.79	35.52
HDL(mg/dl)	1.00	hemorrhagic	.680	2.454	.782	-4.17	5.53
		Ischemic	2.810	1.792	.119	-.73	6.35
	2.00	CVT	-.680	2.454	.782	-5.53	4.17
		ischemic	2.130	2.037	.297	-1.90	6.16
	3.00	CVT	-2.810	1.792	.119	-6.35	.73
		hemorrhagic	-2.130	2.037	.297	-6.16	1.90
LDL(mg/dl)	1.00	hemorrhagic	13.453	11.333	.237	-8.95	35.86
		ischemic	11.214	8.275	.178	-5.15	27.57

2.00	CVT	-13.453	11.333	.237	-35.86	8.95
	ischemic	-2.240	9.405	.812	-20.83	16.35
3.00	CVT	-11.214	8.275	.178	-27.57	5.15
	hemorrhagic	2.240	9.405	.812	-16.35	20.83

Discussion

This study had higher ratio of male:female (10:1) as compared to previous study done by Putaala et al,[4] which showed a male: female ratio of 1.7:1 and a ratio of 1.8:1 in another study by Razzaq et al.[16] There were higher proportion of females in hemorrhagic group as compared to ischemic stroke group and CVT. This study also found that CVT was more prevalent in younger age group as compared to ischemic and hemorrhagic strokes in young.

In this study, highest incidence of ischemic strokes (69%) was found as compared to hemorrhagic strokes (13.2%) and CVT (18.1%), which is corroborated by previous studies from Asia and other parts of the world.[4,17,25,26,27]

This study showed that common risk factors in cases of stroke in young were dyslipidemia (38.8%), hypertension (34.7%), followed by multiple risk factors in 15.3% cases and diabetes was found in 10.4% cases. In this study, we found alcohol consumption in 48.6% and smoking in 25% of strokes in young. Previous studies also showed that alcohol and smoking were important risk factors.[15,28,29,30] Strong dose response relationship between cigarette smoking and risk of ischemic stroke in young has reinforced the need for aggressive smoking cessation efforts. The risk of having stroke decreases after 3 years of cessation of smoking and reaches to the level of non smokers after 5 years of cessation of smoking. Smoking cessation has immediate and long term health benefits to men and women of all age groups and the life expectancy in a smoker who quits smoking before attaining the age of 35 years is as good as non smokers.[31]

In our study, Hypertension was present in 50 (34.7%) cases of stroke in young. Hypertension was more prevalent in haemorrhagic stroke (63.2%) than ischaemic stroke, none was hypertensive in case of CVT. Hypertension was statistically significant as a risk factor in cases of hemorrhagic strokes and ischemic strokes as compare to CVT (p value<0.001).

The study by Nayak et al showed 42% cases of stroke had dyslipidemia, 18% had hypertension and diabetes mellitus was present in 7%.[28]Sridharan et al found hypertension, dyslipidemia and diabetes mellitus associated as risk factors with stroke in young population[32,] in our study we found higher percentage (34.7% of patients) had hypertension amongst strokes similar to study conducted by Lee et al which showed hypertension in 45.8% of young strokes. A study from Switzerland found hypercholesterolemia in 39% and hypertension in19% of cases of strokes in young.[30] Helsinki Young Stroke Registry found multiple causes in 21 patients out of 1008 patients of young strokes.[4] A study from Pakistan showed hypertension in 14% and miscellaneous causes in 4% of cases.[33]

Among 4467 patients in Fabry patients study, most frequented modifiable risk factors were smoking (55.5%), physical inactivity (48.2%), arterial hypertension (46.6%), dyslipidemia (34.9%), obesity 922.3%) and alcohol consumption (33%)[10] as also in our study we found alcohol(48.6%), smoking(25%), dyslipidemia (38.8%) diabetes (10.4%) and multiple risk factors in 15.3 % cases.

In a case control study in South India stroke cases had higher prevalence of smoking (multivariate adjusted Odd's ratio(OR) 7.77, CI 1.93 to 31.27, higher systolic blood pressure (OR per SD increment of 1.88, 95% CI 1.01 to 3.49], and fasting blood glucose [OR per SD increment of 4.55, 95% CI 1.63 to 12.67], but lower high density lipoprotein (HDL) cholesterol [OR per SD increment of 0.17, 95%CI 0.09 to 0.30] when compared with community control. In the same study when compared with hospital control, stroke patients had higher prevalence of smoking [OR 3.95, 95% CI 1.61 to 9.71], and lower HDL cholesterol [OR per SD increment 0.27, 95% CI 0.17 to 0.44]. [29] In a study on long term prognosis after stroke in Netherland (n 406), smoking (46.1%), dyslipidemia (30.8%), hypertension (25.4%), diabetes (4.7%), and excess drinking (4.9%) were significant cardiovascular risk factors.[2]In our study, we found that diabetes is mainly a risk factor for ischemic stroke as supported by previous studies.[4, 15, 32]In our study obesity was less (10.4%) as against 22.3% in Fabry study.[10] Obesity, both general and abdominal is associated with higher risk of stroke, which may be the cause of increased incidence of stroke in women[10]

Dyslipidemia is an important risk factor for stroke in previous studies[4, 10, 28], which is also shown in our study. However, in our study we found that high triglyceride and high cholesterol level were associated more with CVT as compare to ischaemic and haemorrhagic group amongst the different types of stroke.

In our study, we observed that anaemia is an important risk factor in hemorrhagic strokes as compared to ischemic strokes and CVT which is in consonance with earlier studies.[17]

Higher values of hemoglobin were associated with CVT as compared to ischemic and hemorrhagic strokes which is corroborated by previous data that found polycythemia as a known risk factor for CVT.[34]

Conclusions

Amongst lifestyle related problems alcohol, smoking, hypertension, diabetes and dyslipidemia

followed by obesity were important risk factors for strokes in young. Significant proportions of patients were found to have multiple risk factors. Hypertension and lower levels of hemoglobin were associated with hemorrhagic strokes. Higher levels of hemoglobin were associated with CVT. It is well documented that unhealthy life style not only leads to increased chances of stroke, but also carries higher all cause mortality after stroke. The need of immediate vigorous primary and secondary preventive measures targeting the lifestyle modifications and risk factor among young population in developing countries in inevitable to curb the menace.

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