Age And Sex Differences Among Stroke Patients In Mukalla, Hadramout: Analysis Of 1072 Cases

Hussain Saeed Alghazali[1], Rasheed Mohammed Bamekhlah[2]

[1]Assistant Professor, [2]Associated Professor.Department of Medicine, College of Medicine and Health Sciences, Hadramout University. Mukalla, Hadramout,Republic of Yemen.

Abstract:

Background & Objectives: Stroke is the third leading cause of death, and a cause of long-term disability among survivors, age and male sex are risk factors for this disease. Hadramout province is lacking studies about stroke so our aim was to identify age and sex differences among stroke patients.

Patients and methods: A descriptive retrospective study of stroke patients admitted at Ibnseena Hospital, Hadramout, Yemen in between (2011-2013). Data were collected from patients' medical files.

Results: Stroke cases were 1072; ischemic 78.5% and hemorrhagic 21.5%. Males 56.5% and females 43.5%. Patients with age >60 years 72%, in middle-aged (40-60 years) 25.5%, while young <40 years 2.5%. Hypertension was in 63.7% and 53.2% of middle-aged & elderly, and in 29.6% of young ones. Diabetes in 36.3% and 39.5% of middle-aged and old, while in 7.4% of young ones. Elderly had ≥2 risk factors (89.9%), 68.9% of middle-aged and 55.6% of the young. Ischemic type increased with age (63%, 68% & 82.6%), while hemorrhagic was more in young (37%) than in the middle-aged (31.9%) and old (17.4%). Coma was more in the young (29.6%), than in middle-aged (18.3%) and old (19.6%). Non-significant difference in hypertension between males & females (54.6%, 56.2%), diabetes (39.3%, 36.3%), previous attack (8.7%, 8.2%) in family history (13.9%, 9.7%). Smoking had significant difference between males & females (29.2%, 3.9%), 94.2% of males had ≥2 risk factors and females (70%).

Conclusion: stroke increased with age. Ischemic stroke was more in old in and hemorrhagic in young patients. Males were generally more affected, but ischemic type was common in females while hemorrhagic type in males. No sex differences with risk factors rather than smoking was more in males.

Keywords: Stroke, Cerebrovascular accident, Hadramout

اختلافـــات الســـن والجنـــس بين مرضـــى الصدمـــة الدماغية في المكلا– حضرموت :تحليل لــ1072 حالة

حسين سعيد الغزالي[1]   رشيد محمد بامخلاه[2]

[1]أستاذ مساعد الامراض الباطنة [2]أستاذ مشارك الأمراض الباطنة كلية الطب والعلوم الصحية – جامعة حضرموت– المكلا– حضرموت – الجمهورية اليمنية

المقدمة وأهداف الدراسة:

الصدمة الدماغية هي السبب الثالث للوفاة عالميا كما انها سبب للإعاقة المزمنة للناجين منها. السن و الجنس الذكري هما من عوامل الخطورة لهذا المرض. الهدف من هذه الدراسة هو معرفة اختلافات السن والجنس بين مرضى الصدمة الدماغية في مستشفى ابن سيناء التعليمي بالمكلا حضرموت الجمهورية اليمنية.

طريقة البحث:

بحث توصيفي عرضي لدراسة مرضى الصدمة الدماغية حيث تم اخذ المعلومات من واقع ملفات المرضى الذين ادخلوا مستشفى ابن سينا حضرموت الجمهورية اليمنية خلال الفترة بين 1 / 2011 م إلى 12 / 2013م وتم تحليلها.

النتائج :

