Association of Cortisol with severity and duration of depression in male and female

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Abstract

Introduction: Depression is associated with increased serum Cortisol. Many parameters affect the cortisol changes during depression such as gender of patients, severity and duration of disease which might be directly or inversely proportional with Cortisol.

Aim of study: to assess the correlation of serum Cortisol level with depression severity and duration in both genders of depressed patients compared with healthy controls.

Patients and method: a case–control study included thirty three in/out patients diagnosed as mild, moderate and sever depression, they were allowed to use their medications during the study, (24 males, 9 females) and thirty five subjects with out depression as healthy controls (24 male, 11 female). Serum Cortisol level was measured by ELISA (Enzyme Linked Immuno Sorbent Assay) technique.

Results: serum cortisol level increases significantly in patients with depression compared with control group ($P \leq 0.001$), with significant correlation with the severity of depression ($P = 0.01$), there was higher level of cortisol in patients with short duration of disease which is less than two years than those with long duration or chronic for two years and above ($P \leq 0.05$). In female depressed patients, cortisol was significantly higher than male depressed patients ($P \leq 0.001$).
Conclusion: the study found that serum cortisol correlates positively with severity of depression. In long duration of depression the cortisol level is less than short duration. The cortisol level is higher in female depressed patients than the male patients.

Keywords: Cortisol, depression, patients, serum


Introduction

Cortisol is a steroid hormone secreted from adrenal gland, it is (17-hydroxyl-11-dehydrocorticosterone)\(^1\). Anterior pituitary gland secrete Adeno Cortico Trophic Hormone (ACTH), Hypothalamus secrete Corticotropin Releasing Hormone (CRH). Zona Fasciculata and Zona Reticularis secrete Glucocorticoid particularly Cortisol \(^2\). According to many studies which reported that hyperactivity of the hypothalamic-pituitary adrenal axis found in a subgroup of patients with depressive symptoms\(^3,4,5,6,7\). The association of high cortisol levels with depression was first demonstrated in the early 1960s. \(^8\). Depression is associated with Hyperactivity of the Hypothalamus-Pituitary Axis (HPA) in 30-50% of patients \(^9\). Low cortisol levels have been found in post-traumatic stress disorders (PTSD) and chronic fatigue syndromes (CFS), irrespective of comorbid depressive illness \(^10,11\). These results concluded that cortisol hypersecretion occurs only in patients with severe depression, in addition to that illness, chronicity might be related to low, rather than high cortisol levels\(^12,13\). Psychotic depression is more closely associated with hypercortisolism and non suppression of cortisol \(^14\). Psychological changes in cortisol level associated with depression occurs in two models, the first model is hyper cortisolism in depression related to primary factors like trauma and harmful effects in the hippocampus such as neurogenesis inhibition and hippocampus volume loss. In the second model the triggering element of the cognitive effects may be hypercortisolism \(^15,16\). The study aimed to evaluate the correlation of serum Cortisol level with different variables in patients with depression like gender, severity and duration of depression.

Patients and method

Thirty three selected patients with depression, some of them were out patients and the others were admitted to Ibn−rushed training hospital for psychiatry, Baghdad, Iraq. There was no restriction in receiving their therapy or medications prior or during the study and thirty five individual without depression as control group. The approval of the Ibn−rushed training hospital Ethics Committee and written consent were obtained of all patients included in the study. The study excluded bipolar disorder,
hormonal contraceptive using or pregnancy and lactation females. The samples collection was from February 2019 to June 2019. The ICD10 (International Statistical Classification of Diseases and Related Health Problems 10th Revision) criteria was used for diagnosing the depression as mild, moderate and severe in which the presence of three criteria from the total nine considered mild and five criteria present in a patient was moderate and more than five criteria considered as severe depression. The duration of depression or chronicity is classified as follows: less than two years as short duration and two years and more as long duration. The patients were (24 male and 9 female). The blood samples was collected in morning from 8:00 AM to 12:00 AM, the collected samples were centrifuged at 3000 rpm to obtain serum and stored at −40 Cº, then the concentration of Cortisol was measured by competitive enzyme immunoassay ELISA technique. The results of measurement statistically analyzed by Statistical Package for Social Sciences (SPSS), software program version 17.0. A P value less than 0.05 considered statistically significant by using Independent sample test. Mean ± SD was used to express the results.

