Risk Factors for Stroke in Erbil City: A Case-Control Study

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ABSTRACT

Background and Objectives: Stroke is a worldwide health problem. This study was carried out to find out the risk factors associated with stroke in Erbil city.

Methods: A hospital based case-control study was carried out in Erbil city from January, 1st 2009 to June, 30th 2009. The sample included (173 cases and 173 controls) cases admitted to Erbil teaching hospitals with first-ever stroke diagnosed by the consultant internist or neurologists and confirmed by brain CT-scan. Sex and age-matched (± 5 years) patients admitted to the same hospital, who do not have stroke, were taken as a control group.

Results: The mean ± SD ages of cases and controls were 62.2 ±13.4 and 61.54 ±13.16 years, respectively with a male: female ratio of 1.1:1. Nearly 70% were ischaemic and 30% were haemorrhagic. A slightly more than half (51.45%) of strokes occurred in the 7th and 8th decades of life. Multiple logistic regression analysis revealed statistically significant association between smoking (P<0.001), exercise (P<0.001), hypertension (P=0.001), family history of stroke (P=0.004), BMI (P=0.012) and PCV% (P<0.001) with stroke. However multiple logistic regressions of risk factors for ischaemic and haemorrhagic strokes separately revealed that diabetes was significantly associated with ischaemic stroke (P=0.025) while body mass index was significantly associated with haemorrhagic stroke (P=0.001).

INTRODUCTION:

Stroke is a worldwide health problem. It makes an important contribution to morbidity, mortality and disability in developed as well as developing countries [1]. Stroke is a common medical emergency with an annual incidence of between 180 and 300 per 100,000 in United States [2.] In most parts of the world, about 70% of strokes are due to ischemia, 27% are due to hemorrhage, and 3% are of unknown cause [3]. WHO estimated that in 2005, stroke accounted for 5.7 million deaths worldwide, equivalent to 9.9 % of all deaths. Over 85% of these deaths had occurred in people living in low and middle income countries and one third occurred in [4]. In many developing countries, the incidence is rising because of the adoption of less healthy life styles. 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 [5]. Several factors are known to increase the liability to stroke; the most important of these are hypertension, heart disease, diabetes mellitus, cigarette smoking, and hyperlipidemia [6]. Some evidence indicates that the decline in the incidence of stroke observed in many countries is due to better management of hypertension [7]. Despite recognition of modifiable risk factors for a first stroke and the availability of well-known treatments, suboptimal control of risk factors continues

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more than 700,000 strokes in the United States each year [8]. No published data on stroke in Erbil city are available; therefore, this study was carried out to find out the risk factors associated with stroke in Erbil teaching hospitals.

MATERIALS& METHODS:

This hospital based case-control study was carried out on cases admitted to the three teaching hospitals in Erbil city, which is the center of Erbil governorate, located in Kurdistan region of Iraq. The study extended from January, 1st 2009 through June, 30th 2009. Cases with a first attack of stroke (first-ever stroke) diagnosed by the consultant internist or neurologists and confirmed by brain imaging (CT-scan) were included in the study. Sex and age-matched (± 5 years) patients admitted to the same hospital of cases, who do not have (and without previous history of) stroke and transient ischaemic attacks (TIA), were taken as a control group. A case was considered as a "stroke" according to the WHO definition [1]. Patients, known to have previous history of stroke, not residing in Erbil city were excluded from the study. Stroke events discovered to be secondary to brain tumour, or brain metastasis, or caused by trauma were also excluded from the study. Verbal informed consent was obtained from all subjects (cases and controls) or their close relatives. Data were obtained by a direct interview of both cases and controls, if they can answer; otherwise data were obtained from close relatives, using a questionnaire designed by the researchers. Data requested included: age, sex, marital status, smoking (current smoking: smoking at least one cigarette per day [9]), exercise (walking at least 30 minutes per day), and history of systemic diseases (hypertension, diabetes mellitus and heart diseases), family history of stroke and the use of oral contraceptives among females (using of pills for a duration of more than 6 months at any time [10]). Laboratory investigations included: fasting blood sugar, serum total serum LDL-cholesterol and PCV%. Weight and height were measured and body mass index (BMI) was calculated according to Hanlon *et al* [11]. Brain imaging (CT-Scan) was done for all cases. Individuals were considered diabetics if the condition had been previously diagnosed by a physician, or if they have been receiving insulin and/ or treatment before a stroke or they were discovered to have fasting blood sugar of ≥ 126 mg/100ml (≥7mmol/dl) [12]. HbA1c was measured for diabetic subjects. The recommended goal (controlled) for HbA1C is ≤ 7% [13]. Statistical Package for social sciences (SPSS, version 15.0) was used for data entry and analysis. Chi square test of association (when the expected count of more than 20% of the row by column table is <5, Chi square test is not applicable), student t-test and multiple logistic regressions were used. P value of ≤ 0.05 was regarded as statistically significant.

