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Study of prevalence of metabolic syndrome in androgenetic alopecia: a hospital based cross sectional study

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Background: Androgenetic alopecia, the most common type of progressive hair loss in males and females, is a type of non-scarring alopecia which is also known as *pattern baldness or pattern hair loss*. Androgenetic alopecia (AGA) is an androgen-dependent condition influenced by dihydrotestosterone (DHT) and the androgen receptor (AR) in hair follicles. Genetic factors also play a role in its development. Male pattern baldness has been linked to several health issues, including coronary artery disease, insulin resistance, hypertension, an abnormal serum lipid profile, obesity, prostate cancer, and benign prostatic hyperplasia. Elevated androgen levels may also contribute to the development of atherosclerosis and thrombosis, which can lead to hypercholesterolemia and hypertension. The risk intensifies with the number of metabolic syndrome components present. **Methods**: Present study was a cross-sectional study done to study prevalence of metabolic syndrome in androgenetic alopecia. Considering the inclusion and exclusion criteria, 100 cases and 100 controls were recruited in the study and after taking informed consent data were collected using pre tested semi structured questionnaire. **Results**: MS was present in 24% of study participants. Metabolic syndrome was found more in patients who had longer duration of AGA. The majority of study participants (43.5%) were overweight. In research participants with metabolic disorders, mean weight, waist circumference, and BMI were all high. Metabolic syndrome and Anthropometric characteristics were revealed to have a highly significant association. The average FBS level was 94±13 mg/dl, the average HDL level was 447 mg/dl, and the average triglyceride level was 135±22 mg/dl. The average weight was 74±14 kg, the average height was 167±10 cm, the average waist circumference was 84±8 cm, and the average BMI was 26.74±4.64 kg/m2. The metabolic syndrome and laboratory measures were found to have a highly significant association (FBS, HDL and triglycerides). In research individuals with metabolic syndromes, mean FBS and triglyceride levels were high. The majority of patients with metabolic syndrome had grade V AGA, according to the findings. However cross-sectional studies such as ours cannot establish a temporal relationship between AGA and Metabolic syndrome. **Conclusion**: The study findings suggest that there is a signification association between severity of AGA and MS. Obesity, hypertension, diabetes, and dyslipidaemia were found to be more common in AGA patients. There was an association between MS and AGA, which could explain why people with androgenic alopecia are more likely to develop cardiovascular disease.

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Keywords: metabolic syndrome; androgenetic alopecia; hospital, observational study

Introduction

Androgenetic alopecia (AGA) is a hereditary and the most common cause of hair loss, an androgen-dependent dermatological disorder characterized by miniaturization of hair follicle. There is an alteration in the hair cycle dynamics leading to vellus transformation of terminal hair follicles [1].

Androgenetic alopecia (AGA) is a prevalent condition influenced by androgens, particularly dihydrotestosterone (DHT), which interacts with hair follicle androgen receptors (AR) to drive hair loss. This disorder, which poses growing concerns for dermatologists worldwide, is modulated by these hormonal factors and is also significantly impacted by genetic predisposition. Variations in the AR gene can affect how sensitive hair follicles are to DHT, contributing to follicular miniaturization and hair loss. Additionally, genetic factors play a crucial role in the development of AGA, as it often runs in families and is associated with specific genetic markers. Understanding both the hormonal and genetic components is essential for dermatologists in diagnosing and managing AGA effectively.

The underlying pathophysiology linking AGA and metabolic syndrome has not been fully established; but many studies have hypothesized that the excess of androgens in both AGA and metabolic syndrome underpins the underlying mechanism of these two conditions [2-4].

In AGA, androgens (DHT in particular) are the main players in its pathogenesis; DHT binds to androgen receptors on androgen-sensitive follicles and effects follicular miniaturizations.

Over the past few decades, there has been an alarming increase in the prevalence of metabolic syndrome all around the world. Approximately, one-third of the adult population in developed countries can be categorized as having metabolic syndrome by different definitions. In India, incidence of metabolic syndrome was found to be 18.3% in a large-scale trial in Chennai in 2006 [5].

Male pattern baldness has been linked to several health conditions, including coronary artery disease, hypertension, insulin resistance, an abnormal serum lipid profile, obesity, prostate cancer, and benign prostatic hyperplasia. Elevated androgen levels can contribute to the development of atherosclerosis and thrombosis, which in turn can lead to hypercholesterolemia and hypertension. Additionally, metabolic syndrome, a cluster of interconnected risk factors, significantly increases the risk of atherosclerotic cardiovascular disease. The risk intensifies with the number of metabolic syndrome components present [6].

