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Testosterone Levels in Patients with Prostate Cancer and Benign Prostatic Hyperplasia: A Case-Control Study

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Abstract

Background: Prostate gland is the major accessory gland of the male reproductive system. It secretes a thin, slightly alkaline fluid that forms a portion of the seminal fluid. Studies exploring the relationship among circulating testosterone levels, prostate cancer(PC) treatment, and patient prognosis showed contradictory results.

Objective: The current study aimed to measure testosterone levels in prostate cancer and BPH patient and to determine that can be useful marker in monitoring the disease.

Methods : A case control study was conducted on 200 randomly selected patients as case group which among them 100PCa patients and 100 with

BPH, and 100 normal health individual as control group attending the Khartoum Oncology Specialized Center (KOSC) and Gezira hospital in Gezira state-Wad-Madani department of urology. After inform consent, blood samples were collected to measure the level of testosteroneby ELISA (enzyme linkage immunosorbent assay).All analyses were performed using the SPSS version (23).

Results: Testosterone hormone level was compared between PCa and BPH patients and control group, a significant increase was found in BPH patient when compared with control group and PCa patient, significant decrease in hormone level was found in PCa patient when compared with control group and BPH patient with p.value 0.000

Conclusion: According to the finding this study it can be concluded that, testosterone hormone increase in BPH and decrease in PCa patients by action of treatment.

Keywords: Benign Prostatic Hyperplasia, testosterone, Prostate Cancer

Introduction

Prostate gland is the major accessory gland of the male reproductive system. It secretes a thin, slightly alkaline fluid that forms a portion of the seminal fluid. It is composed of glandular and stromal elements which are tightly fused within a pseudo capsule [1]. There are two common forms of prostate disease: benign prostatic hyperplasia (BPH) is a non-cancer enlargement of the prostate gland that affects approximately 50 % of all men over the age of 50 and more than 75 % of men over the age of 60. The second is prostate cancer (PCa) which is the second leading cause of male cancer death. However, early detection also leads to better treatment for prostate cancer. In most cases, prostate cancer can be diagnosed while still localized rather than metastatic (spread) [2]. Androgens (testosterone and

dihydrotestosterone) are essential for the development and differentiated function of the prostate, as well as for proliferation and survival of prostatic cells. Testosterone and dihydrotestosterone and their metabolites play important roles in the disease, but cause-effect relationships have not been established. Androgen deprivation therapy has been used for decades, primarily in the metastatic stage, to inhibit androgen-dependent prostate cancer cell growth [3]. Androgen deprivation, which can be achieved by targeting hormone biosynthesis or androgen receptor activation. serum levels of hormones, such as those reported by Nomura et *al.* [4] and Barrett-Connor *et al.* [5]. The objective of present study was to measure testosterone levels in prostate cancer and BPH patient and to determine that can be useful marker in monitoring the disease.

Materials and methods

Patients: A case control study was conducted on 200 randomly selected patients as case group which among of them 100PCa patients and 100 with BPH, and 100 normal health individuals as control group attending the Khartoum Oncology Specialized Center (KOSC) and Gezira hospital in Gezira state-Wad-Madani department of urology. Prostate cancer and benign prostatic hyperplasia under treatments were included, patients with UIT and any case that increase level of testosterone were excluded.

Sample collection: After informed consent and under aseptic conditions 5ml of venipuncture specimens was collected from the study participants into plain container. Serum had obtained after centrifuged plain container blood at 4000 r.p.m for 10 minutes' samples were stored at -30c and not thawed before analysis. The level of testosterone, were measured by ELISA semi-automated analyzer (enzyme linkage immunosorbent assay) kits the instruction of the manufactures were fully followed.

Statistical analysis : Mean and standard deviation, frequencies and percentage for the data analysis of the background of the data.independent-test was used to compare biochemical quantitative data between case groups. One –way analysis of variance (ANOVA) was used to comparing between classified variable among the group of the study.

All analyses were performed using the SPSS(v23) A decision rule was set based on a p-value set at 0.05 with 95% confidence interval and whenever the p-value was less than 0.05 the null hypothesis was rejected and the alternative hypothesis was considered.

Ethical consideration: The study was approved from ethical committee of AL-neelin University and form Khartoum Oncology Specialized Center and Gezira hospital and carried out in accordance to international ethical Guideline. Written informed consent was obtained from all participants.

