Evaluation of Serum Levels of Vascular Endothelial Growth Factor (VEGF) in Female Patients with Telogen Effluvium

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Material and methods

This study was conducted as a case control study that involved 40 female patients with telogen effluvium and 40 healthy, age and sex matched controls between the age of 18 and 65 years recruited from Dermatology outpatient clinic, Benha University Hospital. All details of the study were discussed with the patients and informed consent was obtained from each patient before enrolment in the study. The protocol was revised and approved by the Ethics Committee of Human Research., Faculty of Medicine, Benha University.

Patients with any of the following conditions were excluded from the study: autoimmune disorders, any disease that may affect VEGF serum level and pregnancy. None of the patients was on systemic or topical treatment for one month before the study.

All patients were subjected to the following:

2.1 History taking

Patients’ demographic data were recorded: name, age and marital status. A detailed history was taken from patients regarding onset, course, duration and recurrence of hair loss. History of crash diet, significant emotional stress, major surgery, febrile illness hair dying, Straightener and any chemical procedures 2 or 3 months before hair loss was obtained. Patients were asked about easy fatigue, rapid weight gain, weight loss, sleep disorders, pregnancy and lactation. Also, patients were asked about medical problems including any systemic or skin diseases or drug intake.

2.2 Clinical examination

Complete general examination was done including body mass index.

Hair examination was done for assessment of hair loss distribution (diffuse or patterned), detection of any thinning or widening especially at the central part, regression or preservation of anterior hair line, patchy area of hair loss. Scalp skin examination was done...
to exclude any abnormalities like erythema, scales, infection, and epidermal changes. Also, hair pull test was done to detect active hair shedding and confirm diagnosis of telogen effluvium. A bundle of about 50–60 hairs was grasped between the thumb, index finger, and middle finger from the base near the scalp. The hair was firmly, but not forcibly, tugged away from the scalp as fingers slide along the hair shaft. The hair was not be shampooed for at least a day. The test was considered positive when more than 10% of the grasped hair (in average more than six hairs) can be pulled out. If fewer than six hairs can be easily pulled out, this was considered normal physiologic shedding. The pull test was done in 4 scalp region: right and left parietal, frontal, and occipital region.

2.3 Blood samples
Blood samples were obtained and samples were allowed to clot for two hours at room temperature before centrifugation for 15 minutes at 1000 ×g. We removed serum and did assay immediately and we stored samples at -20°C or -80°C. we avoided repeated freeze-thaw cycles. After centrifugation, serum was separated by a pipette, divided and kept in eppendorf tubes labeled with the number of the person.

This test was done using Human Vascular Endothelial Cell Growth Factor (VEGF) ELISA Kit provided by CusabioUSA according to the manufacturer’s instructions.

2.4 Statistical Analysis
Statistical presentation and analysis of the present study was conducted, using Statistical package for Social Science (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.).

3. Results and discussion
3.1 Clinical results
The current study was carried out on 40 female patients with telogen effluvium their ages ranged from 18 to 65 years with a mean age of 24.5±5.3 years. The control group included 40 healthy, age-matched women. Their ages ranged from 18 to 65 years with a mean age of 25.4±6.7 years. No statistically significant differences were found between patients and controls regarding age and BMI (Table 1). In all telogen effluvium patients, the hair pull test was positive all over the scalp (including frontal, 2 temporal and occipital regions). Also Telogen effluvium cases showed significantly higher vertex, occiput, right, left temporal, hair pull test when compared to control group Table (2).

### Table (1) Comparison of age and BMI between all studied groups.

<table>
<thead>
<tr>
<th></th>
<th>Control N=40 mean±SD</th>
<th>Telogen Effluvium N=40 mean±SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>25.4 ± 6.7</td>
<td>24.5 ± 5.3</td>
<td>0.87t</td>
</tr>
<tr>
<td>BMI</td>
<td>26.3 ± 3.5</td>
<td>26.1 ± 4.4</td>
<td>0.886t</td>
</tr>
</tbody>
</table>

SD, standard deviation; T, t test.

