DETECTION OF BONE DENSITY OF PARANASAL SINUSES IN WOMEN WITH DIFFERENT LEVEL OF SEX HORMONS

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Introduction

Recognition of rise of adrenal androgens experienced by majority of women during Menopause transition (MT) can explain diversity of female phenotypes at postmenopausal ages. Adrenal androgens may mitigate imminent future fallouts of estradiol decline. Perhaps pattern of adrenal androgens predetermines alterations in female organism after menopause including growing insulin resistance in some of them.

Theory/Approach/ Methodology

Our study made an attempt to collate insulin resistance index (HOMA--IR) with status of adrenal steroids in women during MT.
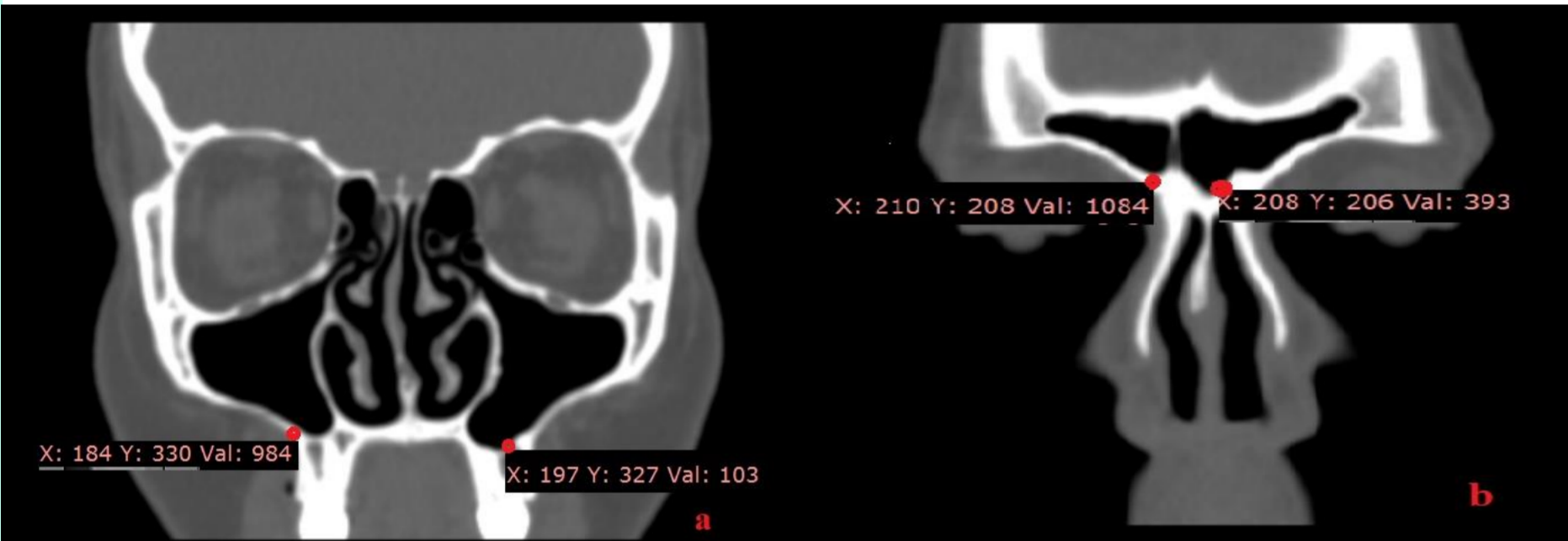

Fig.1 Study of the density of the lower wall of the maxillary (a) and frontal (b) sinuses in physiological conditions. SCT. Coronary sections.

Cross-sectional associations were examined between body mass index (BMI), hip-waist ratio (HWR), HOMA-IR and Serum content of insulin, testosterone (T), sex hormone binding globulin (SHBG), free androgen index (FAI), dehydroepiandrosterone sulfate (DHEAS), androstenedione (Adione), delta-5-androstenediol (Adiol) measured in 315 women of perimenopausal age (age range from 45 to 55 years) with amenorrhea less than 2 years.

The total standard measurement uncertainty of the thickness of the walls of the paranasal sinuses P_H is calculated using the following formula:

$$u_c(H_н) = \sqrt{u_A^2(H_{нi}) + u_B^2(H_{нi})} \qquad (1)$$

where $u_A(H_{Hi})$ is the standard type A uncertainty, $u_B(H_{Hi})$ is the standard type B uncertainty, The standard type A uncertainty is calculated using the following formula:

$$u_A(H_{нi}) = \sqrt{\frac{1}{n(n-1)} \sum_{i=1}^{n} (H_{нi} - H_н)^2} \qquad (2)$$

where H_{Hi} is the i-th value of sample measurement, H_H is the mathematical expectation, n is the number of measurements in a sample.

