Stroke Incidence, Risk Factors and Mortality Rates in Northern Cyprus

Kuzey Kıbrıs'ta İnme İnsidansı, Risk Faktörleri ve Mortalite Oranları

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ABSTRACT Objective: Cerebrovascular diseases incidence are dramatically increasing and are becoming major cause of death worlwide. This study, the first in Northern Cyprus, looks at rates of incidence, stroke types, underlying risk factors and inpatient mortality rates. **Material and Methods:** The study is a retrospective analysis of hospital records on patients, between January 2009 and January 2012, who were diagnosed with stroke and were admitted to Dr. Burhan Nalbantoğlu General Hospital which was the leading hospital where all stroke patients were admitted or transferred. **Results:** Over the three year period, a total of 468 patients, diagnosed and treated for stroke, were admitted to Dr. Burhan Nalbantoğlu General Hospital. The majority, 86.4%, had ischemic stroke and the rest, 13.6%, were diagnosed with haemorrhagic stroke. Female patients were 50.5% and male patients were 49.5%. The average age of patients were 70.6 years. The risk factors rates, observed among the discharged patients, were 82% hypertension, 56.9% hyperlipidemia, 39.2% diabetes mellitus, 23.7% atrial fibrillation. Stroke incidence rates per 100.000 of population were approximately, 48.9 in 2009, 53.8 in 2010 and 73.3 in 2011. 21.6% of patients were recorded dead from the condition.The overall inpatient mortality rates were 26.6% for ischemic and 11.3% for haemorrhagic stroke patients. **Conclusion:** This study, first of its kind, shows the increase in stroke incidence rates over years and highlights the significance of management and treatment of risk factors which will definitely help to prevent cerebrovasculer diseases.

Key Words: Stroke; mortality; epidemiology; risk factors

ÖZET Amaç: Tüm dünyada serebrovasküler hastalıkların görülme sıklığı giderek artmakta, ölüm sebepleri içerisinde önemli bir yer tutmaktadır. Bu çalışmada Kuzey Kıbrıs'ta inme insidansı, tipleri, risk faktörleri ve mortalite oranları değerlendirilmiştir. **Gereç ve Yöntemler:** Ocak 2009 ve Ocak 2012 yılları arasında, Kuzey Kıbrıs'ta inme hastalarının önemli çoğunluğunun başvurduğu veya sevk edildiği Dr. Burhan Nalbantoğlu Devlet Hastanesi'nde inme tanısı alan hastaların hastane kayıtları retrospektif olarak incelenmiştir. **Bulgular:** Üç yıllık dönem içerisinde Dr. Burhan Nalbantoğlu Devlet Hastanesi'nde toplam 468 hasta inme tanısıyla takip ve tedavi edilmiş, %86,4'üne iskemik, %13,6'sına hemorajik inme tanısı konmuştur. Hastaların %50,5'ini kadın, %49,5'ini erkek hastalar oluşturmuş, ortalama yaş 70,6 yıl olarak saptanmıştır. Tedavi edilen hastaların %78,4'ü taburcu edilirken, %21,6'sının izlemi ölümle sonuçlanmıştır. İskemik inmenin mortalite oranı %26,6, hemorajik inmenin %11,3 olarak tespit edilmiştir. Taburcu edilen hastaların %82'sinde hipertansiyon, %56,9'unda hiperlipidemi, %39,2'sinde diabetes mellitus, %36,2'sinde aterosklerotik kalp hastalığı, %23,7'sinde atriyal fibrilasyon tespit edilmiştir. Kuzey Kıbrıs'ta inme insidansı 2009 yılı için 48,9/100.000, 2010 için 53,8/100.000, 2011 için 73,3/100.00 olarak hesaplanmıştır. **Sonuç:** Çalışmamız Kuzey Kıbrıs'ta inme insidansı, risk faktörleri ve mortalite oranlarını araştıran ilk çalışma olması bakımından önem arz etmektedir. İnme sıklığının her yıl artış göstermekte olması dikkat çekmekte, risk faktörleri ile mücadele edilmesi gerekliliğinin önemini ortaya koymaktadır.

