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ОЦЕНКА ОБЩЕГО СОСТОЯНИЯ ЗДОРОВЬЯ ЖЕНЩИН СО СТЕНОЗИРУЮЩИМИ ПРОЦЕССАМИ ПОЗВОНОЧНОГО КАНАЛА С ПОЗИЦИИ НЕКОТОРЫХ ПОКАЗАТЕЛЕЙ ТЕЛОСЛОЖЕНИЯ И ЛИПИДНОГО ОБМЕНА

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Резюме. Исследованы антропометрический и липидный статус 40 женщин со стенозирующими процессами позвоночного канала поясничного отдела позвоночника, жителей г. Иркутска и Иркутской области. Результаты определения индекса массы тела у 87,5% женщин свидетельствовали об увеличение веса, а также ожирение 1 и 2 степени. Вместе с этим у 85% пациенток выявлен центральный (абдоминальный) тип ожирения, являющийся основным признаком метаболического синдрома. Наиболее часто встречающимся нарушениям липидного обмена были: снижение уровня ЛПВП холестерина (в 80% случаев), повышение концентрации ЛПНП (66,7%) и увеличение коэффициента атерогенности (66,6%). При этом установлена положительная корреляция между индексом талия/бёдра и повышением уровня общего холестерина в сыворотке крови ($p<0,05$). Антропометрические особенности и состояние обмена липидов у данной категории больных свидетельствуют о высокой частоте развития метаболических нарушений. В свою очередь, антропометрические показатели соответствуют повышенному, высокому и очень высокому риску развития сопутствующих заболеваний.

Ключевые слова: стенозирующие процессы позвоночного канала поясничного отдела; индекс массы тела, индекс талия/бёдра; липидный обмен; коэффициент атерогенности; сопутствующие заболевания; женщины; Иркутская область

INVESTIGATION OF THE OVERALL HEALTH OF WOMEN WITH STENOSING PROCESSES OF SPINAL CANAL, TAKING INTO ACCOUNT THE POSITION OF SOME OF THE INDICATORS OF THE PHYSIQUE AND LIPID METABOLISM

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Summary. Background. In developing degenerative-dystrophic spinal diseases risk factors occupy an important place. Among those, one can allocate irrecoverable factors (sex and age), and recoverable ones (hypercholesterinemia and obesity). Excess weight, as well as an increased height, also raises the probability of the spinal pathology early manifestation, and, in particular, the spinal canal degenerative stenosis. The overweight women display degenerative changes in intervertebral disks more often, than men do, and obesity facilitates developing degenerative-dystrophic changes. Obesity is closely related to disorders of lipid metabolism and metabolic syndromes. The disorders of the lipid metabolism, being a risk factor for developing vessel atherosclerosis, may facilitate degeneration of intervertebral disks through deterioration of their blood supply. Despite some known achievements, the issues of complex estimating the anthropometric and lipid indicators for the subjects with the spinal canal stenoses in coupling with the comorbidities have not been studied sufficiently, and, therefore, they do not lose their urgency. The objective of our investigation is to study anthropometric peculiarities, the lipid status, and probability of developing comorbidities with the women who suffer from the lumber spinal canal degenerative stenosis. Methods. We investigated anthropometric and lipid status of 40 women with stenosing processes of spinal canal, aged 28 to 66, who lives in Eastern Siberia region (of Irkutsk city and Irkutsk Region). For all the subjects measured were: height, weight, waist and hips circumferences. Besides, we determined the lipid metabolism indicators in the blood serum: total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, triglycerides, aterogenic index and lipoprotein a. Results. Determining the body weight index with 87.5% of the investigated women testified to a weight gain, as well as to the Degree I and II obesity. 85% subjects displayed the central (abdominal) obesity, which is the basic signature of the metabolic syndrome. Decrease in the HDL cholesterol (80% cases), increase in the LDL concentration (66.7%), and the aterogenic index increase (66.6%) were the most often encountered disorders of the lipid metabolism. Simultaneously, we revealed a positive correlation between the waist/hips index and the total cholesterol increase in the blood serum. The anthropometric peculiarities and the lipid metabolism in this category of subjects testify to a a high incidence of metabolic syndrome. In turn, the anthropometric indicators correspond to increased high, and very high risk of developing comorbidities, which is necessary it must be consider determining the therapeutic approach, and developing the prevention program for patients with the lumber spine canal degenerative stenosis. Conclusions. Thus, body build peculiarities in the interrelation with the lipid metabolism disorder indicators testify to a high probability of developing concomitant complications in women with the lumbar spinal canal stenosis. In turn, the higher frequency of metabolic disorders and characteristic anthropometric indices indicate at a high risk of developing somatopathies that require specific correction and complex prophylaxis measures.

