The Effects of Orchidectomy on Serum Cortisol Level in Male Rats

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Abstract—Studies show that there is association between serum testosterone level and adrenal gland function. The main aim of this study was to determine the effects of orchidectomy on serum level of cortisol in male rats. Male Wistar rats were randomly divided into control, sham-operated, uni-orchidectomised and bi-orchidectomised groups of 5 rats in each. After a period of 7 weeks, blood samples were collected using cardiac puncture method. Following serum collection, serum cortisol level was measured by Radioimmunoassay method. Data were statistically analyzed and compared between groups using ANOVA.

Our findings showed that serum level of cortisol was significantly decreased in uni- or bi-orchidectomised rats compared with control animals (p<0.05). There was no significant difference in serum level of cortisol of sham rats and control group. Our finding indicates that lower serum testosterone following orchidectomy can enhance serum cortisol level indicating that decreased serum testosterone can create stress, leading to increased serum cortisol level.

Keyword—Orchidectomy, Cortisol.

I. INTRODUCTION

CORTISOL is the most well-known glucocorticoid that is secreted by adrenal gland and has very important effects on immune system and body metabolism [1]. Increase in serum cortisol can also influence circulatory system [2].

Orchidectomy operation is removing of testes which is exerted through various methods to change the amount of sex hormone, in particular, testosterone level [3]. However, orchidectomy may lead to changes in normal function of other systems including nervous and endocrine system [4].

The studies show that changes in serum level of sex steroid hormones is correlated with alterations in serum level of adrenal hormones specially cortisol [5]. It has also been reported that testosterone regulates cortisol response [6]. There is also physiological cooperation between testosterone and cortisol [7].

Despite the reports indicating the effects of male sex steroid hormones on adrenal gland, there are still conflicting data in this area. This study was exerted to show the effects of decreased male sex steroids on serum cortisol level in male rats.

III. MATERIAL AND METHODS

a. Animals

Adult male Wistar rats were purchased from an original stock of Pasteur Institute (Tehran, Iran). They were housed in plexy glass solid bottom cages with wood shavings for bedding. The temperature was at 22 ±2°C and animals kept under a schedule of 12h light: 12h darkness (lights on at 08:00 a.m.). The animals had free access to the standard laboratory pellet feed (Pars company, Tehran, Iran) and water ad libitum.

b. Surgical procedure

For orchidectomy, the scrotal sac was cleaned with alcohol and a small incision of approximately 2cm was made mid-sagittally at the scrotal septum. The spermatic cord was dissected, tied and cut. The testes were carefully removed from the scrotal sac. The incision was sutured. In uni-orchidectomised one of testis and in bi-orchidectomised two testis were removed. In sham operations, the incisions were immediately sutured and the gonadal system was not manipulated. Groups were then reformed and the animals remained in groups till the end of the experiment. All animal experiments were carried out in accordance with the guidelines of Institutional Animals Ethics Committee.

c. Protocol of study

This work was conducted in Laboratory Complex of IAU – HB (Hamedan, Iran). Animals were randomly divided into control, sham-operated, uni-orchidectomised and bi-orchidectomised groups of 5 rats in each. 7 weeks after operation, blood samples were collected and serum levels of cortisol were measured using radioimmunoassay method.

d. Serum collection

Blood samples were collected in appropriate tubes by cardiac puncture technique. After collection, the blood samples were left to clot at room temperature for 15 minutes and then centrifuged at 2500 r.p.m. for 15 minutes. The serum layer was then separated and aliquoted into small test tubes and stored at -20°C until hormone or CEA determination.

e. Statistical Analysis

All values are presented as mean±SEM. Statistical significance was evaluated by one-way analysis of variance (ANOVA) using SPSS 19. Significance was measured using Game-s Howell significant for the exact P values and significant
differences are noted in the results. Differences with P<0.05 were considered significant.

Table 1 represents cortisol level in control, sham-operated, uni- and bi-orchidectomised groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>cortisol (ng/ml)</th>
<th>P</th>
</tr>
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<tbody>
<tr>
<td>Control</td>
<td>3.06±0.85</td>
<td>NS</td>
</tr>
<tr>
<td>Sham-operated</td>
<td>2.92±1.19</td>
<td>NS</td>
</tr>
<tr>
<td>Uni-orchidectomised</td>
<td>3.97±0.09</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Bi-orchidectomised</td>
<td>3.79±.88</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Statistical analysis suggests that serum level of cortisol was significantly decreased in uni- or bi-orchidectomised rats compared with control animals (p<0.05). There was no significant difference in serum level of cortisol of sham rats and control group.

III. DISCUSSION

In our study, serum level of cortisol was not significantly changed in sham-operated animals indicating that the method or operation procedure did not influence the result. In line with our study, there are reports indicating that alteration in male sex steroids is correlated with changes in serum cortisol level [5],[6]. It has also been shown that there is interrelationship between stress and testosterone [8]-[10]. On the other hand cortisol is the hormone of stress such that increased serum level of cortisol is an important index of stress [11]. Therefore, it is rational to consider a consolidated correlation between testosterone and cortisol and between testosterone and stress.

IV. CONCLUSION

We have shown that reduced serum testosterone level results in increased serum cortisol level. This finding indicates that reduced serum testosterone level play a role in stress.

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REFERENCES