ORIGINAL PAPER

doi: 10.5455/medarh.2015.69.396-399
Med Arh. 2015 Dec; 69(6): 396-399
Received: August 25th 2015 | Accepted: October 25th 2015

Differences Among Body Mass Index (BMI) Groups in Patients Undergoing First Elective Percutaneous Coronary Intervention

Leonard Simoni[1], Ervina Shirka[2], Endri Hasimi[1], Suerta Kabili[1], Artan Goda[1]

[1]Cardiology Department, University Hospital Center "Mother Theresa" Tirana, Albania
[2]Cardiology Service, European Hospital, Tirana, Albania

Corresponding author: Leonard Simoni, MD. E-mail: leonardsimoni@yahoo.com[

ABSTRACT

Background and purpose: Body Mass Index **(**BMI) is known to be an independent risk factor for hypertension, type 2 diabetes mellitus, dyslipidemia and various cardiovascular diseases. Our aim was to investigate the differences among BMI groups in patients undergoing first elective PCI. **Methods:** 781 consecutive patients who underwent their first-time elective PCI from September 2011 to December 2013 in the Department of Cardiology were enrolled in the study. The patients with BMI < 18.5 kg/m2 or > 50 kg/m2 and those who had previously undergone revascularization were excluded from the study. Patients were categorized according to their BMI groups. BMI 18.5 - 24.9 kg/m2 normal group, 25 - 29.9 kg/m2 overweight group and > 30 kg/m2 obese group. We studied the demographic, angiographic, and interventional differences between BMI groups. **Results:** Compared with normal weight individuals, those obese were younger (61.9 ±10.34 vs. 58.41 ± 8.01 p = 0.0006), had higher prevalence of diabetes mellitus (46.4% vs. 26.6% p = 0.0001), dyslipidemia (77.5% vs. 65.4% p=0.0134) and hypertension (1.3% vs. 81.3% p=0.0067). There was a greater use of calcium channel blockers (CCBs) and Angiotensin Enzyme Inhibitors (ACEIs)/Angiotensin Receptor Blockers (ARBs) in obese individuals but it was not statistically significant. Obese individuals were associated with higher risk anatomy (3-Vessel CAD or LM) compared to normal individuals but not statistically significant (18.8% vs. 14.2% p=0.25). Obese patients were associated with a higher length of stents/person used (36.7 ± 22.02 vs. 31.7 ± 17.48 p=0.016) and also a larger diameter of stents/person used (3.14 ± 0.4 vs. 2.98 ± 0.33 p=0.0001) compared to normal individuals. **Conclusions:** Patients with a higher BMI are younger and have diabetes mellitus, hypertension and dyslipidemia more frequently. Patients with a higher BMI have a higher length and larger diameter of stents/person used, probably related to a more extensive coronary artery disease.

Key words: Body mass index, percutaneous coronary intervention, diabetes mellitus, hypertension, dyslipidemia.

1. BACKGROUND

Obesity has been increasing in large proportions over the last decades. The prevalence of overweight in Europe ranges between 32% and 79% in men and between 28% and 78% in women; and the prevalence of obesity ranges between 5% and 23% in men and between 7% and 36% in women (1).

Albania has the highest prevalence of overweight and obesity in Europe ranging around 58% and 22% respectively in men and 40% and 36% respectively in women respectively (1).

Obesity affects the cardiovascular system in different ways – affecting hemodynamics, structure and function (2), as well as increasing the prevalence of heart failure (3), atrial fibrillation (4), coronary artery disease (CAD) (5). BMI is known to be an independent risk factor for hypertension (6-7), type 2 diabetes mellitus (8), dyslipidemia (2, 9). The influence of obesity on such risk factors and also on inflammatory mark-

	BMI 18.5 – 24.9 normal	BMI 25 – 29.9 overweight	P value	BMI >30 obese	P value
Patients	289/781	354/781		138/781	
Male	233 (80.6%)	282 (79.7%)	0.77	96 (69.5%)	0.014
Age, yrs (SD)	61.9(10.34)	61.06 (9.44)	0.29	58.41 (8.01)	0.0006
Diabetes Mellitus	77 (26.6%)	124 (35%)	0.026	64 (46.4%)	0.0001
Smoker	114 (39.4%)	120 (33.9%)	0.16	50 (36.2%)	0.595
Dyslipidemia	189 (65.4%)	254 (71.75%)	0.087	107 (77.5%)	0.0134
Family history of CAD	73 (25.25%)	114 (32.2%)	0.055	44 (31.9%)	0.165
Hypertension	235 (81.3%)	287 (81.1%)	1	126 (91.3%)	0.0067
Previous MI	159 (55%)	171 (48.3%)	0.096	57 (35.8%)	0.0096
Impaired LV function	55 (19%)	45 (12.7%)	0.029	19 (13.8%)	0.22
Impaired renal function	17 (5.9%)	20 (5.65%)	1	14 (10.14%)	0.12
Beta-Blocker	226 (84.9%)	273 (82.2%)	0.53	110 (85.9%)	0.92
CCB	88 (33.1%)	131 (39.4%)	0.13	55 (42.9%)	0.072
ASA + Clopidrogel	253 (95%)	320 (96.4%)	0.57	125 (97.7%)	0.35
Statins	256 (96.3%)	326 (98.2%)	0.22	124 (97%)	0.97
ACEIs/ARBs	200 (75.2%)	236 (71.1%)	0.3	108 (84.4%)	0.053
Diuretics	84 (33.5%)	103 (31%)	0.96	44 (34.3%)	0.6