Standard type B uncertainty is calculated using the following formula:

$$u(H_H) = H_H \frac{\delta_H}{\sqrt{3} \cdot 100} \qquad (3)$$

where σ_H is measurement error of the tool not exceeding 0.0001%.
Then the interval estimate of uncertainty is performed, namely, the expanded uncertainty U according to the following formula:
$$U = k \cdot u_c \qquad (4)$$
where k is the coverage factor. The coverage factor depends on the distribution law of the measured value and the chosen level of confidence p.

Results

For these samples, the hypothesis about the normal distribution law is confirmed, therefore the coverage factor for the probability of 0.95 is assumed to be 2.
It turned out that women who fell into two different subsets according to HOMA-IR (either raised HOMA-IR – 1st group, or within physiological range – 2nd group) showed androgen profile distinctive to each group. The main significant difference was fivefold higher level of Adiol in the 2nd group, when the 1st group shows preponderance of Adione (p<0.05). Also patients of the 2nd group proved to have lower FAI, less fasting insulin, a bit higher DHEAS, lower BMI and HWR.

TABLE I. LEVELS OF HORMONES IN DIFFERENT GROUPS OF PATIENTS

Hormone (serum)	1st group Low density of BPNS (n=30)	2nd group Density of BPNS matching control group (n=33)
Testosterone (T), nmol/l	12.7±0.0002	9.5±0.0014
Sex hormone binding globulin (SHBG), nmol/l	34.8±0.003	50.05±0.034
Free androgen index (FAI),	0.51	0.18
Insulin fasting, mIU/L	6.1±0.0023	4.01±0.2
Dehydroepiandrosteronesulfate(DHEAS),µg/dL	130.6±34.4	280±0.33
Androstenedione (Adione), ng/dL	94.2±0.033	58.4±0.1
Delta-5-androstenediol (Adiol),nmol/l	0.8±0.021	5.3±0.01

TABLE II.DENSITY (Hu) OF BONE TISSUE OF THE MAXILLARY AND FRONTAL SINUSES IN WOMEN WITH AN AVERAGE LEVEL OF DHEAS

Name of the sinus, the studied wall		Density indicators			
		U a	U b	U s	U expanded
Maximum density of maxillary sinuses (lower wall)	right	241.72	0.00048	241.73	483.46
	left	263.97	0.00054	263.971	527.943
Minimum density of maxillary sinuses (lower wall)	left	197.46	3.358	197.464	394.927
	right	159.15	2.7596	159.146	318.291
Density of the right frontal sinus (lower wall)	minimum	231.12	4.9991	231.117	462.233
	maximum	301.86	0.00054	301.861	603.723
Density of the right frontal sinus (lower wall)	minimum	190.2	3.089	190.204	380.407
	maximum	393.90	0.00057	393.901	787.802

TABLE III DENSITY (Hu) OF BONE TISSUE OF THE MAXILLARY AND FRONTAL SINUSES IN WOMEN WITH LOW DHEAS

Name of the sinus, the studied wall		Density indicators			
		U a	U b	U s	Uexpanded
Maximum density of maxillary sinuses (lower wall)	right	240.72	0.0004	240.722	481.444
	left	195.67	0.00036	195.672	391.343
Minimum density of maxillary sinuses (lower wall)	left	146.01	-4.51325	146.011	292.021
	right	211.91	2.16361	211.913	423.827
Density of the right frontal sinus (lower wall)	minimum	153.57	-7.01596	153.565	307.130
	maximum	228.47	0.00035	228.468	456.936
Density of the right frontal sinus (lower wall)	minimum	120.04	-6.173	120.038	240.076
	maximum	401.05	0.00043	401.052	802.104

