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THE ROLE OF ANTHROPOMETRY IN ACUTE ST-ELEVATION MYOCARDIAL INFARCTION TREATED WITH PRIMARY PERCUTANEOUS CORONARY INTERVENTION

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SUMMARY – The aim of this study was to investigate the controversial influence of anthropometry on clinical severity and prognosis of acute ST-elevation myocardial infarction (STEMI). We prospectively analyzed 250 patients with acute STEMI treated with primary percutaneous coronary intervention (September 2011 – September 2012). They were grouped according to the following anthropometric parameters: body mass index (BMI) (<25.0, 25.0-29.9, ≥30.0 kg/m^2), waist circumference (WC) (<102/88, ≥102/88 cm), waist-to-hip ratio (WHR) (<0.90/0.85, ≥0.90/0.85) and waist-to-height ratio (WHtR) (<53/49, 53/49-62/57, ≥63/58). The groups were analyzed by baseline, as well as severity (clinical, laboratory, echocardiography, coronary angiography, in-hospital complications) and prognostic parameters (major adverse cardiovascular events and sick leave duration during 12-month follow up). Patients with BMI <25.0 kg/m^2 had the highest rates of dyspnea and those with BMI ≥30.0 kg/m^2 had the longest hospitalization and widest stents; patients with WHR ≥0.90/0.85 had higher rates of significantly stenosed proximal/middle coronary segments, while those with WHtR ≥63/58 had the highest rates of heart failure and total in-hospital complications ($p<0.05$). BMI <25.0 kg/m^2 increased (odds ratio (OR) 2.00, confidence interval (CI) [1.09-3.68], p=0.026) and BMI 25.0-29.9 kg/m^2 reduced (OR 0.52, CI [0.30-0.91], p=0.022) the risk of dyspnea; WHR ≥0.90/0.85 increased the risk of significant proximal/middle coronary segment stenosis (OR 3.34, CI [1.13-9.86], p=0.029) and WHtR ≥63/58 the risk of heart failure (OR 2.05, CI [1.13-3.71], p=0.017) and total in-hospital complications (OR 1.94, CI [1.13-3.33], p=0.017) ($p<0.05$). In conclusion, WHR and WHtR are better anthropometric parameters than BMI in predicting acute STEMI severity, while WC has no influence on it. Anthropometry has no influence on prognosis.

Key words: *Anthropometry; Obesity; Myocardial infarction; Percutaneous coronary intervention; Sick leave*

Introduction

Overweight and obesity are one of the major public health problems. Worldwide, at least 1.4 billion adults are overweight, i.e. over 200 million men and nearly 300 million women are obese[1]. Obesity prevalence in Europe has reached epidemic proportions (up to 28.3% of men and 36.5% of women) with higher prevalence rates in Central, Eastern, and Southern Europe than those in Western and Northern Europe[2]. Obesity is an independent risk factor for the development of cardiovascular disease (CVD), including coronary artery disease (CAD) and heart failure. It is frequently associated with other CVD risk factors such as arterial hypertension, diabetes mellitus type 2, atherogenic

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dyslipidemia, as well as with an increased risk of all-cause morbidity and mortality[3]. Measurement of body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHR) and waist-to-height ratio (WHtR) is a primary method for diagnosing obesity. While BMI determines overall obesity, other anthropometric parameters are related to central obesity where body fat is primarily located in the abdomen. Central obesity measures, especially WHtR, are stronger predictors of CVD risk than BMI[4,5]. Central obesity correlates with excessive visceral fat, which is directly associated with insulin resistance and compensatory hyperinsulinemia, dyslipidemia and inflammatory states that synergistically lead to smooth muscle cell proliferation, calcium and cholesterol ester deposition in the artery, and finally to atherosclerotic vascular disease[6]. In subjects with acute myocardial infarction (MI), there is positive association of abdominal obesity and decreasing BMI with higher mortality. This has been called the 'obesity paradox'. The possible explanation could be that BMI does not adequately discriminate the difference between body fat (especially abdominal) and lean muscle mass[4].

Using the anthropometric parameters, the aims of this study were:

1. to evaluate the baseline data of patients with obesity and acute ST-elevation myocardial infarction (STEMI), and to compare the results with STEMI patients without obesity;
2. to evaluate the severity and prognosis of acute STEMI in patients with obesity, and to compare the results with STEMI patients without obesity; and
3. to investigate the controversial influence of anthropometric parameters on clinical severity and prognosis of acute STEMI, as well as their unknown influence on the involvement of coronary artery segments with significant stenosis and sick leave duration (SLD).

