Section: Medicine

Original Research Article

STUDY OF TESTOSTERONE LEVELS IN TYPE-II DIABETES MELLITUS MALE PATIENTS – RETROSPECTIVE STUDY

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Abstract

Background: Type II DM is a medical condition that is often associated with sexual dysfunction and erectile dysfunction due to low levels of testosterone hormone. Hence, the duration of diabetes mellitus and levels of testosterone and other clinical manifestations have to be ruled out. **Materials and Methods:** 160 (one hundred sixty) type II DM patients of different age groups were studied and compared with 160 normal (controlled) groups. The blood investigation included FBS and PPBS. Blood urea, serum creatinine, HbA1C, lipid profile, urine albumin-creatinine ratio, and serum testosterone levels were estimated by chemiluminescence immunoassay and HbA1c by HPLC. **Result:** The BMI, age, HbA1C, and serum testosterone levels were compared with the control group, and the p-value was highly insignificant ($p<0.001$). **Conclusion:** It is confirmed that there is a positive correlation between type II DM and falling serum testosterone levels.

INTRODUCTION

Type II diabetes mellitus is predominant globally. Diabetes mellitus is a medical condition that is often associated with male sexual dysfunction. Erectile dysfunction (ED) is estimated to occur in 28-75% of diabetic males, and its prevalence appears to increase with age and duration.[1] The etiology of ED in type II DM is often multi-factorial and includes poor metabolic control, diabetes-induced micro- and macro-vascular alterations, autonomic neuropathy, hypogonadism, or a combination of all these factors.[2] Type II DM, which is not an autoimmune disorder, is also associated with other endocrine diseases, in particularhy pogonadisminmen. Androgen deficiency has recently come to the forefront of the medical literature, often being ignored for decades.

Testosterone biosynthesis is regulated primarily by pulsative secretion of lutenizing hormone (LH), and serum testosterone levels reflect the integrity of the hypothalamic pituitary gonadal (HPG) axis. Therefore, low testosterone levels noted in cases of insulin resistance may indicate a defect at one or more functional levelsof the HPG axis.[3]

Testosterone is the major androgen and is produced by the interstitial cells of Leydig. It is responsible for secondary sexual characteristics, loss of sexual drive,and erectile dysfunction due to nerve damage and poor circulation of blood and low testosterone. These conditions are difficult to treat.[4] Hence, an attempt was made to evaluate the duration of type II DM and the level of testosterone.

MATERIALS AND METHODS

160 males aged between 30-50 years with known type II diabetes mellitus regularly visited SVS Medical College, Yenugonda, Mahabub Nagar, Telangana-509001 were studied.

Inclusive Criteria

Type II DM patients, irrespective of the duration of diabetes, who are currently on oral hypoglycemic drugs or insulin, and gave their consent in writing for the study.

Exclusion Criteria

Patients aged less than 30 years with type II DM and patients with corticosteroids, testosterone, thyroid supplements, chronic renal disease, cirrhosis of the liver, and immune compromised patients were excluded from the study.

Method: A detailed history, occupation, clinical examination, and investigation included CBC, fasting, and postprandial blood sugar, Blood urea, serum creatinine, HbA1C, lipid profile, urine albumin creatinine ratio, and diabetes mellitus weredefined by ADA guidelines (5). Serum testosterone levels (morning sample) were estimated using a chemiluminescence immunoassay. Low testosterone was defined as a serum testosterone level < 241 mg/dl, and the prevalence of its deficiencieswas calculated. Estimation of HbA1C (4.2–6.2%) performed by high-performance liquid

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chromatography (HPLC) All important parameters, like age, BMI, mean HbA1C, and serum testosterone, were compared in healthy volunteers (controlled group).

The duration of the study was from November 2023 to November 2024.

Statistical analysis: Various parameters in type II DM patients were studied and compared with a control group. The statistical analysis was carried out in SPSS software.

RESULTS

[Table 1] Clinical manifestations in type-II DM patients—BMI 25.34 (±2.22), HbA1C 8.83(±1.90), serum testosterone 116.12 (± 82.4), age group 54.12(±8.12)

[Table 2] Distribution of type-II DM patients according to duration of disease—> 1 year39(24.3%),6–10years56(35%),11–15years44(27%),>15years21 (13.1%)

[Table 3] Comparison of clinical manifestations in type II DM and controlled patients

- Age: 54.12 (± 8.12) in type-II DM patients, 38.74 (± 5.36) in the controlled group; t test was 19.5 and $p < 0.001$.
- BMI: 25.34 (± 2.22) in the type II DM group, 24.48 (± 3.6) in the controlled group; the t-test was 2.5 and $p < 0.001$.
- HbA1C: 8.83 (± 1.90) in type II DM, 4.75 (± 0.35) in the controlled group, t test was 26.7, and $p < 0.001$.
- Serum testosterone level: 116.12 (± 82.4) in type II DM patients, 406.9 (±160.5) in the controlled group; the t-test was 20.3 and $p < 0.001$.

