Prevalence of silent stroke in Kurdistan, Iraq

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ABSTRACT

الأهداف: قياس حدوث الجلطات الدماغية الصامتة في سكان كردستان، العراق وبحث عوامل الخطر للجلطات الدماغية الصامتة.

الطريقة: أجريت دراسة مقطعية في المستشفى التعليمي رزكاري – أربيل – العراق خلال الفترة من يناير حتى يونيو 2009م. حضرت العينة المختارة من 200 مريض العيادة الخارجية. تم تحليل نتائج تصوير الكمبيوتر CT، وتصوير الرنين المغناطيس (MRI)، وقياس نسبة الجلطة الدماغية. تمت مقابلة المرضى لفحص ظهور ارتفاع ضغط الدم، والسكر، ومرض إقفار القلب، وتناول الكحول، والتدخين. كما تم قياس مؤشر كتلة الجسم، ومستويات الدهن.

النتائج: من بين 200 فرد ظهرت الجلطة الصامت بنسبة 19%، وأظهر التحليل الإحصائي اللوجستي علاقة مهمة بين ارتفاع ضغط الدم، وزيادة العمر مع ظهور الجلطة الصامتة. كان عمر الأفراد المصابين أكبر من عمر الأفراد غير المصابين.

خاتمة: بلغت نسبة المرضى المصابين بالجلطة الصامتة بين الأفراد الأصحاء نسبة 19%، يجب على الأطباء أن يأخذوا بالاعتبار هذا التشخيص خصوصاً عند الأفراد المصابين بارتفاع ضغط الدم، وكبار السن.

Objectives: To measure the prevalence of silent strokes in the Iraqi Kurdish population, and to identify silent stroke risk factors.

Methods: This cross-sectional study was carried out in Rizgary Teaching Hospital, Erbil, Iraq from January to June 2009. A sample of 200 patients attending the outpatient clinic was taken. The results of CT and MRI were analyzed, and the proportion of silent infarcts was measured. Patients were interviewed for presence of hypertension, diabetes, ischemic heart disease, alcohol drinking, and smoking. Body mass index and serum lipid levels were calculated.

Results: Out of 200 subjects, 19% showed silent infarct(s). Logistic regression analysis showed significant association between hypertension and old age with presence of silent infarcts. The age of affected individuals was significantly higher than the age of the non-affected individuals.

Conclusions: The percentage of silent infarcts among apparently normal individuals in the Kurdish population is around 19%, and physicians must always keep this diagnosis in mind, especially among hypertensive and older aged patients.

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Stroke is defined as the sudden occurrence of a non-convulsive, focal neurological deficit lasting more than 24 hours.[1,2] Pathologically speaking, stroke falls into 3 subtypes, ischemic stroke (approximately 80%), primary intra-cerebral hemorrhage (approximately 15%), and sub-arachnoid hemorrhage (approximately 5%). Cerebral ischemia is usually caused by a reduction in blood flow that lasts for several seconds to a few minutes.[3-5] The incidence of stroke has been estimated by a number of population-based studies carried out almost exclusively in white populations in Europe, Australia, and the United States.[6] These studies showed a lower incidence of stroke in France, and slightly higher in Siberia after standardization for age and gender. There is a steep rise in the incidence with age, with three-quarters of all first strokes occurring after the age of 65 years, at least in white populations.[7] Silent cerebral infarction (SCI) is defined as a brain lesion that is presumably a result of vascular occlusion found incidentally by MRI or CT, or when small blood vessels in the brain become blocked or ruptured without signs and symptoms in otherwise, healthy subjects, or discovered during autopsy.[8,9] Silent cerebral infarctions are also termed covert infarcts or simply MRI infarcts.[10] The SCIs may

