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Original Research Article

A study of the association of premature androgenetic alopecia with metabolic syndrome and coronary artery disease

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ABSTRACT

Background: Androgenetic alopecia (AGA) is a common form of patterned hair loss characterized by transformation of terminal hair of the scalp to vellous hair mediated mainly by androgens. Premature androgenetic alopecia can be defined as androgenetic alopecia developing before 35 years of age and presenting with at least stage 2 of Norwood-Hamilton classification. Premature AGA not only adds to psychological stress but is also reported as a risk factor for cardiovascular diseases, metabolic syndrome and carcinoma prostrate. In many subsequent studies, AGA has been shown to be associated with several diseases such as insulin resistance (IR), abnormal serum lipid profiles and obesity.
Methods: Various parameters of metabolic syndrome were measured in 75 male patients of AGA in the department of dermatology, Safdarjung hospital from June 2015 to April 2016. ECG and echocardiography was done in all patients to look for any evidence of premature coronary artery disease.
Results: In our study grade III and IV of AGA were the most common types (32% each). We found the prevalence of metabolic syndrome to be 8% in our patients with premature androgenetic alopecia in accordance with the NCEP ATP III guidelines. There was a significant positive correlation between grade of androgenetic alopecia and metabolic syndorme in our patients (p=0.049).
Conclusions: The prevalence of metabolic syndrome was not increased as compared to general population.

Keywords: Metabolic syndrome, Androgenetic alopecia

INTRODUCTION

Androgenetic alopecia (AGA) is a common form of patterened hair loss characterized by transformation of terminal hair of the scalp to vellous hair mediated mainly by androgens and increased androgen receptor binding in genetically predisposed men and women. It has a polygenetic pattern.[1] Dihydrotestosterone (DHT) binding to androgenic receptors in hair follicles of the scalp triggers the genes accountable for gradual transformation of large terminal follicles to miniature ones.[2]

Such miniaturization is observed on the fronto-temporal area and vertex in men, and over the crown in women, as these areas are more sensitive to androgen effects. Androgenetic alopecia in males has been classified according to the Hamilton-Norwood classification and in females by the Ludwig classification.[3]

Premature androgenetic alopecia can be defined as androgenetic alopecia developing before 35 years of age and presenting with at least stage 2 of Norwood-Hamilton classification. Premature AGA not only adds to psychological stress but is also reported as a risk factor

for cardiovascular diseases, metabolic syndrome and carcinoma prostrate.[4-9]

In 1972, it was first suggested that AGA may be a risk factor for cardiovascular disease (CVD) when Cotton et al demonstrated an association between the occurrence of CVD and hair loss.[10] Conversely others indicated that there is no association between CVD and AGA. In many subsequent studies, AGA has been shown to be associated with several diseases such as insulin resistance (IR), abnormal serum lipid profiles and obesity.

Metabolic syndrome is defined according to the revised national cholesterol education program adult treatment panel III criteria.[11] The individual components are as following; waist circumference ≥88 cm for women or ≥102 cm for men, fasting blood sugar ≥110 mg/dl, blood pressure ≥130/85 mm hg or on medication for hypertension, HDL <40 mg/dl in men or <50 mg/dl in women, and triglycerides ≥150 mg/dl.

Premature onset coronary artery disease is defined as coronary artery disease (angina, acute myocardial infarction or any revascularisation procedure) occurring in age group <40 years.[12,13]

METHODS

A cross sectional was conducted in the department of Dermatology and STD Vardhman Mahavir Medical College and Safdarjung Hospital New Delhi from June 2015 to April 2016. The Norwood-Hamilton classification was used to assess the grade of androgenetic alopecia in men. Ludwigs classification was used to assess androgenetic alopecia in females. Metabolic syndrome was defined according to the National Cholesterol Education Program Adult Treatment Panel III criteria. Blood pressure, blood glucose, lipid parameters, and body mass index along with anthropometric measurements were assessed in all patients. Blood samples were collected from all patients after 12 hours of overnight fasting and serum lipid profile were estimated according to standard laboratory procedures. For the evaluation of premature coronary artery disease non-invasive tests like ECG, stress test and Echocardiography were done in all patients. Microsoft excel sheets were used for data analysis and p values were calculated between various variables. P<0.05 was taken as significant.

Norwood Hamilton classification of androgenetic alopecia in males

Grade I: There is minimal or no recession of the hairline.

Grade II: There are triangular, usually symmetrical, areas of recession at the frontotemporal hairline.

Grade III: This represents the minimal extent of hair loss sufficient to be considered as baldness according to Norwood. There are deep symmetrical recession at the temples that are bare or only sparsely covered by hair. In Type III vertex, the hair loss is primarily from the vertex with limited recession of the frontotemporal hairline that does not exceed the degree of recession seen in Type III (Figure 1).

Figure 1: Premature androgenetic alopecia grade III in a 23 year old patient having metabolic syndrome.

