Case Fatality Rate of First-Ever Stroke in Erbil City

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ABSTRACT

Background and Objective: Stroke is the third most common cause of death. The objective of this study was to find out the case fatality rate of first-ever stroke in Erbil city.
Methods: This cross-sectional study included 228 first-ever stroke patients hospitalized to teaching hospitals in Erbil city from January, 1st 2009 to August, 31st 2009. Stroke was diagnosed by the consultant internist or neurologist and confirmed by brain CT-scan. Patients were followed-up and one month case-fatality rate was calculated.
Results: The one month case-fatality rate was 23.7% with a higher proportion of deaths occurred in females (26.4%) than in males (21.2%) (P= 0.358). The case-fatality increased with age (P= 0.019); around 75% of deaths occurred in the 7th and 8th decades of life and more than 95% occurred among those 60 years and more. More deaths occurred from haemorrhagic (31.3%) than ischaemic (20.7%) strokes (P= 0.093). The mean ± SD ages of dead and alive were 68.56 ±11.52 and 61.32 ±12.91 years, respectively (P<0.001). Multiple logistic regression revealed significant   association of stroke outcome with age (P= 0.037) and atrial fibrillation (P<0.001).
Conclusions: The one month case-fatality rate was relatively comparable to that reported in other developing countries.
Key words: Stroke, case-fatality, Erbil city.

INTRODUCTION:

Stroke is the third most common cause of death and a leading cause of severe disability in both the developed and developing world[1]. Mortality from haemorrhagic stroke declined consistently over the 20th century in many countries, but ischaemic stroke showed a rise and a fall, mirroring the coronary heart disease epidemic[2].   Despite the decline in mortality from stroke over recent years, there is a looming   epidemic of stroke. The increased proportion of the population in the older age groups that is predicted to occur in future years will contribute to this epidemic   because of the strong association between age and stroke incidence [3]. Every year, there are approximately 5.5 million deaths worldwide as a direct result of strokes, with a further 49 million people subsequently suffering of their stroke attack [4,5]. In many developing countries, the incidence is rising   because of the adoption of less healthy life styles. About one-fifth of patients with an acute stroke will die within a month of the event, and at least half of those who   survive will be left with physical disability [6]. Outcome following stroke is influenced by a number of factors, the most important being the nature and severity of the resulting neurological deficit. The patient's age, the cause of stroke, and coexisting medical disorders also affect prognosis. Overall, somewhat less than 80% of patients with stroke survive for at least 1 month, and   10-year survival rates in neighborhood of 35% have been cited. The latter figure is not surprising, considering the advanced age at which stroke commonly occurs. Of patients who survive the acute period, about one-half to two-thirds regain independent function,

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15% require institutional care[7]. No published data on stroke fatality in Erbil city are available; therefore, this study was carried out to identify the case fatality rate of first-ever stroke in Erbil teaching hospitals.

MATERIALS AND METHODS:

This hospital based cross-sectional study was carried out on cases admitted to Rizgary teaching hospital, Erbil teaching hospital and the Emergency hospital (Hawadith unit) in Erbil city which is the center of Erbil governorate, located in Kurdistan region of Iraq. The study extended from January, 1st 2009 through August, 31st 2009. Patients with first attack of stroke (first-ever stroke) diagnosed by consultant internist or neurologist and confirmed by brain imaging (CT-scan) were included in the study. A case was considered as a "stroke" according to the WHO definition[8]. Patients known to have previous history of stroke and those not residing in Erbil city were excluded from the study. Stroke events discovered to be secondary to brain tumour, or brain metastasis, or caused by trauma were also excluded from the study. Verbal informed consent was obtained from all patients or their close relatives. The data were obtained by a direct interview of the patient; if they can answer; otherwise data were obtained from close relatives, using a questionnaire designed by the researchers. Data requested included: age, sex, smoking (current smoking: smoking at least one cigarette per day[9]), exercise (walking at least 30 minutes per day), and history of systemic diseases (hypertension, diabetes mellitus and heart diseases). Laboratory investigations included fasting blood sugar, serum total cholesterol, serum triglyceride, serum HDL-cholesterol, serum LDL-cholesterol and PCV percentage. Weight and height were measured and body mass index (BMI) was calculated according to Hanlon *et al*[10]. Brain imaging (CT-Scan) was done for all patients. Individuals were considered diabetics if the

