Comparison of Serum Total Testosterone Levels in Controlled versus Uncontrolled Type 2 Diabetes Mellitus Patients

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Abstract- **Background:Type 2 diabetes mellitus (T2DM) is commonly associated with hypogonadism. However, the effect of glycemic control on serum testosterone levels remains inadequately studied.**

Objectives:To compare serum total testosterone (TT) levels in controlled versus uncontrolled male T2DM patients and evaluate the prevalence of androgen deficiency.

Materials and Methods:A cross-sectional study was conducted in 100 male T2DM patients aged 35–70 years. Fifty patients with HbA1c <7% were categorized as controlled and 50 with HbA1c >7% as uncontrolled. Serum TT was measured using chemiluminescence immunoassay. Statistical analysis was performed using SPSS v20.

Results:Controlled diabetics had significantly higher mean TT levels across all age groups ($p<0.0001$). Androgen deficiency (TT <300 ng/dL) was present in 48% of uncontrolled vs 16% of controlled diabetics.

Conclusion:Good glycemic control is associated with significantly higher testosterone levels. Screening for hypogonadism in uncontrolled T2DM may improve patient outcomes.

I. INTRODUCTION

Type 2 diabetes mellitus (T2DM) is increasingly recognized to impact the endocrine system, particularly male gonadal function. Multiple studies report low serum testosterone levels in men with T2DM independent of age or obesity.[12] Low testosterone has been associated with poor glycemic control, increased insulin resistance, and metabolic syndrome.[34] This study aims to compare serum testosterone levels between controlled and uncontrolled male T2DM patients and evaluate the prevalence of androgen deficiency. The prevalence of low testosterone in this population has been reported to be as high as 40–50%, depending on study parameters. This is significant considering that hypogonadism itself contributes to a worsening cardiometabolic profile. Several hormonal and metabolic pathways intersect, including insulin resistance, inflammation, and visceral adiposity. Moreover, studies indicate that testosterone replacement therapy in appropriately selected men with T2DM may improve glycemic control, waist circumference, and lipid profile. These cumulative findings have prompted calls for endocrinologists and diabetologists to include testosterone evaluation as part of routine diabetes management, especially in symptomatic patients or those with poor glycemic control.

II. MATERIALS AND METHODS

This cross-sectional study was conducted at a tertiary care hospital in Andhra Pradesh over 24 months. Inclusion criteria: males aged 35–70 years with T2DM. Exclusion: type 1 DM, chronic

diseases, hormonal disorders, or drugs influencing testosterone. Patients were divided into two groups based on HbA1c: controlled (<7%) and uncontrolled (>7%). Serum testosterone was measured using CLIA between 8–10 AM. Statistical analysis was done using SPSS v20. Continuous variables were compared using the t-test; categorical variables using chi-square test.

III. RESULTS

Mean serum testosterone levels in various age groups are shown in Table 1.

Age Group (years)	Uncontrolled (ng/dL)	Controlled (ng/dL)	T-statistic	P-value
30–39	465.9 ± 21.9	658.6 ± 74.8	5.010	0.004
40–49	305.3 ± 43.4	619.4 ± 35.7	17.296	<0.0001
50–59	269.4 ± 39.2	530.3 ± 57.7	18.834	<0.0001
60–69	213.1 ± 43.4	481.3 ± 75.5	10.412	<0.0001

Table 1: Comparison of mean serum testosterone levels between controlled and uncontrolled T2DM patients.

IV. DISCUSSION

This study found significantly higher testosterone levels in well-controlled diabetic men compared to uncontrolled counterparts. This supports earlier findings that link poor glycemic control with hypogonadism.[56] The mechanisms may include chronic hyperglycemia, increased aromatase activity, or suppression of hypothalamic-pituitary-gonadal axis.[7] Nearly half the men with uncontrolled T2DM in our study had TT <300 ng/dL, indicating high prevalence of biochemical hypogonadism. These findings underscore the complex interplay between endocrine and metabolic systems in men with type 2 diabetes. The link between low testosterone and poor glycemic control suggests that routine metabolic evaluations in diabetic males should also include assessment of gonadal function. In clinical settings, patients with symptoms such as reduced libido, erectile dysfunction, or unexplained fatigue may warrant hormonal screening. It is noteworthy that testosterone not only plays a role in sexual function but also contributes to lean muscle mass, bone density, and insulin sensitivity. Therefore, identifying and treating hypogonadism in diabetes may offer multifaceted benefits.

V. CONCLUSION

Glycemic control in T2DM is strongly associated with serum testosterone levels. Routine testosterone screening should be considered in men with poorly controlled T2DM.

REFERENCES

[1]. Grossmann M. Low testosterone in men with type 2 diabetes: significance and treatment. J Clin Endocrinol Metab. 2011;96(8):2341–53.

[2]. Dhindsa S, Prabhakar S, Sethi M, Bandyopadhyay A, Chaudhuri A, Dandona P. Frequent occurrence of hypogonadotropic hypogonadism in type 2 diabetes. J Clin Endocrinol Metab. 2004;89(11):5462–8.

[3]. Kapoor D, Aldred H, Clark S, Channer KS, Jones TH. Clinical and biochemical assessment of hypogonadism in men with type 2 diabetes. Diabetes Care. 2007;30(4):911–7.

[4]. Corona G, Mannucci E, Schulman C, et al. Hypogonadism as a risk factor for cardiovascular mortality in men. Eur J Endocrinol. 2011;165(5):687–701.

[5]. Ding EL, Song Y, Malik VS, Liu S. Sex differences of endogenous sex hormones and risk of type 2 diabetes: a systematic review. JAMA. 2006;295(11):1288–99.

[6]. Laaksonen DE, Niskanen L, Punnonen K, et al. Testosterone and SHBG predict diabetes in middle-aged men. Diabetes Care. 2004;27(5):1036–41.

[7]. Pitteloud N, Mootha VK, Dwyer AA, et al. Testosterone, insulin sensitivity, and

mitochondrial function in men. Diabetes Care. 2005;28(7):1636–42.

[8]. Gianatti EJ, Dupuis P, Hoermann R, et al. Effect of testosterone on glucose metabolism in men with T2DM. Diabetes Care. 2014;37(8):2098–107.

[9]. Saad F, Haider A, Doros G, Traish A. Testosterone therapy in hypogonadal men with T2DM. Obesity. 2013;21(10):1975–81.

[10]. Araujo AB, Esche GR, Kupelian V, et al. Prevalence of symptomatic androgen deficiency in men. J Clin Endocrinol Metab. 2007;92(11):4241–7.