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Original Article

Chronic diffuse hair loss in women: A case-control study with clinical correlation of serum iron profile and thyroid function

Snigdha N Hegde, Tonita Mariola Noronha*

Department of Dermatology, Kasturba Hospital, Manipal, India.
* Department of Dermatology, K.S.Hegde Hospital, Mangalore, India.

Abstract

Background Although a benign disorder, hairfall is a major psycho-social stressor on the patient's life. In women, telogen effluvium and female pattern hair loss are major causes of alopecia. Chronic telogen effluvium is often confused with female pattern hair loss and requires a detailed work up which is essential for management. An array of nutritional factors such as deficiencies of iron, zinc and other micronutrients can contribute to hair loss.

Material and Methods A hospital based case control study was conducted in the department of Dermatology of a tertiary care teaching hospital in Mangalore from October 2016 to March 2018. A total of 50 females, aged between 18-50 years, with chronic diffuse hair loss of duration more than 6 months, daily hair loss count of more than 100 and positive hair pull test, attending the out-patient department were included as cases. Equal number of age matched healthy females were taken as controls. Serum iron profile and thyroid function parameters were assessed in both groups. Duration of chronic diffuse hair loss, mean hemoglobin, serum iron, serum ferritin, TIBC, T3, T4 and TSH levels were considered as primary outcome variables. IBM SPSS version 22 was used for statistical analysis.

Results The proportion of the mean duration of hair fall in cases was 11.12±5.35 months. The mean serum ferritin 37.25±25.74 ng/ml in cases and it was 40.62±32.24 ng/ml in controls. The mean TSH was 2.1±1.41 (mIU/mL) in cases and it was 2.11±1.09 (mIU/mL) in controls.

Conclusion This study could not find any statistically significant difference in any of the iron metabolism related parameters and thyroid function related parameters between cases and controls. No statistically significant correlation was found between duration of the chronic diffuse hair loss and outcome parameters. Hemoglobin alone is not enough and serum iron levels should be assessed in a patient with chronic diffuse hair loss.

Key words
Chronic diffuse hair loss, chronic telogen effluvium, female pattern hair loss, serum ferritin, iron deficiency.

Introduction

Hair is considered one of the most defining aspects of human experience.[1] Hair fall is one of the common complaints encountered by the dermatologists.[2] Chronic forms of telogen effluvium have shedding patterns lasting for more than six months. This happens when the inciting agents are multiple or persistent. Shortening of the anagen phase of hair growth may be one of the causes for chronic telogen effluvium. It has an insidious onset with a fluctuating course. The hair is normal in

Address for correspondence
Dr. Tonita Mariola Noronha, Associate Professor, Department of Dermatology, Venereology & Leprosy, K.S. Hegde Hospital, Nitte University, India.
Email: tones1980@yahoo.com

thickness, and the hair pull test is usually positive.[3] Some of the causes of chronic telogen hair loss include thyroid disorders (hypo and hyperthyroidism) chronic starvation, acquired zinc and other micronutrient deficiencies.[4]

Iron deficiency is one of the commonly prevalent deficiencies in developing countries. Despite chronic diffuse hair loss being a common problem in clinical practice, only a few studies have been conducted in India and other developing nations for exploring the possible etiologies. This study seeks to address this issue.

Material and Methods

A hospital-based case control study was conducted on 100 (50 cases and 50 controls) female subjects, in the childbearing age group of 18-50 years, with chronic diffuse hair loss, attending the Dermatology Outpatient Department of K.S. Hegde Hospital, Mangalore between October 2016 to March 2018 by convenient sampling till the sample size of 100 was reached. Institutional ethical committee clearance was obtained prior to the start of the study. Cases were women in the child-bearing age group of 18-50 years with clinically diagnosed chronic diffuse hair loss (history of diffuse hair loss for more than six months, daily hair loss count more than 100, positive hair pull test, absence of central parting and miniaturized vellus hair to exclude female pattern hair loss). An equal number of age-matched subjects without chronic diffuse hair loss or any other related disease, attending the OPD/ Special Clinic for routine investigations constituted the controls. Sample size was calculated using Stata IC, software version 13. Women on iron supplements or women with patchy alopecia or signs of inflammatory scalp dermatitis or female pattern hair loss (FPHL) or on anticancer chemotherapy or immunosuppressive therapy or women with concomitant chronic systemic illness or trichodynia were excluded. Detailed history with special queries regarding major febrile illness, psychological stress or any surgery and childbirth in the recent past (6 months prior to the onset of hair loss) history of chronic blood loss, crash diet and any drug intake and complete physical examination including the extent of hair loss using a hair pull test was done. Hair pull test was performed by holding 20-60 hairs between the thumb, index and middle finger from the base of the hairs near the scalp and firmly, but not forcefully, tugged away from the scalp. This was performed over all four quadrants of the scalp. The test was considered positive if more than 10% of pulled hair was detached from the scalp. Specific signs of anaemia, jaundice and thyroid swelling were looked for during general clinical examination. Type of hair loss, hair thinning and temporal recession was noted during scalp examination.

