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Original Research Article

Likelihood of rising stroke in populace of western India: a case control study

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ABSTRACT

Background: Cerebrovascular accident (Stroke) is a non-communicable disease of increasing importance. According to the World Health Organization, 15 million people suffer from stroke worldwide each year. The National Commission on Macroeconomics and Health, India, has estimated 1.67 million stroke cases in India. Due to the increasing prevalence of hypertension, diabetes, dyslipidemia, fast changing lifestyle and re-structuring of population, stroke will be an epidemic in India in the days to come. Few studies have been carried out in developing countries like India. So, this study intended to know the presentation in addition to risk factors, patterns of warning signs and symptoms of stroke in patients admitted to state tertiary care Hospital.
Methods: Assuming the power ratio of the number of controls same as numbers of cases specifying values for two sided confidence level 95% and odd ratio 2.15 which was the minimum risk factor in previous study was taken to calculate sample size.
Results: After studying of 148 cases of stroke and same controls, we conclude that most common type of stroke is ischemic stroke followed by haemorrhagic stroke. After multivariate analysis we found, modifiable risk factors were mainly mental stress, active and passive smoking, hypertension and obesity.
Conclusions: Due to the sheer magnitude, devastating consequences and residual sequelae of the stroke, early intervention in the form of patient education, modification of the lifestyle, non-pharmacological and pharmacological interventions for modifiable risk factors should be an integral aspect of patient care.

Keywords: Cerebrovascular accident, Haemorrhagic stroke, Ischemic stroke, Stroke

INTRODUCTION

In today's fast paced world, the epidemic of non-communicable diseases, which include cardiovascular diseases, diabetes, hypertension, stroke, most forms of cancers and injuries is gradually become a public health problem of grave concern. Out of these, Cerebrovascular accident (Stroke) is increasing importance as presenting with medical emergency and can cause permanent neurological damage and death.[1]

According to the World Health Organization (WHO), 15 million people suffer from stroke worldwide each year. Globally, in 2013 there were 6.5 million stroke deaths; this makes stroke the second most common leading cause of death after ischemic heart disease.[2]

The National Commission on Macroeconomics and Health, India, has estimated 1.67 million stroke case in India in 2015.[3] The cumulative incidence of stroke in India ranged from 105 to 152/100,000 persons per year during the past two decades in different parts of the

country.[4] Prevalence reflects the balance between incidence and mortality, a low prevalence may be due to low incidence or high mortality or both; conversely, a high prevalence may be due to high incidence or low mortality or both.[5]

There are two types of episodes of stroke depending on its site of occurrence in the brain. A minor episode of the stroke (TIA) may result in minor problems, such as weakness in an arm/s or leg/s. A major episode of the stroke may lead to paralysis or even death. Many stroke patients are left with weakness on one side of the body, difficulty in speaking, incontinence and/or bladder problem.

There are two major stroke sub-types: Ischemic stroke and hemorrhagic stroke. Ischemic stroke occurs as a result of an obstruction within a blood vessel supplying blood to the brain, it may be thrombotic or embolic. It accounts for 87 percent of all stroke cases.[6] Hemorrhagicstroke caused by the rupture of a blood vessel in or on the surface of the brain with bleeding into the surrounding tissue.

Stroke is a multi-factorial disease that occurs due to a combination of various risk factors, all of which may not necessarily be present at the time of its occurrence. Due to the increasing prevalence of hypertension, diabetes, dyslipidemia, fast changing lifestyle and re-structuring of population, stroke will be an epidemic in India in the days to come.[3]

As defined by WHO, the most common symptoms/signs of a stroke is sudden onset of weakness or numbness of the face, arm/s or leg/s, most often on one side of the body. Other symptoms include: confusion, difficulty in speaking or understanding speech; difficulty in seeing with one or both eyes; difficulty in walking, dizziness, loss of balance or coordination; severe headache with no known cause; fainting or unconsciousness.[7]

Few studies have been carried out in developed countries, but very fewer studies are done in developing countries like India etc.[8-11] These studies identified several risk factors that are significantly associated with cerebrovascular stroke. As well, studies reveal that primary prevention and lifestyle modification will reduce the incidence of cerebrovascular stroke. The present study was conducted to ascertain the patterns of warning signs and symptoms and likelihood of stroke in populace.