Materials and methods

STUDY DESIGN: Observational cross-sectional study.

STUDY CENTRE: Department of Dermatology, Venereology and Leprosy, Index Medical College Hospital & Research Centre, Indore.

DURATION OF STUDY: 1.5 years

INCLUSION CRITERIA:

Case:

- only males
- with age of 18-50 years
- with clinically diagnosed androgenetic alopecia will be considered as cases.

Control:

- Without androgenetic alopecia- considered as controls, with age 18-50 years

EXCLUSION CRITERIA

- Patients >50 years of age due to the increase in the prevalence of androgenic alopecia with age and increase prevalence of metabolic syndrome with age.
- Patients receiving hormone replacement therapy with testosterone.

· Known case of hypertension or diabetes mellitus.

- Those on corticosteroid therapy.

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Male Patients presenting to Dermatology, Venereology & Leprosy outpatient department (OPD) who after detailed history and clinical examination was done in view of AGA. Patients, who fulfilled the inclusion and exclusion criteria were taken for study.

Written and informed consent was taken from the patients for enrolment in the study

• The history included age, occupation, duration of alopecia (based on patient history), treatment details for alopecia, smoking, alcohol consumption and sedentariness (<30 min of physical activity/day).

• Personal history or drug history for hypertension, diabetes mellitus and dyslipidaemia were obtained.

• Diagnosis of androgenetic alopecia is based on history and clinical findings and pattern of increased hair thinning on frontal and parietal scalp with greater hair density on the occipital scalp.

• Family history of androgenetic alopecia was taken.

• The degree of androgenetic alopecia was based on the Norwood scale.

· Data on weight, height and waist circumference were recorded.

• Waist circumference was measure at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest at the end of a normal expiration.

• Systolic and diastolic blood pressure (BP) was measure after a 5-min rest and again 10 min later, recording the mean value.

• Body mass index was calculated by dividing weight (in kg) by height (in m2).

• Fasting plasma sugar and complete lipid profile was analysed in blood samples drawn between 8 and 9 am, after a 12 hour fast.

INVESTIGATION DETAILS

• Fasting blood sugar (FBS)

• Triglycerides (TG) value

• High-density lipoprotein (HDL)

• Those with hypothyroidism and psoriasis.

• Smoker and alcoholic.

ASSESSMENT CRITERIA

- Clinical examination

- Elaborate general, physical, and systemic examinations were carried out and recorded. Complete examination of scalp was done with emphasis on pattern and severity of hair loss. Hair loss was graded according to Hamilton-Norwood Scale.

- Anthropometric and blood pressure measurement

- Height

It was measure against a vertical board with attached metric rule and by bringing a horizontal headboard in contact with the uppermost point on the head. It was recorded in barefoot, full erect position with deep inspiration.

- Weight

It was recorded without footwear and with light clothes on Indian Standards Institute certified weighing machine.

- Body mass index

It was calculated as weight in kg/height in m2 (kilogram/square meter). In adults, overweight is defined as body mass index (BMI) between 25 and 29.9 and obese is defined as BMI ≥30.

- Waist circumference

It was measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest, using a stretch-resistant tape.

- Blood pressure measurement

Blood pressure (BP) was recorded with sphygmomanometer on the right arm in a sitting position after a 5-min rest and again 10 min later, recording the mean value.

Systolic BP ≥130 mm of Hg and diastolic BP ≥85 mm of Hg was taken as cutoff points for hypertension.

Results

Prevalence of AGA

AGA affects all races, but the prevalence rates vary. Caucasians are most affected by AGA followed by Asians and African Americans, then Native Americans and eskimos. A population-based study conducted in India among 1005 subjects showed 58% prevalence of AGA in males aged 30-50 years. Almost all patients have an onset prior to age of 40 years. There is a marked variation in other races which often show much less balding. Lower prevalence has been observed in oriental races. Most Chinese retain the pre-pubertal hairline hence baldness is less common, less extensive and starts later. Japanese men also show a lower incidence and delayed balding about 10 years later than Caucasians. African-Americans also retain a full head of hair four times more than Caucasians. The aetiology of such racial variation is unclear, but probably its genetic as these variations are retained regardless of the geographical location of individuals. According to a study done by Hamilton in 1951, by the age of 30 years the mean prevalence of androgenetic alopecia was 30%, 40% in mid-forties, and this rate rises to 50% by the age of 50 years in Caucasian men.

