

Type 2 diabetes mellitus and erectile dysfunction: A study on risk factors and their correlation to serum testosterone level

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ABSTRACT

Background: Diabetes mellitus (DM) is one of the major cause of erectile dysfunction (ED). Testosterone regulates nearly every component of ED and this subnormal testosterone concentration contribute to ED. The objective of our work was to study the age of the patient, duration of DM, body mass index, glycosylated hemoglobin (HbA1c), and urinary albumin creatinine ratio (uACR) in type 2 diabetic male patients as etiology for ED and their relation to the serum testosterone level. **Methodology:** We studied 100 male type 2 diabetic patients selected from the outpatient department of the Family Medicine Department in Olive Healthcare. We divided our patients into two groups: Group A: 50 patients with type 2 DM with ED and Group B: 50 patients with type 2 DM without ED. We assessed their history with special focus on the age of the patient, disease duration, and laboratory investigations. The patients answered the five item version of the International Index of Erectile Function questionnaire. **Results:** The total serum testosterone was significantly lower in type 2 diabetic male patients with ED compared to those without ED. HbA1c, diabetes duration, and uACR were independently negatively correlated with testosterone level. **Conclusion:** The duration of diabetes, glycemic control, and uACR contributed to ED in type 2 diabetics and they are independently and negatively correlated with total serum testosterone level.

Key words: *Erectile dysfunction, Glycemic control, Glycemic variability, Glycosylated hemoglobin, Hyperglycemia, Serum testosterone, Type 2 diabetes mellitus, Urine albumin creatinine ratio*

Multi-organ dysfunction and sexual dysfunction are the two major long-term complications of progressive hyperglycemia [1]. Persistent inability to achieve or maintain penile erection sufficient for satisfactory sexual performance defines erectile dysfunction (ED) [2]. There are a lot of modifiable and non-modifiable risk factors for ED in diabetic patients [3]. A major cause in diabetic men which contributed to ED was found to be subnormal testosterone levels [4]. We designed this study to analyze the patient's age, diabetes duration, glycosylated hemoglobin (HbA1c), urine albumin creatinine ratio (uACR), and body mass index (BMI) as risk factors for ED in type 2 male diabetics and their correlation to serum testosterone levels.

METHODOLOGY

We conducted our study on 100 male type 2 diabetic patients aged above 40 years and with a duration of diabetics more than 5 years. The patients were selected from the outpatient clinics of the Family Medicine Department of Olive Healthcare, Thrissur, Kerala, India. An informed consent was obtained from the selected patients before they were exposed to examination

and investigations. The study was done from October 2021 to February 2021.

The diabetic patients were divided into two groups.

- Group A: 50 type 2 diabetic male patients with ED
- Group B: 50 type 2 diabetic male patients without ED.

The subjects with hepatic or renal diseases, malignancy, those receiving testosterone or steroid, those using medications that cause hypogonadism and those with history of trauma or surgery were excluded from our study. Neurological complications and ED are common in type 1 diabetes and they were excluded from our study population.

We focused on history with special emphasis on age, duration of diabetes mellitus (DM), and detailed drug history. The subjects were examined physically monitoring their weight, height, and BMI. Laboratory investigations included complete hemogram, liver function tests, renal function tests, HbA1c, urine analysis, uACR, and total serum testosterone. The study population filled the Malayalam version of the International Index of Erectile Function questionnaire consisting 5 questions with five-point ordinal score, where the lower values represented poor erectile function. Patients with score <22 were considered to have ED.

Table 1: Demographic and laboratory data comparison

Study variable	Group A (n=50)	Group B (n=50)	Test of significance	p-value
Age (years)	52.34±5.81	50.71±7.12	t=3.07	0.001*
Duration of diabetes (years)	9.28±3.21	7.27±2.81	Mw=2.81	0.001*
BMI (kg/m ²)	32.19±5.2	28.9±5.33	t=3.429	0.002*
HbA1c (%)	10.22±2.58	8.28±1.49	t=4.612	0.002*
uACR (mg/g/cr)	480.16±120	26.39±88.35	Mw=9.012	0.005*
Total serum testosterone (ng/dl)	195±106.68	452±102.34	Mw=8.015	0.001*

t=Student t-test, Mw=Mann-Whitney U-test, *=Statistically significant at p≤0.05, BMI: Body mass index, HbA1c: Glycosylated hemoglobin, uACR: Urinary albumin creatinine ratio

Statistical Analysis

Statistical Package for the Social Science (SPSS) computer software program version 15, IBM Corp, IBM SPSS statistics for Windows, version 15.0 Armonk, NY: IBM Corp, Chicago, USA) were used for data analysis. Mean and standard deviation were focused for quantitative data analysis. p ≤ 0.05 was fixed as significant level.

