The association of androgenetic alopecia with metabolic syndrome: a case control study on Iranian population

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Background: Androgenetic alopecia (AGA) is the most prevailing type of progressive hair loss**.** Thus far, some previous studies have investigated the correlation between AGA and metabolic syndrome (MetS). However, due to the inconsistency of their results, our study aims at evaluating the association between AGA and MetS.

Methods: Fifty two male patients with grade III-V AGA, based on Ebling's scale, and 50 control subjects were enrolled in the present study. All participants were evaluated for the presence of Mets based on the National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III).

Results: The prevalence of MetS was 51.3% in AGA group and 17.8% in control group (P=0.003). Among MetS parameters, Systolic blood pressure (P=0.003) and waist circumference (P<0.001) were statistically significant in AGA patients compared to the control group.

Conclusion: Our study demonstrated that the association between AGA and MetS is of great importance. Therefore, early detection can be beneficial for early intervention to lower the incidence of MetS and further complications.

Keywords: Alopecia, metabolic syndrome, androgens

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INTRODUCTION

Androgenetic alopecia (AGA), the most common type of progressive hair loss, is an inheritable thinning of hair caused by androgens in a genetically predisposed individual [1]. Androgens, particularly dihydrotestosterone which is a testosterone metabolite, have an important role in the development of AGA in males [2]. AGA involves the vertex and frontotemporal regions of the scalp in males and the crown in females because these regions are more sensitive to the effects of androgen [3].

Metabolic syndrome (MetS) is defined as a group of metabolic disorders such as glucose intolerance, insulin resistance (IR), dyslipidemia, central obesity, and hypertension. It is also associated with increased risk of cardiovascular disease (CVD) [4].

In 1972, Cotton *et al.* were the first who proposed that AGA might be a risk factor for CVD. Their study indicated a relevance between hair loss and the occurrence of CVD [5]. Many subsequent studies have revealed the correlation of AGA with several disorders such as insulin resistance (IR) [6], abnormal serum lipid profiles [6,7], hypertension [8], and obesity [9].

Until now, only a few studies [10-17] have reported the association between AGA and MetS. However,

it should be noted that four studies reported a non-significant relationship between these two conditions [18-21]. These controversies necessitate a more cautious assessment of MetS parameters in AGA patients. The objective of the present research was to investigate the correspondence between MetS prevalence and AGA.

MATERIAL AND METHODS

The study was conducted on patients attending the Dermatology Clinic of Imam-Reza Hospital, Mashhad, Iran. This study was approved by the Ethics Committee of Mashhad University of Medical Sciences. A total of 102 male subjects (aged 35-55 years) were enrolled in the study. Fifty two AGA cases with a mean body mass index (BMI) < 27 and with alopecia stage ≥ 3 according to the Ebling's Scale [22] were in the study group. The 50 control subjects had a mean BMI < 27 and no AGA. Exclusion criteria were scarring alopecia, alopecia areata, congenital adrenal hyperplasia, Cushing's disease or glucocorticoid treatment within the previous six months or any other systemic disorders. The BMI was calculated by dividing the body weight by the square of the height (kg/m^2). Waist circumference was measured using a tape measure at the midpoint of the narrowest part between the top of the iliac crest and the bottom of the rib cage while the participant was standing erect with the abdomen relaxed, feet together and arms at the sides. Blood pressure was measured in all the study subjects. After an overnight fast, blood samples were obtained from each subject for the measurement of serum glucose (FBS), total cholesterol (TC), high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, and triglyceride (TG).

MetS was determined based on the NCEP ATP III by the presence of three or more criteria as follows [4]: (a) FBS ≥ 110 mg/dL, (b) TGs value ≥150 mg/dL, (c) HDL-C <40 mg/dL in males, (d) waist circumference ≥102 cm in males and (e) BP ≥ 130/85 mmHg.

Further investigated were the association between the Ebling's Scale, systolic blood pressure (SBP), diastolic blood pressure (DBP), the levels of glucose, TC, triglycerides, LDL-cholesterol, and HDL-cholesterol in the AGA group.

Data were analyzed using IBM SPSS software package version 15.0. Statistical differences in baseline characteristics among groups by the prevalence of AGA, were evaluated by means of chi-square test or Fisher exact test for categorical variables and Student *t* test for continuous variables. Shapiro–Wilk test for normality and Levene homogeneity of variance test were conducted prior to *t* test. Multivariate logistic regression was assessed to find the factors affecting AGA independently. Statistical significance of the obtained results was judged at the level of 5%.

RESULTS

A total of 102 participants were enrolled in the present research. The patient group involved 52 male subjects and the control group comprised 50 healthy male subjects. The mean age of the participants in the patient and control group was 42.65 ± 6.07 and 45.60 ± 6.33 years, respectively. The age difference between the groups was significant (p = 0.018). The groups were compared in terms of weight, height, BMI, FBS, systolic and diastolic blood pressure, LDL-c, and HDL.

