

Etiological Role of Ferritin and Vitamin D in Patients with Telogen Effluvium

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Abstract

Introduction: Telogen effluvium (TE) is an abnormality of hair cycling that result in an abrupt onset of generalized shedding of telogen hairs from the scalp, with or without an entifiable trigger. Ferritin and vitamin D play an important role in hair follicle differentiation.

Aim: The work was to investigate level of serum ferritin and vitamin D levels in patients with acute/chronic TE.

Subject and methods: This case control study was conducted on 30 patients with TE. They were 25 females and 5 males and they were also classified clinically into 15 patients (50%) suffered from acute form of the disease, they aged (18 to 48 years) and 15 patients (50%) have chronic form, aged (24 to 49 years). Thirty healthy persons were included as a control group

Result: There was a significant difference between patients and control groups as regard serum ferritin while higher significant difference regarding vitamin D level in patients than in control group. There were no significant difference regarding serum ferritin and vitamin D with age, sex or duration of the disease.

Conclusion and recommendation: Significant relation was detected between TE and decreased serum ferritin levels. However large scale prospective studies should be performed on a large number of people to clarify the relation between serum ferritin and vitamin D with TE and routine investigations of serum ferritin and vitamin D in all patients with TE should be done.

Keywords: Telogen effluvium (TE); Ferritin; Vitamin D

Introduction

Telogen Effluvium is a very common and distressing disease in which sudden and diffuse hair loss caused by normal hair growth cycle interruption due to many factors [1].

Many mechanisms are impeded as severe fever, pregnancy, chronic systemic diseases, horrible hemorrhage, crash diet, sudden starvation, nutritional deficiency, accidental trauma, surgical operations and severe emotional stress [2].

If hair shedding lasts less than 6 months so it is acute TE, while chronic TE is hair shedding lasting longer than 6 months. In some patients, hair shedding continues to be intermittently or continuously greater than normal for long time [3].

Hair on all parts of the body can be affected in TE but, only scalp hair loss is triggering for medical consultation [4].

Ferritin the main iron-binding protein in nonerythroid cells is a highly conserved protein complex that plays an important role in iron storage [5].

Iron is a vital metal to the normal physiological processes including many metabolic processes; it works as an oxygen transporter and in

DNA synthesis. The Iron stores in body are reflected by serum ferritin level. Low serum ferritin levels are associated with diseases as TE, iron deficiency anemia, and bone mineral density [6].

The epidermal keratinocytes have the required enzymes to metabolize vitamin D, and receptor for 1, 25 (OH) 2D3 [7] so, epidermis is the main site for synthesis of 25(OH) D3, mediated by sunlight [8].

Healthy hair follicles contain vitamin D instate of unhealthy one [9].

Role of vitamin D on the prevention of diseases, such as telogen effluvium, cardiovascular disease, MetS and anemia have been proved recently [6].

Vitamin D regulates hair follicle cycles so a shorter life span of hair follicles is associated with its deficiency. Absorption of calcium that is essential for hair health needs presence of vitamin D. Omega 3 fatty acids contained in vitamin D help to protect against micro-organisms and promotion of scalp circulation [10].

Aim of the Study

Aim of the work was to investigate level of serum ferritin and vitamin D levels in patients with acute/chronic TE.

Subjects and Methods:

This study [a case-control study) included 30 patients with TE attending the outpatient clinic of dermatology at Al-Haud Al-Marsoud and Al Zahraa and El-fayoum University hospitals during period from February to July 2017. There were 5 males (16.7%) and 25 females (83.3%) their ages ranged from 18 to 49 years [mean \pm SD=32.33 \pm 9.46).

Thirty age and sex matched healthy subjects were selected as a control group, they were also 5 males (16.7%) and 25 females (83.3%) their ages ranged from 18 to 49 years (mean \pm SD=32.30 \pm 9.40).

