

Clinical Patterns and Early Prognosis of Stroke in Babol, Northern Iran

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Abstract: Background: Stroke is the second leading cause of death worldwide. Data on the epidemiology of stroke, patterns and risk factors in recent years in our region are brief. Methods and Material: This retrospective study from 2014 to 2015 on stroke patients in Ayatollah Rouhani hospital in Babol was conducted. The MRS and Barthel index were used at admission and discharge of stroke patients. Patient's demographic data and checklist used to identify stroke types, risk factors and early prognosis. Findings: A total of 230 patients were included in this study, 122 patients (53%) was female, 194 cases (84%) was ischemic type vs. 36 (16%) hemorrhagic, $P<0.001$. The difference in underlying disease was statistically significant (168 patients (73%) Hypertension, 121 (52.6%) Diabetes Mellitus, 118 (51.3%) Cardiac Disease, 108 (46.9%) Hyperlipidemia, 58 (25.2%) Smoking and 46 patients (20%) had the Opioid addiction, $P<0.001$). Hypertension was statistically significant and increased in hemorrhagic subtype (25 patient (70%) Intracerebral vs. 11 patient (30%) Subarachnoid, $P=0.01$). The difference in Cardiac disease ($p<0.0001$), Diabetes Mellitus ($p<0.001$), Smoking ($p<0.001$), Opioid Addiction ($p<0.04$) was statistically significant and increased in Intracerebral patients. Up to the first week of hospitalization, 10% of stroke patients (7% elderly, 3% non-elderly) were expired. Conclusions: Hypertension was most frequent stroke risk factor especially in Intracerebral Hemorrhage and male patients. High smoking was seen in Intracerebral Hemorrhage. The early mortality rate in stroke patients was low. It suggests that health ministry do screening plan in nonelderly, especially female, male with Hypertension and smoking consider as target population.

Keywords: Stroke, Ischemic Stroke, Hemorrhagic Stroke, Hypertension

1. Introduction

Stroke is the second leading cause of death worldwide [1] and the leading cause of acquired disability in adults [2]. Countries of low and middle-income have the largest burden of stroke [3], accounting for more than 85% of stroke mortality worldwide [4]. Stroke incidence in the Middle East and North Africa vary from 10% in Kuwait to 31.5% in Iran [3]. Two-thirds of all strokes occur in the developing countries in spite of their preventable nature, are increasingly becoming a major health problem [5, 6]. It is expected that the deaths resulting from stroke will nearly double in the Middle East and North Africa by 2030. few reliable data are available to identify risk factors for stroke in most of low and

middle income countries [4]. Hypertension, smoking, diabetes, ischemic heart disease obesity, hyperlipidemia and smoking (cigarettes) are the main risk factors for stroke [7]. Smoking is a major risk factor for stroke and cardiovascular disease event in Asian countries [8]. Hypertension and cardiac disease are the primary risk factors for stroke [9]. Diabetes is one of the most important vascular risk factors for stroke and a high-yield target for preventive measures. In studies conducted in Iran reported that the incidence of stroke is about 43 patients per 100,000 populations [10]. The most common risk factor was high blood pressure with a prevalence rate of 54%. The incidence of stroke was slightly higher in women in all age groups (51-53%). the average age of its incidence is in the seventh decade of life, however, in

the age group of 15-45 years, stroke was more common in men [8]. 28 days early fatality rate has reported at 19.2% [20] and 31.5% [21] in Iran [3]. Considering that few epidemiological studies have been previously conducted in Babol [8] and due to change of the different aspect of stroke in this region. Therefore, this study was conducted.

2. Method

This retrospective, census study on patient from 20 March 2015 to 20 februraty 2016 (equal Persian Calendar 1394) that admitted to Neurology center at Ayatollah Rouhani hospital of Babol University of Medical Sciences; which is the only center for admission of all stroke cases in Babol city, all villages around it with total population 550 000 and only center for admission from Emergency Medical Services Center (115).

2.1. Ethic

This study was approved by the ethics committee of (BUMS). Informed consent was obtained from each participant or the next of kin before any interview or neurologic examination was conducted. All stroke admitted to this hospital in the Babol were registered.

