Association of Androgenetic Alopecia with Metabolic Syndrome

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ABSTRACT

Objective: To determine the association of androgenetic alopecia (AGA) with metabolic syndrome (MetS) in either gender.
Study Design: Descriptive study.
Place and Duration of the Study: OPD complex, Pak Emirates Military Hospital, Rawalpindi, Pakistan, from February to August 2021.
Methodology: The study included a total of 90 patients who met the specified criteria for enrolment. Each group (case and control) contains 45 patients. Diagnosis of androgenetic 2 alopecia was done clinically and grading was based on the Norwood-Hamilton classification in males and Ludwig classification in females. Body mass index (BMI) was calculated and blood pressure was measured for all enrolled patients. Following an overnight fasting period, blood samples were collected from each patient to measure clinical parameters including triglycerides (TGs), fasting blood sugar (FBS), and high-density lipoprotein (HDL) levels.
Results: There were 85.6% males and 4.4% females with a mean age of 43.38 years. Out of which, 34.4% and 15.6% of patients fell in severity 1 and severity 2 Class. Patients were stratified on the basis of AGA with respect to TGs, FBS, HDL, and BMI. The p-value was significant when stratified on the basis of BMI, FBS, and HDL except TGs. Odd ratio of both groups on the basis of (MetS) 8.1. Odd ratio between androgenic alopecia and metabolic syndrome was of 2.4.
Conclusion: An association existed between androgenetic alopecia and metabolic syndrome indicating the potential benefit of early MetS screening for individuals with androgenic alopecia. This proactive approach could help prevent unforeseen complications through timely lifestyle adjustments.

Key Words: *Metabolic syndrome, Androgenic alopecia, Cholesterol, Triglycerides.*

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INTRODUCTION

The most common kind of progressive hair-loss is androgenetic alopecia (AGA), which affects 30–50% of males by the time they are 50 years of age.[1] Despite being medically unharmful, this illness has a large emotional impact on people. It is the most common cause of progressive symmetrical hair loss in both men and women induced by androgens in genetically predisposed people.[2,3] In men it causes recession of frontal hair-line and loss of hair in temporal areas, resulting in reshaping of the hairline and complete baldness. In women, it produces gradual thinning of hair, part being widest anteriorly, and never results in complete baldness.[4]

Dihydrotestosterone (DHT), a metabolite of testosterone, is one androgen that is particularly important in the development of AGA in men.[5]

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The specific cause is still unknown, however, the aetiology combines hereditary and environmental factors. Numerous elements have been proposed as potential causes, including hormonal impacts, insulin resistance, cardiovascular disorders, and malignancies.[2] The term "metabolic syndrome" (MetS) refers to a collection of risk factors for diabetes and cardiovascular disease that are becoming more well-understood for their importance. With several studies emphasising the link between AGA, MetS, and coronary artery disease, prompt detection and assessment are essential to reduce negative outcomes.[6] Type 2 diabetes mellitus and cardiovascular disease (CVD) show a substantial connection with metabolic syndrome. Establishing a connection between MetS and AGA may provide more information on the similar clinical signs and symptoms of both diseases. The aim of this study was to evaluate the association of AGA with MetS in either gender as there has been no such study conducted on the Pakistani population. The rationale of this study was to help medical professionals quickly identify instances so that timely treatments may be made to lower the incidence of MetS and its related consequences.

METHODOLOGY

It was a comparative study conducted in the OPD complex, Pak Emirates Hospital, Rawalpindi, Pakistan, from February to

August 2021. The sample size was calculated by using WHO sample size calculator the keeping level of significance at 5%, power of test at 90%, anticipated population proportion at I: 51.3%, and anticipated population proportion II at 17.8%.[5]

The sample size was 90 (45 in each group). Non-probability consecutive sampling techniques were used. Patients of either gender, aged between 30 - 60 years, having onset <35 years and alopecia grade >2 in men according to Norwood-Hamilton classification and Grade 1 in women according to Ludwig classification were included. Whereas, patients with alopecia which caused scar, alopecia areata, congenital adrenal hyperplasia, Cushing's disease, glucocorticoid treatment within the previous six months or any other systemic disorders were excluded.

After the approval of the Ethical Committee of Pak Emirates Military Hospital, Rawalpindi, written informed consent was taken from patients fulfilling the inclusion criteria. A detailed history and complete physical examination of all the patients were performed. The demographic profile (name, age, gender, and contact number of the patients) was obtained directly from the patients. Patients were admitted through outdoor departments. The control group included patients attending the setup without AGA. Diagnosis of AGA was done clinically and grading was based on the Norwood-Hamilton classification in males and Ludwig classification in females. BMI and waist circumference were calculated. Blood pressure was measured for all enrolled patients. After an overnight fast, blood samples were obtained from each patient 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 also determined according to operational definition.

