ORIGINAL ARTICLE

Body Mass Index (BMI) and its various associations among patients who presented with ST Segment Elevation Myocardial Infarction (STEMI)

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ABSTRACT

Aim: To determine the body mass index (BMI) and its various associations among patients who presented with ST segment elevation myocardial infarction (STEMI) at tertiary care hospital, Gujranwala, Pakistan

Methods: In this cross-sectional study, acute STEMI patients were categorized according to their BMI (Kg/m^2).Independent sample T test was used to compare the mean values of quantitative variables in two groups of a qualitative variable. The p value was taken statistically significant if < 0.05

Results: Amongst 668 patients, 1.2% were underweight, 34.1% normal weight, 43% overweight, 16.9% class 1 obese, 3.6% severe obese, and 1.2% morbid obese. The mean BMI of patients was 27.06±4.16 Kg/m^2. The mean BMI was significantly higher among patients who had coexisting diabetes mellitus (p<0.001), hypertension (p<0.001), inferior wall MI (p<0.001), right ventricular involvement (p=0.002) and who died during hospitalization (p<0.001). The mean BMI was significantly lower among group of patients whose ST segment got settled >50% at first post-admission day (p=0.013). As compared to non-obese patients, obese patients reached hospital earlier (p=0.006), had more baseline maximum ST segment elevation (p=0.027) and significantly lower pulse rate per minute at 1st post-admission day (p=0.019)

Conclusion: Majority patients who suffered STEMI were overweight. The higher BMI was predictive of inferior wall MI, right ventricular involvement, and death outcome of hospitalization while the lower BMI was significantly associated with more than 50% ST segment settlement at first post-admission day. As compared to non-obese patients, obese patients reached hospital earlier, perhaps being feared. They had more baseline maximum ST segment elevation and significantly lower pulse rate per minute at 1st post-admission day

Keywords: BMI, Obesity, STEMI, cross-sectional study, SPSS

INTRODUCTION

Obesity is defined by an abnormal accumulation of fat in the body[1]. According to 2016 WHO statistics, 13% of adult population is obese world-wide[2]. In Pakistan, 19% men and 26% women are obese[3]. Imagingstudies like dual energy x ray absorptiometry (DEXA) are the gold standard to measures of the quantity and distribution of body fat[4]. These imaging studies have elaborated that fat distribution (specifically visceral fat) is moreassociated with higher mortality risk than total fat levels[5]. However, these imaging techniques are cumbersome and expensive, therefore adiposity is most commonly assessed by indirect method of body mass index (BMI) —body weight normalized by height squared (kg/m^2)[6]. Being a very simple and cheap method, BMI is the basis for WHO's definition of underweight (BMI $\leq$18.4), normal-weight (BMI18.5-24.9), over-weight (BMI 25-29.9), and obesity (BMI ≥30). Obesity is further categorized into Class 1 (BMI 30-34.9 Kg/m^2, ClassII Severe obesity (BMI 35-39.9), and class III morbid obesity (BMI≥40)[7]. Acute myocardial infarction (MI) is adominant cause of morbidity and mortality worldwide[8]. In our subcontinent, its annual incidenc is approx 6.44%[9]. The previous available studies have pointed about an "obesity paradox". It means that non-obese patients with ST segment elevation myocardial infarction (STEMI) have more post-STEMI complications as well as mortality than the obese patients[10,11]. However, these "obesity paradox" studies were performed on the western populations, not on the Asian population. It is well-known that the Asian population is generally leaner than the western one; therefore, we intended to evaluate whether this obesity paradox is present in our population. Hence, the objective of our present study was to determine the body mass index (BMI) and its various associations among patients who presented with ST segment elevation myocardial infarction (STEMI) at tertiary care hospital, Gujranwala, Pakistan.

