

Risk Factors for Stroke in Sulaimaniyah Iraqi Kurdistan Region-Iraq

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Abstract

Background: Stroke is a frequent medical problem and a leading cause of death and disability worldwide. Several conditions and lifestyle factors have been associated with stroke. **Aim:** To evaluate risk factors in stroke patients in Sulaimani city. **Results:** 110 patients with stroke were included in this study, hypertension was found to be the most common risk factor in current study. Out of 110 cases, 83 (75.5%) were hypertensive. Peak stroke-prone age was (60 - 69) year for male, (70 - 79) year for female. We found a statistically significant relation between level of TSC, LDL with ischemic stroke ($r = 0.4047$, $P < 0.0001$) and ($r = 0.4052$, $P < 0.0001$) respectively. While there was a significant inverse relation between HDL and ischemic stroke (Correlation coefficient = -0.4862 , $P < 0.0001$). On the other hand, there was no significant relation between level of TG and ischemic stroke ($r = 0.2403$, $P < 0.0114$). Also correlation statistic between TSC/HDL, LDL/HDL and result of CT scan, showed that there is statistical significance correlation between infarction and value of atherogenic index, ($r = 0.5301$, $P < 0.0001$, $r = 0.4990$, $P < 0.0001$) respectively, but there is no correlation between haemorrhage & the index. **Conclusion:** Hypertension is the leading risk factor of stroke. It is therefore essential to detect and treat hypertension at its outset. High value of atherogenic index mostly associated with ischemic stroke .while no relation found with haemorrhagic stroke.

Keywords

Stroke, Risk Factors, CT Scan, Brain, Lipid Profile, Echocardiography

1. Introduction

Cerebrovascular diseases include disorders in which there is a disturbance of blood supply to the brain. Stroke occurs when an artery supplying blood to a part of the brain

suddenly becomes blocked (ischaemic stroke) or bleeds (haemorrhagic stroke), accounting for about 85% & 15% of cases respectively [1]. This causes loss of function of part of the brain and may affect functions [1] [2]. Transient ischaemic attack (TIA), sometimes called “mini-stroke”, is a temporary manifestation of cerebrovascular disease [3]. Stroke is a major public health problem, being among the top three causes of death in most countries. It affects the brains of almost a half million people every year. Ischemic stroke accounts for more than 80 percent of all strokes. Intracranial Haemorrhage (ICH) usually accounts for 10 to 30 percent of cases depending on the origin of the patient, with greater relative frequencies reported in Asians and blacks [4].

Stroke is classified into two major types: **Brain ischemia** due to thrombosis, embolism, or systemic hypoperfusion. **Brain hemorrhage** due to intracerebral hemorrhage or subarachnoid hemorrhage [5]. Risk factors for stroke comprise both modifiable and nonmodifiable characteristics; **no modifiable** include **Age**: Doubles for each decade of life after age 55(6). **Heredity (family history) and race**: Greater if a parent, grandparent, sister or brother has had stroke [6] [7]. **Gender**: Stroke is more common in men than in women. In most age groups, more men than women will have a stroke in a given year [8]. **Prior stroke, TIA or heart attack**—The risk of stroke for someone who has already had one is many times that of a person who has not. TIAs are strong predictors of stroke. A person who’s had one or more TIAs is almost 10 times more likely to have a stroke than someone of the same age and sex who hasn’t [9]. While **modifiable risk factors include**: **High blood pressure**—High blood pressure is the most important controllable risk factor for stroke [10] [11]. **Cigarette smoking**—In recent years, studies have shown cigarette smoking to be an important risk factor for stroke [11]. **Diabetes mellitus**—Diabetes is an independent risk factor for stroke. Many people with diabetes also have high blood pressure, high blood cholesterol and are overweight [11]. **Carotid or other artery disease**—The carotid arteries supply blood to brain. A carotid artery narrowed by fatty deposits from atherosclerosis may become blocked by a blood clot. **Atrial fibrillation**—This heart rhythm disorder raises the risk for stroke. **Other heart disease**—People with coronary heart disease or heart failure have a higher risk of stroke than those with hearts that work normally. Dilated cardiomyopathy, heart valve disease and some types of congenital heart defects also raise the risk of stroke [11]. **High blood cholesterol**—People with high blood cholesterol have an increased risk for stroke. Also, it appears that low HDL (“good”) cholesterol is a risk factor for stroke [10] [11]. **Poor diet**—Diets high in saturated fat and cholesterol can raise blood cholesterol. Diets high in sodium (salt) can contribute to increased blood pressure. Diets with excess calories can contribute to obesity [9]-[11]. **Physical inactivity and obesity**—Being inactive, obese or both can increase your risk of high blood pressure, high blood cholesterol, diabetes, heart disease and stroke [11]-[17].

