



Original Research Article

Clinico-laboratory and trichoscopic evaluation of various patterns of female baldness – A prospective case control study



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ABSTRACT

Introduction: Female pattern hair loss (FPHL) is a form of non scarring diffuse hair loss and hair thinning in a pattern fashion. The role of hyperandrogenemia is not clear in FPHL. An association between iron deficiency and FPHL is also debated. Literature investigating trichoscopic features in this condition are few.

Aim : To analyse the clinico laboratory findings in women with pattern baldness and to correlate the trichoscopic parameters in the three forms of FPHL namely Ludwig, Olsen, Hamilton & Norwood.

Materials and Methods : This was a prospective case control study. Seventy (70) female patients of age between 18-48 years with pattern baldness and thirty(30) age matched females were included in the study. Trichoscopy was done for all the cases. Laboratory evaluation was done for both cases and controls. The data was analysed using SPSS 16.0 version. Chi Square and ' t ' tests were used and the results expressed in mean, standard deviation.

Results: A statistically significantly difference was observed between the mean values of total testosterone, DHEAS, TSH of cases when compared to controls. The serum ferritin level less than the cut off level of 40 mic.gram/L was seen in 52% of cases and the mean serum ferritin values of cases is less than that of controls. Hair diameter diversity(90%), peripilar sign(91.4%) were the most frequent trichoscopic findings.

Conclusion: The biochemical findings in our study support the role of hormones, Iron deficiency in the etiology of FPHL. The trichoscopic findings did not differ significantly between the three forms of FPHL.

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1. Introduction

Hair loss can potentially result in low self-esteem and poor body image especially in women. Female pattern hair loss (FPHL) is a form of non scarring diffuse hair loss and hair thinning in a pattern fashion and can affect women as early as in their teen years.¹ Genetic predisposition & hormonal abnormalities like hyperandrogenism, hair cycle defects and follicular miniaturization have been implicated as etiopathogenetic factors for androgenic alopecia. There is a difference in the pathogenesis of patterned baldness in men and women. The role of hyperandrogenemia is not very clear in FPHL.² An association between iron deficiency and

FPHL is also debated. Trichoscopy as a tool for evaluating hair loss disorders had gained momentum for the past one decade. However, studies investigating the features of patterned hair loss in females are few. This study was aimed to analyse the clinico-laboratory findings in women with pattern hair loss and to correlate the trichoscopic parameters in the three forms of female pattern hair loss namely Ludwig, Olsen, Hamilton & Norwood.

2. Materials and methods

2.1. Cases

Seventy female (70) patients of age between 18 to 48 years with history of hair loss over the scalp with the clinical features of pattern hair loss like thinning of hair over the

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crown, temporal area, recession of hair line, widening of central partition were included in the study after taking informed consent. The study has been approved by the institutional ethics committee.

2.2. Exclusion Criteria

Pregnant women, lactating mothers, postmenopausal or hysterectomised patients were excluded.

Patients with known endocrine disorders or those who are on hormonal therapies like oral contraceptive pills were excluded.

Patients on oral or topical treatments for hair loss were not included in the study.

Patients on drugs causing hair loss such as steroids, immunosuppressives, retinoids, anti cancer drugs were also excluded.

Patients with other types of cicatricial, non cicatricial alopecia and any hair shaft disorders were excluded

2.3. Controls

Thirty (30) female patients of age between 18 to 48 years with no clinical signs of hair loss or hyperandrogenism were included in the control group after taking informed consent.

History was obtained from each patient using a standard proforma which included age, marital status, parity, age of onset of hair loss, duration, menstrual irregularities.

Cutaneous examination was done to look for signs of hyperandrogenism like acne, hirsutism, acanthosis nigricans, striae. Scalp and hair were examined to rule out any signs of inflammation or scarring or any hair shaft abnormalities. The extent and pattern of hair loss was assessed by the severity of hair loss on the crown, recession of frontal hair line, involvement of fronto-temporal area and the patients were then classified into Ludwig,³ Olsen,⁴ Hamilton & Norwood⁵ types.