Data analysis was done by using SPSS 22. Mean and standard deviation were calculated for quantitative variables, such as age, height, weight, BMI, B.P, FBS, TC, HDL cholesterol, LDL cholesterol, and TG. Frequencies and percentages were used for qualitative variables i.e. gender and AGA. Effect modifiers such as age, gender, BMI, B.P, FBS, HDL cholesterol, LDL cholesterol, and TG were stratified. Post-stratification the Chi-square test was applied and p-value ≤0.05 was considered as significant. Odds ratio was calculated to measure association between AGA with metabolic syndrome with confidence level of 95%.

RESULTS

A total of 90 patients were enrolled, out of which, 77 (85.6%) were males and 13 (14.4%) were females with a mean age of 43.38 years. The mean BMI of all the patients was 23.4 Kg/m^2. Mean BP of Group A and Group B was 131.73 ± 14.51 and 123.97 ± 8.73 mmHg, respectively. Mean HDL levels of Group A and Group B 40.15 ± 3.85 and 44.71 ± 3.06, respectively. Mean total cholesterol of Group A and Group B 249.51 ± 38.81 and 244.28 ± 36.9 mg/dL, respectively. Mean and standard deviation of different variables for each group are shown in Table I.

Further association factors for AGA severity were done for gender, blood pressure, TGs, cholesterol, fasting blood sugar, and LDL. Blood pressure less than 130 mmHg was taken as normal and above was taken as hypertension. Age was also divided into groups. Fasting blood sugar levels above 120 mg/dl were taken as high. Cholesterol levels above 240 mg/dl were taken as high, values between 200 - 239 mg/dl were borderline, and below that was considered normal. LDL above 159 mg/dl were taken as high. The association is shown in Table II.

The distribution of MetS in the two groups shows a significant relationship between AGA and MeTS (60% *vs.* 15.5%, p <0.001, OR 8.143 CI 95% = 2.98 - 22.19).

Table I: Demographic characteristics between different groups (n = 90).

Variable	Case Group (A) n = 45	Control group (B) n = 45	p-value (t-test and Chi-square)
Age (years)	43.84 ± 8.06	42.93 ± 7.10	0.57
Male	37 (82.2%)	40 (88.9%)	0.48
Female	8 (17.8%)	5 (11.1%)	
Height (cm)	169.73 ± 8.19	168.53 ± 7.70	0.48
Weight (Kg)	63.98 ± 8.18	65.44 ± 8.27	0.40
BMI (kg/m^2)	22.92 ± 4.83	23.93 ± 4.15	0.29
High density Lipoproteins	40.16 ± 3.86	44.71 ± 3.06	<0.001
Blood Glucose Fasting (mg/dl)	111.13 ± 19.45	95.40 ± 10.46	<0.001
Systolic Blood Pressure (mmHg)	131.73 ± 14.51	123.98 ± 8.73	0.003
Triglycerides (mg/dl)	157.66 ± 22.83	140.91 ± 16.6	<0.001

Table II: Association of severity of AGA with different variables (n = 45).

Variable	AGA Severity 1 (n = 31)	AGA Severity 2 (n = 14)	p-value (Chi-square test and Fischer's exact test)
Gender			0.08
Male	28 (90.3%)	9 (64.3%)	
Female	3 (9.7%)	5 (35.7%)	
Age Groups			0.96
30 - 40 years	14 (45.2%)	6 (42.9%)	
41 - 50 years	12 (38.7%)	6 (42.9%)	
>50 years	5 (16.1%)	2 (14.3%)	
BMI			0.597
Underweight	2 (6.5%)	2 (14.3%)	
Normal	23 (74.2%)	11 (78.6%)	
Overweight	4 (12.9%)	1 (6.5%)	
Obese	2 (6.5%)	0 (0.0%)	
Systolic Blood Pressure			0.04
Normal	22 (71%)	5 (35.7%)	
High	9 (29%)	9 (64.3%)	
Fasting Blood Sugar			0.99
Normal	6 (19.4%)	2 (14.3%)	
High	25 (80.6%)	12 (85.3%)	
LDL Levels			0.63
Normal	23 (%)	9 (%)	
High	8 (%)	5 (%)	
Cholesterol			0.04
Normal	6 (19.4%)	3 (21.3%)	
Borderline	5 (16.1%)	1 (8.3%)	
High	20 (64.5%)	10 (71.4%)	
Triglycerides			
Normal	7 (22.6%)	2 (14.3%)	0.51
High	24 (77.4%)	12 (85.3%)	
MeTS			
Present	12 (38.7%)	11 (78.6%)	0.02
Absent	19 (61.3%)	3 (21.4%)	