Grade IV: The frontotemporal recession is more severe than in Type III and there is sparse hair or no hair on the vertex. The two areas of hair loss are separated by a band of moderately dense hair that extends across the top. This band connects with the fully haired fringe on the sides of the scalp.

Grade V: The vertex hair loss region is still separated from the frontotemporal region but it is less distinct. The band of hair across the crown is narrower and sparser and the vertex and frontotemporal regions of hair loss are bigger.

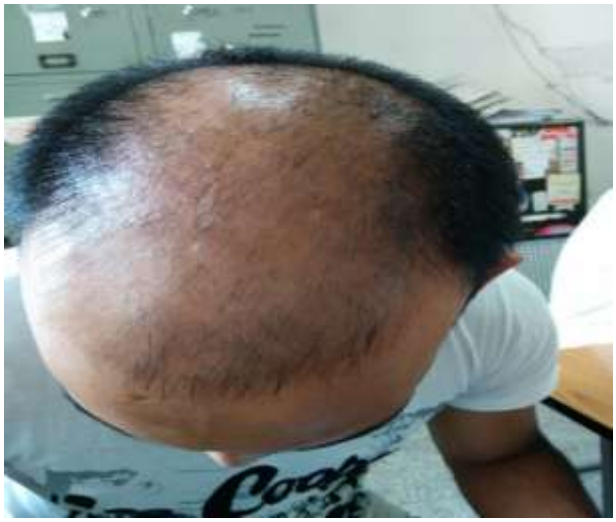

Figure 2: Premature AGA grade VI in an 18 year old male having androgenetic alopecia.

Grade VI: The bridge of hair that crosses the crown is gone with only sparse hair remaining. The frontotemporal and vertex regions are joined together and the extent of hair loss is greater (Figure 2).

Grade VII: The most severe form of hair loss and only a narrow band of hair in a horseshoe shape remains on the sides and back of the scalp. This hair is usually not dense and may be quite fine.

RESULTS

1. *Age*

The age of the patients varied from 18 to 35 years with an average age of 25.7 years (Table 1).

Table 1: Age distribution of patients with AGA.

Age group	Percentage of patients (%)	Number of patients
18 - 20	7	5
21 - 23	24	18
24 - 26	31	23
27 - 29	19	14
≥30	20	15

2. *Grading of AGA*

Maximum number of patients had grade 3 and grade 4 androgenetic alopecia (Table 2).

Table 2: Grading of AGA.

Grades	Number of patients	Percentage of patients (%)
2	4	6
3	22	32
4	22	32
5	15	22
6	5	7

3. *Waist circumference*

The waist circumference (WC) varied from 70 to 110 cm, with an average of 93.5 cm. Out of the 9 patients with an abnormal WC (>102 cm) only 3 were found to have metabolic syndrome.

There was no significant correlation between grade of AGA and waist circumference of patients. In our observation of 75 patients, (r=0.21, p=0.07) value was observed not significant at p<0.05.

4. *High density lipoprotein levels*

HDL levels varied from 30 to 71with an average of 40.2 mg/dl.

HDL levels were abnormal in 33 patients (Table 3).

Table 3: Showing number of patients with normal and abnormal TG levels.

HDL levels (males)	Number of patients	Percentage of patients (%)
Normal	35	51
Abnormal	33	49

Out of these 33 patients, metabolic syndrome was found in 5 patients.

There was no significant positive correlation between grade and high density lipoprotein levels of patients. In our observation of 75 patients, (r=0.01, p=0.92) value was observed not significant at p<0.05.

There was no significant correlation between HDL levels and waist circumference in our study. In our observation of 75 patients, (r=0.09, p=0.43) value was observed not significant at p<0.05.

5. *Metabolic syndrome*

Metabolic syndrome was present in 6 out of 75 (8%) patients. There was significant correlation between waist circumference and metabolic syndrome in patients (p=0.02) (Table 4).

Table 4: Showing percentage of patients having metabolic syndrome.

Metabolic syndrome	Number of patients	Percentage of patients (%)
Present	6	8%
Absent	69	72%

6. *Prevalence of metabolic syndrome according to modified NCEP ATP III criteria*

The prevalence of metabolic syndrome increased from 8% to 13% when modified NCEP ATP III criteria was used in which WC cut-off for males is ≥ 90 cm and ≥ 80 cm in females.

There was a significant positive correlation between grade of androgenetic alopecia and metabolic syndrome in patients. In our observation of 75 patients, (r=0.22, p=0.049) value was observed significant at p<0.05. This significance was only observed on using the modified NCEP ATP III criteria.

There was no significant correlation between high density lipoprotein levels and metabolic syndrome in patients. In our observation of 75 pateints, (r=0.07, p=0.56) value was observed not significant at p<0.05 (Table 5).

Table 5: Showing percentage of patients having metabolic syndrome according to modified NCEP ATP III criteria.

