

# The Epidemiology of Stroke in Northern Palestine: A 1-Year, Hospital-Based Study

Waleed M. Sweileh, PhD,\* Ansam F. Sawalha, PhD,† Sana M. Al-Aqad, MSc,\*  
Sa'ed H. Zyoud, MSc,† and Samah W. Al-Jabi\*

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*Background:* Although stroke is one of the leading causes of morbidity and mortality worldwide, no studies on stroke were reported from Palestine. The objective of this study was to identify the risk factors and incidence rates of stroke in a well-defined area in north Palestine (i.e., the district of Nablus) with 362,159 native Palestinian inhabitants. *Methods:* All patients admitted to Al-Watani governmental hospital from September 2006 to August 2007 and given the diagnosis of acute stroke were included in the study. Diagnosis of stroke was confirmed by computerized tomography scan. Demographic characteristics and clinical data pertaining to the patients were obtained from their medical files. *Results:* A total of 186 patients with stroke (95 female and 91 male) were identified during the study. The average age of the patients was  $69.09 \pm 10.9$  years. Among the total patients, 112 had a first-ever stroke (FES) and 74 had recurrent stroke (RS). Hypertension, diabetes mellitus, and renal dysfunction were the most common risk factors with comparable prevalence in both FES and RS. The majority of patients (153; 82.3%) had ischemic stroke subtype whereas 33 (17.7%) had hemorrhagic stroke subtype. The overall (FES + RS) annual crude incidence rate of stroke was 51.4 per 100,000 persons whereas the annual crude incidence rate of FES was 31 per 100,000 persons. The age-adjusted incidence rates were 54.5 (FES) and 89.8 (FES and RS). The overall inhospital mortality was 21% and was higher in patients with RS than in those with FES. *Conclusion:* Modifiable risk factors were common among patients with stroke. Better control of these risk factors might decrease incidence of stroke and all consequences thereafter. Incidence rate and inhospital mortality of stroke reported in this study were within the range reported from other Arab countries. **Key Words:** Stroke—incidence rate—Palestine.

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Stroke is one of the leading causes of morbidity and mortality worldwide.<sup>1</sup> Ethnic and racial variations in risk factors, incidence rates, and outcome of stroke are well documented.<sup>2-8</sup> Therefore, epidemiologic studies

on stroke in different parts of the world are needed. Such data are important for health policy makers to direct resources and implement preventive measures, especially in developing countries where stroke is still a true economic and health burden. Although epidemiologic studies on stroke were carried out in different parts of the world including some neighboring Arab countries,<sup>9-12</sup> there were no published data from Palestine. In Palestine, the Ministry of Health is the major provider of medical services for a total population of 4,151,668 inhabitants. In the northern part of Palestine, Nablus district is a well-defined area with a total population of 362,159 native Palestinian inhabitants (Fig 1). Al-watani Hospital is the only referral governmental hospital in Nablus district that offers medical services to patients with acute stroke.

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From the \*College of Pharmacy and †Poison Control and Drug Information Center, An-Najah National University, Nablus, Palestine.

