



BODY MASS INDEX, WAIST CIRCUMFERENCE AND BODY FAT CONTENT AS
PROGNOSTIC FACTORS IN ACUTE MYOCARDIAL INFARCTION: A
PROSPECTIVE STUDY AT SMS MEDICAL COLLEGE JAIPUR

General Medicine

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ABSTRACT

Background: Obesity is a well-established risk factor for acute myocardial infarction (AMI), yet the prognostic role of obesity indices such as body mass index (BMI), waist circumference (WC), and body fat content (BFC) remains debated. This study aims to compare BMI, WC, and BFC as prognostic factors in AMI patients to determine which parameter is the best predictor of outcomes in acute coronary syndrome (ACS). **Methods:** A prospective comparative study was conducted at a tertiary care hospital in Jaipur, India, from 2023 to 2024. A total of 400 AMI patients were included. Data on demographics, clinical characteristics, BMI, WC, and BFC were collected. Patients were followed up for six months to assess outcomes, including mortality, recurrent MI, heart failure, and hospital readmissions. Patients were classified based on BMI (underweight, normal, overweight, and obese), WC, and BFC according to WHO guidelines for the Asian population. **Results:** The mean age of the patients was 54.2 ± 11.01 years, with 75.5% males. At six months, 9.5% of patients had died, 17% had recurrent MI, 13.5% had heart failure, and 7.5% had arrhythmias. BMI and BFC showed a strong correlation, while WC was not as consistent in identifying obesity. Patients with higher BMI and BFC had lower mortality, reflecting the obesity paradox. **Conclusion:** BMI and BFC appear to correlate well in assessing obesity in AMI patients, while WC alone may underestimate risk. The obesity paradox was observed, with obese patients showing better outcomes than their normal-weight counterparts. A combination of BMI, WC, and BFC may provide a more accurate risk assessment for ACS prognosis.

KEYWORDS

Body Mass Index, Waist Circumference, Body Fat Content, Acute Myocardial Infarction, Obesity Paradox, Prognostic Factors.

INTRODUCTION

Almost 70-80% of myocardial infarction (MI) or coronary artery disease (CAD) patients are either obese or overweight^(1,2). Even though obese and overweight people have higher incidence of AMI, on contrary obesity has been considered as good prognostic factor in acute coronary syndrome (ACS) or heart failure patients and termed as obesity paradox^(3,4). It is still unclear how obesity can be risk as well as good prognostic factor in ACS. There are numerous indices to measure obesity like body mass index(BMI), waist circumference (WC), waist hip ratio (WHR) and body fat content (BFC) which measure internal fat deposition.

To add further ambiguity, it is not clear which indices are most suitable to measure obesity and which one correlate best in ACS outcome. BMI is the most commonly used parameter in clinical practice for obesity but it is not a true reflection of fat as large muscle mass also increases BMI, WC measures central fat distribution which has been shown good correlation with CAD⁽⁵⁾. Body fat content indicates visceral fat and has not been studied for its association with CAD. More over in south Asian countries like India, the cut off value to define obesity are different than western countries. In a study, BMI as a measure of peripheral obesity and WC/WHR as central obesity were compared on outcome of acute MI. BMI showed significant inverse association between obesity and risk of in-hospital and 1 year mortality following ACS. Obesity by WC & WHR showed lower mortality and inverse association of 1 year mortality⁽⁶⁾.

Hence we plan to study outcomes in acute myocardial infarction patient's index in tertiary care centre in North Indian population as per obesity. This study intended to assess the index outcome and 6month outcome of acute MI patients presenting to emergency according to their BMI, WC, and body fat content (BFC). In this study we compare three indices of obesity with each other and to look which parameter is better indicator of obesity. The objective of this study was to look for index hospitalization and six months mortality, recurrent MI, rehospitalisation for any reason.

Methodology:

This study was done in a tertiary care institute in northern India. This was a prospective comparative analysis study done in 2023 and 2024.

Patients with obesity secondary to endocrine disorder were excluded. Four hundred patients 18 years onwards were studied for ACS outcome. Demographic profile and clinical details of patients were noted at presentation. Once the patient was stabilized then height, weight and body fat content of the patient was measured. Then again after 6 months, follow up of these patients was done either in person or by telephonically for the outcomes. Any hospitalization because of heart failure or arrhythmia or any recurrent MI or death of the patient during that 6months period was noted. From the collected data, outcome of MI patients on the basis of degree of obesity was estimated. Patients were divided based on WHO criteria for Asian population, BMI $<18.5 \text{ kg/m}^2$ as underweight, $18.5 - 22.99 \text{ kg/m}^2$ as normal weight, $23 - 24.99 \text{ kg/m}^2$ as overweight or pre obese, $>25 \text{ kg/m}^2$ as obese⁽⁷⁾. Patient's socio economic status is assessed by Modified Kuppuswamy scale.

