The Effect of Dihydrotestosterone Hormone on the Sulfotransferase 1A1 Enzyme Level in the Scalp Hair Follicle in Patients with Androgenic Alopecia and its Effect on Response to Minoxidil

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Abstract

Objective: to evaluate the association between the dihydrotestosterone hormone level and the level of sulfotransferase 1A1 enzyme inside the scalp hair follicle in patients with androgenic alopecia. Method: The study was conducted with the participation of 67 androgenic alopecia patients (37 females and 30 males). The level of serum dihydrotestosterone hormone was estimated using enzyme linked immunosorbent assay. The sulfotransferase enzyme 1A1 was extracted from the plugged scalp hair follicle by sonication and estimated using enzyme linked immunosorbent assay. Results: In this study, it was found that there is a significant association between the level of serum dihydrotestosterone hormone and the level of sulfotransferase 1A1 enzyme inside the scalp hair follicle in patients of androgenic alopecia (p-value< 0.001), which means that whenever the level of serum dihydrotestosterone hormone increases, the concentration of the sulfotransferase 1A1 enzyme inside the scalp hair follicle decreases, and probably it will affect the response of a patient toward the minoxidil. Conclusion: reducing the level of serum dihydrotestosterone hormone, could increase the level of sulfotransferase 1A1 enzyme inside the scalp hair follicle and that concept can lead to modulate the treatment regimen of androgenic alopecia.

Introduction

Androgenic alopecia (AA) is the most common type of hair loss in both sexes, affecting high percentage of population worldwide. It is also called male and female pattern hair loss as it differs in the pattern of hair loss, path physiology and etiology between the two sexes. There are two main reasons for AA disposition: genetic factors [1, 2], and hormonal factors [3,4], as the hair follicle will respond differently to an external stimuli like hormones according to genetic variations leading to different hair characteristics.

Increasing levels of androgen will affect the hair growth rate and decrease the anagen phase length [5, 6].Smith and Wells concluded that balding is probably multi factorial [7], and current thinking is that the predisposition to balding has a polygenic basis. Topical minoxidil and oral finasteride are the only two treatments approved by FDA for treatment of androgenic alopecia and both require long time treatment with minimum time of three to six months. Minoxidil has vasodilators properties, and upregulate the vascular endothelial growth factor [8, 9]. Minoxidil is a prodrug and it is sulfonated to its active metabolite Minoxidil sulfate by Sulfotransferase 1A1 enzyme; the enzyme that its activity predicts the response to Minoxidil [10, 11, 12]. Finasteride is a synthetic azo-steroid that is a potent and highly selective antagonist of type II 5 α- reductase. It binds irreversibly to the enzyme and inhibits the conversion of testosterone to dihydrotestosterone; a hormone that is responsible for scalp hair miniaturization and hair fall [13, 14].

In this study we are trying to find if Finasteride will potentiate the action of Minoxidil through the relation between sulfotransferase 1A1 enzyme activity in the scalp hair follicle and the level of the circulating dihydrotestosterone hormone. The aim of the present study is aiming to prove that the concomitant using of Minoxidil and Finasteride is better than using Minoxidil alone in the treatment of AA, through the reduction of DHT level and its suppressive action on the scalp hair follicle and that will lead to
increment of SULT1A1 concentration and then increment in the activation of Minoxidil.

Subjects and Methods

Study Subjects

This study was performed in Hilla City, Babylon governorate, Iraq; in the department of clinical biochemistry, college of medicine. The present study lasts from October 2015 to May 2017. Sixty seven patients diagnosed with AA were included in our study of the effect of DHT on the level of SUL1A1 in the follicle of the scalp hair (30 men and 37 women). They are aged 19-49 years their mean of age is 31year +7.569 SD. Patients were excluded for anemia, thyroid disease, and use of any of AA treatments.

Ethical Concept

- This study got the approval of the scientific committee of clinical biochemistry department, college of medicine, Babylon University.
- Verbal approval of all the participants is taken to get the samples.
- Determination of the Concentration of Sulfotransferase 1A1 Enzyme by ELISA Technique Using Elab science® Kit

Plucked hairs were collected from the patients from the area where the hair starts to fall and checked visually for not to be damaged, immersed in the phosphate buffer of PH 8, sonicated for 30 seconds, the hair then removed and the solution was centrifuged and used as a sample to detect the level of SULT1A1 enzyme using the sandwich ELISA Elab science® kit, according to the instructions of the manufacturer.