RESULTS

The mean age, hbA1c, BMI, and uACR were higher and statistically significant in Group A compared to Group B. Total serum testosterone was lower and statistically significant in Group A compared to Group B (Table 1). Total serum testosterone had negative correlation with duration of diabetes, hbA1c, BMI, and uACR (Table 2). Independent negative correlation was seen between total serum testosterone level and duration of diabetes, hbA1c, and uACR (Table 3).

DISCUSSION

Giuliano *et al.* did a cross-sectional study in 2004 on 7,689 patients in Italy [5]. They concluded that increasing age was indeed related to increasing prevalence of ED. Our observation was also similar and we could find that the age of the patients with ED was significantly higher than the age of those without ED. Increasing age can result in low testosterone levels further attributing to ED. Yang *et al.* did an observational study in 2010 on 5,477 Chinese diabetic males [6]. They concluded that the duration of DM had significant association with the presence and severity of ED. We also had a similar observation of statistically significant association between duration of diabetes and presence of ED. The total testosterone level had independent negative correlation with duration of diabetes.

Hayek *et al.* did a cross-sectional study in 2013 and concluded that the prevalence of low testosterone was higher in patients with longer duration of DM [7]. In 2014, Shaheen *et al.* found a negative correlation between serum testosterone and duration of DM [8]. Our study showed that the prevalence of low testosterone was higher in patients with a longer duration of DM similar to that of Hayek *et al.*

In 2006, Bacon *et al.* did a prospective study to find the risk factor for ED [9]. In their study which included 22,086 United

Table 2: Correlation between total serum testosterone and study variables

Study variable	Total serum testosterone (ng/dl) rs	Total serum testosterone (ng/dl) P value
Age (years)	0.084	0.51*
Duration of diabetes (years)	-0.326	0.003*
BMI (kg/m ²)	-0.342	0.021*
HbA1c (%)	-0.426	0.010*
uACR (mg/g/cr)	-0.812	0.004*

rs=Spearman Coefficient, *=Statistically significant at p≤0.05, BMI: Body mass index, HbA1c: Glycosylated hemoglobin, uACR: Urinary albumin creatinine ratio

Table 3: Linear regression for the study variables affecting total serum testosterone

Study variable	Total serum testosterone (ng/dl) (B)	Total serum testosterone (ng/dl) (SE)	Total serum testosterone (ng/dl) P value
Age (years)	0.05	0.052	0.512*
Duration of diabetes (years)	27.120	12.84	0.042*
BMI (kg/m ²)	0.621	0.51	0.312*
HbA1c (%)	0.071	0.02	0.006*
uACR (mg/g/cr)	0.079	0.001	0.001*

B=Unstandardized coefficient, SE=Standard error, *=Statistically significant at p≤0.05, BMI: Body mass index, HbA1c: Glycosylated hemoglobin, uACR: Urinary albumin creatinine ratio

States men from 40 to 75 years, they found that BMI was inversely associated with the risk of ED. Group A patients in our study had significantly higher BMI as compared to Group B patients. We got a significant negative correlation between BMI and testosterone level.

Rabijewski *et al.* studied the incidence of hypogonadotropic hypogonadism in type 2 diabetic polish men [10]. They found significant negative correlation between HbA1c and testosterone concentration in type 2 DM. Our results were in agreement to Rabijewski *et al.* Our study showed that patients with ED had significantly higher HbA1c when compared to patients without ED. Moreover, HbA1c was found to be independently negatively correlated with testosterone levels.

Chuang *et al.* conducted study on 455 patients to evaluate albuminuria as an independent risk factor for ED in type 2 diabetic males [11]. Our study results were in agreement with Chuang *et al.*, as uACR was significantly higher in our Group A compared

to Group B and it was independently statistically significantly negatively correlated with total serum testosterone. Ghazi *et al.* found that 94% of type 2 diabetic patients with low testosterone had ED compared with 61% with normal serum testosterone [12]. ElSagheh *et al.* also had similar conclusions [13]. Our study was in agreement to Ghazi *et al.* and El Sagheh *et al.* We found that patients with ED had significantly lower total serum testosterone levels than those without ED.

Diabetic neuropathy impairs autonomic and somatic nerves responsible for erections. Long-term poor glycemic control results in impaired relaxation of cavernosal smooth muscle, leading on to ED [14]. Uncontrolled diabetes results in a decline in the levels of pituitary hormones responsible for stimulating testicular production of testosterone, thus causing low serum testosterone levels leading on to a decline in sexual desire and, directly or indirectly, to ED [15].

Low testosterone can be prevented in diabetes patients by focusing on their lifestyle [16]. Appropriate diet therapy, weight reduction, exercise, and addiction free lifestyle are the keys to prevent testosterone reduction in diabetes.

CONCLUSION

High prevalence of low serum testosterone level is seen in type 2 diabetic patients with ED. This was significantly negatively correlated with duration of diabetes, HbA1c, and uACR. Periodic checking of these risk factors and promoting awareness on importance of the risk factors plays an important role in prevention of ED in type 2 DM.

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