Fig.2 Correlation between density of the lower wall of maxillary sinus and DHEAS
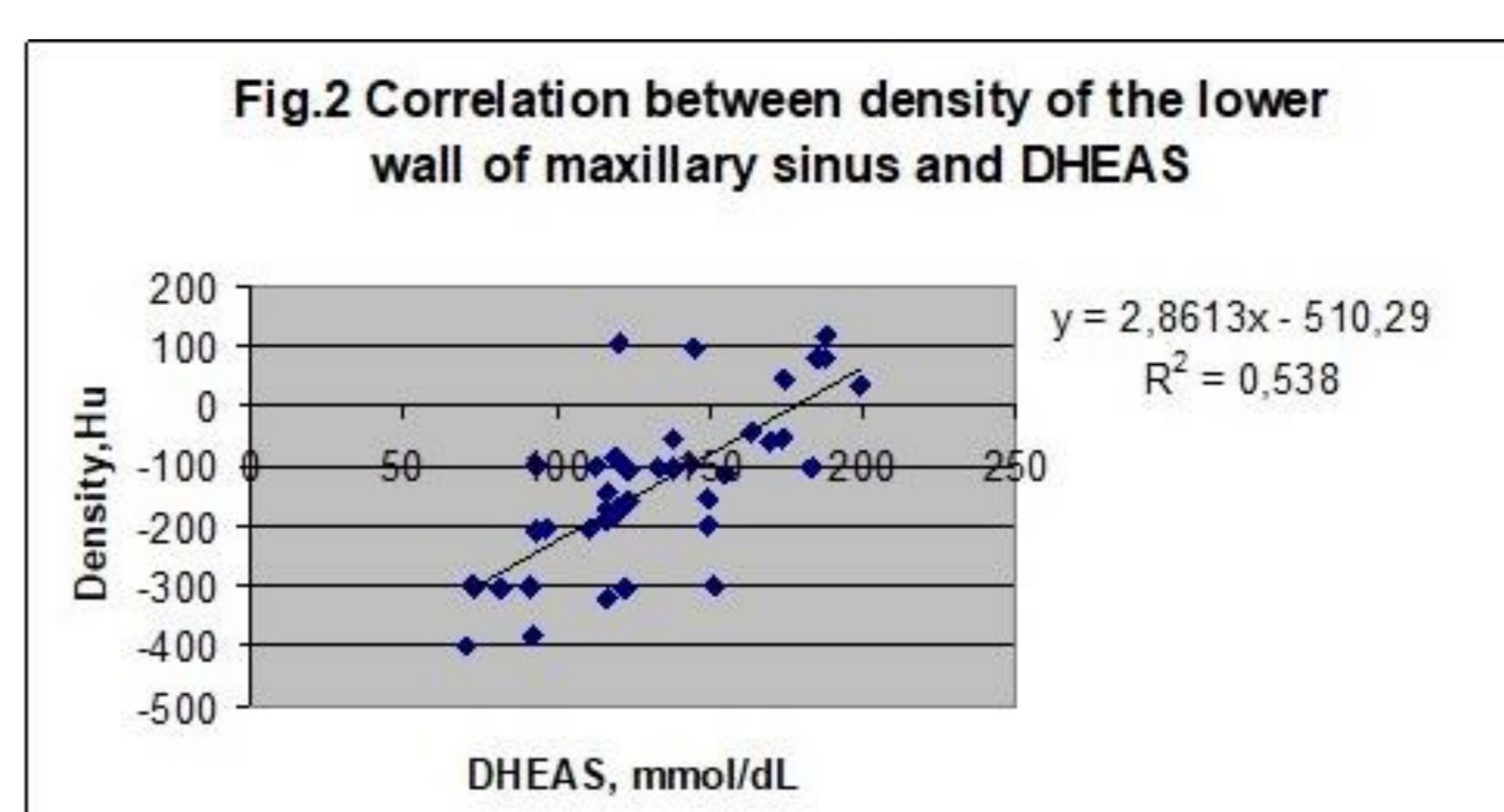
$y = 2,8613x - 510,29$
$R^2 = 0,538$

TABLE IV. VALUES OF THE BONE DENSITY (Hu) OF BONE TISSUE OF THE MAXILLARY AND FRONTAL SINUSES IN THE CONTROL GROUP OF WOMEN

Name of the sinus, the studied wall		Density indicators	
		U a	Uexpanded
Maximum density of maxillary sinuses (lower wall)	Right	310.2026	395.0
	Left	306.7441	613.4882
Minimum density of maxillary sinuses (lower wall)	Left	220.178	440.356
	Right	197.617	395.0
Density of the right frontal sinus (lower wall)	minimum	155.282	276.43
	maximum	374.24	732.274
Density of the left frontal sinus (lower wall)	minimum	138.217	310.56
	maximum	366.1371	748.48

Conclusions

High Adiol that is the evidence of activated delta-5 steroidogenic pathway (ethnicity-specific or inherited), provides the ground for physiological course of MT. Too excessive androgen activity (Adione – probably ensued from overactivated delta 4/5 isomerase pushing delta-5 hormones to turn into delta-4 ones; T, low SHBG, higher FAI) may incur insulin resistance, android type of fat deposition. Stressful excessive cortisol production devastates resources for DHEAS rise and exhaust resources for adrenal androgens.

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