اجمالي عدد مرضى الصدمة الدماغية (1072) حالة, النوع الإقفاري منها شكل (78.5 ٪) والنوع النزفي (21.5 ٪)، الذكور (56.5 ٪) والإناث (43.5 ٪)، المرضي <60 عام شكلوا ٪72 من اجمالي المرضى و بين 60–40 عام 25.5 ٪, والشباب اقل من 40 عام 2.5 ٪. ارتقاع ضغط الدم كان في 53.2 ٪ من كبار السن و 63,7 ٪ من متوسطي العمر و 29.6 ٪ من الشباب. السكري كان في 39.5 ٪ من الكبار و 36.3 ٪ من متوسطي العمر و 7.4 ٪ فقط من الشباب. الكبار الذين لديهم ≥2 من عوامل الخطورة كانوا 89.9 ٪ منهم مقابل 68.9 ٪ من متوسطي العمر و 55.6 ٪ من الشباب. النوع الاقفاري تزداد نسبته من السن (63 ٪ و 68 ٪ و 82.6 ٪) بينما العكس بالنسبة للنوع النزفي (37 ٪ و 31.9 ٪ و 17.4 ٪)، الغيبوبة كانت اكثر بين الشباب (29.6 ٪) منها بين متوسطي العمر (18.3 ٪) و بين الكبار (19.6 ٪)، كان هناك فرق بدون اهمية بين الذكر والأنثى   في ارتفاع ضغط الدم (54.6 ٪ و 56.2 ٪) و السكري (39.3 ٪ و 36.3 ٪) وتكرار المرض (8.7 ٪ و 8.2 ٪) و التاريخ الاسري (13.9 ٪ و 9.7 ٪)، اما التدخين فهناك فارق ذا اهمية بين الجنسين الذكور (29.2 ٪) والإناث (٪3.9)، بينما ٪94.2 من الذكور لديهم ≥2 من عوامل الخطورة, ٪ 70 فقط من الإناث لديهم ذلك.

الاستنتاج:

الصدمة الدماغية تزداد مع العمر والنوع الإقفاري وجد اكثر بين الكبار بينما النوع النزفي اكثر عند الشباب. الذكور بشكل عام اكثر عرضة للمرض, ولكن النوع الإقفاري اكثر بين الإناث بينما النزفي بين الذكور. لا فوارق بين الجنسين . لا فوارق مهمة بين الجنسين في نسبة عزامل الخطوره ماعدا التدخين الذي وجد مرتفع عند الذكور.

الكلمات المفتاحية:

الحادث الدماغي الوعائي، الصدمة الدماغية, حضرموت.

Introduction:

Stroke or cerebrovascular accident (CVA) is a non-communicable disease of increasing socioeconomic importance in ageing populations. According to WHO, stroke was the second commonest cause of mortality worldwide in 2016 and the third commonest cause of mortality in more developed countries (Sarti et al., 2000); with two-thirds of these deaths occurring in less developed countries (WHO, 2016), Stroke is also a major cause of long-term disability (Foulkes et al., 1988) and has potentially enormous emotional and socioeconomic results for patients. Ischemic stroke is more common than the hemorrhagic type, males are affected more than females, and its incidence is increasing with age (Lavados et al., 2005). In addition to increasing age and male sex stroke has many risk factors including hypertension (Dunbabin and Sandercock, 1990), diabetes mellitus (Bak et al., 1995), smoking (Bronner et al., 1995), hyperlipidemia (Bamekhlah et al., 1997) previous stroke attacks and family history (Qari, 2000).

In Hadramout and Yemen there are insufficient published data about stroke, the aim of our work: to determine age and sex differences in relation to risk factors and clinical presentation in stroke patients in Mukalla, Hadramout, Republic of Yemen.

Material And Methods:

A retrospective descriptive study of patients with CVA admitted in Ibn-seena Hospital, Mukalla, Hadramout, Republic of Yemen, during the period between January 1st. 2011 and December 31st. 2013. Data were collected in a questionnaire from patient medical files. The questionnaire involved risk factors (age, sex, hypertension, diabetes mellitus, hyperlipidemia, smoking, previous attacks and family history), type of stroke, time of hospital seeking, onset and consciousness level at presentation, and outcome. All cases were divided into 3 groups according to age: group I (young patients) < 40 years, group II (middle-aged patients) 40-60 years and Group III (old patients) >60 years.

Data processing and statistical analysis:

All data collected were entered into a personal computer, using Statistical Package for Social Sciences (SPSS) Program version 2014 software for entering data and analysis purposes. Descriptive statistic such as frequencies and percentages as well as means, standard deviation, chi square test and P value were calculated and then study results were presented in tables and graphs using Excel and Word program.