Patients and Methods

Patient population

This prospective monocentric study was performed on 250 consecutive patients with acute STEMI. They were treated with primary percutaneous coronary intervention (PCI) at Department of Cardiology, Sestre milosrdnice University Hospital Center (September 2011 – September 2012). The diagnosis was established and primary PCI performed using the criteria of the European Society of Cardiology[7,8]. The inclusion criteria were presenting within 12 h from the onset of symptoms (history of chest pain/discomfort lasting for 10-20 minutes or more, not responding fully to nitroglycerine), persistent ST-segment elevation on electrocardiography in at least two consecutive leads, or (presumed) new left bundle-branch block, and elevated cardiac laboratory biomarkers (cardiac troponin T (cTnT) and creatine kinase (CK)). The study was approved by the Ethics Committee of the Sestre milosrdnice University Hospital Center, Zagreb, Croatia.

Data collection

After primary PCI, patients were grouped according to anthropometric parameters as follows: BMI (<25.0, 25.0-29.9 and ≥30.0 kg/m^2 for normal weight, overweight and overall obesity, respectively), WC (<102/88 and ≥102/88 cm for normal weight and central obesity in males/females, respectively), WHR (<0.90/0.85 and ≥0.90/0.85 for normal weight and central obesity in males/females, respectively) and WHtR (<53/49, 53/49-62/57 and ≥63/58 for normal weight, overweight and central obesity in males/females, respectively)[4,9]. The groups were analyzed by baseline, as well as severity and prognostic parameters of acute STEMI.

Baseline parameters

Baseline demographic and medical history parameters included gender, age, arterial hypertension, dyslipidemia (elevated triglycerides and/or low HDL-cholesterol), hyperglycemia, smoking status, known family history of cardiovascular events (MI, cerebrovascular insult), previous MI, previous PCI and coronary artery bypass grafting (CABG).

For the diagnosis of dyslipidemia, hypertension and hyperglycemia, we used the criteria published by the National Cholesterol Education Program – Adult Treatment Panel III group[9], as follows:

1. hypertriglyceridemia: triglycerides ≥150 mg/dL (1.7 mmol/L), or on medication for elevated triglycerides;
2. low HDL-cholesterol: <40 mg/dL (1.04 mmol/L) in males or <50 mg/dL (1.29 mmol/L) in

females, or on medication for low HDL-cholesterol;
3. hypertension: blood pressure ≥130/85 mm Hg, or on medication for hypertension; and
4. hyperglycemia: fasting plasma glucose ≥100 mg/dL (5.6 mmol/L), or on medication for hyperglycemia.

Severity parameters

The severity of acute STEMI was estimated by clinical presentation (angina pectoris, dyspnea, and length of hospitalization), in-hospital complications (arrhythmias, conduction disturbances, reperfusion arrhythmias, heart failure, cardiogenic shock, cardiac arrest, mechanical ventilation, reinfarction, repeated PCI, mortality, and total in-hospital complications), laboratory (maximal cTnT, CK), echocardiography (left ventricular ejection fraction, LVEF) and coronary angiography findings.

Serum CK activity was measured by spectrophotometry (Olympus 680, Beckman Coulter Inc., California, USA). Serum cTnT levels were measured by electrochemiluminescence (ECL) assay (Cobas e411, Roche Diagnostics, Sussex, UK). During hospital stay, echocardiography (Acuson Sequoia 512, Siemens, Munich, Germany) was performed in all patients according to the clinical standards and current echocardiography guidelines[10].

