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Research article

Body Mass Index Predicts Stroke Prognosis

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Abstract

Purpose: The aim of this study was assess whether Body mass index(BMI) can predict the six-month-length prognosis of stroke using UNSS scale as the outcome measure.

Methods: A group of 116 ischemic stroke patients admitted to the neurology ward of Razi University hospital in Tabriz were enrolled to a prospective study. BMI was measured at admission to hospital and its correlation with the change in UNSS score over six months after stroke was assessed.

Results: Out of the 100 patients studied, 70% were males. Mean weight of the patients was 72.4 Kgs with a standard deviation of 10.9 Kgs. Mean height of the participants was 1.64 meters with a standard deviation of 0.09 meters. Mean (SD) of BMI was 26.8(3.27) Kg/m². Mean change in Unified Neurological Stroke Scale(UNSS) score from admission time to a follow-up time after six months was 9.28 with a standard deviation of 4.98. To assess the correlation between BMI and stroke prognosis, Pearson correlation coefficient was calculated to be -0.58 between the change in UNSS score over the study period and BMI($p < 0.001$).

Conclusion: BMI irrespective of its role in increasing the likelihood of stroke incidence could also predict its prognosis.

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Introduction

Stroke is a medical emergency condition and can cause permanent damage to the neural system and lead to irreversible consequences and mortality. Stroke remains among the major causes of mortality regardless of the successful history of medicine worldwide. It is also well known and well investigated for the large burden of disability it causes[1]. When compared to previous four decades, through which in low- and middle-income countries(LMICs) the stroke rates were considerably lower than those in high income countries, recently however, the pattern has changed and stroke rates has astonishingly increased in LMICs and in some places the rates have approximately doubled, whereas stroke rate in some high income countries has diminished. Unfortunately, worth to state is that the rates of stroke disability and mortality have turned to be up to 10 times greater in some LMICs[2,3]. Ischemic stroke accounts for about 3/4th of all strokes. Like other cardiovascular diseases, several known risk factors exist for it including diabetes, smoking, hypertension and obesity. These are the focus of ongoing research globally. Obesity has gained the attention of researchers, clinicians and health policy makers in recent decades. The burden of obesity and high body mass index has increased so much that it is usually considered as an epidemic in many countries including Iran and also a pandemic[4-6]. It has been projected that the number of overweight and obese adults will reach up to 1.35 billion By 2030[6]. Although the role of obesity and increased BMI as a risk factor of developing many diseases has extensively been investigated and several studies have also studied its prognostic role in some diseases, its prognostic value in stroke has not been well elaborated with respect to stroke using functional

prognostic outcomes. The aim of this study was assess whether BMI can predict the six-month-length prognosis of stroke using UNSS scale as the outcome measure.

Methods

A group of 116 ischemic stroke patients admitted to the neurology ward of Razi University hospital in Tabriz, Iran were enrolled to a prospective study. A convenient consecutive sampling method was used to enroll the subjects into the study.

Data were collected using predesigned standard questionnaire. Various variables were assessed in this study including demographic characteristics, past medical history and medical examination, laboratory measurements such as fasting blood sugar, total cholesterol, LDL and computerized tomographic imaging assessments. Transcranial Doppler sonography was also done for all the patients, results of which are presented elsewhere[7]. As a surrogate variable of stroke prognosis, scores from UNSS function scale were also measured for all patients at admission time followed by another measurement after six months on 100 patients who were followed up by the investigators. Body mass index(BMI) was also assessed to be investigated as possible predictor of stroke prognosis in this study. BMI was defined and classified based on world health organization standards. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m²) and classified as in Table 1 referred and freely distributed by World Health Organization[8].

Data were analyzed using SPSS statistical software package version 16. Bivariate correlational tests such as t-test and Pearson's

correlational coefficient were used to analyze the data. Study was approved by the committee of ethics in Tabriz University of medical sciences and conducted under a thesis title for degree of MD in Tabriz Islamic Azad University.

Table 1: World health classification of body mass index

Classification	BMI(KG/M)	
	Principal cut-off points	Additional cut-off points
underweight	<18.50	<18.50
Severe thinness	<16.00	<16.00
Moderate thinness	16.00-16.99	16.00-16.99
Mild thinness	17.00-18.49	17.00-18.49
Normal range	18.50-24.99	18.50-24.99
		23.00-24.99
Overweight	≥ 25.00	≥ 25.00
Pre-obese	25.00-29.99	25.00-27.49
		27.50-29.99
Obese	≥ 30.00	≥ 30.00
Obese class I	30.00-34.99	30.00-32.49
		32.50-34.99
Obese class II	35.00-39.99	35.00-37.49
		37.50-39.99
Obese class III	≥ 40.00	≥ 40.00

Results

Out of the 100 patients studied, 70% were males. All except one patient were married. Mean(SD) of the participants was 62.2(12) years. Seven patients were left-handed. About 2/3rd were illiterate and only three patients had academic education. Forty patients were smokers, six used to consume alcohol and five were drug addicts. Fifty-six cases were hypertensive and 23 diabetics. Table 2 presents the mean & standard deviation the basic laboratory finding of the patients.

