Association of metabolic syndrome with early-onset androgenetic alopecia: a case-control study

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Background: Androgenetic alopecia is defined as patterned hair loss caused by androgens in genetically susceptible individuals. Metabolic syndrome is a cluster of interrelated risk factors that increase the risk of coronary artery disease. Androgenetic alopecia is associated with metabolic syndrome components including insulin resistance, dyslipidemia, and obesity. This study aimed to compare the prevalence of metabolic syndrome in androgenetic alopecia patients with controls.

Methods: The study groups consisted of 50 androgenetic alopecia patients and 50 controls who agreed to participate. Following recruitment into the study, history taking, clinical examination, and laboratory investigations were carried out, and details of each individual were recorded into a pre-structured case record sheet.

Results: The groups were not statistically different in terms of age or sex distribution, height and weight, glucose levels, thyroid hormone level, blood counts, and lipid levels. We found that 26% of patients in the case group and 6% in the control group satisfied the definition of metabolic syndrome; this difference was significant ($P = 0.007$). We observed a statistically significant difference in LDL and HDL levels between the cases and controls ($P = 0.0027$ and 0.0091, respectively).

Conclusion: Patients with androgenetic alopecia have an increased likelihood of having metabolic syndrome and must be routinely screened for hypertension, diabetes mellitus, and dyslipidemia. They should be made conscious of the more serious implications of the apparently cosmetic disorder.

Keywords: metabolic syndrome, androgenetic, alopecia

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INTRODUCTION

Androgenetic alopecia (AGA) is defined as patterned hair loss caused by androgens in genetically susceptible individuals. It has a polygenic inheritance pattern and may affect both sexes. The pathogenesis essentially involves the progressive conversion of large terminal follicles to miniature ones. This is accomplished by dihydrotestosterone (DHT) binding to androgenic receptors in the scalp's hair follicles, which activates the responsible genes [1]. AGA is easily diagnosed clinically and is noted chiefly on the frontotemporal area and vertex in men and over the crown in women [2]. Early-onset androgenetic alopecia is when the age of onset is less than 35 years of age [1].

Cotton *et al.* [3], in 1972, were the first to suggest that "baldness" was associated with cardiovascular

disease (CVD). In succeeding studies, AGA was linked with metabolic syndrome (MetS) components including insulin resistance(IR) [4], dyslipidemia [5], and obesity [6]. On the other hand, the absence of such an association has also been reported [7].

In their study, Acibucu *et al.* [8] observed that 25% of patients with AGA had MetS, in contrast to 10.4% of controls. Arias-Santiago *et al.* [9] reported that the criteria for MetS were satisfied by 57.1% of the patients with AGA as opposed to 14.3% of the controls. However, the findings of Yi *et al.* show that the association between MetS and AGA may be significant only in females [10].

Despite the high rate of MetS in India [11-12], there is a relative dearth of data regarding the prevalence of MetS in AGA. Thus, this study compared the occurrence of MetS in patients with AGA versus controls.

PARTICIPANTS AND METHODS

Participants and study design

A case-control study was conducted on subjects attending the outpatient department of a tertiary care hospital between January 2020 and May 2020. The study groups consisted of 50 early-onset AGA patients and 50 controls who had decided to participate in the study.

Inclusion criteria: Cases included AGA patients of both sexes with onset at less than 35 years of age. Controls were volunteers without AGA recruited from students, residents, and other hospital staff aged between 20 and 50 years. The recruitment ratio was 1:1.

Individuals with a known history of thyroid disease (hypo or hyper), chronic kidney disease, liver failure, psoriasis, inflammatory bowel disease, rheumatic diseases, or coronary artery disease were excluded.

Metabolic syndrome is a constellation of mutually related risk factors that increase coronary artery disease risk. In our study, we adapted the definition of metabolic syndrome (MS) by the "National Cholesterol Education Programme (NCEP) Adult Treatment Panel III" [13].

