

BODY MASS INDEX AND COMPLIANCE IN PATIENTS WITH CORONARY HEART DISEASE COMORBID WITH DIABETES MELLITUS**Sanakulov J.M 1, Yuldashov N.P 2, Kholikulov S.SH 3
Yuldashova Kh.A2, Pirmanov SH.V3**¹ "Samarkand regional branch of the Republican Specialized Scientific and Practical Medical Center of Cardiology."² Center for the development of professional qualification of medical workers³ Multidisciplinary medical center "Sog'lom Hayot"
Tashkent, Samarkand, Uzbekistan

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Abstract: Objective: to evaluate the relationship between body mass index and compliance in patients with coronary artery disease comorbid with diabetes mellitus.

Material and methods: 148 patients with stable angina pectoris (hereinafter referred to as: stable angina - SA) and type 2 diabetes mellitus (DM), i.e. with IHD+DM. Median age = 60.9±8.5 years. According to the blood glucose level, 3 groups were divided: group 1 – 74 patients whose blood glucose level was ≤ 10.0 mmol/l; Group 2 – 43 patients whose blood glucose level was = 10.1-15.0 mmol/l; Group 3 – 31 patients whose blood glucose levels were ≥ 15.1 mmol/l. Of the entire sample of patients, in 99 (66.9%) cases the body mass index was calculated - BMI, kg/m² (n=99). The median BMI was 29.0±3.6 kg/m². Compliance was assessed using the Morisky-Green questionnaire.

Results: In patients with coronary artery disease + diabetes, an increase in blood glucose levels ≥ 15.1 mmol/l was associated with a trend towards obesity, which was confirmed by an increase in both the number of patients with obesity and the increase in the degree of obesity in them (p<0.05).

In patients with high blood glucose levels, in terms of calculating BMI, there was a more pronounced tendency to obesity and low adherence to drug therapy, while, according to CAG data, the frequency of lesions of the circumflex artery was more than 4.5 times more prevalent, in comparison with lesions of the LAD and RCA.

Conclusion: Given the increased risk of diabetes complications in obese patients, clinicians must understand how to treat obesity in patients with diabetes, including adherence to drug therapy, as well as prevention of its complications

Keywords: Coronary heart disease, type 2 diabetes mellitus, body mass index, compliance, adherence to drug therapy.



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Introduction

Type 2 diabetes mellitus (DM) is considered an independent risk factor for the development of ischemic heart disease (IHD) and is prognostically regarded as an equivalent to IHD [1]. IHD accounts for 80% of deaths and 75% of hospitalizations in patients with DM.

Obesity, traditionally defined as an excess of body fat that harms health, is clinically assessed using the body mass index (BMI), expressed as the ratio of body weight in kilograms to height in square meters (kg/m²) [2]. Despite remarkable progress made in combating cardiovascular diseases (CVD), obesity remains a modifiable risk factor for which an acceptable solution has not been found (unlike hypertension, dyslipidemia, DM, and smoking). Moreover, previous studies have shown that the majority of CVD risk associated with high BMI or increased waist circumference is largely mediated by altered intermediate risk factors (atherogenic dyslipidemia, hypertension, and DM) [3].

Numerous large-scale randomized clinical trials have demonstrated the effectiveness of guideline-recommended treatment methods in reducing the risk of recurrent ischemic events and mortality in patients with IHD [4-6]. However, existing data indicate suboptimal adherence of patients to medical recommendations [7]. Non-adherence to treatment regimens is associated with an increased risk of cardiovascular mortality, hospitalizations for CVD, coronary revascularization procedures, and financial costs [8,9].

From all the above, it follows that the problem of IHD in combination with DM and obesity has many "white spots," and in combination with the issue of compliance, it is a complex, multifaceted, and highly debatable problem, which served as the basis for conducting this pilot scientific study.

Methods

A total of 148 patients with stable angina (SA) and type 2 diabetes mellitus (DM) comorbid with IHD were examined.

The average age of the study sample was 60.9±8.5 years (range 40 to 81 years).

The gender ratio was 97/51 (male/female).

The nosological structure of IHD in the examined patients was as follows: 29 (19.6%) patients had SA functional class II (according to the classification of the Canadian Cardiovascular Society), and 119 (80.4%) patients had SA functional class III. A history of myocardial infarction (MI) was reported in 67 (45.3%) respondents, and hypertension was present in 97 (65.5%) patients.

The diagnosis of DM was established after consultation with an endocrinologist in accordance with the criteria proposed by the WHO in 1999 and revised in 2006.

