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CARDIOVASCULAR RISK IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND ELEVATED BLOOD PRESSURE AND ARTERIAL HYPERTENSION

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Abstract

Introduction. Cardiovascular disease mortality accounts for 20-30% of total mortality in patients with chronic obstructive pulmonary disease (COPD), highlighting the critical need for cardiovascular risk assessment in this population.
Aim. To analyze current scientific publications and determine the characteristics of cardiovascular risk and the methods for its assessment to define the prognosis in patients with chronic obstructive pulmonary disease and elevated blood pressure or arterial hypertension.
Materials and methods. A literature search was conducted across the PubMed/MEDLINE, Web of Science, Scopus, and Google Scholar databases. All identified publications were evaluated by the authors according to generally accepted criteria.
Results. Research analysis indicates that chronic obstructive pulmonary disease significantly influences cardiovascular risk indicators, markedly increasing them within the first 1-30 days following an exacerbation. The article examines the prognostic value of modern cardiovascular risk assessment scales, including SCORE2, SCORE2-OP (for older persons), the Life's Essential 8 (LE8) score, and the Predicting Risk of Cardiovascular Disease EVENTs (PREVENT™) scale. While existing scales and their corresponding online calculators are primarily recommended for use in cases of elevated blood pressure and arterial hypertension, they have specific limitations when applied to patients with COPD. Other risk factors, such as galectin-3, C-reactive protein, fibrinogen, and others, also warrant attention and further research in the context of these comorbid conditions.
Conclusions. The results of this study demonstrate that chronic obstructive pulmonary disease is not merely a comorbid condition but a powerful and independent amplifier of cardiovascular risk in patients with arterial hypertension. Modern cardiovascular risk assessment scales are primarily recommended for patients with elevated blood pressure and arterial hypertension; however, there is a lack of research and guidelines justifying the use of these scales for prognostic purposes in patients with concomitant chronic obstructive pulmonary disease.

Keywords: **chronic obstructive pulmonary disease, elevated blood pressure, arterial hypertension, cardiovascular risk**

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) and arterial hypertension (AH) are recognized as major global public health problems that significantly contribute to morbidity and mortality worldwide [1].

According to expert estimates, the number of COPD cases globally among individuals aged 25 years and older is expected to increase by 23% between 2020 and 2050, approaching nearly 600 million patients by 2050 [2].

Morbidity and mortality of COPD are substantially higher among smokers, men, and individuals over 40 years of age and are projected to rise further due to population aging and the spread of smoking in low- and middle-income countries [3]. At the same time, systemic arterial hypertension remains the most important

modifiable risk factor for cardiovascular disease (CVD), accounting for approximately 54% of strokes and 47% of ischemic heart disease cases [4].

Patients with COPD have more than twice the rate of hospitalization and cardiovascular mortality compared with individuals without COPD [5, 6].

COPD is closely associated with cardiovascular diseases, including arterial hypertension, ischemic heart disease, stroke, and atrial fibrillation [7-9].

Rodríguez Hermosa J. L. et al. (2025) [8] conducted a retrospective cohort study of 167 patients with newly diagnosed COPD in primary care centers in Madrid, Spain. Cluster analysis identified three distinct clinical phenotypes: «Low-symptom preserved status,» «Frequent attenders/high-risk patients,» and «Silent treatment discontinuers.» The authors concluded that improving early diagnosis in primary care requires a proactive, stratified, and personalized approach rather than a universal strategy [8].

Current international guidelines, such as those issued by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) [3], and the European Society of Cardiology (ESC), often consider these conditions separately and do not sufficiently address integrated diagnostic, therapeutic, and risk stratification approaches [5, 6]. This represents a significant barrier to the comprehensive management of patients with comorbid conditions and underscores the need for further research aimed at improving diagnosis, treatment, and prevention of cardiovascular risk in patients with COPD and elevated blood pressure (EBP).