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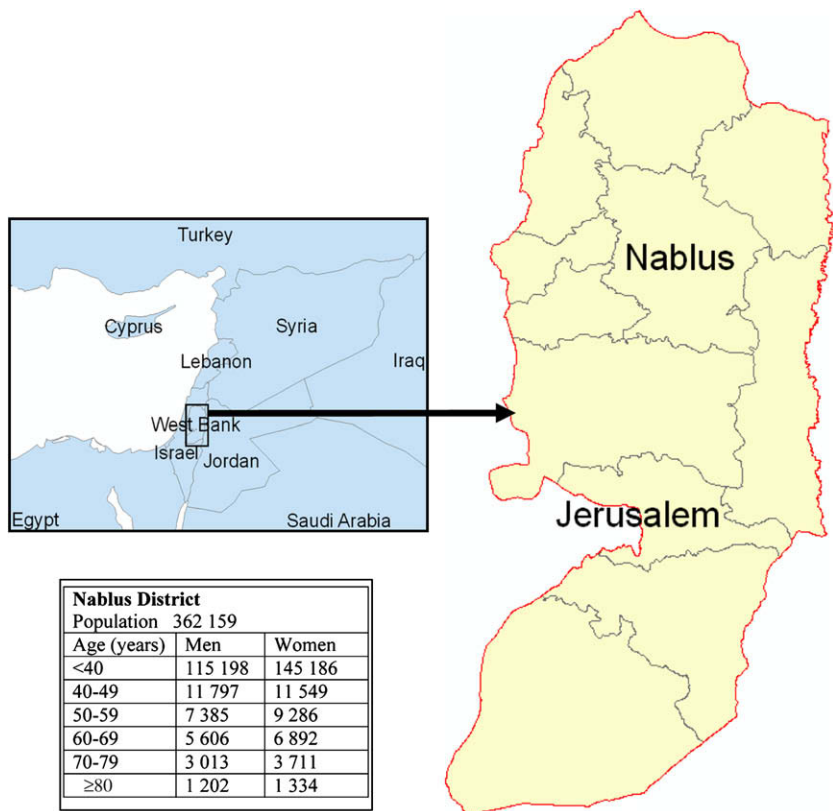
Address correspondence to Waleed M. Sweileh, PhD, College of Pharmacy, An-Najah National University, Nablus, Palestine. E-mail: waleedsweileh@najah.edu.

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**Figure 1.** Map of Nablus district, West Bank, Palestine.



Patients with acute stroke are admitted to the emergency department of Al-watani Hospital and treated as inpatients. The hospital is located in the center of the district and offers 24-hour emergency services for acute stroke. This study was carried out with the following objectives: (1) identify stroke-related risk factors among patients with stroke; and (2) estimate the incidence of stroke in Nablus district, northern Palestine.

## Methods

This 1-year, hospital-based study was conducted from September 1, 2006, until August 31, 2007. All patients admitted with acute stroke were included in the study. Two of the authors were responsible for the 24-hour coverage of the patients admitted to the hospital with stroke diagnosis during the study period. One author was responsible for death certificates and identification of the cause of death. Follow-up during hospital stay was assigned to the other two authors. Diagnosis of stroke was carried out by computerized tomography (CT) scan. Patients with no confirmed CT scan or those suspected of having transient stroke were excluded from the study. Data collection was approved by the hospital administration and by medical ethics committee. Data for this study were obtained from patients' medical files. The data collected included: age, sex, and risk factors. Risk factors that were considered in this study were: hypertension (HTN), diabetes

mellitus (DM), congestive heart failure, atrial fibrillation, ischemic heart disease, renal dysfunction, obesity, and smoking. Renal dysfunction was defined as creatinine clearance (CrCl) less than 60 mL/min. CrCl was calculated for all patients using Cockcroft-Gault formula and values for female patients were obtained by multiplying the result by 0.85. Obesity was defined as a body mass index greater than 30 for both male and female patients. To compare our results with those reported from the neighboring Arab countries, a PubMed search was conducted using the key word "stroke" followed by the name of each Arab country. The results obtained were used for comparative purposes.

## Statistical Analysis

Analysis of data was carried out using software (Statistical Package for Social Sciences [SPSS], Version 15.0, Chicago, IL). Overall incidence rates and age- and sex-specific rates were calculated using the incidence rate formula. The annual incidence rate was presented as number of cases per 100,000 persons. The age variable was presented as 10-year age groups. The 95% confidence interval (CI) of the incidence rates was calculated using standard statistical techniques. The age-adjusted incidence rates were calculated based on the standard world population. The total number of population and the age-specific population in Nablus district were obtained from