condition had been previously diagnosed by a physician, or if they have been receiving insulin and/or treatment before the stroke or they were discovered to have fasting blood sugar of 126 mg/100ml (≥7mmol/L) [11, 12]. The case fatality rate represents the killing power of the stroke. Case fatality rate was defined as the number of people who died of stroke divided by the number of people who had stroke [13, 14]. In this study the case fatality rate was calculated for the first month after stroke onset; therefore, patients with first attack of stroke who were discharged alive were followed-up for one month by telephone contact and home visit. The patients or their close family members were asked about the patients' health status. If a patient died during the first month after the event, it was assumed that has died because of stroke only if other etiologies such as a motor vehicle accident could be ruled out. Statistical Package for social sciences (SPSS, version 15.0) was used for data entry and analysis. Chi square test of association, student t-test and multiple logistic regressions were used. P value of ≤ 0.05 was regarded as statistically significant[13].

RESULTS:

The sample included 228 patients, 118 males (51.8%) and 110 females (48.2%); their age ranged from 12 to 89 years (mean ± SD = 63.04 ±12.94) with a male: female ratio of 1.07:1. The mean ± SD ages of males and females were 62.96 ±13.09 and 63.11 ±12.84 years, respectively (P = 0.934). The mean ± SD ages of dead and alive were 68.56 ±11.52 and 61.32±12.91years,respectively (P<0.0001). The case-fatality rate during the 1st month was 23.7% with a higher proportion of deaths occurred in females (26.4%) than in males (21.2%) (P=0.358). The case-fatality increased with age (P=0.019); around 75% of deaths occurred in the 7th and 8th decades of life and more than 95% occurred in those 60 years and more. More deaths occurred

Table 1: One-month case fatality rate by age, sex and stroke subtypes.

Age (years)	No. of cases	No. of deaths (CFR*)	P - value
<40	8	1 (12.5)	
40-49	29	3 (10.3)	
50-59	49	6 (12.2)	
60-69	54	12 (22.2)	**0.019**
70-79	68	24 (35.3)	
≥ 80	20	8 (40.0)	
Total	**228**	**54 (23.7)**	
Sex			
Male	118	25 (21.2)	
Female	110	29 (26.4)	**0.358**
Total	**228**	**54 (23.7)**	
Stroke subtype			
Ischaemic	164	34 (20.7)	
Haemorrhagic	64	20 (31.3)	**0.093**
Total	**228**	**54 (23.7)**	

* CFR: Case fatality rate

(31.3%) than ischaemic (20.7%) strokes (P=0.093) (Table1). The case fatality rate at 7 days was 15.4% with a higher proportion of deaths also occurred in females (57.1%) than in males (42.9%) (P= 0.892). There was statistically significant association of stroke outcome with atrial fibrillation (P<0.001) (Table 2), and means (P<0.001) and serum triglyceride (P=0.008) (Table 3). However, logistic regression analysis of risk factors by stroke outcome revealed that only age (P= 0.037) and atrial fibrillation (P<0.001) have a statistical significant association with stroke outcome (Table 4).

Table 2: Stroke outcome by risk factors

Risk Factor	Dead (n=54) No. with risk factor (%)	Alive (n=174) No. with risk factor (%)	P - value
Hypertension	37 (68.5)	97 (55.7)	0.096
Diabetes mellitus	16 (29.6)	47 (27.0)	0.707
Heart diseases	14 (25.9)	29 (16.7)	0.129
Atrial fibrillation	21 (38.9)	14 (8.0)	**<0.001**
Current smoking	17 (31.5)	61 (35.1)	0.885
Lack of exercise	54 (100.0)	163 (93.7)	0.058

Table 3: Stroke outcome by age, lipid profile, BMI and PCV%.