Table 1. Baseline demographics of patients undergoing PCI

	BMI 18.5 – 24.9 normal	BMI 25 – 29.9 overweight	P value	BMI >30 obese	P value
1 vessel CAD	150 (51.9%)	179 (50.6%)	0.75	68 (49.3%)	0.68
2 vessel CAD	98 (33.9%)	126 (35.6%)	0.68	43 (31.2%)	0.58
3 vessel CAD/LM	41 (14.2%)	51 (14.4%)	1	26 (18.8%)	0.25
PCI of LAD	171 (59.2%)	215 (60.7%)	0.75	81 (58.7%)	1
PCI of LCX	91 (31.5%)	107 (30.2%)	0.73	39 (28.3%)	0.57
PCI of RCA	96 (33.2%)	135 (38.1%)	0.21	54 (39.1%)	0.235
No. of vessels treated (SD)	1.25 (0.47)	1.30 (0.49)	0.256	1.28 (0.49)	0.59
No. of stents (SD)	1.685 (0.91)	1.8 (0.96)	0.12	1.95 (1.17)	0.014
Stent length (SD)	31.7 (17.48)	34.4 (18.85)	0.072	36.67 (22.02)	0.016
Stent diameter (SD)	2.98 (0.33)	3.05 (0.43)	0.028	3.143 (0.4)	0.0001

Table 2. Angiographic and procedural characteristics of patients undergoing PCI

ers and prothrombotic state (10) predisposes for more extensive coronary atherosclerosis.

The aim of our analysis was to evaluate the differences among BMI groups on demographic, angiographic and procedural findings in patients undergoing their first elective percutaneous coronary intervention (PCI).

2. METHODS

2.1. Data Sources

All consecutive patients, who underwent their first elective PCI procedures from September 2011 to December 2013 were enrolled in the study. Patients who had previously undergone PCI or coronary artery by-pass grafting (CABG) and who underwent primary procedures for coronary acute syndromes were excluded from the study. At the same time, patients with BMI <18.5 or >50 kg/m2 were excluded. The remaining patients comprised the study cohort. Based on these selection criteria, 781 patients were enrolled in the study.

2.2. Definitions

BMI was calculated as body weight (kg) divided by the square of the height (m). Weight was categorized as normal weight (BMI 18.5 – 24.9 kg/m2), overweight (25 – 29.9 kg/m2), obese (≥ 30kg/m2).The patients were divided into these 3 groups according to each BMI categories.

The extent of coronary artery disease was classified according to the number of coronary arteries with significant (> 50%) stenoses, one, two, or three vessel disease or left main stenosis (> 50%). High risk anatomy was defined as either three vessel disease or left main stenosis.

Hypertension was defined as blood pressure ≥ 140/90 mmHg or under antihypertensive therapy. Dyslipidemia was defined as Total cholesterol ≥ 200 mg/dL, LDL ≥ 150 mg/dL, HDL ≤ 40 mg/dL and Triglycerides ≥ 150 mg/dL or under hypolipemiant therapy.

Diabetes mellitus was defined as fasting glucose level ≥126mg/dL and load glucose level ≥ 180 mg/dl or under therapy for known diabetes mellitus.

We also studied previous family history of CAD, smoking, previous myocardial infarction, left ventricular (LV) impairment (EF < 50%), renal function impairment (seric creatinine >1.4 mg/dl), medical treatment, type of vessel treated, number of vessels treated/person, number, length and diameter of stents/person.