Results

Table 1 clarifies that patients with CVA admitted to the medical department of Ibn-seena Hospital between January 1st 2011 and December 31st 2013 were (1072) cases with ages range (24-102) years, and mean (66.7 ± 15.3) years. Affected males were more than females (56.5% versus 43.5%) with no significant difference. Seventy-two percent of patients were aged >60 years (Group III), 25.5% (40-60 years – Group II) and only 2.5% (<40 years –Group I). Old females were more affected among all female patients (260/466) comparing old males (412/606) (77.2% vs 68%).

Table 2 shows the frequency of risk factors in each age group, hypertension was more in middle-aged patients (Group II) (174/273, 63%) compared with Young patients (Group I) (8/27, 29.6%) and old ones (Group III) (411/772, 53.2%). Diabetes was more in Group II and III), 36.6% and 39.5% respectively while only 7.4% of group I were diabetics. Smoking was more in Group I (37%) while but only 22% and 16.2% in Group II and III respectively. Family history was in Group I, II and III, 14.8%, 15% and 10.9%, hyperlipidemia, 7.4%, 12.8% and 8.8%, previous attacks 7.4%, 7.3% and 8.9% respectively. Atrial fibrillation was rare in our study, only 2 cases in Group I (7.4%), 3 cases in Group II (1.1%) and no cases reported in Group III.

Table 1 : General data of Stroke patients admitted to Ibnseena Hospital, Mukalla Hadramout (2011-2013).

N= 1072		Males		Females		Total	
No. of Patients		**606**	**56.5%**	**466**	**43.5%**	**1072**	**100%**
Age (groups): **<40 years** **40-60 years** **>60 years**		21 173 412	3.5% 28.5% 68%	06 100 360	1.3% 21.5% 77.2%	27 273 772	2.5% 25.5% 72%
Age (years)	**•Range** **Mean ± SD***	36 - 102 66.7 ± 15.3		24 - 96 0.9 ± 12.4		24 - 102 66.1 ± 14.6	

*SD = standard deviation

Figure 1 illustrates that he number of risk factors increased with age where 40.7% of Group I patients had one risk comparing with Group II (24%) and Group III (10.1%), while in Group III 89.9% had ≥2 risk factors, 68.9% of Group II and only 55.6% of Group I.
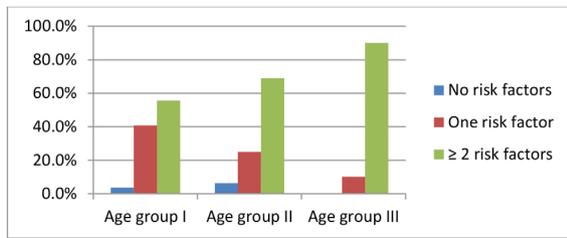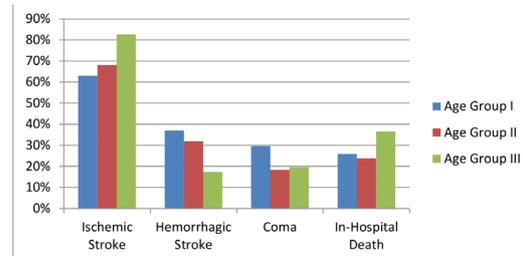
Fig. 1: The number of Risk Factors in Each Age Group.

Fig. 2: Some Clinical Data among Stroke patients in Relation to Age Group.

Table 2 : Risk Factors among Stroke patients in Relation to Age.

Item N=1072	Group I		Group II		Group III		Total	
	No.	%	No.	%	No.	%	No.	%
Hypertension	8	29.6	174	63.7	411	53.2	593	55.3
Diabetes mellitus	2	7.4	100	36.6	305	39.5	407	38
Smoking	10	37	60	22	125	16.2	195	18.2
Family history	4	14.8	41	15	84	10.9	129	12
Hyperlipidemia	2	7.4	35	12.8	68	8.8	105	9.8
Previous attacks	2	7.4	20	7.3	69	8.9	91	8.5
Atrial fibrillation	2	7.4	3	1.1	0	0	5	0.5
Total	27	100	273	100	772	100	1072	100

Table 3 : Clinical Data among Stroke patients Relation to Age.