Trichoscopy was done using DermaIndia Wifi 2.0 dermoscope. Frontal, temporal, vertex, occipital areas were observed and images captured with the help of iPhone 6 for analysis. Image capturing was performed by a single person to avoid variation. Morning blood sample was collected for hormonal and biochemical analysis on 3rd to 5th day of the menstrual cycle from the patients with regular cycles or on any other day from the patient who haven't menstruated in the past 2 months.

Total testosterone, dehydroepiandrosterone acetate (DHEAS), LH / FSH, prolactin, T3, T4, TSH, serum ferritin were done.

Ultrasound pelvis was done between 3rd and 5th day of menstrual cycle. A diagnosis of PCOS was done based on modified National Institute of Health (NIH) criteria.⁶

The data was tabulated in excel sheets and analysed using SPSS 16.0 version. The parametric data was analysed by unpaired 't' test and non parametric data by Chi Square test.

P value <0.05 was considered statistically significant. The results were expressed in mean, standard deviation.

3. Results

Out of the 70 patients, majority 42(60 %) were in 29 to 38 year age group followed by 15(21.43%) in 18 to 28 year age group and 13(18.57%) in 39 to 48 year age group (Table 1). The mean age at presentation was 33 years (sd ± 4.5). The mean age of control group was 31.7 years (sd ± 3.2).

The mean age of onset of hair fall was 26.6(sd ± 2.4) years and the mean duration of hair loss was 4.8 (sd ± 1.8) years. In more than half of the patients,(53%) the duration of hair fall was 2 to 4 years where as it was less than 2 years in 30% of patients and the rest 17% of patients had hair loss for more than 4 years.

Family history of pattern hair loss was positive in 56% of patients. After detailed examination of scalp, the patients were classified into the three patterns of FPHL (Table 2).



Fig. 1: Hamilton & Norwood pattern

PCOS was diagnosed by modified NIH criteria in 19 patients (27.14 %) of the total cases.

The parameters observed on trichoscopy were (Figures 1, 2, 3, 4 and 5)

Table 1: Age distribution of cases and controls

Age in years	Cases (n= 70)	Controls (n=30)
18-28	15 (31.43 %)	6 (20%)
29-38	42 (60%)	16 (53.3%)
39-48	13 (18.57 %)	8 (26.66 %)

Table 2: classification of patients according to Pattern of hair loss and Associated cutaneous findings

Variables		Number	Percentage
Pattern of hairloss	Ludwing	48/70	68.5%
	Olseci	18/70	25.8%
	Hamilton and Narwood	4/70	5.7%
Cutaneous findings	Acne	20/70	28.5%
	Acanthosis nigricans	26/70	37%
	Hirsutism	28/70	40%



Fig. 2: Olsen pattern



Fig. 3: Ludwig pattern

1. Hair diameter diversity (HDD): corresponds to vellus hair transformation
2. Brown peripilar sign (BPPS): subtle brown halo around the hair shaft
3. White peripilar sign (WPPS): larger in size as white halo at the follicular ostium
4. Yellow dots (YD) are are follicular infundibula with keratotic material and/or sebum
5. Focal atrichia: They are areas of total hair loss on scalp, usually in a size of a pencil eraser
6. Scalp honeycomb pigmentation (SHCP): which correspond ds to melanotic rete ridges
7. Single follicular unit(SFU)

4. Discussion

In this study, majority of the patients(60%) were in the age group of 29 -38 years similar to the study done in Tandon S et al² where in more than half of the patients were in 28-37 year age group. Similar observations were made by Lee et al⁷ in their study of 445 patients out of which 252(56.68%) were in the third decade of their life. The mean age of presentation in the present study was 33 years (sd ±4.5). It was 37 years in a recent study by Ummita A et al⁸ while it was 35.8 years in Hu et al⁹ study done on