Laboratory investigations such as estimations of haemoglobin, serum ferritin, TIBC (Total iron binding capacity), serum iron, T3 (triiodothyronine), T4 (thyroxine) and TSH (Thyroid stimulating hormone) were done. All the relevant parameters were documented in a structured study proforma.

Haemoglobin, serum iron, serum ferritin, TIBC, T3, T4 and TSH were considered as primary outcome variables. Study group (Cases Vs Control) was considered as a Primary explanatory variable. All Quantitative variables were checked for a normal distribution within each category of cases and control by using visual inspection of histograms and normality Q-Q plots. Shapiro-wilk test was also conducted to assess normal distribution. Shapiro-wilk test p-value of >0.05 was considered as a normal distribution. For normally distributed Quantitative parameters (hemoglobin, serum iron, serum ferritin, TIBC, TSH, T3 and T4) the mean values were compared between study

groups using Independent sample t-test (2 groups). Categorical outcomes were compared between study groups using Chi square test. P value <0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.

Results

Among the study population, 50 (50%) participants were cases, and 50 (50%) participants were controls. The comparison of baseline parameters is given in **Table 1**.

Among the cases, the mean age was 25.74±8.06 years and it was 25.68±7.78 years in controls. The difference in the age between cases and controls was not statistically significant (p-value 0.970). The mean duration of hair fall was 11.12±5.35 months in the study population. The difference in the diet between cases and controls was statistically not significant (P value 0.401). The mean haemoglobin was 12.41±1.31g/dl in cases and it was 12.84±1.08 g/dl in controls. The difference in the haemoglobin between cases and control groups was statistically not significant (p-value 0.071). The mean serum ferritin was 37.25±25.74 ng/ml in cases and it was 40.62±32.24 ng/ml in the control group. The difference in the serum ferritin between case and control groups was statistically not significant (p-value 0.564). The mean serum iron was 68.24±34.29 in cases and it was 62.98±26.98 in the control group. The difference in the serum iron between cases and control groups was statistically not significant (p-value 0.396). The mean TIBC was 360.17±69.99 in cases, and it was 352.39±43.85 in control groups. The difference in the TIBC between cases and controls was statistically not significant (p-value 0.570). Among the cases, the mean TSH was 2.15±1.41 (mIU/mL), and it was 2.11±1.09 (mIU/mL) in control. The difference in the TSH between cases and control groups was statistically not significant (p-value 0.877).

Table I: Comparison of baseline characteristics between the cases and controls

S.No.	*Parameter*	*Group*		*P value*
		Cases (N=50)	*Control (N=50)*	
1	Age*	25.74 ± 8.06	25.68 ± 7.78	0.97
2	Age groups[#]			
	18 to 25	33 (66%)	34 (68%)	
	26 to 35	10 (20%)	11 (22%)	0.82
	36 and above	7 (14%)	5 (10%)	
3	Duration of hair fall (in months)*	11.12 ± 5.35		
	6 to 11 months	25 (50%)		
	12 to 21 months	20 (40%)		
	22 and above	5 (10%)		
4	Diet[#]			
	Vegetarian	9 (18%)	6 (12%)	0.401
	Omnivore	41 (82%)	44 (88%)	
5	Haemoglobin (g/dl)*	12.41 ± 1.31	12.84 ± 1.08	0.071
6	Serum ferritin (ng/ml)*	37.25 ± 25.74	40.62 ± 32.24	0.564
7	Serum iron* (µg/dL)	68.24 ± 34.29	62.98 ± 26.98	0.396
8	TIBC* (µg/dl)	360.17 ± 69.99	352.39 ± 43.85	0.507
9	Total Triiodothyronine (T3) (ng/ml)*	1.18 ± 0.24	1.14 ± 0.19	0.381
10	Total Thyroxine (T4) (µg/dl)*	8 ± 1.45	8.14 ± 1.28	0.611
12	Thyroid Stimulating Hormone (TSH) (mIU/mL)*	2.15 ± 1.41	2.11 ± 1.09	0.887

***** Mean±Standard deviation [#] Frequency (Percentage)

Discussion

A total of 100 subjects were included in this study with 50 cases and 50 controls. The cases experienced hair fall for an average duration of 11.12 months ranging from 6 to 26 months. The mean age of cases was 25.74 years and that of the controls was 25.68 years.

