Association between antioxidant status and lipid profile in patients with arterial hypertension and subclinical hypothyroidism

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BACKGROUND

Arterial hypertension (AH) is one of the most widespread non-communicable diseases. Subclinical hypothyroidism (SH) is known to have a relevant impact on the cardiovascular risk (CVR) [1]. Available evidences suggest that patients with plasma thyrotropin levels above 10 mU/L, especially subjects < 65 years, may have an increased risk of cardiovascular diseases [2]. Varu S.K. and Kshitiz K.K. (2017) revealed highly significant impairment of lipid metabolism in patients with SH compared to healthy controls, suggesting SH is one of the risk factor for the onset of coronary artery disease (CAD) [3]. Therefore, the study of the features of lipid impairment in patients with AH and concomitant SH appears to be useful in order to improve the primary and secondary prevention of CAD.

Oxidative stress (OS) plays an important role in the development and progression of both of AH and SH. That is why antioxidant system impact on the pathogenesis of hypothyroidism and its complications is currently receiving attention. However, mechanism of OS influence and the results obtained differ within the studies [4-6].

Nowadays, not only reproducible methods for the redox balance disturbances assessment have been searched, but also various indicators that indirectly indicate changes in the OS.

OBJECTIVE

to analyze the association between lipid profile and OS in patients with AH and SH.

METHODS

A prospective cohort study was conducted from 2019 to 2020 including 35 patients with the mean age 47,5±10,3 years (57% women, 43% men) divided into 2 groups. ***Group 1*** (controls) included patients without AH and SH (n=14), ***group 2*** (comparison group) consisted of patients with stage I-II degree 1-2 AH and SH (n=21).

Complete blood test and lipid profile, namely total cholesterol (TC), triglycerides (TG), low density lipoprotein cholesterol (LDL-C), very low density lipoprotein cholesterol (VLDL-C), high density lipoprotein cholesterol (HDL-C), and serum concentrations of ferric reducing antioxidant power (FRAP), were measured in both groups. Monocyte count to high density lipoprotein cholesterol ratio (MHR) as a recently emerged indicator of OS also was calculated for all patients.

All statistical analyses were performed using the IBM SPSS Statistics (Version 26).

RESULTS AND DISCUSSION

Overall data of the examined patients are presented in ***Table 1*** as ***Q2 [Q1; Q3]***, where Q2 – median, Q1 – lower quartile, Q3 – upper quartile.

Ferric reducing antioxidant power (FRAP)

FRAP assay is a widely used method that uses antioxidants as reductants in a redox-linked colorimetric reaction, wherein Fe3+ is reduced to Fe2+. In some literature the FRAP method is referred to as the ferric reducing ability of plasma.

It is noteworthy that FRAP levels were decreased in group 2, indicating that total antioxidant capacity (TAC) was reduced. Results of Joshi B. et al (2018) also showed decreased TAC concentration in the hypothyroid group; and Verma M. K. et al. (2019) also found decreased FRAP levels in hypertensive patients in comparison to healthy control [6, 7].

However, TAC activity was significantly higher in subjects with high lifetime CVR than in subjects with lifetime LT-CVR due to RodrÍguez-SÁnchez E. et al. (2019) [5]. Similar data were shown by Aydogdu A. et al. (2017) who compared patients with SH and healthy ones using Trolox equivalent antioxidant capacity to measure TAC. [4].

Monocyte count to HDL-C ratio (MHR)

HDL-C exerts anti-oxidative effects in part via paraoxonase-1 (PON1). In addition, it has been shown to defend endothelial cells against the unfavorable effects of LDL-C. Therefore, this indicator has recently been used in various indices to assess OS and *MHR* is one if them [8, 9]. On the other hand, the beneficial effects of human HDL are highly unstable and can transform into proatherogenic properties under oxidative attack [10].

Since the calculation of MHD includes the level of NDL-S, the correlation between them is not taken into account.

Table 1. Comparative characteristics of patients within group 1 and group 2

Parameters	Group 1 – without AH & SH (n=14)	Group 2 – with AH & SH (n=21)	*p*-value
Age, years	44.25 [31.5; 46.5]	52.8 [45.8; 57.0] ↑	**0.001**
TC, mmol/L	1.57 [1.02; 4.78]	2.46 [1.51; 4.49]	0.541
TG, mmol/L	0.63 [0.46; 0.96]	1.06 [0.68; 1.26] ↑	**0.022**
LDL-C, mmol/L	3.53 [2.3; 3.89]	3.26 [2.21; 3.98]	0.302
VLDL-C, mmol/L	1.18 [0.6; 1.37]	1.00 [0.67; 1.19]	0.302
HLDL-C, mmol/L	1.98 [1.29; 3.3]	2.24 [1.3; 4.50]	0.541
FRAP, mmol/L	1.06 [0.91; 1.27]	0.91 [0.72; 1.03] ↓	**0.027**
MHR, -	2.48 [1.71; 2.99]	2.17 [1.75; 2.98]	0.302

As can be seen in ***Tables 2,3***, in both groups FRAP levels were significantly correlated with MHR. But unlike the controls, precisely in patients with AH and SH the decrease in FRAP levels and MHR was associated with the development of a proatherogenic lipid profile. The results indicate a violation of antioxidant status in patients with AH and SH.

Table 2. Relationships between FRAP, MHR and lipid profile in group 1

FRAP/TC	**0.461***
FRAP/VLDL-C	**-0.396***
FRAP/HDL-C	**-0.595****
FRAP/MHR	**0.496****
Notes: * p=0.05, ** p=0.01	

Table 2. Relationships between FRAP, MHR and lipid profile in group 1

FRAP/TC	**-0,301***
FRAP/HDL-C	**0,344****
FRAP/MHR	**0.430****
MHR/TC	**-0,263****
MHR/TG	**-0,294****
Notes: * p=0.05, ** p=0.01	

SUMMARY & CONCLUSIONS

The obtained data indicate that antioxidant defense is impaired in patients with AH and SH, resulting in reduced levels of FRAP. This, in turn, is associated with the development of proatherogenic changes in serum.

MHR can be used both as reliable indicator of antioxidant status and proatherogenic changes in patients with AH and SH

DISCLOSURE OF POTENTIAL CONFLICTS OF INTEREST

No potential conflicts of interest were disclosed

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