Characteristic	Dead (Mean ± S.D)	Alive (Mean ± S.D)	P- value
Age (years)	(68.56 ± 11.52)	(61.32 ± 12.91)	**<0.001**
Total serum cholesterol (mmol/l)	(4.76 ± 1.38)	(4.92 ± 1.32)	0.440
Serum triglyceride (mmol/l)	(1.26 ± 0.49)	(1.5 ± 0.79)	**0.008**
HDL-cholesterol (mmol/l)	(1.15 ± 0.30)	(1.15 ± 0.37)	0.877
LDL-cholesterol (mmol/l)	(3.08 ± 1.28)	(3.11 ± 1.20)	0.880
PCV (%)	(42.85 ± 6.21)	(42.80 ± 5.67)	0.958
BMI (kg/m^2)	(26.68 ± 4.85)	(27.30 ± 4.75)	0.407

Table 4: Multiple logistic regressions of risk factors by stroke outcome.

Risk factor	B	P-value	Odds ratio	95.0% CI* for odds ratio	
				Lower	Upper
Age	0.032	**0.037**	1.032	1.002	1.064
Sex	0.300	0.439	1.350	0.631	2.889
Hypertension	0.282	0.464	1.325	0.623	2.818
Diabetes mellitus	0.190	0.635	1.209	0.552	2.651
Heart disease	0.066	0.882	1.068	0.448	2.547
Atrial fibrillation	1.733	**<0.001**	5.655	2.446	13.072
Serum total cholesterol	- 0.580	0.359	0.560	0.162	1.935
Serum triglycerides	- 0.201	0.640	0.818	0.353	1.897
Serum HDL-cholesterol	0.682	0.386	1.978	0.423	9.244
Serum LDL-cholesterol	0.532	0.392	1.702	0.503	5.758
PCV%	0.035	0.288	1.036	0.971	1.106
BMI	- 0.023	0.565	0.977	0.903	1.057

*Confidence Interval

DISCUSSION:

A household survey in Erbil city from 1st October 2008 to 31st July 2009 revealed that out of 4203 persons (905 families), only 33 patients (17 males and 16 females) were found to have stroke, with a life time prevalence of 7.8/1000 population. The mean age ±SD of patients was 59.88± 15.09 years (ranged from 25-80 years) with a male: female of 1.1:1. 72.7% of strokes were ischaemic and 27.3% were haemorrhagic[15]. The case fatality rate at 7 days revealed by this study (15.4%) was higher than that previously reported in Erbil (12.5%) [16], South London (9.6%) and Barbados (11.9%) [17], but lower than that reported in Mosul, Iraq (23.6%) [18]. The one month case fatality rate (23.7%) is lower than the 28-day case fatality rate of stroke patients reported in Isfahan, Iran (31.5%) [19] and Kerala, India [20] (27.2%). The one month case fatality rate was 38% in Senegal [21] and 27% in Gambia [22]. In Australia, this figure has been reported to vary between 23.9% and 35.5% in different months [23]. In community-based stroke studies in developing countries, the one month case fatality rate has been reported to be 23.3% in Chile [24], 19.3% in Martinique [25] and 13.6% in China [26] (the latter was calculated as 1- year case fatality rate); the 28 day case fatality rate in Bulgaria was 35%[27]. The higher proportion of deaths in females (26.4%) than males (21.2%) revealed by this study is consistent with other studies done in Estonia [28], Sweden [29] and Italy [30], but inconsistent with the studies done in Erbil[16] and Mosul [18]. This is may be due to the fact that women are older when they get their first-ever stroke [31]. This study revealed also that there is higher proportion of deaths from haemorrhagic than ischaemic stroke, a finding which is consistent with a study done in Italy [32]. The majority of stroke patients in this study were in the 6th, 7th and 8th decades of life, a finding which is consistent with the fact that increasing age is one of the most important risk factors for stroke [28, 33]; at this age people usually suffer from chronic diseases like hypertension, diabetes mellitus and heart diseases that are predisposing to cerebrovascular diseases. The mean age of stroke patients in our study (63.04 years) is lower than that reported by a study in Isfahan, Iran (68.10 years) which contributed to high case fatality rate in later study [19]. Multiple regression analysis revealed the most important risk factors for fatality were age and atrial fibrillation. This result is consistent with that of the study done in Mosul [18]. Although this study revealed that hypertension, diabetes mellitus, lipid profiles and smoking had non-significant association with case-fatality; strong *et al* [34] reported that hypertension causes 54% of stroke mortality in low-income and middle-income countries, followed by high cholesterol (15%) and tobacco smoking