**Table 1.** Patient characteristics of first-ever stroke were compared with recurrent stroke

Variable	FES n (%)	RS n (%)	Total stroke n (%)
Sex			
Male	48 (42.9)	43 (58.1)	91 (48.9)
Female	64 (57.1)	31 (41.9)	95 (51.1)
Age (mean), y	68.24 ± 11.29	70.39 ± 10.25	69.09 ± 10.9
Age categories, y			
40-49	7 (6.3)	2 (2.7)	9 (4.8)
50-59	16 (14.3)	8 (10.8)	24 (12.9)
60-69	35 (31.3)	18 (24.3)	53 (28.5)
70-79	32 (28.6)	29 (39.2)	61 (32.8)
>80	22 (19.6)	17 (23)	39 (21)
Stroke subtype			
Ischemic	92 (82.1)	61 (82.4)	153 (82.3)
Hemorrhagic	20 (17.9)	13 (17.6)	33 (17.7)
Smoking	29 (25.9)	10 (13.5)	39 (21)
Hypertension	72 (64.3)	58 (44.6)	130 (69.9)
Diabetes	47 (42)	37 (50)	84 (45.2)
Congestive heart failure	14 (12.5)	9 (12.2)	23 (12.4)
Ischemic heart disease	11 (9.8)	3 (4.1)	14 (7.5)
Atrial fibrillation	17 (15.2)	9 (12.2)	26 (14)
Renal dysfunction	31 (27.7)	32 (50.8)	63 (33.9)
Obesity	19 (17)	12 (16.2)	31 (16.7)
Die in hospital	15 (13.4)	24 (32.4)	39 (21)

Abbreviations: FES, first-ever stroke; RS, recurrent stroke.

the Palestinian Central Bureau of Statistics and were based on the latest national census.<sup>13</sup>

## Results

During the study period, 186 patients with acute stroke were admitted to Al-Watani Hospital and were treated as inpatients (Table 1). The majority (58%) of the patients were admitted during the 4 cold months (December, January, February, and March) whereas 29.6% of the patients were admitted during the 4 hot months (May, June, July, and August). The average age of the patients with stroke was 69.09 ± 10.9 years and there was no significant differ-

ence in the mean age between patients of either sex (69.46 ± 10.76 years for men *v* 68.74 ± 11.09 years for women). In all, 74 (39.8%) of the patients had recurrent stroke (RS) attacks whereas 112 (60.2%) had a first-ever stroke (FES). Table 1 describes the age, sex, and risk factors in patients with FES or RS. The mean age in both groups was comparable. Male sex was more common in FES whereas female sex was more common in patients with RS. In the whole stroke sample, male:female ratio was approximately 1:1. In both groups, HTN was the most common risk factor followed by DM and renal dysfunction. CT scan results indicated that 153 (82.3%) of all stroke cases were of the ischemic subtype and 33 (17.7%) cases were

**Table 2.** Age- and sex-specific annual incidence rates per 100,000 persons for first-ever and recurrent stroke in Nablus, northern Palestine

Age category, y	Male			Female			Total			
	n	Rate	95% CI	n	Rate	95% CI	n	Rate	95% CI	Adjusted rate*
≤39	0	0	0	0	0	0	0	0	0	0
40-49	3	25.4	0-54.21	6	51.9	10.4-93.4	9	38.55	13.4-63.7	4.6
50-59	13	176	80.3-271.7	11	118.5	48.5-188.5	24	144	86.4-201.6	12.95
60-69	26	463.8	284.8-640.8	27	391.8	243.8-539.8	53	424	309.8-538.2	29.68
70-79	29	962.5	612.2-1312.8	32	862.3	563.8-1161.2	61	907.2	679.4-1134.8	27.22
≥80	20	1664	934.8-2393.2	19	1424.3	784.1-2064.5	39	1537.8	1055.2-2020.4	15.37
Total	91	49.4	39.2-59.6	95	53.4	42.7-64.1	186	51.4	44-58.8	89.82

Abbreviations: CI, confidence interval.

\*Adjusted rates were calculated based on standard world population.

**Table 3.** Age- and sex-specific annual incidence rates per 100,000 persons for first-ever stroke in Nablus, northern Palestine

Age category, y	Male			Female			Total			
	n	Rate	95% CI	n	Rate	95% CI	n	Rate	95% CI	Adjusted rate*
≤39	0	0	0	0	0	0	0	0	0	0
40-49	3	25.4	0-54.21	4	34.7	0.7-68.7	7	29.8	7.6-52.2	3.59
50-59	7	94.8	24.5-165.1	9	96.9	33.6-160.2	16	96	49-143	8.4
60-69	14	249.7	118.7-379.7	21	304.7	174.4-435	35	280	187.2-372.8	19.6
70-79	15	497.8	245.8-749.8	17	458.1	240.4-675.8	32	475.8	310.9-640.7	14.27
≥80	9	748.7	259.6-1237.8	13	974.5	445.2-1503.8	22	867.4	505-1229.8	8.67
Total	48	26	18.6-33.4	64	36	27.2-44.8	112	31	25.3-36.7	54.53

Abbreviations: CI, confidence interval.