Anahtar Kelimeler: İnme; ölüm oranı; epidemiyoloji; risk faktörleri

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Cerebrovascular disease is one of the main causes of death in the world.[1] There is a wealth of data on ethnic and racial variations in risk factors and on the after effects of stroke but studies on epidemiology in different parts of the world are scant.[2] Stroke is largely preventable, so knowing what causes stroke in a particular country is an essential step towards reducing incidence and financial burden of the health care for patients. Different countries have different lifestyles and the effect of vascular risk factors such as hypertension and diabetes are likely to be different between cultures and countries which constitutes the purpose of this study.[3]

FIGURE 1: Cyprus divided by green line.

MATERIAL AND METHODS

Cyprus is a politically and ethnically divided island located in the Mediterranean Sea. It is in two parts divided by the so called 'green line' which also crosses through Nicosia, the capital city. The Turkish community, lives in the North in the self-proclaimed state of Turkish Republic of Cyprus. Greeks govern the rest of the island as the Republic of Cyprus which is sometimes referred to as the Southern part (Figure 1). There are 265.903 inhabitants living in the North of which 98.739 live in the Turkish part of Lefkoşa. The Dr. Burhan Nalbantoğlu General Hospital is the biggest and the only hospital fully equipped in Northern Cyprus. The health service is free and easily accessible so any one suffering from acute illness such as stroke can seek treatment in the accident and emergency department. The province is not short of private clinics or smaller hospitals but where a stroke is suspected, the patient is usually transferred to the state hospital in Nicosia.

The health service in the Northern runs separately as do other public services because there is a long standing political stalemate between the two communities. As a result, although the World Health Organisation is able to report statistics on different countries, figures for Cyprus may not fully reflect the trends in Northern part of the island.[4]

The study is for the period January 2009 to January 2012 and covers patients with first case of stroke only. The first of point of referral for cases of stroke from subarachnoid haemorrhage was usually the neurosurgeons so we were not able to cover these in our study. In addition, 101 patients were recorded dead from stroke and most of them were dead within 24 hours of admission to hospital, before there was a chance to establish the risk factors. As a result our study was deprived of information relating to these patients.

All the information used to calculate incidence rates came from hospital records, some of it, such as details of demographic characteristics and clinical data were extracted from paper files while details of diagnosis were verified from computerized tomography (CT) and magnetic resonance imaging (MRI) scans taken soon after admission to hospital, or later. At this period none of the patients were scanned for cerebral magnetic resonance angiography or computerized tomography angiography.

We defined first-ever stroke (FES) as stroke where the patient had no history of the condition before and so our estimates of rates of stroke relate to 'first-in a-lifetime' cases only. We determined history of stroke by sifting through whatever information was available from hospital records. At the same time, we did not include patients who had infarction or haemorrhage shown by an old CT scan which constituted evidence of a previous stroke. We kept close to established guidelines to group cerebral infarction into four clinical types,

namely: Lacunar infarction, atherotrombotic infarction, cardioembolic infarction and the undetermined category. The guidelines were drawn from **a)** Classification of Cerebrovascular Disease III by the National Institute of Neurological Disorders and Stroke, **b)** 'Trial of Org 10172 in Acute Stroke Treatment (TOAST) 11 and **c)** Cerebral Embolism Task Force.[5-7] Diagnosis of cerebral infarction and the different types were determined with reference to detailed clinical topographies, the ancillary laboratory tests, up to date imaging of the brain including CT and MRI scans, echocardiography and the carotid duplex scan. We thought the morphological findings were sufficiently significant and used the clinical features as benchmark in assessments.

RISK FACTORS

We established the risk factors for cerebral infarction and cerebral haemorrhage after thorough checking of the patient files and records of follow up examinations and investigations during patient stay in the hospital. Patients were admitted to either the intensive care unit or to a ward in the neurology department on the basis of clinical neurological condition.

