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SEX HORMONES AS PREDICTORS OF THE DEVELOPMENT OF DYNAPENIA IN THE ELDERLY

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Abstract:

Age-associated changes in muscle strength and mass are among the basic factors in the formation and progression of senile asthenia (frailty). All while a lot of research has been carried out with regard to sarcopenia (reduction of muscle mass and strength), the problem of dynapenia (or presarcopenia, which is a decrease in muscle strength without a change in muscle mass) remains rarely considered. This paper presents the results of the studies of the levels of the main sex hormones in elderly women and men with dynapenia and with dynapenic-obesity. It was shown that the dynapenia in elderly women and men is associated with an imbalance in the level of sex hormones in the form of a decrease in the content of someof them in the blood serum. This imbalance is exacerbated by the combination of dynapenia and obesity, and a deficient level of total testosterone may serve as a predictor of the development of dynapenia in both elderly men and women.

Keywords: *dynapenia, obesity, elderly, testosterone, estradiol, progesterone.*

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INTRODUCTION:

In recent years, gerontological science and practice have been focusing on various aspects of the influence of geriatric syndromes on the outcomes of diseases and the quality of life [1-3]. At present, it has been proved that sarcopenia is an important component of pathological aging and senile asthenia of premature aging [4, 5]. At the same time, very few works are devoted to the problems of the formation of an early stage of sarcopenia - presarcopenia, or dynapenia, which is important for the search in the future for adequate methods of prevention and treatment of this stage both within the framework of classical and preventive geriatrics [6-9]. As the literature review on the problem of aging prevention shows, some hormones and signaling molecules can make a difference in the genesis of sarcopenia (sex hormones, vitamin D, thyroid hormones, etc.). At the same time, their role in dynapenia has not been fully established [10, 11, 12]. On the other hand, the important problem of geriatrics is the development of sarcopenic obesity in patients, when the age-associated deficiency of muscle mass and strength is accompanied by the appearance of an excessive fatty tissue, which leads to further progression of sarcopenia. But the problem of the relationship between dynapenia and obesity in the literature is practically not considered. There is little information about the interrelationships between the exchange of sex hormones and the stage of dynapenia in connection with obesity, which actualizes the research topic.

Objective of this research is to study the levels of sex hormones during dynapenia in elderly women and men.

MATERIALS AND METHODS:

The study involved 477 elderly aged 65 to 74 years who were divided into the following groups:

1. Elderly female patients (n=239, average age 69.2±2.8 years old):

1.1. no dynapenia and no obesity (n=78, average age of patients - 68.9±2.7 years old);

1.2. dynapenia without obesity (n=80, average age of patients - 69.1±2.8 years old);

1.3. dynapenia with obesity (n=80, average age of patients - 69.3±2.8 years old).

2. Elderly male patients (n=238, average age 69.1±2.8 years old):

2.1. no dynapenia and no obesity (n=79, average age of patients - 69.9±2.8 years old);

2.2. dynapenia without obesity (n=80, average age of patients - 70.0±2.8 years old);

2.3. dynapenia with obesity (n=79, average age of patients - 69.8±2.8 years old).

All patients had no oncological diseases, and the available somatic diseases were compensated and did not classified as the heavy and medium-heavy forms. Each patient gave his/her informed consent to participate in the study.

To determine dynapenia, a bioimpedanceometric study was carried out on AVS-02 Medass equipment (Russia), measurement of muscle strength using the DMER-120-0.5-D dynamometer (Tves, Russia), based on the recommendations of the European Society for the Study of Osteoporosis and Sarcopenia (2009).To determine the degree of obesity, the calculation of the body mass index was used. Obesity was diagnosed with body mass index more than 30 kg/m^2, (World Health Organization, WHO: Global Database on Body Mass Index, 2014).

We determined the levels of total testosterone, estrogen, progesterone. Venous blood was sampled in each subject in the morning on an empty stomach by a puncture method from the ulnar vein with a wide needle into centrifuge tubes with an anticoagulant (EDTA, heparin or citrate serum), followed by centrifugation an by hormone level study. The content of hormones in the blood was determined by electrochemiluminescent immunoassay (ECLIA), on the MR-96A Mindray immunoassay plate analyzer (China), and the Beckman Coulter 33560 reagents were used. The level of testosterone was considered to be 0.1-1.42 nmol/l in women, and 6.68-25.7 nmol/l in men. With respect to estradiol, the level of this hormone was 0-54.7 pg/ml in women, and 7.63-42.6 pg/ml in men. With respect to progesterone, the level of this hormone was considered to be normal in women - 0.3-2.5 nmol/l, in men - 0.7-4.3 nmol/l.

The processing of the results of the study included the application of the following methods: calculation of the mean absolute and relative values with the calculation of the mean error; evaluation of the significance of the differences between the two sets by the Student t-test. The materials contained in the formalized maps were added to the Excel tables, the mathematical and statistical data processing was performed using Statgraphics plus for Windows, version 8.0.

RESULTS AND DISCUSSION:

During our work, we studied the use of sex hormone levels as predictors of the development of dynapenia in elderly people.