Key words: stenosing process of the spinal canal at the lumbar level; body mass index, waist/hips index; lipid metabolism; the rate of haemoglobin; co-morbidities and complications; women; Irkutsk region.

In developing degenerative-dystrophic spinal diseases, as well as in developing somatic pathology, risk factors occupy an important place. Among those, one can allocate irrecoverable factors (sex and age), and recoverable ones (hypercholesterinemia and obesity) [1-6, 15, 16, 19]. Excess weight, as well as an increased height, also raises the probability of the spinal pathology early manifestation, and, in particular, the degenerative stenosis of the spinal canal [6]. Studies of Lee DY et al. revealed that overweight women display degenerative changes in intervertebral disks more often, than men do [7], and obesity facilitates developing degenerative-dystrophic changes [8]. On the other hand, obesity is closely related to disorders of lipid metabolism and metabolic syndromes [9, 10]. The main feature of a metabolic syndrome is the central (abdominal) obesity, when the waist circumference exceeds 80 centimeters for women, and among its additional criteria, one notes an increase in the triglyceride level, a decrease in the high-density lipoprotein level, and growth in the low-density lipoprotein level. There is evidence that the disorders of the lipid metabolism are

risk factor for developing vessel atherosclerosis, can facilitate degeneration of intervertebral disks through deterioration of their blood supply [8].

At the same time, there are assumptions that there is a dependence of the total cholesterol level and the lipid metabolism on the gene NAT2 allelic variants. In particular, the NAT2 mutations leading to slow acetylation can break a complex and multiphase process of the cholesterol synthesis [11]. The genetic homozygous mutations causing slow acetylation are shown to be revealed more often at the Degree I and II arterial hypertension, which consistent with the total cholesterol levels with relation to the arterial hypertensia increased degree. The connective tissue metabolism, where the NAT1 and NAT2 enzymes participate actively, plays the key role in the pathogenesis of developing spine canal stenoses, but it is scarcely studied [11,12].

We note that there are no data in the literature that characterize the habitus and metabolic peculiarities of women with spinal diseases, who live in the Eastern Siberia region. Despite some known achievements, the issues of complex estimating the anthropometric and lipid indicators for the subjects with the spinal canal stenoses in conjunction with the comorbidities have not been studied sufficiently, and, therefore, they do not lose their urgency [13].

The objective of our investigation is to study anthropometric peculiarities, the lipid status, and probability of developing comorbidities of women who suffer from the lumbar spinal canal degenerative stenosis.

Materials and methods

We examined 40 women with stenosing processes of spinal canal, aged 28 through 66, who live in the Eastern Siberia region (of Irkutsk city and Irkutsk Region). All patients signed a voluntary informed consent for participation in the study. The clinical diagnosis was confirmed by the results of a magneto-resonant and multispiral X-ray computer spine tomography according to the classification of J. Stephen (1995). All patients were measured: height, weight, waist and hips circumferences. Besides, we determined the following lipid metabolism indicators in the subjects' blood serum: total cholesterol, high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), triglycerides (TGs), aterogenic index (AI), and lipoprotein a (Lp(a)). The concentration of the total cholesterol and of its fractions in the blood serum was measured by the Biosystems (Spain) commercial test systems. The Lp(a) level was determined by a set of Mindray (China) reagents. As a measuring device, we used the Dirui CS-T240 (China) automatic biochemical analyzer.

