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RISK FACTORS FOR STROKE : A CASE CONTROL STUDYVijaya Sorganvi¹, M. S. Kulkarni², Deepak Kadeli³, Suhasini Atharga³¹Dept. of Community Medicine, BLDE University's (Deemed), Shri B.M.Patil Medical College, Hospital and Research Centre, Solapur Road, Bijapur, Karnataka, India²Department of P & SM, Goa Medical College, Bambolim Goa, India³Dept. of General Medicine, BLDE University's (Deemed), Shri B.M.Patil Medical College, Hospital and Research Centre, Solapur Road, Bijapur, Karnataka, India

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ABSTRACT

Background: Stroke is global health problem and is a leading cause of disability. It is one of the leading causes of mortality and morbidity worldwide. In rapid increase in burden of stroke in coming years and limited availability of stroke care in India, it would be better to study stroke prevention strategies. The current hospital based case-control study was undertaken with aim, to identify the risk factors for stroke.

Material and Method: Study was carried out in BLDEU's Shri B M Patil Medical College, Hospital & Research Centre. A prospective case-control, age and sex matched study was designed to find the risk factors. Cases: The study consisted of 100 hospitalized computed demography (CT) scan proved cases of stroke. Controls: The controls were selected from patients who attended the study hospital for conditions other than stroke (confirmed with CT scan). For each case of stroke, one control was selected. The controls were matched to cases in respect to age (± 5 years), sex. One hundred controls were selected in the same manner.

Results: Bivariate analysis included odds ratio and its 95% confidence intervals were indentified, hypertension (OR=3.807), diabetes (OR=3.473), hypercholesteremia (OR=3.768), obesity (OR=2.471), smoking (OR=2.42), family history of stroke (OR=2.359), and transient ischemic attack (OR=2.006) as a risk factors for stroke.

Conclusion: This is a study that quantifies the contribution of different factors to the overall risk of stroke. Finding that, hypertension, hypercholesterolemia, diabetes are the biggest risk factors for all type of strokes is important because like many other factors, these are modifiable risks, that can be treated by appropriate medication and life style changes.

Keywords: Stroke, Risk factors, case-control study, odds ratio, 95% confidence interval.

INTRODUCTION

It has been suggested that no single medical measure could makes as much as contribution to the quality of life in old age as prevention of cerebro-vascular disease. An understanding of the etiological factors that contribute to the onset of stroke is required in order to assess the potential for stroke prevention (1).

Stroke is global health problem and is a leading cause of disability. It is one of leading causes of mortality and morbidity worldwide.

Approximately 20 million people each year will suffer from stroke ⁽²⁾. And of these 5 million will not survive. Developing countries accounts for 85% of global deaths from stroke (3). Stroke is also a leading cause of impairment with 20% of survivors requiring institutional care after 3

months and 15% - 30% being permanently disabled⁽⁴⁾. It is a life changing event that affects not only the person who may be disabled, but their family and caregivers.

India with more than 1 billion inhabitants is undergoing remarkable economic and demographic changes in recent years, resulting in a transition from poverty - related infections and nutritional deficiency diseases towards lifestyle related cardiovascular and cerebro-vascular diseases^(5,6). Despite rapid economic boom, a large segment of the Indian population still lives in poverty. Given the anticipated increase in burden of stroke incoming years.

The prevalence of stroke in India varies in different regions of country and the estimated prevalence rates increases from 0.3/1000 in <45 years age group to 12-20/1000 in the 75-84 years age group.⁽⁷⁾ Approximately 12% of all strokes occur in a population < 40 years of age.⁽⁸⁾

It is generally acknowledged that stroke is a multi-factorial condition. A number of risk factors have been shown to be associated with stroke namely age, sex, hypertension, serum cholesterol, alcohol intake, smoking diabetes mellitus obesity, physical inactivity, family history of transient ischemic attack and dietary factors. However, their relative contribution in the outcome of stroke varies from study to study and from population to population^(9- 20).