Table 3: Trichoscopic findings

Total no. of cases (n=70)	Ludwig (n=48)	Olsen (n=18)	Hamilton &Norwood (n=4)	'P' value
Yellow dots (40)	27 (56.21)	10 (55%)	3 (75%)	0.82(>0.05)
BPPS (33)	23 (48%)	8 (44.4)	2(50%)	0.96(>0.05)
WPPS (31)	20 (41.6%)	9(50%)	2(50%)	0.51(>0.05)
HDD (63)	43 (90%)	16 (89.5%)	4 (100%)	0.79(>0.05)
SFU (56)	37(77%)	16 (88%)	3 (75%)	0.56(>0.05)
WD (29)	19 (39.5%)	9 (50%)	1 (25%)	0.64(>0.05)
Scalp pigmentation(42)	29 (63%)	11 (66%)	2 (50%)	0.91(>0.05)
Focal atrichia (11)	7 (14.5)	3 (16.6%)	1 (25%)	0.97(>0.05)

Table 4: Laboratory findings

HORMONE	Units	Cases Mean±sd	Controls Mean±sd	P VALUE
Total testosterone	ng/dl	52.7 ±19.75	35.2 ±12.36	<0.05 #
DHEAS	mic.gm/dl	179 ± 61.27	154.56 ±52.14	<0.05 #
T3	ng/dl	121.52 ±48.07	123.56 ± 36.04	>0.05
T4	mic.gm/dl	7.9 ±2.72	7.72±1.98	>0.05
TSH	Micro IU/ml	6.87±1	3.17±1.97	<0.05 #
LH/FSH ratio		0.8±0.32	0.75±0.58	>0.05
PROLACTIN	ng/lit	16.95 ±6.22	14.53 ± 7.26	>0.05
S.FERRITIN	microgm/lit	43.74 ±25.77	51.03 ± 29.2	>0.05

