

Influence of Hypersecretion of Testosterone on Lipid Metabolism

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ABSTRACT

The aim of our study was to evaluate the influence of hypersecretion of testosterone on lipid metabolism. Observational cross-sectional study was carried out. 62 women, selected by randomization, aged before 30 years, were investigated. Clinical, ultrasound, hormonal investigations were carried out. The markers of lipid metabolism – TC, HDL, LDL, VLDL, TG, I.A.T were detected as well. According to our results testosterone, one of the powerful androgen, is characterized with atherogenic effect and realized by elevation of levels of TC, LDL and I.A.T. In cases of oversecretion of both DHEAS (androgen of adrenal origin) and T, their opposite effects towards lipid metabolism are balanced and lipid parameters didn't differ from normal, physiological values.

KEYWORDS: *lipid metabolism, free testosterone, dehydroepiandrosterone sulfate*

Lipids carry out many important function in human organism. Besides that they are the source of high concentrated energy for functioning of organism, they are significant structural compounds for cells as well.

Lipid metabolism is difficult process, androgens influence on it in some extent. According to the literature, testosterone decreases the level of high-density lipoproteins (HDL) and increases the levels of low density lipoproteins (LDL). This feature explains the negative effect of testosterone on disease development such as the obesity, type 2 diabetes mellitus, atherosclerosis, cardiovascular problems [2,3]

These data are controversial, so we aimed to study the influence of hypersecretion of testosterone on lipid metabolism in patients of reproductive age.

MATERIAL AND METHOD

Observational cross-sectional study was carried out at Zhordania Institute of Human Reproduction, chair of Reproductology in Medical Academy during 2003-2005 years.

62 women, selected by randomization, aged before 30 years, with complains as hirsutism excessive weight. All of them had statistically high level of free testosterone. These patients were divided into two groups. I group consists 29 patients with hypersecretion of free testosterone only, II group consists 33 patients with hypersecretion of both hormones – free testosterone and dehydroepiandrosterone sulfate (androgen of adrenal origin). The control group included same aged 14 fertile women with normal weight and without any signs of androgenization.

Clinical, ultrasound, hormonal and biochemical investigations were carried out. Body mass index (BMI) were calculated by body weight (kg) height² ratio. Distribution of fat was detected by index of waist/hip ration (W/H). Hirsute number was evaluated with Ferriman. Gallwey score. Existence of acne, seborrhea alopecia was tacked into consideration. In blood samples the levels of free testosterone (FT), dehydroepiandrosterone sulfate (DHEAS), 17 α hydroxyprogesterone (17 α OHP), prolactine (PRL), follicle stimulating hormone (FSH), luteinizing hormone (LH), basal and by glucose induced immunoreactive insulin (IRI) were determined by

immunofermentive method using the "Humana" kits (Germany) on 6-7 days of menstrual cycle. In blood samples by biochemical analysis with fermentative colorimetric tests using the "Humana" kits (Germany) the markers of lipid metabolism – total cholesterol (TC), high – density lipoproteins (HDL), low-density lipoproteins (LDL), very-low density lipoproteins (VLDL), triglycerids (TG) and index of atherogenicity (I.A.T) were detected as well.

Analysis of variance (ANOVA) was used for analysis the results.

RESULTS

In I group mean age of menarche was 12,41 \pm 0,17 and didn't differ from the controls – 12,74 \pm 0,24. Menstrual cycle was disturbed in all patients: amenorrhea occurred in 17,2%, oligomenorrhea – in 51,7%, anovulatory cycle and insufficiency of luteal phase – in 31,1%. Hypoplasia of uterus and polycystic ovaries were detected by ultrasound in S/F and 50,4%, polycystic ovaries – in 50,4%.

Hirsutism was very common and frequent clinical signs of hyperandrogenia and encountered in 83%. Of patients with mean hirsute number – 21,37 \pm 0,17. (healthy women – 7,0 \pm 0,47). That indicates on high androgenization in this study group. Acne occurred in 44,8%, seborrhea – in 48,3%. Acanthosis nigricans in perineum area were detected in 55,7%, under mammae and behind neck – in 33,5%. Male type baldness had only 4 patients.

Mean Beu I was 33,1 \pm 0,33 mean W/H – 0,83 \pm 0,01. These values compared with normal values (Bui<25 and W/H<280).

In II group mean age of menarche – 12,96 \pm 0,17 didn't differ from controls as well. Amenorrhea occurred in 18,4%, oligomenorrhea – in 45,5%, anovulatory menstrual cycle – in 36,1%. By ultrasound hypoplasia of uterus was detected in 53,5%. polycystic ovaries – in 45,7%. Hirsutism with mean hirsute number 21,5 \pm 0,7 was noted in 90%. acne – in 72,7% seborrhea – in 70,7%, acanthosis nigricans, mainly in perineum seborrhea in 53,5%, alopecia didn't occur.

Mean BMI 31,24 \pm 1,27 and mean W/H – 0,82 \pm 0,01 statistically exceeded control values as well.