In rapid increase in burden of stroke in coming years and limited availability of stroke care in India, it would be better to study on population based stroke prevention strategies, because preventive methods will reduce the incidence of stroke. So in view of the increasing incidence, high health care costs and the potential for prevention of stroke a current study was undertaken to identify the important risk factors contributing to the outcome of stroke.

METHODS

The present study was carried out at BLDEU's Shri B M Patil Medical College, Hospital &

Research Centre, Bijapur India. The study was designed as age (± 5) and sex matched case control study.

CASES

The study consisted of 100 hospitalized computed demography (CT) scan proved cases of stroke. The recruitment of cases in the study was performed prospectively and only incident cases (first ever in the lifetime) were included. Hence we did not include cases who had a past history of any type of stroke.

CONTROLS

The controls were selected from patients who attended the study hospital for conditions other than stroke (confirmed with CT scan). For each case of stroke, one control was selected. The controls were matched to cases in respect to age (± 5 years), sex. One hundred controls were selected in the same manner.

SAMPLE SIZE

A pilot study, using the method described below, was performed to determine the sample size and for assessing the feasibility of the study. Six risk factors for stroke were determined in 30 randomly selected stroke cases admitted in medicine wards and equal number of age and gender matched controls admitted to diseases other than stroke in the same medicine wards.

The odds ratio of six risk factors were estimated. An average odds ratio 3.0 and prevalence of hypertension in general population 10%,⁽²¹⁾ allowable error of 5% and with 90% the power of study, sample size calculated was 93 (Lwanga SK and Lemeshow S)²².

Hence a total of 100 cases and equal number of controls were finally included in the study.

RISK FACTORS

Eight risk factors namely hypertension, diabetes mellitus, cigarette smoking, serum cholesterol, smoking, alcohol consumption, waist to hip ratio,

family history of stroke and transient ischemic attack were identified.

Subjects were considered to have hypertension if they had systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg. Diabetes mellitus was diagnosed. If a subject had fasting blood glucose level was ≥ 120 mg/dl. On admission we have considered only those who currently smoked cigarettes, which was defined as smoking more than 10 cigarettes per day for more than 6 months. We defined alcohol consumption as a person who has consumed alcohol at least once a day for a minimum period of 6 months. Transient ischemic attack defined as abrupt onset of focal neurological deficit lasting less than 24 hours. Subjects were considered to have obesity only when waist hip ratio was ≥ 0.9 cm in males and ≥ 0.8 cm in females. And if participants had serum cholesterol ≥ 220 mg/dl, were considered as hypercholesterolemia.

Statistical Analysis

Bivariate analysis on matched pairs was carried out. Odds ratio, their 95% confidence interval (CI), Chi square test was calculated for all the risk factors.

The continuous type of data namely Age, systolic and diastolic blood pressure, fasting blood sugar level, waist to hip ratio and serum cholesterol level were presented with mean \pm SD and were compared by using unpaired 't' test and Mann Whitney 'U' test.

RESULTS

Table 1 and Table 2 show the distribution of cases and controls according to age and gender. Among cases 85% were ≥ 50 years of age group and among controls 83% were ≥ 50 years of age. The mean age of cases were 62.88 years and that of controls were 61.39 years. Statistically there was no significant difference found between cases and controls.

Among cases and controls 59% of subjects were males and 41% were females. As sex was one of the matching variable, the number of males and

females in controls is identical. Male and female ratio in the study was 1:1.7 as shown in (Table 2). The potential risk factors for stroke were investigated as shown in Table 3. Both systolic blood pressure. (155.88 mmHg vs 127.73 mmHg) and diastolic blood pressure (90.67 mmHg vs 80.35 mmHg) were higher among cases than among controls. Stroke victims had higher fasting blood sugar level (137.15 mg/dl vs 109.19 mg/dl) and serum cholesterol levels (242.17 mg/dl vs 191.51 mg/dl) and higher waist hip ratio i.e. more abdominal obesity (1.030 cm vs 0.996 cm) than control group. The difference between cases and controls across all risk factors was found to be statistically significant.

We performed a univariate analysis to identify the association between risk factors and stroke.