RESULT:

The sample included 346 subjects (173 cases and 173 controls); the age of patients ranged from 12 to 89 years for cases and 14 to 87 years for controls. The male: female ratio was 1.1:1 for both cases and controls. The mean ± SD ages of cases and controls were 62.2 ±13.4 and 61.54 ±13.16 years, respectively. There was no statistically significant difference between the means of age of cases and controls (P=0.648). Nearly 70% were ischaemic and 30% were haemorrhagic. In males, 71.4% of cases were ischaemic and 28.6% were haemorrhagic while in females, 68.3% of cases were ischaemic and 31.7% were haemorrhagic. The age distribution of cases by stroke subtype is shown in (Table1). A slightly more than half (51.45%) of strokes occurred in the 7th and 8th decades; 54.55% of ischaemic strokes occurred in the 7th and 8th decades of life, while 44.23% of haemorrhagic strokes occurred in this age group and 21.15% of cases occurred in the 5th decade of life. In males high proportion of both ischaemic (60%) And haemorrhagic (46.2%)

strokes occurred in the 7th and 8th decades of life, while in females 48.2% of ischaemic strokes occurred in the 7th and 8th decades, and 46.1% of haemorrhagic strokes occurred in the 5th and 6th decades of life. Table 2 shows that there was statistically significant association between stroke and hypertension (P<0.001), diabetes mellitus (P<0.001), uncontrolled diabetes mellitus (P=0.012), smoking (P<0.001), lack of exercise (P<0.001), heart diseases (P= 0.007), overweight and obesity (P=0.001), family history of stroke (P=0.001) and use of oral contraceptive pills (P=0.015). A significant association between diabetes mellitus with stroke subtypes (P=0.027) was demonstrated (Table 3). The means of serum lipid levels (cases vs. controls) in mmol/l were as follow: serum cholesterol (4.98 vs. 4.84); serum triglycerides (1.42 vs. 1.51); HDL-cholesterol (1.17 vs. 1.17) and LDL-cholesterol (3.18 vs. 3.00). However, these variations have no statistical significance. Multiple logistic regression analysis revealed statistically significant association between smoking (P<0.001), exercise (P<0.001), hypertension (P= 0.001), family history of stroke (P=0.004), BMI (P=0.012) and PCV% (P<0.001) with stroke (Table 4). However, multiple logistic regressions of risk factors for ischaemic strokes and for haemorrhagic strokes separately revealed that diabetes was significantly associated with ischaemic stroke (P=0.025) while BMI (obesity and overweight) was significantly associated with haemorrhagic stroke (P=0.001) (Table 5).

Table 1: Age distribution of cases by stroke subtype**.**

Age (years)	Ischaemic			Haemorrhagic			Total
	Male No (%)	Female No (%)	Total No. (%)	Male No (%)	Female No (%)	Total No. (%)	No. (%)
<30	1 (1.5)	0 (0.0)	1 (0.83)	0 (0.0)	0 (0.0)	0 (0.00)	1 (0.58)
30-39	2 (3.1)	1 (1.8)	3 (2.48)	2 (7.7)	1 (3.8)	3 (5.77)	6 (3.47)
40-49	7 (10.8)	9 (16.1)	16 (13.22)	4 (15.4)	7 (26.9)	11 (21.15)	27 (15.61)
50-59	14 (21.5)	11 (19.6)	25 (20.66)	4 (15.4)	5 (19.2)	9 (17.31)	34 (19.65)
60-69	19 (29.2)	12 (21.4)	31 (25.62)	6 (23.1)	4 (15.4)	10 (19.23)	41 (23.70)
70-79	20 (30.8)	15 (26.8)	35 (28.93)	6 (23.1)	7 (26.9)	13 (25.00)	48 (27.75)
≥ 80	2 (3.1)	8 (14.3)	10 (8.26)	4 (15.4)	2 (7.7)	6 (11.54)	16 (9.25)
Total	65 (100)	56 (100)	121 (100)	26 (100)	26 (100)	52 (100)	173 (100)

Table 2: Distribution of risk factors among cases and controls .