\*Adjusted rates were calculated based on standard world population.

of the hemorrhagic subtype. Similar distribution of stroke subtypes was found in patients with FES or RS. In this study, 21% of patients (13.4% FES and 32.4% RS) died in the hospital. Mortality was higher in men, patients with RS, and those with hemorrhagic stroke subtype.

The overall annual crude incidence rate of stroke (RS and FES) was 51.4 per 100,000 persons (95% CI: 44-58.8): 49.4 for men and 53.4 for women. The age- and sex-specific incidence rates are demonstrated in Table 2. Results show a steep increase in the incidence of stroke with increasing age in both sexes (Tables 1 and 2). The peak age-specific incidence rates in both sexes were in the seventh decade. The lowest incidence rate was in patients younger than 50 years in both men and women. In general, the incidence rates in men were higher than women across all age groups except for the patients in the age group younger than 50 years. In this particular age group, the annual incidence rate in women was almost double that in men (51.9 v 25.4/100,000 persons, respectively). The overall annual crude incidence rate was slightly in favor of women (53.4 v 49.4/100,000 persons). The age-adjusted annual incidence rate for the overall stroke sample (FES + RS) was 89.8 per 100,000 persons.

**Table 4.** Unadjusted annual incidence rates per 100,000 population in different study populations of different Arab countries

Place of study	No. of cases	Unadjusted incidence rate	Reference
Saudi Arabia	488	29.8	[14]
Kuwait	80	27.6	[32]
Qatar	217	41	[9]
Libya	921	48	[33]
Libya*	329	63	[29]
Palestine	112	31	Current study
Palestine*	186	51.4	

All these studies except the one from Saudi Arabia were hospital based.

\*Incidence of first-ever and recurrent stroke.

The annual crude incidence rate of FES was 31 per 100,000 person-years (95% CI: 25.3-36.7) (Table 3). In FES group, male patients had a lower annual crude incidence rate than female patients (male 26, 95% CI: 18.6-33.4; female 36, 95% CI: 27.2-44.8). Furthermore, in the FES group, women had higher incidence rates across all age groups compared with men. The peak age-specific incidence in both sexes was in the eighth decade. The age-adjusted annual incidence rate for the FES was 54.4 per 100,000 persons.

## Discussion

In this 1-year, hospital-based study, risk factors and incidence rate in a well-defined area in north Palestine were described. In the current study, male:female ratio was different than that reported from other countries.<sup>14-16</sup> Most of the previously published reports showed a higher ratio for male patients. However, our results regarding sex distribution was similar to some studies carried out in Saudi Arabia and Babol/Iran.<sup>17,18</sup> The unexpectedly low male:female ratio in our study might suggest the presence of undiagnosed or poorly controlled stroke-related risk factors among women in Palestine. This finding mandates raising the awareness of stroke-related risk factors among women. Screening and management of existing risk factors, such as HTN and DM, should be the primary prevention strategy in stroke management. The high prevalence of HTN in the current study might suggest poor treatment or poor compliance with HTN medication. Studies have indicated that the use of anti-HTN treatment can substantially reduce the risk of stroke.<sup>19-21</sup> Nonetheless, blood pressure is poorly controlled among individuals who have experienced a previous stroke.<sup>22</sup> DM was the second most common risk factor in the current study, which is in agreement with many other studies. In the current study, approximately one third of the patients had renal dysfunction (CrCl < 60 mL/min) on hospital admission. A recent study indicated that mild degrees of renal dysfunction are associated with

increased risk of incident ischemic stroke or transient ischemic attack in patients with pre-existing atherosclerotic disease.<sup>23</sup> Recent studies have also established that patients with end-stage renal disease have 5- to 10-fold risk of stroke compared with patients without end-stage renal disease.<sup>24</sup>