In this study, MetS was defined by the existence of three or more of the following:

(a) Waist circumference > 40 inches (males), 35 inches (females);
(b) Triglycerides (TG) value ≥150 mg/dL or on pharmacotherapy;
(c) HDL-Cholesterol (HDL-C) < 40 mg/dL (males), < 50 mg/dl (females) or on pharmacotherapy;
(d) Fasting glucose (FPG) ≥ 100 mg/dL or on medication;
(e) B*P* > 130 mmHg diastolic or > 85 mmHg diastolic or on pharmacotherapy.

Clinical assessment

Following recruitment into the study, history taking, clinical examination, and laboratory investigations were carried out, and details of each individual were recorded into a pre-structured case record sheet. Weight, height, and waist circumference were noted. Waist measurement was taken on the end of a normal breath, midway between the last palpable rib and the top of the iliac crest. The body mass index (BMI) was calculated as weight in kg divided by the square of the height in meters. Blood pressure (BP) was measured on the right arm in sitting posture after some (> 10 min) rest. This was done on three separate occasions when the individuall visited for consultation.

Statistical methods

Study size: Taking into consideration a study [14] conducted in Bengaluru, India, where MetS was seen in 53 cases and 17 controls, respectively, with an α of 0.05 and power of 80%, the sample size of 27 was calculated. We proposed to include 50 patients and 50 controls.

The data obtained were compared using the t-test for parametric variables and the chi-squared test/Fisher's exact test for categorical variables. Significant differences were indicated by *P*-values < 0.05. Microsoft Excel (2017) and MedCalc version 19.3 for PC were used for calculation and representation.

Ethical considerations: We adapted the Declaration of Helsinki for medical research involving humans. Subject recruitment and study-related activity commenced after gaining written approval from the Institutional Ethics Committee and patients' consent in the Informed Consent Form for voluntary participation. Confidentiality was ensured.

RESULTS

One hundred patients (cases = 50, controls = 50) were studied. The mean age was 30.0 ± 4.2 years and 31.2 ± 4.4 years for the case and control groups, respectively. The difference between the groups was not significant (unpaired t-test, $P = 0.1$). The groups were not significantly different regarding sex-wise distribution (chi-squared test $P = 1.0$). The data measured in the cases and control groups are presented in Table 1. The groups were not different in terms of age or sex distribution, height and weight, glucose levels, thyroid hormone level, blood counts, and lipid levels. However, the groups were different in terms of systolic blood pressure (SBP), diastolic blood pressure (DBP), and high density (HDL) and low-density lipoproteins (LDL).

Hypertension was present in 29 (58%) patients in the study group in contrast to 19 (38%) patients in the control group. However, the difference was not significant (chi-squared test $P = 0.0716$)

Table 2 shows the number of cases fulfilling the MetS definition in both groups. Accordingly, 26% of patients in the case group and 6% in the control group satisfied the definition of MetS. The difference was significant (Fisher's exact test $P = 0.007$), and the null hypothesis was refuted.

Table 2. Presence of metabolic syndrome in case and control groups

	Metabolic syndrome	No metabolic syndrome	Total
Cases	13 (26%)	37 (74%)	50
Controls	3 (6%)	47 (94%)	50
Total	16 subjects	84 subjects	100

DISCUSSION

We compared the clinical and laboratory parameters of 50 cases of early-onset AGA and 50 controls to determine the prevalence of MetS in each group.

In the current study, hypertension was found in 29 (58%) patients in the study group as matched to 19 patients (38%) in the control group. However, this difference was not statistically significant ($P = 0.0716$). The differences in SBP and DBP in cases and control groups were found to be statistically significant ($P < 0.05$ and $P = 0.02$, respectively). This agreed with Indian studies [15-17] and studies from abroad.