2.2. Stroke Definition and Diagnose

Stroke was defined as rapidly developing neurologic symptoms and signs that caused by Focal involvement of the central nervous system that has the vascular origin and takes more than 24 h, generally divided into two types: Ischemic stroke (IS) and hemorrhagic stroke (HS). Diagnosis of stroke and its types was based on criteria of National Institute of Health Stroke Scale (NIHSS) [11]. IS was divided to thrombotic and embolic subtype and HS was divided into Intracerebral and subarachnoid hemorrhage subtype. To determine of stroke intensity at admission and discharge was based on criteria of Modified Rankin Scale and Barthel index [12]. Stroke was diagnosed by a neurologist, based on the patient's history, neurological examination and neuroimaging studies which were performed for all stroke patients. Exclusion criteria for stroke cases were hemiparesis or any focal neurological findings due to head trauma, metabolic encephalopathy, brain mass lesions such (tumor or abscess), hemiplegic migraine, postictal of seizures [13].

2.3. Data

Prospective data collection was performed by using a questionnaire which included age, gender, time of stroke onset, stroke type and subtype, intensity and time of admission to hospital, previous medication, stroke anatomic localization, acute-stroke management complications, medication for secondary prevention, and severity of the clinical deficit at discharge time. Then checklist used to identify another risk factor that include of hypertension (HTN), vascular risk factors and prior ischemic heart diseases, diabetes mellitus, dyslipidemia, addiction (include opiate addiction, alcoholism and amphetamine, cocaine abuse

(oral, I.V.) and smoking (at least 5 cigarette per day for last year). History of addiction was determined by self-reporting of patients or their relatives who indicate the continuous use of this substance and drugs at least in last year [14]. The presence of a past history of hypertension, diabetes, hyperlipidemia, cardiac disease, and transient ischemic attack (TIA) was obtained from medical records or from patient interview.

2.4. Underlying Disease Definition

Hypertension was defined as the history of elevated blood Pressure 140/90 mm Hg at 2 independent readings before stroke or patients that consumed antihypertensive medication before the stroke. Ischemic heart disease (history and confirmed by at least one electrocardiogram, or presence of Coronary heart disease during hospitalization), we merged several cardiac causes into a single variable of cardiac cause [15]. Diabetes mellitus was defined as history of elevated blood glucose FBS ≥ 126 mg/dl [15, 16] at 2 independent readings before stroke or elevated hemoglobin A1C at admission or used anti-diabetic medication. Hypercholesterolemia was defined as history of elevated total Cholesterol 220 mg/dl, Low HDL was identified by HDL cholesterol 40 mg/dl in men or 50 mg/dl in women, LDL > 130 mg/dl [15] at 2 independent readings before stroke or Lipid-lowering medication. Smoking status was defined as never or former and current smoker. We defined current smokers as individuals who smoked any tobacco in the past 12 months. Former smokers were defined as those who had quit more than a year earlier [11]. Also, severity of the clinical deficit or any mortality as early prognosis in the first week of hospitalization was recorded in the checklist.

2.5. Analysis

SPSS software for Windows (version 23, SPSS Inc. Chicago, IL, USA) was used for the statistical analysis of the data. Chi-square test was used for the comparison between categorical variables. $P < 0.05$ was considered significant.

3. Result

A total of 230 patients were included in this study, 122 patients (53%) were female, 108 patients (47%) were male, with mean age 61.2 ± 6 year. Most of stroke patients were IS (194 patients (84%) IS vs. 36 patients (16%) HS, $p < 0.001$). The difference in age was significant, 156 cases (68%) were elderly (65-year old or more) and 74 cases (32%) were non-elderly, $P < 0.001$). Demographic and health characteristic were shown in Table 1.

Table 1. Demographic and health characteristic of stroke patients, admitted to Ayatollah Rouhani hospitals, 2014-2015.

