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Lacunar Strokes: A Single Institutional Experience

Laküner İnmeler: Bir Kurumun Deneyimleri

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ABSTRACT

Purpose: Lacunar ischemic strokes comprise approximately 25% of all ischemic strokes. We compared the risk factors and clinical pattern of this type of stroke between males and females.

Materials and Methods: This observational study involved 50 consecutive patients with their first-ever lacunar stroke and was conducted at the department of neurology of Sulaimaniya general teaching hospital, Iraq from December 1, 2010 to March 1, 2013. Patients' risk factors, clinical presentation, and strokes' patterns were noted and a comparison was made between males and females.

Results: Males (64%) outnumbered females (36%) with a male to female ration of 1.7. The mean age of males was 63 years while it was 61 years in females. Although hypertension was more common in females than in males, diabetes and smoking were more common in the latter group; however, there were no statistically significant differences between the 2 genders in terms of hypertension and diabetes while smoking was strongly associated with male gender (P-value<0.0001). Pure motor hemiparesis, ataxic hemiparesis, pure sensory stroke, and dysarthria-clumsy hand syndrome were more common in males; only senori-motor stroke revealed a statistically significant difference in favor of males (P-value<0.0001; 95% CI -1.7 to 19.2). There was no statistically significant difference in terms of which side of the brain was infarcted between males and females.

Conclusion: Males around the age of 63 years were the main target for these lacunar strokes. Cigarette smoking and sensorimotor strokes were significantly associated with male gender.

Key Words: Lacunar infarction; stroke; lipohyalinosis; hypertension

ÖZET

Amaç: Laküner Iskemik inmeler tüm iskemik inmelerin yaklaşık % 25'ini oluşturmaktadır.Bu çalışmada bu inme türünün kadınlar ve erkeklerde risk faktörleri ve klinik paternleri açısından karşılaştırılması amaçlanmıştır.

Materyal ve Metod: Bu gözlemsel çalışma, ilk kez Laküner inmesi olan 50 ardışık hastada 1 Aralık 2010-1 Mart 2013 tarihleri arasında Irak Süleymaniye Genel Eğitim Hastanesi Nöroloji Bölümünde yapılmıştır.Hastaların risk faktörleri, klinik sunumu, ve inme paternleri kaydedilerek erkekler ve kadınlar arasında bir karşılaştırma yapıldı.

Bulgular: Erkek ve kadın oranı 1.7'dir, erkekler (% 64) kadınlardan (% 36) sayıca fazladır. Kadınlarda ortalama yaş 61 iken erkeklerin yaş ortalaması 63'tür.Hipertansiyon kadınlarda erkeklere göre daha sık olmasına rağmen, diyabet ve sigara kullanımı erkeklerde daha yaygındır; ancak, 2 cinsiyet arasında hipertansiyon ve diyabet açısından istatistiksel olarak anlamlı bir fark yokken sigara kullanan erkeklerde anlamlı farklılıklar mevcuttur. Saf motor hemiparezi, ataksik hemiparezi, saf duyusal inme ve dizartri-beceriksiz el sendromu erkeklerde daha yaygındır; sadece sensorimotor inme erkeklerde istatistiksel olarak anlamlıdır (P-değeri<0.0001; 95% CI -1.7 ve 19.2 arası). Erkek ve kadınlar arasında enfarktüsün beynin hangi tarafında olduğu açısından istatistiksel olarak anlamlı bir fark yoktur.

Sonuç: 63 yaş civarındaki erkekler laküner inmeler için ana hedefi teşkil etmektedir. Erkeklerde sigara ve sensorimotor inmeleri arasında önemli ilişki mevcuttur.

Anahtar Kelimeler: Laküner enfarktüs,inme, lipohiyalinosis, hipertansiyon

INTRODUCTION

Lacunar strokes are ischemic infarctions of less than 20 mm in maximum diameters, deep within the brain parenchyma and comprise around 25% of all ischemic strokes[1]. Hypertension, diabetes, and smoking are well-recognized risk factors[2]. At least 20 types of lacunar stroke syndromes have been categorized by Fisher but the most widely known ones are pure motor hemiparesis, pure sensory stroke, ataxic hemiparesis, dysarthria-clumsy hand syndrome, and sensori-motor type[3]. Although the pattern of the neurological deficits varies widely, the functional outcome is generally better than other strokes' types[4].