All selected individuals were enrolled in the study after an informed consent after taking the approval of Research Ethics Committee of the Faculty of Medicine for Girls, Al-Azhar University and Faculty of Medicine-El fayoum University.

We excluded drug abusers, patients exposed to recent severe hemorrhage, patients who are on calcium modifying drugs, females with recent pregnancy or labour, Patients with systemic diseases as autoimmune diseases and those on immunosuppressive drugs.

All members of the study were subjected to: Full history taking, clinical examination to exclude any systemic illness that may cause TE. Local examination was done to exclude other causes of hair loss.

Gentle pulling test: Approximately, 60 hairs were grasped between thumb, index and middle fingers and gently pulled. A negative test [\leq 6 hairs obtained) indicates normal shedding, whereas a positive test [$>$ 6 hairs obtained) indicates active hair shedding. Laboratory investigations: Sample collection: 3 ml of venous blood was collected from all studied groups for estimation of 25 hydroxy vitamin D and serum ferritin by ELISA technique.

Statistical analysis

All statistical calculations were done using computer programs SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

Data was summarized using mean, standard deviation and range for quantitative variables and number and percent for qualitative variables.

| P value | F | Status | | | | | | |
|---------|------|--------------------|-------|--------------------|-------|--------------------|--------|-----------|
| | | Chronic N=15 | | Acute N=15 | | Control N=30 | | |
| | | Standard Deviation | Mean | Standard Deviation | Mean | Standard Deviation | Mean | |
| 0.01 S | 4.88 | 29.86 | 12.77 | 44.10 | 26.69 | 0.75 | 0.84 | Vitamin D |
| 0.05 S | 3.26 | 80.17 | 78.33 | 86.17 | 73.72 | 60.73 | 123.79 | Ferritin |

Table 2: Comparison between the mean of vitamin D and ferritin in control, acute and chronic TE patients.

There was higher significant difference concerning vitamin D serum level in the acute and chronic TE patients than in control groups as shown in Table 2.

| Age | \leq 30 N=14 | | $>$ 30 N=16 | | t | P value |
|-----|----------------|--------------------|-------------|--------------------|---|---------|
| | Mean | Standard Deviation | Mean | Standard Deviation | | |
| | | | | | | |

Results

This case control study was conducted on 30 patients with telogen effluvium. The patients were classified as 25 females and 5 males and they were also classified clinically into 15 patients (50%) presented with acute form of the disease, there ages ranged from (18 to 48 years) and also 15 patients (50%) with chronic form, there ages ranged from (24 to 49 years).

| | | Patient | Control |
|-----------------|---------------|-----------------|------------------|
| Age | Range | 18-49 | 18-49 |
| | Mean \pm SD | 32.3 \pm 9.5 | 32.3 \pm 9.4 |
| Vitamin D ng/ml | range | 0.36-116.9 | 0.03-3.09 |
| | Mean \pm SD | 19.7 \pm 37.7 | 0.83 \pm 0.7 |
| Ferritin ng/ml | range | 16.3-278.0 | 27.64228-239.02 |
| | Mean \pm SD | 76.0 \pm 81.8 | 123.7 \pm 60.7 |
| Sex | Male | 5 (16.7%) | 5 (16.7%) |
| | Female | 25 (83.3%) | 25 (83.3%) |

Table 1: Descriptive table of the studied TE patients and control subjects.

