Section: General Surgery

Original Research Article

ASSOCIATION OF TRIGLYCERIDE GLUCOSE INDEX WITH ERECTILE DYSFUNCTION IN SUBJECTS WITHOUT CARDIOVASCULAR DISEASE

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ABSTRACT

Background: Erectile dysfunction (ED) is a prevalent condition with significant implications for men's health and quality of life. Insulin resistance (IR) has been identified as a key metabolic factor in ED pathogenesis. The triglyceride-glucose (TyG) index, a simple surrogate marker for IR, has gained attention for its role in predicting metabolic disorders. This study aims to evaluate the association between the TyG index and ED severity in patients without cardiovascular disease.

Material and Methods: A prospective observational study was conducted at a tertiary care center in Saurashtra region, Gujarat from January 2023 to December 2023, including 120 male participants (106 with ED and 54 controls). Clinical and biochemical parameters were recorded, and the TyG index was calculated. Logistic regression analysis assessed predictors of ED severity, while ROC curve analysis determined the TyG index cut-off for ED prediction.

Results: Patients with ED had significantly higher TyG index values compared to controls (p = 0.003). Logistic regression showed that age, total cholesterol, LDL-C, and the TyG index were significant predictors of ED (p < 0.001). ROC curve analysis identified a TyG index cut-off of 9.13, with 70.8% sensitivity and 65.2% specificity for predicting ED severity.

Conclusion: The TyG index is significantly associated with ED severity, reinforcing its potential role as a metabolic marker in ED assessment. Incorporating the TyG index into routine clinical evaluation may aid in early identification and management of ED, particularly in patients without cardiovascular disease.

Keywords: Cardiovascular Disease, Insulin Resistance, Triglyceride Glucose Index, Erectile Dysfunction.

INTRODUCTION

Erectile dysfunction (ED) is a common sexual disorder affecting millions of men worldwide, with a significant impact on quality of life and psychological well-being. It is defined as the persistent inability to achieve or maintain an erection sufficient for satisfactory sexual performance.[1] The pathophysiology of ED is complex and multifactorial, involving vascular, neurogenic, hormonal, and psychological components. Among these, endothelial dysfunction, a key determinant of vascular health, plays a significant role in the development of ED.[2] In particular, insulin resistance (IR) has emerged as a critical metabolic factor contributing to endothelial dysfunction, leading to impaired nitric oxide production and reduced penile blood flow.[3]

The triglyceride-glucose (TyG) index, a novel and simple surrogate marker of insulin resistance, has gained attention in recent years for its potential role in predicting metabolic and cardiovascular

disorders. Calculated using fasting triglyceride and glucose levels, the TyG index has been shown to correlate well with traditional measures of insulin resistance, such as the homeostasis model assessment of insulin resistance (HOMA-IR).[4] Elevated TyG index levels have been linked to an increased risk of metabolic syndrome, type 2 diabetes, and cardiovascular diseases.[5] Given the well-established association between metabolic disorders and ED, the potential link between the TyG index and ED warrants further investigation.

Recent studies suggest that higher TyG index values may be associated with an increased prevalence and severity of ED. A study by Oflar et al,[2] found that men with ED exhibited significantly higher TyG index values compared to healthy controls, indicating a possible role of insulin resistance in the pathogenesis of ED. Additionally, another study reported a negative correlation between International Index of Erectile Function-5 (IIEF-5) scores and TyG index values, reinforcing the hypothesis that metabolic dysregulation contributes to ED severity.[3] Given that traditional cardiovascular risk factors such as hypertension, obesity, and dyslipidemia often coexist with ED, assessing the TyG index as a predictive marker for ED may aid in early diagnosis and intervention.[4]

Despite these findings, the relationship between the TyG index and ED remains an area of ongoing research, particularly in men without diagnosed cardiovascular disease. Understanding this association could provide valuable insights into the metabolic underpinnings of ED and facilitate the development of targeted therapeutic approaches. Therefore, this study aims to investigate the role of the TyG index in patients with ED, exploring its potential as a diagnostic and prognostic marker for erectile dysfunction.

MATERIALS AND METHODS

Study Design and Setting

This study was designed as a prospective, observational study conducted at a tertiary care center in Saurashtra region, Gujarat. The study was conducted over a period of 12 months, from January 2023 to December 2023.

Sample Size and Selection Criteria

A total of 120 male patients aged 30–65 years presenting with complaints of erectile dysfunction (ED) were included in the study. The diagnosis of ED was confirmed using the International Index of Erectile Function-5 (IIEF-5) questionnaire. Patients were categorized based on their IIEF-5 scores as having mild, moderate, or severe ED.

Inclusion Criteria

- Males aged 30–65 years.
- Patients diagnosed with ED based on IIEF-5 scoring.
- Patients who provided informed consent for participation in the study.