METHODS

In this case control study, assuming the power ratio of the number of controls same as numbers of cases specifying values for two sided confidence level 95% and odd ratio 2.15 which was the minimum risk factor in previous study was taken to calculate sample size. So, considering 82% percent of cases with exposure and 68% percent of controls with exposure, the total sample size was 296 including 148 cases and 148 controls have been selected.

Cases were those whose diagnosis was confirmed by CT Scan/MRI. The recruits of cases in the study were incident cases (first ever in the lifetime) within 72 hours after admission. If the patient was unable to communicate sufficiently to complete the study questionnaire, proxy respondent was used.

The controls were selected from patients who were admitted in the same ward for conditions other than stroke. For each case of stroke, one control was selected. 148 controls were selected in the same manner, as explained in sample size.

A standard profoma approved by IECHR of government medical college was used to collect patient's details. We collected data from medicine wards and MICU of tertiary care hospital of western India from January 2018 to June 2018. Data entry and analysis completed in august 2018 when final report prepared in October 2018.

Data was collected by using a structured questionnaire in local language. Data was entered in MS excel 2007, and was analysed by with using EPI INFO TM 7 software. Descriptive analysis will be used for analysis to determine characteristics of cases and controls. Odds ratio will be calculated for each and every risk factor. Exposure factors among cases and control will be calculated by chi-square test for all the risk factors. Univariate analysis and multivariate analysis to assess risk factors associated with cerebrovascular stroke. Odds ratio with 95% confidence interval was calculated using univariate and multivariate Cox regression models respectively. All variables with significant association in univariate analysis were included in the logistic multivariate analysis.

Possible bias in this study might be selection bias and recall bias. It was not possible to remove bias completely, but due care has been taken to minimize bias.

RESULTS

In present case control study, 148 newly diagnosed confirmed patients of cerebrovascular accident (stroke), the recruits of cases in the study were incident cases (first ever in the lifetime) within 72 hours after admission in hospital, were enrolled as cases and controls were selected among patients who were admitted in the same ward for conditions other than cerebrovascular accident. For each case of stroke, one control was selected from the same ward

Types of stroke

As shown in Figure 1, 112 (75.68%) were an ischemic stroke followed by 35 (23.65%) were haemorrhagic stroke and one (0.68%) patient having both ischemic and haemorrhagic stroke. Ischemic stroke are more in this

study, and same thing observed by the study done by Kubota Y et al (2017), during the 698 946 person-years of follow-up, a total number of 2738 incident cases of stroke, including 1007 haemorrhagic strokes (747 intra-parenchymal and 260 subarachnoid haemorrhages) and 1721 ischemic strokes (1206 non-embolic and 515 embolic infarctions).[12]

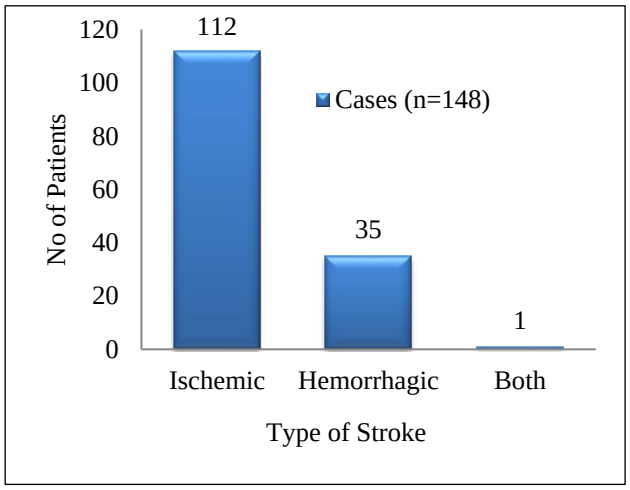

Figure 1: Distribution of cases according to types of stroke (n=148).

Arterial involvement in ischemic stroke

Figure 2 showing, distribution of study subjects according to arterial involvement in ischemic stroke. 23.21% were ICA and PCA involvement, 21.43% were MCA involvement, 20.54% were ICA involvement followed by small arteries 9.28%, MCA and PCA 8.93%, PCA 6.25%, vertebral artery 2.68%, ICA and Basilar artery 2.68%, age related atrophy 2.68%, ICA and vertebral artery 0.89% and 0.89% (one) patient having venous sinus thrombosis respectively.

