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The Significance of the Triglyceride-to-High-Density Lipoprotein Cholesterol Ratio in the Assessment of Cardiovascular Risk

Introduction. The Systematic Coronary Risk Evaluation 2 (SCORE2) is currently a widely recognised tool for assessing cardiovascular risk (CVR) in patients aged 40-69 years and is recommended in most European clinical guidelines [10].

However, in countries with the highest population risk, including Ukraine, its practical application is limited by the phenomenon of excessive risk stratification. In real-world clinical practice, a substantial proportion of men older than 45 years and women older than 50 years who smoke are automatically classified as being at very high risk (> 10.0 %), which significantly reduces the discriminative capacity of SCORE2.

In addition, SCORE2 does not always allow timely identification of patients with latent metabolic disorders, particularly insulin resistance or dyslipidemia with normal total cholesterol levels [1].

In recent years, the triglyceride (TG) -to-high-density lipoprotein cholesterol (HDL-C) ratio (TG/HDL-C) has been considered not merely as an auxiliary laboratory parameter but as an integral marker of lipid and carbohydrate metabolism disorders directly involved in atherogenesis [3].

An important aspect is the correlation of the TG/HDL-C ratio with visceral adipose tissue volume, the degree of hepatic steatosis, and insulin resistance. In this context, the parameter may be regarded as an accessible indicator for the early identification of non-alcoholic fatty liver disease [4], as its elevation often precedes carbohydrate metabolism abnormalities and is linked to endothelial dysfunction [9].

A synthesis of available studies supports further investigation of the TG/HDL-C ratio in CVR assessment as a complementary component to established models, including the SCORE2, particularly in individuals with an adverse metabolic profile.

The aim of the study. To determine the clinical relevance of the TG/HDL-C ratio in CVR assessment by analysing its associations with clinical and laboratory parameters used to assess cardiovascular and metabolic status.

Materials and methods. The results of clinical and laboratory examinations of 152 patients with arterial hypertension aged 40-69 years (mean age 56 ± 2.3 years), including 100 men and 52 women, were analysed. The patients underwent examination and treatment at the outpatient department of the University Clinic of Odesa National Medical University in 2024.

All participants were assessed for CVR using the SCORE2. All parameters comprising the integral CVR SCORE2 percentage were calculated separately, and only the resulting values were entered into the Excel table. Additionally, the following parameters were evaluated and recorded: body mass index (BMI), waist circumference, fasting blood glucose, creatinine, alanine aminotransferase (ALT) and aspartate aminotransferase (AST) activities, and the TG/HDL-C ratio.

We additionally carried out an independent evaluation of the participants' oncological history. Prior to performing correlation analyses, the distribution characteristics of each variable were assessed. Since the majority of continuous variables deviated from normality, as demonstrated by the Shapiro-Wilk test ($p < 0.05$), Spearman's rank correlation coefficient was applied to determine associations. The main analytical strategy consisted of examining the relationship between the TG/HDL-C ratio and all variables listed earlier.

Results and discussion. The results demonstrated that among participants classified into high and very high SCORE2 risk categories, an increased TG/HDL-C ratio was significantly associated with waist circumference ($\rho = 0.43$; $p = 0.01$) and fasting glucose levels ($\rho = 0.31$; $p = 0.04$). These findings are in agreement with data reported in both older [6] and younger cohorts [7], thus supporting previously identified trends. Conversely, no statistically significant relationships were observed

between the TG/HDL-C ratio and ALT (ρ = 0.132; $p = 0.1$) or AST (ρ = 0.06; $p = 0.45$) levels in this sample.

A weak but statistically significant association was identified with BMI (ρ = 0.2; $p = 0.015$). This may indicate that the TG/HDL-C ratio is more closely related to abdominal adiposity, which is more accurately captured by waist circumference than by BMI. Moreover, no meaningful correlations were found between the TG/HDL-C ratio and either a history of malignancy or serum creatinine levels within the studied cohort. Owing to the relatively limited number of participants in the relevant subgroup, it was not possible to confidently distinguish a separate group characterized by an extremely elevated ratio (> 3.0).

Recent evidence suggests that a TG/HDL-C ratio exceeding 2.0 is linked to a higher incidence of cardiovascular events, poorer outcomes following revascularization, and an increased likelihood of heart failure [5, 11]. Prospective studies indicate that in middle-aged women, this ratio, which reflects the atherogenic properties of lipoproteins, serves as a more reliable predictor of cardiovascular risk than total cholesterol [8].

Additionally, the ratio has been associated with chronic kidney disease progression and declining glomerular function [2].

Its independent prognostic value for total and cardiovascular mortality [6] further supports its role as a useful adjunct for risk stratification alongside established predictive models.

Conclusions. In subjects with high or very high risk according to the Systematic Coronary Risk Evaluation 2, the triglyceride to high-density lipoprotein cholesterol ratio is strongly correlated with waist circumference and glycemic levels. This metabolic marker reflects subclinical metabolic disturbances and impaired metabolic flexibility, enhances the predictive value of the Systematic Coronary Risk Evaluation 2, and is suitable for clinical application in high-risk populations.

