

Incidence and pattern of cerebrovascular diseases in Benghazi, Libya

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SUMMARY During a 12 month study period, a total of 329 incident cases of stroke occurred in Benghazi, Libya. This provided an unadjusted annual incidence rate for stroke of 63 per 100,000 population; the corresponding rates for the male and female were 69 and 58 per 100,000 respectively. The sex dependent difference in the incidence was not statistically significant. Cerebral infarction was the commonest type of stroke accounting for 80.9%. The incidence rates increased with age in all categories of stroke. Hypertension and ischaemic heart disease were common risk factors among the male patients, while diabetes and hypercholesterolaemia were more frequent in the female patients.

The incidence of cerebrovascular disease or stroke is reported to be declining.¹ It is unclear whether this trend is a real decrease due to change in the prevalence of risk factors, or only an apparent decrease reflecting changes in the diagnostic fashion over time. The relative contribution of the racial characteristics and environmental factors towards susceptibility for this disease is still unsettled. Most of the population-based epidemiological studies on stroke from the developed countries of the world,²⁻⁹ show very high incidence of stroke. Studies representing the Jews in Israel,¹⁰ and the African Negro¹¹ showed much lower incidence rates.

The people of Libya are of mixed Arab, African, Turkish and South European descent.¹² It is not the purpose of this paper to discuss any new facts concerning the risk factors or type of stroke in Benghazi, but to report the incidence of cerebrovascular disease in this complex ethnic group situated in the north of Africa.

Material and methods

Situated in the north-eastern part of Libya on the southern Mediterranean coast, at a latitude of 32°N and a longitude of 20°E, the city of Benghazi covers an area of 17,000 km². The average mean temperature is 20°C (13°C in January and 25°C in August) and annual precipitation rate is 26.5 cm.¹²

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Medical organisation in Benghazi is efficient and comprehensive. Patients are referred from the walk-in polyclinics to the four university hospitals and to a rehabilitation centre for the handicapped. Private medical practice is not allowed. The people are affluent and medical care is free. In addition, state financed medical treatment abroad and desire to obtain disability certificates for tax benefits make people attend the clinics even for minor problems. Patients with neurological problems are referred from the medical clinics and university hospitals to the neurology outpatient clinics conducted in two of the polyclinics 5 days per week. The Neurology Unit in Seventh April Hospital, Benghazi, (the only one of its kind for the northeastern region of Libya), has three qualified neurologists. Neuroradiological investigations are facilitated by the availability of two computed tomography scanners in Benghazi. All the cases were personally examined by one of the neurologists.

Cranial CT was performed on 264 cases (80.2%) within the first week of onset of stroke. The diagnosis and categorisation of the type of stroke was based on the algorithm laid down by the US National Survey of Stroke.¹³ All the cases were classified into (a) occlusive due to thrombosis or embolism (b) haemorrhagic, of intracerebral or sub-arachnoid type. Thus all the cases were categorised as "definite" or "highly probable" and avoided any case of stroke of "undetermined type".

A prospective search for all the incident cases of stroke occurring among the Libyan residents of Benghazi was made for a 12 month period between November 1, 1983 and October 31, 1984 through polyclinics, University hospitals and centres for the handicapped. Patients with only transient ischaemic attacks, previous history of stroke or those living outside the study area, were excluded from the study. The July, 1984 Libyan nationwide official census provided the population data.

The associated risk factors analysed in this study include hypertension (sustained systolic blood pressure

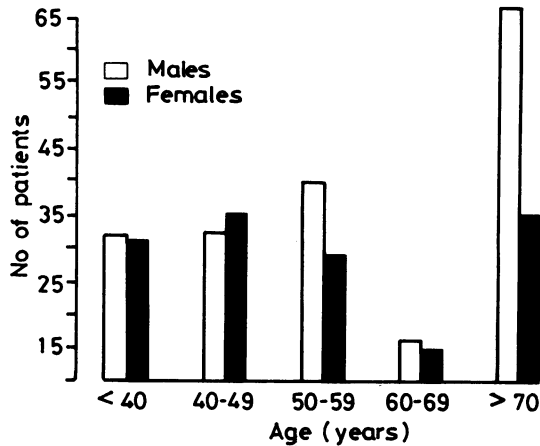


Fig 1 Age and sex distribution of the patients.

> 160 mmHg and/or a diastolic blood pressure > 95 mmHg for at least one week after the stroke), diabetes mellitus (a casual blood glucose level > 160 mg/dl or a blood glucose level > 200 mg/dl 1 hour after a 50 g oral glucose load), hypercholesterolaemia (serum cholesterol > 260 mg/dl) and ischaemic heart disease confirmed by a standard 12 lead ECG examination. In those patients who died within the first one week of stroke, a previous diagnosis of hypertension and diabetes or drug therapy for the same, were considered as evidence of these risk factors.