RESULTS:

Out of 400 patients, 302 were males (75.5%) and 98 were females (24.5%). The mean age of the patients was 54.2 ± 11.01 years.

Among study population, 78(19.5%) belong to upper class, 110 (27.5%) belong to upper middle class and 86 (21.5%) belong to lower middle class and 72(18%) belong to upper lower class and 54 (13.5%) belong to lower class. There is no significant correlation between distribution of obesity and different socioeconomic class of the patient in our study.

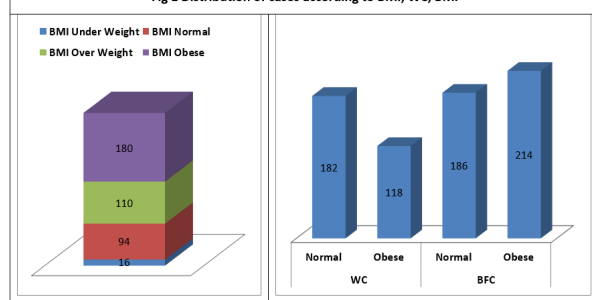
Table 1: Distribution of males and females according to BMI, WC, BMI

	Under Weigh t (BMI)	Normal (BMI)	Over Weight (BMI)	Obese (BMI)	Normal (WC)	Obese (WC)	Normal (BFC)	Obese (BFC)
Frequency	16	94	110	180	182	118	186	214
Male	8	68	80	146	226	76	130	172
Female	8	26	30	34	56	42	56	42

Risk Factors: 140 (35%) were smokers. 188 (47%) had DM and 186 (46.5%) had HTN. Family history of premature CAD was present in 16(4%) and past history of CAD was present in 100(25%).

Dyslipidemia was noted in 124 (31%) and 274 (68.5%) of patients were involved in less physical activity. 22 (5.5%) patients had PAD. Out of all diabetics 84 were obese as per BMI, 140 were normal as per WC, 100 had higher BFC. 88 hypertensives were obese as per BMI, 130 had normal WC, 144 had higher BFC. As per BMI, 48 obese had previous CAD, 76 had normal WC, and Only 48 had high BFC. 102 & 130 as per BMI, 80 & 96 as per WC, 112 & 148 as per BFC had dyslipidemia and were having less physical activity respectively.

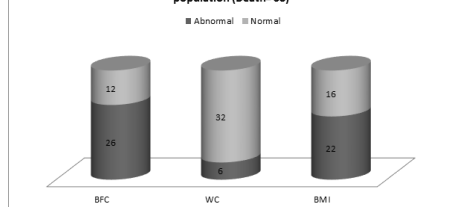
Fig 1 Distribution of cases according to BMI, WC, BMI



Primary Outcome:

38 (9.5%) patients were dead at the end of 6 month follow up period. 68 (17%) had heart failure, 54 (13.5%) and 30 (7.5%) had hospital admissions during 6 month observational period because of heart failure and arrhythmias respectively. Among 38 deceased, 6 (15.8%) were underweight, 16 (42.1%) were normal weight, 6 (15.8%) were overweight, 10 (26.3%) were obese according to BMI. 32 (84.2%) were normal and 6 (15.8%) were obese according to waist circumference. 26 (68.4%) were obese and 12 (31.6%) were normal according to body fat content.

Fig 2 Relationship between death and obesity indicators in the study population (Death=38)



Secondary Outcomes:

68 patients had recurrent MI during 6 months follow up period. Out of which 4 were underweight, 10 were normal, 16 were overweight, and 38 patients were obese according to BMI. 32 patients had normal WC and 36 patients had high WC. 40 patients had normal BFC, 28 patients had high BFC.

54 patients had heart failure requiring admission during 6 months of follow up period. Out of these, 6 were underweight, 10 were normal, 8 were overweight, and 30 patients were obese according to BMI. 30 patients had normal WC and 24 patients had high WC. 32 patients had normal BFC, 22 patients had high BFC.

DISCUSSION:

In this prospective comparative analysis study, we intend to find if one parameter of obesity is superior to another in measuring outcome or prognosis in acute coronary syndrome. In our study 2.65% males were under weight, 22.51% were having normal weight, 26.49% over weight. 8.16% females were underweight, 26.53% were having normal body weight, 30.61% were overweight as per BMI in our study. 48.3% of males and 34.69% of females were obese as per BMI. 25.16% males, 42.85% females were obese as per WC respectively. 56.9% males were obese as per BFC, 42.85% females were obese as per BFC. Hence in our study central obesity was more in females as compared to males, more males were obese as per body fat content. A study among the Indian population in 2006 also showed that prevalence of abdominal obesity is 46% in men but 64% in women⁽⁸⁾.

