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Could A New Measurement, A New Body Shape Index, Replace BMI in Detecting Obesity and Predict The Presence of Obesity and Depression in Asthma Control?

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ABSTRACT

Obesity is common in asthma. Depression is thought to be one of the risk factors that increase obesity. It is known that depression has an effect on poor asthma control. Body Mass Index (BMI) is mostly used to define obesity. In recent years, however, the 'A Body Shape Index' (ABSI) based on waist circumference (WC) measurement has been developed and the higher ABSI corresponds to a more central body volume concentration. Our aim was to examine the effect of obesity and depression on asthma control in a way that questions the usability of ABSI, which is new in abdominal obesity measurement.

A total of 99 asthmatic patients aged between 18-80 years who were followed up in Chest Diseases outpatient clinics were included in the study. Demographic and medical history of the patients were recorded. Waist circumference $/BMI^{2/3} X$ Length(m) $^{2/3}$ was calculated for ABSI measurement. Beck Depression Scale (BDS) and Asthma Control Test (ACT) were applied. Pulmonary Function Test was applied to all patients by the same trained person.

Obese and morbidly obese patients had poor asthma control. We found that the presence of depression caused poor asthma control in all BMI groups. The poorly controlled asthma group and the obese and morbidly obese patients had higher depression scores. BMI and waist circumference were higher in the poorly controlled asthma group (p=0.002, 0.033 respectively). However, there was no significant difference between the asthma groups in terms of ABSI (p=0.529).

The findings of this study indicate that depressive symptoms, increased BMI and WC were significantly associated with poor asthma control. But ABSI is no superior to BMI in detecting asthma control and depressive mood. However, we should prompt our patients to treatment and exercise, especially for abdominal obesity. We should recommend that asthma patients with depression consult a psychiatrist. In this way, we can control our asthma patients more effectively by minimizing the existing risks.

Keywords: Asthma, depression, body mass index, a body shape index

Introduction

Obesity is the most common cause of preventable death, after smoking (1,2). Increased adipose tissue in obesity is thought to be associated with many diseases such as Type 2 diabetes, metabolic syndrome, hypertension and asthma. Asthma is a lifelong disease that makes it difficult to breathe with narrowing of the airways and continues in attacks. Controlling asthma is important both to prevent the progression of the disease and improve the quality of life (3). Obesity increases asthma attacks and physiological loss of lung function (4). Depression may be one of the risk factor that increase obesity in these patients. 60% of people with depression are obese and the rate of depression in obese people has doubled (5, 6).

Studies have demonstrated the relationship between depression and poor asthma control (7).

BMI is the measurement used to assess obesity. However, it is now thought that central or abdominal fat deposition is more dangerous for diseases, whereas BMI does not measure for deposition locations for fat (8,9). WHO reported that Waist circumference (WC) is associated with disease risks and suggests that WC could be used as a alternative to BMI (10). Recently, a new obesity index (A Body Shape Index, ABSI) based on WC was developed. ABSI is a new health indicator reflecting the fatal dangers behind obesity due to both obesity and internal fat and calculated as Waist circumference /BMI^{2/3} X Length(m) ^{2/3} (11).

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In this study, our aim was to examine the effect of obesity and depression on asthma control in a way that questions the usability of ABSI, which is new in abdominal obesity measurement.

Materials and Methods

A total of 99 asthma patients aged between 18-80 years who were diagnosed and followed up in outpatient clinics of Chest Diseases Department were included in the study.

Height, weight and waist circumference of the patients were measured. Body mass index was calculated by weight / height² (kg / m²) formula. The range of 27.9-31.1 for men and the range of 27.4-32.2 for women were defined as obese. The range of 31.2-45.4 for men and the range of 32.3-44.8 for women were defined as morbidly obese. Waist circumference / BMI $^{2/3}$ X length (m) $^{2/3}$ were calculated for A Body Shape Index measurement. The ABSI is indicated numerically. It does not have a classification as in BMI.

Steroid use, comorbidities and psychiatric fallowup were determined as the hospital system records of patients who were diagnosed by a doctor and received regular treatment for at least one years were obtained.

Pulmonary Function Test was applied to all patients by the same trained person. Asthma Control Test was applied. If total score is 25, it is evaluated as full control, 24-20 as partial control and ≤ 19 as non-control (12).