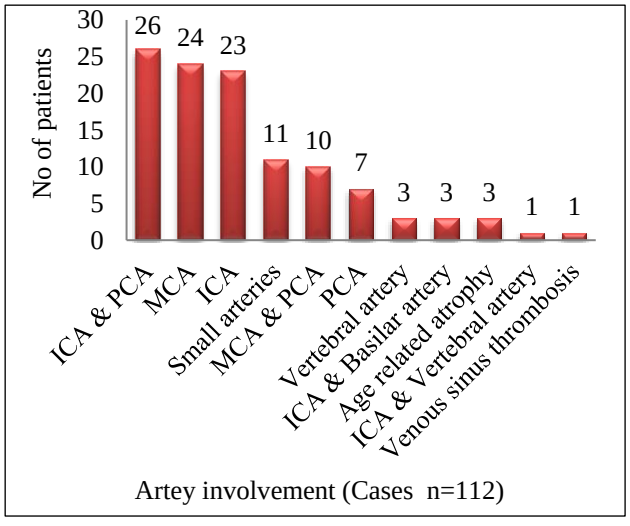

Figure 2: Distribution of cases according to arterial involvement in ischemic stroke (n=112).

Haemorrhagic stroke (area of lesion in brain)

Figure 3 showing, distribution of study subjects according to involvement of brain site in haemorrhagic stroke. More than half of patients (63%) having multiple brain area involvement. Followed by parietal lobe 9%, temporo-parietal lobe 6%, fronto-parietal lobe 6%, frontal lobe 6%, gangliocapsular region 6%, thalamus 2% and cerebellar 2% brain site involvement.

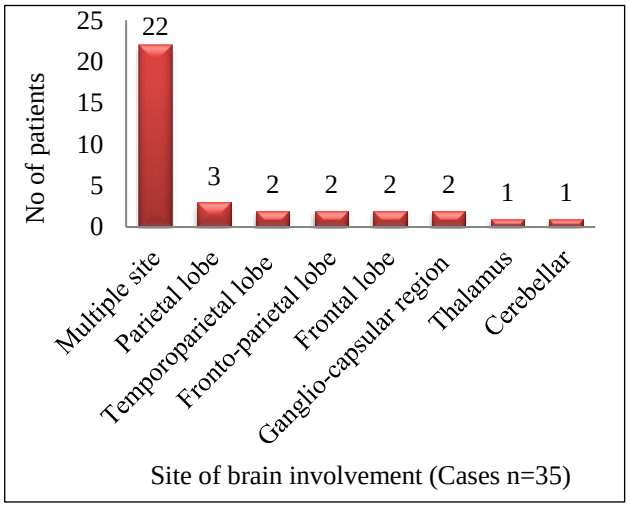

Figure 3: Distribution of cases according to affected brain site in haemorrhagic Stroke (n=35).

Sign of stroke

Distribution of cases according to sign of stroke as shown in Figure 4, 97 male cases and 48 female cases having weakness of one half of body/part of body, 84 male cases and 39 female cases having inability/difficulty in speech, 62 male cases and 29 female cases having dizziness/spinning followed by 58 male cases and 29 female cases having imbalance, 35 male cases and 19 female cases having severe headache, 23 male cases and 10 female cases having loss of consciousness, 16 male cases and 4 female cases having seizures and 12 male cases and 9 female cases having blindness/decrease vision and.

Out of the 296 subjects in the study, 148 cases and 148 controls were distributed by their sociodemographic profile as shown in Table 1.

In the present study, 28 (19%) of the 148 cases were less than 40 years of age. We found multiple risk factors that may be the likely cause of stroke in the young age group, the frequencies of risk factors are in descending manner mental stress for family (14.19%), stress about job (13%), passive smoker (12%), warning of LDL/HDL ratio found in (12.16%), mental stress for both job and family (10.14%), high waist hip ratio (10%), family of stroke/TIA (8.11%), obesity (7.43%), and smoker (7%).