Based on blood glucose levels, patients were divided into 3 groups:

- Group 1: 74 patients with blood glucose levels ≤ 10.0 (median = 7.0±1.4) mmol/L;

- Group 2: 43 patients with blood glucose levels = 10.1-15.0 (median = 14.0±0.9) mmol/L;
- Group 3: 31 patients with blood glucose levels ≥ 15.1 (median = 17.4±2.3) mmol/L.

In the entire sample, the body mass index (BMI) was calculated in 99 (66.9%) cases (n=99, hereinafter referred to as 100%). The median BMI was 29.0±3.6 kg/m². Of these 99 patients, only 3 (3.0%) had a normal weight (BMI=18.5-24.9 kg/m²), 60 (60.6%) had overweight (BMI=25.0-29.9 kg/m²), and in the remaining 36 (36.4%) cases, obesity (BMI ≥ 30.0 kg/m²) was recorded.

Results and Discussion

Evaluation of patients by BMI level showed that of all patients, overweight was noted in 60 (60.6%) cases (i.e., BMI=25.0-29.9 kg/m²), and obesity of varying degrees of severity was observed in 36 (36.4%) cases (i.e., BMI ≥ 30 kg/m²). Only 3 (3.0%) patients had BMI values corresponding to normal weight (BMI=18.5-24.9 kg/m²).

When considering patients directly by the analyzed groups, it was found (Table 1) that out of 3 patients with normal weight, 2 patients were from Group 1, and 1 patient was from Group 3. Overweight was most commonly observed in patients in Group 2 (67.6%).

Table 1

Occurrence of BMI values in the analyzed groups of patients (depending on the blood glucose level)

Groups by blood glucose level	BMI values, kg/m ²			Bcero (n=99)
	18,5-24,9	25,0-29,9	≥ 30	
1 group	2 (5,7%)	21 (60,0%)	12 (34,3%)	35
2 group	-	23 (67,6%)	11 (32,4%)	34
3 group	1 (3,3%)	16 (53,3%)	13 (43,4%)	30
Total	3	60	36	99

Notes: Group 1 - Glucose < 10.0 mmol/L; Group 2 - Glucose = 10.1-15.0 mmol/L; Group 3 - Glucose ≥ 15.1 mmol/L; n - number of patients with calculated BMI; data presented in absolute and percentage terms.

Among respondents in Group 3, the highest number of cases were also individuals with overweight (53.3%), as well as those with obesity (43.3% - in Group 3, compared to 32.4% and 34.3% in Groups 2 and 1, respectively). Thus, from the presented data, it follows that patients with high blood glucose levels (≥ 15.1 mmol/L) were more prone to obesity than patients from Groups 1 and 2 (i.e., with blood glucose levels < 15.0 mmol/L).

The direct analysis of patients with BMI ≥ 30 kg/m² (n=36) showed the following (Figure 1). Patients with BMI=30.0-34.9 kg/m², i.e., with obesity of 1st degree, predominated in all three groups. Moreover, in Group 1, there were 8.4% more such patients than in Group 2 (p=0.283 and $\chi^2=1.155$) and 2.8% more than in Group 3 (p=0.410 and $\chi^2=0.680$). Conversely, the number of patients with BMI = 35.0-39.9 kg/m² (i.e., with obesity of the 2nd degree) was higher in Groups 2 and 3 (2 patients

in Group 1 compared to 4 patients in Group 2 and 4 patients in Group 3). The difference between Groups 2 and 1 was 5.5% and between Groups 3 and 1 was also 5.5% (both $p>0.05$).