REFERENCES:

(12%).
1. Yusuf S, Reddy S, Ounpuu S, Anand S. Global burden of cardiovascular diseases. Part I. General considerations, the epidemiologic transition, risk factors and impact of urbanisation. Circulation 2001; 104: 2746-53.
2. Lawlor DA, Davey-Smith G, Leon DA, Sterne J, Ebrahim S. Secular trends in mortality by stroke subtype in the 20th century: a retrospective analysis. Lancet 2002; 360: 1818-23.
3. Nicol MB, Thrift AG. Knowledge of risk factors and warning sings of stroke. Vasc Health Risk Manag 2005; 1(2):137–47.
4. WHO. World health report 2004 changing history. Geneva: WHO. 2004.
5. Cox AM, McKevitt C, Rudd AG, Wolfe CDA. Socioeconomic status and stroke. Lancet Neurol 2006; 5:181–8.
6. Allen CMC, Lueck CJ, Dennis M. Neurological diseases. In: Boon AN, Colledge RN, Walker RB, editors. Davidson's principles and practice of medicine. 20th ed. Edinburgh: Churchill Livingstone; 2006. P. 1145-256.
7. Aminoff MJ, Greenberg DA, Simon RP. Clinical neurology. 6th ed. New York: McGraw-Hill; 2005. P. 285-319.
8. Park K. Parks textbook of preventive and social medicine. 18th ed. Jabalpur (India): Banarsidas Bhanot Publishers; 2005.
9. Marouf IT. Quality of life and morbidity pattern of a sample of geriatric population in Erbil city. M.Sc.

10. Hanlon P, Byers M, Walker BR, Summerton C. Nutrition, metabolic and environmental disease. In: Boon AN, Colledge RN, Walker RB, editors. Davidson's principles and practice of medicine. 20th ed. Edinburgh: Churchill Livingstone; 2006. P. 93-129.

11. Frier BM, Fisher M. Diabetes mellitus. In: Boon NA, Colledge NR, Walker BR editors. Davidson's principles & practice of medicine. 20th ed. Edinburgh: Churchill Livingstone Elsevier; 2006. P. 805-47.

12. WHO, COSIT. National survey for NCD risk factors for population age 25-65 years old / Iraq. Geneva: WHO. 2006.

13. Hennekens CH, Buring JE. Epidemiology in medicine. 3rd ed. Boston, USA: Little, Brown and Company; 1987.

14. Gordis L. Epidemiology. Philadelphia.USA. W.B. Saunders; 1996. P. 30-88.

15. Mawlood FJ. Prevalence of stroke in Hawler city: A household survey. Diploma thesis. Hawler Medical University. College of Medicine. Iraq. 2009.

16. Khidhir AJ. Risk factors, subtypes and clinical outcome of patients with acute stroke admitted to Erbil teaching hospitals from 1st June 2003 to 1st Feb 2004. Diploma thesis. Salahaddin University, College of Medicine. Iraq, 2004.

17. Wolfe CDA, Corbin DOC, Smeeton NC, Gay GHE, Rudd AG, Hennis AJ *et al*. Post stroke survival for Black-Caribbean population in Barbados and South London. Stroke 2006; 37: 1991-6.

