A case control study of relationship between body iron stores and non scarring diffuse hair loss in non menopausal women

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Abstract

Introduction: Iron is involved in physiological processes of the hair cycle, iron deficiency (ID) is suspected to disrupt normal hair growth. The relationship between body iron status and hair loss has been investigated in a number of studies, with relatively discrepant findings. This study was taken up to support the importance of iron stores in non scarring diffuse hair loss in non menopausal women.

Objective: To determine relationship between body iron stores and diffuse non-scarring hair loss in non-menopausal women.

Materials and Methods: This was a controlled study of 40 women aged 15 years or older with diffuse hair loss (Female pattern hair loss (FPHL) /chronic telogen effluvium (CTE)) and 40 controls who had no history or physical findings of hair loss at tertiary hospital. Subjective hair loss was evaluated using a standardized questionnaire in all. The iron status was assessed by a serum ferritin and hemoglobin levels.

Statistical analysis: Descriptive and inferential statistical analysis using Mean ± standard deviation, Chi-square, Fisher Exact test and Student t test.

Results: Analysis allowed us to identify three categories: "Absence of hair loss" in none (0%), "moderate hair loss" (82.5%) and "excessive hair loss" (17.5%). Among the women affected by hair loss there was statistically significant increase in the incidence of ID (Serum ferritin <40ug/L and Hb<12gd/L) in non menopausal women with diffuse hair loss 67.5%(n = 27) when compare to controls 22.5%(n = 9).

Conclusion: Low iron stores are associated with diffuse hair loss in females in non menopausal women. Screening to establish these levels in cases of hair loss and supplementing with them when they are deficient is beneficial in the treatment of disease.

Keywords: Diffuse hair loss, Non-Menopausal women, Iron stores, Serum ferritin, Anemia.

Introduction

Hair loss in women is a common age depended condition causing significant reduction in quality of life.[1] Hair loss affects over 25% of women in developed countries,[2] in the United States; by age 50years around 50% women are affected with hair loss hair [3]and 25-30% non menopausal women in the Caucasian population.[4]

There are mainly three types of hair disorders -telogen effluvium, androgenetic alopecia and alopecia aerate accounting for most of cases of non scarring alopecia in women.[1] Androgenic alopecia is noted 37% of post-menopausal women but only 10-13% of non menstruating women.[5] Around 30% of women in the USA, UK and Japan are affected chronic telogen effluvium.[6] There is no exact data on prevalence of hair fall in the Indians in literature. However estimated lifetime prevalence was 1.7% is not a reliable estimate.[7]

Generalized normal club hairs fall for more than 6months after a triggering event is called chronic telogen effluviums (CTE). Female pattern of hair loss (FPHL) is gradual diffuse hair loss with thinning of central scalp or front temporal. CTE and FPHL accounts for the majority of diffuse non scarring alopecia cases and are major concerns in dermatology.[8] The diffuse non scarring hair loss may seem trivial to the unaffected, but it has got devastating effect on the quality of life of women.[9]

Event commonly precipitating hair loss include childbirth, fever and medications.[10] Nutritional deficiencies have been proposed to play an important role in persistent hairloss[11,12] of which Iron deficiency(ID) has been suspected to represent one of the possible causes of excessive hair loss in women.[13,14]

Total iron in the body is distributed in 3 compartments: functional iron, transport iron and storage iron. The reduction of total body iron leads to spectrum of ID and variable effects on each compartment, which includes: 1: iron depletion i.e. reduced stores, 2: iron-deficient erythropoietin due to deficiency of iron stores, and low transport of iron leads to compromise of production of cofactor presenting with and without anemia, and 3:Iron deficiency anemia (IDA) which is complete depletion of all body iron. It is difficult to interoperate relationship between hair loss and iron deficiency (ID). Ferritin which is a secretory form of glycosylated protein in the circulation, declines with depletion of tissue iron stores which increases inflammation, cancer, or liver disease. Thus serum ferritin concentration is taken as early indicator for status of iron stores in the absence of nonspecific inflammation and chronic diseases.[15,16]

So far, a direct relationship between iron stores and diffuse hair loss has not been confirmed by other studies in comparison normal population in non menopausal women and is still a matter of debate. The present study will help in understanding the profile of non menopausal women with diffuse hair loss and role of iron body stores as a risk factor. Thus help to plan for laboratory evaluation and treatment strategy.

