Effect of orchiectomy on rat physical capacity

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ABSTRACT

Objective: Bilateral orchiectomy is indicated for the treatment of patients with testicular cancer or advanced prostate tumors. The influence of hypogonadism on physical activity is still not known. The purpose of this work was to verify the effect of bilateral orchiectomy on physical performance. Methods: Sixteen rats were divided into two groups: Group 1 (Control), in which only skin incision and suture were made (n = 5) and Group 2, in which the rats were submitted to bilateral orchiectomy (n = 11). The animals were trained to run on a treadmill at the speed of 14 meters per minute until they were fatigued. The results were compared using the Mann-Whitney test. Results: There was no difference between the animals submitted to orchiectomy and the Control Group. Conclusions: Bilateral orchiectomy does not affect the physical performance of the rat.

Keywords: Orchiectomy adverse effects; Hypogonadism; Castration; Exercise; Motor activity; Rats

INTRODUCTION

Testosterone is an anabolic steroid from the androgen group that stimulates protein synthesis and promotes a high muscle mass/fat mass ratio¹. The interstitial cells of the testes secrete this hormone. The production is controlled by the interstitial cell-stimulating hormone/luteinizing hormone (ICSH/LH) which is produced by the anterior lobe of the pituitary gland. The testes secrete more than 95% of total testosterone in males; the remainder is produced by the adrenal cortex. Hypogonadism is considered a risk factor for certain diseases, such as osteoporosis, osteopenia, increased blood triglyceride levels, obesity and hypertension²-⁵. In the aging male, “physiologic” hypogonadism is associated with a loss of lean body mass and an increase in fat mass with a consequent loss of physical capacity. Therefore, considering that testosterone helps maintaining muscle tone, it is possible that secondary hypogonadism may affect physical conditioning.

A review of literature produced no studies correlating orchiectomy and physical performance. Most research is done by administration of testosterone or other metabolites to individuals with sex hormone deficiencies to determine their effects on body composition⁶-⁹.
OBJECTIVE

The purpose of this study was to assess the aerobic performance of hypogonadal rats.

METHODS

This study was conducted in accordance with the recommendations of the Guiding Principles in the Care and Use of Animals, and was approved by the Ethics Committee of the Surgery Department of the Medical School of Universidade Federal de Minas Gerais (UFMG)(10-11).

Sixteen male Wistar rats (*Rattus norvegicus albinus*) with a mean weight of 359.6 ± 38.2 g were divided into two groups: Group 1 (Control), made up of five rats that underwent only skin incision and suture; Group 2, made up of 11 rats submitted to bilateral orchiectomy.

All animals were anesthetized with an association of ketamine, at the dose of 60 mg/kg of body weight, and xylazine, at the dose of 10 mg/kg of body weight. The anesthetics were applied intramuscularly in the right gluteal region. Orchiectomy was done through an anterior median incision in the scrotum. Each testicle was exposed through the surgical incision. The ductus deferens were isolated, ligated, and severed allowing the testicle to be removed. The incision was then closed and sutured with 3-0 chromic catgut.

In Group 1, the sham operation involved the exposure of the testes without isolation. The incision was closed and sutured with 3-0 cromic catgut.

Five months after the operation, the animals were trained to run on a treadmill (Modular T readmill, Columbus Instruments, USA) at a constant speed of 14 m/min., with zero inclination, for five minutes each day, during four consecutive days (Figure 1).

Before initiating the definitive exercise, the animals were weighed. To test their physical performance, the rats ran on the treadmill at a constant speed of 20 m/min., with zero inclination, until they were fatigued. The test was interrupted when the animal could not keep running at a determined velocity, when it kept falling off or spent more than ten seconds off the treadmill. The number of falls and the time during which the rats remained off the treadmill were determined by observation of the animals(12).

The results were assessed by the non-parametric Mann-Whitney test, to compare the independent samples to the variable of interest. The p value < 0.05 was considered statistically significant.

RESULTS

Upon evaluation of results (Table 1), no differences were found in the body weight of animals in each group. Table 1 also reveals that the mean total exercise time was slightly higher among the orchiectomized rats. However, this difference was not statistically significant when compared to the Control Group.

**Table 1. Body weight and total exercise time on treadmill of control rats (Group 1) and orchiectomized rats (Group 2)**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group 1 (n = 5)</th>
<th>Group 2 (n = 11)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>327.1 ± 25.4</td>
<td>359.6 ± 38.2</td>
<td>0.2573</td>
</tr>
<tr>
<td>Time (min)</td>
<td>81.6 ± 40.3</td>
<td>100.9 ± 44.2</td>
<td>0.1405</td>
</tr>
</tbody>
</table>

Mean ± standard deviation of mean and p value calculated by the Mann-Whitney test.

DISCUSSION

Testosterone is important for the maintenance of muscle tone in animals and men. Replacement therapy with testosterone and its metabolites promotes changes in body composition of fat and muscle mass. Regular physical activity also affects body composition. However, there is still a paucity of information concerning the influence of hypogonadism on physical performance.

An increased body weight, mainly due to fat mass, in men who underwent chemical or surgical castration for therapeutic purposes has been described(13). On the other hand, the body fat and muscle mass of healthy men diminish after testosterone administration(6-8). An increase in muscle mass with a consequent increase in lean body mass, without fat change, was observed in HIV positive hypogonadal patients who received testosterone replacement(9,14).
High doses of the testosterone metabolite, dehydroepiandrosterone, were given to women with adrenal insufficiency, but no changes in their physical performance or body content were observed. No changes in physical performance or organic structure occurred in healthy elderly men that received testosterone metabolite.

CONCLUSIONS

The effects of testosterone on the rat physical activity and muscle strength did not seem to be significant; other organic processes may be considered in further investigation.

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