Keeping in mind research question, proposed hypothesis, aims and objectives and plan of analysis of the study was as follows:

Descriptive analysis- was done to show the distribution in the form of frequency and percentage.

Inferential Analysis- chi-square test, paired t test and Pearson correlation coefficient analysis were used to find association between dependent and independent variables.

1. **Age wise distribution of study participants**

Mean age of study participants was 30±7 years. Majority of the study participants (56.5%) belonged to age group of 18-30 years followed by 36.5% of study participants belonging to age group of 31-40 years. 7% of study participants belonged to age group of 41-50 years.

2. **Distribution of duration of AGA among study participants**

Mean duration of AGA was 21±11 months. Majority of the study participants 18% had AGA for less than 12 months and 17.5% had AGA for 25-36 months. 12.5% of study participants had AGA for 13-24 month. Only 2 % of study participants had AGA for more than 36 months.

3. **Distribution of Severity of AGA among study participants**

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Majority of study participants (16.5%) had grade 4 AGA followed by grade 3 AGA (11.5%) and grade 5 AGA (9%). 5 % of study participants had Grade 2 and grade 6 AGA each. Grade 7 AGA was present in only 2.5% of study participants.

4. **Distribution of Family history of AGA and Comorbidities among study participants**

Family history of AGA was present in 42.5% of study participants. 2.5% and 5.5% of study participants were known cases of Diabetes and Hypertension respectively.

5. **Mean anthropometric values of study participants**

Mean weight was 74±14 kg, mean height was 167±10 cm, mean waist circumference was 84±8 cm and mean BMI was 26.74±4.64 Kg/m^2

6. **Distribution of BMI category among study participants**

Majority of the study participants (43.5%) were in overweight category followed by 31% in normal weight category, 17.5% in Obesity category 1, 6% in Obesity category 2 and 2 % in underweight category (Figure 1).

7. **Mean laboratory parameters values of study participants**

Mean FBS was 94±13 mg/dl, mean HDL was 44±7 mg/dl and mean triglyceride was 135±22 mg/dl.

8. **Distribution of presence of metabolic syndromes among study participants**

24% of study participants had metabolic syndrome.

9. **Association of metabolic syndrome with Laboratory parameters**

Mean FBS and triglyceride were high in study participants with metabolic syndromes. Highly significant association was found between metabolic syndrome and laboratory parameters (FBS, HDL and triglycerides) $p<0.05$.

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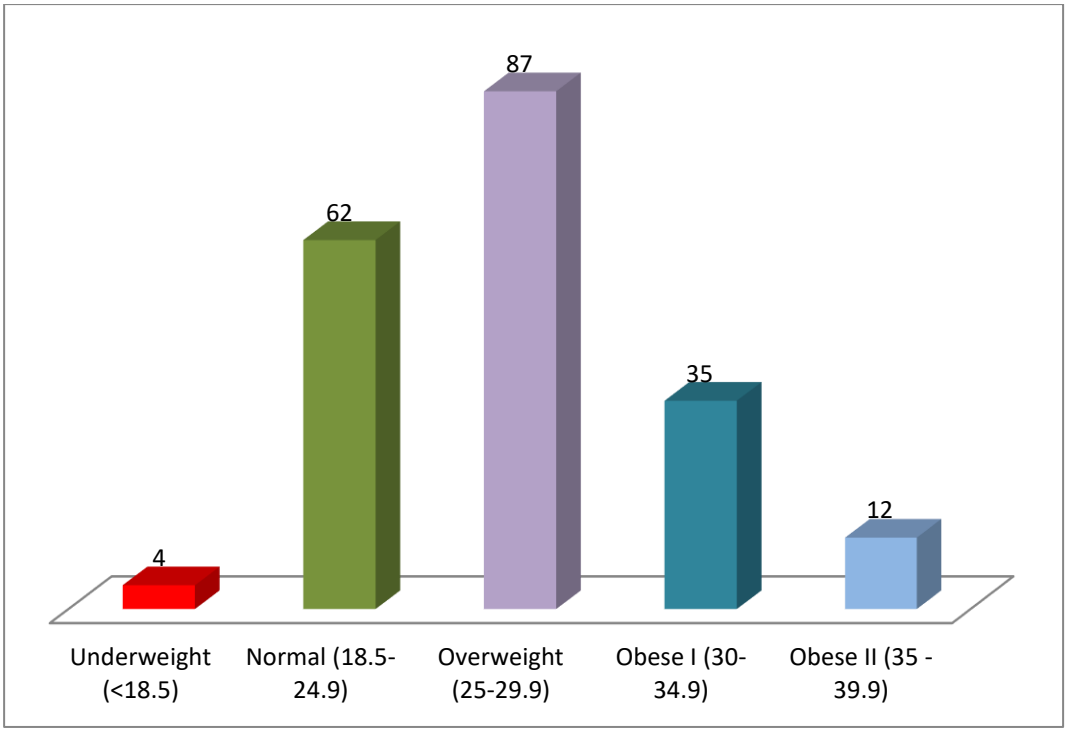