Risk factor	Cases(n =173) No. with risk factor (%)	Controls (n =173) No. with risk factor (%)	P - value
Hypertension	101 (58.4)	38 (22.0)	<0.001
Diabetes mellitus	50 (28.9)	20 (11.6)	<0.001
Uncontrolled diabetes	45† (90.0)	13†† (65.0)	0.012
Heart diseases	31 (17.9)	14 (8.1)	0.007
Current smoking*	60 (34.7)	13 (7.5)	<0.001
Lack of exercise	166 (96.0)	104 (60.1)	<0.001
Family history of stroke	19 (11.0)	4 (2.3)	0.001
Overweight and obesity	113 (65.3)	83 (48.0)	0.001
Oral contraceptive use (n=82)	25 (30.5)	12 (14.6)	0.015

† Out of 50 **†† Out of 20**

Table 3: Risk factors by stroke subtype.

Risk factor	Ischaemic(n =121) No. with risk factor (%)	Haemorrhagic (n =52) No. with risk factor (%)	P - value
Hypertension	67 (55.4)	34 (65.4)	0.221
Diabetes mellitus	41 (33.9)	9 (17.3)	0.027
Uncontrolled diabetes	37* (90.2)	8** (88.9)	0.902
Heart diseases	24 (19.8)	7 (13.5)	0.316
Current smoking	44 (36.4)	16 (30.8)	0.478
Lack of exercise	117 (96.7)	49 (94.2)	0.451
Family history of stroke	13 (10.7)	6 (11.5)	0.878
Overweight and obesity	79 (65.3)	34 (65.4)	0.990
Oral contraceptive use	16† (28.6)	9†† (34.6)	0.580

*** Out of 41** **** Out of 9** **† Out of 56** **†† Out of 26**

Table 4: Multiple logistic regression of risk factors of stroke (cases and controls)

Risk factor	Odds ratio	P- value	95% CI*
Smoking	3.04	<0.001	2.05 - 4.51
Exercise	0.08	<0.001	0.03 - 0.21
Hypertension	2.78	0.001	1.51- 5.12
Diabetes mellitus	1.78	0.132	0.84 - 3.75
Heart diseases	1.36	0.472	0.59 - 3.18
Family history of stroke	9.49	0.004	2.06 - 43.85
BMI	1.09	0.012	1.02 - 1.17
PCV	1.11	<0.001	1.05 - 1.17

***Confidence Interval**

Table 5: Multiple logistic regression of risk factors of ischaemic and haemorrhagic strokes

Risk factor	Ischaemic			Haemorrhagic		
	Odds ratio	P- value	95% CI	Odds ratio	P- value	95% CI
Smoking	2.83	<0.001	1.861- 4.310	4.21	<0.001	2.237- 7.928
Exercise	0.08	<0.001	0.025 - 0.238	0.06	<0.001	0.012 - 0.280
Hypertension	2.37	0.012	1.211-4.638	4.61	0.001	1.830 - 11.591
Diabetes mellitus	2.42	0.025	1.115 - 5.267	0.57	0.388	0.159 - 2.045
Heart diseases	1.59	0.305	0.657 - 3.834	0.39	0.157	0.106 - 1.437
Family history of stroke	6.74	0.027	1.236 - 36.754	33.12	<0.001	4.779 - 229. 503
BMI	1.08	0.052	0.999 - 1.157	1.22	0.001	1.089 - 1.374
PCV	1.10	0.002	1.034 - 1.160	1.12	0.018	1.020 - 1.226

DISCUSSION:

This study revealed that ischaemic strokes were more common than haemorrhagic strokes, a finding which is consistent with other studies. The proportion of ischaemic stroke was 83% in Erbil, Iraq[14], 82.1% in Turkey[15], 70% in Sengal[16], 68.4% in Isfahan, Iran[17] and 62.2% in Lebanon[18]. The prevalence of haemorrhagic strokes was considerably high in some countries like China[19] (ranging from17.1% to 39.4%) in Japan[20] was 37.8%. The proportion of hypertension was high among cases where large proportion of patients (58.4%) had history of hypertension before the onset of stroke, while only 22% of the controls had history of hypertension. This is consistent with the study done in Erbil, where the proportion of hypertension was 64.5% [14] and a study done in Mosul, where the proportion of hypertension was 78.3% [10]. It was also consistent with other studies carried out outside Iraq. Those studies