occur without apparent clinical manifestations, either because the patient and family are unaware of minor symptoms, or a so-called silent area of brain has been affected.[11] The SCIs are frequently demonstrated in the subcortical white matter or the basal ganglia in stroke patients and elderly subjects.[12] The reported prevalence of SCIs varies, depending on the studied subjects. Silent cerebral infarctions were first described by Fisher[13] in a cohort of 114 subjects whose brains were examined after death; 88 brains had at least one lacunae in the absence of clinical deficit, or a history of stroke.[13] The prevalence of SCIs increases in patients with symptomatic strokes ranging from 10-40%.[14-16] A prevalence of 13% was reported in a small population study,[15] of normal subjects, but in a study on a large number of elderly subjects (age more than 65 years) the prevalence reached 33%.[16] Those with SCIs are generally considered to be a high-risk group for clinical stroke. Several studies have examined the incidence of SCIs and its relation to risk factors for recurrent symptomatic strokes and cognitive disorders.[17-19] Most of these studies also demonstrated that age and hypertension strongly and independently correlated with SCIs.[20] The aim of the current study is to identify the proportion of SCIs among the Iraqi Kurdish population in Erbil city, and to verify the most common and significant risk factors for silent strokes. The Kurdish people living mostly in the north of Iraq are of 2 ancestries, the Sorani and the Badini group, they are Muslims, and they speak either the Sorani or Badini language.

Methods. This cross-sectional study (survey) was carried out in Rizgary Teaching Hospital, Erbil, Iraq from January to June, 2009. Inclusion criteria were adult patients referred for MRI or CT scan by different specialties, such as, Ear Nose and Throat specialists, neurosurgeons, neurologists, and general physicians for different reasons (or patients' complaints) such as headache, vertigo, unusual paresthesias of the body and face, and so forth, even those with history of transient ischemic attacks (TIAs) (as claimed by patients themselves, and not diagnosed by doctors) were included in the study. Patients with clear (doctor diagnosed) history of stroke or TIAs, and patients with features of multiple sclerosis or leukodystrophy were excluded from the study. A convenient sample was taken that involved 200 patients from 322 referred patients. Verbal informed consent was taken from the patients after explaining the design and aims of the study, and all had no objection to participating in the study. The Research Committee at the College of Medicine/Hawler Medical University approved the study protocol. A questionnaire form was used to collect information from the patients regarding general health and history of medical or surgical problems, such as, hypertension, diabetes mellitus (DM), and coronary heart disease, in addition to information regarding family history of stroke, and vascular risk factors. Patients were also questioned on habits such as smoking and alcohol consumption. Subjects were examined for physical and neurological signs or features of possible silent strokes, such as, exaggerated reflexes, pyramidal weakness, mild cerebellar signs, sensory signs, or long tracts signs. The MRI and CT scan images were examined and interpreted through collaborative discussions between a consultant Radiologist and a consultant Neurologist. The CT scan machine was Siemens Single Slices Spiral Somatom Emotion with 4-8 mm slices thickness, (Siemens, Erlangen, Germany) and the MRI scanner was Siemens 1.5 tesla (Siemens, Erlangen, Germany). Silent infarcts were considered if they were smaller than 15 mm in diameter involving the subcortical white matter, and periventricular structures such as basal ganglia, thalamus, and internal capsule.[21] Data on body mass index (BMI) (overweight was defined as BMI ≥25 Kg/m^2 and obesity BMI ≥30 Kg/m^2) were obtained, also, participants were investigated for dyslipidemia (serum cholesterol more than 200 mg/dl, and serum triglyceride more than 150 mg/dl).

The Statistical Package for Social Sciences version 15 (SPSS Inc., Chicago, IL, USA) was used for data analysis. Chi square test was used for association between SCIs and risk factors. Student t-test was used to compare the means of 2 numerical variables. Logistic regression analysis was used to control for confounders. A *p*-value of ≤0.05 was considered statistically significant.

Results. The 200 subjects comprised 76 (38%) males, and 124 (62%) females. The mean age ± SD was 58 ± 10.3 years, ranging from 38-89 years, median 55 years. Among the subjects, 162 (81%) showed normal MRI and CT scans, and in 38 (19%), their MRI images and head CT scans showed one or more SCI's. **Table 1** shows that the prevalence of SCI among females was insignificantly higher than the prevalence among males. The results showed that the older the age, the higher the prevalence of SCIs. **Table 2** shows that the lowest prevalence was among the age group <50 years old, whereas the highest prevalence was among the age

Table 1 - Prevalence (n, %) of silent cerebral infarcts (SCI) according to gender.

Gender	Normal	Positive (SCI)	Total	*P*-value
Male	63 (82.9)	13 (17.1)	**76 (100)**	
Female	99 (79.8)	25 (20.2)	**124 (100)**	0.593
Total	**162 (81.0)**	**38 (19.0)**	**200 (100)**	

Table 2 - Prevalence (n, %) of silent cerebral infarcts (SCI) according to age.