18. Hussein ST. Risk factors for stroke. A case-control study. M.Sc. thesis. University of Mosul, College of Medicine. Iraq, 1993.

19. Oveisgharan S, Sarrafzadegan N, Shirani S, Hosseini S, Hasanzadeh P, Khosravi A. Stroke in Isfahan, Iran: Hospital admission and 28-day case fatality rate. Cerebrovasc Dis 2007; 24: 495-9.

20. Sridharan SE, Unnikrishnan JP, Sukumaran S, Sylaja PN, Nayak SD, Sarma PS *et al*. Incidence, types, risk factors, and outcome of stroke in a developing country: The Trivandrum, Kerala, India. Stroke 2009; 40 (4): 1212-8.

21. Sagui E, M'Baye PS, Dubecq C, Fall KB, Niang A, Gning S *et al*: Ischemic and hemorrhagic strokes in Dakar, Senegal: a hospital-based study. Stroke 2005; 36:1844–7.

22. Walker RW, Rolfe M, Kelly PJ, George MO, James OFW. Mortality and recovery after stroke in Gambia. Stroke 2003; 34:1604-9.

23. Wang Y, Levi CR, Attia JR, D'Este CA, Spratt N, Fisher J. Seasonal variation in stroke in the Hunter Region, Australia: a 5-year hospital-based study, 1995-2000. Stroke 2003; 34: 1144-50.

24. Lavados PM, Sacks C, Prina L, Escobar A, Tossi C, Araya F *et al*. Incidence, 30 day case fatality rate, and prognosis of stroke in Iquique, Chile: a 2-year community-based prospective study. Lancet

25. Smadja D, Cabre P, May F, Fanon JL, Rene-Corail P, Riocreux C *et al*. Epidemiology of stroke in Martinique, French West Indies. Part I. Methodology, incidence, and 30-day case fatality rate. Stroke 2001; 32: 2741–7.

26. Liu X, Xu G, Wu W, Zhang R, Yin Q, Zhu W. Subtypes and one-year survival of first-ever stroke in Chinese patients. Cerebrovasc Dis 2006; 22: 130–6.

27. Powles J, Kirov P, Feschieva N, Stanoev M, Atanasova V. Stroke in urban and rural populations in north-east Bulgaria: incidence and case fatality findings from a 'hot pursuit' study. BMC Public Health (online) 2002; 2: 24. [about 19 pages] Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC130018/. (Accessed 3 Oct 2009).

28. Vibo R, Kõrv J, Roose M. The Third Stroke Registry in Tartu, Estonia: decline of stroke incidence and 28-day case-fatality rate since 1991. Stroke 2005; 36:2544–8.

29. Hallström B, Jönsson AC, Nerbrand C, Norrving B, Lindgren A. Stroke incidence and survival in the beginning of the 21st century in Southern Sweden. Comparisons with the late 20th century and projections into the future. Stroke 2008; 39:10–15.

30. Musolino R, La Spina P, Serra S, Postorino P, Calabró S, Savica R *et al*. First-ever stroke incidence and 30-day case fatality in the Sicilian Aeolian archipelago, Italy. Stroke 2005; 36: 2738–41.

31. Appelros P, Stegmayr B, Terent A. Sex differences in stroke epidemiology. Stroke 2009; 40 (4): 1082-90.

32. Sacco S, Marini C, Toni D, Olivieri L, Carolei A. Incidence and 10-year survival of intracerebral hemorrhage in a population-based registry. Stroke 2009; 40(2):394-9

33. *Thorvaldsen P, Davidsen M, Brønnum-Hansen H, Schroll M*. Stable stroke occurrence despite incidence reduction in an aging population. Stroke 1999; 30: 2529–34.

34. Strong K, Mathers C, Bonita R. Preventing stroke: saving lives around the world. Lancet Neurol 2007; 6:182–7.