Patients were evaluated for the risk factors as with a history of hypertension, diabetes mellitus and hyperlipidemia or were newly diagnosed. We used past medical history and findings from electrocardiography (ECG), echocardiography (ECO) and angiography to evaluate patients for potential atherosclerotic heart disease, atrial fibrillation and heart valve disease.

STATISTICAL ANALYSIS

We used the SPSS (Version 15.0, Chicago, IL) software package to analyse the data. The estimates for overall incidence rates and for specific groups of age and gender were derived from the incidence rate formula. The annual incidence rate is measured as number of cases per 100 000 of population. Age difference between groups is 10 years. We applied the standard statistical techniques to calculate the 95% confidence interval (CI) for incidence rates. The age-adjusted incidence rates are based on the basic figure for world population and the figures for the population of North Cyprus came from general census (Turkish Cypriot State Planning Department).

RESULTS

A total of 468 patients were admitted to hospital with first case of stroke. A total of 405 patients were diagnosed with ischemic and 63 with intracerebral haemorrhage (ICH). 101 patients died in the hospital while under treatment for the condition (Table 1).The gender distribution in our sample is 232 females (49.5%) and 236 males (50.5%). The mean age was 73.9 for women and 67.4 for men. Over the period, the average age for men was lower than women. Half of the ICH patients (n=30) died and women patients (n=21) constituted most of the death.

Lacuner infarction composed 49.6%, cardioembolic 24,8%, atherothrombotic 12.0% of total ischemic stroke patients. Atherothrombotic and cardioembolic infarction were found to be more common among women while among men, lacunar infarction was the main etiology of stroke (Table 2).

TABLE 1: Total patients with ischemic and haemorrhagic stroke distrubuted by gender.

	Ischemic stroke	ICH
Patients	**Total (w/m)***	**Total (w/m)**
Alive	334 (152/182)	33 (14/19)
Dead	71 (45/26)	30 (21/9)
Total	405	63

*: w:women; m:men.

TABLE 2: Ischemic stroke subtypes of total discharged patients distrubuted by gender.

	Total	Women	Men
Stroke Subtype	**No. of cases**	**No.of cases**	**No.of cases**
Cerebral infarction	367	166	201
Lacuner	182(49.6%)	56	126
Cardioembolic	91(24.8%)	61	30
Aterotrombotic	44(12.0%)	27	17
Undetermined	17(4.6%)	8	9

RISK FACTORS

Hypertension was the most frequently cited risk factor (82%) for both ischemic and ICH stroke cases. 28.6% of patients with ischemic stroke had cardiac sources of embolism. In cases of lacuner infarcts, hyperlipidemia and diabetes were right behind hypertension as the highest risk factors compared to large vessel territory infarcts. 144 patients (39.2%) had diabetes mellitus. Atrial fibrillation was diagnosed in 87 (23.7%) patients and it was more common in women. 133 (36.2%) patients had atherosclerotic heart disease which was more common in men. Hyperlipidemia was diagnosed in 209 patients (56.9%) of whom 128 were males (61.2%) and 81were females (38.8%).

INCIDENCE OF STROKE

In 2009 incidence rate was found to be 48.9 and rates were nearly equal between genders.The adjusted rate was found to be 42.2. In 2010 incidence rate rised to 53.8 where there was a male dominance.The adjusted rate was found to be 47.3. In 2011 incidence rate was found to be 73.3 where women gender was the majority and the adjusted rate was 64.7. These figures clearly show the increase in stroke over the years (Table 3, 4).

MORTALITY

Majority of deaths were due to ischemic stroke (n=71) while ICH accounted for the remainder. There were more female than male deaths (66 and 35) and 45 female patients died due to ischemic stroke and 21 from ICH. The number of male patients, who died due to ischemic stroke was 26 and 9 for ICH. The mean age was 78.8 years for ischemic 72.2 years for ICH deaths. Mortality was calculated for categories by age, gender and stroke. To help compare mortality rates across age we divided patients into three groups with a 10 year age differential namely, those aged 45 years old and over, those falling between aged 45 and 64 and last, aged 65 and over. (With age adjustment within each category according to the North Cyprus Standard population) (Table 5, 6).