As shown in table 1, the study included 60 subjects, 30 patients with TE there were 5 males (16.7%) and 25 females (83.3%), there ages ranged from 18 to 49 years (mean \pm SD=32.33 \pm 9.46). Serum vitamin D ranges from (0.36 to 116.9) (mean \pm S=19.7 \pm 37.7) and serum ferritin ranged from (16.3 to 278.0) (mean \pm SD=76.0 \pm 81.8) and 30 age and sex cross matched apparently healthy subjects free from TE were selected as a control group. They were also 5 males (16.7%) and 25 females (83.3%) there age ranged from 18 to 49 years (mean \pm SD=32.3 \pm 9.4). Serum vitamin D ranges from (0.03 to 3.09) (mean \pm SD=0.83 \pm 0.7) and serum ferritin ranged from (27.64228 to 239.02) (mean \pm SD=123.7 \pm 60.7).

| | | | | | | |
|-----------|--------|--------|--------|--------|-------|----------|
| Vitamin D | 22.604 | 37.802 | 17.216 | 38.614 | 0.385 | 0.703 NS |
| Ferritin | 67.977 | 76.316 | 83.073 | 88.196 | 0.498 | 0.623 NS |

Table 3: showed that there was no significant difference in different age groups (\leq 30) concerning vit D level and serum ferritin.

There was a significant difference between mean of ferritin in acute and chronic TE patients with the mean of ferritin in control as shown in Table 3.

| Sex | Females N=25 | | Males N=5 | | t | P value |
|-----------|--------------|--------------------|-----------|--------------------|-------|----------|
| | Mean | Standard Deviation | Mean | Standard Deviation | | |
| Vitamin D | 19.981 | 38.356 | 18.476 | 38.213 | 0.08 | 0.937 NS |
| Ferritin | 75.45 | 77.389 | 78.922 | 112.15 | 0.085 | 0.933 NS |

Table 4: Comparison between sex difference and serum ferritin and vitamin D levels.

The level of vitamin D and serum ferritin level showed no significant relation between males and females as shown in Table 4.

| Status | Acute N=15 | | Chronic N=15 | | t | P value |
|-----------|------------|--------------------|--------------|--------------------|-------|----------|
| | Mean | Standard Deviation | Mean | Standard Deviation | | |
| Vitamin D | 26.69 | 44.1 | 12.77 | 29.86 | 1.012 | 0.320 NS |
| Ferritin | 73.72 | 86.17 | 78.33 | 80.17 | 0.152 | 0.882 NS |

Table 5: Comparison between acute and chronic TE patients concerning serum vitamin D and ferritin levels.

No significant relation between serum vitamin D and ferritin and duration of TE as shown in Table 5 and Figure 1.

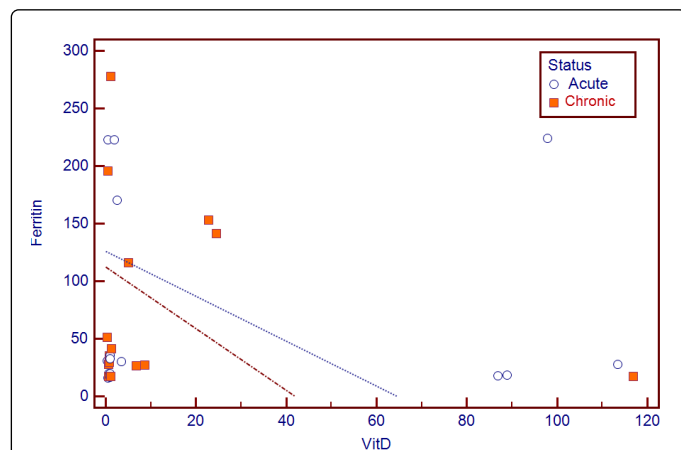


Figure 1: The diagram showed that there was no significant correlation between serum vitamin D and ferritin in telogen effluvium patients.

Correlation is significant at the 0.05 level. Person correlation coefficient = -0.06, P=0.7678

Discussion:

Telogen effluvium is defined as an interruption in the normal hair growth cycle resulting in abrupt and diffuse hair loss [1].

Many etiologic factors including metabolic or hormonal disturbances, stress or medications are implicated in pathogenesis of TE [11].

According to its duration (more or less than six months), TE is classified into acute and chronic [12].

Ferritin (the main iron-binding protein in non erythroid cells) is a highly conserved protein complex playing an important role in iron storage [5].