Item N=1072		Group I		Group II		Group III		Total	
		No	%	No.	%	No.	%	No.	%
Timing of hospitalization	<24hrs	23	85.2	196	71.8	557	72.2	776	72.4
	>24hrs	4	14.8	77	28.2	215	27.8	296	72.4
Type of stroke	Ischemic	17	63	186	68.1	638	82.6	841	78.5
	Hemorrhagic	10	37	87	31.9	134	17.4	231	21.5
Onset	Sudden	23	85.2	250	91.6	655	84.8	928	86.6
	Gradual	4	14.8	23	8.4	117	15.2	144	13.4
Conscio-usness	Fully	14	51.9	143	52.4	443	57.4	600	56
	Disturbed	5	18.5	80	29.3	178	23.1	263	24.5
	Coma	8	29.6	50	18.3	151	19.6	209	19.5
Outcome on discharge	Alive	20	74.9	208	76.2	490	63.5	718	67
	Died	7	25.9	65	23.8	282	36.5	354	33
Total		27	100	273	100	772	100	1072	100

Table (3) and Figure (2) demonstrate clinical data of each Age group. Regarding to hospital seeking, 85.2% of young patients (Group I) occurred within the first 24 hours of the attack (early hospitalization), comparing to middle aged (Group II) 71.8% and old ones (Group III) 72.2%. Haemorrhagic stroke was more in Group I (37%) while in Group II there was in 31.9% and only 17.4% in Group III. Sudden onset in Group I was 85.2%, in Group II was 91.6 % and in group III was 84.8% Coma was the clinical presentation in 29.6% of Group I patients which was higher than in Group II (18.3%) and in Group III (19.6%).

in-hospital death was more in Group III (36.5%) comparing to Group I and II (25.9% and 23.8% respectively).

Table (4) shows risk factors in both sexes, hypertension was the most common risk factor (54.6% and 56.2% of males and females respectively), also diabetes was (39.3% and 36.3%), which shows no significant differences between both sexes. While smoking was more in male (29.2%) than in female patients (3.9%), otherwise there were no valuable differences in other risk factors between both sexes.

316

Figure (3) describes the number of risk factors in each sex, all males had at least one risk factor, but females 3.9% of them had no, only 5.8% of males had one risk factor comparing with females whom 26.1% had, while 94.2 % of males and 70% of female had ≥2 risk factors.

Table 4 : Risk Factors among Stroke patients in Relation to Sex.

Item	Male		Female		Total	
N=1072	No	%	No.	%	No.	%
Hypertension	331	54.6	262	56.2	593	55.3
Diabetes mellitus	238	39.3	169	36.3	407	38
Family history	84	13.9	45	9.7	129	12
Smoking	177	29.2	18	3.9	195	18.2
Hyperlipidemia	54	8.9	51	10.9	105	9.8
Previous attacks	53	8.7	38	8.2	91	8.5
Atrial fibrillation	0	0	5	1.1	5	0.5
Total	606	100	466	100	1072	100

Table (5) and Figure (4) explain clinical data in both sexes, 71.8 % of males were hospitalized within 24 hours from attack comparing with 73.2% of females, 76.2% of males and 81.3% of females had ischemic type, while only 23.8% of males and 18.7% of females had hemorrhagic one, 21.5% of male patients presented with coma comparing with 17% 0f females. Sudden onset was presented in 88.4% of males and 84.1% of females, and in-hospital death occurred in 31.4% of males and 35.2% of females.
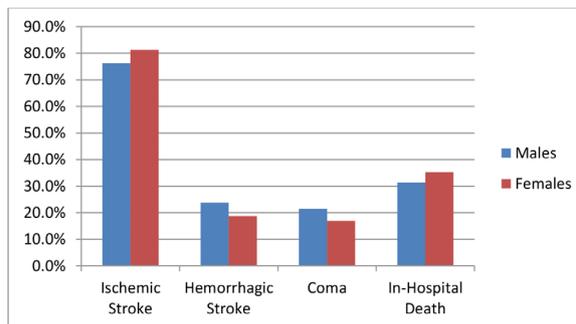

Fig. 4 : Some Clinical Data among Stroke patients in Relation to Sex.

