Association between stroke and acute myocardial infarction and its related risk factors: hypertension and diabetes

Akut miyokard infarktüsü, inme ve ilgili risk faktörleri (hipertansiyon ve diyabet) arasında ilişki

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ABSTRACT

Objective: The aim of this study was to find the association between stroke, acute myocardial infarction (AMI) and assess related risk factors such as diabetes, hypertension and atrial fibrillation.

Methods: This is a cohort study with prospective and retrospective outcomes. All patients who were hospitalised in Hamad General Hospital, Hamad Medical Corporation with stroke from January 1999 to December 2003 were included. The diagnostic classification of stroke and associated risk factors were made in accordance with the International Classification of Disease 9th revision.

Results: Total 377 stroke patients were treated during the five years period. The average annual incidence of stroke for 5 years was 11.7 per 100,000 population. The incidence of AMI was higher in males than in females (73.5% vs 26.5%). There was a significant difference in stroke patients with AMI in respect of their gender (P<0.001).

Conclusion: The present study supports the hypothesis that there is a strong association between stroke, AMI and related risk factors such as diabetes, hypertension and other cardiovascular disease risk factors. Furthermore, present study showed that 60% of stroke patients had AMI and nearly 46.4% of stroke patients had diabetes mellitus. *(Anadolu Kardiyol Derg 2006; 6: 24-7)*

Key words: Epidemiology, acute myocardial infarction, stroke, hypertension, diabetes, Qatar

ÖZET

Amaç: Bu çalışmanın amacı inme ve akut miyokard infarktüsü (AMİ) arasında ilişkilerini araştırmak ve bunlarla ilgili diyabet, hipertansiyon ve atriyal fibrilasyon gibi risk faktörleri incelemektir.

Yöntemler: Kohort çalışmasında prospektif ve reprospektif olaylar incelendi. Çalışmaya Ocak 1999 ve Aralık 2003 arasında Hamad General Hastanesine yatırılan tüm hastalar dahil edildi. İnme ve ilgili risk faktörlerinin diyagnostik sınıflaması `International Classification of Disease 9th revision``a göre yapıldı.

Bulgular: Beş yıllık süre içinde toplam 377 hasta inme nedeni ile tedavi gördü. Ortalama yıllık inme insidansı 5 yıl içinde 100.000 kişide 11.7 idi. Erkeklerde AMİ insidansı kadınlara göre daha yüksek idi (%26.5 e karşın %73.5). İnme ve AMİ'lü hastaların cinsiyete göre dağılımında önemli farklılıklar bulundu (p<0.001).

Sonuç: Bu çalışmanın sonuçları inme, AMİ ve ilgili risk faktörleri (diyabet, hipertansiyon ve diğer kardiyovasküler risk faktörleri) arasında kuvvetli ilişki bulundu hipotezini desteklemektedir. Ayrıca, bu çalışmada inmeli hastaların %60'ında AMİ ve %46.4'ünde diyabetes mellitus olduğu gösterilmiştir. *(Anadolu Kardiyol Derg 2006; 6: 24-7)*

Anahtar kelimeler: Epidemiyoloji, akut miyokard infarktüsü, inme, hipertansiyon, diyabet, Qatar

Introduction

Stroke is a major cause of long-term disability and the third leading cause of death in most developed countries (1,2). It affects both sexes, with males slightly more affected than females (3). Epidemiologic data on acute myocardial infarction (AMI) and stroke are important for diagnostic, therapeutic, rehabilitation and preventive purposes. Increased global interest in AMI and stroke has resulted in an increasing number of publications (1-12). Stroke is a major health problem in Qatar because of its associated mortality and morbidity (4). The aim of this study is to find the association between stroke and acute myocardial infarction and assess its related risk factors in a newly developed State of Qatar.

Methods

This is a cohort study with prospective and retrospective outcomes conducted in the State of Qatar. Qatar is a small country with an area of 11,427 Sq. km extending into the Persian

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Gulf from the eastern coast of Arabian Peninsula. The land is stony, barren and extremely hot and arid climate prevails. Humidity is high during the summer, which runs from April to October and at the same time average annual rainfall is less than 127mm. Qatar has a population of 7,24,125 according to 2003 census and is densely populated at the capital city of Doha. The entire country of Qatar is served by the Hamad General Hospital. All patients with stroke requiring hospitalization in Qatar were treated at this hospital for the five-year period between 1999 and 2003 were identified. The age of presentation, gender, and cardiovascular risk factor profiles (smoking, hypertension, hypercholesterolemia, diabetes, and pre-existing coronary heart disease) were analyzed. The physicians reported the events in a prescribed form with items related to neurological deficit, trends of symptom and past history.

The classification and type of stroke was defined according to the International Classification of Disease 9th revision (ICD-9), (1-3,5-6). Stroke cases were determined by non-contrasts brain computerized tomography (CT) scan within 3 days of admission to the hospital. Repeat CT scan or magnetic resonance imaging (MRI) was performed within 2 weeks of admission if the initial CT scan was normal. Vascular investigations were performed occasionally, but these data were not analyzed. The markers used for identifying myocardial necrosis were creatinine kinase -MB fraction or troponin.