The role of Iron deficiency (ID) in hair loss remains unclear. However this could be explained by: matrix cells of hair follicle are group of the most rapidly proliferating cells so ID may contribute to hair loss *via* its role as a cofactor for ribonucleotidereductase (DNA synthesis rate-limiting enzyme). Iron regulates multiple genes identified in the human hair follicle [13].

Exposure to UV radiation in the UVB spectrum (290-320 nm) converts 7-dehydrocholesterol to vitamin D3 in the skin. Vitamin D is found in healthy hair follicle on the contrary to unhealthy one [9].

Vitamin D is a precursor to the hair growth cycle [7]. It helps to reduce stress and depression related to hair loss [14].

Accordingly, our aim was to study serum ferritin and vitamin D levels in patients with telogen effluvium in comparison to control subjects and to demonstrate if serum ferritin and vitamin D could be used as diagnostic biomarkers of TE and hence treating those patients with iron and vitamin D supplementations.

Our study was conducted on thirty patients with telogen effluvium and thirty control subjects who were age and sex cross matched. The study was included 15 patients with chronic telogen effluvium (hair loss more than 6 months) and 15 patients with acute telogen effluvium (hair loss less than 6 months).

We found that the serum levels of ferritin were significantly lower in acute and chronic patients with TE compared to control group. This could be argued that iron acts as a cofactor for ribonucleotide reductase enzyme which is important for DNA synthesis needed for synthesis of hair growth stem cells [15].

This finding was in agreement with: many studies [16-22] who examined the relationship between iron deficiency and hair loss

On the contrary Bregy and Trueb found no statistically significant difference in the telogen rate between the two groups. The group with serum ferritin less than or equal to 10 ng/mL was too small to draw statistical significance [23].

Regarding vitamin D, our study revealed that the levels of serum vitamin D were significantly higher in patients with TE than in control

group. This was in agree with an interesting study by Karadage and his colluges in which increased vitamin D levels in patients with TE was found [21]. This may be attributed to small sample size.

On the contrary many studies demonstrated that low serum 25 (OH) D is associated with TE, androgenetic female pattern hair loss and alopecia areata [24].

Vegesna et al. demonstrated that in nude mice, the application of vitamin D lead to a dramatic stimulation of hair growth, associated with increased expression of several hair keratins [25].

Three reports from Saudi Arabia [26,27] and Kuwait [28] revealed the presence of vitamin D deficiency among people from the Arabian Gulf. This deficiency was more common in veiled Kuwaiti women compared with non-veiled women. Vitamin D plays an important role in the absorption of calcium, another mineral that is essential for hair health and Omega 3 fatty acids contained in vitamin D help to protect the scalp from bacteria and other microorganisms and promote blood circulation in the scalp [10].

In the present study there was no significant difference between males and females as regard both serum ferritin and vitamin D levels. This may be due to relative small number of males compared to females. Also the exclusion of females with recent labour from our study may explain the absence of significant relation between them as regard serum ferritin.

Our study revealed that there was a non-significant correlation between serum ferritin and vitamin D with degree of telogen effluvium patients

Conclusion

Significant increase in the serum ferritin level causes a significant decrease in percentage of hair in TE. There was a significant difference between patients and control groups as regard serum ferritin. There was higher significant difference regarding serum vitamin D level in patients than in control groups. Serum ferritin and vitamin D are not dependent on age, sex and acute or chronic forms of the disease. No correlation was found between serum ferritin and vitamin D in telogen effluvium patients.

Recommendation

We recommend the following items that may help more clarifications to pathogenesis of TE:

Large scale prospective study should be performed on a large number of people to clarify the relation between serum ferritin and vitamin D with telogen effluvium.

Routine investigation of serum ferritin and vitamin D in all patients with telogen effluvium.

Searching for other causes that may play a role in TE rather than ferritin and vitamin D as hormonal disturbances, malabsorption, and psychological impacts.

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