Table 2: Descriptive statistics of the basic laboratory measurements in patients

Measure	with stroke	
	Mean	SD
Blood urea nitrogen(mg/dL)	12.94	11.34
Creatinin (mg/dL)	0.96	0.37
Hemoglobin(g/dl)	14.79	1.76
Hematocrit(%)	44.44	4.98
Triglyceride(mg/dL)	153.22	54.9
Cholestrol(mg/dL)	191.58	39.51
High density lipoproteins(HDL) (mg/dL)	53.18	13.17
Low density lipoproteins(HDL) (mg/dL)	110.76	34.36
Fasting blood sugar(mg/dL)	115.13	50.48
PT(seconds)	13.25	2.19
PTT(seconds)	34.87	10.13
INR	1.03	0.17

Mean(SD) weight of the patients was 72.4(10.9) Kgs. Mean height of the participants was 1.64 meters with a standard deviation of 0.09 meters. Mean (SD) of body mass index(BMI) was 26.8(3.27) Kg/m². The CT-Scan imaging was indicative of the relevant clinical finding in 58.6 percent of the patients. In 41.4% no relevant imaging finding was observed.

Mean change in UNSS score from admission time to a follow-up time after six months was 9.28 with a standard deviation of 4.98. To assess the correlation between BMI and stroke prognosis, Pearson correlation coefficient was calculated to be -0.58 between the change in UNSS score over the study period and BMI(p<0.001). This correlation is plotted in figure 1. The graph shows a reverse correlation which appears to get decayed as the BMI reach a threshold of 30 Kg/m².

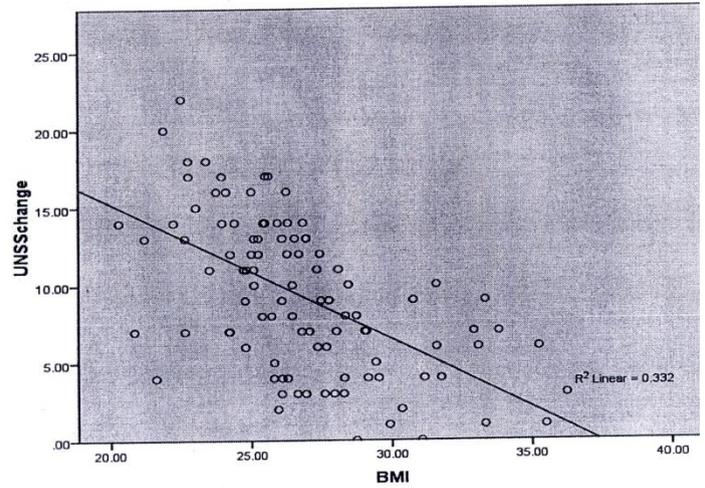


Figure 1: The scatterplot of BMI and UNSS change among stroke patients

Discussion

The available pharmacological treatments of stroke have not proven to be perfect in reversing the functionality loss after the event. Evidence is being accumulated on possible effect of obesity on prognosis of cardiovascular diseases. Based on World Health Organization the adult obesity rate in Iran has increased from 10.3 percent in 1999 to 14.2 in 2005 continuing the increasing trend even in recent years. The prevalence of overweight and obesity was 59% and 15% respectively being higher than the general population. This quite is in line with the evidence on the role of obesity as a risk factor for cardiovascular diseases.

Many factors may have a role in predicting stroke prognosis. These predictors could be could be symptotomatologic, biomarkers, imaging and individual physiologic predictors[7,9-23]. The role of BMI in prediction of disease prognosis has been investigated with respect to various conditions[24-34].

In this study we investigated to find out whether BMI irrespective of its role in increasing the likelihood of stroke incidence could also predict its prognosis. The present study was able to show existence of such an association.

Razinia et al. in their study on 805 ischemic stroke patients in Los Angeles found that those with higher BMI have higher length of stay[35]. This is while the current study found such an association of the BMI and stroke prognosis over a longer follow-up time up to six months. A large prospective cohort on about 39000 female participants declaring the BMI to be a risk factor of stroke, it has been postulated that BMI plays its role through diabetes, hypertension and hypercholesterolemia[36]. This helps with our with an understanding

that the predictive role of BMI may prove plausible considering at least the known role of above mentioned conditions on prognosis. Similar findings was also discovered by Kurth et al. on a cohort on 21000 male subjects[37].

Another study was done to assess the association of BMI and the change in motor impairment and functional mobility after a gait rehabilitation plan among chronic stroke patients. In line with our study the researchers found that chronic stroke patients with higher BMI were less likely to show improvement after rehabilitation, irrespective of their treatment intervention[38]. Studies assessing the stroke case-fatality rate have also come to similar results with us on predictive role of BMI on disease prognosis[39-41]. Other studies with variations on methodology, study population or mainly the outcome measure of choice in assessing prognosis have also come to similar findings on the prognostic role of BMI in stroke[42].

BMI irrespective of its role in increasing the likelihood of stroke incidence could also predict its prognosis. This indicates an additional alert for the health education programs focused on general population to consider also the patients after stroke with respect to BMI. Such people may have higher motivation to learn about their health if they understand that obesity may affect their health even in short term prognosis of their disease.

Limitations: The main limitation in this study was the rather small sample size. Moreover, the study setting, Razi University hospital, admits mostly mild and moderate stroke cases and the generalizability of results to severe stroke cases would be limited.

Conflict of interests: The authors declare lack of any conflict of interest with respect to this article.

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