Objectives

To determine relationship between body iron stores and diffuse non-scarring hair loss in non menopausal women.

Material and methods

After obtaining written informed consent and the institutional ethical committee approval, a total of 40 consecutive women presenting to OPD at tertiary care hospital with diffuse non-scarring hair loss (CTE/FPHL) and total of 40 age matched women with absence of hair loss were included as controls in the study.

Patients with alopecia totalis or universalis, with systemic diseases (inflammatory),who have not attained menarche or those with menopause, Diffuse hair loss less than 6months, History of any stressful events in the last 6 months e.g. surgery, prolonged illness chemotherapy, emotional stress, crash diet, pregnancy were excluded.

All participants were questioned regarding their medical history including their current clinical status (with regard to the onset and course of their hair loss) and the past (illness, type and dose of drugs and/or changes of these, pregnancy and menstrual cycle).General and local examinations were carried out to determine any systemic or local dermatological condition that might be related to hair loss. Diagnosis of diffuse non-scarring hair loss was done based on history and physical examination.

Severity of hair loss was assessed using a set of descriptive self-assessment questionnaire. The quantification of hair loss was estimated by hairs lost during washing, while brushing, after drying hair with towel, on the pillow after a night's sleep and on clothes. Hairs that shed were quantified as none, few and lot of hairs. This allowed us to identify three distinct groups characterized by excess hair loss, moderate degree of hair loss and absence of hair loss. (Form 1)

Blood was sent for complete hemogram and iron profile which included serum ferritin, total iron and total iron binding capacity. Because of the variety of ferritin levels used in the literature to define ID, serum ferritin concentrations of 10–15 µg/L which gives only a sensitivity of 59%and a specificity of 99%and values of 40µg/L and above yields a sensitivity of 98%and a specificity of 98%for diagnosing ID. Serum ferritin levels above 70µg/L are considered as normal.[4, 17] Hence, in this study we use three different serum ferritin levels ≤ 15 µg/L, ≤ 40 µg/L and ≤ 70 µg/Land anemia as hemoglobin less than 12 g/dL(WHO defination) to evaluate the prevalence of ID in the patients and control subjects.

Statistical Methods: Descriptive and inferential statistical analysis was carried out in the present study. Results on continuous measurements are presented on Mean ± SD and results on categorical measurements are presented in Number (%). Significance is assessed at 5%level of significance. Student t test was used to find the significance of study parameters on continuous scale between two groups on metric parameters. Leven`s test for homogeneity of variance has been performed to assess the homogeneity of variance. Chi-square/ Fisher Exact test to find the significance of study parameters on categorical scale between two or more groups.

Results

This study included forty non menopausal patients suffering from CTE 80%(n = 32) and FPHL 20%(n = 8), with the mean age (26.98 ± 7.86 years) and Forty healthy female controls age ranging between (32.18 ± 6.36) (Table no 1). 40%(n = 16) cases had a positive family history of hair loss which was statistically significant p = 0.001.

On examination pallor was noted in57.5%(n = 23) and hair pull test positivity was noted in 37.5%(n = 15) which was significant p<0.001and p<0.001 respectively. Hair loss quantification was done based on self-assessed questionnaires and showed statistically significant change in cases in compared with controls (Table 2).

On blood sample analysis the following link was noted between hair loss and serum ferritin levels ≤ 15 µg/L, ≤ 40 µg/L, and ≤ 70 µg/L in 27.5%(n = 11), 57.5%(n = 23), 15%(n = 6) respectively in cases (table 3).The mean hemoglobin level was 10.96g/dL, and 12.38 g/dL for control subjects which was statistically significant (p = 0.001) (Table 3).