Exclusion Criteria

- Patients with known cardiovascular disease, diabetes mellitus, or hypertension.
- Patients on medications known to affect erectile function (e.g., phosphodiesterase-5 inhibitors, antihypertensives, antidepressants).
- Patients with a history of pelvic surgery or trauma.
- Individuals with psychiatric disorders affecting sexual function.

Data Collection and Study Variables

Demographic data, including age, body mass index (BMI), and medical history, were recorded for all participants. Fasting blood samples were collected to measure triglyceride (TG) and fasting plasma glucose (FPG) levels.

The participants were divided into groups based on their TyG index values, and the association between the TyG index and ED severity was assessed.

Statistical Analysis

Data was analyzed using SPSS (version 25.0). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Pearson's correlation coefficient was used to assess the relationship between the TyG index and IIEF-5 scores. A **p-value < 0.05** was considered statistically significant. Receiver operating characteristic (ROC) curve analysis was performed to determine the optimal TyG index cut-off value for predicting ED severity.

Ethical Considerations

Ethical approval was obtained from the institutional ethics committee before the commencement of the study. Informed consent was obtained from all participants, and confidentiality of patient data was strictly maintained.

RESULTS

Table 1 presents the clinical and demographic characteristics of the study and control groups. The study group (n=106) consisted of patients with erectile dysfunction (IIEF-5 score ≤21), while the control group (n=54) included individuals with normal erectile function (IIEF-5 score ≥22). The study group had a significantly higher mean age compared to the control group ($p < 0.001$). Total cholesterol, LDL-C, triglyceride levels, fasting glucose, and the TyG index were significantly higher in the study group ($p < 0.05$), suggesting a potential link between metabolic dysfunction and erectile dysfunction. Other parameters such as hemoglobin, leukocyte count, platelet count, and creatinine levels showed no statistically significant difference between the groups ($p > 0.05$). These findings indicate that individuals with ED tend to have poorer metabolic profiles, particularly in terms of lipid and glucose metabolism, compared to those without ED.

Table 2 presents the results of the univariate logistic regression analysis for predicting mild-to-moderate, moderate, and severe erectile dysfunction. Age, total cholesterol, LDL-C, and the TyG index were found to be significant predictors of erectile dysfunction ($p < 0.001$). The odds ratio (OR) for age was 1.152 (95% CI: 1.089-1.220), indicating that for each one-year increase in age, the likelihood of ED increased by approximately 15.2%. Similarly, higher total cholesterol (OR: 1.030, 95% CI: 1.015-1.046) and LDL-C levels (OR: 1.048, 95% CI: 1.019-1.078) were associated with an increased risk of ED. Notably, the TyG index exhibited a strong association with ED (OR: 1.910, 95% CI: 1.025-3.360), suggesting that higher insulin resistance, as indicated by an elevated TyG index, significantly increases the likelihood of ED. These findings support the hypothesis that metabolic dysregulation plays a crucial role in the pathophysiology of erectile dysfunction.

Figure 1 presents the Receiver Operating Characteristic (ROC) curve analysis of the Triglyceride-Glucose (TyG) index for predicting mild-to-moderate, moderate, and severe erectile dysfunction (ED). The curve illustrates the trade-off between the true positive rate (sensitivity) and the false positive rate (1-specificity) across different cut-off values of the TyG index. The area under the curve (AUC) value indicates the discriminative ability of the TyG index in identifying ED cases. A higher AUC suggests a stronger predictive power, with an AUC close to 1.0 representing excellent discrimination. The diagonal reference line (dashed) represents a model with no predictive ability (AUC = 0.5). This analysis highlights the potential clinical utility of the TyG index as a metabolic marker for early identification and risk stratification of ED in patients.

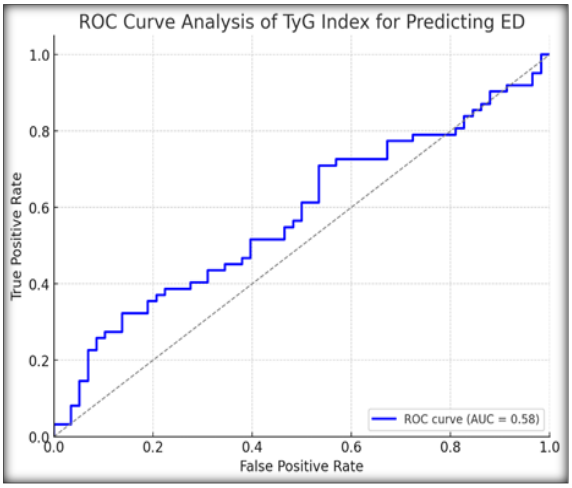

Figure 1: ROC curve analysis of TyG index for predicting mild-moderate, moderate and severe ED

Table 1: Clinical and demographic characteristics of the study and control groups

