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ADAPTIVE POTENTIAL FOR SARCOPENIC OBESITY IN ELDERLY AGE

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Abstract. *Sarcopenia is an age-associated atrophic degenerative change in skeletal muscles, leading to a loss of strength and volume, contributes significantly to an increased risk of disability, and is one of the five risk factors for mortality in the elderly. The article presents the results of studying the adaptive potential in sarcopenic obesity in the elderly: in practically healthy elderly people, a normal level of adaptation was observed, in people with obesity, adaptation strain, in people with sarcopenia, unsatisfactory adaptation, and in people with sarcopenic obesity, adaptation failure. To predict the decline in functional ability after 60 years, it is advisable to use the continuum obesity - sarcopenia - sarcopenic obesity, to determine the level of energy metabolism.*

Introduction. Sarcopenia is an age-associated atrophic degenerative change in skeletal muscles that leads to loss of strength and volume, contributes significantly to an increased risk of disability, and is one of the 5 risk factors for mortality in the elderly. The term "sarcopenic obesity", reflecting the combination of obesity and sarcopenia, has been used relatively recently. Currently, there is an increase in the prevalence of both sarcopenia and sarcopenic obesity, which is due, on the one hand, to an increase in life expectancy of the population (in 2000 there were about 600 million people over 60 years old, and by 2050 up to 2 billion are expected).). On the other hand, this is due to an increase in the prevalence of obesity in the population [1-6].

The purpose of this work is to study the adaptive potential in sarcopenic obesity in the elderly.

Materials and methods

The study included 162 elderly people aged 65 to 74 years, incl. 72 men and 90 women, the average age of the patients was 69.2+3.4 years.

All people were divided into 4 groups. The 1st group included practically healthy elderly people (38 people), the 2nd group - obese, but not having sarcopenia (46 people), the 3rd - elderly people with sarcopenia, but not obese (37 people), in the 4th - people with sarcopenic obesity (41 people). The relevant characteristics are shown in table 1.

All people included in the study underwent anthropometric measurements: measurement of height, body weight, measurement of waist, hips, their ratio, calculation of the Quetelet index. Also, a bioimpedance study was performed using the AVS-02 Medass equipment (Russia), muscle strength was measured using a DMER-120-0.5-D dynamometer (Tves, Russia).

The interpretation of the results of the study was carried out in accordance with the recommendations of the European Working Group on Osteoporosis and Sarcopenia (2009).

Blood samples were taken from all people included in the study.

The state of adaptation of the body was assessed on the basis of anthropometric and hemodynamic data, as well as biochemical blood parameters: the content of adenosine triphosphate (ATP), adenosine diphosphate (ADP) and lactate dehydrogenase (LDH). The cell energy potential (EP) was calculated, reflecting the rate of mitochondrial respiration according to the ratio: EP = ATP/ADP. The level of adaptation was characterized based on the values of the adaptive potential (AP), the calculation of which was carried out according to the method of R.M. Baevsky in the modification of A.P. Berseneva et al. (1987, 1997) according to the following formula:

AP (in points) = 0.011 • (HR) + 0.014 • (SBP) ++ 0.008 • (DBP) + 0.014 • (age, years) ++ 0.009 • (body weight, kg) – 0.009 • (height, cm) - 0.27,

where HR is the heart rate (per minute); SBP - systolic blood pressure (mm Hg); DBP - diastolic blood pressure (mm Hg).

Index values were taken as satisfactory adaptation

AP = 2.1 and below, the adaptation voltage was stated at values from 2.11 to 3.2 points; at values from 3.21 to 4.3 - unsatisfactory adaptation and from 4.3 and above - failure of adaptation.

For statistical analysis of the results obtained during the study, we used the Student's t-test. and the 0-distribution hypothesis, wherein the difference in scores is significant at t 2, in which case $p<0.05$. The Upton method was also applied (the study of data in contingency tables «2x2» to assess the differences between non-parametric parameters with the calculation of the indicator $\chi 2$. Statistical processing of the data was carried out, which were entered into Excel spreadsheets, mathematical and statistical analysis of the data was carried out using program «Statgraphics plus for Windows», version 11.0.

Results and its discussion

Table 1 shows the characteristics of adipose tissue in the composition of the body of the elderly, depending on the presence / absence of sarcopenia and obesity. The index of fat mass in obesity (Group 2) and sarcopenic obesity (Group 4) was comparable and amounted to 27.1+0.7 kg and 26.2+0.2 kg, respectively. At the same time, the indicator of fat mass in obesity was significantly higher ($p<0.05$) than in people without obesity and sarcopenia (Group 1), in which this indicator was 18.1+0.6 kg, and in elderly people with sarcopenic obesity, this indicator was significantly higher ($p<0.05$) than in people with sarcopenia (group 3), in which it was 17.2 + 0.5 kg.

The proportion of fat in obesity (Group 2) and sarcopenic obesity (Group 4) was comparable and amounted to 35.8+0.03% and 32.7+0.02%, respectively. At the same time, the indicator of fat mass in obesity was significantly higher ($p<0.05$) than in people without obesity and sarcopenia (Group 1), in which this indicator was 28.5+0.02, and in elderly people with sarcopenia In obese patients, this indicator was significantly higher ($p<0.05$) than in people with sarcopenia (Group 3), in whom it was 26.4+0.01.