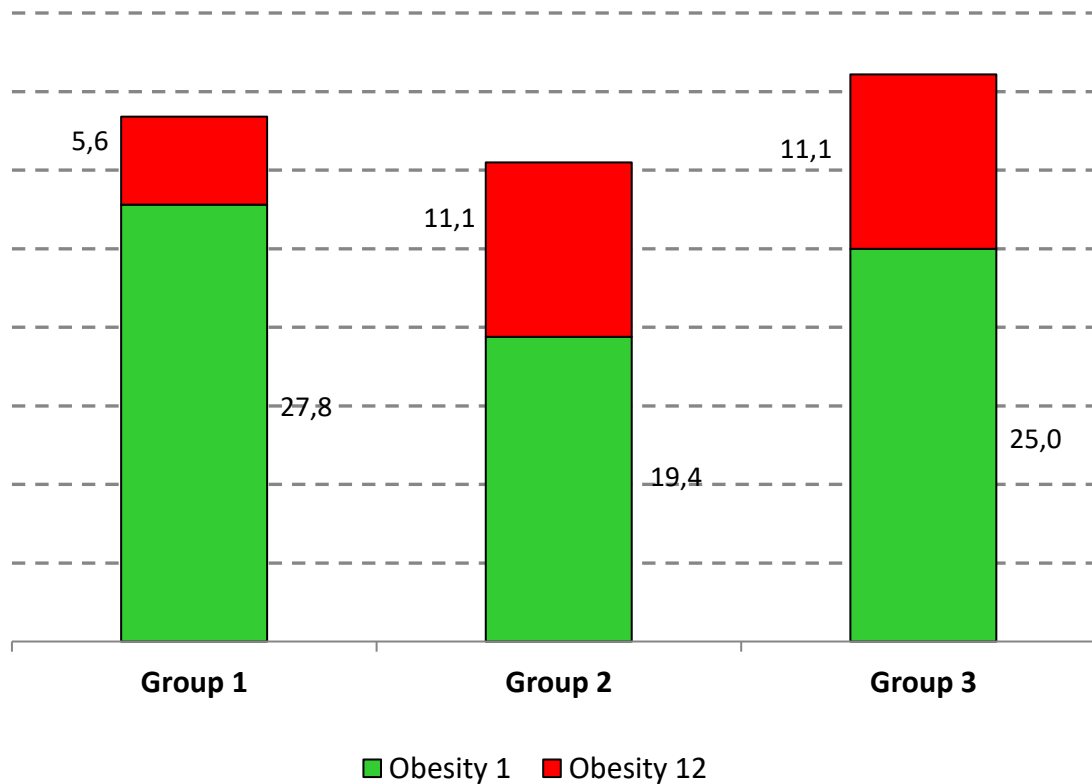


Figure 1. Comparative analysis of the frequency of occurrence of various degrees of obesity (by BMI level) in the analyzed patient groups.

Note: The data are presented in percentage (%) ratio. There were no individuals with $\text{BMI} \geq 40.0$ kg/m^2 in the analyzed sample.

So, the increase in blood glucose levels was associated with both an increase in the number of patients with obesity and an increase in the degree of obesity among them. This was confirmed by conducting a correlation analysis between the blood glucose level and BMI values, which revealed a statistically significant positive correlation (Figure 2).