DISCUSSION

In many circumstances, population-based studies provide the best estimation of incidence of stroke. With this study, we made every effort to provide a comprehensive case analysis. Stroke strikes in the most sudden and dramatic way and, Northern Cyprus being a small area with only one hospital with full equipment where health service is free and available on request means nearly almost everyone suspecting or having acute stroke comes to Dr. Burhan Nalbantoğlu General Hospital. Moreover, every patient suspected of having a stroke is seen by a neurologist which means the risk of missing diagnosing stroke is much reduced. There are five specialists working as neurologists in the Dr. Burhan Nalbantoğlu General Hospital. The department of neurology has a ward with thirty beds and an intensive care unit with eight beds. This is why the Dr. Burhan Nalbantoğlu General Hospital is the best equipped hospital in the province and the main reason for patient referral from smaller hospitals. Therefore, the findings of this study are a true representation of North Cyprus as a whole. We accept that some patients, especially the very elderly, who died at home, or patients with mild symptoms who missed out on being diagnosed, are omitted from the study. Nevertheless, the study is as representative as possible, notwithstanding these unavoidable omissions, and represents the true incidence of stroke in the province. It is also the first study to come out of Northern Cyprus which carries important implications for the management of stroke.

Ischemic stroke is the main type of stroke both in developed and developing countries. At the literature review Benamer et all showed 55-87% ischaemic stroke and 6.3-41.3% cerebral haemorrhage in Arap countries.[8] This is also the case in our study which showed ischemic stroke accounted for 86.4 per cent of all the cases leaving 13.6 per cent only for ICH. Lacuner infarction was also the main subtype of ischaemic stroke similar in studies of Bahou et al. and Al-Shammri et al.[9,10]

Hypertension is the most potent risk factor for all types of stroke. In our study, hypertension (82%) and hyperlipidemia (56,9%) were the main

TABLE 3: Shows estimates of incidence rates of each year respectively for ischemic stroke and intracerebral haemorrhage.