2. Patients and Methods

This cross sectional study was approved by the scientific committee of the directory of health in sulaimani city and was conducted to evaluate risk factors for stroke in those

patients admitted to the General Teaching Hospital in Sulaimani city-Iraq, from November 2009 to November 2010. The total sample size was 110 patients.

2.1. Inclusion & Exclusion Criteria

All patient with proven stroke by CT-scan included in this study, those who have no CT-scan & having space occupying lesion on CT where excluded from study. **Trans-thoracic echocardiography** performed using PHILIPS EnVisor C machine combines real-time two-dimensional imaging of the heart and cardiac valves. All patients in the study had a C.T scan (SOMATOM AR.SP, version B41A) of the brain (without contrast) to confirm the clinical diagnosis of stroke and the results was read by expert radiologists within 24 hours of presentation [17]. Estimation of lipid profile (TSC, TG, HDL, and LDL) was done using TECO DIAGNOSTICS kits, Interpretation of result was done according to the National Cholesterol Education Program (**ATP III Guidelines**). Atherogenic index measured by dividing LDL over HDL, also ratio of TSC/HDL was measured [18] [19].

2.2. Statistical Analyses

Data were translated into codes using a specially designed coding sheet, and then converted to computerized database. An expert statistical advice was sought and statistical analyses were done using (**SPSS**) (Statistical Package for Social Science) version 17 computer software. The degree of association between the variables (lipid profile and CT scan results) calculated using Rank correlation *i.e.* Spearman's rho and/or Kendall's tau rank correlation coefficients. P-value < 0.05 regarded as statistically significant.

3. Results

A total of 110 patients with stroke were enrolled in the study; 73 ischemic strokes and 27 hemorrhagic ones (**Table 1**). Altogether, males (59%) outnumbered females (41%). Peak stroke-prone age was (60 - 69) year for male, (70 - 79) year for female. **Table 2** shows the patients' age and gender distribution, males out number females in most age groups. Hypertension was found to be the most common risk factor in current study (75.5%),. Out of 110 cases, 83 (75.5%) were hypertensive, followed by cigarette smoking (52.7%) and ischemic heart disease (37.3%) (**Table 3**). The fasting serum total cholesterol was within its normal reference range in 84.5% of the patients. However, serum LDL levels were elevated in 25.4% and serum HDL was low in 78.2.% of the patients, We found a statistically significant relation between level of TSC, LDL with ischemic stroke ($r = 0.4047$, $P < 0.0001$) and ($r = 0.4052$ $P < 0.0001$) respectively (**Table 4**). While there was a significant inverse relation between HDL and ischemic stroke (Correlation coefficient = -0.4862 , $P < 0.0001$).On the other hand, there was no significant relation between level of TG and ischemic stroke ($r = 0.2403$, $P < 0.0114$) (**Table 4**). Also correlation statistic between TSC/HDL, LDL/HDL and result of CT scan, showed that there is statistical significance correlation between infarction and value of atherogenic index, ($r = 0.5301$, $P < 0.0001$, $r = 0.4990$, $P < 0.0001$) respectively, but there is no correlation

Table 1. Stroke subtype, note that ischemic stroke is more frequent than hemorrhagic stroke, (73% versus 27%).

Ischemic stroke	73%
Hemorrhagic stroke	27%

Table 2. Age and sex distribution of stroke.