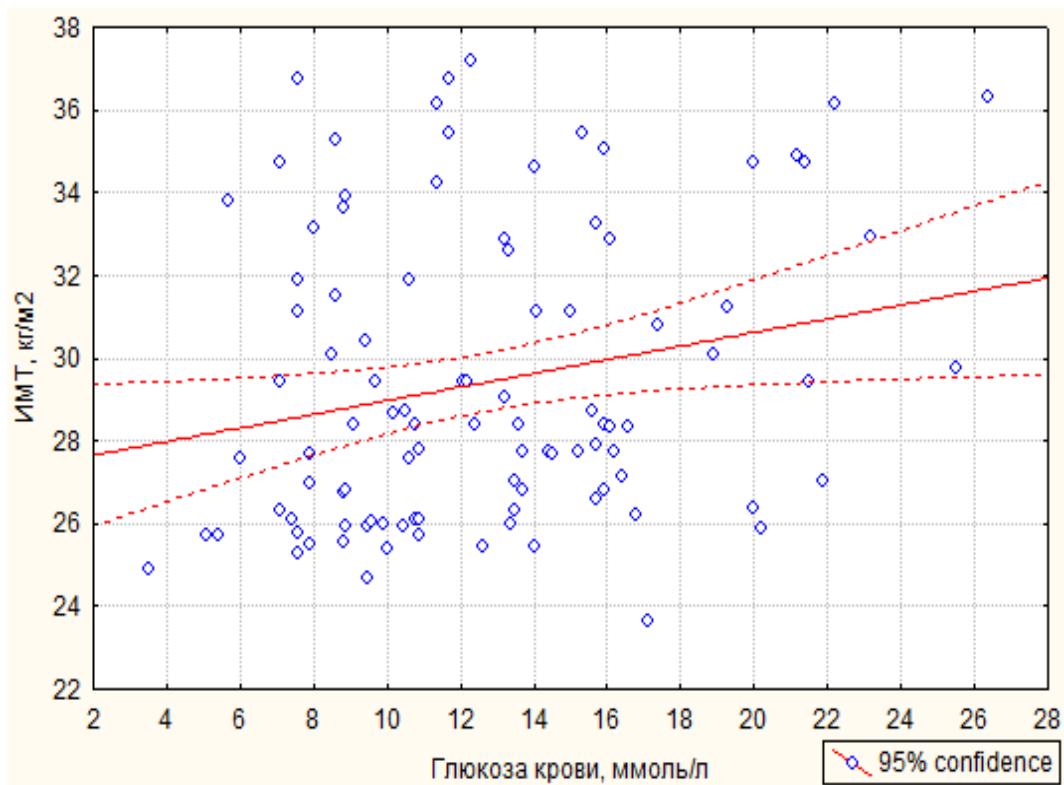


Figure 2. Graphical representation of the correlation between blood glucose levels and BMI values (n=99). $r=0.028$; $r=0.220$; $t=2.226$.

Notes: On the X-axis - blood glucose levels in patients (mmol/L); on the Y-axis - BMI values (kg/m²).

The total score on the Morisky-Green scale for the group (n=99) was 1.72 ± 0.71 points. However, analysis based on the identified groups showed that respondents in Group 1 were the most adherent to medication therapy (average score = 1.77 ± 0.69) compared to patients in Groups 2 and 3 (average score in Group 2 = 1.74 ± 0.75 ($p=0.916$) and in Group 3 = 1.63 ± 0.72 ($p=0.888$), respectively).

When conducting a correlation analysis between BMI values and the number of points on the Morisky-Green scale, an inverse relationship with a tendency toward significance was identified (Figure 3). That is, an increase in BMI values was associated with a decrease in the level of compliance among patients with IHD+DM.

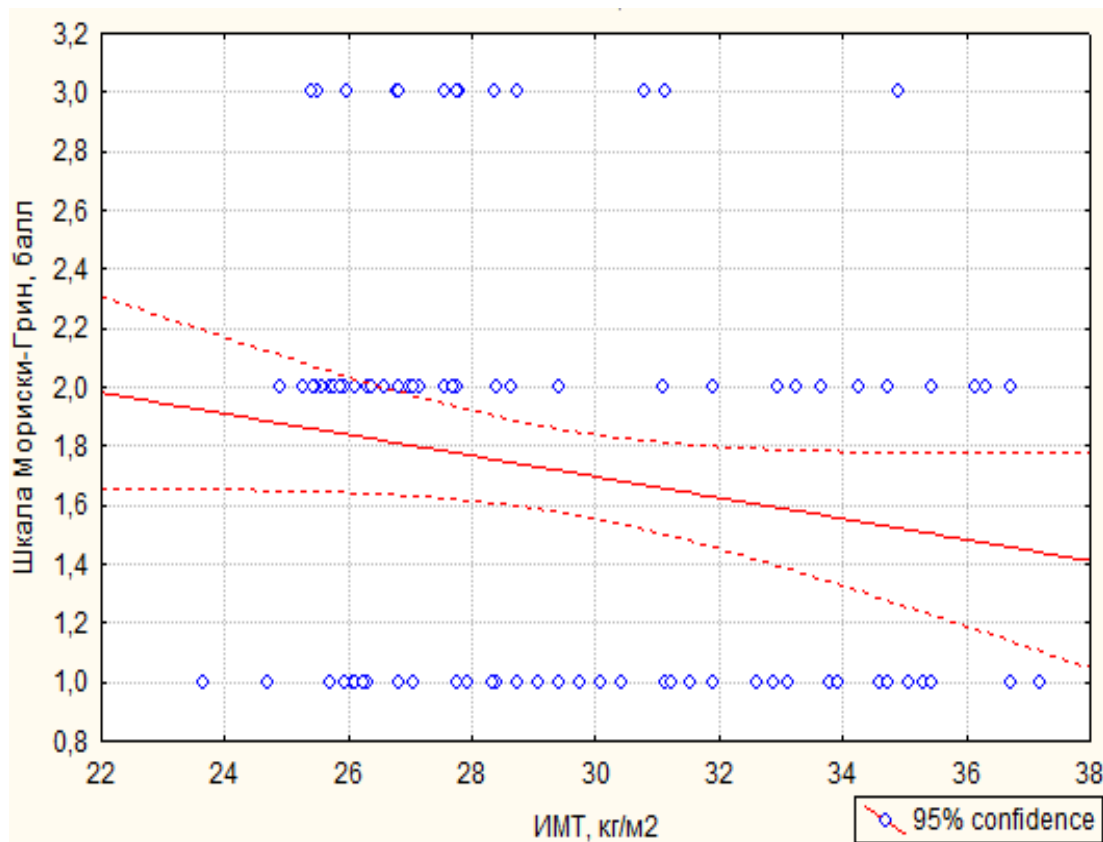


Figure 3. Graph of the correlation between BMI values and the number of points on the Morisky-Green scale (n=99).