	Women			Men			Total		
Age category (year)	**n**	**Rate**	**95%CI***	**n**	**Rate**	**95%-CI**	**n**	**Rate**	**95%-CI**
Year 2009									
0-24	1	2,22	0-6.57	0	0,00	0-0	1	1,08	0-3.21
25-34	0	0,00	0-0	1	4,50	0-13.33	1	2,25	0-6.66
35-44	3	15,04	0-32.07	3	14,65	0-31.24	6	14,85	2.97-26.73
45-54	7	38,50	9.98-67.02	6	32,11	6.42-57.79	13	35,26	16.09-54.42
55-64	7	53,79	13.94-93.64	19	147,20	81.01-213.39	26	100,30	61.75-138.86
65-74	11	123,66	50.58-196.75	17	227,35	119.27-335.42	28	171,02	107.67-234.36
75-84	27	561,27	349.56-772.99	17	493,83	259.08-728.58	44	533,14	375.61-690.67
85-	8	995,02	305.511-1684.54	3	574,71	0-1225.06	11	829,56	339.32-1319.8
Total	64	48,13	36.34-59.93	66	49,65	37.67-61.62	130	48,89	40.49-57.29
Year 2010									
0-24	0	0,00	0-0	0	0,00	0-0	0	0,00	0-0
25-34	1	4,49	0-13.3	0	0,00	0-0	1	2,25	0-6.66
35-44	0	0,00	0-0	1	4,88	0-14.46	1	2,47	0-7.32
45-54	3	16,50	0-35.17	6	32,11	6.42-57.79	9	24,41	8.46-40.36
55-64	9	69,16	23.97-114.34	26	201,43	124-278.86	35	135,02	90.29-179.76
65-74	19	213,60	117.56-309.65	21	280,84	160.7-400.96	40	244,31	168.6-320.03
75-84	20	415,76	233.54-597.97	19	551,92	303.75-800.1	39	472,56	324.24-620.87
85-	12	1492,54	648.05-2337.02	6	1149,43	229.6-2069.16	18	1357,47	730.35-1984.58
Total	64	48,13	36.34-59.93	79	59,43	46.32-72.53	143	53,78	44.96-62.59
Year 2011									
0-24	1	2,22	0-6.57	0	0,00	0-0	1	1,08	0-3.21
25-34	0	0,00	0-0	2	9,00	0-21.48	2	4,50	0-10.73
35-44	0	0,00	0-0	4	19,54	0.39-38.69	4	9,90	0.2-19.6
45-54	8	44,00	13.51-74.49	13	69,56	31.75-107.38	21	56,95	32.59-81.31
55-64	6	46,10	9.21-83	19	147,20	81.01-213.39	25	96,45	58.64-134.25
65-74	23	258,57	152.9-364.25	19	254,10	139.84- 368	42	256,53	178.94-334.11
75-84	45	935,45	662.1-1208.7	27	784,31	488.47-1080.16	72	872,41	670.89-1073.93
85-	21	2611,94	1494.8-3729.9	7	1341,00	347.57-2334.42	28	2111,61	1329.46-2893.77
Total	104	78,22	63.18-93.25	91	68,45	54.39-82.52	195	73,33	63.04-83.63
Total of 3 years									
0-24	2	4,44	0-10.59	0	0,00	0-0	2	2,17	0-5.17
25-34	1	4,49	0-13.3	3	13,51	0-28.79	4	8,99	0.18-17.81
35-44	3	15,04	0-32.07	8	39,08	12-66.16	11	27,22	11.13-43.3
45-54	18	98,99	53.26-144.73	25	133,77	81.33-186.21	43	116,62	81.76-151.48
55-64	22	169,05	98.41-239.69	64	495,84	374.36-617.32	86	331,77	261.65-401.89
65-74	53	595,84	435.42-756.26	57	762,29	564.39-960.18	110	671,86	546.3-797.41
75-84	92	1912,48	1521.68-2303.29	63	1830,07	1378.1- 2281	155	1878,10	1582.43-2173.78
85-	41	5099,50	3538.54-6660.46	16	3065,13	1563.2-4567	57	4298,64	3182.68-5414.61
Total	232	174,48	152.03-196.94	236	177,53	154.88-200.2	468	176,00	160.0-191.5

*: Confidence Interval.

risk factors for all types of cerebral infarction. Hypertension as a risk factor found among stroke patients in Arap countries was 24.9-76%.[11-26] Diabetes Mellitus was present in 39.2% of patient in our study which was found 11.6-69.4 % among patients in Arab countries.[10-13,15,19,20,22,23,25,26] Hyperlipidemia was 4-61% in studies among Arap countries.[6,10,17,20,22,23,25] In Asian countries quite the contrary serum total cholesterol levels are generally low although the levels have increased during the

TABLE 4: Shows age adjusted incidence rates of each year respectively.

Age category (year)	2009 Adjusted rate	2010 Adjusted rate	2011 Adjusted rate	Total Adjusted rate
0-24	0.46	0.00	0.46	0.93
25-34	0.35	0.35	0.70	1.40
35-44	2.04	0.34	1.36	3.74
45-54	4.02	2.79	6.50	13.31
55-64	8.30	11.17	7.98	27.44
65-74	8.84	12.63	13.26	34.74
75-84	12.96	11.48	21.20	45.64
85-	5.23	8.55	13.30	27.08
Total	42.19	47.31	4.76	154.26

past 50 years.[27-29] In our country hyperlipidemia is attributed to a sedentary lifestyle and diet which is generally meat based.[30] Northern Cyprus, like most developed countries in Western Europe is also facing an aging population which is another reason for high incidence of stroke.

