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Association Between Androgenetic Alopecia and Coronary Artery Disease in Men A Prospective Case Study

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ABSTRACT

Androgenetic alopecia (AGA) is a common form of hair loss predominantly affecting males and is linked to genetic and hormonal factors. Emerging evidence suggests that AGA may be associated with systemic health conditions, particularly coronary artery disease (CAD). CAD remains a major cause of morbidity and mortality worldwide and there is growing interest in understanding the potential relationship between AGA and CAD, which may share common risk factors such as dyslipidemia, endothelial dysfunction and insulin resistance. This study aimed to evaluate the association between AGA and CAD in young men, particularly focusing on the prevalence and severity of AGA and its correlation with cardiovascular risk factors, including dyslipidemia, hypertension and smoking. A hospital-based case-control study was conducted in South India, involving 150 young male participants aged 18-45 years. The participants were divided into two groups: 75 CAD patients and 75 age-matched controls without CAD. The severity of AGA was assessed using the Hamilton-Norwood scale and cardiovascular risk factors were evaluated through clinical examination and biochemical parameters, including lipid profiles and fasting blood glucose levels. Multivariate logistic regression was performed to identify predictors of CAD. Severe AGA was significantly more prevalent in the CAD group (36%) compared to the control group (10.7%), with moderate and mild AGA being more common in the controls. Severe AGA was also strongly associated with higher levels of dyslipidemia, hypertension and smoking. Multivariate analysis revealed that severe AGA was an independent predictor of CAD (adjusted OR: 3.8, $p<0.001$). The study suggests a significant association between AGA and CAD in young males, with more severe AGA correlating with higher cardiovascular risk. These findings highlight the potential of AGA as a marker for increased cardiovascular risk, supporting early screening and preventive strategies for individuals with severe AGA.

INTRODUCTION

Androgenetic alopecia (AGA) is a common form of hair loss, predominantly affecting males and is characterized by progressive thinning of the scalp hair. It is believed to be caused by a combination of genetic predisposition and hormonal factors, particularly an increased sensitivity to dihydrotestosterone (DHT)[1]. While AGA is often perceived as a cosmetic concern, there is increasing evidence suggesting that it may be associated with systemic health conditions, particularly cardiovascular diseases (CVD). Coronary artery disease (CAD) is a major manifestation of cardiovascular disease and remains a leading cause of morbidity and mortality worldwide [2]. Recent studies have indicated that AGA may share common pathophysiological pathways with CAD, particularly through mechanisms involving dyslipidemia, endothelial dysfunction and insulin resistance. Therefore, understanding the potential relationship between AGA and CAD could provide valuable insights into the shared risk factors and pathophysiology of these conditions[3]. AGA is highly prevalent worldwide, affecting up-50% of men by the age of 50 years. The condition is more common in men of European and Asian descent, with varying degrees of severity. In India, the prevalence of AGA among males ranges from 30%-40%, with the incidence increasing with age[1]. On the other hand, CAD remains a significant public health issue globally, contributing to approximately 31% of all deaths annually, with increasing rates in younger populations[4]. In India, the incidence of CAD has been rising, particularly among the younger male population, driven by changing lifestyles, poor dietary habits, sedentary behavior and high prevalence of traditional risk factors such as smoking, hypertension and dyslipidemia[5]. Several studies have explored the relationship between AGA and cardiovascular risk factors. A study by Liu[6] found that men with AGA had a significantly higher prevalence of CAD risk factors such as hypertension, smoking and elevated cholesterol levels compared to men without AGA. Amparo[7] suggested that AGA might serve as a clinical marker of increased cardiovascular risk, proposing that the hormonal and genetic pathways implicated in AGA could also predispose individuals to CVD. Another study by Helen[8] reported that severe AGA was associated with a higher incidence of CAD, particularly in younger men and that the severity of AGA correlated with poorer lipid profiles. However, while these studies have established some link between AGA and cardiovascular risk, the exact nature of this association remains poorly understood, particularly in the younger male population. The available literature largely focuses on older adults and there is limited research addressing how AGA correlates with CAD in younger individuals, especially in India.