Coronary angiography was performed by applying a monoplane system (Axiom Artis, Siemens, Erlangen, Germany) by a common technique, as recommended in current guidelines[8]. Patients received 70 IE/kg unfractionated heparin, 300 mg aspirin, a loading dose of 600 mg clopidogrel, and a GPIIb/IIIa inhibitor according to judgment of interventional cardiologist. Coronary artery stenosis of more than 50% was considered clinically significant. We analyzed the number of significantly narrowed coronary arteries, and number, length and diameter of stents used. Additionally, for the first time, we analyzed significantly stenosed segments of coronary arteries. For that purpose, and according to the modified American Heart Association classification[11], coronary arteries were divided into 16 segments. Segments were classified in two groups, as follows:

1. proximal and middle coronary segments: segment 1 (right coronary artery (RCA), proximal), segment 2 (RCA, mid), segment 5 (main stem), segment 6 (left anterior descending coronary artery (LAD), proximal), segment 7 (LAD, mid), segment 9 (first diagonal), segment 11 (left circumflex artery (LCX), proximal), segment 12 (obtuse marginal); and
2. distal coronary segments: segment 3 (RCA, distal), segment 4 (right posterior descendens), segment 8 (LAD, distal), segment 10 (second diagonal), segment 13 (LCX, distal), segment 14 (LCX, posterolateral branch), segment 15 (LCX, posterodescendens branch), segment 16 (RCA, posterolateral branch).

Prognostic parameters

The prognosis of acute STEMI was estimated using major adverse cardiovascular events (MACE) parameters (reinfarction, coronary artery restenosis and/or new stenosis, cardiac and non-cardiac rehospitalization, cerebrovascular insult, urgent CABG, mortality, total MACE) during 12-month follow up. Data were collected by medical examination, checking medical documentation, or telephone contact with patients, family members or home physicians. In addition, during the same follow up period, we collected data on SLD of working population.

Statistical analysis

Qualitative data were expressed as absolute number and percentage. We used χ^2-test with Yates correction for comparison and analysis. Quantitative data were expressed as median and corresponding interquartile range. Differences between two groups were tested by Mann-Whitney U test. Differences among three groups were tested by nonparametric analysis of variance (Kruskal-Wallis ANOVA). Logistic regression analysis was used to investigate the relationship between one dependent and one or more independent variables that may influence or predict the value of the dependent variable. The limit of statistical significance was set at $p<0.05$. Processing was done using the STATISTICA 6.0 for Windows software.

Results

Among 250 patients, there were 72 (28.8%) patients with BMI ≥30.0 kg/m², 149 (59.6%) with WC ≥102/88 cm, 222 (88.8%) with WHR ≥0.90/0.85 and

Table 1. Baseline characteristics of patients according to BMI (kg/m²) and WC (cm)

Parameter	BMI <25.0 (n=60)	BMI 25.0-29.9 (n=118)	BMI ≥30.0 (n=72)	p	WC <102/88 (n=101)	WC ≥102/88 (n=149)	p
Men, n (%)	37 (61.7)	88 (74.6)	52 (72.2)	0.191	87 (86.1)	90 (60.4)	**0.000**
Women, n (%)	23 (38.3)	30 (25.4)	20 (27.8)	0.191	14 (13.9)	59 (39.6)	**0.000**
Age (years)	64 (40-90)	62 (25-92)	61 (39-85)	0.201	60 (41-90)	63 (25-92)	0.080
Arterial hypertension, n (%)	34 (56.7)	84 (71.2)	63 (87.5)	**0.000**	54 (53.5)	127 (85.2)	**0.000**
Dyslipidemia, n (%)	40 (66.7)	88 (74.6)	62 (86.1)	**0.030**	72 (71.3)	118 (79.2)	0.151
Hyperglycemia, n (%)	13 (21.7)	26 (22)	22 (30.6)	0.353	23 (22.8)	38 (25.5)	0.622
Smoking, n (%)	37 (61.7)	54 (45.8)	38 (52.8)	0.130	57 (56.4)	72 (48.3)	0.208
Family history, n (%)	19 (31.7)	55 (46.6)	33 (45.8)	0.135	44 (43.6)	63 (42.3)	0.841
Previous MI, n (%)	5 (8.3)	10 (8.5)	7 (9.7)	0.948	10 (9.9)	12 (8.1)	0.613
Previous PCI, n (%)	5 (8.3)	11 (9.3)	7 (9.7)	0.961	11 (10.9)	12 (8.1)	0.442
Previous CABG, n (%)	0 (0)	0 (0)	1 (1.4)	-	0 (0)	1 (0.7)	-

BMI = body mass index; CABG = coronary artery bypass graft; MI = myocardial infarction; PCI = percutaneous coronary intervention; WC = waist circumference

81 (32.4%) with WHtR ≥63/58. We recorded the following results:

1) BMIs ≥30.0 kg/m² had the highest rates of hypertension and dyslipidemia, the longest hospitalization and widest stents, while BMIs <25.0 kg/m² had the highest rates of dyspnea ($p<0.05$). Other baseline and parameters of severity, as well as all prognostic parameters were without significant differences (Tables 1 and 2).