The overall rate of incidence per 100 000 of population was 48.9 in 2009, 53.8 in 2010 and 73.3 in 2011. Age adjusted incidence rates were 42.2 in 2009, 47.3 in 2010, 64.8 in 2011. It is clear the numbers for stroke and the financial burden on society of the medical care are likely to increase greatly.When we look at total of 3 years age adjusted incidence rate raises to 154.3. When comparing the age adjusted stroke incidence rates with Middle East countries, our incidence rate is higher but still lower than rates reported from Western countries.[31,32] In Saudi Arabia rate was the lowest with 38.5, in Iran rate was 61.5, in Palestine 62.7, in Kuwait 92.2, in Bahrain 96.2, in Libya 114.2 and in Qatar rate was the highest with 123.7.[2,11,19,22,24,33,34] Also our incidence rate is lower than rates reported from Al Quseir City and Al Kharga district in Egypt.[35,36]

In our country there was a marked increase in stroke cases in May, June and July which can be explained by the fact that these are months of incredibly high temperatures (Table 7). Hot weather triggers hypertension and this adds to the likelihood of stroke.[37] Also the study showed men to be generally more susceptible to stroke but in 2011 there was a steep rise of stroke among women. Reports

TABLE 5: Mortality rates of patients diagnosed with cerebral infarction.

Ages (year)	No	*CI Women Rate	%95 CI	No	*CI Men Rate	%95 CI	No	CI Total Rate	%95 CI
Less than 45	2	2.29	0-5.26	2	2.22	0-5.14	4	2.26	0-5.21
45-65	0	0	0	2	6.33	1.4-11.26	2	3.19	0-6.69
Above 65	43	288.37	255.09-321	22	188.99	161.12-214	65	244.23	213.6-274
Total	45	33.74	22.35-45.1	26	19.52	10.86-28.1	71	26.64	16.52-36.7

*CI:Cerebral infarction.

TABLE 6: Mortality rates of patients diagnosed with intracerebral haemorrhage.

Ages (year)	No	*ICH Women Rate	%95 CI	No	ICH Men Rate	%95 CI	No	ICH Total Rate	%95 CI
Less than 45	2	2.29	0-5.26	1	1.11	0-3.18	3	1.69	0-4.24
45-65	2	6.41	1.45-11.37	2	6.33	1.4-11.26	4	6.37	1.42-11.32
Above 65	17	114.01	93.08-134	6	51.27	37.24-65.3	23	86.42	68.2-104.64
Total	21	15.75	7.97-23.53	9	6.76	0-11.85	30	11.25	4.67-17.83

*ICH: Intracerebral haemorrhage.

TABLE 7: Stroke frequency classified by months.

	Frequency	Percent
January	36	7.7
February	30	6.4
March	36	7.7
April	44	9.4
May	49	10.5
June	57	12.2
July	55	11.8
August	24	5.1
September	22	4.7
October	46	9.8
November	32	6.8
December	37	7.9

on the subject consistently show rates of stroke increasing exponentially with age and that a greater incidence of stroke is found in men than in women.Only three studies reported incidence of stroke higher in women.[2,33,34] Haemorrhagic stroke is reported more commonly in women which is the same as our finding.[37,38]

The mortality rate was 26.6% for ischemic stroke and 11.25% for ICH. The mortality rates of ischemic stroke and ICH were in ranges reported from Qatar, Saudi Arabia, Libya but were lower than in Nigeria and the United States.[11,19,22,40,41] Hypertension was the main etiology of haemorrhages. The mortality rates for ischemic and ICH cases were high in women. The advanced age of women patients may have been a contributory factor for this phenomenon.

CONCLUSION

The Turkish Republic of Northern Cyprus is not a politically recognised sovereign state and this often means the area is generally ignored in international studies. To our knowledge, there has never been a study on stroke in Northern Cyprus. Risk factors were common among patients in the study so as a result screening and better control of these risk factors should be a priority in the strategy to prevent and manage cerebrovascular diseases.

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