Justification: The association between AGA and CAD in younger males is a topic of growing interest but has not been extensively studied in the Indian context. In young males, the early detection of CAD and the identification of modifiable risk factors is crucial to preventing the long-term complications associated with cardiovascular diseases. If AGA is indeed a reliable marker for cardiovascular risk, it could offer an early indicator for preventive interventions. This study aims to address this gap by exploring the relationship between AGA and CAD risk factors in a young male cohort. Understanding this relationship could help identify individuals at higher risk for cardiovascular disease based on the presence and severity of AGA, facilitating early intervention and personalized treatment strategies.

Aims and Objectives:

Aim: To evaluate the association between androgenetic alopecia (AGA) and cardiovascular risk factors, particularly coronary artery disease (CAD), in young male patients with a history of hair fall.

Objectives:

- To determine the prevalence and severity of AGA (using the Hamilton-Norwood scale) in young male patients diagnosed with CAD compared to controls without CAD.
- To assess the correlation between AGA severity and traditional cardiovascular risk factors, including dyslipidemia, hypertension and smoking.

MATERIALS AND METHODS

Study Design: A hospital-based case-control study was conducted to assess the association between androgenetic alopecia (AGA) and cardiovascular risk factors, including coronary artery disease (CAD), in young male patients with a history of hair fall.

Study Setting: The study was carried out in the Departments of Cardiology and Dermatology at a tertiary care hospital in south India, over a period of one year.

Study Population: The study included a total of 150 young male participants aged between 18 and 45 years, divided into two groups:

- **Cases (n=75):** Male patients with angiographically confirmed CAD.
- **Controls (n=75):** Age-matched males without any clinical or angiographic evidence of CAD.

Inclusion Criteria:

- Males aged 18-45 years.
- **Cases:** Diagnosed with CAD based on coronary angiography.

- **Controls:** Free of clinical or diagnostic evidence of CAD.
- Participants with a history of hair fall suggestive of AGA.

Exclusion Criteria:
- Presence of other causes of hair loss (e.g., alopecia areata, telogen effluvium, scalp infections).
- Systemic illnesses such as autoimmune diseases, malignancies, or chronic kidney disease.
- Use of medications affecting cardiovascular or dermatological health (e.g., finasteride, minoxidil).
- Previous history of myocardial infarction or coronary interventions in controls.

Sample Size: A total sample size of 150 (75 cases and 75 controls) was calculated based on the prevalence of AGA in previous studies and expected differences between groups, with a 95% confidence interval and 80% power.

Assessment and Measurements:

AGA Severity:
- AGA was graded using the Hamilton-Norwood Scale, classifying participants into mild (Grade I-II), moderate (Grade III-IV) and severe (Grade V-VII) categories.
- A dermatologist performed the grading under standardized lighting conditions.

Cardiovascular Risk Factors:
- Data on traditional risk factors such as smoking, hypertension, diabetes mellitus, family history of CAD and obesity were collected using a structured questionnaire and clinical examination.
- Blood pressure was measured using a standard sphygmomanometer. Hypertension was defined as $\geq$140/90 mmHg or use of antihypertensive medication.
- **Anthropometric Measurements:** Body mass index (BMI) was calculated as weight (kg)/height² (m²).

Biochemical Parameters:
- Blood samples were collected after 12 hours of fasting for lipid profile analysis, including total cholesterol, LDL, HDL and triglycerides.
- Fasting blood glucose levels were measured and diabetes mellitus was defined as fasting glucose $\geq$126 mg/dL or use of antidiabetic medication.

Coronary Artery Disease Diagnosis:
- Cases were diagnosed based on coronary angiography showing $\geq$50% stenosis in at least one coronary artery.

Data Collection: All participants underwent a structured interview and clinical examination by trained investigators. Data on sociodemographic characteristics, lifestyle factors (e.g., smoking, physical activity), AGA severity and cardiovascular risk profiles were recorded.

Statistical Analysis:
- Descriptive statistics were used to summarize baseline characteristics of cases and controls. Continuous variables were expressed as mean±standard deviation (SD) and categorical variables as frequencies and percentages.
- The prevalence of AGA and its severity was compared between cases and controls using the chi-square test.
- Logistic regression analysis was performed to determine the association between AGA severity and CAD, adjusting for confounders such as smoking, hypertension and dyslipidemia.
- Pearson's correlation coefficient was used to assess the relationship between AGA severity and lipid parameters in the CAD group.
- Statistical significance was set at **$p<0.05$.**

Ethical Considerations: The study was approved by the institutional ethics committee. Written informed consent was obtained from all participants before enrollment. Data confidentiality was maintained throughout the study.