statistically significant

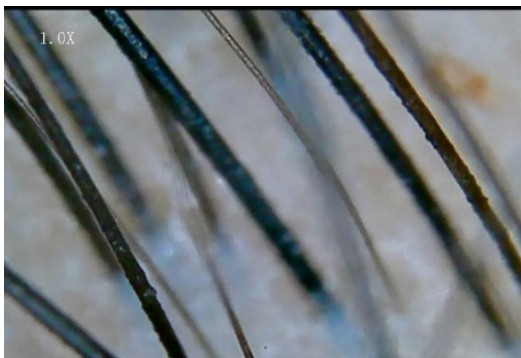


Fig. 4: HDD

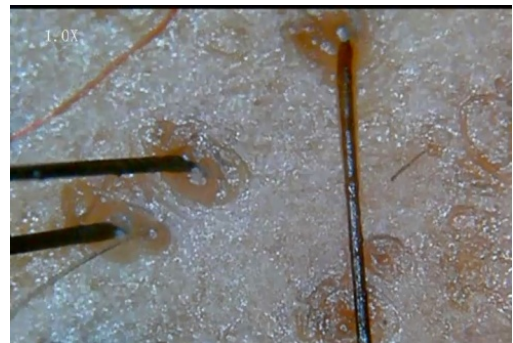


Fig. 6: BPPS

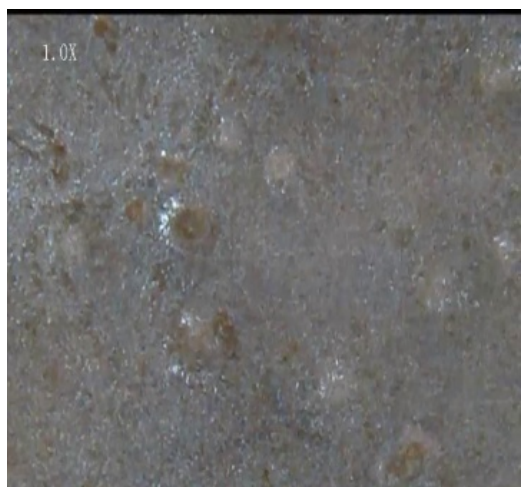


Fig. 5: YD & WD

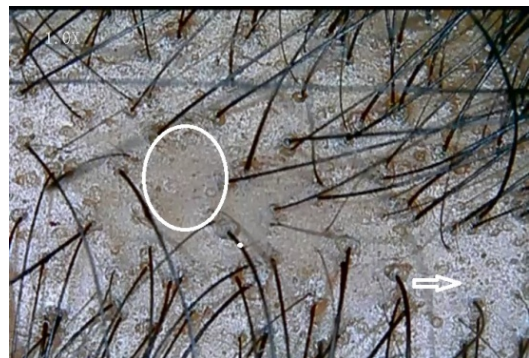


Fig. 7: Focal atrichia & SHCP

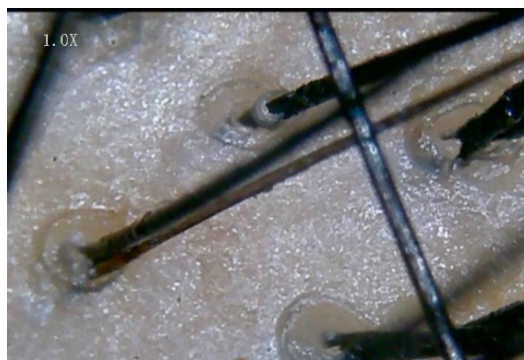


Fig. 8: WPPS

Chinese population.

The mean age of onset of hair fall was 26.6(sd \pm 2.4) years in our study which is nearer to the study by Tandon S et al² (26.1 years). In a study conducted by Shilpashree et al¹⁰ mean age of onset was 28.4 \pm 8.2 years which is very similar to our study. Norwood¹¹ reported that Caucasian women had FPHL which begins in late 20s which is in accordance with this study. The mean age of onset was little high (29.8 years) in a study by Zhang et al¹ on Chinese women and it was little less (23 years) in the study done by Kasick et al¹²

The mean duration of hair fall was 4.8 years (sd \pm 1.8) in the present study which is well in agreement with the studies of Zhang et al¹ and Tandon S et al² where the mean duration was 5.1 years and 4.49 years respectively.

Family history of hair loss was noticed in 56% of our patients which is similar to the study conducted by Shilpashree et al¹⁰ at 51%. It varied from 19.2 to 32.4% in various Chinese studies.^{11,13} The incidence of family history of baldness was 45.2% in the study by Paik et al¹⁴ on Korean women and 45% in the study by Zhang et al¹ on Chinese women which are in near agreement with our study. In the study by Tee Wei Siah et al¹⁵ 85% of patients had family history of baldness.

The cutaneous findings of hyperandrogenism observed in association with FPHL in our patients were Hirsutism (40%), Acanthosis nigricans (37%) and acne (28.5%)

Most of the previous studies reported hirsutism in 12–22% of patients.^{16–18} whereas Tandon S et al² reported hirsutism in 66.6% of their patients.

Cela et al¹⁶ reported acne in 38 of 80 patients (43%) and Moltz¹⁷ and Tandon S et al² observed acne in 41.6% and 36.6% of their patients respectively.

43.3% of patients with FPHL had acanthosis nigricans in the study by Tandon S et al² which is little higher than that observed in our study (37%).

PCOS was diagnosed based on modified NIH criteria in 19 of the total 70 patients (27.14%). Cela et al¹⁶ at the reproductive endocrinology service in London reported a higher prevalence of PCOS (67%) while Quinn et al¹⁹ and Tandon S et al² reported 22% and 26.6% respectively

which is similar to the present study. This difference in the prevalence could be due to different population groups studied, difference in sample size and screening methods used in diagnosis.

Various studies have evaluated the role of hyperandrogenemia in FPHL but the results were discordant. Molly Quinn et al¹⁹ did not find a difference in overall biochemical hyperandrogenemia between subjects with and without AGA. Similarly, Ozdemir et al²⁰ concluded that AGA was not a marker for hyperandrogenemia. In contrast, Cela et al¹⁶ reported a higher total testosterone, androstenedione and free testosterone index in 89 women with AGA compared with 73 control women.

In the present study, the difference between the mean values of total testosterone, DHEAS and TSH of cases were statistically significant when compared with that of controls (Z-test $p < 0.05$) which is similar to the observations made by Tandon et al.² Kasick et al¹² also reported a significant increase in DHEAS levels in cases compared to controls. However, total serum testosterone levels were normal in all their subjects whereas 19% of our patients had serum total testosterone above the normal range.