Results

The 329 incident cases of stroke consisting of 184 men and 145 women occurred in a population of 518,745 to give a crude annual incidence rate of 63 per 100,000 population per year. The crude incidence rate for men is 69 per 100,000 and for women is 58 per 100,000 population. The distribution of the patients by age and sex is shown in fig 1. The sex difference between the number ($\chi^2 = 6.907$, $p < 0.5$, > 0.1) was not significant.

The age and sex specific incidence rates for total strokes are given in table 1. In both the sexes, the rates gradually increased with the age, and were highest above 70 years of age. Excepting for the 4th decade,

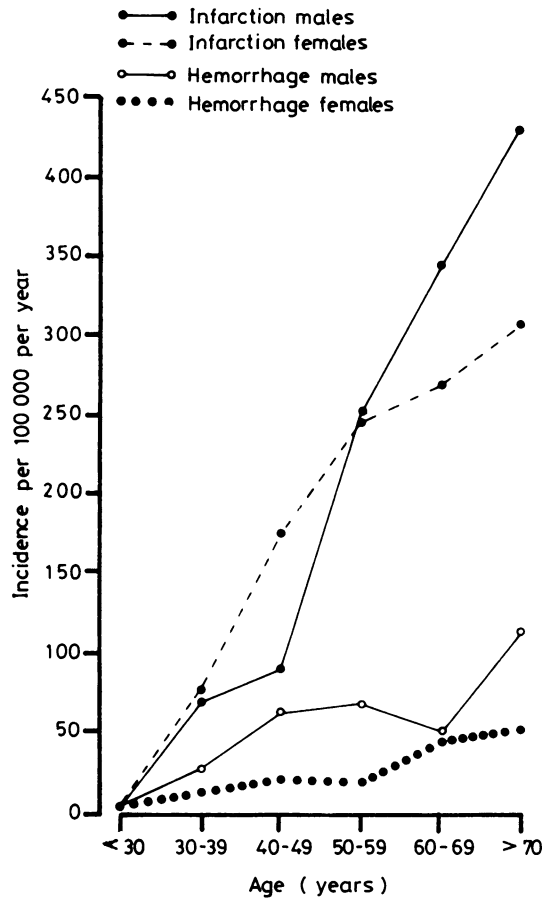


Fig 2 Incidence of stroke, by diagnostic category, age and sex.

the crude incidence rates for males were higher than the females. The Libyan population in Benghazi above 15 years of age is 251,511 giving an incidence rate of 131.1 per 100,000 population above 15 years of age. Similarly the total incidence rate in the age group 15-65 years was 92.9 per 100,000 population.

Cerebral infarction constituted 80.9% (thrombosis

Table 1 Age- and sex-specific incidence rates of stroke (per 100,000 population per year) in Benghazi.

Age (yr.)	Male			Female			Both sexes	
	Population	No. of cases	Rate	Population	No. of cases	Rate	No. of cases	Rate
< 30	192,289	6	3	182,740	9	5	15	4
30-39	25,851	26	101	24,652	22	89	48	96
40-49	21,123	32	152	18,425	36	195	68	172
50-59	12,290	39	317	10,650	28	263	67	292
60-69	4,100	16	390	4,515	14	310	30	348
> 70	11,937	65	545	10,173	36	354	101	457
All ages	267,590	184	69	251,155	145	58	329	63

Table 2 Incidence rates of stroke by age, sex, and diagnostic category

Age (yr.)	Cerebral Infarction				Haemorrhage			
	Male		Female		Male		Female	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate
< 30	5	3	7	4	1	1	2	1
30-39	18	70	19	77	8	31	3	12
40-49	19	90	32	174	13	62	4	22
50-59	31	252	26	244	8	65	2	19
60-69	14	342	12	266	2	49	2	44
> 70	52	436	31	305	13	109	5	49
Total	139	52	127	51	45	17	18	7

69.6%, embolism 11.3%) of the total strokes, while haemorrhagic stroke contributed to the remaining 19.1% (intra cerebral 14.6%, subarachnoid 4.5%). The incidence of haemorrhagic stroke was considerably higher in the males for all the age groups. On the other hand incidence of cerebral infarction was higher among the females up to the fifth decade, after which the males predominate (fig 2, table 2). Fifty seven incident cases died during the first month of the onset of stroke (case fatality ratio 17.3%). This comprised 35 cases of occlusive stroke and 22 cases of cerebral haemorrhage; the corresponding case fatality ratios were 13% and 35% respectively (table 3).

Among the 266 patients of stroke occurring after the age of 40 years, eighteen patients did not have any associated risk factor. Hypertension was the commonest association accounting for 54% of the cases, and were more common in the males. While hypercholesterolaemia and diabetes were more frequent among the females, ischaemic heart disease was commoner among the males (fig 3).