To integrally estimate the anthropometric data, we used the body mass index (BMI), calculated as follows:

$$BMI = \frac{weight\ in\ kg}{height\ in\ m^2}$$

and the waist/hips index (WHI), calculated as:

$$WHI = \frac{waist\ circumference\ in\ cm}{hips\ circumference\ in\ cm}.$$

The waist circumference (WC) indicator was estimated based on the Recommendations[11]. As the comparison data, we used similar indicators for the East-Siberian women without musculoskeletal diseases [15,16]. The obesity classification and the estimation of risk of developing comorbidities were performed by the WHO criteria. We used the latter when estimating the probability of cardiovascular diseases (CVDs). The indicators for the lipid metabolism – total cholesterol, HDL, LDL, TGs, AC, and Lp (a) – were estimated by the referential values in the test system manual. The aterogenic index was calculated as:

$$AI = \frac{total\ cholesterol - HDL}{HDL}.$$

We performed the statistical analysis within the Microsoft Office Excel 2003. The obtained results are presented in the form of a median, 5th, and 95th percentiles.

Results and Discussion

The monosegmentary central spinal canal stenosis was diagnosed for 26 women, one subject had it at L2-L3, one subject – at L3-L4, 18 subjects – at L4-L5, 6 subjects – at L5-S1. The polysegmentary stenosis was localized at L3-L4, L4-L5 and L4-L5, L5-S1 for 6 and 8 women, respectively. Tables 1, 2 present the subjects' age, weight, and anthropometric indicators as compared with the literature data.

Table 1

Anthropometric indicators, age, and weight of women study group compared with the literature data

Anthropometric indicators	Women with the spinal canal degenerative stenosis (n=40)	Women without musculoskeletal diseases (from the literature)		
		S.N. Derevtsova, 2010 [14]		E.V. Kapustina et al., 2013 [15]
Age	50 (31.8; 62.15)	45.1 ± 0.5	62.1 ± 0.4	-
Height	163(153.95; 171.05)	161.9 ± 0.4	159.9 ± 0.4	163.3 ± 0.2
Weight	83(61.9; 101.4)	66.5 ± 1.1	72.5 ± 1.0	61.1 ± 0.3
Body Mass Index (BMI)	32.55(23.27; 38.55)	-	-	23.05 ± 0.5

Table 2

Anthropometric indicators of women with the spinal canal degenerative stenosis

Women (n=40)	Waist Circumference (WC)	Hips Circumference (HC)	Waist/Hips Index (WHI)
	93.5(77.9; 109)	110(95.95; 123)	0.86(0.76; 0.94)

The height of the studied subjects was revealed comparable with the body height of the eastern-siberian women without musculoskeletal diseases [14,15]. At the same time, the subjects have a higher weight and, as consequence, the WHI increase. It found that the WHI median corresponds to obesity I degree and a high risk of developing comorbidities. The majority (35 subjects) have increased high, and very high risk of developing comorbidities (table 3). The results are consistent with the data of K.Yu. Golovin et al. that most patients with the spinal canal stenoses have enlarged body masses or suffer from obesity [16].

Table 3

Distribution of women according to BMI obesity classification (n=40)

	BMI obesity classification and risk of comorbidities by the WHO criteria (1997)				
BMI value	18.5-24.9	25-29.9	30-34.9	35-39.9	over 40
BMI estimation of body mass (BM)	Normal BM	BM increase	Degree I obesity	Degree II obesity	Degree III obesity
Risk of developing comorbidities	Usual	Elevated	High	Very high	Extremely high
Number of subjects	4	11	12	12	1

In turn, the waist circumference median with 34 subjects exceeds 80 cm, which indicates at the central (abdominal) obesity type (fig. 1). Also, the WHI median is within 0.8 to 0.89, and indicate a moderate probability of developing comorbidities. A moderate risk of comorbidity development was revealed for 22 women, whereas 10 subjects were estimated as having a high risk. The results formed the database basis [17].