Evaluating for incidence of IDA, Anaemia was noted in concerned35.7%(n = 10) and 60.7%(n = 17) of women presenting a serum ferritin level lower than ≤ 15 µg/L and≤ 40 µg/L respectively and only one (3.6%) of woman showed anaemia with serum ferritin of ≤ 70 µg/L. which was statistically significant p = 0.004 in comparison to control were only 12 patients presented without anemia with serum ferritin value 8.3%(n = 1),50%(n = 6),41.7%(n = 5)respectively (Table 3).

Hair loss questionnaire.
1. Do you feel that you are having hair loss problem?
Yes   No
2. If you are having hair loss problem
Do your hair loss corresponds to transient hair loss (>6months)
Yes   No
Do your hair loss corresponds to persistent hair loss (>6months)
Yes   No
3. Currently, during hair wash, how much hair is lost?
Many hairs   Few Hairs   Very few hairs or none
4. Currently, during drying your hair with towel, how much hair is lost?

Many hairs   Few Hairs   Very few hairs or none
5. Currently, during hair combing, how much hair is lost?
Many hairs   Few Hairs   Very few hairs or none
6. Currently, after a night sleep, how much hair is lost on the pillow?
Many hairs   Few Hairs   Very few hairs or none
7. Currently, during a day, how many hair is lost on clothes?
Many hairs   Few Hairs   Very few hairs or none

(Note: The questionnaire will was translated to the vernacular language and then given to the patients)
If the answer is "No" or "Very few hairs or none" for most of the questions – Absence of hair loss
If the answer is "Yes" or "Few hairs" for most of the questions – Moderate hair loss
If the answer is "Yes" or "many hairs" for most of the questions-Excessive hair loss

Table 1: Age distribution.

Age in years	Cases	Control	Total
11-20	8(20%)	0(0%)	8(10%)
21-30	21(52.5%)	19(47.5%)	40(50%)
31-40	9(22.5%)	16(40%)	25(31.3%)
41-50	2(5%)	5(12.5%)	7(8.8%)
Total	40(100%)	40(100%)	80(100%)
Mean 0%)D	26.980%)86	32.180%)36	29.580%)57

P = 0.002**, Significant, Student t test

Table 2: Hairlost distribution in two groups in studied.

Hair lost	Cases (n = 40)	Control (n = 40)	Total (n = 80)
During Wash			
• Very few hair or none	0(0%)	27(67.5%)	27(33.8%)
• Few hairs	9(22.5%)	13(32.5%)	22(27.5%)
• Many hairs	31(77.5%)	0(0%)	31(38.8%)
In Towel			
• Very few hair or none	11(27.5%)	28(70%)	39(48.8%)
• Few hairs	28(70%)	12(30%)	40(50%)
• Many hairs	1(2.5%)	0(0%)	1(1.3%)
During Combing			
• Very few hair or none	0(0%)	25(62.5%)	25(31.3%)
• Few hairs	18(45%)	15(37.5%)	33(41.3%)
• Many hairs	22(55%)	0(0%)	22(27.5%)
On pillow after night sleep			
• Very few hair or none	16(40%)	31(77.5%)	47(58.8%)
• Few hairs	22(55%)	9(22.5%)	31(38.8%)
• Many hairs	2(5%)	0(0%)	2(2.5%)
On cloths during a day			
• Very few hair or none	16(40%)	31(77.5%)	47(58.8%)
• Few hairs	16(40%)	9(22.5%)	25(31.3%)
• Many hairs	8(20%)	0(0%)	8(10%)

Chi-Square/Fisher Exact Test P<0.001

Table 3: Corrs tabulation between serum ferritin levels (µg/L) and hemoglobulin levels (g/dl).