2) WCs ≥102/88 cm were more frequently recorded in males and were associated with higher rates of hypertension ($p<0.05$). Other baseline, as well as all severity and prognostic parameters were without significant differences (Tables 1 and 2).

3) WHRs ≥0.90/0.85 were more frequently found in males and were associated with higher rates of dyslipidemia and significantly stenosed proximal/middle coronary artery segments ($p<0.05$). Other baseline and parameters of severity, as well as all prognostic parameters were without significant differences (Tables 3 and 4).

4) WHtRs ≥63/58 were more frequently found in females and were associated with the highest rates of arterial hypertension, heart failure and total in-hospital complications ($p<0.05$). Other baseline and parameters of severity, as well as all prognostic parameters were without significant differences (Tables 3 and 4).

5) BMI <25.0 kg/m² increased (OR 2.00, CI [1.09-3.68], p=0.026) and BMI 25.0-29.9 kg/m² reduced the risk of dyspnea (OR 0.52, CI [0.30-0.91], p=0.022); WHR ≥0.90/0.85 adjusted for gender increased the risk of significant proximal/middle coronary segment stenosis (OR 3.34, CI [1.13-9.86], p=0.029), while WHtR ≥63/58 adjusted for hyperglycemia increased the risk of heart failure (OR 2.05, CI [1.13-3.71] p=0.017) and total in-hospital complications (OR 1.94, CI [1.13-3.33] p=0.017). The number of significantly stenosed coronary arteries, adjusted for LVEF and distal coronary segment stenosis increased the risk of total MACE (OR 1.79, CI [1.17-2.77], p=0.008).

Discussion

The main objective of this study was to investigate the controversial influence of anthropometric parameters on clinical severity and prognosis of acute STEMI, as well as their unknown influence on the involvement of coronary segments with significant stenosis and SLD.

We found the measures of central obesity (WHR and WHtR) to be superior to BMI in predicting clinical severity (significant proximal/middle coronary segment stenosis, heart failure and total in-hospital complications *vs.* dyspnea), while WC had no influence on it. Also, anthropometric parameters had no influence on prognosis. Finally, the number of significantly ste-

Table 2. Severity and prognosis of acute ST-elevation myocardial infarction according to BMI (kg/m^2) and WC (cm)