Table 1

Body composition data in the elderly

Index	Patients groups			
	1 (n=38)	**2 (n=46)**	**3 (n=37)**	**4 (n=41)**
Fat mass (kg)	18,1±0,6	27,1±0,7*	17,2±0,5	26,2±0,2*
Fat percentage (%)	28,5±0,02	35,8±0,03*	26,4±0,01	32,7±0,02*
Subcutaneous fat (cm2)	211,3±4,0	261,1±2,2*	215,1±4,1	256,2±3,2*

Visceral fat (cm^2)	46,2±0,3	65,9±2,9*	45,2±0,4	62,2±1,8*
Body mass index (kg/m^2)	23,2±1,1	33,1±0,7*	21,4±2,0**	26,2±3,1**

*p<0.05 compared with the 1st (control) group and with the 3rd group (with sarcopenia);

**p<0.05 compared to group 2 (obese).

The index of subcutaneous fat in obesity (Group 2) and sarcopenic obesity (Group 4) was also comparable and amounted to 261.1+2.2 cm^2 and 256.2+3.2 cm^2, respectively. At the same time, the indicator of fat mass in obesity was significantly higher (p<0.05) than in people without obesity and sarcopenia (Group 1), in whom this indicator was 211.3+4.0 cm^2, and in elderly people with in sarcopenic obesity, this indicator was significantly higher (p<0.05) than in people with sarcopenia (group 3), in whom it was 215.1+4.1 cm^2. A similar picture was observed in the analysis of indicators characterizing visceral fat. The indicator of visceral fat in obesity (Group 2) and sarcopenic obesity (Group 4) was also comparable and amounted to 65.9+2.9 cm^2 and 62.2+1.8 cm^2, respectively. At the same time, the indicator of fat mass in obesity was significantly higher (p<0.05) than in people without obesity and sarcopenia (Group 1), in which this indicator was 46.2+0.3 cm^2, and in elderly people with in sarcopenic obesity, this indicator was significantly higher (p<0.05) than in people with sarcopenia (group 3), in whom it was 45.2+0.4 cm^2.

Thus, it turned out that the characteristics of adipose tissue in the body of elderly people who are practically healthy and those with sarcopenia are identical. Characteristics of fat in the body composition of people with sarcopenic obesity were generally similar to those in people with obesity, with the exception of the body mass index, which was significantly lower (26.2+3.1 kg/m^2 vs. 33.1+0.7 kg $/m^2$, p<0.05), which is explained by the loss of muscle mass.

We studied adaptation rates in the elderly depending on the presence/absence of sarcopenia and obesity (Table 2).

Table 2

Data on adaptation levels (adaptive potential) in elderly patients

Index	**Group**			
	1 (n=38)	**2 (n=46)**	**3 (n=37)**	**4 (n=41)**
Normal adaptation (Person /%)	9 (23,6%)	3 (6,5 %)	0	0
Adaptation voltage (Person/%)	26 (68,5%)	21 (45,8 %)	9 (24,3 %)	8 (19,5 %)
Unsatisfactory adaptation (Person /%)	3 (7,9 %)	17(36,9%)	12 (32,5%)	6 (14,7%)
Disruption of adaptation (Person /%)	0	5 (10,8%)	16 (43,2 %)	27 (65,8 %)
AP, points	2,0±0,02	2,9±0,04*	3,4±0,03*,**	4,4±0,07*,**,#

*p<0.05 compared with the 1st (control) group;
**p<0.05 compared with group 2 (obese);
#p<0.05 compared to the 3rd group (with sarcopenia).

Analysis of adaptation in elderly patients showed the following results. Thus, in the group of practically healthy elderly people, the level of normal adaptation was 23.6%, the level of stress of adaptation was 68.4%, the level of unsatisfactory adaptation was 7.9%, and the indicator of the level of adaptation failure was 0. For a group of people with obesity , but without sarcopenia, the following results were obtained: the level of normal adaptation - 6.5%, the level of stress of adaptation - 45.6%, the level of unsatisfactory adaptation - 36.9%, the level of adaptation failure - 10.8%. In the group of elderly people with sarcopenia, but not obese, the indicators were as follows: the level of normal adaptation - 0, the level of stress of adaptation - 24.3%, the level of unsatisfactory adaptation - 32.4%, the level of adaptation failure - 43.2% . In the group of people with sarcopenic obesity, the indicator of normal adaptation was equal to 0, the level of stress of adaptation was 19.5%, the level of unsatisfactory adaptation was 14.6%, the level of adaptation failure was the highest in comparison with other groups - 65.8%.

Conclusions

1. Practically healthy elderly people had a normal level of adaptation, people with obesity had a strain of adaptation, people with sarcopenia had an unsatisfactory adaptation, and people with sarcopenic obesity had a failure of adaptation.

2. With an increase in the degree of carbohydrate metabolism disorder, an increasing decrease in the adaptive capabilities of the body took place, and the development of senile asthenia in the form of sarcopenia as its manifestation potentiates this negative cascade up to a breakdown in adaptation during the development of sarcopenic obesity.

3. To predict the decline in functional ability after 60 years, it is advisable to use the continuum obesity - sarcopenia - sarcopenic obesity.

4. To develop comprehensive gerontological programs in the detection of sarcopenic obesity, it is advisable to use not only standard methods, such as bioimpedancemetry, but also to determine the level of energy metabolism, which reaches maximum values in sarcopenic obesity, which should be considered as a predictor of adaptation failure and risks of a progressive decrease in functional ability .

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