According to the results of hormonal investigations (Tab.1) in both groups elevation of mean LH/FSH ratio were noted. Mean level of PRL was at normal range in groups. In I group mean level of FT – $5,49 \pm 0,3$ ng/m was significantly higher as compared to the control – $1,37 \pm 0,03$ ng/m ($p < 0,01$), but mean levels of DHEAS and 17 α OHP didn't differ from controls values. In II group there were noted hypersecretion on both FT and DNEAS with mean levels $4,98 \pm 0,32$ ng/ml and $3,36 \pm 0,2$ ng/ml that statistically exceeded control values. Mean levels of based IRI were normal in both groups, but after glucose tolerance test hypersecretion of IRI exists.

Evaluation of lipid metabolism revealed, that In I group, when isolated elevation of FT exists the mean levels of TC,

LDL and IAT were statistically high than in controls. There was not statistically significant difference between the I and control groups regarding to the levers of TG, HOL and VLDL. These results proves the literature data about atherogenic, effects of free testosterone.

In II group, when hypersecretion of both androgens – FT and DNEAS (androgen with feature of lipolysis) exists, the mean levels of all lipids – TC, TB, HDL, LDL, VLOL and IAT were difference between the study and control groups regarding them. So it can be said that in this case atherogenic effect of FT is balanced by antagonistic effect of DHEAS (antitherogetic) towards lipid metabolism.

	LH	FSH	LH/FSH	PRL	DHEAS	17 α -OHP	Free T	IRI
I groups M \pm M, n=29	$7,14 \pm 0,61$ $p < 0,01$	$2,87 \pm 0,27$ $p > 0,05$	$2,76 \pm 0,22$ $p < 0,01$	$1,56 \pm 0,32$ $p > 0,2$	$1,56 \pm 0,32$ $p > 0,05$	$0,55 \pm 0,1$ $p > 0,05$	$5,49 \pm 0,3$ $p < 0,01$	$13,3 \pm 2,3$ $p > 0,01$
II groups M \pm M, n=33	$7,02 \pm 0,57$ $p < 0,05$	$2,69 \pm 1,47$ $p > 0,05$	$2,64 \pm 0,13$ $p < 0,01$	$3,36 \pm 0,2$ $p > 0,2$	$3,36 \pm 0,2$ $p < 0,01$	$2,16 \pm 0,33$ $p < 0,01$	$4,98 \pm 0,32$ $p < 0,01$	$12,1 \pm 1,3$ $p > 0,01$
Control groups M \pm M, n=14	$4,25 \pm 0,51$	$3,37 \pm 0,34$	$1,25 \pm 0,07$	$9,05 \pm 0,75$	$1,17 \pm 0,7$	$0,40 \pm 0,05$	$1,37 \pm 0,03$	$10,93 \pm 1,14$

Tab.1 Hormonal parametrs.

	TC dl/ml	TG dl/ml	HDL dl/ml	LD dl/ml	VLDL dl/ml	IAT dl/ml
I groups M \pm M, n=29	$176,79 \pm 8,01$	$147,1 \pm 17,7$	$42,96 \pm 1,9$	$131,8 \pm 7,9$	$28,27 \pm 2,87$	$3,08 \pm 0,14$
II groups M \pm M, n=33	$161,78 \pm 6,44$	$139,01 \pm 5,95$	$39,27 \pm 1,58$	$101,8 \pm 4,55$	$26,69 \pm 1,37$	$2,64 \pm 0,1$
Control groups M \pm M, n=14	$151,6 \pm 6,36$	$149,28 \pm 5,75$	$42,57 \pm 2,07$	$100,07 \pm 7,4$	$29,8 \pm 1,16$	$2,33 \pm 0,08$
P ₁	$P < 0,05$	$P > 0,01$	$P > 0,05$	$P < 0,02$	$P > 0,05$	$P < 0,05$
P ₂	$P > 0,05$	$P > 0,05$	$P > 0,05$	$P > 0,05$	$p > 0,01$	$P > 0,05$
P ₁₋₂	$P > 0,05$	$P > 0,05$	$P > 0,05$	$P < 0,01$	$P > 0,05$	$P < 0,02$

Tab.1 Lipid parameters.

CONCLUSION

According to our study results and literature, it can be concluded that, testosterone has atherogenic effect and influences negatively on lipid metabolism - increases the levels of TC, LDL, IA and risk of development of cardiovascular disease. At young ages possibility of

development such disease are prevented by antagonistic effect of DHEAS towards lipid metabolism. Intensity of its secretion reaches maximum at 19-30 years and after that decreases by 2% per yearly.

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Влияние гиперсекреции тестостерона на метаболизм липидов

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Р Е З Ю М Е

Целью исследования - изучение влияния тестостерона на липидный обмен. Проведено одномоментное наблюдательное обследование специально отобранных пациентов - 62 женщин с гиперсекрецией тестостерона. Наряду с клинико-гормональными и ультразвукографическими исследованиями определяли маркеры липидного обмена - ОХ, ТРГ, ХВЛ, ХНП, ХОНП и индекс атерогенности. Установлено, что тестостерон - один из самых сильных андрогенов, характеризуется выраженным атерогенным эффектом, который реализуется повышением уровней ОХ, ХНП и индекса атерогенности. При одновременном избыточном образовании ДГЭА-С и тестостерона эффекты взаимно уравновешиваются и липидный спектр не отличается от нормы.

Ключевые слова: метаболизм липидов, свободный тестостерон, сульфат дегидроэпиандростерона