There was a statistically significant difference between the two groups (AGA and Control) regarding waist circumference (P <0.0001), SBP (P = 0.003) and TC (P = 0.017). The comparison between the two groups with respect to TG, HDL-C, LDL-C, FBS and DBP, shows no statistically significant difference. (Table 1)

The percentage of smoking was 44.2% (n=23) in AGA group and 21.3% (n=10) in the control group, with a P value of 0.008. There was a significant correlation between smoking and androgenetic alopecia.

In view of the relationship between age and smoking with androgenetic alopecia and metabolic syndrome, these two variables (age and smoking) were considered as confounding variables and adjusted by multiple logistic regression.

According to the Ebling's scale, 26 (50%) patients were classified as grade III, 18 (34.6%) as grade IV, and 8 (15.4%) as grade V. The overall prevalence rate of metabolic syndrome among the 102 participants was 31.4% (n = 32). With respect to MetS frequency, 24 (46.2%) patients in the AGA group and 8 (16.0%) participants in the control group were found to have MetS, and the difference was statistically meaningful (p < 0.05) (Table 2).

The prevalence of MetS regardless of the effect of age and smoking was 46.2% in AGA group and 16.0% in the control group (P=0.001); however, after taking into account the two factors, it was calculated to be 51.3% and 17.8%, respectively (P=0.003). The association between AGA and MetS was still significant after considering age and smoking status. (Table 3)

After taking into consideration the effect of age and smoking, the odds ratios of developing MetS were respectively 5.957, 8.286, and 1.563 among grade III, grade IV, and grade V Androgenetic Alopecia compared to the control group (Table 4). The odds ratio for grade V androgenetic alopecia was not statistically significant in comparison with control group (probably due to the small sample size).

DISCUSSION

As mentioned before, there are several studies investigating the association of AGA and MetS with inconsistent results.

It has been pointed out that there are more androgen receptors in the scalp of the patients with severe AGA and higher levels of serum total and free testosterone [19,23]. Higher levels of androgens lead to atherosclerosis and increase the susceptibility to hypercholesterolemia and hypertension [24]. A relationship between AGA and hypertension, irrespective of age, has also been shown [8].

Fifty two AGA cases and 50 controls were investigated for MetS parameters such as hyperlipidemia, hypertension, fasting blood glucose levels, and different grades of AGA according to the Ebling's score. All the patients were subjected to blood testing for TC, LDL-c, HDL-c, TG, and FBS.

To the best of our knowledge, this is the first comparative study in Iranian population to evaluate the correlation of AGA and MetS.

A similar age group distribution was observed by Arias-Santiago *et al*. In their study, the distribution of alopecia according to the Ebling's scale was as follows: grade III: 31.4%, grade IV: 45.7%, and grade V: 22.9%. Unlike our study, there was no association between alopecia severity and metabolic syndrome in Arias *et al*.

In the present study, the relationship between AGA and SBP was statistically significant. The increase in the levels of serum androgens in AGA patients [25] contributes to smooth muscle cell proliferation in vessels [26] and thus augmentation of the susceptibility to hypertension [24].

In our research, as opposed to most previous studies, the mean value of TC in the control group (176.68±36.09) was higher compared to the AGA group (157.46±43.65) (P=0.017). This indicates the need for further research in our country.

We observed that the correlation between waist circumference and AGA was statistically significant in comparison to the controls (P<0.001). Similar results were reported in studies conducted by Acibucu *et al*. [27] Arias-Santiago *et al*. [14] and Ola Ahmed Bakry *et al*. [28].

Regarding our patients, MetS was significantly associated with AGA. The prevalence of MetS in cases (46.2%) was statistically significant as compared to the control group (16%) (P< 0.05). Similar results were reported by Arias-Santiago *et al*. [14], Acibucu *et al*. [27], Chakrabarty, *et al*. [29], and Ola Ahmed Bakry, *et al*. [28]. However, Mumcuoglu, *et al*. [19] (20)showed (20) no statistically significant difference between the cases and controls.

Other MetS parameters such as diastolic BP, TG levels, FBS levels, HDL-c levels, LDL-c levels were not statistically significant.

In our study, the comparison of MetS prevalence was statistically significant when grade III (46.2%) cases were compared to grade IV (55.6%) (P<0.05). The prevalence of MetS in grade V cases was lower than other grades (probably due to the small sample size). However, it is to be noted that MetS is still more prevalent in comparison to the control group.

CONCOLUSION

MetS was more prevalent in AGA patients compared to the control group, showing a significant association between AGA and MetS. Therefore, early detection could be beneficial for early intervention in order to reduce the incidence of MetS and further complications.

Conflict of Interest: None declared.

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