The diagnostic classification of definite AMI cases was made according to the criteria recommended by the WHO (8). For the purpose of this study, the old definition of systemic hypertension (HTN), a blood pressure reading of greater than 140/90 mm Hg in the non-acute phase or the use antihypertensive medications, was used (4-7,9). Patients were classified as diabetic if both of their venous blood glucose values equal or >7.0 mmol/l or if they were currently taking diabetic medication (9-11).

Student-t-test was used to ascertain the significance of differences between mean values of two continuous variables. Fisher exact test and Chi-square analysis were performed to test for differences in proportions of categorical variables between two or more groups. Stepwise logistic regression was used to predict the risk factors for AMI and stroke cases by entering all factors by forward stepwise logistic regression method. The level of $p<0.05$ was considered the cut-off value of significance.

Results

Of the total 377 patients admitted with stroke, 234 (62.1%) patients had AMI. Also, the incidence of AMI was higher in males than in females (73.5% vs 26.5%). The mean age of stroke patients with AMI was 54.9±12.5 years and in stroke cases without AMI it was 58.0±15.0 years.

Table 1 presents baseline clinical characteristics and biochemical profile of AMI patients among stroke cases. Non-Qataris were more likely to have AMI when compared with Qataris (p=0.005). Moreover, prevalence of AMI in stroke patients was 10% higher in subjects below 50 years (35.5% vs. 25.9%); with borderline significance of p=0.052. Smokers were twice more likely to have AMI than non smokers 36.8% vs. 14.7% (p<0.001). The prevalence of hypercholesterolemia was significantly higher in AMI subjects but diabetes mellitus did not show any association. Cholesterol levels and triglyceride levels were comparable across groups. Mortality was significantly higher among AMI subjects 45.3% vs. 30.1% (p=0.003).

Stepwise logistics regression analysis showed smoking and hypercholesterolemia were strong predictors for AMI in stroke patients (Table 2).

Figure 1 shows the incidence rate of stroke per 100,000 population by gender. The incidence of stroke in males reduced by the year 2003 compared to previous years. The patients were admitted to intensive care unit or stroke unit and the median duration of length of stay was 7 days. The median time of onset of AMI after stroke in the diagnosed patients was 30 days.

Figure 2 shows the Venn diagram for myocardial infarction and its related risk factors as hypertension and diabetes mellitus (DM) in stroke patients. Among the stroke patients, 46.4% were diabetic, 28.9% were hypertensive and 62% had AMI.

Discussion

The population-based studies provide the best estimation of stroke incidence (1-3,5-9,12). The present study results represent the true incidence of risk factors in stroke and will serve to guide the health authorities in stroke management.

Table 1. Socio-demographic and clinical characteristics of stroke patients with and without AMI (N=377)

Variables	With AMI n(%)	Without AMI n(%)	P
Frequency	234	143	
Nationality			
Qatari	91(38.9)	77(53.8)	0.005
Non Qatari	143(61.1)	66(46.2)	
Age Groups			
<50 years	83(35.5)	37(25.9)	0.052
≥50 years	151(64.5)	106(74.1)	
Smoking habit			
Smoker	83(36.8)	21(14.7)	<0.001
Non Smoker	148(63.2)	122(85.3)	
Complications			
Diabetes mellitus	111(47.4)	64(44.8)	NS
Hypertension	58(24.8)	51(35.7)	0.024
Hypercholesterolemia	50(21.4)	15(10.5)	0.007
Old MI	24(10.3)	28(19.6)	0.011
Congestive Heart Failure	40(17.1)	40(28.0)	0.012
Atrial Fibrillation	7(3.0)	16(11.2)	0.001
Laboratory data (Mean±SD)			
Total Cholesterol, mmol/L	5.0±1.3	4.9±1.6	NS
HDL, mmol/L	1.15±0.62	1.20±0.93	NS
Triglyceride, mmol/L	1.9±1.0	1.8±1.0	NS
Mortality			
Dead	106(45.3)	43(30.1)	0.003
Alive	128(54.7)	100(69.9)	

AMI - acute myocardial infarction, HDL - high density lipoprotein cholesterol, NS- not significant

The annual incidence rate of stroke that we observed in our study is similar to Saudi Arabia (13), Libya (14) and is less than the Western countries (1,5-8,12]. Among the Qatari patients who were hospitalized with stroke, the incidence was higher in females, whereas for non-Qataris, the incidence was higher in males. In Qatar, a higher ratio was expected in expatriates because men grossly outnumber women.

In the present study, 35.5% of the stroke patients with AMI were below 50 years of age, on the contrary a lower percentage was reported in Saudi Arabia (10%) (13). In Sweden, 25% of young patients with cerebral infarction were hypertensive and 5% were diabetic (3).