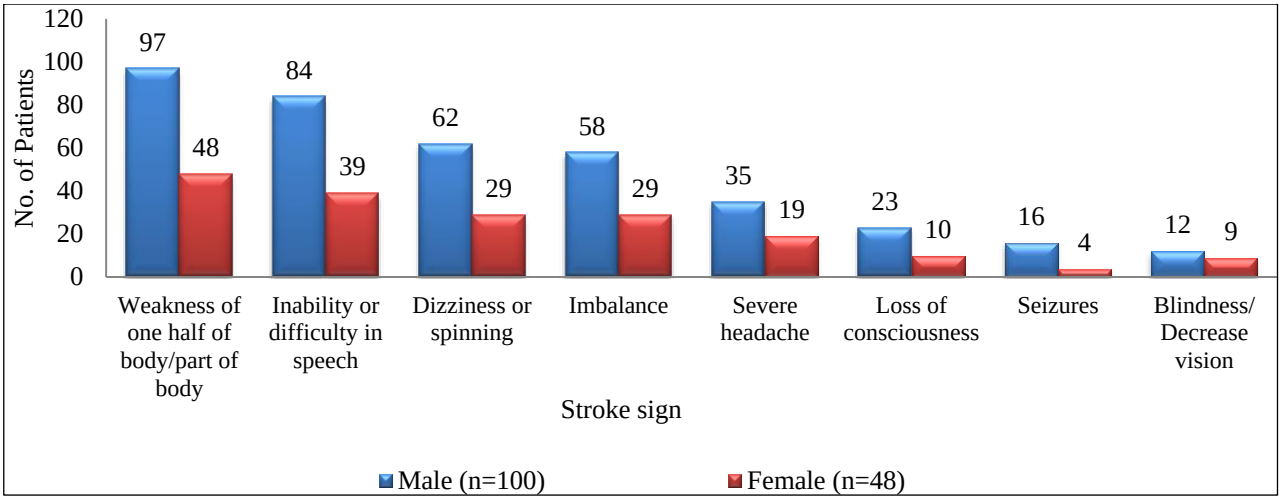

Figure 4: Distribution of cases according to sign of stroke.

Table 1: Socio-demographic characteristics of patients of cerebrovascular accident (stroke) and controls selected from the tertiary care hospital of western India.

Variables	Cases (n= 148)	Controls (n=148)
Gender distribution		
Male	100 (67.57%)	100 (67.57%)
Female	48 (32.43%)	48 (32.43%)
Religion of patients		
Hindu	135 (91.22%)	127 (85.81%)
Muslim	13 (8.78%)	21 (14.19%)
Marital status*		
Married	120 (81.08%)	142 (95.95%)
Unmarried	4 (2.70%)	2 (1.35%)
Other	24 (16.22%)	4 (2.70%)
Socio-economic class**		
Class – 5	5 (3.38%)	0
Class – 4	3 (2.03%)	6 (4.05%)
Class – 3	11 (7.43%)	10 (6.76%)
Class – 2	40 (27.03%)	37 (25%)
Class – 1	89 (60.14%)	95 (64.19%)
Age distribution		
< 30 years	13 (8.78%)	6 (4.05%)
31 - 40 years	15 (10.14%)	7 (4.73%)
41 - 50 years	28 (18.92%)	18 (12.16%)
51 - 60 years	41 (27.70%)	64 (43.24%)
61 - 70 years	39 (26.35%)	46 (31.08%)
> 70 years	12 (8.11%)	7 (4.73%)
Geographical distribution		
Rural	95 (64.19%)	90 (60.81%)
Urban	53 (35.81%)	58 (39.19%)

* Other (Widow, Widower and Divorce). ** According to the Modified BG Prasad's Socio-economic Classification-2018 (Modified according to current CPI Jan 2018=288

After applying logistic regression, we found result as shown in Table 2, Odds of getting stroke was 3.55 (CI: 1.66-7.60) times higher in smokers, 2.35 (CI: 1.16-4.75) times higher in passive smoker, 3.40 (CI: 1.79-6.42) times higher in those patients having stress about family, 2.79 (CI: 1.38-5.66) times higher in hypertensive patients, 5.89 (CI: 2.16-16.07) times higher in patients with high waist hip ratio and 2.20 (CI: 1.14 to 4.24) times higher in obese patients.

Table 2: Multivariate analysis of risk factors affecting stroke after applying unconditional logistic regression.