Variable	Subgroups	Frequency (%)	p-value
Age	<65 year	156 (68)	$P < 0.001$
	>65 year	74 (32)	
Gender	Male	108 (47)	$P = 0.35$
	Female	122 (53)	

Variable	Subgroups	Frequency (%)	p-value
Stroke	Ischemic	194 (84)	P<0001
	Hemorrhagic	36 (16)	
Blood Pressure	HTN	168 (73)	P<0001
	Normal	62 (27)	
Diabetes	Diabetes	121 (53)	P=0.42
	Normal	109 (47)	
Total Cholesterol	High	118 (51.4)	P=0.69
	Normal	112 (48.6)	
Past History	Stroke	35 (15)	P<0001
	TIA	76 (33)	
	Cardiac Disease	112 (48)	
	Addictions	104 (45)	
Expy	first week of hospitalization	23 (10)	P<0001

The difference in underlying disease was statistically significant. 168 patients (73%) Hypertension, 118 patients (51.3%) Cardiac Disease, 121 patients (52.6%) Diabetes Mellitus, 108 patients (46.9%) Hyperlipidemia, 58 patients (25.2%) Smoking and 46 patients (20%) had Opioid Addiction, P<0001). In HS, hypertension was statistically significant and increased in intracerebral subtype (25 patients (70%) Intracerebral vs. 11 patients (30%) Subarachnoid, (P=0.01). Also, the difference in Cardiac Disease (p<0.0001), Diabetes Mellitus (p<0.001), Smoking (p<0.001), Opioid Addiction (0.04) was statistically significant and increased in Intracerebral patients. On another hand in IS, the difference of past history of heart disease and other risk factors was not statistically significant in Thrombotic and Embolic patients. Risk factors in different Stroke subtype were shown in Table 2.

Table 2. Risk factors in different Stroke subtype in patients admitted to Ayatollah Rouhani hospitals, 2014-2015.

Stroke subtype		Gender	Hypertension	Cardiac Disease	Diabetes Mellitus	Hyperlipidemia	Smoking	Opioid Addiction
Ischemic 194 (84)	Thrombotic 102 (52)	Male	40 (39.2)	30 (29.4)	28 (27.4)	21 (20.5)	14 (13.7)	12 (11.7)
		Female	34 (33.3)	26 (25.4)	31 (30.3)	21 (20.5)	6 (5.8)	7 (6.8)
	Embolic 92 (48)	Male	34 (36.9)	22 (23.9)	20 (21.7)	28 (30.4)	12 (7.6)	8 (8.6)
		Female	28 (30.4)	20 (21.7)	24 (26)	24 (26)	4 (4.3)	3 (3.2)
		p-value	0.61	0.15	0.13	0.30	0.50	0.14
Hemorrhagic 36 (16)	Intracerebral 22 (61)	Male	14 (63.6)	9 (40.9)	9 (40.9)	4 (18)	14 (63.6)	8 (36.3)
		Female	9 (40.9)	9 (40.9)	7 (31.8)	5 (22)	5 (22.7)	4 (18.1)
	Subarachnoid 14 (39)	Male	6 (42.8)	2 (14.2)	1 (0.07)	3 (21.4)	2 (14.2)	2 (14.2)
		Female	3 (21.4)	0 (0)	1 (0.07)	2 (14.2)	1 (5.1)	2 (14.2)
		p-value	0.01	0.0001	0.001	0.28	0.001	0.04
Stroke	Total	230 (100)	168 (73)	118 (51.3)	121 (52.6)	108 (46.9)	58 (25.2)	46 (20)

23 stroke patients (%10) expired up to the first week of hospitalization. An investigation between Age groups and mortality rates show that we had not mortality in the patient less than 40 years. Age groups and mortality rates were shown in Table 3.

Table 3. Age groups and mortality rates in the patients, admitted to Ayatollah Rouhani hospitals, 2014-2015.

Age group	Frequency N (%)	Admitted group			Died group		
		gender	ischemic	hemorrhagic	ischemic-mortality	hemorrhagic mortality	Mortality (%)
<40	14 (6)	Male	6 (3)	2 (5)	0 (0)	0 (0)	0 (0)
		female	6 (3)	0 (0)	0 (0)	0 (0)	0 (0)
41-50	22 (9)	Male	9 (4)	3 (8.3)	0 (0)	1 (12.5)	2 (8.6)
		female	9 (4)	1 (2.7)	1 (6.6)	0 (0)	1 (4.3)
51-60	41 (17)	Male	9 (4)	3 (8)	2 (13.3)	1 (12.5)	5 (21)
		female	17 (8)	3 (8)	1 (6.6)	1 (12.5)	2 (8.6)
61-70	94 (40)	Male	35 (18)	8 (22)	2 (13.3)	2 (25)	7 (30)
		female	44 (22)	7 (19)	2 (13.3)	1 (12.5)	3 (13)
71-80	47 (20)	Male	17 (8)	3 (8)	2 (13.3)	1 (12.5)	6 (26)
		female	23 (11)	4 (11)	2 (13.3)	1 (12.5)	3 (13)
81>	12 (5)	Male	3 (1.5)	1 (2)	1 (6.6)	0 (0)	3 (13)
		female	7 (3.6)	1 (2)	2 (13.3)	0 (0)	2 (8.6)
total	230 (100)	Total	194	36	15 (65.2)	8 (34.7)	23 (10)

