POSSIBILITY OF ARTERIAL HYPERTENSION DEVELOPMENT IN THE POPULATION OF THE NORTHWEST OF RUSSIA WITH EXCESSIVE BODY WEIGHT AND OBESITY

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The results of the study showed the prevalence of arterial hypertension, excessive body weight and obesity in population of 2 areas of the Northwest of Russia. Possibility of arterial hypertension development in respondents with excessive body weight and obesity of various degrees was determined. High risk and strong correlation between the II-III degrees of obesity and parameters of arterial hypertension was proved.

Keywords: selective study, prevalence of arterial hypertension, obesity, relation of chances, correlation dependence.

The aim of the work was to study prevalence of arterial hypertension (AH), EBW and obesity in population of the Northwest of the Russian Federation, and also to determine the chances of combination of obesity in patients with arterial hypertension of various degrees considering sex and age-related features.

Introduction
According to modern ideas, obesity serves as the triggering mechanism of the whole metabolic cascade; it predisposes to AH and may cause the decrease of peripheral tissue sensitivity to insulin, and subsequent excessive body weight. According to Fremingemsky study, the probability of development of AH and cardiovascular pathology in general is 50% higher for people with excessive body weight than for those with normal body weight. There are convincing data, that obesity can be both an independent risk factor, and aggravating one, significantly worsening the course and prognosis of both arterial hypertension, and ischemic heart disease (IHD).

The risk of cardiovascular and general mortality rate was noted to increase even when reaching the upper limit of the normal body weight. It was found out that the risk of IHD in patients with arterial hypertension is 2-3 times and that of stroke – 7 times higher than in normal subjects. According to the results of Fremingemsky study both systolic and diastolic BP increased on the average by 1 mm Hg with the increase of body weight by 1 kg (Ackroff K., Sclafani A., 1996). Degree of cardiovascular risk at obesity depends on distribution of fatty tissue in the body, and is significantly higher at central or “android” type.

Control over arterial pressure is a primary task in treatment of the given contingent of patients. It allows reducing the number of the main cardiovascular events by 51%, while lipidemia control reduces the risk of mortality from the ischemic heart disease only by 36%, and correction of hyperglycemia level can reduce frequency of myocardial infarctions only by 16%.

Materials and methods

The characteristic of selective study
Selective epidemiological study (cross-sectional study) was carried out to reveal the arterial hypertension (AH) and its separate risk factors (RF) in adult population of the Novgorod and Pskov areas. Single random sample based on the number of a general totality was used in the study.

Body weight parameter (BWP) was calculated using the formula: weight (kg) / height (m²) according to references of WHO international group on obesity (IOTFF WHO, 1997).

AH assessment was carried out according to JNC classification VII “the Seventh report of the United National Committee of the USA on Prevention, Revealing, Evaluation and Treatment of Hypertension” and ESH-ESC, 2003 “Recommendations of the European Society for Hypertension and the European Society of Cardiologists for AH Treatment” (Britov A.N., Bystrova M.M., 2003).

Table 1

| Age          | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70 and over | Total |
|--------------|-------|-------|-------|-------|-------|-------------|-------|
| Men          |       |       |       |       |       |             |       |
| Group of patients with AH | 30    | 43    | 69    | 92    | 95    | 82          | 411   |
| Control group | 135   | 100   | 85    | 52    | 37    | 19          | 428   |
| Women        |       |       |       |       |       |             |       |
| Group of patients with AH | 23    | 44    | 126   | 159   | 159   | 146         | 657   |
| Control group | 286   | 151   | 188   | 89    | 51    | 25          | 790   |
| Total        |       |       |       |       |       |             | 2286  |
Considering that the data obtained are characterized by asymptomatic normal distribution, coefficient of disagreement or Mantek-Henzel relation of chances was used (Odds ratio).

Statistical data processing was done using the program STATISTICA 99, version 5.5A. License No. axr 107b218402fa.

Results of own research
Results of the selective study performed in the population of the Novgorod and Pskov areas on AH prevalence have revealed statistically reliable differences between the level of AH prevalence in the population of the Northwest of the Russian Federation (due to materials of examination of the population of the Novgorod and Pskov areas) and the data for the entire Russian Federation.

Thus, if the level of AH prevalence in women in the Northwest of the Russian Federation is 7.7% higher than an average index in Russia, at the same time it is 12.1% in men. Accordingly parameters in the Novgorod area are the highest across the compared territories, and in men the parameter is 2.3% higher than that in women (in the Pskov area – 2.6%). As for sex-age features of AH prevalence in the population of the Novgorod area, high density of parameters (r=0.93) irrespective of gender features was found, except for the age group of 20-29, in which the initial AH values in men were found to exceed similar values in women (P<0.01). In other age groups no statistically significant differences were registered (> 0.05).