Beck Depression Scale consisting of 21 questions was applied. In this test, the person is asked to choose the most suitable one among four quarters. Each item gets incremental points

between 0-3 and the total score is obtained by summing them. Total score ranges from 0-9 point: normal, 10-18 point: mild depression, 19-29 point: moderate depression, 30-63 point: severe depression (13).

The study was approved by the Ethics Committee of Medical Faculty of our hospital (19.12.2019/12) and was conducted in accordance with the principles of the Declaration of Helsinki. Prior to participation, all patients signed written documentation that the informed consent process was completed.

Statistical Analysis: Descriptive statistics for the continuous variables were presented as Mean and Standard deviation while count and percentages for categorical variables. One-way ANOVA was performed for the comparison of group means. Following the ANOVA, Duncan multiple

comparison test was used to identify different groups. Chi-square and Fisher's Exact tests were used to determine the relationship between categorical variables. Statistical significance level was considered as 5% and SPSS (ver: 20) statistical program was used for all statistical computations.

Results

A total of 99 asthma participants were enrolled in the primary study. When compare according to Asthma Control Test results, demographic characteristics of the individuals are listed in Table 1. In all groups, most participants were female. Asthma control worsened with increasing age. There was no differences between the groups in terms of asthma duration year and smoking. FEV1 and FVC levels were significantly lower in partial control and poor control groups. Steroid use in last 12 months, comorbidities and psychiatric admission rate was higher in poor control group. BMI and waist circumference were higher in poor control group and this was statistically significant (p=0.002, 0.033 respectively). But in terms of ABSI, there was no difference in the groups.

The relationship between Beck Depression Scale and BMI classification according to male and female patients are reported in Table 2. Obese and morbid obese asthmatics reported high score in Beck Depression Scale than lean and normal weight asthmatics.

Asthma Control Test (ACT) and BMI classification according to gender are reported in Table 3. As assessed by the Asthma Control Test, obese and morbidly obese patients had poorer asthma control. Poor control asthmatics had higher depression scores as assessed with the Beck Depression Scale (Table 4). Depression symptoms are not shown in full control asthmatics.

When we compare BMI and ABSI in terms of correlation with ACT results, we found that BMI obtained statistically significant results than ABSI (Table 5) (p=0.002, p=0.529 respectively). Also when we compare BMI and ABSI in terms of Beck Depression Scale, there was no statistically difference to create significant correlation (Table 6) (p=0.126, p=0.719 respectively).

Discussion

As a result of our study, we found that obese and morbidly obese patients had poor asthma control. We found that the presence of depression caused poor asthma control in all BMI groups. In addition, both

Table 1. Demographics, functional parameters, and laboratory results of the asthma patients

	ACT<20	ACT: 20-24	ACT: 25	0
Parameter	Poor control	Partial control	Full control	р 1
	(n=59)	(n=34)	(n=6)	value
Age (y)	42.8 ± 12.9	41.7 ± 15.4	34 ± 12.9	0.332
Gender (male / female)	20/40	7/27	2/4	0.469
Smoking % (never, current, former)	46.6/41.6/10.1	61.8/26.5/11.8	50/50/0	0.512
Asthma duration (y)	5.1 ± 4.2	5.1 ± 4.1	2.3 ± 1.3	0.275
FEV1, lt	64.8 ± 12.2 b #	65.2 ± 14.6 b	84.5 ± 18 a	0.004
FVC, lt	64.6 ± 13.1 b	64.6 ± 15.9 b	83.8 ± 16.3 b	0.008
Steroid use in last 12 months (n)	1.27 ± 1.59	1.24 ± 1.61	0.33 ± 0.51	0.375
Comorbidities (%)	56.6	50	16.6	0.373
Psychiatric fallow-up (%)	13	3	1	0.266
BMI $(kg/m 2)$	30.7 ± 5.2 a	26.9 ± 5.1 b	26.3 ± 2.8 b	0.002
Waist circumference (cm)	100.9 ± 11.5 a	94.4 ± 12.5 b	93.8 ± 13.3 b	0.033
ABSI	0.0803 ± 0.008	0.0822 ± 0.0065	0.0805 ± 0.0053	0.529

Abbreviations: BMI: Body Mass Index, ABSI: A Body Shape Index, ACT: Asthma Control Test, FEV1- forced expiratory volume in 1 second; FVC, forced vital capacity; FEV1/FVC, percentage of forced vital capacity expelled in the first second of forced expiration.