DHEAS, apart from conversion to potent androgens, has a direct action on hair follicle as inhibitor of G6PD (glucose 6 phosphate dehydrogenase) thereby inhibiting nucleic acid synthesis. This suggests that the low potent adrenal androgens are sufficient to cause FPHL with or without other findings of hyperandrogenism. However, Montalto et al²¹ and Rushton et al¹⁸ did not find a significant increase in the plasma levels of DHEAS in their studies.

TSH and prolactin can interact with androgen metabolism at various levels. Futterweit et al²² reported that two patients had hyperprolactinemia out of the 109 female patients with diffuse alopecia. Schimdt et al²³ had studied hypothyroidism and hyperprolactinemia as a possible cause of androgenetic alopecia in females and found that 23% of their patients had raised TSH which is in accordance with our study where 28.5% patients had raised TSH levels. One third of (29%) their patients had raised prolactin. In contrast, all our patients had normal prolactin levels.

The relationship between serum ferritin and hair loss has been investigated in a number of studies however with relatively discrepant findings. Sinclair²⁴ in his study found no direct relationship between low serum ferritin and hair loss. Rasheed et al²⁵ found that serum ferritin levels in TE and FPHL cases were significantly lower than in controls. There is a wide range of serum ferritin level (6–160 mic.gm/l). However, as per the literature a cut off of 41 mic.gm/l yields specificity of 98% and sensitivity of 98%. When this cut off level was taken, more than half (52%) of our patients fall under this group which is comparable to Olsen et al²⁶ (58.8%) and Rushton et al¹⁸ studies (65%) indicating an association between Iron deficiency and

FPHL. In our study, the mean serum ferritin level of patients were less than that of controls but this was not statistically significant.

The patients were classified in to three patterns of hair loss (Table 2) and the trichoscopic findings in each pattern were as shown in Table 4.

Hair shaft diameter diversity (HDD) was established by Rakowska et al²⁷ as one of the major criteria of FPHL. It was observed in 93% of our patients similar to the study done by Galliker and Treub et al²⁸ where HDD was seen in 72% of early and 100% of advanced female androgenetic alopecia patients.

Brown peripilar sign (BPPS) was seen in 47% of our patients similar to Ummiti A et al⁸ 40% and Hu et al⁹ (44.5%) studies. It was 31.7% in a Chinese study by Zhang et al.¹ In contrast, Deloche et al²⁹ reported it to be 86% in caucasian women with FPHL and Inuis et al³⁰ detected this finding in 20%.

White peripilar sign (WPPS) was noticed in 44.2% of patients in the present study. Its incidence varied from 15 to 68% in various studies^{1,8,9}

Yellow dots(YD) were seen in 40 out of 70 pts (57%) in our study. Contrastingly its incidence was high (88%) in Ummiti A et al⁸ and very low in Zhang et al¹ study(1.67%). Hu et al⁹ observed this finding in 24% of FAGA patients. This disparity of findings can be due to different skin phenotypes with variation in sebaceous gland activity as well as degree of pigmentation of scalp as suggested by Ummiti A et al.⁸

Focal atrichia referred to as pencil erased focal loss of hair was found in 18.6% in our study nearer to that observed by Ummiti A et al⁵ (24%) whereas Hu et al⁹ & Zhang et al¹ reported its incidence in more than half of their patients. Zhang et al¹ correlated this finding with advancing stage of androgenic alopecia.

Scalp honey comb pigmentation was observed in 60% patients similar to Zhang et al¹ (61.7%) study where as in a chinese study by Hu et al⁹ it was seen in 30.5% and in Ummiti A et al⁸ study it was seen in 80% of patients.

In addition to these, we observed white dots (representing empty follicles) in 41.4% of patients and single follicular units in 80% of patients. To the best of our knowledge, there are no previous studies comparing the trichoscopic findings in various forms of female baldness. As per our study, there is no stastically significant difference in the incidence of parameters of trichoscopy among the three patterns of hair loss.

5. Funding

None.

6. Conflict of Interest

None.

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