Age	No. (n = 110)	Male (%)	Female (%)	P value
30 - 39	3	1 (33.3)	2 (66.7)	0.9935
40 - 49	12	6 (50)	6 (50)	0.6831
50 - 59	17	13 (76.5)	4 (23.5)	0.0085
60 - 69	40	27 (67.5)	13 (32.5)	0.0002
70 - 79	32	18 (56.2)	14 (43.7)	0.4777
80 - 89	5	1 (20)	4 (80)	0.2059
90 - 99	1	0 (0)	1 (100)	0.0001

Table 3. Risk factors in stroke patients in decreasing order of frequency; note that hypertension was the commonest one.

Risk factors	No. {n = 110} (%)
Hypertension	83 (75.5)
Smoking	58 (52.7)
Ischemic heart disease	41 (37.3)
History of prior stroke	40 (36.4)
Family history of stroke	33 (30.8)
Diabetes mellitus	24 (21.8)
Atrial fibrillation	21 (19.1)
Valvular heart disease	7 (6.2)
Oral contraceptive pills	9 (8.2)
Increased hematocrit	8 (7.3)
Alcohol	7 (6.4)
On Anticoagulants	2 (1.8)

between haemorrhage and the index. Trans-thoracic echocardiography showed that 56.4% of the patients have hypertensive heart disease and that 27.3% of the patients demonstrated evidence of ischemic heart disease; the study was unremarkable in 15.5% of the patients (**Table 5**).

4. Discussion

The patients included in the present study represent a random sample of patients hospitalized in medical department with acute stroke with variable duration of in-patient care. The frequency of these risk factors in our study distributed as follows (in decreasing order):

Table 4. Fasting serum lipid profile results in strokes patients (n = 110).

Lipid profile	No.	%
Normal TSC	93	84.5
High TSC	17	15.4
Low HDL	86	78.2
High HDL	24	21.8
Normal LDL	82	74.5
High LDL	28	25.4
Normal TG	96	87.3
High TG	14	12.7

Table 5. Transthoracic echocardiographic findings of stroke patients. This table shows that “hypertensive heart disease” is the main finding (56.3%).

TTE finding	No. of patients (n = 110)	Percentage of patients
Hypertensive heart disease	62	56.4
Ischemic heart disease	17	27.3
Normal	13	15.5
Aortic sclerosis	9	8.2
Valvular heart disease	7	6.3
Atrial septal defect (secondum type)	1	0.9
Atrial myxoma (left-sided)	1	0.9

Hypertension is the commonest risk for stroke (75%), smoking (52%), ischemic heart disease (37%), history of prior stroke (36%), family history of stroke (30%), diabetes mellitus (21%), atrial fibrillation (19%), valvular heart disease (8%), oral contraceptive pills (8%), increased hematocrit (7%), alcohol (6%), and anticoagulant use (1%).

Stroke rates increase dramatically with age. About two thirds of all strokes occur after the age of 65. in our study the most affected age group was between (60 - 70) years of age [20].

Stroke is more common in male sex than female’s one according to many series [20] [21]; in our study it was also more common in male sex (59%) as compared to that of female (41%).

Stroke subtype: Ischemic stroke had been reported to be more frequent than hemorrhagic stroke and accounted for 73% versus 27% of that of haemorrhagic stroke in our study. This percentage of hemorrhagic stroke (27%) is a slightly higher than the western figures (especially in USA, which is around (10% - 15%), but coincides with the results of studies done on Asian populations [22]-[24].

Hypertension: The above findings indicate that hypertension is the commonest risk factor identified and is the most important risk factor for stroke, and this observation is consistent with other studies. For people of all ages and both sexes, higher levels of both systolic and diastolic blood pressure have been associated with an increased incidence

of ischemic and hemorrhagic stroke [25]-[34].

Smoking: Smoking has been seen as a risk factor for stroke incidence in some studies [35] [36]. In the Oslo study of men, smoking was found to be a stronger predictor of stroke mortality than incidence [37]. A dose response was seen with cigarette smoking, and smoking cessation reduced the stroke incidence risk [38]. Other studies have shown this effect, which suggests that a real way to reduce both stroke occurrence and mortality is to encourage smoking cessation. In line with these observations, in our study 58 cases (among 110 cases) were smokers.