Metabolic syndrome	Number of patients	Percentage of patients (%)
Present	10	13
Absent	69	87

7. Premature coronary artery disease

Premature CAD was not present in any of the patients.

DISCUSSION

A cross sectional study of 75 patients with premature androgenetic alopecia was done and patients were investigated for the presence of metabolic syndrome and premature coronary artery disease.

Grade of AGA

Wang et al in their study found grade II AGA to be the commonest type.[14] Shankar et al in their study also found grade II and grade III to be the most common type of AGA.[15] However in our study more severe grade III and IV were the most common types (32% each).

Metabolic syndrome

We found the prevalence of metabolic syndrome to be 8% in our patients with premature androgenetic alopecia in accordance with the NCEP ATP III guidelines. This is in contrast to previously reported studies in Indian patients where Banger et al reported an incidence of 22% and Chakrabarty et al reported an incidence of 43.5% in their patients of premature androgenetic alopecia.[16,17]

Other studies also reported a higher incidence. A study by Acibucu et al titled "The association of insulin resistance and metabolic syndrome in early androgenetic alopecia" observed that 25% patients with AGA had metabolic syndrome as compared to 10.4% in controls.[18]

But there have been studies which did not support the association between premature androgenetic alopecia and metabolic syndrome. A study by Guzzo et al compared the serum lipid profile of 50 patients with Hamilton grade III and IV vertex alopecia patients with a control group, and found no difference in HDL, LDL, total cholesterol, TG and total cholesterol/LDL rates.[19]

Mumcuoglu et al found a relationship between AGA and insulin resistance but not with metabolic syndrome in 50 male patients with grade ≥3 AGA.[20]

Nabaie et al did not did not find a relationship between AGA and the parameters, FBG, serum fasting insulin levels, total cholesterol, TG, HDL, and IR in 97 male AGA patients.[21]

When we compared the prevalence of metabolic syndrome according to the modified NCEP ATP III guidelines in our study the prevalence increased to 13% but this was still lower than most studies.

In our study, 59 out of 75 patients (79%) were found to have at least one abnormal parameter of metabolic syndrome and 32 out of 75 patients (43%) were found to have at least two abnormal parameters of metabolic syndrome.

Thus there is no conclusive evidence of significant increase in metabolic syndrome in patients with premature androgenetic alopecia. However larger community based studies are required to establish if there is an association of metabolic syndrome in patients of premature androgenetic alopecia.

Grade of androgenetic alopecia and metabolic syndrome

There was a significant positive correlation between grade of androgenetic alopecia and metabolic syndrome in our patients. In our observation of 75 patients, ($r=0.22$, $p=0.049$) value was observed significant at $p<0.05$. This significance was only observed on using the modified NCEP ATP III criteria. Thus in our study patients with metabolic syndrome had more severe alopecia. However a recent Indian study by Chakrabarty et al showed that severity of AGA did not correlate with the presence of metabolic syndrome.[22]

HDL levels

In our study HDL values were deranged in a majority of patients. Su et al in their study found that among metabolic syndrome components, high-density lipoprotein cholesterol (HDL) (OR 2.36, 95% CI 1.41-3.95; p=0.001) was revealed as the most important factor associated with AGA.[23]

However low HDL levels have been commonly reported in the Indian population. Enas et al in their study titled "Prevalence of coronary artery disease in Asian Indians," found that only 4% of Asian Indian men and 5% Asian Indian women had optimal HDL levels.[24] Similarly Sawant et al in their study showed that around 64.2% men and 33.8% women less than 25 years of age had abnormally low levels of HDL.[25] Hence low HDL levels may be part of the general population.

There was no significant positive correlation between grade of androgenetic alopecia and high density lipoprotein. In our observation of 75 patients, ($r=0.01$, $p=0.92$) value was not significant at $p<0.05$.

Association between grade of AGA and triglyceride levels, HDL levels and waist circumference

There was no significant positive correlation between grade of AGA and triglyceride levels of patients. In our observation of 75 patients, (r=0.001, p=0.99) value was not significant at p<0.05.

There was no significant positive correlation between grade and high density lipoprotein levels of patients. In our observation of 75 patients, (r=0.01, p=0.92) value was not significant at p<0.05.

Similarly there was no significant correlation between severity and waist circumference of patients. In our observation of 75 patients, (r=0.21, p=0.07) value was observed not significant at p<0.05.

Premature coronary artery disease

Dogramaci et al in their study found that structure and function of the heart was normal in echocardiography and excercise echocardiography was also normal.[26] These findings were similar in our study where we did not detect premature CAD in any of our patients.

Similarly Shahar et al concluded that male pattern baldness is not an important risk factor for myocardial infarction or asymptomatic atherosclerosis.[27] In addition they did not find statistically significant differences in carotid intima-media thickness according to the degree of alopecia, despite studying a large number of patients. In our study also no patient had coronary artery disease although carotid intima thickness was not measured in our study.

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