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MATERIAL AND METHODS

This cross-sectional study was conducted in the Department of Cardiology, GMC Teaching hospital, Gujranwala from June 2017 to May 2018. Permission was sought from the Ethical Committee to start this research. After written informed consent, the data was collected by purposive sampling using a structured proforma. All the patients diagnosed with STEMI who were hospitalized were included in this study. The diagnosis was made by ST segment elevation or new left bundle branch block and raised cardiac enzymes in a patient with acute chest pain.BMI of all the patients was calculated using their weight (Kg) and height (m^2) using a calculator[12]. The obesity was defined by a BMI value of≥30 Kg/m^2. The

patients were categorized according to their BMI as follow: underweight if BMI ≤18.4Kg/m^2, normal-weight if BMI 18.5-24.9 Kg/m^2, over-weight if BMI 25-29.9 Kg/m^2, Class 1 obese if BMI 30-34.9 Kg/m^2, Severe obese if BMI 35-39.9 Kg/m^2, morbid obese if BMI ≥40 Kg/m^2. (7) Statistical Package for Social Science (SPSS), version 25 was used for the statistical analysis. BMI, time from onset of symptoms till arrival at hospital in minutes, door to needle time in minutes, baseline pulse, baseline systolic BP, baseline diastolic BP, baseline minimum ST segment elevation, baseline maximum ST segment elevation, pulse rate per minute at 1st post-admission day, systolic BP at 1st post-admission day, and diastolic BP at 1st post-admission day were quantitative variable, while gender, hypertension, diabetes mellitus, personal H/O IHD, cardiac wall involved by STEMI, right ventricular involvement, ST segment settlement >50% at 1st post-admission day, outcome of hospitalization, and obesity were the qualitative variables. Frequencies and percentages were computed for qualitative variables while mean and standard deviation for qualitative variables. Independent sample T test was used to compare the mean values of quantitative variables in two groups of a qualitative variable. The p value was taken statistically significant if < 0.05.

RESULTS

Amongst 668 patients who admitted with STEMI, 22.9% were obese and 77.1% were non-obese. The mean BMI of the patients was 27.06±4.16 Kg/m^{2}with a range of 15.6-41.1 Kg/m^2.According to BMI classification, 8(1.2%) were underweight, 228(34.1%) normal weight, 287(43%) overweight, 113(16.9%) class 1 obese, 24(3.6%) severe obese, and 8(1.2%) morbid obese (Picture 1&2).There was statistically insignificant difference in mean BMI among gender (p=0.502) and patients with personal H/O IHD (P=0.104). The mean BMI was significantly higher among patients who had coexisting diabetes mellitus (p<0.001) and hypertension (p<0.001). Similarly, the mean BMI was also higher among patients with inferior wall MI (p<0.001), right ventricular involvement (p=0.002) and who died during hospitalization (p<0.001). On the other hand, the mean BMI was significantly lower among group of patients whose ST segment on ECG got settled >50% at first post-admission day (p=0.013) (Table 1).As compared to non-obese patients, obese patients reached hospital earlier (p=0.006), perhaps being feared. The obese patients had more baseline maximum ST segment elevation (p=0.027) and significantly lower pulse rate per minute at 1st post-admission day (p=0.019). The presence or absence of obesity had no statistically significant association with door to needle time (p=0.135), baseline pulse (p=0.947), baseline systolic BP (p=0.306), baseline diastolic BP (p=0.107), baseline minimum ST segment elevation (p=0.268), systolic BP at 1st post-admission day (p=0.186), and diastolic BP at 1st post-admission day (p=0.194) (Table 2).