Results

The patients’ group mean age ± SD was 62.7±8.1, the control group was 58.4±7.7. There were 24 male patients and 9 female with 24 male and 11 female for control individuals. 13 patients with short duration and the other 20 with long duration chronicity as shown in Table (1).

Table (1): Demographic characteristics

<table>
<thead>
<tr>
<th>Groups</th>
<th>Patients (N= 33)</th>
<th>Control (N=35)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(years)</td>
<td>62.71±8.18&lt;sub&gt;NS&lt;/sub&gt;</td>
<td>58.42±7.75</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>24(72.7%)</td>
<td>24(68.6%)</td>
</tr>
<tr>
<td>Female</td>
<td>9(27.3%)</td>
<td>11(31.4%)</td>
</tr>
<tr>
<td>Duration of disease (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2 years (short)</td>
<td>13(39.4)</td>
<td></td>
</tr>
<tr>
<td>≥2 years (long)</td>
<td>20(60.6%)</td>
<td></td>
</tr>
</tbody>
</table>

N/S: non-significant

The concentration of serum Cortisol highly significant higher in patients compared with Controls ($P<0.001$) as demonstrated in Table (2) and Figure (1).

Table (2): Cortisol Level

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The depression severity: there was significant association of Cortisol with the severity of depression in depressive patients ($P=0.01$). See Table (3) and Figure (2).

Table (3): The Relation between Serum Cortisol Levels and severity of Depression

<table>
<thead>
<tr>
<th>Severity of depression</th>
<th>Mild (N=4)</th>
<th>Moderate (N=9)</th>
<th>Severe (N=20)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cortisol Concentration (µg/dl)</td>
<td>8.29±0.59</td>
<td>14.63±3.91</td>
<td>20.4±3.47</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Figure 1: Cortisol level in both depression patients and controls.
The duration of depression (Chronicity): the short duration was significant higher than long duration \((P<0.05)\). According to patients gender the Cortisol concentration was significantly higher in female than male depressive patients as noticed in Table (4).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Cortisol Concentration (µg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients (N=33)</td>
<td></td>
</tr>
<tr>
<td>Male (n=24)</td>
<td>17.36±5.40***</td>
</tr>
<tr>
<td>Female (n=9)</td>
<td>15.17±4.51***</td>
</tr>
<tr>
<td>Duration of disease (years)</td>
<td></td>
</tr>
<tr>
<td>&lt;2 years (short n=13)</td>
<td>23.2 ± 2.31***</td>
</tr>
<tr>
<td>≥2 years (long n=20)</td>
<td>17.14±5.99**</td>
</tr>
<tr>
<td>Control (N=35)</td>
<td></td>
</tr>
<tr>
<td>Male (n=24)</td>
<td>4.53±2.54</td>
</tr>
<tr>
<td>Female (n=11)</td>
<td>4.20±2.61</td>
</tr>
</tbody>
</table>

*Statistically significant difference \((p<0.05)\)

***Statistically significant difference \((p<0.001)\)

a: represent significant within patients group

Independent sample test

**Discussion**

The results of the present study demonstrate that, there was association of cortisol with depression in which the level of serum Cortisol increased with depression and these findings go with a study done by (Wolkowitz ,1999) who revealed higher serum cortisol level among patients with depression compared...
with control group\textsuperscript{(17)}. While (Vythilingam et al., 2010) study reported low early morning plasma cortisol level in patients with depression\textsuperscript{(18)}. Many studies demonstrate that not all patients with depression have hypercortisolism, and not all patients with hypercortisolism have depression which might explained these interpretations\textsuperscript{(19)}. The present study found positive correlation of Cortisol with the severity and that similar to (Maher A. et al., 2015) study who reported relationship was determined between the serum cortisol levels and depression severity\textsuperscript{(19)}, the other result was Cortisol inversely proportional with duration of depression, this relation is the same with (A.J. Oldehinkel et al., 2001) who mentioned subjects with a long lasting depression had significant lower urinary free Cortisol (UFC), his definition to the duration was as follows: chronicity of depression was defined according to shorter or longer than 2 years\textsuperscript{(20)}. There was significant difference of Cortisol in male and female of depressed patients, the females was higher than males, this similar to the result of (A.J. Oldehinkel et al., 2001) study, who revealed that quite unexpectedly, depression appeared to be significantly related to decreased (UFC) Urinary Free Cortisol secretion in depressive males\textsuperscript{(20)}. This deference in gender might be related to physiological hormonal changes in aging which differ from males.

References