Age	Normal	Positive (SCI)	Total	*P*-value
<50	40 (90.9)	4 (9.1)	**44 (100)**	
50-59	66 (88.0)	9 (12.0)	**75 (100)**	
60-69	35 (87.5)	5 (12.5)	40 **(100)**	<0.001
≥70	21 (51.2)	20 (48.8)	41 **(100)**	
Total	**162 (81.0)**	**38 (19.0)**	**200 (100)**	

Table 3 - Risk factors for silent cerebral infarcts (SCI) (n, %).

Risk factor	Normal	Positive (SCI)	Total	*P*-value
History of TIA				
Present	10 (55.6)	8 (44.4)	**18 (100)**	0.009
Absent	152 (83.5)	30 (16.5)	**182 (100)**	
Family history				
Present	6 (54.5)	5 (45.5)	**11 (100)**	0.037
Absent	156 (82.5)	33 (17.5)	**189 (100)**	
Hypertension				
Present	57 (68.7)	26 (31.3)	**83 (100)**	<0.001
Absent	105 (89.7)	12 (10.3)	**117 (100)**	
IHD				
Present	18 (62.1)	11 (37.9)	**29 (100)**	0.005
Absent	144 (84.2)	27 (15.8)	**171 (100)**	
Hyperlipidemia				
Present	35 (63.6)	20 (36.4)	**55 (100)**	<0.001
Absent	127 (87.6)	18 (12.4)	**145 (100)**	
Diabetes				
Present	26 (81.3)	6 (18.8)	**32 (100)**	0.969
Absent	136 (81.0)	32 (19.0)	**168 (100)**	
Smoking				
Present	26 (70.3)	11 (29.7)	**37 (100)**	0.065
Absent	136 (83.4)	27 (16.6)	**163 (100)**	

TIA - transient ischemic attack, IHD - ischemic heart disease

group ≥70 years old. The mean age (±SD) of those with SCIs (64.74 ± 11.55 years) was significantly higher than the mean age (56.35 ± 9.35 years) of those with normal CT scan or MRI findings (p<0.001). **Table 3** shows that a history of TIA, family history of stroke, and a history of hypertension, diabetes, ischemic heart disease (IHD), and hyperlipidemia had higher proportions of abnormal CT scans or MRI findings than those without such a history. Diabetes and smoking were found to be non-significant predictors of SCIs (p>0.05). Results show that the mean (±SD) BMI of those with abnormal CT scan or MRI was 26.97 ± 4.52 Kg/m^2, while the mean BMI of those with normal findings was 26.41 ± 4.47 Kg/m^2 (p=0.49). When considering the risk factors simultaneously, logistic regression analysis showed that only age and hypertension could be considered as significant predictors of SCIs (**Table 4**).

Discussion. Silent brain infarcts are infarcts identified only by neuro-imaging. There is no accompanying clinical history of stroke or TIA. However, this relationship is somewhat clouded as a more detailed history may elicit symptoms to suggest that a lesion is not truly silent in some patients. On many occasions recurrent silent strokes will be associated with more diffuse neurological deficit like dysphagia, dysarthria, or decline in cognitive performance.[19,22] Some patients had MRI brain images, while others had brain CT scan images as they had been already referred from other doctors with their brain images for different reasons, and initially we did not request any brain imaging, as clinical neurological examination was almost always normal or nearly normal, and SCI was just an incidental finding. In our study, patients with symptoms suggestive of TIAs were also included (despite the former diagnosis

Table 4 - Logistic regression analysis where the presence of silent cerebral infarcts is the outcome variable.

Variables	B	SE	Wald	df	*P*-value	Odds ratio	95% CI for odds ratio	
							Lower	Upper
Age	0.079	0.022	12.955	1	0.000	1.082	1.037	1.130
Hypertension	1.330	0.451	8.692	1	0.003	3.782	1.562	9.159
Gender	0.581	0.500	1.349	1	0.245	1.788	0.671	4.764
Family history	1.396	0.741	3.556	1	0.059	4.041	0.946	17.251
Diabetes	-1.080	0.593	3.314	1	0.069	0.340	0.106	1.086
Smoking	0.770	0.523	2.171	1	0.141	2.160	0.775	6.020
IHD/MI	0.366	0.540	0.459	1	0.498	1.441	0.500	4.152
Hyperlipidemia	0.725	0.447	2.630	1	0.105	2.065	0.860	4.958
Constant	-10.515	2.107	24.912	1	0.000	0.000		

IHD - ischemic heart disease, MI - myocardial infarction, df - degrees of freedom, CI - confidence interval

of silent infarcts) because, first, their symptoms were not confirmed by a physician or a neurologist previously, and second, to show the prevalence of brain infarcts among those patients, and to compare it with the prevalence among apparently healthy individuals.