Variable	Study Group (n=106)	Control Group (n=54)	P value
Age (years)	47.12±7.10 47 (42-52)	41.05±6.20 40 (36-45)	<0.001 *
Smoking (n, %)	40 (37.7%)	26 (48.1%)	0.398
Alcohol (n, %)	22 (20.7%)	18 (33.3%)	0.215
Total cholesterol (mg/dL)	210.45±89.35 208 (180-236)	175.20±37.10 165 (150-200)	<0.001 *
HDL-C (mg/dL)	48.10±18.95 45 (39-50)	51.00±22.80 43 (38-55)	0.912
LDL-C (mg/dL)	132.28±36.15 130 (104-155)	104.35±34.50 98 (82-120)	<0.001 *
Triglyceride (mg/dL)	165.74±85.90 145 (100-202)	140.50±78.25 102 (80-190)	0.023 *
Glucose (mg/dL)	110.52±11.85 112 (105-118)	104.50±6.05 104 (100-106)	0.041 *
Hemoglobin (g/dL)	14.85±1.30 15 (14-16)	14.50±2.15 15.2 (12.5-16.3)	0.96
Leukocyte count (10â• ¹/L)	10.12±4.75 8.7 (6.2-14.5)	8.35±3.60 9.1 (4.2-11.2)	0.238
Platelet count (10â• ¹/L)	250.33±70.40 238 (200-295)	235.60±72.00 242 (211-277)	0.965
Creatinine (mg/dL)	1.14±0.38 1.01 (0.73-1.00)	1.03±0.49 1.01 (0.81-1.02)	0.752
TyG index	8.98±0.55 9.02 (8.57-9.32)	8.54±0.52 8.60 (8.27-9.18)	0.002 *

Table 2: Univariate logistic regression for prediction of mild-to- moderate, moderate and severe disease

Variable	P value	OR	95% CI
Age	<0.001 *	1.152	1.089-1.220
Total cholesterol	<0.001 *	1.03	1.015-1.046
LDL-C	<0.001 *	1.048	1.019-1.078
TyG index	<0.001 *	1.91	1.025-3.360

DISCUSSIONS

Erectile dysfunction (ED) is a multifaceted condition often intertwined with metabolic disturbances, notably insulin resistance (IR). The Triglyceride-Glucose (TyG) index, derived from fasting triglyceride and glucose levels, has emerged as a reliable surrogate marker for IR and has been linked to various metabolic and cardiovascular disorders.[6] Our study corroborates existing literature by demonstrating a significant association between elevated TyG index values and the presence and severity of ED.

The univariate logistic regression analysis in our study revealed that age, total cholesterol, LDL-C, and the TyG index are significant predictors of ED severity. Specifically, the odds ratio (OR) for the TyG index was 1.910 (95% CI: 1.025-3.360, $p < 0.001$), indicating that higher TyG index values substantially increase the likelihood of experiencing more severe forms of ED. This finding aligns with previous research highlighting the role of metabolic factors in ED pathogenesis.[7]

Our ROC curve analysis identified a TyG index cut-off value of 9.13, which predicted mild-to-moderate, moderate, and severe ED with 70.8% sensitivity and 65.2% specificity. This cut-off is consistent with prior studies that have proposed similar thresholds for the TyG index in predicting ED risk.[8] For instance, a study by Yilmaz et al. found that a TyG index cut-off value of 8.88 was associated with ED, with a sensitivity of 67% and specificity of 68.6%.[9]

The relationship between the TyG index and ED underscores the importance of metabolic health in sexual function. Insulin resistance contributes to endothelial dysfunction, a key factor in the development of ED.[10] Elevated TyG index values reflect underlying metabolic disturbances that may impair endothelial function, leading to compromised penile blood flow and, consequently, erectile dysfunction.[11]

Moreover, the TyG index's utility extends beyond ED prediction; it has been associated with various cardiovascular risk factors and conditions. Studies have demonstrated that higher TyG index values are linked to an increased risk of atherosclerosis and cardiovascular events.[12] Given the shared pathophysiological mechanisms between ED and cardiovascular diseases, the TyG index serves as a valuable marker for identifying individuals at heightened risk for both conditions.[13]

In clinical practice, the TyG index offers a simple, cost-effective tool for assessing insulin resistance and associated risks. Its calculation requires only routine measurements of fasting triglycerides and glucose, making it easily implementable in various healthcare settings.[14] Incorporating the TyG index into the evaluation of patients with ED could facilitate early identification of metabolic abnormalities, enabling timely interventions to mitigate cardiovascular risk and improve sexual health outcomes.

However, our study has limitations that warrant consideration. The cross-sectional design precludes establishing causality between elevated TyG index values and ED. Longitudinal studies are necessary to elucidate the temporal relationship and potential causative links.[15] Additionally, our study population was limited to a specific geographic region, which may affect the generalizability of the findings. Future research should encompass diverse populations to validate the TyG index's predictive value across different demographic groups.[16]

CONCLUSION

Our study reinforces the association between the TyG index and erectile dysfunction, highlighting its potential as a predictive marker for ED severity. The findings advocate for the integration of the TyG index into routine clinical assessments to identify individuals at risk for ED and related metabolic disorders, ultimately guiding targeted therapeutic strategies.

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