Picture.1: Prevalence of obesity among patients admitted with diagnosis of STEMI (n=668)

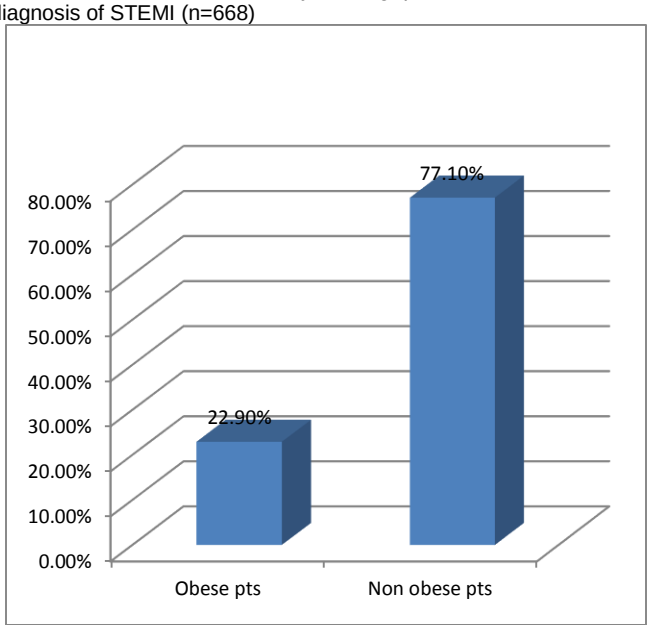

Table 1: Various associations of BMI among patients admitted for STEMI(n = 668) *

Associated factors	Mean BMI (Kg/m^2)	St. D	Mean difference	p-value
Gender				
Male	27.00	4.22	-0.26	0.502
Female	27.26	3.94		
H/O Diabetes mellitus				
Yes	27.97	4.49	1.29	< 0.001
No	26.68	3.96		
H/O Hypertension				
Yes	27.96	4.69	1.96	< 0.001
No	26.00	3.11		
Personal H/O IHD				
Yes	26.65	4.33	-0.58	0.104
No	27.23	4.08		
Cardiac wall involved by STEMI:				
Inferior wall	27.77	4.18	1.26	< 0.001
Other walls	26.51	4.06		
Right ventricle involvement				
Yes	28.89	5.33	1.88	0.002
No	26.91	4.01		
ST segment settled >50% at 1st post-admission day				
Yes	26.86	4.04	-0.97	0.013
No	27.83	4.51		
Outcome of hospitalization				
Death	31.36	5.59	4.47	
Discharge/ No death	26.89	4.00		< 0.001

*Independent sample T-test was used

Picture 2: Classification of patients admitted with diagnosis of STEMI according to their BMI (n=668)

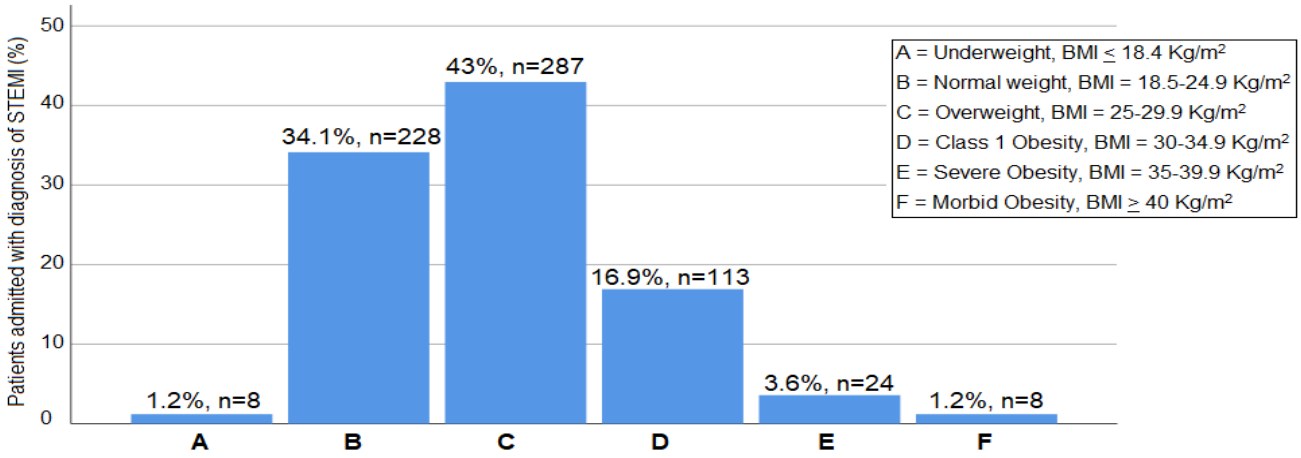

Table 2: *Correlation of obesity (present/absent) with various quantitative variables among patients admitted for STEMI (n = 668)* [*]