$r=0.078\#$; $r= -0.177$; $t= -1.779$.

Notes: BMI - Body Mass Index; on the X-axis - BMI values (kg/m²); on the Y-axis - number of points on the Morisky-Green scale; # - tendency toward significance.

The assessment of coronary angiography (CAG) parameters also showed that the most frequently affected coronary territory was the RCA (58.6% of the total number of patients (n=99)). In the analyzed groups, this indicator was 23 cases in Group 1; 23 (p=0.865 and $\chi^2=0.029$) in Group 2; and 12 cases (p=0.039 and $\chi^2=4.298$) in Group 3.

Lesions in the LCA were present in 29 (29.3%) patients overall: in Group 1 - 10; in Group 2 - 9 (p=0.787 and $\chi^2=0.073$); and in Group 3 - 10 (p=0.736 and $\chi^2=0.114$) cases.

Lesions in the LMCA were observed in 12 (12.1%) patients overall, with 2 in Group 1; 2 in Group 2 (p=0.977 and $\chi^2=0.001$); and 8 in Group 3 (p=0.020 and $\chi^2=5.488$). Figure 4 shows the structure of coronary territory involvement in the analyzed groups in percentage terms (Figure 4). As seen in Figure 4, in Group 3, the frequency of LMCA involvement was 4.7 times higher than RCA and 4.5 times higher than

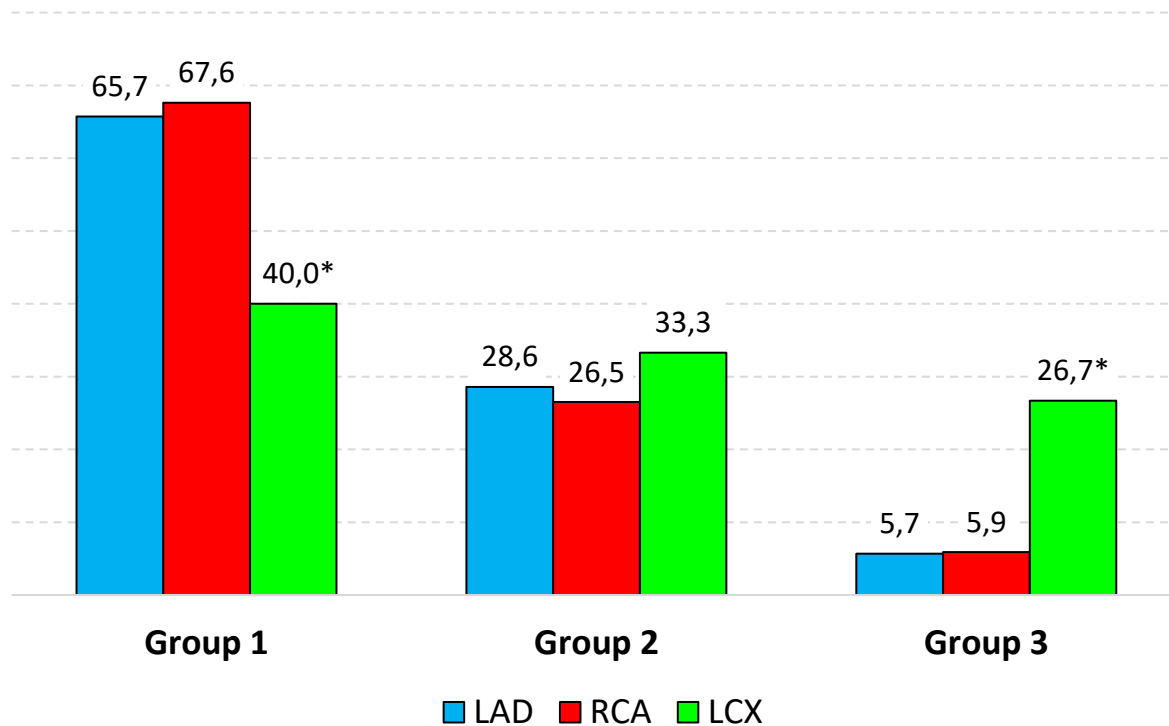


Fig. 4 Occurrence of lesions in the major coronary arteries in the analyzed groups.