Table 4 Described comparison of cases and controls according to exposure to risk factors and results of univariate analysis.

Hypertension: In the current study among cases of stroke 62%, among controls 30%, had hypertension and the difference was found statistically significant ($X^2 = 20.612$, $P < 0.0001$). Hypertension was found to be significantly associated with stroke. (OR = 3.807, 95% C.I. 2.114 -6.856).

When we analysed about systolic and diastolic blood pressure separately, among cases 84% patients had SBP ≥ 140 mmHg compared to 37% among controls, OR=3.866, 95% C.I. 2.206 to 6.773, $P < 0.0001$) and 76% had DBP ≥ 90 compared to 35% among controls (OR= 5.881, 95% C.I. 3.176 to 10.890, $P < 0.001$) SBP and DBP were found to be significantly associated with stroke.

Thus hypertension, whether systolic or diastolic has emerged as a significant risk factor for stroke in the present study.

DIABETES MELLITUS

The stroke cases had significantly higher proportion of diabetes mellitus (38%) than controls (15%) ($X^2 = 13.587$, $P \leq 0.0002$). The

risk of stroke associated with diabetes mellitus was also high and significant (OR= 3.473, 95% C.I 1.757-6.866).

Smoking: Out of 100 cases of strokes 49% were smokers compared to 30% of controls. This difference was statistically significant ($X^2 = 7.553$, $P < 0.0060$). Risk of stroke associated with habit of smoking (OR= 2.42, 95% C.I 1.255 – 4.005).

Alcohol: In the present study, 32% were alcoholic in the stroke cases and 20% among controls. The risk of stroke was not associated with alcohol (OR=1.882, 95% C.I 0.9870 – 3.590). Statistically it was found significant difference between cases and controls ($X^2 = 3.742$, $P = 0.0531$).

Family History: 31% had family history of stroke compared to 16% among the controls. It was found to be statistically significant difference among cases and controls ($X^2 = 6.258$, $P = 0.0124$). And also risk of stroke is associated with family history of stroke (OR= 2.359, 95% C.I. 1.192 – 4.667).

Transient Ischemic Attack (TIA)

Among cases 32% had significant past history of transient ischemic attack whereas, among controls 19% had reported such a history ($X^2 = 4.448$; $P = 0.0349$). The past history of TIA doubled the risk of stroke (OR = 2.006, 95% C.I. 1.044 – 3.854).

Obesity: Among cases 84% and among controls 68% were obese. And is statistically associated with strokes. ($X^2 = 8.018$, $P < 0.0081$). The risk of obese doubled the risk of stroke (OR=2.471, 95% C.F. 1.251 – 4.877).

Hypercholesterolemia: 66% of cases had value of serum cholesterol > 220 mg/dl as against only 34% among controls. It was found that, Hypercholesterolemia level is significantly associated with stroke. ($X^2 = 20.480$, $P < 0.0001$); also the risk of stroke associated with hypercholesterolemia was three times higher (OR= 3.768, 95% C.I. 2.099 to 6.766).

DISCUSSION

The current case-control study of risk factors for stroke identified eight risk factors.

Univariate analysis demonstrated that hypertension is the most important risk factor for stroke (62%, OR=3.807) followed by hypercholesterolemia level (66%, OR = 3.768), Diabetes mellitus (38%; OR = 3.474), obesity (84% OR 2.471), Family history of stroke (31% OR = 2.2.359), smoking (49%, OR= 2.242), Transient Ischemic Attack (32%, OR 2.006).

Similar findings were found in many studies. A recent study conducted in Gujarat, it was found that, modifiable risk factors such as hypertension (40%), smoking (28%), and hyperlipidemia (17%) are the commonest cause of stroke among elderly (23%)⁽²³⁾

Prasad *et al* study titled as “Stroke in young: An Indian prospective” found that smoking, increased BMI, diabetes and hypertension are significantly associated with strokes among young people⁽⁷⁾.

Recent study on hospital based multicentre prospective stroke registry in India with 5301 acute stroke patients from 100 hospitals found that, patients with stroke had high rates of risk factors including high alcohol consumption, tobacco consumption, diabetes, hypertension and dyslipidemia⁽²⁴⁾.