Table 4 presents the indicators obtained when studying

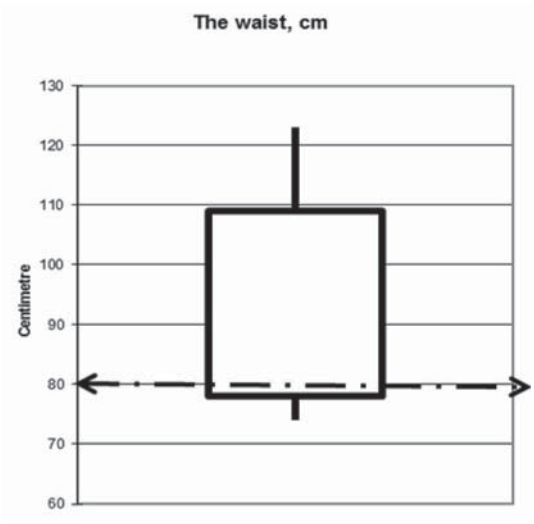

Fig. 1. Distribution of women in the study group by the waist circumference: extreme points are the maximal and minimal values in the group, the white rectangle is confined by the 5th and 95th percentiles, up to 80 cm is the WC normal value [10].

the lipid metabolism. These or other disorders in the lipid metabolism were revealed in 80% of the subjects within the study group. The lowering of HDL level often determined. HDL is an index of reverse cholesterol transport from tissues to the liver and remover it from the body. The increase of the total cholesterol level occurs, as a rule, at the expense of the HDL fraction and due to an increase of triglycerides less. Atherogenic factor that reflects the risk of atherosclerosis development exceeded safe limits in 66.6% of patients. High levels of Lp(a) have been identified in the 6.3% of patients. Lp(a) is proatherogenic factor it can not be treated at the present [18].

Table 4

Indicators of the lipid metabolism in women

Indicators reflecting the lipid metabolism level	Cholesterol	TGs	HDL	LDL	AC	Lp(a)
Units	Mmol/l	Mmol/l	Mmol/l	Mmol/l	-	Mg/l
Reference values*	under 5.8	under 1.7	over 1.68	under 3,9	1.98 – 2.51	0 - 300
Median	6.3	1.85	1.526	3.56	3.13	88.1
5th and 95th percentiles	3.34; 7.78	0.91; 3.4	1.16; 1.82	1.97; 4.18	1.08; 4.73	0; 743.5
Fraction of subjects with the lipid metabolism disorders	68.2%	53.3%	80.0%	66.7%	66.6%	6.3%
*according to the test system manufacturer's manual						

We note that the WC, HC, WHI have increased synchronously with weight and BMI; however, only the WHI have increase correlated with an increase in the total cholesterol level in the blood serum ($p < 0.05$). During the correlation analysis the interrelation was not identified between age and the lipid disorders in the study group of patients. Although sex hormone levels decline with age is the cause of abdominal type of obesity. Besides, the degree of impairment of thyroid functional activity increases, there is decline in the metabolic activity. All this adversely affects the lipid metabolism and these processes more expressed in females [19].

Conclusions

Thus, particular physique and indicators lipid metabolism disorder indicate a high risk for developing concomitant complications in women with stenoses of the lumbar spine. So high incidence of metabolic disorders and specific anthropometric indices indicate a high risk of somatic diseases and require specific correction and prevention measures.