	Parameter	BMI <25.0 (n=60)	BMI 25.0-29.9 (n=118)	BMI ≥30.0 (n=72)	p	WC <102/88 (n=101)	WC ≥102/88 (n=149)	p
Clinical presentation	Angina pectoris, n (%)	60 (100)	114 (96.6)	71 (98.6)	0.283	99 (98)	146 (98)	0.985
	Dyspnea, n (%)	25 (41.7)	27 (22.9)	23 (31.9)	**0.032**	27 (26.7)	48 (32.2)	0.353
	Hospitalization (days)	9 (2-31)	8.5 (2-21)	9 (6-32)	**0.028**	8 (2-30)	9 (3- 32)	0.126
In-hospital complications	Arrhythmias, n (%)	11 (18.3)	20 (17)	12 (16.7)	0.964	14 (13.9)	29 (19.5)	0.250
	Conduction abnorm., n (%)	6 (10)	6 (5.1)	4 (5.6)	0.422	4 (4)	12 (8.1)	0.194
	Heart failure, n (%)	17 (28.3)	25 (21.2)	22 (30.6)	0.306	20 (19.8)	44 (29.5)	0.084
	Cardiogenic shock, n (%)	6 (10)	8 (6.8)	4 (5.6)	0.598	7 (6.9)	11 (7.4)	0.892
	Cardiac arrest, n (%)	9 (15)	16 (13.6)	11 (15.3)	0.937	12 (11.9)	24 (16.1)	0.350
	Mechanical ventilation, n (%)	2 (3.3)	5 (4.2)	3 (4.2)	0.955	2 (2)	8 (5.4)	0.180
	Reinfarction, n (%)	0 (0)	1 (0.8)	0 (0)	-	0 (0)	1 (0.7)	-
	Re-PCI, n (%)	1 (1.7)	3 (2.5)	0 (0)	-	1 (1)	3 (2)	-
	Mortality, n (%)	6 (10)	6 (5.1)	7 (9.7)	0.365	10 (9.9)	9 (8.3)	0.258
	Total, n (%)	27 (45)	45 (38.1)	32 (44.4)	0.575	36 (35.6)	68 (45.6)	0.116
Laboratory	Max. cTnT (ng/mL)	3.7 (0-10)	3 (0-10)	2.9 (0-10)	0.642	3.5 (0-10)	2.8 (0-10)	0.246
	Max. CK (U/L)	1915.5 (107-15617)	1779 (25-13769)	1900 (85-14094)	0.952	2571 (70-15617)	1701 (25-14094)	0.296
ECHO	Left ventricle ejection fraction (%)	50 (28-70)	53 (25-70)	50 (30-76)	0.949	50 (25-64)	50 (28-76)	0.521
Coronary angiography	Stenosed CAs	2 (1-4)	2 (1-4)	1 (1-3)	0.456	1 (1-4)	2 (1-4)	0.399
	≥2 stenosed CAs, n (%)	33 (55)	60 (50.8)	35 (48.6)	0.761	48 (47.5)	80 (53.7)	0.339
	Number of stents	1 (1-4)	1 (1-3)	1 (1-3)	0.266	1 (1-4)	1 (1-3)	0.269
	Stents diameter (mm)	3 (2.5-4)	3.5 (2.3-4)	3.5 (2.8-4)	**0.000**	3 (2.8-4)	3.5 (2.3-4)	0.184
	Stents length (mm)	18 (8-36)	20 (8-38)	20 (8-38)	0.099	18.5 (8-38)	20 (8-38)	0.060
	Proximal/middle CA segment stenosis, n (%)	54 (90)	106 (90.6)	66 (91.7)	0.944	88 (88)	138 (92.6)	0.217
	Distal CA segment stenosis, n (%)	27 (45)	47 (40.2)	23 (31.9)	0.289	38 (39.2)	59 (39.6)	0.800
MACE	Reinfarction, n (%)	1 (1.9)	0 (0)	1 (1.5)	-	1 (1.1)	1 (0.7)	-
	Restenosis, n (%)	2 (3.8)	4 (3.8)	1 (1.5)	0.655	4 (4.4)	3 (2.2)	0.349
	New stenosis, n (%)	1 (1.9)	3 (2.8)	3 (4.4)	0.712	4 (4.4)	3 (2.1)	0.349
	Cardiac rehosp., n (%)	8 (15.1)	18 (17)	11 (16.2)	0.954	13 (14.3)	24 (17.6)	0.502
	Non-cardiac rehosp., n (%)	5 (9.4)	3 (2.8)	1 (1.5)	0.059	4 (4.4)	5 (3.7)	0.786
	CVI, n (%)	1 (1.9)	0 (0)	0 (0)	-	0 (0)	1 (0.7)	-
	Urgent CABG, n (%)	1 (1.9)	3 (2.8)	2 (2.9)	0.925	1 (1.1)	5 (3.7)	0.236
	Mortality, n (%)	3 (5.7)	1 (0.9)	0 (0)	-	2 (2.2)	2 (1.5)	-
	Total, n (%)	11 (20.8)	20 (18.4)	16 (23.5)	0.706	18 (19.8)	29 (20.9)	0.842
Other	Sick leave duration (weeks)	12 (2-52)	12 (1-28)	14 (2-48)	0.401	12 (1-48)	12 (3-52)	0.093

BMI = body mass index; CABG = coronary artery bypass graft; CA = coronary artery; CK = creatinine phosphokinase; cTnT = cardiac troponin T; CVI = cerebrovascular insult; ECHO = echocardiography; MACE = major adverse cardiovascular events; PCI = percutaneous coronary intervention; WC = waist circumference

