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Evaluation of Paraoxonase 1 Serum Level in Male Androgenetic Alopecia Patients

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Abstract:

Background: Hair The medical term for male pattern hair loss is androgenetic alopecia (AGA). Cells in the dermal papilla have been shown to be under oxidative stress in AGA patients. Paraoxonase 1 (PON1) is an important antioxidant that prevents oxidation of low-density lipoprotein (LDL) (LDL). Blood PON1 levels may be influenced by inflammation changes and oxidised LDL concentrations. The goal of this study was to compare the blood PON1 levels of male AGA patients with those of healthy controls. Discussion of Topics and Methods This study used a case-control design, with 60 male patients diagnosed with AGA and 20 age- and sex-matched healthy volunteers serving as cases and controls, respectively. People who went to Benha University Hospitals' Dermatology Outpatient Clinic between April 2020 and December 2021 were considered for inclusion. Serum PON1 and HDL levels were lower in AGA patients than in controls. Reduced levels of PON1 were seen in people with AGA, and oxidative stress was identified to be a possible cause. Androgenetic alopecia; paraoxonase 1 (PON1) in serum; male-pattern baldness.

Keywords: Serum Paraoxonase 1; Male androgenetic alopecia; PON1; AGA.

1.Introduction

Male Androgenetic alopecia is characterised by progressive hair thinning and loss (AGA). Androgens and their receptor have been debated as potential contributors to the development of AGA. Cells in the dermal papilla have been shown to be under oxidative stress in AGA patients. The risk of metabolic syndrome, atherosclerosis, and cardiovascular disease is higher in persons with AGA, as shown by a number of studies (CVD). (1) Paraoxonase 1 (PON1) is made in the liver and subsequently released into the circulation, where it travels to high-density lipoprotein (HDL). PON1's anti-inflammatory, anti-oxidative, anti-atherogenic, and anti-microbial activities have all been demonstrated2.

Paraoxonase 1 is an antioxidant that is essential for preventing atherosclerosis by blocking the oxidation of low-density lipoprotein (LDL). PON1 levels may be influenced by inflammatory reactions and oxidised LDL concentrations in the blood (ox-LDL) Third, LDL oxidation is facilitated by an excess of reactive oxygen and nitrogen species (ROS and RNS, respectively). Peroxynitrite, a powerful oxidant that induces endothelial dysfunction4, is produced when nitric oxide binds with hydrogen peroxide. This in turn stimulates the oxidation of polyunsaturated fatty acids on the surface of LDL.

2.Patients and Methods

Patients: This Sixty male AGA patients were paired with twenty healthy volunteers of the same age and gender. Patients who went to the Dermatology, Venereology, and Andrology Outpatient Clinic at Benha University Hospitals were considered. The study lasted from April of 2020 until December of 2021.

All participants met the following criteria for inclusion. The Benha Faculty of Medicine Research Ethical Committee gave its support to the study. Everyone who took part voluntarily gave their permission.

Inclusion Requirements AGA male patients, aged 18 and above, who agreed to take part in the study were recruited.

Patients who were receiving cancer therapy, had a history of systemic diseases, or were on anti-hyperlipidemic drugs were not eligible to participate in the study.

Methods: The overall sample size was divided in half.

The AGA patients in Group A were 60 in total.

Twenty volunteers of the same age and gender made up Group B, which served as a control.

All individuals had a thorough history taking, general examination (including BMI and blood pressure), clinical examination, and laboratory measurement (Serum PON1 and lipid profile).

Statistical Methods

The data was managed and analysed using SPSS version 25. (IBM, Armonk, New York, United States). To ensure that the quantitative data were normally distributed, we employed the Kolmogorov-Smirnov test (for cases) and the Shapiro-Wilk test (for controls), as well as direct data visualisation approaches (for both).

The numerical data were summarised by means and standard deviations (SDs) or medians and ranges. The categorised data was then used to construct quantitative and percentage summaries. Quantitative data from each study group was compared using the independent t-test. Categorical variables were compared using the Chi-square test.

The diagnostic accuracy of PON1 and LDL in separating patients from controls was analysed using ROC. Area under the curve (AUC) with 95% confidence interval (CI) and diagnostic indices were calculated. Pearson's and Spearman's correlation coefficients were employed to examine the associations between the variables. The PON1 levels of smokers and nonsmokers were compared using the independent t-test. AGA

projections were improved with the help of a logistic regression study. Both the relative risk and the 95% CI were calculated. There was no bidirectionality in any of the statistical tests. In order to highlight statistical significance, p values under 0.05 were employed.

3.Results:

This Sixty males with AGA and twenty controls of similar age and sex were studied in a case-control fashion. Patients who were seen at the Dermatology, Venereology, and Andrology Outpatient Clinic at Benha University Hospitals were included.

Patients and controls did not vary significantly from one another in terms of age, body mass index, smoking status, systolic blood pressure, or diastolic blood pressure (Table 1).

Table (1) General characteristics of patients and control groups

		Patients (n = 60)	Control (n = 20)	Test	*P*
Age (years)	Mean ±SD	41 ± 7	38 ± 7	***t*** = -1.732	0.087
BMI	Mean ±SD	29 ± 5	27 ± 6	***t*** = -1.453	0.150
Smoking	n (%)	40 (66.7%)	13 (65%)	$\mathbf{X^2}$= 0.019	0.891
Systolic blood pressure (mmHg)	Mean ±SD	133 ± 12	130 ± 8	***t*** = -1.213	0.231
Diastolic blood pressure (mmHg)	Mean ±SD	86 ± 6	85 ± 5	***t*** = -0.744	0.459

Regarding the lipid profile (Table 2), total cholesterol (TC), triglycerides (TGs) and LDL were significantly higher in patients than control. In contrast, HDL was significantly lower in patients than control.