RESULTS AND DISCUSSIONS

Table 1: Baseline Demographics and Clinical Characteristics of Study Population

Variable	CAD Group (n=75)	Control Group (n=75)
Mean age (years)	38.2±5.6	37.8±6.0
BMI (kg/m²)	27.4±3.5	25.6±3.2
Smoking (%)	46 (61.3%)	20 (26.7%)
Family history of CAD (%)	42 (56.0%)	15 (20.0%)
Hypertension (%)	38 (50.7%)	15 (20.0%)

This table summarizes the demographic and clinical profiles of the CAD group and the control group. The CAD group had a slightly higher mean BMI compared to the control group (27.4 vs. 25.6 kg/m²). The prevalence of smoking, family history of CAD and hypertension were significantly higher in the CAD group, indicating a greater burden of traditional cardiovascular risk factors.

Table 2: Prevalence and Severity of AGA in Study Groups

Hamilton-Norwood Grade	CAD Group (n = 75)	Control Group (n = 75)
Grade I-II (Mild)	18 (24.0%)	42 (56.0%)
Grade III-IV (Moderate)	30 (40.0%)	25 (33.3%)
Grade V-VII (Severe)	27 (36.0%)	8 (10.7%)

This table compares the distribution of AGA severity between the CAD and control groups using the Hamilton-Norwood Scale. Severe AGA (Grade V-VII) was significantly more prevalent in the CAD group (36%) compared to the control group (10.7%). Conversely, mild AGA (Grade I-II) was more common in the control group (56%) than in the CAD group (24%).

Table 3: Cardiovascular Risk Factor Profile by AGA Severity in the CAD Group

Variable	Mild AGA (n=18)	Moderate AGA (n=30)	Severe AGA (n=27)	P-value
Dyslipidemia (%)	6 (33.3%)	18 (60.0%)	22 (81.5%)	<0.001
Hypertension (%)	4 (22.2%)	16 (53.3%)	18 (66.7%)	0.01
Smoking (%)	7 (38.9%)	20 (66.7%)	19 (70.4%)	0.02

This table compares the distribution of AGA severity between the CAD and control groups using the Hamilton-Norwood Scale. Severe AGA (Grade V-VII) was significantly more prevalent in the CAD group (36%) compared to the control group (10.7%). Conversely, mild AGA (Grade I-II) was more common in the control group (56%) than in the CAD group (24%).

Table 4: Multivariate Logistic Regression Analysis for Predictors of CAD

Variable	Adjusted Odds Ratio (95% CI)	P-value
Severe AGA	3.8 (1.8-8.1)	<0.001
Smoking	2.7 (1.3-5.7)	0.008
Hypertension	2.2 (1.1-4.4)	0.03
Dyslipidemia	3.1 (1.6-6.0)	<0.001

This table presents the results of a multivariate logistic regression analysis identifying significant predictors of CAD. Severe AGA emerged as a strong independent predictor of CAD, with an adjusted odds ratio (AOR) of 3.8 (95% CI: 1.8-8.1., p<0.001). Dyslipidemia, smoking, and hypertension were also identified as significant predictors, further emphasizing the multifactorial nature of CAD risk.

Table 5: Correlation of AGA Severity with Lipid Profile in CAD Group

Lipid Parameter	Mild AGA (n=18)	Moderate AGA (n=30)	Severe AGA (n=27)	P-value
Total cholesterol (mg/dL)	185±24	210±30	235±28	<0.001
LDL (mg/dL)	110±18	135±20	155±22	<0.001
HDL (mg/dL)	50±8	45±7	40±6	<0.001
Triglycerides (mg/dL)	150±35	175±30	190±28	<0.001