Ahouansou *et al.*, in their study on 250 Caucasian men, established a strong association between hypertension and AGA [18]. In a population-based Finnish study [19], higher hypertension rates were found in AGA patients than in controls (65% vs. 45%). The explanation proposed was the existence

Table 1. Clinical and laboratory data in cases (n = 50) and controls (n = 50)

	Case (mean ± SD)	Control (mean ± SD)	*P*-value	Inference
Age (yrs)	30 ± 4.2	31.2 ± 4.4	0.1965	NS
Height (cm)	163.38 ± 8.5114	162.88 ± 7.3419	0.7538	NS
Weight (kg)	64.82 ± 12.4764	66.9 ± 11.9305	0.3963	NS
BMI	24.2926 ± 3.5	25.1872 ± 3.7	0.2251	NS
SBP (mm/Hg)	132.8 ± 13.4	116.54 ± 13.5	< 0.0001	S
DBP (mm/Hg)	84.88 ± 9.4408	79.86 ± 12.9252	0.0289	S
Waist circ. (cm)	86.48 ± 12.1609	88.8 ± 8.6990	0.2753	NS
FPG	94.14 ± 15.4616	89.02 ± 14.0821	0.0866	NS
PPPG	118.84 ± 19.9011	115.14 ± 27.5637	0.4434	NS
TSH	3.4666 ± 4.3251	3.412 ± 4.2585	0.9494	NS
Hb. (gm %)	13.3262 ± 1.7495	13.158 ± 1.8265	0.6392	NS
TLC (cu.mm)	7837.6 ± 1616.7081	7869.8 ± 1814.4010	0.9255	NS
Platelet	2.2364 ± 0.4794	2.1858 ± 0.4963	0.6052	NS
Total cholesterol (mg/dl)	171.7 ± 38.0881	181.68 ± 25.8508	0.1285	NS
VLDL (mg/dl)	28.22 ± 13.3314	29.9 ± 7.3519	0.4371	NS
HDL (mg/dl)	47.98 ± 12.0059	42.74 ± 7.0358	0.0091	S
LDL (mg/dl)	102.08 ± 30.4120	117.48 ± 18.1167	0.0027	S

Abbreviations: BMI = Body mass index; SBP = Systolic blood pressure; DBP = Diastolic blood pressure; FPG = Fasting plasma glucose; PPPG = Post prandial plasma glucose; TSH = Thyroid stimulating hormone; Hb = Hemoglobin; TLC = Total leucocyte count; cu.mm = cubic millimeter; VLDL = Very low density lipoprotein; HDL = High density lipoprotein; LDL = low density lipoprotein; NS = Not statistically significant; S = statistically significant; SD = Standard deviation

of vascular receptors that bind androgens, causing AGA and elevating blood pressure. Arias-Santiago *et al.* also found elevated aldosterone levels and hypertension in women with early-onset AGA as compared to controls [9].

In the current study, the difference in waist circumference was not significant between the two groups ($P = 0.27$). This was despite NCEP-ATP guidelines [14] hinting that abdominal obesity is correlated more with metabolic risk factors than elevated BMI.

The current study also could not recognize any significant difference in FPG levels between the groups. This finding is in corroboration with that of Chakrabarty [20]. This can be ascribed to the relatively young population evaluated in the study.

We saw a statistically significant difference in LDL and HDL levels between the cases and controls ($P = 0.0027$ and 0.0091, respectively). This has also been observed previously [4,9,21]. On the contrary, Guzzo *et al.* [22] found no differences in lipid parameters between the two groups when comparing lipid profiles. The elevated lipids may boost other mechanisms to develop CVD in AGA patients. Raised levels of LDL ("bad") cholesterol are known to be a key determinant of CAD risk, while HDL ("good") cholesterol is cardio-protective.

We found that 26% of patients in the case group and 6% in the control group satisfied the definition of MetS. This difference was statistically significant. Thus, we may safely conclude that the number of subjects with MetS in the case group was significantly different from the control group. Thus, our data seem to agree with previous findings from India and abroad [8,9].

Patients with early-onset AGA are more likely to have MetS than the general population and must be routinely screened for hypertension, dyslipidemia, and diabetes mellitus. They should be made aware of the serious connotations of the apparently cosmetic disorder.

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Conflict of interest: None declared.

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