Table (5):Clinical Data among Stroke patients in Relation to Sex.

Item		Male		Female		Total	
N=1072		No	%	No.	%	No.	%
Timing of hospitalization	<24hrs	435	71.8	341	73.2	776	72.4
	>24hrs	171	28.2	125	26.8	296	72.4
Type of stroke	Ischemic	462	76.2	379	81.3	841	78.5
	hemorrhagic	144	23.8	87	18.7	231	21.5
Onset	Sudden	536	88.4	392	84.1	928	86.6
	gradual	70	11.6	74	15.9	144	13.4
consciousness	fully	329	54.3	271	58.1	600	56
	disturbed	147	24.3	116	24.9	263	24.5
	coma	130	21.5	79	17	209	19.5
Outcome on discharge	Alive	416	68.6	302	64.8	718	67
	died	190	31.4	164	35.2	354	33
Total		606	100	466	100	1072	100

Discussion:

In this retrospective descriptive study we estimated age, sex and stroke type differences in relation to risk factors and clinical presentation at hospital admission. The frequency of stroke increases with age and many studies reported it where in the age group $\geq$ 60 years was more than in other younger age groups (Awad et al., 2010, D'Alessandro et al., 1992, Desalu et al., 2011, Kawle et al., 2015, Lavados et al., 2005) and the same that our work revealed that 72% of cases were old. Hypertension was related to middle-age group (40-60 years) more than the young group (<40 years) and old-age group (>60 years), which was consistent with Awad et al., (2010) and Schulte, (1989),while Khan et al., (2008) reported that hypertension was more frequent in old cases. Diabetes was a significant risk factor in our cases but it was more related to old cases, the same was revealed by Kawle et al., (2015) and Khan et al., (2008), Smoking is significantly high among young patients (<40 years) comparing with old ones (>60 years), and that what was reported by Kawle et al (2015) and Khan et al., (2008). Previous attacks, hyperlipidemia and family history were observed as important risk factors for stroke, but there were no significant differences between age groups. The number of risk factors increased with age in our work, just as Khan et al., (2008) in Qatar reported.

Ischemic stroke was more frequent in the old-age group that may be attributed to multiple risk factors could be associated with age like hypertension, diabetes, hyperlipidaemia, etc., in contrast hemorrhagic type appeared more among the young-age group, the same finding was reported by Lavadoste al., (2005). In-hospital deaths were more among old patients compared with the young, just as revealed by Khan et al., (2008) which may be due to increasing risk factors as well as many health problems the elderly people face.

Old female patients were more frequent among all female patients, comparing to old males, and this was agreed withLavadoste al., (2005) in Chile, D'Alessandro et al., (1992), inItaly, Desalu et al., (2011)in Nigeria andMinelli et al., (2007) in Brazil, but opposed by other studies such as Awad et al., (2010) in Iraq, Ashok et al., (1986) in Libya and Ahangar et al., (2005) in Iran. Smoking was clearly more frequent in males than in females (29.2% versus 3.9%), and this may be attributed to social, cultural and religious factors which do not accept women to smoke in our country; and this can be explained that studies from USA showed no sex difference (Jha et al., 2013 and Thun et al., 2013)) as well as those from Europe (Kelly et al., 2008 and Woodward et al., 2007)) while studies from other countries were more or less similar to our findings (Honjo et al., 2010, Lam et al.,2007, Nakamura et al., 2012, Pham et al.,2007, Sarfo et al., 2014 and Shankar et al., 2008), furthermore there was an American study reported than smoking was even more in female patients (Yusuf et al., 1998) however, globally by a systemic review and meta-analysis of 81 prospective cohort studies that included 3 980 359 individuals and 42 401 strokes, smoking was an independent risk factor for stroke in both sexes (Peters et al., 2013). No sex differences in our work reported regarding hypertension, diabetes, previous attacks of stroke and family history, although they remain as important risk factors for stroke, Chang 2009 stated that family history remains significant after adjustment of diabetes, hypertension, smoking and possible other modifiable risk factors.