proportions of hypertension among stroke patients like the studies done in USA[21], England[22], and Turkey[23] (71%, 61%, and 69.4% respectively). The proportion of diabetes among cases in this study is slightly higher than a study done in Mosul [10] (26.3% among cases and 13% among controls), and higher than previous study done in Erbil [14] where only 18.75% of stroke patients were diabetic, and also higher than a case-control study done in England [22] (16.5% among cases and 6.9% among controls), but lower than those revealed in Aydin, Turkey (38.8%) [23]. Multiple logistic regression analysis revealed that diabetes was associated with ischaemic stroke and this is true because diabetes is one of the risk factor for atherosclerosis leading to stroke. This high proportion of hypertension and diabetes among cases could be attributed to less healthy lifestyle like eating large amount of unhealthy diet, sedentary life style and lack of physical activity and exercises, all of these leading to increasing weight which is one of the important predisposing factors to type II diabetes mellitus, hypertension and cardiovascular and cerebrovascular diseases. Most of stroke patients who were diabetic had uncontrolled diabetic index (their HbA1C levels were more than 7%); this is either due to incorrect treatment or eating large amount of diabetogenic food. In a developing society like Iraq with rapid social and economic transition to industrialization, more and more people are being employed as office workers and their lifestyles became westernized (e.g., consuming foods with high energy and high fat but taking less physical activity). Results revealed that the majority of stroke patients are of older age group and this is consistent with the fact that increasing age is one of the most important risk factors for stroke[24], and most of cases occurred in 7th and 8th decades and this is because at these age groups more people suffered from other diseases (like hypertension, diabetes mellitus and heart diseases) that are the most important predisposing factors mean age of stroke patients in this study is (62.2 years) lower than the study done in Isfahan, Iran (68.10 years)[16], but higher than reported in Senegal (60.4 years)[16]. Results revealed that there was no statistically significant association between total serum cholesterol, serum triglycerides, LDL-cholesterol and stroke subtypes and this is consistent with the study done in Mosul [10], but Ebrahim *et al* found that low concentrations of cholesterol were associated with haemorrhagic stroke while high concentrations were associated with ischaemic stroke [25]. Results revealed that the mean of PCV% was higher among cases than controls and this is consistent with the study done in Mosul[10]. Hematocrits above 46% were associated with reduced cerebral blood flow, and the risk of stroke[2]. Results revealed that most of the cases were overweight and obese which is one of the predisposing factors for the development of stroke. This result was inconsistent with the study done in Mosul [10] where revealed that there is no significant association between the presence of overweight and obesity with stroke development, but consistent with a study done in England [22] that showed the proportion of obesity was higher among cases than controls (11.6% vs. 5.8%). Multiple logistic regression analysis revealed that obesity and overweight were significantly associated with haemorrhagic stroke. Most of the cases have positive family history of stroke. Genetic factors appear to be important in stroke pathogenesis, but the cause of most strokes is likely to be multifactor, involving both polygenic and environmental influences[2]. Health promotion strategies and lifestyle interventions targeting people with higher family average income could be helpful in the campaigns against stroke. Meanwhile, to prevent stroke world-wide, it is also important to spread the knowledge to all populations experiencing economic and lifestyle transitions in the developing communities so that they can avoid taking

westernization.

REFERENCES:

1. Park K. Park's textbook of preventive and social medicine. 18th ed. Jabalpur (India): Banarsidas Bhanot Publishers, 2005.
2. Aminoff MJ, Greenberg DA, Simon RP. Clinical neurology. 6th ed. New York: McGraw-Hill. 2005. P. 285-319.
3. Gunatilake SB, Jayasekera BA, Premawardene AP. Stroke subtypes in Sri Lanka: A hospital-based study. *Ceylon Med J* 2001; 46 (1): 19–20. WHO.
4. WHO STEPS stroke manual: The WHO Stepwise approach to stroke surveillance. Geneva, WHO. 2006.
5. Allen CMC, Lueck CJ, Dennis M. Neurological diseases. In: Boon AN, Colledge RN, Walker RB, editors. Davidson's principles and practice of medicine. 20th ed. Edinburgh: Churchill Livingstone. 2006. P. 1145-256.
6. Ropper AH, Brown RH. Adams and Victor's principles of peurology. 8th ed. New York: McGraw -Hill. 2005. P. 660-746.
7. MacWalter RS, Shirley CP. A benefit-risk assessment of agents used in the secondary prevention of stroke. *Drug Saf* 2002; 25 (13): 943–63.
8. Gorelick PB, Sacco RL, Smith DB, Alberts M, Mustone-Alexander L, Rader D *et al*. Prevention of a first stroke. A review of guidelines and a multidisciplinary consensus statement from the national stroke association. *JAMA* 1999; 281: 1112-20.
9. Galanti MR, Rosendahl I, Post A, Gillijam H. Early gender differences in adolescent tobacco use-the experience of Swedish cohort. Scand J Public Health 2001; 29(4): 314-7.
10. Hussein ST. Risk factors for stroke. A case - control study. M.Sc. thesis. University of Mosul. Iraq. 1993.
11. Hanlon P, Byers M, Walker BR, Summerton C. Nutrition, metabolic and environmental disease. In: Boon AN, Colledge RN, Walker RB, editors. Davidson's principles and practice of medicine. 20th ed. Edinburgh: Churchill Livingstone. 2006. P. 93-129.
12. Frier BM, Fisher M. Diabetes mellitus. In: Boon, NA, Colledge, NR, Walker, BR editors. Davidson's principles & practice of medicine. 20th ed. Edinburgh: Churchill Livingstone Elsevier, 2006. P. 805-47.
13. Sacco RL, Adams R, Albers G, Alberts MJ, Benavente O, Furie K *et al*. Guidelines for prevention of stroke in patients with ischemic stroke or transient ischemic attack: the American academy of neurology affirms the value of this guideline. *Stroke* 2006; 37(2): 577-617.
14. Khidhir AJ. Risk factors, subtypes and clinical outcome of patients with acute stroke admitted to Feb 2004. Diploma thesis. Salahaddin University. Iraq. 2004.
15. Gurcay E, Bal A, Cakci A. Health- related quality of life in first- ever stroke patients. *Ann Saudi Med* 2009; 29 (1): 36-40.
16. Sagui E, M'Baye PS, Dubecq C, Fall KB, Niang A, Gning S *et al*: Ischemic and hemorrhagic strokes in Dakar, Senegal: a hospital-based study. *Stroke* 2005; 36:1844–7.
17. Oveisgharan S, Sarrafzadegan N, Shirani S, Hosseini S, Hasanzadeh P, Khosravi A. Stroke in Isfahan, Iran: Hospital admission and 28-day case fatality rate. *Cerebrovasc Dis* 2007; 24: 495 -9.
18. Riachy M, Sfeir F, Sleilaty G, Hage-Chahine S, Dabar G, Bazerbachi T *et al*: Prediction of the survival and functional ability of severe stroke patients after ICU therapeutic intervention. *BMC Neurol* (Online) 2008; 8: 24. [18 screens]. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2443378/. (Accessed June 15, 2009).
19. Zhang X, Patel A, Horibe H, Wu Z, Barzi F, Rodgers A *et al*. Cholesterol, coronary heart disease and stroke in the Asia Pacific region. *Int J Epidemiol* 2003; 32: 563-72.
20. Fukiyama K, Kimura Y, Wakugami K, Muratani H. Incidence and long-term prognosis of initial stroke and acute myocardial infarction in Okinawa, Japan. *Hypertens Res* 2000; 23 (2): 127–35.
21. Barrett KM, Brott TG, Brown RD, Frankel MR, Worrall BB, Silliman SL *et al*. Sex differences in stroke severity, symptoms, and deficits after first-ever ischemic stroke. *J Stroke Cerebrovasc Dis* 2007; 16 (1): 34-9.
22. Du X, Cruickshank K, McNamee R, Saraee M, Sourbutts J, Summers A, *et al*. Case-control study of stroke and the quality of hypertension control in north west England. *BMJ* 1997; 314 (7076): 272-6.
23. Memis S, Tugrul E, Evci ED, Ergin F. Multiple causes for delay in arrival at hospital in acute stroke patients in Aydin, Turkey. *BMC Neurol* (Online) 2008; 8: 18. [About 11 pages]. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2387166/?tool=pmcentrez#1. (Accessed July 23, 2009).
24. Thorvaldsen P, Davidsen M, Brønnum-Hansen H, Schroll M. Stable stroke occurrence despite incidence reduction in an aging population. Stroke 1999; 30: 2529–34.
25. Ebrahim S, Sung J, Song Y, Ferrer RL, Lawlor DA, Davy-Smith G. Serum cholesterol, haemorrhagic stroke, ischaemic stroke, and myocardial infarction: Korean national health system prospective cohort study. *BMJ* 2006; 333 (7557): 22-4.