The difference in the mortality rate was not statistically significant with stroke subtype (15 patients (65.2%) IS vs. 8 patients (34.7%) HS, p=0.14) and gender (12 patients (52%) male vs. 11 patients (48%) female, p=0.83). The rate of disability of survivor of different stroke subtype at discharge time (in average one week after hospitalization) in 48 cases (23%) of was in moderate disability (based on Modified Rankin Scale and Barthel index) that were shown in Table 4.

Table 4. Rate of disability of survivor of different stroke subtype based on Modified Rankin Scale and Barthel index in babol (2014-2015).

Modified Rankin Scale	Barthel index	Stage	Frequency	Hemorrhagic	ischemic	Thrombotic	embolic
0	100	Without symptoms	31 (14.9)	2 (6.5)	29 (93.5)	10 (35)	19 (65)
1	100	Symptoms without signs	42 (20.2)	6 (14.3)	36 (85.7)	19 (52)	17 (47)
2	80-100	Mild disability	40 (19.3)	6 (15)	34 (85)	16 (48)	18 (52)
3	60-80	moderate disability	48 (23.1)	7 (15)	41 (85)	22 (54)	19 (46)
4	20-60	Moderate to severe disability	28 (13.5)	5 (18)	23 (82)	14 (61)	9 (39)
5	0-20	Severe disability	18 (8.6)	3 (17)	15 (83)	10 (67)	5 (33)
total			207 (100)	29 (15)	178 (85)	91 (52)	87 (48)

4. Discussion

Stroke was slightly higher in the female that was similar to previous study and similar to Feiginin in Auckland, New Zealand, Yoon study in Australia and Bagbanian study in Iran [8, 17-19]. Regarding the sex pattern of the stroke in previous studies conducted in Babol and Iran [8, 10], present study confirmed that female was more likely to experience stroke than male, this may be due to the longer life span of female [20] and post-menopausal hormonal changes. However, in our study diabetes mellitus and hyperlipidemia was more common in the female and IS that was similar to Franconi study [21]. This difference may be due to less physical activity in female that was seen in Hosseini study in this region [22], but further research is needed to determine the causes of these differences between incidence of stroke in male and female. The mean age of Babol stroke patients was 61.2 year but in previous study in 2003 it was 68 years [8] it was showed a decrease in mean age of stroke patients. 32% of stroke patients in our study was non-elderly cases (<65-year). Although stroke incidence was more common in elderly patients, but in low and middle-income countries stroke is also a problem in young age people [4]. In Azarpazhooh study mention that the reason for the high incidence of stroke in Mashhad in younger ages was not clear [23]. Similar to the findings reported by other studies, mean age in Daneshfard study was 68 years [3, 10, 24]. The high rate of stroke in non-elderly could be referred to inadequate prevention of stroke risk factors in young and middle age people in our region. However, in this study we hadn't any data in relation to risk factors for stroke in young patients but in our previous study in young stroke patients in this region, H.T.N, past history of cardiovascular disease, addiction (smoking) and drug abuse were most risk factors of stroke in younger patients [25]. Most of the stroke patients were IS (84%) with the thrombotic subgroup (52%) that similar with other studies. In the United States, about 780,000 strokes occur each year while 87% were IS and 13% was HS (26-28). In Daneshfard study in Iran 89% was IS (3). This is comparable with the results of a population-based study conducted in Mashhad and the finding reported by Azarpazhooh [23]. Prevalence of HS in this and previous study was decreased, (16% vs. 33%, respectively) [8]. This might be due to better treatment of H.T.N in general population in Iran in recent years; also it can be due to better

diagnosing of this silent disease in general population with improving in health government policies and education to check blood pressure routinely.