Table 3. Baseline characteristics of patients according to WHtR and WHR

Parameter	WHtR <53/49 (n=42)	WHtR 53/49-62/57 (n=127)	WHtR ≥ 63/58 (n=81)	p	WHR <0.90/0.85 (n=28)	WHR ≥0.90/0.85 (n=222)	p
Men, n (%)	36 (85.7)	105 (82.7)	36 (44.4)	**<0.0001**	8 (28.6)	169 (76.1)	**0.000**
Women, n (%)	6 (14.3)	22 (17.3)	45 (55.6)	**<0.0001**	20 (71.4)	53 (23.9)	**0.000**
Age (years)	60 (42-86)	60 (25-92)	64 (39-85)	0.162	70 (39-88)	61 (25-92)	**0.021**
Arterial hypertension, n (%)	24 (57.1)	84 (66.1)	73 (90.1)	**<0.0001**	21 (75)	160 (72.1)	0.744
Dyslipidemia, n (%)	33 (78.6)	97 (76.4)	60 (74.1)	0.849	17 (60.7)	173 (77.9)	**0.044**
Hyperglycemia, n (%)	8 (19.0)	29 (22.8)	24 (29.6)	0.364	6 (21.4)	55 (24.8)	0.698
Smoking, n (%)	27 (64.3)	62 (48.8)	40 (49.4)	0.196	11 (39.3)	118 (53.2)	0.166
Family history, n (%)	19 (45.2)	52 (40.9)	36 (44.4)	0.831	12 (42.9)	95 (42.8)	0.995
Previous MI, n (%)	5 (11.9)	11 (8.7)	6 (7.4)	0.704	3 (10.7)	19 (8.6)	0.704
Previous PCI, n (%)	6 (14.3)	13 (10.2)	4 (4.9)	0.199	2 (7.1)	21 (9.5)	0.689
Previous CABG, n (%)	0 (0)	1 (0.8)	0 (0)	-	0 (0)	1 (0.5)	-

CABG = coronary artery bypass graft; MI = myocardial infarction; PCI = percutaneous coronary intervention; WHR = waist-to-hip ratio; WHtR = waist-to-height ratio

nosed coronary arteries increased the risk of total MACE, which is consistent with literature data[12].

Several studies have reported a paradoxical clinical effect of elevated BMI on improved survival after primary PCI in patients with acute STEMI, i.e. the overall 'obesity paradox'. Overweight and obese patients had wider stents, normal LVEF, lower CK levels, in-hospital and overall mortalities, as well as lower rates of MACE during 12-month follow up[13-16].

According to other authors, obese patients with acute STEMI had similar PCI characteristics and MACE as normal weights and overweights[17]. Iakobishvili *et al.* and Li *et al.* found no significant differences in infarct size, and in 3-month and 1-year outcomes among the BMI categories with acute STEMI and primary PCI[18,19].

The 'obesity paradox' could explain why we found no significant differences among normal weight, overweight and overall obese patients in prognosis, as well as that of the severity parameters, normal weight increased and overweight reduced the risk of dyspnea.

The presence of increased WC is associated with greater myocardial necrosis in patients with acute MI[20]. However, it has been reported that increased WC has a protective role for the presence of significant angiographic CAD, i.e. central 'obesity paradox'[21]. Subcutaneous fat component is probably mainly responsible for the paradoxical protective effect of central obesity, whereas visceral fat may have an opposing effect and increase the risk of significant angiographic CAD. WC does not add prognostic information for predicting six-month mortality or myocardial reinfarction in patients with acute MI[22]. In this study, we found no significant differences in any of the parameters of severity and prognosis between patients with normal and increased WC.

The presence of increased WHR is associated with significant coronary stenosis, but not with the number of significantly stenosed coronary arteries[23]. In acute STEMI, patients with increased WHR more frequently have heart failure and WHR ≥0.90/0.85 is an independent predictor of six-month mortality[24]. In our study, where a small number of patients with normal WHR was found as expected, the presence of increased WHR was associated with significant stenosis of proximal/middle coronary segments, but without significant differences in other severity and in all prognostic parameters.