Recent data from the study as Inter heart and Inter stroke studies conducted in 22 countries included India by Ponnell *et al* identified major risk factors for stroke that contribute to 90% of stroke in these countries. He showed that the top risk factors for stroke are – Hypertension (34.6%), smoking (18.9%), waist hip ratio (26.5%) Diet (18.8%), Regular Physical activity (28.5%), Diabetes (8%), Alcohol intake (5%), psychosocial stress (4.6%) depression (5.2%), cardiac causes (6.7%)⁽²⁵⁾.

CONCLUSION

This is a study that quantifies the contribution of different factors to the overall risk of stroke. It

was found that, hypertension, hypercholesterolemia, diabetes are the biggest risk factors for all type of strokes and are important. Like many other factors, these are modifiable risks. That can be treated by appropriate medication and life style changes. This is very important to low-income settings as screening programmes, relatively little training, resources and interventions are expensive: weight reduction reducing alcohol intake, cessation of cigarette smoking and exercise these simple methods and life style alterations have a greater potential for stroke prevention.

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RESULTS

Table - 1: Distribution of cases and controls according to age

Age (years)	Cases (%)	Controls (%)
30-40	5 (5%)	3 (3%)
40-50	10 (10%)	9 (9%)
50-60	22 (22%)	15 (15%)
60-70	30(30%)	12 (12%)
70-80	20 (20%)	15 (15%)
≥ 80	13(13%)	5 (5%)
Total	100	100

Table 2: Distribution of cases and control according to gender

Gender	Cases (%)	Controls %
Males	59 (59%)	59 (59%)
Females	41 (41%)	41 (41%)
Total	100	100

Table 3: Mean and standard deviation of selected Risk factors in cases and controls.

Risk factors	Cases/Controls	Mean	S.D	t.Test/Mean Whitney U Test	P Value
Mean age (Years)	Cases Controls	62.88 61.39	12.82 12.27	t = 0.8398	1.98 P = 0.4020
Mean systolic blood pressure (mmHg)	Cases Controls	155.98 127.73	27.510 26.865	U = 2196.0	P< 0.0001
Mean diastolic blood pressure (mmHg)	Cases Controls	90.67 80.35	15.36 13.68	U=2852	P<0.0001
Mean fasting blood sugar mm/dl	Cases Controls	137.15 109.19	57.778 31.658	U=3859.0	P=0.0053
Mean serum cholesterol (mm/dl)	Cases Controls	242.1717 191.51	50.868 40.209	U=2170.5	P<0.0001
Waist – hip ratio (cm)	Cases Controls	1.0300 0.9966	0.1116 0.1247	U=3942.5	P=0.0098

Table-4: Univariate Analysis of risk factors of stroke

Risk factors	Cases	Controls	OR	95% C.I.	X2	P value
Hypertension Present Absent	62 38	30 70	3.807	2.114- 6.856	20.612	P<0.0001
Blood Pressure SBP≥ 140 SBP≤140	84 16	37 63	3.866	2.206- 6.773	23.230	P<0.001
DBP≥ 90 DBP≤90	76 24	35 63	5.881	3176- 10.890	34.032	P<0.0001
Diabetes Mellitus Present (FBS≥120) Absent (FBS≤120)	38 62	15 85	3.473	1.757- 6.866	13.580	P=0.0002
Smoking Smokers Non-smokers	49 51	30 70	2.242	1.255- 4.005	7.553	P=0.0060
Alcohol Present Absent	32 68	20 80	1.882	0.987- 3.590	3.742	P=0.0531
Family History of stroke Present Absent	31 69	16 84	2.359	1.192- 4.667	6.258	P=0.0124
Transient Present Absent	32 68	19 81	2.006	1.044- 3.854	4.448	0.0349
Obesity Present Absent	84 16	68 32	2.471	1.251- 4.877	7.018	0.0081
Hypercholesterolemia Present Absent	66 34	34 66	3.768	2.099- 6.766	20.480	P<0.0001