The difference in HTN, Cardiac Disease, Diabetes Mellitus, Smoking and Opioid Addiction was statistically significant and increased in I.C.H patients. Our findings showed the high proportion of underlying disease in these patients. These relationships were more increased in I.C.H Patients. The result of study showed that H.T.N (73% cases) was the most important risk factor for all stroke subtypes. However, our results showed the increasing rate of hypertension and change of rate and sex dependent distribution of some other stroke risk factors in recent years in comparison of a decade ago [8]. In HS, Hypertension was statistically significant and increased in I.C.H Hypertension and ischemic heart disease was more common in the male. In Wu study, 73% patient had HTN and it was identified as the first cause of stroke [29]. Also in Chang, Baghbanian and previous study, HTN was the first risk factor for Stroke that is similar to this study [8, 19, 30]. Hypertension was more common in the male that could be one explanation for the high rate of HS in men. Prevalence of hypertension in this study was increased in comparison with the previous study (73% vs. 54%, respectively) [8] which might be due to the high prevalence of obesity and high intake of salt in the diet. Most patients and especially nonelderly might be unaware of their H.T.N that it is necessary to screen blood pressure in the early of Health center. Diabetes and Cardiac Disease was the second and third risk factor of stroke respectively in this study that was similar to Daneshfard and the previous study that diabetes was the second risk factors [3, 8]. The opioid addiction also was more common in I.C.H patient's%20 of cases and%82.8 of I.C.H patients. The frequency of smoking in our stroke patients was%25.2 of cases. %86 of I.C.H patients had the history of smoking that similar to Hosseini and previous study in this region [8, 10]. Smoking was common in Iran, Argentina and Latin America [10, 26, 31]. Although smoking is a defined risk factor in for stroke. however, smoking as a risk for I.C.H is not approved [32]. However, our results showed that smoking is more common in I.C.H. than other stroke types. Up to the first week of hospitalization, 10% of Babol stroke patients (7% elderly vs. 3% non-elderly) expired. Stroke Prognosis was better than from previous study (23 (10%) vs. 48 (19.2%), Respectively) [8]. Although we had not any thrombolytic or any interventional therapy in this center during this study,

mortality of different types of stroke at first week of hospitalization was similar to other studies [10, 28, 33-35]. Our study showed that in the patient less than 40 years we had not any mortality. The rate of disability of survivor of different stroke subtype at discharge time (in average one week after hospitalization) in 48 cases (23%) was in moderate disability. In Luengo-Fernandez study in the UK, the rate of early disability in (23%) was moderate [36]. We hope that by establishing the possibility of thrombolytic therapy in our center since 2016, the rate of disability of our patients Decrease in the coming years.

Strength of this study, it is a basic study that can use for policy making and planning for future. The study had limitation. It was a hospital-based study that has less accuracy in comparison with population-based studies, although Ayatollah Rouhani Hospital was a major center for referring these patients in in Babol and all villages around it. We did not separate the types of cardiac disease, systolic and diastolic pressure as risk factors alone and did not follow up after hospital discharge for the longer period.

5. Conclusion

Female gender has more strokes; IS was the most stroke type. Mean age of stroke patients was decreased and inclined to none elderly. H.T.N was most frequent stroke risk factor especially in I.C.H and male patients. High smoking especially was seen in I.C.H. Early mortality rate in Babol stroke patients was low. Stroke Prognosis was better than from the previous study. Our emphasis is on better diagnose and control of H.T.N, Diabetes, cardiac disease and smoking and opium addiction especially in non-elderly stroke patients. It suggests that health ministry do screening plan in general population; nonelderly, especially female, male with H.T.N and smoking consider as target population and Codification Health policies to decrease stroke risk factor especially H.T.N

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Conflict of Interest

There was no conflict of interest.

Authors' Contributions

Alijan Ahmadi Ahangar: designed the study, prepared the manuscript, approved the final version and supervised the study. Payam saadat participated in neurologic examination and diagnosis of stroke patients; Seyedeh Tahereh Taheri collected the data and prepared the manuscript. Shayan

Alijanpour participated in data analysis and writing of manuscript.