2.3. Statistical Analyses

Demographic characteristics, angiographic and procedure related variables were summarized using mean ± SD for continuous variables compared using t tests and frequency and percentage for categorical variables compared using chi-squared (χ^2) tests. Statistical significance was set at $p \leq 0.05$

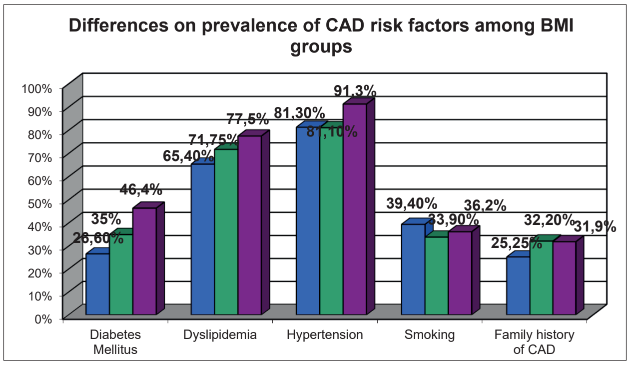

Figure 1. Differences in prevalence of CAD risk factors among BMI groups

3. RESULTS

3.1. Demographic findings

Of the 781 patients who underwent PCI, 289 (37%) were of normal weight individuals, 354 (45.3%) were overweight and 138 (17.7%) were obese individuals. (Table 1). Males were predominant in all groups (80.6% vs. 77.4% vs. 69.5%), but the percentage of females was higher in the obese group compared to the normal weight group (30.5% vs. 19.4% p = 0.014). Obese patients were younger (61.9 ± 10.34 vs. 58.41± 8.01 p=0.0006) than normal weight patients.

Obese individuals have a worst risk factors profile. Obese patients have higher prevalence of diabetes mellitus (46.4% vs. 26.6% p = 0.0001), dyslipidemia (77.5% vs. 65.4% p=0.0134) and hypertension (91.3% vs. 81.3% p=0.0067). There was no significant difference among groups in family history of CAD, smoking status, in proportions of patients with impaired LV function and impaired renal function. Normal weight patients have more often a history of myocardial infarction (55% vs. 35.8% p=0.0096) compared to obese individuals.

There were no significant differences in medical treatment. There was a greater use of CCBs (42.9% vs. 33.1% p=0.072) and ACEIs/ARBs (84.4% vs. 75.2% p = 0.053) in the high BMI group, but without reaching statistical significance.

3.2. Angiographic and procedural findings

Patients who were selected for PCI were predominantly 1- vessel CAD in all BMI groups (51.9% vs. 50.6% vs. 49.3%) without statistically significant differences. Obese patients had a higher risk anatomy (3-vessel CAD + LM) compared to normal weight individuals, but it was not statistically significant (18.8% vs. 14.2% p=0.25). (Table 2).

In all groups, the left anterior descending artery (LAD) was the vessel treated most often, with no significant difference between groups (59.2% vs. 60.7% vs. 58.7%) There was also no difference between groups in the treatment of the left circumflex (LCX) and right coronary artery (RCA).

There was no difference among BMI groups in the number of vessels treated per person (1.25±1.17 vs. 1.3±0.49 vs. 1.28±0.49).

Compared to normal weight patients, obese patients have a higher number of stents/person used (1.95±1.17 vs. 1.685±0.91 p=0.014), a higher length of stents/person used (36.67±22.02 vs. 31.7±17.48 p=0.016), and also a larger stent diameter (3.14±0.4 vs. 2.98±0.33 p=0.0001).

4. DISCUSSION

It is well-known that obesity is an independent risk factor for serious health conditions, including diabetes mellitus, hypertension and dyslipidemia (6-10). In our study we documented that obese individuals undergoing percutaneous coronary intervention have various differences in baseline demographics on presentation compared to normal individuals. Obese patients are younger, presenting with CAD earlier in time than normal weight patients. Obese patients undergoing PCI, in accordance with many other studies (11, 12, 13), are more likely to have diabetes, dyslipidemia and hypertension, influencing directly to more extensive coronary artery disease . (Figure 1).

In a recent study Kang et al. (14) showed that a higher BMI was associated with a larger plaque area and a greater plaque burden. Our study indirectly supports the existence of more extensive coronary disease in obese individuals based on the higher length of stents/person used in each procedure.

Obesity is characterized by the increase of filling pressure and volume leading to a left ventricular chamber dilatation and hypertrophy (2), which is correlated to an increased coronary lumen diameter (15). Dilated coronary lumen can also result during arterial remodeling because of the atherosclerosis process. Kang et al (14) also showed that the higher BMI group had a larger external elastic membrane area and volume (positive remodeling) indicating a greater compensatory response to plaque accumulation that preserves lumen area and volume. This larger lumen area allows the use of larger stents. In our study the diameter of stents/person used in obese individuals was larger than in normal ones, just as it resulted in the Des-DE study (11).

