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MALE INFERTILITY ASSOCIATED WITH OBESITY

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ABSTRACT — Obesity should be considered as a separate risk factor that contributes to the development of male infertility.
Aim. To assess obesity impact level on semen disturbances.
Methods. The study included 130 males with fertility disorders, who, depending on the level of body mass index (BMI), were divided into two groups. The first group included 67 men with a BMI of 22,7±2,9 kg/m². The second group included 63 men with 38,6±4,3 kg/m² ($p < 0.05$).
Results. The significant tendency to decrease in the levels of LH, FSH, testosterone and an increase in the level of estradiol in men with an increase in BMI compared to men with normal weight was established ($p<0.05$). In addition, obese men sperm motility was 8.2% worse ($p<0.05$).
Conclusion. In men with obesity and fertility disorders, the concentration and number of motile forms of spermatozoa are significantly lower compared to men with a normal body mass index.

KEYWORDS — male infertility, obesity, Body Mass Index (BMI), ejaculate, spermatozoa concentration, asthenozoospermia.

INTRODUCTION

Every tenth married couple faces the problem of infertility during their reproductive life [1]. Moreover, male infertility accounts for 30–50% [2, 3]. In recent years, due to the high interest in andrology, many factors of the pathogenesis of male infertility have been clarified: varicocele, infections, oxidative stress, genetic mutations, repair of inguinal hernias, etc. [4, 5, 6,7]. One of the factors that affects sperm quality is obesity [8].

It has been established that about two billion people in the world are overweight, a significant part of which are men of reproductive age. Among the different types of obesity, abdominal obesity has the most pronounced negative effects. It is abdominal obesity that is closely associated with the risk of developing cardiovascular diseases, type 2 diabetes mellitus, metabolic disorders, erectile dysfunction and male reproductive health disorders. [9] However, until now there is no unified view on the effect of obesity on spermogram indicators.

Aim

To assess obesity impact level on semen disturbances.

METHODS

We examined 130 men over the age of 18 with male infertility. Exclusion criteria from the study: cryptorchidism, varicocele, hydrocele, sexually transmitted diseases, genetic abnormalities, thyroid diseases, primary hypogonadism. When examining patients, we took into account their height, weight, body mass index (BMI). In all men, we examined the ejaculate according to the WHO 2010 standard. Blood hormones were also tested: luteinizing hormone (LH), follicle-stimulating hormone (FSH), thyroid-stimulating hormone (TSH), total testosterone, progesterone, estradiol, cortisol.

The men were distributed into 2 groups depending on the BMI indicator:

1st group (n=67) — men with impaired fertility and normal body mass index (20–24,9kg/m²).

2nd group (n=63) — with impaired fertility and obesity (body mass index >30 kg/m²).

The statistical analysis was performed using spreadsheets "EXCEL" and "STATISTICA 8.0". Statistical processing was carried out with the calculation of arithmetic mean values (M) and their errors (m). Differences were considered significant at $p < 0.05$.

RESULTS

The average age of all patients (n=130) ranged from 18 to 50: in the first group of patients it was 34.6±4.8 years, in the second group — 32.1±6.2 years ($p>0.05$). BMI indicators in men of both groups are shown in Figure 1. As it's shown in the Fig. 1, the BMI in patients of the second group was 1.7 times higher than in men of the first group ($p<0.05$).

When analyzing hormonal changes in obese patients, we found a clear relationship between the level of sex hormones and BMI. With an increase in BMI, the more pronounced decrease in the level of LH, FSH, testosterone and an increase in the level of estradiol was noted ($p<0.05$) (Table 1).

Table 2 shows the indicators of the ejaculate in infertile men with obesity and normal BMI. The data