References

- [1] Feigin VL KR, Parmar P, Norrving B, Mensah GA, Bennett DA, et al. Update on the global burden of ischemic and hemorrhagic stroke in 1990-2013: the GBD 2013 study. *Neuroepidemiology*. 2015; 28 (3): 161-76.
- [2] Esenwa C, Gutierrez J. Secondary stroke prevention: challenges and solutions. *Vascular Health and Risk Management*. 2015; 11: 437-50.
- [3] Daneshfard B, Izadi S, Shariat A, Toudaji MA, Beyzavi Z, Niknam L. Epidemiology of stroke in Shiraz, Iran. *Iranian Journal of Neurology*. 2015; 14 (3): 158-63.
- [4] O'Donnell MJ, Xavier D, Liu L, Zhang H, Chin SL, Rao-Melacini P, et al. Risk factors for ischaemic and intracerebral hemorrhagic stroke in 22 countries (the INTERSTROKE study): a case-control study. *Lancet*. 2010: 112-23.
- [5] Reeves MJ, Bushnell CD, Howard G, Gargano JW, Duncan PW, Lynch G, et al. Sex differences in stroke: epidemiology, clinical presentation, medical care, and outcomes. *Lancet Neurol*. 2008; 7 (10): 915-26.
- [6] Romero JR, Morris J, Pikula A. Stroke prevention: modifying risk factors. *Ther Adv Cardiovasc Dis*. 2008; 2 (4): 287-303.
- [7] Armin Grau CW, Florian Bugge, Alexander Heinrich, Michael Goertler, Stefan Neumaier, et al. Risk Factors, Outcome, and Treatment in Subtypes of Ischemic Stroke The German Stroke Data Bank. *Stroke*. 2001; 32: 2559-66.
- [8] Ahangar AA, Ashraf Vaghefi SB, Ramzani M. Epidemiological evaluation of stroke in Babol, northern Iran. *Eur Neurol*. 2005; 54 (2): 93-7.
- [9] Chong D, Aaron R, Steven N. Physical Activity and Stroke Risk A Meta-Analysis. *Stroke*. 2003; 34: 2475-82.
- [10] Hosseini AA, Sobhani-Rad D, Ghandehari K, Benamer HT. Frequency and clinical patterns of stroke in Iran, Systematic and critical review. *BMC Neurol* 2010; 10 (72).
- [11] Armin Grau, Christian Weimar, Florian Bugge, Alexander Heinrich, Michael Goertler, Stefan Neumaier, et al. Risk Factors, Outcome, and Treatment in Subtypes of Ischemic Stroke The German Stroke Data Bank. *Stroke*. 2001; 32: 2559-66.
- [12] Harrison JK, McArthur KS, Quinn TJ. Assessment scales in stroke: clinometric and clinical considerations. *Clinical Interventions in Aging*. 2013; 8: 201-11.
- [13] Kasper M, Fauci N, Hauser L, Longo F. Harrison's principles of internal medicine. 19 edition, editor: Mc Graw Hill; 2015.
- [14] Putaala J, Metso A, Metso T, Konkola N, Kraemer Y, Haapaniemi E. Analysis of 1008 consecutive patients aged 15 to 49 with first-ever ischemic stroke: the Helsinki Young Stroke Registry. *Stroke*. 2009; 40: 1195-203.
- [15] Chobanian AV, Bakris GL, Black HR. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension*. 2003; 42: 1206-52.