Figure 1 - Distribution of BMI category among study participants

10. **Association of metabolic syndrome with Anthropometric parameters**

Mean weight, waist circumference and BMI were high in study participants with metabolic syndromes. Highly significant association was found between metabolic syndrome and Anthropometric parameters (Weight, waist circumference and BMI) $p<0.05$.

11. Mean age distribution of study participants of AGA and NON-AGA

Mean age of study participants with AGA and Non-AGA was 29±6 years and 31±7 years respectively.

12. Association of age with AGA and NON-AGA

63% of AGA was present in age group of 18-30 years followed by 34% in age group of 31-40 years and 3% in age group of 41-50 years. Majority of participants with AGA were less than 30 years of age

13. Association of AGA with Family history of AGA and Comorbidities among study participants

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Majority of the cases of AGA had family history of AGA. Family history of AGA, K/C/O DM and HTN were found to be statistically significant with presence of AGA.

14. Association of anthropometric parameters and AGA and Non-AGA diseases.

Study participants with AGA were found to have higher mean weight (76.77) and BMI (27.38) than study participants with NON-AGA disease. Highly significant association was found between weight, BMI and AGA and non AGA disease ($p<0.05$).

15. Association of laboratory parameters and AGA and Non-AGA patients

Study participants with AGA were found to have higher mean FBS (96.43), waist circumference (86.17) than study participants with NON AGA disease. Highly significant association was found between FBS, waist circumference and AGA ($p<0.05$).

16. Association of metabolic syndrome and AGA and Non-AGA patients.

Presence of metabolic syndrome was found to be associated with AGA and non-AGA diseases and it was statistically significant. Majority of study participants with metabolic syndrome were also found to have AGA.

17. Association of metabolic syndrome and severity of AGA.

Study participants with metabolic syndrome had severe AGA. It was found that majority of those who had metabolic syndrome (n=11) had grade V AGA on Norwood Hamilton scale. Statistically significant association was found between metabolic syndrome and severity of AGA ($p<0.05$)

18. Association of metabolic syndrome and duration of AGA.

Study participants with metabolic syndrome had longer duration of AGA. It was found that majority of those who had metabolic syndrome (n=22) had longer duration of AGA (25-36 months) statistically significant association was found between metabolic syndrome and duration of AGA ($p<0.05$) (Table 1).

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Table 1 – Characteristics of the study

ASSOCIATION OF METABOLIC SYNDROME WITH DURATION AND SEVERITY OF AGA							
		AGA		NON-AGA (OTHER DISEASES)			
METABOLIC SYNDROME	YES	34		14			
	NO	66		86			
DURATION OF AGA (MONTHS)							
		<12 MONTHS	13-24 MONTHS	25-36 MONTHS	37-48 MONTHS		
METABOLIC SYNDROME	YES	4	4	22	4		
	NO	32	21	13	0		
GRADING OF AGA							
		ii	iii	iv	v	vi	vii
METABOLIC SYNDROME	YES	0	2	10	17	6	5
	NO	11	21	23	7	4	0

Discussion

The present study was a cross-sectional study done to study prevalence of metabolic syndrome in androgenetic alopecia. Keeping in mind research question, proposed hypothesis, aims and objectives analysis was done. Descriptive analysis was done to

show the distribution in the form of frequency and percentage and inferential analysis were used to find association between dependent and independent variables.