We found no significant sex differences in the timing of admission which explains that there wasequal social awareness and health care for both sexes, Nayak et al., 2015, in India shared our findings. Ischemic stroke is slightly more frequent among women than men and the opposite for haemorrhagic type which was agreed with Khan et al., (2008) and Ashok et al., (1986), although globally, men continueto have a higher incidence of ischemic type than women (Pham et al., 2007). The onset of the accident and presentation with coma showed no difference between both sexes. Most reports clarified that there was no difference in in-hospital mortality (Ahangar et al., 2005, Ashok et al., 1986, Bamekhlah et al., 1997, Jha et al., 2013, Minelli et al., 2007 and Thun et al., 2013), although Woodward et al.,(2007) found that it was slightly higher in females the study that we shared.

Conclusion:

Stroke increased with age. Ischemic stroke was more in old in and hemorrhagic in young patients. Males were generally more affected, but ischemic type was common in females while hemorrhagic type in males. No sex differences with risk factors rather than smoking was more in males.

Reference:

1. Awad SM, Al-Jumaily HF, Al-Dulaimi KM and Abdulghafoor RH.Assessment of major risk factors among stroke patients. Saudi Med J 2010. 31(9):1028-31.

2. Ahangar AA, Ashraf Vaghefi SB and Ramaezani M. Epidemiological evaluation of stroke in Babol, northern Iran (2001-2003). Eur Neurol. 2005;54(2):93-7.

3. Ashok PP, RadhakrishnanK, Sridharan R and MA El-Mangoush MA. Incidence and Pattern of cerebrovascular diseases in Benghazi, Libya. J Neuorol, Neurosurg and Psychiattry 1986;49:519-23.

4. Bak S, Bak L and Sørensen JS. Prevalence of risk factors in cerebral ischemia. Ugeskr Laeger 1995. ;157 (4):444-6.

5. Bamekhlah RM, El-Sawi AA, Soltan II and Mansour LA. Lipoprotein (a) level in cerebrovascular stroke. Thesis submitted in partial fulfillment of M.Sc. Degree in Internal Medicine. Faculty of medicine, Cairo University, Egypt 1997. PP: 142-147.

6. Bronner LL, Kanter DS and Manson JE. Primary stroke prevention. N. Engl. J. Med 1995; 333(21):1392-1400.

7. Chang KC. Update of Association of Stroke and Family History of Stroke in Taiwan. Acta Neurol Taiwan 2009;18:153-154.

8. D'Alessandro G, Di Giovanni M, Roveyaz L, Iannizzi L, Compagnoni MP, et al. Incidence and prognosis of stroke in the Valle d'Aosta, Italy. First- year results of a community-based study. Stroke 1992; 23:1712-1715.

9. DesaluO, WahabKW, FawaleB et al.;. A review of stroke admissions at a tertiary hospital in rural Southwestern Nigeria. Ann Afr Med 2011; 10: 80-5.

10. Dunbabin DW and Sandercock PAG. Preventing stroke by modification of risk factors. Stroke 1990; 21 (suppl. 4): IV-16 – IV-39.

11. Foulkes MA, Wolf PA, Price TR, Mohr JP, Hier DB. The stroke data bank: design, methods, and baseline characteristics. Stroke 1988; 19: 547–54.

12. Honjo K, Iso H, Tsugane S, Tamakoshi A, Satoh H, Tajima K, et al. The effects of smoking and smoking cessation on mortality from cardiovascular disease among Japanese: pooled analysis of three large-scale cohort studies in Japan. Tob Control. 2010;19:50–57.

13. Jha P, Ramasundarahettige C, Landsman V, Rostron B, Thun M, Anderson RN, et al. 21st-century hazards of smoking and benefits of cessation in the United States. N Engl J Med. 2013;368:341–350

14. Kawle AP, Nayak AR, Neha H Lande NH, et al;. Comparative evaluation of risk factors, outcome and biomarker levels in young and old acute ischemic stroke patients. Ann Neurosci. 2015;22(2):70-7.

15. Kelly TN, Gu D, Chen J, Huang JF, Chen JC, Duan X, et al. Cigarette smoking and risk of stroke in the chinese adult population. Stroke. 2008;39:1688–1693.