Serum Ferritin levels (m fer	Hemoglobin Levels (g/dl)		Total (n=80)
	<12	**>12**	
Cases			
• <15.0	10(35.7%)	1(8.3%)	11(27.5%)
• 16-40	17(60.7%)	6(50%)	23(57.5%)
• 41-70	1(3.6%)	5(41.7%)	6(15%)

• >70	0(0%)	0(0%)	0(0%)
• Total	28(100%)	12(100%)	40(100%)
Controls			
• <15.0	7(58.3%)	9(32.1%)	16(40%)
• 16-40	2(16.7%)	13(46.4%)	15(37.5%)
• 41-70	2(16.7%)	6(21.4%)	8(20%)
• >70	1(8.3%)	0(0%)	1(2.5%)
• Total	12(100%)	28(100%)	40(100%)

Chi-Square/Fisher Exact Test P<0.004

Fig. 1: Chronic telogen effluvium

Fig. 2: Female pattern of hair loss

Discussions

This is for the first time a case control study was done on non menopausal women to provide a strong association between depleted iron stores and hair loss, particularly non scarring diffuse hair loss in non menopausal women when compared with healthy individuals.

Our study consisted mainly of young adulthood age groups 21-30yrs {n = 21(52.5%)) cases and n = 19(47.5%)

controls} which was statistically significant p = 0.002which deferred from study by Whiting DA[18] (table 1)

Women in the present study were mainly with CTE 80%(n = 32) followed by FPHL 20%(n = 8) which was similar to previous study by H Rasheed[19] and Raichur SR[20] and differed from studies Olsen EA [21] and Kantor J[9].We found in the present study moderate degree of hair loss was seen in majority, mainly in CTE(n = 25) followed by FPHL(n = 8),while excessive hair loss was seen only in CTE (n = 7) which differed from Claire Delo[1]and Rushton et al[6] uncontrolled study with mainly excessive hair loss.

Present study confirms that low ferritin levels in diffuse hair loss, defined by a ferritin level of ≤15 µg/L, ≤40 µg/L, and ≤ 70 µg/L in 27.5%(n = 11), 57.5%(n = 23), 15%(n = 6) respectively is a common problem in women with hair loss in comparison with controls 40%(n = 16),37.5%(n = 15)and 2.5%(n = 1) serum ferritin respectively(Table 3).Our results agree with finding of Rushton[11] reported that the critical threshold of serum ferritin was 40µg/L, for increased hair shedding and also similarly using a lower level of ferritin to define ID by two population based surveys of ID in Iceland (ferritin\12 g/L)and Canada (ferritin\15 g/L) reported ID in 5.7%and 30%of menstruating women, respectively.[22,23]. Thus it difficult to interpreting previous study due the variability in data and the control populations used.

Non anemic iron deficiency was suggested as etiologic factor for diffuse hair loss in women in 1963[24]in contrast to present study anemia was noted in 32.1%(n = 9),46.4%(n = 13),21.4%(n = 6) with serum levels of ≤ 15 µg/L, ≤ 40 µg/L, and ≤ 70 µg/L respectively. Thus showing low iron stores have a possible contributing factor for diffuse hair loss in non-menopausal women to a study.

A study of anemia patients noted with the serum ferritin of < 70µ g/L lack of macrophage and/or sideroblast iron stains on bone-marrow aspirate. Thus a serum ferritin level of > 70 µg L) is required for a 99%confidence interval for iron staining in the bone marrow, an alternative marker of adequate iron stores.[25]

In the present study, among the 40 cases, 60.7%(n = 17) presented with iron depleted stores (serum ferritin level < 40ug/l with mean Hb 8.9g/dl) but only 16.7%(n = 2) of control women, which was statically significant (Table 3). Thus a relationship b/w hair loss and anaemia was noticed mainly when body iron stores was below 40ug/L. The results showed that low iron stores (serum ferritin mainly <40ug/L and Hb 12g/dL) are significantly linked to the presence of hair loss in non menopausal women.

Conclusion

The present study helps in understanding the profile of non menopausal women with non scarring diffuse hair loss and reduced iron body stores as a risk factor. Thus laboratory evaluation is needed for planning treatment.

Limitations: Effectiveness of iron supplementation in non menopausal women with diffuse hair loss is not known.

Conflict of Interest: None.

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