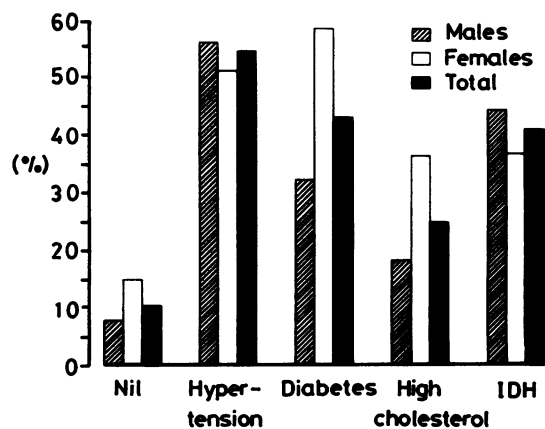


Fig 3 Percentage distribution of risk factors for all types of strokes.

Table 3 Case fatality ratio by age, sex and diagnostic category

Age group (yr.)	Case fatality ratio (%)				Total
	Infarction		Haemorrhage		
	Male	Female	Male	Female	
< 40	—	11.5	44.4	20	12.7
40-59	8	8.6	23.8	50	12.6
> 60	19.7	23.3	40	42.9	24.4
All ages	12.2	14.2	33.3	38.9	17.3

Table 4 Incidence rate of stroke (per 100,000 per year) in various studies

Reference No.	Place	Population	No. of cases	Rate
Present Study	Benghazi, Libya	518,745	329	63
2	Oxfordshire, England	660,391	168	163
3	Kuopio, Finland	95,420	373	235
4	Middlesex, Connecticut	83,500	191	230
5	Auckland, New Zealand	829,464	535*	130
6	Mannitoba, Canada	660,391	1367	138
7	Rochester, Minnesota	42,809	993	154
10	Jerusalem, Israel	208,750	1522	90
11	Ibadan, Nigeria	611,539	318	26

*50% patients sampled.

Discussion

The crude annual incidence rate for stroke in Benghazi of 63 per 100,000 population, appears lower than the corresponding rates from most of the developed countries of the world.²⁻⁹ Knowledge of the population at risk, diagnostic precision, and the availability of a comprehensive and free medical care facility in

Benghazi, ensure the reliability and completeness of the present epidemiological study.

Most of the reported incidence rates for stroke from Europe and North America show a wide fluctuation ranging between 130 and 830 per 100,000 population.²⁻⁹ (table 4). There are however scanty population-based epidemiological data available from the developing countries. The incidence of 26 per 100,000 population in the Nigerian African¹¹ is far below the Benghazi figure. It is unclear whether this difference is attributable to genetic or environmental factors. It has been reported that the US blacks experience a higher stroke rate than the whites.⁸ On the contrary, the incidence was three times as high among the Japanese in Japan as compared with Japanese-Americans in Hawaii,¹⁴ suggesting an environmental factor.

The population of Benghazi is relatively young as compared with those of the developed countries of Europe and North America. Since strokes, especially cerebral infarction are common at the age 65—or over in both sexes,¹⁵ difference in total incidence rates may reflect dissimilarities in the age structure of the population. The difference can be avoided when the age-specific rates are determined. It is of interest to note that while 77% of strokes in the Middlesex study⁴ occurred above 65 years of age, the corresponding figure for Benghazi is only 35%. The incidence of 92.9 per 100,000 in the 15–65 year age group for Benghazi is much higher than the corresponding rates of 54.7 and 73 for Auckland⁵ and Göteborg¹⁶ respectively. This is however in contrast with the above 15 years age incidence rate of 131.1 per 100,000 for Benghazi being lower than the corresponding figure of 174 for Auckland.⁵ Also the total estimated incidence of 200 per 100,000 for Göteborg¹⁶ is far higher than that of the present study. It becomes very clear that the incidence of stroke in Benghazi is not low as reflected by the unadjusted rates.

Cerebral infarction (80.9%) was the most frequent and subarachnoid haemorrhage (4.5%) the least common in the present study, concordant with most other reports. The Framingham study¹⁷ reported 18% incidence of subarachnoid haemorrhage; this high incidence was postulated as a reflection of the younger age of the population. The Benghazi population also being relatively young, the high incidence of cerebral infarction and very low incidence of subarachnoid haemorrhage is unexpected.

The total case fatality ratio of 17.3% for all strokes in Benghazi is far below that of the Nigerian African.¹¹ Mortality rates for cerebrovascular disease have been declining in most countries since 1920, with the decrease continuing to the present time. Concordant with most other reports, haemorrhagic stroke caused a higher mortality than did infarctions.

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Excepting for the young male strokes, the mortality rates were higher among the female patients in all other ages irrespective of the type of stroke.

Hypertension is accepted as the commonest risk factor for stroke^{19,20} and was the single most common association accounting for 54% of cases in Benghazi. The role of hypercholesterolaemia is controversial,¹⁵ although along with diabetes it was far more common among the female Libyan subjects.

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