### Table (2) Comparison of hair pull test between studied groups

<table>
<thead>
<tr>
<th></th>
<th>Control N=40 Mean±SD</th>
<th>Telogen Effluvium N=50 Mean±SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertex</td>
<td>1.10 ± 0.3</td>
<td>6.64 ± 0.9</td>
<td>&lt;0.001t</td>
</tr>
<tr>
<td>occiput</td>
<td>1.53 ± 0.5</td>
<td>7.00 ± 0.9</td>
<td>&lt;0.001t</td>
</tr>
<tr>
<td>Right temporal</td>
<td>1.48 ± 0.4</td>
<td>7.00 ± 1.2</td>
<td>&lt;0.001t</td>
</tr>
<tr>
<td>Left temporal</td>
<td>1.08 ± 0.3</td>
<td>7.26 ± 1.3</td>
<td>&lt;0.001t</td>
</tr>
<tr>
<td>hair pull test</td>
<td>1.29 ± 0.3</td>
<td>6.97 ± 0.7</td>
<td>&lt;0.001t</td>
</tr>
</tbody>
</table>

3.2 Laboratory results
There was a statistically significant lower in the Mean serum level of VEGF in patients than controls Table (3).

### Table (3) Comparison serum VEGF concentration between all studied groups.

<table>
<thead>
<tr>
<th></th>
<th>Control N=40 mean±SD</th>
<th>Telogen Effluvium N=50 mean±SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>VEGF (pg/mL)</td>
<td>124.56 ± 20.5</td>
<td>87.4 ± 18.3</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>

SD, standard deviation; T, t test.
Telogen Effluvium is a very common and distressing disease in which sudden and diffuse hair loss is caused by normal hair growth cycle interruption due to many factors [7].

Pull test is a noninvasive diagnostic technique, very easy to perform and to repeat. It is very helpful to rapidly determine the ongoing activity and severity of any kind of hair loss. A positive test present in more than one scalp region can be seen during a telogen effluvium. The patients suffering from female patterned hair loss may have a positive pull test only during the active phases in the affected area [8].

In our study, the pull test is positive in 4 scalp regions detecting active hair shedding. This result is similar to other studies as Hodeib et al., (2017) found that the hair-pull test was positive all over the scalp (including frontal, parietal, and occipital regions) in all TE patients [9]. Also Obaidat et al., (2005) which confirm the diagnosis of chronic telogen effluvium patients with positive hair pull test [10].

On comparing both groups of patients and controls in this study, there was a significant decrease of the mean serum level of VEGF in patients than in controls.

Growth factors are capable of inducing cell proliferation of vascular endothelium and dermal fibroblasts, prolonging anagen and delaying catagen onset in a hair follicle. Hence, anagen can be prolonged and hair growth can be stimulated with the help of these growth factors [3].

Vascular endothelial growth factor plays important roles in promoting angiogenesis by stimulating capillary proliferation, migration and permeability, and by regulating the growth, differentiation and development of a variety of tissues [4].

The biological effects of VEGF are mediated by receptor tyrosine kinases. VEGFR-2, the primary receptor for VEGF, is thought to mediate most functional effects [5].

It’s found that hair follicle cycling is associated with vascular remodeling [11] and the expression of VEGFR-2 changed during the hair cycle was significantly stronger during anagen II and anagen IV than during anagen VI, catagen and telogen. So this result clearly indicates that VEGFR-2 is associated with maintenance of hair cycling. Decreased expression of VEGFR-2 leads to decreased cell proliferation and increased apoptosis, causing the hair follicle to enter telogen [12].

Several studies assess the role of VEGF in hair growth as Meephansan et al. (2017) found that topical tofacitinib was effective in promoting hair growth and the possible mechanism involves increased VEGF levels and lowered inflammation. The study was done on Eight-week-old male C57BL/6 mice. They were divided equally into four groups and treated topically with tofacitinib, minoxidil, dimethyl sulfoxide and ethanol (as two controlled groups) once daily for 21 days. Tofacitinib-treated mice exhibited more rapid hair growth than either minoxidil-treated or control mice. Histopathology showed that VEGF mRNA and protein expression was significantly greater than those in the other groups with increase in the number of hair follicles, mostly in the anagen phase [13].

So, VEGF has an important functional role in hair biology, control of normal hair growth and cycling and any decrease in its level may lead to hair loss.

4. Conclusion

Our results showed the contribution of decreased VEGF in the development of telogen effluvium.

References