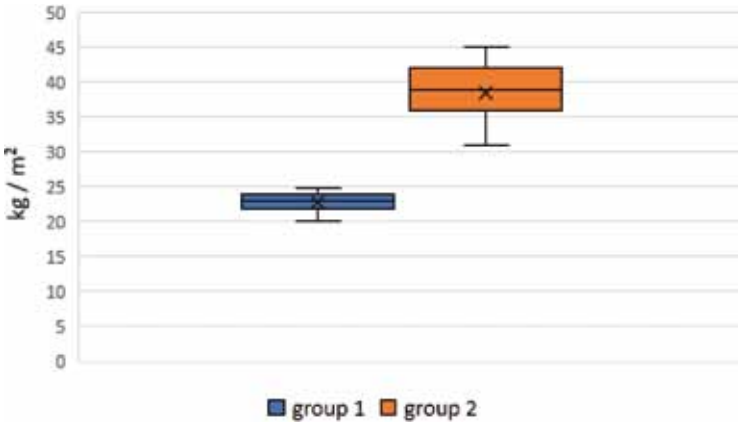

Fig.1. *BMI indicators in patients of the first and second groups (p<0.05)*

Table 1. *Serum hormone levels in infertile men with obesity and normal BMI*

Hormone indicators	1group, (n=67)	2 group, (n=63)	p
LH (IU/ml)	4,6 ± 0,4	2,9 ± 0,5	p<0,05
FSH (IU/ml)	5,7 ± 0,8	4,4 ± 0,4	p<0,05
TTH, IU/L	2,0 ± 0,1	2,2 ± 0,2	p >0.05
Total testosterone (nmol/L)	19,2 ± 2,1	11,2 ± 0,8	p<0,05
Progesterone, nmol/L	1,3 ± 0,2	1,4 ± 0,3	p >0.05
Estradiol, nmol/L	88,3 ± 5,7	114,7 ± 3,9	p<0,05
Cortisol, nmol/L	351,2 ± 25,2	348,5 ± 24,8	p >0.05

obtained by us indicate a clear role of obesity in the pathogenesis of ejaculate fertility disorders. In the presence of obesity, more pronounced changes in spermogram parameters were observed: a decrease in the concentration of germ cells and a violation of their motility (p<0.05).

DISCUSSION

The pathogenesis of male infertility linked to obesity has many factors. Firstly, obesity can have a negative effect on hormonal balance. Due to disorders in the hypothalamus-pituitary-gonad axis, testosterone levels decrease and estradiol levels increase. As well as a violation of the ratio of androgens and estrogens due to peripheral aromatization of testosterone in adipose tissue[2]. Secondly, an increase in the amount of fat in men can lead to an increase in the temperature of the scrotum, which contributes to a violation of spermatogenesis in the testicle and the maturation of germ cells in the appendage of the testicle [8]. And the last, an increase in the volume of adipose tissue can cause a violation of the amount of proteins that should ensure the normal viscosity of the ejaculate and the mobility of sperm in it.

Clinical studies show that in obese men, the risk of male infertility occurs two times more often than in men with normal weight [2].

A meta-analysis of 25 studies showed that in men with an increase in BMI for every five units, the parameters of the ejaculate will decrease: the total number of spermatozoa, sperm concentration and sperm volume by 2.4%, 1.3% and 2.0%, respectively [8].

We have found that there is a direct relationship between the patient's weight and the indicators of LH, testosterone, estradiol. This means that the higher a man's BMI, the more the concentration of sex hormones changes. Our study showed that in men with a BMI above normal, the proportion of actively motile spermatozoa decreases (p <0.05).

Table 2. *Indicators of the ejaculate in infertile men with obesity and normal BMI*

Semen analysis indicators		1group, (n=67)	2 group, (n=63)	p
Spermatozoa concentration		26,9±4,6	18,2±4,9	p<0,05
Ejaculate volume (ml)		3,7 ± 1,8	2,8 ± 1,2	p>0,05
pH		7,2 ± 0,2	7,4 ± 0,3	p>0,05
Spermatozoa motility	A+B (%)	34,8±1,5	26,6±1,3	p<0,05
	C (%)	26,8 ± 3,4	31,5 ± 3,6	p>0,05
	D (%)	38,4 ± 4,9	41,9 ± 5,2	p>0,05
The proportion of normal sperm forms (%)		18±1,2	16,5±1,7	p>0,05
Leukocyte number (mln/ml)		0,6 ± 0,1	0,5 ± 0,3	p>0,05

CONCLUSION

Obese males with fertility disorders most often have a low concentration and number of motile forms of spermatozoa compared to men with a normal body mass index. Therefore, for the treatment of pathological disorders in sperm in obese men, it's important to measure body weight and use drug therapy with aromatase inhibitors and antiestrogens.

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