Table (2) Lipid profile of patients and control groups

		Patients (n = 60)	Controls (n = 20)	*T*	*P*
TC (mg/dl)	Mean ±SD	217 ± 40	190 ± 23	-3.666	0.001*
TGs (mg/dl)	Mean ±SD	147 ± 58	117 ± 38	-2.706	0.009*
HDL (mg/dl)	Mean ±SD	43 ± 7	51 ± 8	4.046	<0.001*
LDL (mg/dl)	Mean ±SD	144 ± 37	116 ± 25	-3.807	<0.001*

All patient and control sera were tested for paraoxonase 1. Patients had considerably decreased levels of PON1 compared to controls. Patients' PON1 levels were significantly inversely related to their body mass index, systolic blood pressure, diastolic blood pressure, illness severity, and AGA grading. In addition, PON1 in the patient group correlated negatively with triglycerides (TGs), cholesterol (LDL), and total cholesterol. On the other hand, it was positively correlated with HDL. Patients who smoked and those who had AGA at an earlier age had lower levels of PON1 than nonsmokers and those who developed AGA later in life.

4. Discussion

Male The condition known as androgenetic alopecia affects a large percentage of men and women. Patients with AGA show signs of oxidative stress, including lower total antioxidant activity and higher MDA levels in plasma samples. Hypertension, dyslipidemia, obesity, insulin resistance, metabolic syndrome, and cardiovascular disease5 were all linked to AGA. Overproduction of reactive oxygen and nitrogen species promotes oxidation of low density lipoprotein. Polyunsaturated fatty acids on the surface of LDL are quickly oxidised by free radicals into fatty acid fragments. Antioxidants in the body are unable to keep LDL, which oxidises quickly, protected if the circulating LDL level is high. PON1 is crucial in avoiding the oxidation of LDL6. In this investigation, AGA patients had a lipid profile that was different from that of controls, with increased total cholesterol, triglyceride, and low-density lipoprotein levels. Despite this, AGA patients had much lower HDL than controls. Multiple studies that looked at the correlation between AGA and lipid profile found similar findings. 7-10

Arias-Santiago et al.7 found that individuals with AGA had substantially higher TGs, TC, and LDL levels compared to controls. Higher blood TC, TGs, and LDL levels were also seen in AGA patients compared to controls, as shown by Kim et al.8. However, AGA patients had a much lower HDL level than the controls. Qazi et al.9 also discovered reduced HDL levels in AGA patients and increased LDL, TGs, and TC levels. Furthermore, alterations in lipid profiles were more prevalent in individuals with severe AGA compared to those with mild to moderate AGA, a statistically significant difference between the two patient groupings. AGA patients also have considerably increased levels of TGs and LDL, as shown by Bakry et al.10.

Statistically significant variations in TGs and HDL levels were seen in AGA patients, however there was no difference in TC or LDL levels, contrary to the findings of the present investigation. No statistically significant difference in blood TGs levels was seen between AGA patients and control in the studies conducted by Saeedah et al. 12 and Al-Sadat et al. In addition, Akn et al.14 found no significant difference between AGA patients and controls with regards to TGs or HDL levels. In addition, Adel et al.15 found no statistically significant difference in TC and TGs between AGA patients and control groups, but did find substantially greater LDL and lower HDL values in patients compared with control.

Patients with AGA had substantially reduced PON1 levels compared to controls. Cwynar et al.16 observed that PON1 activity was considerably lower in AGA patients compared with control groups, therefore our results are in line with their findings. PON1 levels were also shown to be considerably lower in AGA patients compared to control groups (Tantawy et al., 2017).

In the present investigation, substantial negative correlations were found between PON1 and TC, TGs, and LDL in the lipid profiles of AGA patients, whereas a significant positive connection was found between PON1 and HDL. PON1 levels were significantly lower, were positively connected with HDL, and were inversely correlated with LDL in other systemic illnesses. Diseases include diabetes mellitus18,19, coronary heart disease20, and polycystic ovarian syndrome21 showed similar associations.

Oxidative stress has been linked to AGA in several reports1,22,23. Upton et al.1 found that ROS levels are elevated in the dermal papilla cells of individuals with AGA. Patients with AGA who developed the disease at a young age also had higher total oxidant levels and an elevated oxidative stress index, as discovered by Kaya Erdogan et al.22. Serum levels of oxidative stress indicators and total oxidant status were also observed to be considerably greater in AGA compared to the control group by Balk et al.23, whereas total antioxidant status, total thiol, and total disulfide were significantly lower in AGA patients compared to controls.

Low PON1 levels have been linked to several systemic illnesses characterised by elevated biomarkers of oxidative stress. Serum PON1 activity was significantly lower in individuals with metabolic syndrome than in controls, according to research by Adhe-Rojekar et al.24. PON1 concentrations were also shown to be lower in CVD patients compared to controls, as reported by Murillo-González et al.25.

5. Conclusions

It was hypothesised that serum PON1 levels might be used as a standalone predictor of AGA. It is possible that elevated oxidative stress is to blame for the decreased PON1 levels seen in AGA patients.

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