MATERIALS and METHODS

A total of 50 consecutive patients who were diagnosed with their first-ever lacunar stroke were involved in this observational study, which was conducted at the department of neurology of Sulaimaniya general teaching hospital, Iraq, from December 1, 2010 to March 1, 2013.

To be enrolled in the study, patients should have developed their first-ever lacunar stroke with their neurological deficit(s) lasting for more than 24 hours. The neurological deficit(s) should be consistent with one of the 5 subtypes of lacunar strokes[3]. Patients with transient ischemic attacks, previous stroke (ischemic or hemorrhagic; clinical or radiological-only), more than 60% carotid artery stenosis, cardiac dysrhythmia, valvular heart disease, and cardiomyopathy were excluded from the study[2].

All patients (n=50) underwent a thorough history taking as well as clinical and neurological examinations by a neurologist and neurology trainees. Routine blood tests (including lipid profile and thyroid function), 12-lead resting ECG, carotid Doppler ultrasonography and transthoracic echocardiographic examination were performed in all patients. An urgent non-contrast CT brain scanning was done at the time of A&E admission (n=50); a repeat CT brain scan (n=29; after 12-24 hours) or gadolinium enhanced brain MRI examination (n=17; after 24-48 hours) were ordered if the initial brain imaging was unremarkable.

The collected data were organized, tabulated, and statistically analyzed using Statistical Package for Social Sciences (SPSS) version 17 by an independent statistician. A comparison of continuous variables was performed by an unpaired two-tailed Student's t-test, whilst Chi-square tests were used for categorical variables. Significance levels were set at *P*-value of less than 0.05 in all cases.

RESULTS

Table 1 shows the various patients' risk factors and ages as well as their strokes' subtype, site, and side. Tables 2 and 3 display the comparison between males and females, in terms of their risk factors and stroke subtypes. Figure 1 demonstrates the CT brain findings of 4 patients.

Table 1. Patients' ages and risk factors, site and side of the lacunes, and subtypes of the lacunar strokes.

Character	Age range (median), in years	Hypertension	Diabetes	Smoking	Site of the lacunar infarct	PMH	PSS	AHP	DCH	SMS
Males (n=32)	51-78 (63)	21 (65%)	12 (37%)	15 (46%)	R 19 L 13	12 R 9 L 3	5 R 3 L 2	6 R 2 L 4	3 R 0 L 3	6 R 5 L 1
Females (n=18)	47-79 (61)	14 (77%)	6 (33%)	1 (5%)	R8 L 10	9 R 5 L 4	3 R 1 L 2	3 R 1 L 2	2 R 1 L 1	1 R 0 L 1
Total (n=50)	47-79 (62)	35 (70%)	18 (36%)	16 (32%)	R 27 L 23	21 (42%)	8 (16%)	9 (18%)	5 (10)%)	7 (14%)

PMH, pure motor hemiparesis; PSS, pure sensory stroke; AHP, ataxic hemiparesis; DCH, dysarthria-clumsy hand syndrome; SMS sensorimotor stroke; R, right; L, left.

Table 2. A comparison between males and females in terms of their risk factors for lacunar stroke.

Character	P-value	X^2	95% Confidence Interval Lower	Upper
Hypertension	0.3	1.4	-2.6	32.1
Diabetes	0.07	3.2	-1.2	44.7
Smoking	0.001*	10.8	-3.4	21.6

*A P-value of <0.05 is statistically significant.
- X^2, Chi Square test.

Table 3. A comparison between the 2 genders with respect to their lacunar ischemic stroke subtype.

Type of lacunar stroke	P-value	95% Confidence Interval Lower	Upper
Pure motor hemiparesis	0.17	-1.2	32.6
Pure sensory stroke	0.2	-4.1	27.8
Ataxic hemiparesis	0.7	-2.8	35.3
Dysarthria-clumsy hand syndrome	0.09	-4.4	41.8
Sensorimotor stroke	0.001*	-1.7	19.2

*A P-value of <0.05 is statistically significant.
- There was no statistically significant difference between the right and left side of the hemisphere (P value=0.4).