Data on the levels of total testosterone in elderly women and men are presented in Table 1. Women without dynapenia and obesity had the level of total testosterone equal to 1.33±0.7 nmol/l, which

corresponds to normal, women with dynapenia without obesity - 0.10±0.2 nmol/l (p<0.05 compared with the previous group), women with dynapenia and obesity - 0.08±0.1 nmol/l (p<0.05 compared with patents without dynapenia and without obesity, but compared with women with dinapenia without obesity the difference in indices is insignificant, p>0.05). It can be stated that the presence of dynapenia in women was associated with a deficient level of serum testosterone.

Men without dynapenia and obesity had the level of total serum testosterone equal to 15.1±4.1 nmol/l, which corresponds to normal, men with dynapenia without obesity - 5.8±3.6 nmol/l, which is 3 times lower than in patients without dynapenia (p<0.05), men with dynapenia and obesity - 4.1±2.3 nmol/l (p<0.05 compared with patents without dynapenia and without obesity, but compared with men with dinapenia without obesity the difference in indices is insignificant, p>0.05).It can be stated that the presence of dynapenia in men, as well as in women, was associated with a deficient level of serum testosterone.

Table 1.The content of total serum testosterone in elderly people (nmol/l)

Parameter	Groups		
	Women		
	1.1 (n=78)	1.2 (n=81)	1.3 (n=80)
Total testosterone, nmol/l	1.33±0.7	0.10±0.2*	0.08±0.1*
	Men		
	2.1 (n=79)	2.2 (n=80)	2.3 (n=79)
Total testosterone, nmol/l	15.1±4.1	5.8±3.6*	4.1±2.3*

* p<0.05 compared with people without dynapenia and without obesity

The results of the study of estradiol levels in elderly women and men are presented in Table 2.

Table 2. The content of estradiol in elderly people (nmol/l)

Parameter	Groups		
	Women		
	1.1 (n=78)	1.2 (n=81)	1.3 (n=80)
Estradiol, nmol/l	25.2±3.2	22.1±3.1	15.9±2.8*,**
	Men		
	2.1 (n=79)	2.2 (n=80)	2.3 (n=79)
Estradiol, nmol/l	10.6±4.1	8.8±1.6	7.7±1.3*,**

* p<0.05 compared with people without dynapenia and without obesity
** p<0.05 compared with people with dynapenia and without obesity

Women without dynapenia and obesity had the level of estradiol equal to 25.2±3.2 nmol/l, which corresponds to normal; women with dynapenia without obesity - 22.1±3.1 nmol/l (the difference in the indices is insignificant compared to the previous group, p>0.05), but women with dynapenia and obesity had the level lower than in other groups of women and amounted to only 15.9±2.8 nmol/l (p<0.05). Thus, a significant decrease in the serum estradiol level occurred only in women with the combination of dynapenia and obesity. As for men, the following data were obtained. Men without dynapenia and obesity had the level of estradiol equal to 10.6±4.1 nmol/l, which corresponds to normal, men with dynapenia without obesity had this level slightly lower equal to 8.8±1.6 nmol/l, which also refers to the norm and does not differ from the corresponding indicators in men without dynapenia and without obesity (p>0.05). A similar situation was observed in men with dynapenia and obesity, whose serum estradiol level was 7.7±1.3 nmol/l and did not differ from the estradiol level in men of the other two groups (p>0.05).

The study of the level of serum progesterone in elderly people revealed the following patterns (Table 3).

Table 3. The content of progesterone in elderly people (nmol/l)

Parameter	Groups		
	Women		
	1.1 (n=78)	1.2 (n=81)	1.3 (n=80)
Progesterone, nmol/l	1.3±0.9	1.1±0.5	0.8±0.3*,**
	Men		
	1.1 (n=79)	1.2 (n=80)	1.3 (n=79)
Progesterone, nmol/l	1.5±0.7	0.9±0.1*	0.8±0.1*

* p<0.05 compared with people without dynapenia and without obesity
** p<0.05 compared with people with dynapenia and without obesity

Women without dynapenia and obesity had the level of progesterone equal to 1.3±0.9 nmol/l, which corresponds to normal; women with dynapenia without obesity - 1.1±0.5 nmol/l (the difference in the indices is insignificant compared to the previous group, p>0.05), while women with dynapenia and obesity had the level of serum progesterone significantly lower (p<0.05) than in other groups of women and amounted to 0.8±0.3 nmol/l. The examined men without dynapenia and obesity had the progesterone level equal to 1.5±0.7 nmol/l, men with dynapenia without obesity and men with dynapenia and obesity had significantly lower progesterone levels (p<0.05) compared to those without dynapenia and obesity: 0.9±0.1 nmol/l and 0.8±0.1 nmol/l, respectively. It is interesting that in all three groups of men, despite the significant difference in serum progesterone levels, the mean values corresponded to the normal ones.

SUMMARY:

1. Dynapenia in elderly women and men is associated with an imbalance in the level of sex hormones in the form of a decrease in the content of some of them in the blood serum, exacerbated by the combination of dynapenia and obesity.
2. The deficient level of total testosterone may serve as a predictor of the development of dynapenia in both elderly men and women.
3. The study of levels of estradiol and progesterone cannot serve as a predictor of the development of dynapenia, since the level of estradiol is reduced only by the combination of dynapenia and obesity, and the levels of progesterone do not exceed values interpreted as normal for the elderly.
4. Decreased levels of estradiol and progesterone in the combination of dynapenia and obesity can be a risk factor for the progression of dynapenia into sarcopenia.

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