The average age of the patients in this study was higher than that reported in some developing countries but lower than that reported from developed countries.<sup>9,25,26</sup> It is noteworthy that, in the current study, less than 1% of all patients with stroke were younger than 45 years whereas in most studies from Arab countries, relatively higher percentages of patients with stroke were younger than 45 years. Stroke in young adults has been reported in countries such as Qatar, Libya, and Saudi Arabia.<sup>27-30</sup> The low frequency of stroke in young patients (<45 years) in the current study compared with those in neighboring Arab countries is difficult to explain. The prevalence of stroke in young patients seems to vary between different ethnic groups of various geographic areas. For instance, only 3% to 5% of all strokes occur in individuals younger than 45 years in some countries, whereas in others they constitute as much as 19% to 30%.<sup>27,29,31</sup>

The overall and the FES crude annual incidence rates reported in our study were within the range of rates reported in other Arab countries (Table 4). Incidence rates from 29.8 to 63 were reported from different Arab countries.<sup>9,14,29,32,33</sup> The age-adjusted annual incidence rate reported in this study was close to that reported from Qatar (54.5 v 57/100,000 persons).<sup>9</sup> The crude annual incidence rate reported in this study is considered a close estimate because it included the vast majority of patients with stroke in Nablus district, yet it did not take into consideration the very few patients with stroke who could have been treated at home for mild stroke or those who might have a fatal stroke attack at home. Nevertheless, our results are good as a guide for the Palestinian Ministry of Health regarding stroke management.

## Conclusion

This is the first study to report the incidence rate of stroke from Palestine. Future population-based epidemiologic studies regarding stroke are needed to have more accurate estimates of incidence rates of stroke. Risk factors were common among patients in the study. Screening and better control of these risk factors, especially in women, is important.

## References

- Strong K, Mathers C, Bonita R. Preventing stroke: Saving lives around the world. *Lancet Neurol* 2007;6(2):182-187.
- Howard VJ, Cushman M, Pulley L, et al. The reasons for geographic and racial differences in stroke study: Objectives and design. *Neuroepidemiology* 2005;25(3):135-143.
- Pandey DK, Gorelick PB. Epidemiology of stroke in African Americans and Hispanic Americans. *Med Clin North Am* 2005;89(4):739-752.
- White H, Boden-Albala B, Wang C, et al. Ischemic stroke subtype incidence among whites, blacks, and Hispanics: The Northern Manhattan Study. *Circulation* 2005;111(10):1327-1331.
- Deleu D, Hamad AA, Kamram S, et al. Ethnic variations in risk factor profile, pattern and recurrence of non-cardioembolic ischemic stroke. *Arch Med Res* 2006;37(5):655-662.
- Stansbury JP, Jia H, Williams LS, et al. Ethnic disparities in stroke: Epidemiology, acute care, and postacute outcomes. *Stroke* 2005;36(2):374-386.
- Carter K, Anderson C, Hackett M, et al. Auckland Regional Community Stroke (ARCOS) Study Group. Trends in ethnic disparities in stroke incidence in Auckland, New Zealand, during 1981 to 2003. *Stroke* 2006;37(1):56-62.
- al-Rajeh S, Larbi E, Bademosi O, et al. Pattern and ethnic variations in stroke in Saudi Arabia. *J Neurol Sci* 1991;102(1):112-128.
- Hamad A, Hamad A, Sokrab TE, et al. Stroke in Qatar: A one-year, hospital-based study. *J Stroke Cerebrovasc Dis* 2001;10(5):236-241.
- Al Rajeh S, Awada A. Stroke in Saudi Arabia. *Cerebrovasc Dis* 2002;13(1):3-8 (review).
- Bahou Y, Hamid H, Raqab MZ. Ischemic stroke in Jordan 2000 to 2002: A two-year, hospital-based study. *J Stroke Cerebrovasc Dis* 2004;13(2):81-84.
- Sokrab TE, Sid-Ahmed FM, Idris MN. Acute stroke type, risk factors, and early outcome in a developing country: A view from Sudan using a hospital-based sample. *J Stroke Cerebrovasc Dis* 2002;11(2):63-65.
- Palestinian National Census, 2007. Palestinian Central Bureau of Central Statistics. Available from: URL:<http://www.pcbs.gov.ps>.
- Al-Rajeh S, Larbi EB, Bademosi O, et al. Stroke register: Experience from the eastern province of Saudi Arabia. *Cerebrovasc Dis* 1998;8(2):86-89.
- al Rajeh S, Awada A, Niazi G, et al. Stroke in a Saudi Arabian National Guard community: Analysis of 500 consecutive cases from a population-based hospital. *Stroke* 1993;24(11):1635-1639.
- Qari FA. Profile of stroke in a teaching university hospital in the western region. *Saudi Med J* 2000;21(11):1030-1033.
- El Sayed MM, Adeuja AO, El-Nahrawy E, et al. Characteristics of stroke in Hofuf, Saudi Arabia. *Ann Saudi Med* 1999;19(1):27-31.
- Ahangar AA, Ashraf Vaghefi SB, Ramaezani M. Epidemiological evaluation of stroke in Babol, northern Iran (2001-2003). *Eur Neurol* 2005;54(2):93-97.
- Gueyffier F, Boissel JP, Boutitie F, et al. Effect of antihypertensive treatment in patients having already suffered from stroke: Gathering the evidence; the INDANA (individual data analysis of antihypertensive intervention trials) project collaborators. *Stroke* 1997;28:2557-2562.
- PATS Collaborating Group. Post-stroke antihypertensive treatment study: A preliminary result. *Chin Med J (Engl)* 1995;108:710-717.
- Progress Collaborative Group. Randomized trial of a perindopril-based blood-pressure-lowering regimen among 6105 individuals with previous stroke or transient ischemic attack. *Lancet* 2001;358:1033-1041.
- Qureshi A, Suri MF, Guterman LR, et al. Ineffective secondary prevention in survivors of cardiovascular events in the US population: Report from the third national