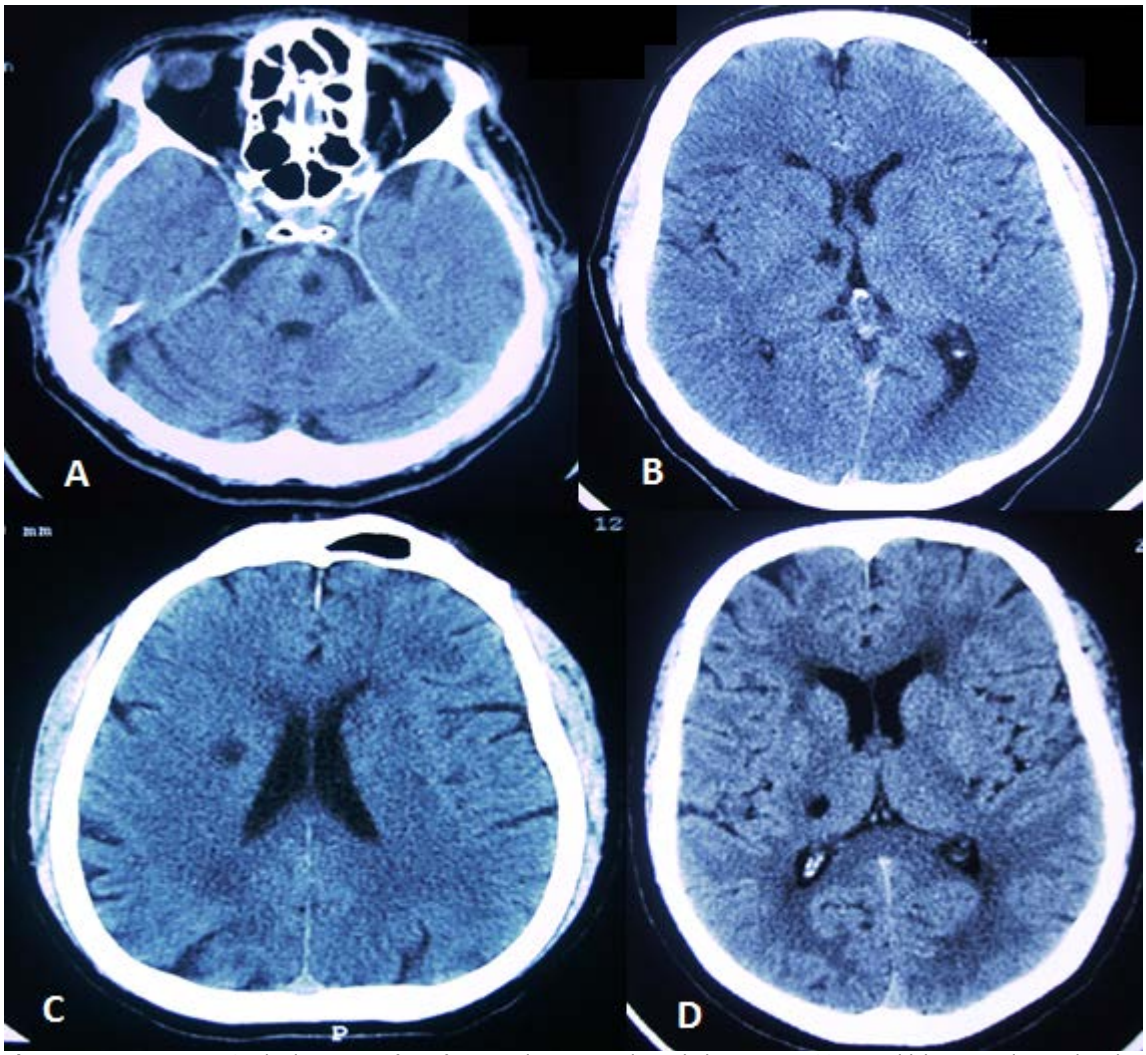

Figure 1. Non-contrast CT brain scans of 4 of our patients. Panel "A" belongs to a 66-year-old hypertensive male who presented with dysarthria-clumsy hand syndrome; note the hypodense lacune within the left side of the pons. Panel "B" is from a 62-year-old hypertensive and diabetic female who presented with pure sensory stroke; note the lacune inside the right thalamus. Panel "C" represents a 65-year-old hypertensive and smoker male who was diagnosed with ataxic hemiparesis; note the lacune at the right corona radiata. Panel "D" shows a lacune at the posterior limb of the right internal capsule which abuts on the right thalamus; this is a 69-year-old hypertensive male who had pure motor hemiparesis.