Results

Socio-demographic characteristics of study participants

Demographic data show that out of 100 prostate cancer patients, 79 (79.0%) were > 60 years of age and 21 (21.0%) were ≤60 years of age, 92 (92.0 per cent) were ≤5 Years of illness and 8 (8.0 per cent) > 5 Years of illness,74(74%) under therapy and 25(25%) were untreated patients. Demographic data also shows that out of out of 100 patients with BPH,75 (75.0%)were >60 years of age and 25 (25.0%)were ≤60 years of age. 82 (82.0%)were ≤5 Years of disease and 18 (18.0%)> 5 Years of disease and 50 (50.0%)with the white race.77(77.0%)under therapy and 31(31.0%) were untreated patients.

Testosterone hormone level was compared between PCa and BPH patients and control group,significant increase was found in BPH patient when compared with control group and PCa patient, significant decrease in

hormone level was found in PCa patient when compared with control group and BPH patient with p.value 0.000 (Table1).

Table 1: comparison of testosterone level between case group and control (n=30)

	(**Mean ±SD)**	**PCa**	**BPH**	**Control**	**P-value**
Testosterone (ng/ml)		2.2±0.4	13.7±7.7	5.4±2.4	**0.000**

Testosterone levels were found to significantly increase in untreated prostate cancer relative to treated patients with p. 0.00. **(**Table 2), and found significant increase in Testosterone levels in treated BPH patients when compared with un- treated patients with p. value 0.00**.(Table).**

Table 2: Comparison the mean concentration levels of testosterone between treated and untreated PCa patients. n= 100.

	Treated (Mean ±SD)	Untreated (Mean ±SD)	*P-value*
Testosterone (ng/ml)	1.26±0.6	4.8±2.4	0.000

Table 3: Comparison the mean concentration levels of testosterone between treated and untreated BPH patients. n= 100.

	Treated (Mean ±SD)	Untreated (Mean ±SD)	*P-value*
Testosterone (ng/ml)	16.0±7.4	6.1±1.0	0.000

Testosterone levels have been altered according to therapy status (treated, untreated) in patients with BPH. (Table 3). Testosterone concentrations vary among treated patients by type of therapy and foundsignificant increase in testosterone level in patients under 5-alpha reductase inhibitor therapy when compared withpatients under 1-alpha blocker therapy with p. value 0.00. (Table 4).

Table 4 : Comparison of mean concentration levels of testosterone between different types of treatment among BPH patients n= 77.

Treatment	5- Alpha Reductase inhibiters	1- Alpha Blocker	*P-value*
Testosterone (Mean ±SD)	18.6 ± 5.5	7.9 ± 6.3	0.000

SD=standard deviation.

Discussion

prostate cancer tumors require androgen receptor (AR) signaling for survival, When the prostate is growing, testosterone is converted into dihydrotestosterone (DHT), which is the androgen receptor's major activator [7,8]. In Compared to the control group, this study found that

testosterone levels were lower in prostate cancer patients and higher in BPH patients, this findings consistence with Morgentaler et al (2012) whichfound levels of testosterone was higher in BPH patient and lower in PCa in compared with control group. in comparing testosterone levels between PCa and BPH patients, our study found that BPH patients had a high testosterone level inversely to PCa patients. these findings concur with study done by (Eaton et al and Ross et al 1997) who reported that there was difference in concentration of Testosterone between PCa and and BPH patients and inconsistent with results of Gabriela et al and Roddam et al, 2008, who found that patients with PCa and BPH presented higher values of Testosterone and when comparing to PBH patients and Controls, suggesting that Differences in testosterone levels between BPH and PCa patients arose from the treatment action, in PCa patients the treatment action relied on androgen inhibition, while BPH dependency on inhibit the conversion of DHT to testosterone [8].Our results reinforced this finding when patients with PCa and BPH compared their levels of testosterone between the new case and the treated patients found that, new case patients with PCa and BPH had a normal testosterone level rather than PCa treated patients had a low level and BPH patients had a high level of testosterone. In this study, two forms of BPH therapy was included in this study (5-alpha reductase inhibitor and 1-alpha blocker)in comparing the testosterone level between two different types of therapy our study found that, higher testosterone level was found in patients treated with 5-alpha reductase inhibitor while lower in patients treated with 1-alpha blocker;suggesting that this difference originates from the treatment action which 5-alpha reductase inhibitor prevents the conversion of testosterone to DHT and 1-alpha-alpha blocker doesn't have function on testosterone it act as bladder relaxer [9].

Conclusion:

According to the finding this study concludes that, testosterone hormone increase in BPH and decrease in PCa patients by action of treatment so measurement of serum testosterone in patients with PCa and BPH can be use as good indicator of effectiveness of therapy.

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Data Availability

The data that support these findings are available on reasonable request.

Conflict of interest

The authors declare no conflict of interest

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