Term	Odds ratio	95%C.I.	Coefficient	S. E.	Z-statistic	P-value
Smoker (Yes/No)	3.55	1.66 to 7.60	1.27	0.39	3.26	0.001
In contact with smoker (yes/no)	2.35	1.16 to 4.75	0.85	0.36	2.38	0.017
Fruits consumption (yes/no)	0.57	0.27 to 1.17	-0.57	0.38	-1.53	0.13
Stress about family (yes/no)	3.39	1.79 to 6.42	1.22	0.33	3.75	0.0002
Known case of DM (yes/no)	2.18	0.96 to 4.97	0.78	0.42	1.85	0.06
Known case of HT (Yes/No)	2.79	1.38 to 5.66	1.03	0.36	2.85	0.004
Waist/hip ratio-(moderate/low)	0.97	0.37 to 2.54	-0.03	0.49	-0.06	0.95
Waist/hip ratio (high/low)	5.89	2.16 to 16.07	1.77	0.51	3.46	0.0005
Physical activity (moderate/vigorous)	0.84	0.41 to 1.74	-0.17	0.37	-0.46	0.64
Physical activity (sedentary/vigorous)	1.62	0.72 to 3.67	0.49	0.41	1.18	0.24
BMI (obese/normal)	2.20	1.14 to 4.24	0.79	0.33	2.36	0.02

Table 3: Presence of four risk factors in cases with percentage of occurrence of stroke.

Risk factors	Total no of patients	%
Stress for family + F/H of stroke + Obese + W/H ratio (high)	19	12.84
Stress for job + F/H of stroke + Obese + W/H ratio (high)	15	10.14
Stress for both job and family + F/H of stroke + Obese + W/H ratio (high)	11	7.43
HT + F/H of stroke + Obese + W/H ratio (high)	11	7.43
DM + F/H of stroke + Obese + W/H ratio (high)	7	4.73

Table 4: Presence of three risk factors in cases with percentage of occurrence of stroke.

Risk factors	Total no of patients	%
Stress for both job and family + HT + Passive smoker	35	23.65
F/H of stroke + Obese + W/H ratio (high)	26	17.57
Stress for both job and family + HT + DM	26	17.57
Stress for both job and family + DM + Passive smoker	24	16.22

Table 5: Presence of two risk factors in cases with percentage of occurrence of stroke.

Risk factors	Total no of patients	%
Stress for family + HT	59	39.86
Stress for both job and family + Passive smoker	55	37.16
Stress for Job + HT	48	32.43
Stress for both job and family + HT	42	28.39
DM + Family stress	41	27.7
DM + HT	38	25.68
Job stress + DM	37	25
Stress for both job and family + DM	31	20.95

After applying multivariate logistic analysis, we found chance of getting stroke was six times higher among patients with high waist hip ratio (OR-5.89, 95% CI-2.16 to 16.07, p-0.0005), four times higher among smokers (OR-3.55, 95% CI-1.66 to 7.60, p-0.001), three times higher among those patients having stress for family (OR-3.39, 95% CI-1.79 to 6.42, p-0.0002), three times higher among hypertensive patients (OR-2.79, 95% CI-1.38 to 5.66, p- 0.004), two times higher among passive smoker (OR-2.35, 95% CI-1.16 to 4.75, p-0.02) and two times higher among obese patients (OR-2.20, 95% CI-1.14 to 4.24, p-0.02).

As per the three Table (3 to 5) shows that presence of multiple risk factors with frequency of occurrence of stroke, the presence of four risk factors, stress for family + family history of stroke + Obese + W/H ratio (high) with 19 (12.84%) of cases, the presence of three risk

factors stress for both job and family + HT + Passive smoker with 35 (23.65%) of cases and presenting of two risk factors stress for family + HT 59 (39.86%) of cases have a higher risk for stroke.

DISCUSSION

Some reference studies as mentioned below, we observed that their results are more or less same as of our study.

A meta - analysis conducted by Shou et al, DM is an independent risk factor for stroke recurrence; a meta - analysis of 18 studies involving 43,899 pre-stroke participants showed a higher recurrence of stroke in patients with DM compared to those without (HR, 1.45; 95 percent CI, 1.32-1.59).[13]

A study conducted by Lee et al and Oono et al, meta-analyses estimated a pooled RR of 1.25 for exposure to (or nearest equivalent) spousal smoking and stroke risk. A dose-response relationship between second - hand smoke exposure and risk of stroke has also been reported.[14,15]

A study conducted by Lindbohm et al, The FINRISK study found a strong association between current smoking and SAH compared to non-smokers (HR, 2.77; 95% CI, 2.22–3.46) and reported a dose - dependent and cumulative association with the highest risk of SAH in high-smoking women.[16]