- health and nutrition examination survey. *Arch Intern Med* 2001;161:1621-1628.
23. Koren-Morag N, Goldbourt U, Tanne D. Renal dysfunction and risk of ischemic stroke or TIA in patients with cardiovascular disease. *Neurology* 2006;67(2):224-228.
  24. Seliger SL, Gillen DL, Tirschwell D, et al. Risk factors for incident stroke among patients with end-stage renal disease. *J Am Soc Nephrol* 2003;14:2623-2631.
  25. Sagui E, M'Baye PS, Dubecq C, et al. Ischemic and hemorrhagic strokes in Dakar, Senegal: A hospital-based study. *Stroke* 2005;36(9):1844-1847.
  26. Iemolo F, Beghi E, Cavestro C, et al. Incidence, risk factors and short-term mortality of stroke in Vittoria, southern Italy. *Neurol Sci* 2002;23(1):15-21.
  27. Khan FY. Risk factors of young ischemic stroke in Qatar. *Clin Neurol Neurosurg* 2007;109(9):770-773.
  28. Awada A. Stroke in Saudi Arabian young adults: A study of 120 cases. *Acta Neurol Scand* 1994;89(5):323-328.
  29. Radhakrishnan K, Ashok PP, Sridharan R, et al. Stroke in the young: Incidence and pattern in Benghazi, Libya. *Acta Neurol Scand* 1986;73(4):434-438.
  30. Awada A, Daif A, Obeid T, et al. Nontraumatic cerebral hemorrhage in the young: A study of 107 cases. *J Stroke Cerebrovasc Dis* 1998;7(3):200-204.
  31. Srinivasan K. Ischemic cerebrovascular disease in the young: Two common causes in India. *Stroke* 1984;15(4):733-735.
  32. Abdul-Ghaffar NU, el-Sonbaty MR, el-Din Abdul-Baky MS, et al. Stroke in Kuwait: A three-year prospective study. *Neuroepidemiology* 1997;16(1):40-47.
  33. El Zunni S, Ahmed M, Prakash PS, et al. Stroke: Incidence and pattern in Benghazi, Libya. *Ann Saudi Med* 1995;15(4):367-369.