There was no significant difference in the dietary habits among the cases and controls. The number of vegetarians among the cases and controls was 9 (18%) and 6 (12%) respectively. In the study by Deo *et al*.[5] (2016), 63.1% had a vegetarian diet which is much higher than the 15% in the current study.

There was no significant difference in the mean haemoglobin, serum iron, serum ferritin, TIBC between the study groups. The mean haemoglobin value of the cases was 12.41g/dL, and that of controls was 12.84g/dL. In contrast, the study by Karim *et al*.[6] reports that the mean haemoglobin level among the cases with hair fall was 11.5g/dL while among the controls, it was significantly higher at 12.8g/dL. The findings are in concordance with the study by Fatani *et al.*[7], where the mean serum haemoglobin among women with hair fall was 11.56g/dL among cases and 11.26g/dL among controls, which was not a statistically significant difference.

The cases had an average serum ferritin of 37.25ng/mL while the controls had an average serum ferritin level of 40.62ng/mL. The mean serum ferritin is lower than the study by Deo *et al.*[5] where the mean serum ferritin level was 54.73ng/mL. The mean serum ferritin levels among the cases in the study by Bregy *et al.*[8] was 54.95ng/mL. The findings in our study are in contrast to the findings of Kantor *et al.*,[9] where the mean serum ferritin levels among women with hair loss was 37.3ng/mL while among normal controls it was 59.5ng/mL. Moeinvaziri *et al.*[10] found a significant difference in the mean serum ferritin between the cases (16.3ng/mL) and controls (60.3ng/mL). Another study conducted by Rasheed H *et al.*[11] report that the mean serum ferritin was significantly lower among women with hair loss, measuring at 14.7ng/mL while among healthy controls it was 43.5 ng/mL. The mean serum ferritin levels of cases were significantly higher than controls without hair loss. The findings are in contrast with the current study. Similarly, another study by Fatani *et al.*[7] report that the mean serum ferritin among cases with hair fall was 34.30ng/mL while among the controls, it was 75.57ng/mL.

Among the cases, the average serum iron was 68.24µg/dL while among the controls, it was 62.98µg/dL. This is in accordance with Abdel Aziz *et al.*[12] where there was no significant difference in mean serum iron levels between those with and without hair loss. This is not in agreement with the study by Deloche *et al.*[13] where 59% of women with the excessive hair loss had low serum iron level of less than 40µg/dL, while only 48% of women without hair loss had low serum iron levels. Similarly, Gowda *et al.*[14] also reported a higher prevalence of low serum iron levels among women with hair fall.

Among the cases, the mean total iron binding capacity was 360.17µg/dL, while among the controls the mean TIBC was 352.39µg/dL. In contrast, according to Moeinvaziri *et al.*,[15] the total iron binding capacity was significantly higher among women with hair loss compared to normal women. The mean TIBC among cases with hair loss in their study was 367.8±58.2µg/dL while among healthy controls it was 319.2±60.1µg/dL.

With respect to the thyroid function, the mean T3, T4, TSH levels had no statistically

significant difference between the cases and controls. The average total T3 levels among the cases were 1.18 ng/mL and among the controls was 1.14ng/mL. In the study by Jain *et al.*,[15] the mean serum T3 levels were lower than 0.07ng/mL among 7% of cases. The average total T4 levels among the cases were 8µg/dL and among the controls was 8.14µg/dL. The mean TSH levels among the cases were 2.15mIU/mL and among the controls was 2.11mIU/mL. These findings are in contrast with the study by Vincent *et al.*[16] where 23.7% of the cases with hair loss had thyroid dysfunction. In the study by Deo *et al*.[5] 17% had thyroid disorders with 9.63% having hypothyroidism and 7.4% having hyperthyroidism. In the study by Jain *et al.*,[15] 8% of the patients had TSH levels of >7mIU/ml.

Conclusion

We compared the serum iron profile and thyroid function parameters between women with chronic diffuse hair loss and normal healthy controls. We could not find any statistically significant difference in any of the iron metabolism related parameters and thyroid function related parameters between cases and controls.

We infer that haemoglobin alone is not sufficient and serum iron levels should be assessed in a patient with chronic diffuse hair loss.

Limitations The generalizability of our study results was limited by a sample size and the sampling population and method. In order to prove our hypothesis, further large population prospective studies are needed to establish the association between chronic diffuse hair loss with Iron deficiency and thyroid dysfunction in the future. If the association is established, it can be an important therapeutic target to treat chronic diffuse hair loss.

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