#: Different lower cases in the same row represent statistically significant differences

Table 2. Beck D	epression Scala	and BMI C	lassification	According To	Gender
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		Beck Depres	ssion Scale		
BMI Group	0-9 Normal (n= 36) n (%)	10-18 Mild depression (n=25) n (%)	19-29 Moderate depression (n=18) n (%)	30-63 Severe depression (n=20) n (%)	p value
Lean					0.272
<20.7 for men	0 (0)	1(4)	1(5.6)	0 (0)	
<19.1 for women					
Normal					
[20.7-26.4 for men,	8(22.2)	7(28.0)	4(22.2)	3(15.8)	
19.1-25.8 for women]					
Overweight					
[26.5-27.8 for men,	6(16.7)	3(12.0)	0 (0)	2(10.5)	
25.9-27.3 for women]					
Obese					
[27.9-31.1 for men,	13(36.1)	9(36.0)	9(50.0)	4(21.1)	
27.4-32.2 for women]					
Morbid obese					
[31.2-45.4 for men,	9(25.0)	5(20.0)	4(22.2)	11(52.6)	
32.3-44.8 for women]					

Abbreviations: BMI: Body Mass Index

the poorly controlled asthma group and the obese and morbidly obese patients had higher depression scores. BMI and waist circumference were higher in the poorly controlled asthma group. However, there was no significant difference between the asthma groups in terms of ABSI. Symptoms are more severe in asthma associated with obesity, increased frequency of hospitalization due to attacks and difficult to respond to treatment. In recent studies was reported that obese asthmatics were approximately five times more hospitalized compared to lean

		Asthma Control Test		
	ACT<20	ACT: 20-24	ACT:25	
BMI Group	Poor control	Partial control	Full control	p value
	(n=59)	(n=34)	(n=6)	
	n (%)	n (%)	n (%)	
Lean	1(1.7)	1(3.0)	0(0)	0.014
<20.7 for men				
<19.1 for women				
Normal	6(10.2)	15(42.4)	2(33.3)	
[20.7-26.4 for men,				
19.1-25.8 for women]				
Overweight	6(10.2)	4(12.1)	1(16.7)	
[26.5-27.8 for men,				
25.9-27.3 for women]				
Obese	22(37.3)	10(30.3)	3(50.0)	
[27.9-31.1 for men,				
27.4-32.2 for women]				
Morbid obese	24(40.7)	4(12.1)	0(0)	
[31.2-45.4 for men,				
32.3-44.8 for women]				

Abbreviations: BMI: Body Mass Index, ACT: Asthma Control Test

Table 4. Data on Asthma Control Test (ACT) and in the distinct Beck Depression Scala

	Beck Depression Scale				
	0-9	10-18	19-29	30-63	
	Normal	Mild depression	Moderate depression	Severe depression	p value
ACT	(n=36)	(n=25)	(n=18)	(n=20)	
	n (%)	n (%)	n (%)	n (%)	
ACT<20					0.086
Poor control	19(52.8)	16(64)	12(66.7)	13(63.2)	
(n=59)					
ACT: 20-24					
Partial control	11(30.6)	9(36)	6(33.3)	7(36.8)	
(n=34)					
ACT:25					
Full control	6(16.7)	0(0)	0(0)	0(0)	
(n=6)					

asthmatics (14). A number of common mechanisms have been identified that increase the incidence of both obesity and asthma. These can be listed as mechanical effects of obesity, inflammation, oxidative stress, genetic and epigenetic factors, lifestyle and environmental exposures.

When we inquired about the applications of the patients to the psychiatric outpatient clinic, we found that those who were under poor asthma control had higher psychiatric admissions. Asthmatic patients with depression may not be able to assess asthma symptoms correctly. Also they may have difficulty in detecting impaired lung functions. Frequent shortness of breath attacks are very stressful for a poorly controlled asthma patient. This may be accompained by different psychological disorders such as depression, panic attacks and anxiety (15). The negative effect of depression on cognitive functioning may affect