Note: The total sample size is $n=99$; LAD, RCA, and LCX stand for Left Anterior Descending, Right Coronary Artery, and Left Circumflex Artery. The data are presented in percentage terms.

Median stenosis values per group were as follows: in Group 1 - $82.1 \pm 5.8\%$; in Group 2 - $86.2 \pm 14.0\%$; and in Group 3 - $90.6 \pm 4.9\%$ (all $p > 0.05$). The mean values of lesion length and coronary artery diameter were: in Group 1 - 26.7 ± 4.4 mm and 3.5 ± 0.5 mm, respectively; in Group 2 - 25.6 ± 6.8 mm and 3.2 ± 0.4 mm; and in Group 3 - 26.4 ± 4.3 mm and 2.8 ± 0.3 mm, respectively (all $p > 0.05$).

From all the above, it can be concluded that among patients with high blood glucose levels, there was a more pronounced tendency towards obesity and low adherence to medication therapy. Moreover, from the coronary angiography (CAG) data, it was found that the frequency of involvement of the obtuse marginal artery (OMA) was more than 4.5 times higher compared to involvement of the posterior descending artery (PDA) and the right coronary artery (RCA).

Discussion

Obesity and diabetes often coexist, yet their individual contributions to cardiovascular risk remain debatable. Large population studies attempting to identify independent cardiovascular risk associated with diabetes show that adjustment for body mass index (BMI) does not significantly reduce the link between diabetes and cardiovascular mortality. However, the relationship between BMI and cardiovascular disease (CVD) is potentially complex: BMI above or below the normal range is associated with a higher risk of CVD mortality. According to literature data, diabetes reduces life expectancy by a full 10 years, with CVD being the leading cause of death in patients with diabetes. Moreover, individuals with diabetes are disproportionately affected by CVD compared to those without diabetes. Haffner SM et al. reported on mortality rates from cardiovascular causes over a 7-

year period in patients with and without diabetes. Among individuals with diabetes, the mortality rate was 15.4% among those without a history of myocardial infarction (MI) and 42.0% among those with a history of MI. In contrast, among patients without diabetes, the cardiovascular mortality rates were 2.1% and 15.9%, respectively. The results of our study also showed a direct correlation between obesity and the severity of diabetes, with high blood glucose levels being associated with a predominant involvement of the OMA. Furthermore, it was found that the combination of ischemic heart disease (IHD) and diabetes, along with obesity, negatively affected patients' adherence to medication therapy. Individuals with diabetes and high BMI have poorer glycemic control, as confirmed by our study and supported by existing literature. There are reports indicating that high BMI is a major contributing factor to complications associated with diabetes, including CVD and peripheral vascular diseases. Experiments with discrete choice have shown that preventing weight gain is an important attribute of treatment. In one study, for individuals with limited mobility, preventing weight gain was even more important than achieving moderate control of blood glucose levels. Using a standard risk assessment approach, it has been previously demonstrated that a weight loss of 3% or 5% is associated with increased health benefits, whereas the benefits decrease with an equivalent increase in weight among individuals with diabetes. In this study, weight change had a stronger impact on compliance among obese individuals. In an international study, a telephone survey among people with diabetes identified weight gain as one of the main reasons for skipping/non-adhering to insulin therapy. Our results also showed that among patients with IHD and diabetes, increasing BMI was associated with decreased adherence to therapy. However, other authors have shown that some patients continue to take medications that cause weight gain to avoid severe consequences and complications of diabetes, even though they knew that weight loss is considered a key goal of diabetes management. These studies do not provide any information in this direction, but it can be assumed that some patients are not concerned about weight gain; they do not perceive it as harmful to their health, so this fact did not affect their adherence to treatment and showed a high level of compliance.

Conclusion

Thus, our results allow the following conclusions to be drawn. Among patients with IHD and diabetes, an increase in blood glucose levels ≥ 15.1 mmol/l was associated with a tendency towards obesity, as evidenced by an increase in both the number of patients with obesity and the degree of obesity among them ($p < 0.05$). Among patients with high blood glucose levels, there was a more pronounced tendency towards obesity and low adherence to medication therapy. Moreover, from the CAG data, the frequency of involvement of the OMA was more than 4.5 times higher compared to involvement of the PDA and the RCA. Considering the increased risk of diabetes complications in patients with obesity, physicians should understand how to treat obesity in patients with diabetes, including adherence to medication therapy, as well as the prevention of its complications.

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