Rates of AH parameters increase (fig. 1) have different values, and are most expressed at transition from the age group of 30-39 (24%). In the subsequent age groups rates of growth of the parameter are reduced (18.2; 7.5%, accordingly) and double again in the age group of 70+ (15.1 %). The maximum figures are registered in the age group of 70+, however, a turning-point in the dynamics of parameter growth is the age group of 50-59.

Regarding the dynamics of AH prevalence in the population of the Pskov area (fig. 2), gender features connected with the excess of AH level prevalence in men of the age groups of 20-29 (P <0.05) and 30-39 (P <0.01) and women of the age group of 60-69 (P <0.01) were found. In other age groups no statistical differences were registered. Lower initial AH values in the population of the Pskov area are of special interest. Dynamics of growth of AH parameter in women is of the linear character up to the age group of 60-69, and in men – step-like, in which the critical age is 40-49 - 50-59 (parameter increase by 26.8%).

The study showed (fig. 3, 4) that body weight deficiency (BWD) in male subpopulation was 1.4%, in female – 3.1%, i.e. in women prevalence of the given parameter was 2.2 times higher than the same parameter in men.
The normal body weight parameter (NBW) is in one statistical line and has no statistical gender differences. It was 43.8% in men and 38.2% in women. Preobesity parameter is quite comparable with NBW and is 40.5% in men and 31.4% in women, i.e. in women the number of persons with NBW and preobesity is a little bit lower, than in men.

The most significant statistical differences were found in assessment of various degrees of obesity. Thus, if the 1st degree obesity in men was 11.8%, in women it was 19.3%. The 2nd degree obesity was 1.8% in men and 5.8% in women, and obesity of the 3rd degree was 0.7% and 2.2%, accordingly.

Thus, the above data shows that 27.3% of women and 14.3% of men suffer from obesity. At the same time obesity of the 2nd and the 3rd degree is faced by 2.5% of men and 8% of women.

As for sex-age features of BWD prevalence (fig. 5, 6) it was established, that the parameter tends to decrease with age. The highest values were noted in the age group of 20-29, especially in women, and in the age group of 30-39. In men the parameter is statistically non-uniform depending on the age group. Thus, in the senior age groups it is 1.5-2 times lower, than in the younger age groups. The most significant statistical differences were noted in the senior age groups in women, where the parameter is several times lower, than in the younger age groups.

Sex-age feature of NBW prevalence in the population is of the parabolic type of distribution with the orientation of the bottom part of the parabola to the age group of 50-59 and 60-69, irrespective of sex. Special feature of the given type of BW parameter is statistical compatibility of age parameters, irrespective of sex.

The same pattern was found in the study of preobesity, except for distribution of the type of the parabola, which had the classical form with the peak of distribution in the age group of 50-59.

In assessment of various degrees of obesity clear-cut statistical gender differences with higher parameters in men were registered.

Prevalence of the 1st degree obesity is of exponential character in women with a step-like type of increase of trend waves with the increase of age gradation. In men less expressed "steepness" of the wave and statistical stabilisation of the parameter in the senior age groups was noted.

Similar pattern was observed in assessment of obesity of the 2nd degree, except for the age group of 70+, in which the decline of the wave was noted. Both in the 1st and the 2nd degrees of obesity distinctly expressed gender differences were present.

In the assessment of the 3rd degree obesity the peak of distribution was found (in the age group of 60-69 in women), and exponential type of distribution in the previous age cohorts. In men the distribution peak was in the age group of 50-59, and the parameter was present only in the senior age groups.

Thus, the above data shows markedly expressed age and gender features of distribution of obesity of various degrees with the prevalence of obesity in women of the senior age groups and deficiency of weight in women in the age group of 20-29.

In order to assess the type of obesity, features of prevalence of the abdominal form of obesity there were studies conducted (tab. 3).

The abdominal type of obesity was shown to be characteristic for 30.9% of women and 15.6% of men. A turning-point in the formation of the given type of obesity is the age group of 40-49, irrespective of sex. Statistical stabilisation of the parameter within 15% is characteristic for men; in women prompt growth with maximum point was noticed in the age group of 70+ (48.5%).

Thus, the obtained results revealed the feature of type of obesity in the population of the Northwest of the Russian Federation due to the prevalence of the abdominal type of obesity in women in the postmenopausal period.

The studies with the use of criteria of demonstrative medicine on the parameter of excessive body weight showed that the relation of chances reached its maximum – 3.0 in women in the age group of 70+ (CI 0.25 ÷ 35.3) and, in general, it was higher in women population (tab. 4).