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The Significance of the Triglyceride-to-High-Density Lipoprotein Cholesterol Ratio in the Assessment of Cardiovascular Risk

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Introduction. Despite the leading role of cardiovascular diseases in mortality, the use of the Systematic Coronary Risk Evaluation 2 (SCORE2) scale does not always allow timely identification of latent metabolic changes, highlighting the need to improve risk stratification approaches.

The aim of the study. To evaluate the value of the triglyceride-to-high-density lipoprotein cholesterol ratio in assessing cardiovascular risk and to determine its correlation with traditional clinical and laboratory parameters.

Materials and methods. A total of 152 patients aged 40-69 years (100 men, 52 women) were examined. Cardiovascular risk (CVR) was assessed using the SCORE2 scale. Additionally, body mass index (BMI), waist circumference, fasting blood glucose, creatinine, alanine aminotransferase (ALT) and aspartate aminotransferase (AST) activities, and the triglyceride-to-high-density lipoprotein cholesterol (TG/HDL-C) ratio were determined. Associations between the TG/HDL-C ratio and other investigated parameters were analysed using Spearman's rank correlation coefficient.

Results. In patients with high and very high CVR, an elevated TG/HDL-C ratio was significantly correlated with waist circumference ($\rho = 0.43$; $p = 0.01$) and fasting glucose ($\rho = 0.31$; $p = 0.04$). A weak but statistically significant correlation was observed with BMI ($\rho = 0.2$; $p = 0.015$). No associations were found with creatinine, ALT, or AST.

Conclusions. The triglyceride-to-high-density lipoprotein cholesterol ratio reflects the presence of subclinical metabolic disturbances and may complement the Systematic Coronary Risk Evaluation 2 scale in cardiovascular risk stratification, particularly in patients with an unfavourable metabolic profile.

Keywords: cardiovascular risk, SCORE2 scale, TG/HDL-C ratio, metabolic disturbances.

Значення критерію співвідношення тригліцеридів до ліпопротеїнів високої щільності в оцінюванні серцево-судинного ризику

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Вступ. Серцево-судинні захворювання є основною причиною смертности, що потребує вдосконалення методів оцінювання ризику. Шкала Systematic Coronary Risk Evaluation 2 (SCORE2) не завжди уможливлює виявити приховані метаболічні порушення, що вимагає уточнення за рахунок додаткових інформативних показників.

Мета. З'ясувати клінічне значення співвідношення тригліцеридів до ліпопротеїнів високої щільности як додаткового критерію оцінювання серцево-судинного ризику, дослідити його кореляцію з традиційними клінічними й лабораторними показниками у пацієнтів із артерійною гіпертензією.

Матеріяли й методи. Проаналізовано результати клінічно-лабораторного обстеження 152 пацієнтів (100 чоловіків і 52 жінки) віком 40–69 років (середній вік 56 ± 2,3 року). Усі пацієнти проходили обстеження і лікування в поліклінічному відділі Університетської клініки Одеського національного медичного університету впродовж 2024 р.

Показник серцево-судинного ризику (ССР) визначали за шкалою SCORE2. Додатково оцінювали індекс маси тіла, обвід талії, вміст глюкози в крови натще, креатинін, активність аланінамінотрансферази (АлТ), аспартатамінотрансферази (АсТ), а також визначали співвідношення тригліцеридів до ліпопротеїнів високої щільности (ТГ/ЛПВЩ). Перш ніж провести кореляційній аналіз, оцінювали характер розподілу даних; із огляду на відхилення від нормального розподілу застосовували коефіцієнт рангової кореляції Ч. Е. Спірмена.

Результати. У пацієнтів із високими й дуже високими показниками SCORE2 констатовано достовірний позитивний кореляційний зв'язок між показником ТГ/ЛПВЩ і обводом талії ($\rho = 0{,}43$; $p = 0{,}01$), а також між ТГ/ЛПВЩ і вмістом глюкози натще ($\rho = 0{,}31$; $p = 0{,}04$). Виявлено слабку, проте статистично значущу кореляцію з індексом маси тіла ($\rho = 0{,}2$; $p = 0{,}015$), що свідчить про тісніший зв'язок показника з абдомінальним ожирінням, ніж зі загальною масою тіла. Кореляція між ТГ/ЛПВЩ і активністю АлТ ($\rho = 0{,}132$; $p = 0{,}1$) і АсТ ($\rho = 0{,}06$; $p = 0{,}45$) була недостовірною. Не виявлено взаємозв'язку з показником креатиніну й онкологічним анамнезом.

Висновки. Співвідношення тригліцеридів до ліпопротеїнів високої щільности є інформативним маркером прихованих метаболічних порушень. Його використання може підвищити інформативність стратифікації серцево-судинного ризику за шкалою SCORE2 та сприяти точнішій ідентифікації пацієнтів із метаболічно несприятливим профілем, особливо в групах високого й дуже високого ризику.

Ключові слова: серцево-судинний ризик, шкала SCORE2, співвідношення ТГ/ЛПВЩ, метаболічні порушення.

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