- [16] Williams L. Third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III) final report. *Circulation*. 2002; 106 (25): 3143.
- [17] Feigin VL, Krishnamurthi RV, Barker-Collo S, McPherson KM, Barber PA, Parag V. 30-Year Trends in Stroke Rates and Outcome in Auckland, New Zealand (1981-2012): A Multi-Ethnic Population-Based Series of Studies. *PLOS ONE*. 2015; 10 (8).
- [18] Yoon SS, Heller RF, Levi C, Wiggers J, Fitzgerald PE. Knowledge of Stroke Risk Factors, Warning Symptoms, and Treatment Among an Australian Urban Population. *Stroke*. 2001; 32: 1926-30.
- [19] Baghbanian SM, Ramezani M, Abedini M, Yazdani Charati J. Difference between Risk Factors of Common Ischemic Brain Strokes on Anterior and Posterior Circulation. *Journal of Mazandaran University of Medical Sciences*. 2013 Jun 15; 23 (101): 49-54.
- [20] Howden LM, Meyer JA. Age and sex composition: 2010 Census Briefs. In: US Department of Commerce EaSA, editor. US Census Bureau 2010.
- [21] Franconi F, Campesi I, Occhioni S, Tonolo G. Sex-gender differences in diabetes vascular complications and treatment. *Endocrine, Metabolic & Immune Disorders-Drug Targets (Formerly Current Drug Targets-Immune, Endocrine & Metabolic Disorders)*. 2012; 12 (2): 179-96.
- [22] Hosseini SR, Cumming RG, Kheirkhah F, Nooreddini H, Baiani M, Mikaniki E, et al. Cohort profile: The Amirkola health and aging project (AHAP). *International journal of epidemiology*. 2014; 43 (5): 1393-400.
- [23] Azarpazhooh MR, Etemadi MM, Donnan GA, Mokhber N, Majdi MR, Ghayour-Mobarhan M. Excessive incidence of stroke in Iran: evidence from the Mashhad Stroke Incidence Study (MSIS), a population-based study of stroke in the Middle East. *Stroke*. 2010; 41 (1): 3-10.
- [24] Appelros P, Stegmayr B, Terent A. Sex differences in stroke epidemiology: a systematic review. *Stroke*. 2009; 40 (4): 1082-90.
- [25] Ahangar AA, Saravi M, Alijanpour S, Boora MM, Hoseinalipour S, Zadeh HH, et al. Comparison of Risk Factors of Stroke and Myocardial Infarction in Patients 15 to 45 Years in Affiliated Hospitals of Babol University of Medical Sciences. *Zahedan Journal of Research in Medical Sciences*. 2016; 18 (12).
- [26] Estol CJ, Rojas MM. Stroke in Argentina. *Int J Stroke* 2010; 5 (1): 35-9.
- [27] Murray V, Norrving B, Sandercock PA, Terent A, Wardlaw JM, Wester P. The molecular basis of thrombolysis and its clinical application in stroke. *J Intern Med*. 2010; 267 (2): 191-208.
- [28] Grysiewicz RA, Thomas K, Pandey DK. Epidemiology of ischemic and hemorrhagic stroke: incidence, prevalence, mortality, and risk factors. *Neurol Clin* 2008; 26 (4): 871-95.
- [29] Wu L, Wang A, Wang X, Zhao X, Wang C, Liu L, et al. Factors for short-term outcomes in patients with a minor stroke: results from China National Stroke Registry. *BMC Neurology*. 2015; 15: 253.
- [30] Chang WH, Park C-h, Kim DY, Shin Y-I, Ko M-H, Lee A, et al. Cerebrolysin combined with rehabilitation promotes motor recovery in patients with severe motor impairment after stroke. *BMC Neurology*. 2016; 16 (31).
- [31] Reimers CD, Knapp G, Reimers AK. Exercise as stroke prophylaxis. *Dtsch Arztebl Int*. 2009; 106 (44): 715-21.
- [32] Surgeon JD, Folsom AR, Longstreth W, Shahar E, Rosamond WD, Cushman M. Risk factors for intracerebral hemorrhage in a pooled prospective study. *Stroke*. 2007; 38 (10): 2718-25.
- [33] Fisher M. Stroke and TIA: epidemiology, risk factors, and the need for early intervention. *Am J Manag Care*. 2008; 14 (6): 5204-11.
- [34] Khaw KT. Epidemiology of stroke. *J Neurol Neurosurg Psychiatry* 1996; 61 (4): 333-8.
- [35] Barba R, Marco J, Ruiz J, Canora J, Hinojosa J, Plaza S, et al. The obesity paradox in stroke: impact on mortality and short-term readmission. *Journal of Stroke and Cerebrovascular Diseases*. 2015; 24 (4): 766-70.
- [36] Luengo-Fernandez R, Paul NL, Gray AM, Pendlebury ST, Bull LM, Welch SJ, et al. Population-based study of disability and institutionalization after transient ischemic attack and stroke. *Stroke*. 2013; 44 (10): 2854-61.