A Meta-analysis done by Guo et al, the pooled adjusted RR of stroke was 1.36 (95% CI: 1.28-1.44) for overweight in young adulthood and 1.81 (95% CI: 1.45-2.25) for obesity in young adulthood. In subgroup analyses, overweight and obesity in young adulthood increased the risk of stroke in most groups, except for the group of stroke subtype. For ischemic stroke, the adjusted RR was 1.40 (95% CI: 1.24-1.58) for overweight in young adulthood and 1.78 (95% CI: 1.003-3.16) for obesity in young adulthood, whereas adjusted RR for haemorrhagic stroke was 1.25 (95% CI: 0.83-1.90) for overweight in young adulthood and 1.80 (95% CI: .97-3.35) for obesity in young adulthood. The risk effect gradually increases with increasing body weight.[17]

A study done by Ohlsson et al, BMI increase through puberty and adolescence (hazard ratio [HR] 1.21 per SD increase; 95% confidence interval [CI] 1.14-1.28), but not childhood BMI, was independently associated with risk of adult stroke. Sub analyses revealed that BMI increase through puberty and adolescence was associated with both IS (HR per SD increase 1.19; 95% CI 1.11-1.28) and ICH (HR per SD increase 1.29; 95% CI 1.15-1.46). High BMI increase during puberty was strongly associated with increased risk of adult hypertension (odds ratio per SD increase 1.35; 95% CI 1.32–1.39).[18]

A study done by Lee et al, participants with high TG and low HDL levels had a 1.32-fold greater HR (hazard ratios) (95% CI 1.06-1.64) for CHD than those with normal TG and normal HDL levels. It was observed in participants with diabetes, but not in those without diabetes, that high TG plus low HDL levels were associated with a 1.54-fold greater HR (95% CI 1.15-2.06) for CHD (*P* value for interaction = 0.003) and a 2.13-fold greater HR (95% CI 1.06-4.29) for stroke (*P* value for interaction = 0.060). High TG and low HDL level was associated with CHD risk in participants with an LDL-C level of ≥130 mg/dl, but this was not observed in those participants with lower LDL-C levels. Sex did not appear to modify these associations. Adults with both high TG and low HDL-C, particularly those with diabetes, have increased risks of incident CHD and stroke. In particular, those with an LDL-C level ≥130 mg/dl may have an increased risk of incident stroke.[19]

This study has some limitations. The Generalisability of the results of the study is limited to those attending the state hospital. This is a hospital based study and patients reaching tertiary care hospital include those who are chronically ill have failed to get relief at various previous treatment centres or have come directly to hospital therefore generalisation is limited. The study has all the inherent limitations of a case control study, i.e. inaccurate information on the recall.

CONCLUSION

After studying of 148 cases of cerebrovascular stroke for type and pattern of sign & symptoms, we conclude that most common type of stroke is ischemic stroke with prevalence of 76% followed by haemorrhagic stroke with prevalence of 24%. Patients with stroke showed warning signs and symptoms depending very much on the involvement of the artery and the brain. The most common signs are the weakness of one half of the body followed by difficulty in speech and dizziness, and the most common involvement of the artery in ischemic stroke is 23% of ICA and PCA followed by 21% of MCA and 21% of ICA and 63% of patients with multiple brain site involvement in haemorrhagic stroke. Socio-demographic characteristics of study subjects indicate Hindu married male patients with mean age of 54 years living in rural areas were affected more. The male female ratio was 2.08. Males have been more affected than females. Since women are neglected in our society and they have less access to the hospitals, this male female ratio could be another reason. After applying multivariate logistic analysis, we found chance of getting stroke was six times higher among patients with high waist hip ratio, four times higher among smokers, three times higher among those patients having stress for family, three times higher among hypertensive patients, two times higher among passive smoker and obese patients.

Recommendations

This study implicates seriousness of the need to implement and sustain appropriate stroke preventive

measures like sensitise the people about cerebrovascular accident, its warning signs/symptoms and its risk factors at different levels and also in primary, secondary and tertiary health care by role play, health talk, displaying posters and must be repeatedly promoted for public awareness in both electronic and print media.

Most of the significant risk factors in the present study are potentially modifiable and increasing awareness of the primary prevention of these risk factors can be beneficial to the at-risk population. Due to the sheer magnitude, devastating consequences and residual sequelae of the stroke, early intervention in the form of patient education, modification of the lifestyle, non - pharmacological and pharmacological interventions should be an integral aspect of patient care.

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