The prevalence of atrial fibrillation was 6.1% and the present study findings revealed that DM (46.4%) was the most common risk factor found in patients with stroke. The current study revealed that 28.9% of patients were hypertensive and this is confirmative with the more recently reported study (9). A study conducted by Barrett-Connor et al (12) also reported the DM as the most common risk factor for stroke. Meanwhile, 54% of stroke patients in Libya (14) and 52% in Saudi Arabia (13) were hypertensive. In other developed countries, HTN ranged from 12% to 17% depending on the patients ethnic groups (1-3, 5-6). In Saudi Arabia, 41% of stroke patients were diabetic (13) and 0.5% to 23% were diabetic in the developed countries (3,12). Recently, few studies were conducted on the epidemiology of hypertension (4,7) and its associated risk factors in the population of Qatar and it was found that 25% were hypertensive and 15% were diabetic (4,7,9). These high rates are attributed to a sedentary lifestyle, stress (especially among expatriates), diet and consanguineous marriage (16).

The male: female ratio was dissimilar from that observed in other parts of the world (1,3,6, 14-17). The study also showed that hypertension with diabetes constituted a potent risk factor for stroke.

Conclusion

The present study supports the hypothesis that there is a strong association between acute myocardial infarction and stroke, and related risk factors such as diabetes, hypertension and other cardiovascular disease risk factors. Furthermore, present study showed that 60% of stroke patients had AMI and nearly 46.4% of stroke patients had DM.

Table 2. Multivariate forward stepwise logistic regression analysis data for stroke and AMI

Predictors of AMI among patients			
Variable	**Odds Ratio**	**95% Confidence Interval**	**p**
Postmenopausal	2.786	2.125-3.652	<0.001
Stroke	6.076	4.019-9.186	0.001
Diabetes mellitus	1.589	1.324-1.908	<0.001
Current smoking	3.498	2.087-5.865	<0.001
Atrial fibrillation	0.227	0.152-0.341	<0.001
Predictors of stroke among patients			
Variable	**Odds Ratio**	**95% Confidence Interval**	**p**
Postmenopausal	2.091	1.081-4.046	0.028
AMI	6.005	3.965-9.094	<0.001
Hypertension	0.623	0.412-0.943	0.025

AMI - acute myocardial infarction

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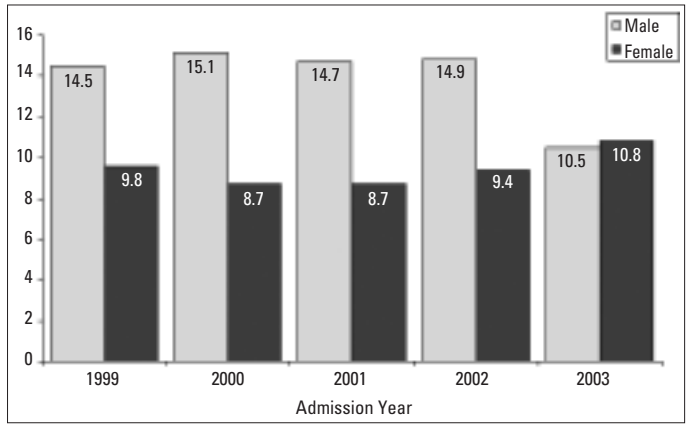

Figure 1. Incidence per 100,000 population of stroke by gender in Qatar from 1999-2003

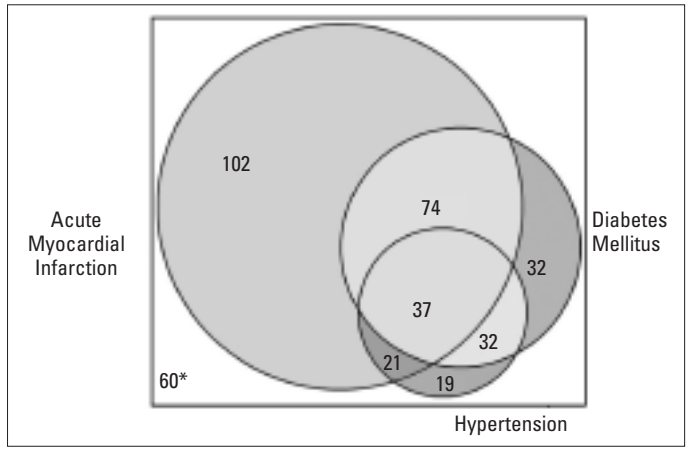

Figure 2. Venn diagram for myocardial infarction, hypertension and diabetes mellitus in stroke patients

• Cases of stroke without AMI, DM or HTN.
102 - AMI only, 32 - DM only, 19 - HTN only, 74 - AMI + DM, 37 - AMI + HTN + DM, 21 - AMI + HTN, 32 - DM +HTN
AMI - acute myocardial infarction, DM - diabetes mellitus, HTN - hypertension

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