Конфликт интересов. *Авторы заявляют об отсутствии конфликта интересов.*

Прозрачность исследования. *Исследование не имело спонсорской поддержки. Исследователи несут полную ответственность за предоставление окончательной версии рукописи в печать.*

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ИЗМЕНЕНИЕ ЦИТОКИНОВОГО ПРОФИЛЯ СЫВОРОТКИ КРОВИ КРЫС ПРИ МОДЕЛИРОВАНИИ БРОНХОЛЕГОЧНОГО ВОСПАЛЕНИЯ И ВВЕДЕНИИ ИММУНОМОДУЛЯТОРОВ

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Резюме. У крыс моделировали экспериментальную бронхопневмонию введением скипидара в трахею под эфирным наркозом. После операции и далее на протяжении 5 дней (1 раз в сутки) животным внутрибрюшинно вводили раствор одного из исследуемых иммуномодуляторов: полиоксидония – 0,75 мг/кг, трекрезана 25 мг/кг или метапрота 25 мг/кг. После декапитации в крови определяли профиль интерлейкинов, используя наборы MilliplexMapRatCitokine/Chemokine (MerkMillipore). Воспаление снижало в крови концентрации как провоспалительных факторов (ИЛ-1β, ИЛ-2, ИЛ-12, интерферона-γ и хемокина MCP-1), так и антивоспалительных (ИЛ-4, ИЛ-10) цитокинов. При этом повышались уровни ФНОα и ИЛ-6, а также противовоспалительного цитокина ИЛ-13. Введение иммуномодуляторов полиоксидония, трекрезана и метапротав значительной степени нормализовало уровень провоспалительных цитокинов ИЛ-1β, ИЛ-2, ИЛ-12(p7), хемокина MCP-1, ИНФγ и противовоспалительных цитокинов ИЛ-4, ИЛ-10. Противовоспалительный эффект препаратов связывают с нормализацией обмена цитокинов.

Ключевые слова: бронхопневмония; цитокины; иммуномодуляторы; полиоксидоний; трекрезан; метапрот.

CHANGES IN CYTOKINES PROFILE OF THE RAT BLOOD SERUM FOLLOWING BRONCHOPULMONARY INFLAMMATION AND ADMINISTRATION OF IMMUNE MODULATORS

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Summary. The experimental bronchopneumonia was modeled in rats by administration of turpentine into the trachea under ether anesthesia. One of the immunemodulators (polyoxydonium 0.75 mg/kg, trekrezan 25 mg/kg or metaprot 25 mg/kg) was injected intraperitoneally for 5 days (once a day) after operation. The rats were decapitated on 5th day and a profile of cytokines in the blood serum was determined using MilliplexMapRatCitokine/Chemokine (MerkMillipore) sets. Inflammation decreased blood levels of both pro-inflammatory factors (IL-1β, IL-2, IL-12, interferon-γand chemokine MCP-1) and anti-inflammatory cytokines (IL-4, IL-10). The content of TNFα and IL-6and anti-inflammatory cytokine IL-13 was increased. Administration of immunemodulators polyoxydonium, trekrezan and metaprot normalized the level of both pro-inflammatory (IL-1β, IL-2, IL-12(p7), chemokineMCP-1, interferon-γ) and anti-inflammatory (IL-4, IL-10) cytokines in significant degree. Therefore, anti-inflammatory effect of the drugs studied in connected with normalization of cytokine metabolism.

Key words: bronchopneumonia; cytokines; immune modulators; polyoxydonium; trekrezan, metaprot.

Предыдущими исследованиями [2,8] был показан высокий защитный эффект полиоксидония, трекрезана и метапрота у животных при воспроизведении у них в эксперименте тяжелого воспаления бронхолегочной ткани. Был выяснен ряд механизмов, составляющих основу развития этого патологического процесса, доказана роль возникновения вторичного иммунодефицита, нарушений энергетического метаболизма и оксидативного стресса в патогенезе экспериментального бронхолегочного воспаления, а также выявлена способность указанных препаратов ограничивать эти патологические сдвиги [2].