Of the anthropometric parameters, WHtR yielded the highest positive correlation with CAD[25]. This was the first study on the effect of WHtR on clinical severity and prognosis of acute STEMI. We found that WHtR ≥63/58 increased the risk of heart failure and total in-hospital complications. Considering the small

Table 4. Severity and prognosis of acute ST-elevation myocardial infarction according to WHtR (kg/m²) and WHR

	Parameter	WHtR <53/49 (n=42)	WHtR 53/49-62/57 (n=127)	WHtR ≥63/58 (n=81)	p	WHR <0.90/0.85 (n=28)	WHR ≥0.90/0.85 (n=222)	p
Clinical presentation	Angina pectoris, n (%)	41 (97.6)	124 (97.6)	80 (98.8)	0.836	27 (96.4)	218 (98.2)	0.529
	Dyspnea, n (%)	15 (35.7)	36 (28.3)	24 (29.6)	0.662	10 (35.7)	65 (29.3)	0.484
	Hospitalization (days)	8 (1-20)	9 (1-32)	9 (3-30)	0.366	9 (5-25)	9 (2-32)	0.193
In-hospital complications	Arrhythmias, n (%)	5 (11.9)	23 (18.1)	15 (18.5)	0.607	2 (7.1)	41 (18.5)	0.135
	Conduction abnorm., n (%)	2 (4.8)	10 (7.9)	4 (4.9)	0.626	3 (10.7)	13 (5.9)	0.322
	Heart failure, n (%)	9 (21.4)	26 (20.5)	29 (35.8)	**0.038**	9 (32.1)	55 (24.8)	0.400
	Cardiogenic shock, n (%)	4 (9.5)	7 (5.5)	7 (8.6)	0.567	1 (3.6)	17 (7.7)	0.431
	Cardiac arrest, n (%)	5 (11.9)	17 (13.4)	14 (17.3)	0.649	2 (7.1)	34 (15.3)	0.246
	Mechanical vent., n (%)	1 (2.4)	4 (3.1)	5 (6.2)	0.467	0 (0)	10 (4.5)	0.252
	Reinfarction, n (%)	0 (0)	0 (0)	1 (1.2)	-	0 (0)	1 (0.5)	-
	Re-PCI, n (%)	0 (0)	4 (3.1)	0 (0)	-	0 (0)	4 (1.8)	-
	Mortality, n (%)	5 (11.9)	9 (7.1)	5 (6.2)	0.499	2 (7.1)	17 (7.7)	0.923
	Total, n (%)	12 (28.6)	49 (38.6)	43 (53.1)	**0.020**	10 (35.7)	94 (42.3)	0.503
Laboratory	Max. cTnT (ng/mL)	3.7 (0.1-10)	3.7 (0-10)	2.6 (0-10)	0.061	2.1 (0-10)	3.2 (0-10)	0.071
	Max. CK (U/L)	2652 (107-15617)	1983 (25-13331)	1420 (85-14094)	0.118	1324 (85-11425)	1926 (25-15617)	0.122
ECHO	Left ventricle ejection fraction (%)	50 (25-65)	50 (28-76)	55 (30-68)	0.691	50 (30-70)	50 (25-76)	0.944
Coronary angiography	Stenosed CAs	1.5 (1-3)	1 (1-4)	2 (1-4)	0.740	1.5 (1-4)	2 (1-4)	0.750
	≥2 stenosed CAs, n (%)	21 (50.0)	62 (48.8)	45 (55.6)	0.629	14 (50)	114 (51.4)	0.893
	Number of stents	1 (1-3)	1 (1-4)	1 (1-3)	0.432	1 (1-3)	1 (1-4)	0.119
	Stents diameter (mm)	3 (2.8-4.0)	3.5 (2.5-4.0)	3.5 (2.3-4.0)	0.062	3 (2.8-4)	3.5 (2.3-4)	0.515
	Stents length (mm)	20 (8-36)	20 (12-38)	20 (12-36)	0.291	20 (8-36)	20 (8-38)	0.905
	Proximal/middle CA segment stenosis, n (%)	37 (88.1)	113 (89.7)	76 (93.8)	0.487	21 (75)	205 (92.8)	**0.002**
	Distal CA segment stenosis, n (%)	15 (35.7)	51 (40.5)	31 (38.3)	0.850	15 (53.6)	82 (37.1)	0.092
MACE	Reinfarction, n (%)	0 (0)	1 (0.9)	1 (1.3)	-	0 (0)	2 (1)	-
	Restenosis, n (%)	2 (5.4)	5 (4.3)	0 (0)	-	1 (3.7)	6 (3)	-
	New stenosis, n (%)	2 (5.4)	3 (2.6)	2 (2.6)	0.659	2 (7.4)	5 (2.5)	-
	Cardiac rehosp., n (%)	3 (8.1)	22 (18.8)	12 (15.8)	0.303	2 (7.4)	35 (17.5)	0.183
	Non-cardiac rehosp., n (%)	1 (2.7)	6 (5.1)	2 (2.6)	0.626	1 (3.7)	8 (4)	0.941
	CVI, n (%)	0 (0)	1 (0.9)	0 (0)	-	0 (0)	1 (0.5)	-
	Urgent CABG, n (%)	0 (0)	4 (3.4)	2 (2.6)	-	0 (0)	6 (3)	-
	Mortality, n (%)	0 (0)	3 (2.6)	1 (1.3)	-	0 (0)	4 (2)	-
	Total, n (%)	5 (13.5)	28 (23.9)	14 (18.4)	0.340	7 (25.9)	40 (19.7)	0.451
Other	Sick leave duration (weeks)	16 (2-24)	12 (1-52)	12 (3-40)	0.118	12 (10-26)	12 (1-52)	0.656