Males outnumbered females with a male to female ration of 1.7. In terms of age at the time of stroke, the mean age of males was 63 years (± SD of 7.4 years) while that of females was 61 years (± SD of 9.1 years).

Altogether, out of the 50 patients who were enrolled in the study, 35 (70%) of them were hypertensive, 18 (36%) had type II diabetes mellitus, and 16 (32%) were smokers.

A previous history of systemic hypertension (with or without medical treatment) was found in 77% of females while 65% of males were hypertensive at the time of admission. Type II diabetes were present in 12 (37%) males and 6 (33%) females while 15 (46%) males were

smokers and only 1 (5%) female smoked cigarette. However, there was no statistically significant differences between males and females with respect to hypertension (P value < 0.3) and type II diabetes (P value < 0.07); however, the percentage of smoking was more significant in males (P value <0.001).

There were 21 (42%) pure motor hemiparesis, 9 (18%) ataxic hemipareses, 8 (16%) pure sensory strokes, 7 (14%) sensorimotor strokes, and 5 (10%) dysarthria-clumsy hand syndromes. Pure motor hemiparesis was the predominant subtype, in both males (n=12) and females (n=9).

The right side of the brain was more commonly involved than the left side in males while the reverse occurred in females. However, there was no statistically significant difference between the genders (P value < 0.4).

Of the 5 subtypes of lacunar stroke syndromes, only the sensorimotor lacunar stroke showed a significant statistical difference between the 2 genders in favor of males (P value < 0.001; 95% CI -1.7 to 19.2).

DISCUSSION

The word lacune (or lacuna) is a French one which means a "lake."[5] Generally speaking, when a small single perforating artery is occluded within the deep cerebral white matter and corona radiate, basal ganglia, thalamus, or pons, the area becomes infarcted and then cavitates resulting in a lacune of 2-20 mm in maximum diameters[6]. The mechanism of "occlusion" of these small arteries can be explained by the development of lipohyalinosis of the penetrating arteries (which is the usual cause), particularly of smaller infarcts (3-7 mm in maximum diameter) and/or microatheroma of the origin of the penetrating arteries stemming off the middle cerebral artery main stem, circle of Willis, or distal basilar or vertebral arteries[3].

Thanks to the work of the late Canadian neurologist Charles Miller Fisher, who extensively analyzed, described, and categorized what we know nowadays as lacunar infarctions. His comprehensive landmark publications during the past century had/have opened the way to enumerable researchers all around the world to study these lacunar strokes extensively[7-13].

From December 1, 2010 to March 1, 2013 (i.e., 15 months), a total of 371 patients were admitted to our department with ischemic stroke; this had encompassed completed strokes and transient ischemic attacks. Of those 371, 82 were of a lacunar category (including first-ever and recurrent), i.e., approximately 22%, a figure that is somewhat close to the international one[1]. We excluded 32 patients, as we have mentioned in the methods section; therefore, first-ever lacunar stroke (from hypertension, diabetes, and/or smoking) would comprise approximately 13% of all these ischemic strokes and would be more common than "recurrent" lacunar strokes.

Males are more commonly affected than females with a mean age of 65 years and the overall incidence of lacunar strokes increases with age[4,14-15]. Our findings were somewhat similar to these international results.

Fisher was the first one who hypothesized that systemic hypertension was the cause behind these lacunar strokes after he found hat almost all of his studied patients were hypertensive and therefore he used the term cerebral hypertensive vasculopathy[2,8]. However, Millikan and Futrell[16] found that hypertension is present in 35-73% of lacunar stroke victims. Seventy percent of our patients were hypertensive (prior to their stroke) and this is consistent with Millikan and Futrell's observation. Diabetes is a well-known risk factor for vascular diseases, as well. You and coworkers[2] found that diabetes ranks 3rd (after hypertension and current smoking) as a strong risk factor for lacunar infarctions. In our study, hypertension was seconded by type II diabetes and smoking. The great difference in smoking status among our patients might be explained by the local cultural factors which impart a negative stigma on females

who smoke. This need further clarification. On the other hand, Jackson and Hutchison[17] concluded that hypertension and diabetes appear equally common in lacunar and non-lacunar ischemic strokes, but lacunar stroke is less likely to be caused by embolism from the heart or proximal arteries, and the lower prevalence of ischemic heart disease in lacunar stroke provides additional support for a non-atherosclerotic arteriopathy causing many lacunar ischemic strokes. On the other hand, Jackson and Sudlow[18] found that atrial fibrillation and carotid stenosis were associated more with non-lacunar than lacunar infarction of lacunar versus non-lacunar infarction. Furthermore, several researchers[19-21] have concluded that emboli from large arteries/heart or from large stenotic atherosclerotic intracranial arteries are uncommon causes of lacunar strokes and their embolic mechanism of stroke is still debated. Therefore, we excluded such patients from our study.