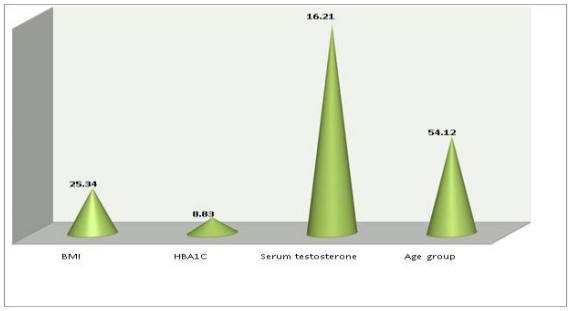

Figure 1: Clinical Manifestations in type-II DM patients

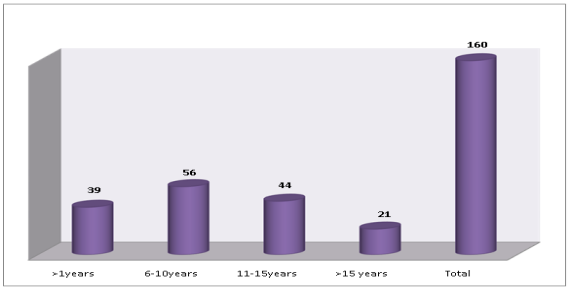

Figure 2: Distribution of type-II DM patients according to duration of disease

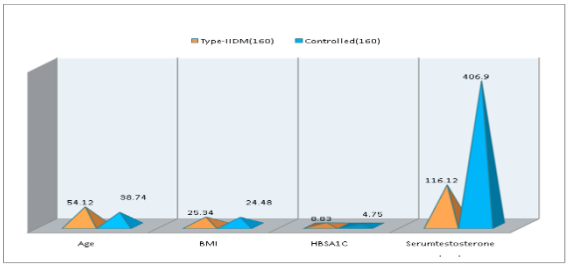

Figure 3: Comparison of clinical Manifestation in type-IIDM patients with controlled groups

Table 1: Clinical Manifestations in type-II DM patients.

Manifestations	Mean ±SD
BMI	25.34(±2.22)
HbA_1C	8.83(±1.90)
Serum testosterone	116.12(± 82.4)
Age group	54.12(±8.12)

Table 2: Distribution of type-II DM patients according to duration of disease

Duration of years	No.of patients(160)	Percentage
> 1 years	39	24.3
6-10years	56	35.0
11-15years	44	27.5
>15years	21	13.1
Total	160	99.9

Table 3: Comparison of clinical Manifestation in type-II DM patients with controlled groups

Parameter	Type-II DM (160)	Controlled (160)	t test	P value
Age	54.12(± 8.12)	38.74(±5.36)	19.5	P<0.001
BMI	25.34(± 2.22)	24.48(± 3.6)	2.5	P<0.001
HbA1C	8.83(±1.90)	4.75(±0.35)	26.7	P<0.001
Serum testosterone level	116.12 (±82.4)	406.9 (±160.5)	20.3	P<0.001

P<0.001=P value is highly significant

DISCUSSION

Present study of testosterone elevelsin type II DM male patients. The clinical manifestations included 25.34(±2.22) BMI, 8.83(±1.90) HbA1C level, 116.12 (±82.4) serum testosterone, and 54.12 (± 8.12) age group [Table 1]. In the distribution of type II DM, the duration of the disease was >1 year for 39 (24.3%),

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56(35%) were between 6–10years, 44 (27.5%) were 11–15 years, and 21 (13.1%) were > 15 years [Table 2]. A comparison of clinical manifestation in type-II DM with the controlled group's age, BMI, HbA1C, serum testosterone has a significant p-value ($p<0.001$) [Table 3]. These findings are more or less in agreement with previous studies.[5-7]

Defining the lower limit of normal for S. testosterone levels poses a challenge for physicians. The adverse clinical outcomes that occur in type II DM are not known.[8] Testosterone in men is synthesized and secreted into circulation almost exclusively by the cells of the Leydig of the testes. It is mostly bound to plasma proteins. S. testosterone is composed of 0.5 to 3% of free testosterone unbound to plasmaproteins, 30–44% sex hormone-binding globulin (SHBG)-bound testosterone, and 54–60% albumin-bound testosterone.[9] Moreover, variations in S. testosterone metabolism are associated with environmental and/or genetic factors.[10]

It was experimented on in lower animals (mice) that testosterone therapy increased muscle mass and reduced fat mass, both of which were expected to decrease insulin resistance. It was also observed in mice that testosterone regulated skeletal muscle genes involved in glucose metabolism, which led to decreased systemic insulin resistance.[11]

It can be hypothesized that a low S. testosterone level could contribute to the development of obesity and type II DM through changes in body composition. In obese men, the peripheral conversion from testosterone to estrogen could attenuate the amplitude of luteinizing hormone pulses and centrally inhibit testosterone production.[12] Moreover, leptin and adipokine have been shown to be inversely correlated with serum testosterone levels in men.

Low testosterone levels can be perpetuated through defects in the HPG axis. Hence, type II DM patients had hypogonadotropic hypogonadism. Aging is also well known to result in a decline in sex hormone levels and is likely a combination of testosterone and pituitary hypothalamic defects. In elderly men, there is a reduced testicular response to gonadotropins with suppressed and altered pulsatility of the hypothalamic pulse generation.

Low testosterone is commonly associated with a high prevalence of metabolic risk factors, including insulin resistance, hypertension, dyslipidemia, obesity (particularly central adiposity), CVD, and type II DM, because testosterone has been shown to dilate coronary vessels in animals and men, suggesting that it might be an important regulator of vasculature compliance and a modifier of blood pressure.

CONCLUSION

In the present study it is shown that low serum testosterone levels in type II DM patients causes insulin resistance, obesity, vascular dysfunction, and inflammation. There is a higher prevalence of type II DM patients across the world. This study demands further study of genetic, hormonal, nutritional, and pharmacological factors to clarify whether low testosterone is merely a reflection of poor cardiovascular risk factor control or is really causing adverse clinical outcomes or higher viscosity of blood in type II DM patients, which may prevent or retard the flow of testosterone, which leads to low testosterone hormone, is still unclear.

Limitation of study: Due to the tertiary location of the research center, the small number of patients, and the lack of the latest techniques, we have limited findings and results.

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