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	Asthma Control Test	n	Mean	Std. Dev.	р
BMI	ACT:25 Full control	6	26.300 b #	2.8643	
	ACT: 20-24 Partial control	34	26.991 b	5.1151	0.002
	ACT<20 Poor control	59	30.742 a	5.2850	
	Total	99	29.185	5.4221	
ABSI	ACT:25 Full control	6	0.08050	0.005394	
	ACT: 20-24 Partial control	34	0.08221	0.006556	0.529
	ACT<20 Poor control	59	0.08039	0.008096	
	Total	99	0.08101	0.007458	

Table 5. Comparison results for BMI and ABSI by Asthma Control Test

Abbreviations: BMI: Body Mass Index, ABSI: A Body Shape Index

: Different lower cases represent statistically significant differences

Table 6. Comparison results for BMI and ABSI by Beck Depression Scala

					р
BMI	0-9 Normal	36	29.142	5.1595	0.126
	10-18 Mild depression	25	27.760	4.6242	
	19-29 Moderate depression	18	28.967	5.9298	
	30-63 Severe depression	20	31.653	5.9516	
	Total	99	29.244	5.4179	
ABSI	0-9 Normal	36	0.08064	0.009131	0.719
	10-18 Mild depression	25	0.08224	0.006863	
	19-29 Moderate depression	18	0.08139	0.006354	
	30-63 Severe depression	20	0.07974	0.005694	
	Total	99	0.08101	0.007458	

Abbreviations: BMI: Body Mass Index, ABSI: A Body Shape Index

decision-making abilities of asthma patents leading low confidence in one's ability to self-manage their asthma (16). Poor health behaviors, such as smoking are more common in patients with depression. These behaviors may aggravate asthma (17). It has shown that proinflammatory cytokines are found at higher levels in patients with depression. These cytokines can cause common somatic symptoms such as fatigue and appetite disorders. (18).

It has been reported that in asthmatics with depressive symptoms, cholinergic-mediated airway narrowing may develop under psychological stress. (19).Medication compliance was reduced in depressive asthmatics (20). In 2002 according the data obtained from the World Health Survey, which collected data from 54 countries by the WHO, 65% of countries showed a relationship between depression and asthma (21). In a study cocluded after a 20- year follow- up period reported that elevated depressive symptoms were associated with a 1.26- fold increased risk of asthma (independent of BMI) (22).

A large study showed that asthma patients had a 1.6 times greater risk of depression than non-

asthma patients (23). Another one showed that asthma control is poorer in less educated, obese, and depressed asthmatics (24). In a meta-analysis, a significant relationship was reported between obesity and depression, especially in women (25). We reached similar resultr in our study.

There is a relationship between concomitant obesity and depression and uncontrolled asthma. This is because depression and obesity can be partially explained as involving a common pathophysiology and common risk factors. The reason for the increase in obesity in asthmatic patients may be a behavior disorder such as tendency to feed with high calorie foods while under physiological stress. Psychological distress Hypothalamic-pituitary-adrenal causes axis dysfunction, increases circulating cortisol levels and results in abdominal obesity (26). Also, psychological distress may be worsen due to the negative body perception of obesity (27).

In our study BMI and waist circumference were higher in poor control asthma group. But there was no statistically significant difference between ABSI and asthma control. There are many studies showing that WC demonstrates the risk of death better than BMI (28, 29). However, ABSI corresponds to a more central body volume concentration (11).

When we compare BMI and ABSI with correlation analysis in terms of ACT results, we found that BMI gave us statistically significant results than ABSI. When we compared them in terms of Beck Depression Scale, there was no difference that would create a significant correlation. Therefore, we concluded that ABSI did not superior to BMI in determining asthma control and beck depression scale. ABSI shows the risk among those of the same sex and age. These factors may have affected the results.

In recent studies, BMI was calculated according to the height and weight reported by the patients themselves (30). We measured weight, height and waist circumference in our study, so we think our results are more reliable. However, selfassessment questionnaires were used in this study. Thus, the evaluation of the asthma control and depressive scores may be influenced by subjective factors. These items are limitations of our study.

In conclusion, the findings of this study indicate that depressive symptoms, increased BMI and WC were significantly associated with poor asthma control. We should also add that ABSI is no superior to BMI in detecting asthma control and depressive mood. However, we should prompt our patients to treatment and exercise, especially for abdominal obesity. We should recommend that asthma patients with depression consult a psychiatrist. In this way, we can control our asthma patients more effectively by minimizing the existing risks.

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