According to Copenhagen general population study, physically inactive individuals have higher incidence of MI and death due to MI⁽¹⁰⁾. 68.5% of patients in our study had lifestyle with less physical activity. Out of these 274 patients, 72.2% were obese according to BMI, 54% were obese according to BFC and 35% were obese according to WC. In our study those who were obese as per WC, were less active and WC showed better correlation than BMI and BFC. As in

BMI and BFC group there was not much difference in activity level in normal or obese patients.

35% of patients in our study population were smokers. According to INTERHEART study, where 2171 patients were observed and it showed threefold risk of MI with smoking⁽¹¹⁾. 25% of study population had past history of CAD in our study. But only 7.5% had CVA in the past and 5.5% had PAD in the past. This risk factor did not show correlation to obesity as per any criteria. Rather more of normal weight had PAD. Hence it is possible that obesity is much more a risk factor for coronary atherosclerosis than elsewhere in the body.

Correlation Of Bmi, Wc, Bfc With Each Other

Out of 400 patients in our study, 16 (4%) were underweight, 94 (23.5%) were normal, 110 (27.5%) were overweight and 180 (45%) were obese according to the BMI. According to WC, 118 (29.5%) patients were obese, 282 (70.5%) were normal. According to body fat content, 186 (46.5%) were normal and 214 (53.5%) were obese. BMI and BFC positively correlate with other and BMI added by BFC might give a better picture of adiposity.

In our study 110 patients were underweight or normal out of 400 patients according to BMI. All 110 patients were having normal waist circumference and 96.3% were having normal body fat percentage. 290 patients were either obese or overweight according to BMI in our study, out of which only 40.6% were obese according to WC but 72.4% are obese according to BFC. This shows that many of the obese patients according to BMI and BFC are having normal waist circumference in our study. 282 patients were having normal WC out of which 61% were obese or overweight according to BMI and 40.4% are obese according to BFC. 118 patients had high WC out of which all 118 patients are obese according to BMI and 84.7% are obese according to BFC. 186 patients had normal BFC out of that 186, 43% are obese according to BMI and only 9.7% had high WC. 214 patients had high BFC and among that 98.1% are obese or overweight according to BMI, and only 46.7% had high WC.

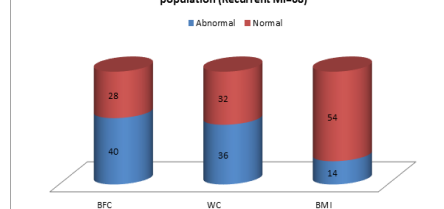
To conclude BFC and BMI showed close relationship in assessing obesity but WC showed some differences in which many of the obese patients according to BMI and BFC had normal waist circumference in our study. On applying Chi square test between BMI, WC, BFC in assessing obesity p value is significant (<0.05) which shows that there is significant difference between these 3 in assessing obesity. But BMI added by BFC, WC will certainly increase the accuracy in assessing obesity. Our study results show that WC alone cannot be used as parameter of CAD risk, if WC is normal then BMI/ BFC need to be checked.

Death And Correlation To Bmi, Bfc, Wc

9.5% of patients died in follow up which was the primary outcome of our study. On applying Chi square test between alive and deceased patients, there is no significant differences between alive and deceased patients for DM (p value 0.138) and HTN (p value 0.936) and past CAD (p value 0.181). More of deceased were involved in less physical activity. Socioeconomic status did not have any association with primary outcome in our study as p value is 0.195. But smoking shows significance (p value 0.031) as 14 out of 38 patients were smokers.

Only 15.8% died were obese according to waist circumference. Among deceased 26 out of 38 were having normal body fat content. So in our study death is more in who had normal WC. Even though incidence of MI is more in obese patients but mortality is lesser in obese patients when compared to normal or underweight patients which is the phenomenon of "obesity paradox".

Fig 3 Correlation between recurrent mi and obesity in the study population (Recurrent MI=68)



Summary & Conclusion:

In this study 6 months mortality was 9.5%. 17% of patients had recurrent MI, 13.5% of patients had heart failure, and 7.5% of patients

had arrhythmia during 6 months follow up period. BMI and BFC positively correlate with each other and BMI added by BFC will give a better picture of adiposity.

But WC showed some differences in which many of the obese patients according to BMI and BFC had normal waist circumference in our study. Hence normal WC circumference cannot be taken a slow risk for CAD. But we could not demonstrate superiority of BFC or BMI over each other.

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