Diabetes mellitus: In our study most cases were of type 2 diabetes, and its contribution to stroke (21%) was a little bit higher than many other studies (5% - 10%). This difference might be explained by the fact that some cases were previously undiagnosed and many others were poorly controlled. Many studies have observed an independent association—in both men and women—of diabetes with an elevated risk of stroke [39], with relative risks of ischemic stroke and stroke of all types of 1.8 to 3.0 for both diabetic men and diabetic women [40] [41].

Dyslipidemia: The relation between serum cholesterol levels and the risk of stroke is not clear. A U-shaped relation between the serum level of total cholesterol and the risk of stroke of all types has been proposed, derived from an inverse association with hemorrhagic stroke and a direct association with ischemic stroke. The inverse relation with hemorrhagic stroke has been observed in numerous studies of populations of Japanese origin [41]-[44].

In our study, we found that patients with high total serum cholesterol (Correlation coefficient $r = 0.4047$; $P < 0.0001$; 95% Confidence interval for $r = 0.2353$ to 0.5503) and low HDL cholesterol (Correlation coefficient $r = -0.4862$; $P < 0.0001$; 95% Confidence interval for $r = -0.6173$ to -0.3289) were mostly associated with ischemic stroke; we measured the atherogenic index (LDL/HDL cholesterol) and the atherogenic ratio (total serum cholesterol/HDL cholesterol) and found that a statistically significant association was established between high atherogenic index (Correlation coefficient $r = 0.4990$; $P < 0.0001$; 95% Confidence interval for $r = 0.3439$ to 0.6276) and high atherogenic ratio (Correlation coefficient $r = 0.5301$; $P < 0.0001$; 95% Confidence interval for $r = 0.3807$ to 0.6526) with ischemic stroke. Also we found that a normal total serum cholesterol does not confirm a protection against stroke, because 28 patients had a high LDL (more than 160 mg/dl; $n = 110$) and 86 patients had a low HDL cholesterol (less than 40 mg/dl; $n = 110$) within the normal total cholesterol range.

Alcohol: The relation of moderate alcohol consumption to the risk of stroke has not been conclusively determined. Several methodologic problems have hampered research, including the contamination of the reference group of lifelong abstainers with former drinkers, which may contribute to the J-shaped relation observed in many studies. Only 6% patients in our study were drinkers; this small number is consistent with other studies about alcohol and stroke [45] [46].

Oral contraceptive pill: Higher-dose formulations of oral contraceptives were found to increase the risk of stroke in some subgroups of women, including women over 35

years of age, cigarette smokers, women with hypertension, and women with a history of migraine headaches [47] [48]. A recent meta-analysis combined the results of 47 case-control and cohort studies and established a relative risk among users, an increased risk of stroke have been observed [49].

In our study 9 cases (8%) had history of taking oral contraceptive pills, six of them were ischemic stroke, which can be explained by its adverse effects, such as increased thrombosis and three cases were haemorrhagic stroke which might be related to its effect on raising blood pressure [50].

Atrial fibrillation: Abnormal contraction of the atria may result in thrombus formation. The risk of stroke secondary to thromboembolism related to atrial fibrillation is approximately 3% to 5% per year [51]. In a study of primary prevention in patients with atrial fibrillation, the annual risk of stroke was 6.3% with no treatment, 3.6% with aspirin therapy, and 2.3% with warfarin therapy [52]. In our study out of 110 stroke patients 21 cases (19%) had atrial fibrillation, 20 cases were ischemic stroke, and only 1 case was hemorrhagic stroke which had history of using anticoagulant drug (warfarin), possibly been over anticoagulated. Randomized treatment trial data have shown that anticoagulation with warfarin can reduce the relative risk of stroke by 70% to 80% in the highest-risk groups (age older than 75 years, prior thromboembolic event, history of hypertension, impaired left ventricular function and diabetes), with low risk of hemorrhagic complications and acceptable adverse-effect profiles [53]. In the current study only 2 cases (1.8%) were they had history of using anticoagulant (both of them had AF), one ischemic and the other was hemorrhagic stroke, which might be one of them under treated or the other been over treated respectively.

Ischemic heart disease: People with coronary heart disease or heart failure have a higher risk of stroke than those with hearts that work normally [54] [55].