CABG = coronary artery bypass graft; CA = coronary artery; CK = creatinine phosphokinase; cTnT = cardiac troponin T; CVI = cerebrovascular insult; ECHO = echocardiography; MACE = major adverse cardiovascular events; PCI = percutaneous coronary intervention; WHR = waist-to-hip ratio; WHtR = waist-to-height ratio number of patients with normal WHR and WHtR values as the main limitation of this study, investigation with a greater number of patients should be performed to confirm these results.

Conclusion

In conclusion, WHR and WHtR are better anthropometric parameters than BMI in predicting acute STEMI severity, while WC has no influence on it. Anthropometry has no influence on prognosis.

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Sažetak

ULOGA ANTROPOMETRIJE U AKUTNOM INFARKTU MIOKARDA SA ST-ELEVACIJOM LIJEČENOM PRIMARNOM PERKUTANOM KORONARNOM INTERVENCIJOM

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Cilj ove studije bio je istražiti proturječni utjecaj antropometrije na kliničku težinu i prognozu akutnoga infarkta miokarda sa ST-elevacijom (STEMI). Prospektivno smo analizirali 250 bolesnika s akutnim STEMI liječenih primarnom perkutanom koronarnom intervencijom (rujan 2011. – rujan 2012.). Oni su grupirani prema antropometrijskim parametrima: indeks tjelesne mase (BMI) (<25,0; 25,0-29,9; ≥30,0 kg/m²), opseg struka (WC) (<102/88, ≥102/88 cm), omjer struk/bokovi (WHR) (<0,90/0,85, ≥0,90/0,85) i struk/tjelesna visina (WHtR) (<53/49, 53/49-62/57, ≥63/58). Skupine su analizirane prema bazičnim te parametrima težine (klinički, laboratorijski, ehokardiografski, koronarografski, bolničke komplikacije) i prognoze (glavni neželjeni kardiovaskularni događaji (MACE) i duljina bolovanja (SLD) tijekom 12 mjeseci praćenja). Bolesnici s BMI <25,0 kg/m² imali su najveću učestalost dispneje, a oni s BMI ≥30,0 kg/m² najdulju hospitalizaciju i najšire stentove; bolesnici s WHR ≥0,90/0,85 učestalije su imali značajno stenozirane proksimalne/srednje koronarne segmente, dok su oni s WHtR ≥63/58 imali najveću učestalost srčanog zatajivanja i ukupnih bolničkih komplikacija (p<0,05). BMI <25,0 kg/m² povećava (*odds ratio* (OR) 2,00, *confidence interval* (CI) [1,09-3,68], p=0,026), a BMI 25,0-29,9 kg/m² smanjuje (OR 0,52, CI [0,30-0,91], p=0,022) rizik dispneje; WHR ≥0.90/0.85 povećava rizik značajne stenoze proksimalnih/srednjih koronarnih segmenata (OR 3,34, CI [1,13-9,86], p=0,029), a WHtR ≥63/58 srčanog zatajenja (OR 2,05, CI [1,13-3,71], p=0,017) i ukupnih bolničkih komplikacija (OR 1,94, CI [1,13-3,33], p=0,017) (p<0,05). Zaključno, WHR i WHtR su bolji antropometrijski parametri od BMI u predviđanju težine akutnog STEMI, dok WC nema utjecaja. Antropometrija nema utjecaja na prognozu.

Ključne riječi: *Antropometrija; Pretilost; Srčani infarkt; Perkutana koronarna intervencija; Bolovanje*