This table illustrates the relationship between AGA severity and lipid parameters in the CAD group. As the severity of AGA increased, there was a progressive and statistically significant worsening of lipid profiles. For instance, total cholesterol increased from 185 mg/dL in the mild AGA group to 235 mg/dL in the severe AGA group (p<0.001), while HDL levels decreased correspondingly. This indicates a strong correlation between AGA severity and dyslipidemia. The present study aimed to assess the association between androgenetic alopecia (AGA) and cardiovascular risk factors, particularly coronary artery disease (CAD), in young male patients with a history of hair fall. The findings of this study indicate a significant relationship between the severity of AGA and the presence of CAD, with more severe AGA correlating with higher cardiovascular risk factors, such as dyslipidemia, hypertension, smoking and a family history of CAD. Our study found that severe AGA (Grades V-VII) was significantly more prevalent in the CAD group (36%) compared to the control group (10.7%), with mild AGA (Grades I-II) being more common in the control group. This finding is consistent with previous studies that have suggested a higher prevalence of AGA in individuals with CAD. For instance, a study by Kamal H Sharma[2] also found a higher prevalence of AGA in CAD patients, suggesting a potential link between the pathophysiology of both conditions. Similarly, Liu[6] noted that AGA may serve as a marker for early detection of cardiovascular disease in males. Our study further demonstrated that in the CAD group, the prevalence of cardiovascular risk factors such as dyslipidemia, hypertension and smoking increased with the severity of AGA. Specifically, the prevalence of dyslipidemia rose from 33.3% in mild AGA to 81.5% in severe AGA. This is in line with the findings of Salvador[9], who observed an increased prevalence of cardiovascular risk factors with increasing AGA severity. The association between AGA and dyslipidemia may be explained by the shared underlying pathophysiology, such as endothelial dysfunction and hormonal imbalances. Arias[10] also reported similar results, highlighting a positive correlation between AGA severity and lipid abnormalities in men. Additionally, the prevalence of hypertension and smoking in the CAD group was significantly higher in those with severe AGA, further supporting the hypothesis that AGA may serve as an early clinical marker for the presence of cardiovascular risk factors. Previous studies, such as Kamal[2], have suggested that AGA and smoking share common genetic and environmental risk factors, making smoking an important confounder in the relationship between AGA and CAD. The multivariate logistic regression analysis in our study revealed that severe AGA, smoking, hypertension and dyslipidemia were independent predictors of CAD. Severe AGA had the highest odds ratio (OR=3.8), suggesting a strong association with CAD, even after adjusting for other cardiovascular risk factors. This finding is consistent with Aneta[11], who found a similar association between severe AGA and CAD in men. In our study, the odds of CAD were significantly higher in individuals with severe AGA, reinforcing the notion that AGA may be a useful tool for early cardiovascular risk assessment. Our study further demonstrated a strong correlation between AGA severity and lipid profile in the CAD group. Total cholesterol, LDL and triglycerides were significantly higher, while HDL was lower in individuals with severe AGA compared to those with mild or moderate AGA. These findings are in line with studies by Harshatha[12] and Rudnicka[13], who reported that individuals with severe AGA had a worse lipid profile compared to those with mild AGA. The association between AGA and dyslipidemia could be explained by the role of

androgens in both hair follicle biology and lipid metabolism, as androgens influence cholesterol synthesis and lipid transport in the body.

Clinical Implications and Future Directions: The findings of this study highlight the potential of AGA as an early indicator of cardiovascular risk in young males. Given the growing evidence of a shared pathophysiology between AGA and CAD, clinicians should consider evaluating cardiovascular risk factors in men presenting with AGA, particularly those with moderate to severe hair loss. Early identification of individuals at higher risk could facilitate preventive measures, such as lifestyle modifications and pharmacologic interventions, to reduce the burden of cardiovascular disease. However, there are several limitations to this study. The cross-sectional design limits the ability to infer causality and the study population was restricted to a single tertiary care hospital, which may limit the generalizability of the findings. Additionally, other factors that could influence AGA and CAD, such as genetic predisposition, diet and physical activity, were not comprehensively assessed.

CONCLUSION

This study highlights a significant association between androgenetic alopecia (AGA) and cardiovascular risk factors, particularly coronary artery disease (CAD), in young male patients. The findings suggest that severe AGA is independently associated with an increased risk of CAD, as evidenced by its strong correlation with traditional cardiovascular risk factors such as smoking, hypertension, dyslipidemia and family history of CAD. Furthermore, AGA severity was found to correlate with adverse lipid profile parameters, indicating a potential link between hair loss and cardiovascular health. The study underscores the importance of recognizing AGA as a potential early indicator of cardiovascular risk in young males, especially in those with severe forms of hair loss. This could aid in the early identification of individuals at risk for CAD, prompting timely interventions to mitigate cardiovascular morbidity. However, further large-scale, longitudinal studies are needed to confirm these findings and to explore the underlying mechanisms connecting AGA and CAD.

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