Although there are more than 20 lacunar stroke syndromes which were described by Fisher[3] the following 5 subtypes have been validated as being highly predictive for the presence of lacunes radiologically: pure motor hemiparesis, pure sensory stroke, ataxic hemiparesis, sensorimotor stroke, and dysarthria-clumsy hand syndrome.

1. Pure motor hemiparesis:

This is the commonest subtype, comprising 45-57% of all lacunar infarctions[22,23]. The weakness involves the face, arm, and leg on one side of the body in the absence of cortical signs or sensory deficit. In our study, 42% of patient developed this lacunar stroke. The usual damaged sites are the posterior limb of internal capsule, basal ganglia, and pons[24,25].

2. Ataxic hemiparesis:

This accounts for up to 18% of cases[22,23]. Patients develop ipsilateral weakness and limb ataxia that is out of proportion to the motor deficit in the absence of cortical signs or sensory deficits. Eighteen percent of our patients developed ataxic hemiparesis. The corona radiata and the anterior limb of the internal capsule are the usual ischemic targets; uncommonly, the upper part of the basis pontis is responsible for this stroke[26].

3. Pure sensory stroke:

It is defined as numbness of the face, arm, and leg on one side of the body in the absence of motor deficit, limb ataxia, or cortical signs. It is responsible for 7-18% of cases[22,23,27] It was found in 16% of our cases. Damages to the thalamus as well as the corona radiata and the posterior limb of internal capsule are the usual culprits[13,28].

4. Sensorimotor stroke:

This is characterized by weakness and numbness of the face, arm, and leg on one side of the body in the absence of cortical signs. It encompasses 15-20% of all cases[22,23,27]. Fourteen percent of our patients had this form of stroke. Ischemic lesions (that are usually larger than other lacunar ischemic strokes subtypes) involving the thalamus, internal capsule, and basal ganglia are responsible for the sensorimotor stroke syndrome[29.30].

5. Dysarthria-clumsy hand syndrome:

Patients develop facial weakness, dysarthria, dysphagia, and mild weakness and clumsiness of one hand. Actually, Fisher initially categorized this syndrome as a variant form of ataxic hemiparesis, but then it had been found to a be a separate entity[12]. It is the least encountered one and is found in 2-6% of all lacunes[12,22,23,27]. It was diagnosed in 10% of our patients, a figure that is higher than the international one. The upper paramedian part of the basis pontis is the usual site[12].

In our study, the right side of the brain was the target in 27 patients while the rest (n=23) involved the left side. The right side was involved more commonly in males while females showed more involvement of the left side of the brain. The pertinent medical literature does not mention whether the right side of the brain is more commonly involved than the left side[3,31]. We did not find a statistically significant difference between the 2 genders (P value < 0.4).

CONCLUSION

In our study, lacunar stroke targeted males more than females, with a median age of 63 and 61 years, respectively. Hypertension and type II diabetes were common in both genders, but only cigarette smoking was significantly found in males; however, the local cultural and religious factors might have governed this risk factor. Therefore, further analytic studies are required to clarify the role of smoking status. Pure motor hemiparesis was the usual phenotype in our patients but sensorimotor stroke statistically was more significantly found in male gender. There was no difference between both sides of the brain.

Limitations of the study:

1. This is a single institutional study that does not mirror the practice of stroke in the whole of Kurdistan, Iraq.
2. All patients were of Kurdish ethnicity (a minor ethnic group at the northeast of Iraq) and were residents of Sulaimaniya city. Neither Arabs nor other ethnic groups were involved in the study.
3. Only first-ever lacunar strokes were recruited.
4. The number of cases was relatively small.
5. There are no similar local or national published researches to compare the results with.

Taking into consideration the aforementioned factors, the findings and conclusion might well have been different if the number of cases was larger, other institutions and other ethnic groups were involved, and all cases of lacunar strokes were included.

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