16. Khan FY, Yasin M, Abu-Khattab M, El Hiday AH, Errayes M, Lotf AK, Ibrahim AS, Abbas MT, Matar I, Alsamawi M and Alhail H.Stroke in Qatar: a first prospective hospital-based study of acute stroke. J Stroke Cerebrovasc Dis. 2008; 17(2):69-78.

17. Lam TH, Li ZB, Ho SY, Chan WM, Ho KS, Tham MK, et al. Smoking, quitting and mortality in an elderly cohort of 56,000 Hong Kong Chinese. Tob Control. 2007;16:182–189.

18. Lavados PM, Sacks C, Prina L, Escobar A et al.Incidence, 30-day case fatality rate, and prognosis of stroke in Iquique, Chile: a 2-year community-based prospective study (PISCIS project). Lancet 2005; 365: 2206–15.

19. Minelli C, Lee Fu Fen LF and Minelli DPC. Stroke Incidence, Prognosis, 30-Day, and 1-Year Case Fatality Rates in Matão, Brazil : A Population-Based Prospective Study. Stroke 2007; 38:2906-2911.

20. Nakamura K, Nakagawa H, Sakurai M, Murakami Y, Irie F, Fujiyoshi A, et al; EPOCH-JAPAN Research Group. Influence of smoking combined with another risk factor on the risk of mortality from coronary heart disease and stroke: pooled analysis of 10 Japanese cohort studies. Cerebrovasc Dis. 2012;33:480–491.

21. Nayak AR, Hussain AA, Lande NH, et al;. Impact of Admission Time on Treatment and Outcome of Stroke in Patients Admitted to Tertiary Care Hospital: A Pilot Study from Central India. J Clin Diagn Res. 2015 , 9(6): BC01-BC07.

22. Peters SAE, Huxley RR, and Woodward M. Smoking as a Risk Factor for Stroke in Women Compared with Men. A Systematic Review and Meta-analysis of 81 Cohorts, Including 3 980 359 Individuals and 42 401 Strokes. Stroke. 2013;44:2821-8.

23. Pham TM, Fujino Y, Tokui N, Ide R, KuboT, Shirane K, Mizoue T, Ogimoto I, Yoshimura T. Mortality and risk factors for stroke and its subtypes in a cohort study in Japan, Prev Med 2007; 44(6):526-30.

319

24. Qari FA. Profile of stroke in a teaching university hospital in the western region. Saudi Med J 2000.; 21(11):1030-3.

25. Sarfo FS, Acheampong JW, Appiah LT Oparebea E Akpalu A Bedu-Addo G. The profile of risk factors and in-patient outcomes of stroke in Kumasi, Ghana. Ghana Med J 2014; 48(1):127-134.

26. Sarti C, Rastenyte D, Cepaitis Z, Tuomilehto J. International trends in mortality from stroke, 1968 to 1994. Stroke 2000; 31: 1588–01.

27. Schulte BPM. Neuroepidemiology of cerebrovascular disease: An overview in advances in neurology. In: Chopra JS, editor. Proceedings of the XIVth World Congress of Neurology, New Delhi, India; 1989. P. 3.

28. Shankar A, Yuan JM, Koh WP, Lee HP, Yu MC. Morbidity and mortality in relation to smoking among women and men of Chinese ethnicity: the Singapore Chinese Health Study. Eur J Cancer. 2008;44:100–109.

29. Thun MJ, Carter BD, Feskanich D, Freedman ND, Prentice R, Lopez AD, et al. 50-year trends in smoking-related mortality in the United States. N Engl J Med. 2013;368:351–364.

30. WHO. The world health statistics 2016. Geneva: WHO, 2016.

31. Woodward M, Brindle P, Tunstall-Pedoe H; SIGN Group on Risk Estimation. Adding social deprivation and family history to cardiovascular risk assessment: the ASSIGN score from the Scottish Heart Health Extended Cohort (SHHEC). Heart. 2007;93:172–176.

32. Yusuf HR, Giles WH, Croft JB, Anda RF, Casper ML. Impact of multiple risk factor profiles on determining cardiovascular disease risk. Prev Med. 1998;27:1–9.