DISCUSSION

MetS and AGA share a number of characteristics. The link between AGA and MetS has been examined and verified in several studies.[7] According to a study by Acibucu *et al*., MetS was present in 25% of patients with AGA compared to 10.4% of the control group.[8] In this study, evaluation of arterial mean systolic and diastolic pressure, serum glucose levels, fasting lipid profile, and BMI along with height, weight, and waist circumference was conducted in all the study participants. The frequency and severity of this kind of hair loss seem to increase with age.[9] The results showed 85.6% subjects with AGA were male and 14.4% were female with a mean age of 43.38 years. In a study conducted by Acibucu *et al*, the mean age was 36.28 ± 7.74 years.[8] Each decade of life sees an increase in the prevalence of the metabolic syndrome MetS, matching the age-related increase in obesity rates, particularly central adiposity.[10] In this study, 82.2% were males and 17.8% were females in case group while in the control group 88.9% were males and 11.1% were females. The prevalence of MetS was lower in women than in men during the NHANES 1988–1994 Cohort. However, the prevalence changed in the subsequent 1999–2002 Cohort, with women showing a greater incidence of MetS than males.[11] In this study, 31 patients were in severity 1 category while 14 patients were in severity 2 category. Twenty-five and 12 male patients with AGA were in severity 1 and severity 2, respectively. Six and two female patients with AGA were in severity 1 and severity 2, respectively. At the age of 40, AGA affects about 40% of males, and by the age of 50, that number rises to about 50%.[12]

However, it has been hypothesised that AGA that manifests early (before to the age of 36 years) may differ genetically from AGA that manifests later in life.[13] In this study, the age group of onset was around 41 to 50 years. Most of the patients in this age group have AGA followed by age group 30 to 40 years. All the patients were evaluated for anthropometric data and a value of 23.4 ± 4.50 Kg/m^2 BMI was noted. The mean height and weight were 169.1 ± 7.92 cm and 64.7 ± 8.21 Kg, respectively. In a study conducted by Chakrabarty *et al.* BMI along with height and weight were significantly different between groups.[14] This study stratified the patients on the basis of BMI and noted that 14 patients were in the normal BMI category followed by the overweight category with a p-value of 0.05. The association of BMI with AGA was significant. This study closely matched the findings of Kamal and Raja's study, which showed a strong relationship between a higher BMI and more severe hair loss in AGA-affected men.[15]

In this study, stratification of enrolled patients was done in the control group on the basis of FBS with a significant p-value (p=0.05). MetS's ability to predict T2D has been shown in several studies. The presence of MetS significantly increases the risk and acts as a reliable indicator for the beginning of new T2D cases.[16] A study conducted by Chakrabarty *et al*. could not identify any significant association with respect to FBS.[14] Stratification of the enrolled patients of the control group on the basis of blood pressure was also done, which showed that the p-value was insignificant. According to Ahouansou *et al*. there is a direct link between AGA and hypertension.[17] A connection between androgenetic alopecia and elevated blood pressure was shown in a recent investigation on the condition in female patients.[18] Arias-Santiago *et al*. discovered significantly higher TGs levels in individuals with AGA when compared to controls.[19] This study showed the p-value to be insignificant regarding TGs. In this investigation, there was a strong correlation between Mets and AGA cases. Studies carried out by Acibucu *et al*. and Chakrabarty *et al*. produced similar findings.[14]

There are a few limitations of the study. With only 90 patients enrolled, the study may not capture the full spectrum of the association between AGA and MetS. Additionally, the study primarily focused on patients from a specific geographical location. This restricts the findings' applicability to other people or areas. Furthermore, the study relies on self-reported data for the diagnosis of AGA and MetS. There is a possibility of misclassification or recall bias, which could affect the accuracy of the results.

CONCLUSION

The severity of AGA and MetS has been found to be significantly correlate with one another. This may imply a connection between AGA and MetS, and early detection of MetS in individuals with AGA is advantageous for avoiding morbidities in the future through lifestyle changes.

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ETHICAL APPROVAL:
All procedures followed were in accordance with the ethical standards of the responsible committee and with the Helsinki Declaration of 1975, as revised in 2000. The study protocol was approved by the Research Ethics Committee bearing letter no: A/28/BC/95; Dated:11/03/2020.

PATIENTS' CONSENT:
A written informed consent was taken from patients after explaining them the procedures and possible side effects.

COMPETING INTEREST:
The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:
HFQ: Conceived and designed the research.
AA: Wrote the manuscript.
AK, SS: Collected data and compiled international research.
SI, NN: Analysed the data.
All authors approved the final version of the manuscript to be published.

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