The use of CCBs and ACEIs/ARBs is greater in obese patients, probably related to a higher prevalence of hypertension in these patients.

5. CONCLUSIONS

Patients with a higher BMI are younger and have diabetes mellitus, hypertension and dyslipidemia more frequently. The patients of the higher BMI group have a greater length and diameter of stents used, probably related to a more extensive coronary artery disease. Further studies are needed to investigate the impact of obesity on the outcomes in patients undergoing percutaneous coronary intervention.

CONFLICT OF INTEREST: NONE DECLARED.

REFERENCES

1. Branca F, Nikogosian H, Lobstein T. The Challenge of obesity in tha WHO European region and the strategies for response. WHO 2007 www.euro.who.int/__data/assets/pdf_file/0008/98243/E89858.pdf
2. Lavie CJ, Milani RV, Ventura HO. Obesity and cardiovascular Disease. Risk factor, Paradox and Impact of weight

loss J Am Coll Cardiol. 2009; 21: 1925-1932. doi: 10.1016/j.jacc.2008.12.068.

3. Kenchaiah S, Evans JC, Levy D, et al. Obesity and the risk of heart failure. N Engl J Med. 2002; 347: 305-313. DOI: 10.1056/NEJMoa020245
4. Wanahita N, Messerli FH, Bangalore S, et al. Atrial fibrillation andobesity - results of a meta-analysis. Am Heart J. 2008; 155: 310-315 doi: 10.1016/j.ahj.2007.10.004.
5. Hubert HB, Feinleib M, McNamara PM, Castelli WP. Obesity as an independent risk factor for cardiovascular disease: a 26-year follow-upof participants in the Framingham Heart Study. Circulation. 1983; 67: 968-977. doi: 10.1161/01.CIR.67.5.968
6. National Institutes of Health. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report. Obes Res. 1998; suppl 2: 51S–209S. http://www.health.gov.au/internet/main/publishing.nsf/Content/obesityguidelines-guidelines-adults.htm
7. Brown CD, Higgins M, Donato KA, et al. Body mass index and the prevalence of hypertension and dyslipidemia. Obes Res. 2000; 8: 605-619. doi: 10.1038/oby.2000.79
8. Zimmet P. Alberti KG, Shaw J. Global and societal implications if the diabetes epidemic. Nature. 2001; 414: 782-787. doi:10.1038/414782a
9. Wilson PW, D'Agostino RB, Sullivan L, Parise H, Kannel WB. Overweight and obesity as determinants of cardiovascular risk: the Framingham experience. Arch Intern Med. 2002; 162: 1867-1872. doi:10.1001/archinte.162.16.1867.
10. Poirier P. Giles TH. Bray G. Obesity and Cardiovascular Disease: Pathophysiology, Evaluation, and effect of Weight loss. Circulation. 2006; 113: 898-918. doi: 10.1161/CIRCULATIONAHA.106.171016
11. Akin I, Tölg R, Hochadel M. et al. DES.DE (German Drug-Eluting Stent) Study Group. No evidence of "obesity paradox" after treatment with drug-eluting stents in a routine clinical practice: results from the prospective multicenter German DES.DE (German Drug-Eluting Stent) Registry. JACC Cardiovasc Interv. 2012; 2: 162-169. doi: 10.1016/j.jcin.2011.09.021.
12. Kaneko H, Yajima J, Oikawa Y, et al. Obesity paradox in Japanese patients after percutaneous coronary intervention: An observation cohort study. J Cardiol. 2013; 62: 18-24. doi: 10.1016/j.jjcc.2013.02.009.
13. Numasawa Y, Kohsaka S, Miyata H, Kawamura A, Noma S, Suzuki M, et al Impact of body mass index on in-hospital complications in patients undergoing percutaneous coronary intervention in a Japanese real-world multicenter registry. PLoS One. 2015 14; 10(4). doi: 10.1016/j.jjcc.2013.02.009.
14. Kang SJ, Mintz GS, Witzenbichler B, Metzger DC, Rinaldi MJ, Duffy PL, et al. Effect of obesity on coronary atherosclerosis and outcomes of percutaneous coronary intervention: grayscale and virtual histology intravascular ultrasound substudy of assessment of dual antiplatelet therapy with drug-eluting stents. Circ Cardiovasc Interv. 2015; 8(1). doi: 10.1161/CIRCINTERVENTIONS.114.001392.
15. Dodge JT, Jr, Brown BG, Bolson EL, Dodge HT. Lumen diameter of normal human coronary arteries. Influence of age, sex, anatomic variation, and left ventricular hypertrophy or dilation. Circulation. 1992; 86: 232-246. doi: 10.1161/01.CIR.86.1.232