The overall prevalence (worldwide) of SCIs is between 10-40% in the population depending on different parameters, the most important of which is the age of the studied population.[16] In this study, 19% of the studied sample showed neuro-imaging findings of silent stroke (their age was above 45 years), and we believe that starting with a young age in collecting our sample is important as there are frequent cases of stroke among the younger age groups. Schmidt et al[18] found in their population-based cross-sectional survey of 267 elderly community residents in Germany, that 12.7% of their studied sample had neuro-imaging evidence of SCIs, and Vernooij et al[23] found that 7% of the 2000 brain images reviewed looking for SCIs and other silent brain disorders caused by the aging process in the Netherlands, had SCIs. Das et al[24] confirmed that 11% of their studied sample (mean age, 62 ± 9 years) showed neuro-imaging evidence of silent strokes. Our results showed a higher prevalence in comparison with the previous findings, possibly as our population has different dietary resources that may be high in cholesterol, and the different ethnic backgrounds. Patients may be ignorant regarding hypertension control with a lack of quality control on the antihypertensive and oral hypoglycemic medications available in the markets. It is worth mentioning that our sample is a hospital-based sample rather than a community-based sample, which may also raise the prevalence rate. This finding warrants the attention of the health care authorities, dietitians, and the media in this region of Iraq.

Price et al[14] described SCIs of 3 mm size were noted in 28% of stroke-free participants in their Cardiovascular Health Study (n=3647). This rate was higher than the rate obtained in our study due to the fact that stroke and cardiovascular disorders carry nearly the same risk factors. Our findings were comparable to the rate (20%) obtained in the Rotterdam Scan Study (n=1077).[19] In our studied sample, 20% of women and 17% of men had SCI's on CT or MRI. This difference, although statistically not significant, could be due to the greater health seeking behavior of women than men for different neurological disorders such as headache. However, this is contradictory to Vermeer et al's[10] findings that male gender is dominant in SCI patients.

There was a significant impact of increasing age on the increasing prevalence of SCIs shown in our study and as also noted by Lee et al.[25] Multivariate analysis of their results demonstrated that old age and hypertension are independent risk factors for SCIs, and mild alcohol consumption was an independent protective factor against SCI. Hypertension is the most important single preventable risk factor for different types of stroke, this study confirmed that hypertension is also one of the significant factors in SCIs etiologies, which is in accordance with Vermeer et al[19] and others.[16,25,26] Coronary artery diseases and dyslipidemia were found to be important risk factors for developing SCIs, possibly as IHDs share the same pathology and may be caused by hyperlipidemia, these results are compatible with other studies.[16,25] Lee et al,[25] and Eguchi et al[26] noted that DM is one of the important and significant factors in SCIs etiology as it complicates microvascular events most of the time in addition to the macrovascular complications, and reported that 62% of diabetic and hypertensive patients had silent strokes, whether hypertension is symptomatic or white-coat hypertension. In this study, DM was studied as a risk factor and found to be not significant for silent stroke etiology in the studied population. Smoking is a known risk for both cerebrovascular and cardiovascular events, and a stroke risk factor.[16] In this study, smoking was not a significant factor for silent stroke possibly due to denial (especially among women) of smoking habits. Studying the effect of body weight and increase in BMI more than 25 as a risk factor for silent strokes did not reveal a significant increase in the prevalence of silent stroke in our studied sample. This could be attributed to the low rate of obesity in the studied sample. Some participants mentioned family history of strokes, however, statistical analysis did not reveal a significant relation to silent stroke etiology.

While collecting data for this study, we did not face any significant limitations, and this study was not designed to promote certain medications.

In conclusion, this study addressed SCIs as a major and important medical condition in the studied population. As a considerable proportion of the studied sample had SCIs, physicians must consider this diagnosis in high-risk patients. Further studies to identify patients with SCIs are highly recommended to prevent subsequent major strokes.

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