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**Table 3**

| Age group | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70+ | Average |
|-----------|-------|-------|-------|-------|-------|-----|---------|
| Men       | 13.9  | 9.8   | 20.8  | 16.7  | 14.4  | 17.8| 15.6    |
| Women     | 10.0  | 21.0  | 24.2  | 38.3  | 43.3  | 48.5| 30.9    |
Table 4

| Age group | Sex  | EBW     | Obesity | Abdominal type |
|-----------|------|---------|---------|----------------|
|           |      |         | Rc      | CI ±95% | Rc      | CI ±95% | Rc      | CI ±95% |
| 20-29     | Men  | 1,7     | 0,6     | 4,6     | 9,8     | 1,5     | 63,5    | 0,9     | 0,2     | 4,0     |
|           | Women| 1,5     | 0,5     | 4,8     | 8,0     | 1,1     | 59,1    | 1,7     | 0,6     | 4,4     |
| 30-39     | Men  | 1,4     | 0,6     | 3,3     | 1,2     | 0,2     | 6,5     | 0,8     | 0,2     | 3,8     |
|           | Women| 2,5     | 1,0     | 6,5     | 1,0     | 0,2     | 4,5     | 1,9     | 0,7     | 5,2     |
| 40-49     | Men  | 1,5     | 0,6     | 3,7     | 4,7     | 1,2     | 18,0    | 0,7     | 0,3     | 2,0     |
|           | Women| 2,1     | 0,9     | 5,0     | 6,6     | 2,5     | 17,3    | 1,2     | 0,5     | 2,6     |
| 50-59     | Men  | 1,3     | 0,5     | 3,2     | 5,1     | 1,4     | 18,9    | 1,2     | 0,4     | 3,1     |
|           | Women| 1,8     | 0,8     | 4,3     | 5,6     | 2,0     | 15,2    | 2,3     | 1,1     | 4,7     |
| 60-69     | Men  | 0,8     | 0,3     | 2,9     | 3,0     | 0,5     | 17,3    | 1,1     | 0,3     | 3,5     |
|           | Women| 1,6     | 0,5     | 4,9     | 1,2     | 0,5     | 3,3     | 1,7     | 0,7     | 3,8     |
| 70+       | Men  | 1,8     | 0,6     | 6,1     | 1,9     | 0,2     | 21,5    | 1,5     | 0,4     | 6,4     |
|           | Women| 3,0     | 0,3     | 35,3    | 1,1     | 0,2     | 7,4     | 9,8     | 1,1     | 85,0    |
| Total     | Men  | 2,0     | 1,4     | 2,8     | 6,2     | 3,5     | 11,1    | 1,6     | 1,0     | 2,4     |
|           | Women| 4,0     | 2,9     | 5,6     | 8,6     | 5,8     | 12,6    | 3,7     | 2,8     | 5,0     |
Due to the parameter of obesity it was established, that the most appreciable chances for AH are in women in the age groups of 20-29, 40-49 and 50-59, where $Rc$ was 7.96 (CI 1.07÷59.12); $Rc$=6.6 (CI 2.52÷17.25); $Rc$=5.56 (CI 2.03÷15.19). Similar picture was observed in men, where $Rc$=9.84 (CI 1.52÷63.54); $Rc$=6.6 (CI 2.52÷17.25); $Rc$=5.56 (CI 1.52÷17.25). The most vulnerable group of the population is men at the age of 20-29 suffering from obesity ($Rc$=9.84).

The characteristic of the relation of chances on the parameter of abdominal type of obesity shows, that the highest chances of development of arterial hypertension ($Rc$=9.78) are for women of the senior age group of 70+; the fact was confirmed by the earlier results of prevalence of the parameter $O/O_b$ in women.

The maximum chances are noticed irrespective of sex in relation to obesity of the 2nd and 3rd degrees, which determines the initiation of medical intervention as AH secondary prevention beginning from a preobesity stage. Taking into account test $X^2$ and the upper border of CI, the female subpopulation is more vulnerable, which is probably due to the disturbance of a hormonal background already as early as 20-29 years of age.

Thus, significant influence of obesity on the possibility of arterial hypertension development in respondents was proved.

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Table 5

| EBW and obesity gradation | Rc    | CI (± 95%) | Test $X^2$ | P    |
|---------------------------|-------|-----------|------------|------|
|                           | Men   | Women     | Men        | Women | Men   | Women     |       |      |
| Body weight deficiency    | 0.37  | 0.39      | 0.05±3.08  | 0.15±1.01| 17.45 | 59.56     | 0.000 |      |
| Preobesity                | 2.05  | 3.5       | 1.42±2.94  | 2.49±4.91| 16.52 | 59.65     | 0.000 |      |
| 1st degree obesity        | 4.44  | 5.87      | 2.42±8.15  | 3.84±8.98| 26.48 | 77.51     | 0.000 |      |
| 2nd degree obesity        | 7.83  | 8.56      | 2.07±29.64 | 4.16±17.6| 36.3  | 62.55     | 0.000 |      |
| 3rd degree obesity        | 10.44 | 13.2      | 1.15±94.78 | 3.68±47.1| 15.71 | 54.08     | 0.000 |      |