Quantitative Determination of Dihydrotestosterone Hormone (DHT), by ELISA Technique Using Elab science® Kit

Blood sample was collected in a gel tube and centrifuged for 15 minutes at 9000 rpm to get the serum. The level of serum dihydrotestosterone was determined using the competitive ELISA EL Ab science® kit, according to the instructions of the manufacturer.

Results

The level of SULT1A1 in the follicle of scalp hair and the level of serum DHT are summarized in table (1). It was found by this study that the mean level of SULT1A1 in the scalp hair follicle is 206.12 pg/ml ±139.495 pg/ml SD, and the mean level of serum DHT is 606.05 pg/ml ± 93.801 pg/m lSD.

Table 1: Concentrations of serum dihydrottestosterone and scalp hair follicle sulfotransferase 1A1 enzyme

<table>
<thead>
<tr>
<th>DHT concentration</th>
<th>SULT1A1 concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>pg/ml</td>
<td>pg/ml</td>
</tr>
<tr>
<td>Mean</td>
<td>606.05</td>
</tr>
<tr>
<td>No.</td>
<td>67</td>
</tr>
<tr>
<td>SD</td>
<td>93.801</td>
</tr>
</tbody>
</table>

The Association between Serum Dihydrotestosterone and the Scalp Hair Follicle Sulfotransferase Concentration

When Pearson Correlation applied to the results of all the sample size (67 patients), it was found that the level of the SULT1A1 enzyme inside the scalp hair follicle is inversely related to the level of serum DHT (p- value is less than 0.001), when the confidence interval of 95%, and that is shown in Figure (1).

![Figure 1: The correlation between SULT1A1 concentration in the scalp hair follicle and serum DHT concentration](image-url)
When Pearson Correlation Test has been applied to find the correlation between SULT1A1 concentration in the scalp hair follicle and serum DHT concentration for the groups of males and females separately, an interesting result was found, the correlation was insignificant for the males group and significant for the females group as the p-values were 0.459 and 0.001 respectively, as shown in Figure (2) and Figure (3).

![Figure 2](image1)
**Figure 2**: The correlation between sulfotransferase 1A1 enzyme concentration and serum dihydrotestosterone hormone concentration of the females group

![Figure 3](image2)
**Figure 3**: The correlation between sulfotransferase 1A1 enzyme concentration and serum dihydrotestosterone hormone concentration of the males group

**Discussion**

Androgenic alopecia is the most common type of hair loss especially in men, and is great cause of psychological discomfort for some patients [15, 16, 17]. Minoxidil and Finasterid are the only two medicines approved by the FDA for the treatment of AA, and that could be life long and that is time and money consuming. Finding the most suitable treatment for each group of patients will be time and cost saving.

The measurement of the SULT1A1 concentration in the scalp hair follicle of the 67 participants was giving the mean of 206.12 pg/ml ± 139.495 pg/ml, is showing high individual variation and this is agreed with [19]. It has been mentioned that individual variation is noticed in the activity of scalp sulfotransferase enzyme [19], and the variation of the enzyme activity could affect the response of a patient to minoxidil [20]. Some studies deals the effect of gene polymorphism on the different types of disease to explain different cases [21-27]. Inclusion of the DHT in the pathogenesis of AA, and how much miniaturization is produced due to high level of DHT is widely controversial [4, 18]. Miniaturization means less scalp hair follicle activity, and that means less level of SULT1A1 enzyme concentration, which is essential in the activity of Minoxidil. This study showed that there is a significant negative relationship between the levels of SULT1A1 enzyme in the scalp hair follicle and the serum level of DHT, and that leads to the conclusion that it could be possible to potentiate the action of Minoxidil by using Finasteride which reduces the level of DHT and then could increase the level of SULT1A1. This study showed that this association can be true for the females (p= 0.001) with high level of DHT, but not for males (p= 0.469). This is could be explained by that the mean level of DHT for the males group was within the normal range, while that of the female group was higher than the normal range.

**Conclusion**

Using of 5 α- reductase inhibitor, could increase the level of sulfotransferase 1A1 enzyme inside the scalp hair follicle and that could potentiate the action of Minoxidil.
Modulating the treatment regimen can give better response and can save money and time for the patients of androgenic alopecia.

References


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