In the present study 41 cases (37%) had previous history of coronary heart disease and also 17 cases (27%) by transthoracic echocardiography had this disease.

12-Increased hematocrit: A high hematocrit is expected to be associated with an increased risk of thrombosis or embolism. Numerous reports from patients with polycythemia vera and pseudopolycythemia confirm a correlation of elevated hematocrit levels and the incidence of thrombosis [56] [57]. The Framingham study established a positive correlation between the hematocrit value and the risk of cerebral infarction [58] and in a prospective study a hematocrit level higher than 0.51 was found to be an independent risk factor for stroke [59]. Incyanotic congenital heart disease, exceedingly high hematocrit values of up to 0.80 have been recorded, and cerebral and pulmonary infarcts as well as cerebral venous thrombosis correlate with hematocrit levels [60]. In line with these observation, in our study 8 cases (among 110 cases) were detected to have a high hematocrit level all of them were ischemic stroke except one.

Transthoracic echocardiography: Echocardiography is the investigation of choice when a cardiac source of embolism is suspected. However, debate persists about which patients with a stroke or thromboembolism requires imaging. This is in part a result of the increasing pressure on already overloaded echo services and a need for prioritiza-

tion, but it also reflects considerable variation in physicians [61]-[64].

Echocardiographic finding in our patients was like that: Hypertensive heart disease (56%), Ischemic heart disease (27%), Normal (15%), Aortic sclerosis (8%), Valvular heart disease (6%), Atrial septal defect (0.9%), atrial myxoma (0.9%). According to the above findings, hypertensive heart disease (left ventricular hypertrophy (LVH) + diastolic dysfunction) was the main echocardiographic finding among our patients. This observation is consistent with other studies: LVH and abnormal LV geometry are independently associated with increased stroke risk [65]. In hypertensive patients, concentric and eccentric hypertrophy was associated with an ≈ 2 -fold increase in stroke incidence, whereas concentric remodeling did not carry increased risk [66] [67].

Aortic sclerosis: The early build-up of calcium deposits that causes the valve to be thicker and more rigid than normal. Aortic sclerosis is diagnosed on echocardiography as focal areas of increased echogenicity on the valve leaflets with normal valve motion and a normal, or only mildly increased, antegrade velocity across the valve [68]-[70]. In our study (8%) of the cases were they have this finding on echocardiography.

Atrial septal defect: The association of ASD with cerebral embolic events has been less well studied. In one series of 103 patients (mean age 52 years) with a presumed paradoxical embolism and an atrial septal abnormality undergoing percutaneous closure, a PFO alone was present in 81, an ASD alone in 12, and both a PFO and ASD in 10 [71] [72]. In our study only one case (0.9%), was had this finding (Atrial septal defect).

Atrial myxoma: The most common benign cardiac tumour, is found more commonly in young adults with stroke or transient ischemic attack (1 in 250) than in older patients with these problems (1 in 750). Strokes are often recurrent, and may be embolic or hemorrhagic, the presentation ranging from progressive multi-infarct dementia, to massive embolic stroke causing death. Because tumour fragments or adherent thrombus may embolize [73] [74]. In our study only one case (0.9%) was detected by trans-thoracic echocardiography.

5. Conclusions

- Hypertension is the leading risk factor of stroke. It is therefore essential to detect and treat hypertension at its outset.
- Stroke incidence increases with age and it is more common in male gender.
- Echocardiography is a useful test as it is cheap, non-invasive and available, to find risk factors for stroke or a complication of these risk factors on the heart.
- Normal total serum cholesterol (TSC) does not exclude the absence of dyslipidemia, as most of our patients have low serum HDL, and or high LDL.
- High TSC and low serum HDL are mostly associated with ischemic stroke.

6. Recommendations

- 1) Hypertension is the main risk factor for stroke, so early diagnosis and prompt management of it is the main stay in preventing stroke.
- 2) Inpatient stroke unit operational under the direction of stroke director.

- 3) Stroke clinic to provide outpatient consultations for stroke care.
- 4) Ongoing program for primary and secondary stroke prevention.
- 5) Stroke nurse-coordinator.

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