Association of severity and duration of AGA with Metabolic syndrome (MS)

MS was present in 24% of study participants. Metabolic syndrome found more in those who had longer duration of AGA. The majority of patients with metabolic syndrome (n=22) had AGA for a longer period of time (25-36 months) There was a statistically significant association between MS and AGA duration [7-9].

The majority of patients with metabolic syndrome (n=11) had grade V AGA, according to the findings. There was a statistically significant association between MS and the severity of AGA. Participants in the study who had metabolic syndrome had severe AGA [10]. However cross-sectional studies such as ours cannot establish a temporal relationship between AGA and Metabolic syndrome. L H Su et al also reported that the risk of having AGA type IV or greater was significantly increased for subjects with metabolic syndrome compared with those without metabolic syndrome [11-14].

Laboratory test and Anthropometry

The majority of study participants (43.5%) were overweight, followed by 31% who were normal weight, 17.5 % who were in obesity category 1, 6% in obesity category 2 and 2 % in underweight category.

In research participants with metabolic disorders, mean weight, waist circumference, and BMI were all high. Metabolic syndrome and Anthropometric characteristics were revealed to have a highly significant association (Weight, waist circumference and BMI).

The average weight (76.77) and BMI (27.38) of study participants with AGA disease were higher than those with non-AGA disease. Weight, BMI, and AGA and non-AGA disease were found to have a highly significant association.

The average FBS level was 94±13 mg/dl, the average HDL level was 447 mg/dl, and the average triglyceride level was 135±22 mg/dl. The average weight was 74±14 kg, the average height was 167±10 cm, the average waist circumference was 84±8 cm, and the average BMI was 26.74±4.64 kg/m2. [15,16]

The metabolic syndrome and laboratory measures were found to have a highly significant association (FBS, HDL and triglycerides). In research individuals with metabolic syndromes, mean FBS and triglyceride levels were high.

Participants with AGA had a higher mean FBS (96.43mg/dl) and waist circumference (86.17cm) than those without the condition. FBS, waist circumference, and AGA and non-AGA illness were revealed to have a highly significant association. [17]

Family history plays an important role in the development of alopecia. Although the true pathogenic mechanism of androgenetic alopecia is not fully recognized, it is currently believed that a polygenic contribution as well as endocrine interaction is involved in its pathogenesis. 42.5 % of research participants had a family history of AGA. Diabetes and hypertension were diagnosed in 2.5 % and 5.5 % of study participants, respectively. [18]

The majority of AGA cases have a family history of the disease. The presence of AGA was found to be statistically significant with a family history of AGA, K/C/O DM, and HTN. [19,20]

Limitations of the Study

- The limited sample sizes in subgroups were one of our study's weaknesses. To establish a link between the severity and duration of androgenic alopecia and metabolic syndrome, as well as its components, more research with large sample numbers is needed.
- The duration of alopecia was determined based on patient history, which may or may not be correct, especially in the case of a disorder with a gradual onset.
- The temporal association between metabolic syndrome and androgenic alopecia could not be established because our study was cross-sectional.

Conclusion

- A higher prevalence of MS is seen in androgenic alopecia cases when compared with that of controls.

- A significant association was seen between the severity of AGA and MS. This may suggest an association of AGA with MS, and early screening for MS is beneficial in

patients with androgenic alopecia to prevent future unforeseen complications by early lifestyle modifications.

- Present study was a cross sectional study done to study prevalence of MS in AGA. Mean values of BMI and waist to hip ratio were even higher in patients with AGA as compared to Non-AGA. Obesity, hypertension, diabetes, and dyslipidaemia were found to be more common in AGA patients. There was an association between MS and AGA, which could explain why people with androgenic alopecia are more likely to develop cardiovascular disease.

- Statistically significant association was found between MS and severity and duration of AGA.

- Study subjects with metabolic syndrome had severe AGA and for longer duration.

- AGA patients with higher BMI or abdominal obesity should be advised regarding lifestyle modifications for weight reduction.

- In health care facilities in patients with AGA, routine metabolic syndrome screening, counselling, and management should be implemented.

- Furthermore, individuals' understanding of risk factors and the utilisation of nutritional, exercise, and behavioural treatments for both prevention and treatment of metabolic syndrome must be improved.

- In patients with androgenic alopecia, early detection and intervention for metabolic syndrome and its components may help to prevent the development of cardiovascular disease.

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