Quantitative variables	Mean of quantitative variable± SD		Mean difference among obese & non-obese	p-value
	Obese	Non-obese		
Time till arrival (minutes)[1]	209.6 8±148.31	298.91±394.99	-89.23	0.006
Door to needle time (minutes)	31.52±49.56	26.59±30.54	4.94	0.135
Baseline pulse (per minute)	86.07±20.51	85.96±18.58	0.11	0.947
Baseline systolic BP (mmHg)	129.37±25.65	131.84±26.46	-2.48	0.306
Baseline diastolic BP (mmHg)	84.60±20.99	81.94±16.26	2.66	0.107
ST segment elevation, minimum (mm)	2.63±1.47	2.47±1.54	0.16	0.268
ST segment elevation, maximum (mm)	5.41±4.49	4.76± 2.68	0.65	0.027
1st post-admission day pulse (per minute)	80.89±14.42	84.18±14.92	-3.20	0.019
1st post-admission day systolic BP (mmHg)	115.49±15.26	113.26±19.07	2.23	0.186
1st post-admission day diastolic BP (mmHg)	75.29±11.07	73.71±13.81	1.58	0.194

[*]Independent sample T-test was used; 1=Time from onset of symptoms till arrival at hospital (minutes)

DISCUSSION

In a retrospective analysis of 94108 acute STEMI patients from 7 clinical trails, mean BMI was 26.53 Kg/m^2. In our study, the mean BMI was comparable to all previous studies (27.06 Kg/m^2)[13]. Like avaiable other reference studies[14,15], in our study, majority patients who suffered STEMI were overweight. The obese as well as normal weight patients were were less in number among suffering of STEMI. Chin-Chang Cheng et al[16] and Sandeep R. Das[14] found in their studies that hypertension was significantly higher among obese STEMI suffering patients. Similarly in our data, higher BMI was significantly associated with hypertension among our STEMI suffering patients (p<0.001). Our study as well as previous available studies[14,17]showed that obese group has significantly higher incidence of diabetes mellitus.In our study, the higher BMI was predictive of inferior wall MI as well as right ventricular involvement. Right ventricular involvement puts a higher risk of negative effects in inferior wall myocardial infarction[18]. Hence, in our patients, higher BMI was also associated with higher mortality among acute STEMI patients. The data on a possible link between BMI and clinical measures in patients with acute myocardial infarction are uncommon and unequal in the literature. Several trials showed an inverse relationship between rate of mortality and BMI, likeTRIUMPH and PREMIER registries including 6359 acute STEMI patients[19] and KAMIR registry involving 3824 acute STEMI patients[20]. In contrast of these trials, several other trials disclosed no inverse relationship between outcomeand BMI[21,22,2]. In our study, increasing BMI and obesity, both were associated with significantly higher mortality. There was also many other useful findings in our data like significant association of lower BMI with more than 50% ST segment settlement on ECG at first post-admission day. Further studies with large sample size are required to validate findings in our population.

CONCLUSION

Majority patients who suffered STEMI were overweight. Body mass Index is a known risk factor for STEMI as well as it affects the disease course as well. In our study, the higher BMI was predictive of inferior wall MI, right ventricular involvement, and death outcome of hospitalization while the lower BMI was significantly associated with more than 50% ST segment settlement at first post-admission day. Significant higher BMI among diabetic and hypertensive patients was suggestive of the role of combination of risk factors of myocardial infarction among our population. As compared to non-obese patients, obese patients reached hospital earlier, perhaps being feared. They had more baseline maximum ST segment

elevation and significantly lower pulse rate per minute at 1st post-admission day.

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