AIM

To analyze contemporary scientific publications and identify the characteristics of cardiovascular risk and methods of its assessment in patients with chronic obstructive pulmonary disease and elevated blood pressure and arterial hypertension.

MATERIALS AND METHODS

A literature search was conducted using open-access databases PubMed/MEDLINE and Google Scholar. The review included original research articles, systematic reviews, meta-analyses, and international clinical guidelines published up to September 1, 2025, using the following keywords: chronic obstructive pulmonary disease, elevated blood pressure, arterial hypertension, cardiovascular risk. The search was limited to publications in English and Ukrainian. Low-quality studies were excluded based on generally accepted criteria, including small sample size, isolated clinical cases, and lack of statistically validated results compared with control or placebo groups etc. All selected publications were independently reviewed by all authors, and data were included after consensus was reached.

RESULTS

Arterial hypertension is one of the most common comorbidities in patients with COPD, with reported prevalence ranging from 28% to over 50%, depending on the population studied and diagnostic criteria [4]. This comorbidity is not coincidental. The prevalence of COPD among patients with heart failure ranges from 13% to 39%, while atrial fibrillation occurs in 10-20% of COPD patients and may reach up to 30% in severe cases [7]. Overall, up to 60% of patients with COPD have at least one concomitant cardiovascular disease, highlighting the importance of this cross-burden in clinical practice [5, 7, 8, 9, 10, 11].

Rao S. et al. (2023) [9] conducted a cohort study of 39,602 individuals aged 55-90 years with a diagnosis of COPD, identified using validated electronic medical records in the United Kingdom, between 1990 and 2009. The association between systolic blood pressure (SBP) and the risk of cardiovascular endpoints was found to be monotonic; the group with the lowest SBP (< 120 mmHg) showed the lowest risk. Compared with the reference SBP (120-129 mmHg), the adjusted hazard ratios for the primary outcome were 0.99 (95% CI, 0.93-1.05) for SBP < 120 mmHg, 1.02 (95% CI, 0.97-1.07) for SBP 130-139 mmHg, 1.07 (95% CI, 1.01-1.12) for SBP 140-149 mmHg, 1.11 (95% CI, 1.05-1.17) for SBP 150-159 mmHg, and 1.16 (95% CI, 1.10-1.22) for SBP ≥ 160 mmHg [9].

On the other hand, Tajeu G. S. et al., 2017 [11], evaluated the proportion of incident cardiovascular disease (CVD) events occurring at SBP/DBP < 140/90 mmHg in a pooled analysis of three contemporary cohort studies in the United States: REGARDS (Reasons for Geographic and Racial Differences in Stroke), MESA (Multi-Ethnic Study of Atherosclerosis), and JHS (Jackson Heart Study) (n = 31,856; REGARDS = 21,208; MESA = 6,779; JHS = 3,869) [11]. The authors found that most events occurred among participants with systolic/diastolic blood pressure < 140/90 mmHg, both in those aged < 65 years (66.7%; 95% CI, 60.5-73.0) and ≥ 65 years (60.3%; 95% CI, 51.0-69.5) [11].

The coexistence of both COPD and CVD significantly worsens the course of each disease and leads to a poorer clinical prognosis. Specifically, Vogelmeier C. F. et al., 2025 [12], in an 8-year retrospective observational cohort study of a database including 250,000 patients with COPD in Germany, found that patients with COPD died on average 2.3 years earlier (at 75.7 years) compared to the control group without COPD (78.0 years) and had a higher number of comorbidities (mean 4.53 vs. 3.65) [12]. The study also revealed that in patients with COPD, the risk of heart

failure was 42% higher (HR 1.42; 95% CI, 1.38-1.47), the risk of ischemic heart disease was 30% higher (HR 1.30; 95% CI, 1.25-1.35), and the risk of atrial fibrillation was 27% higher (HR 1.27; 95% CI, 1.21-1.32) [12]. Mortality related to both respiratory and cardiovascular diseases was more likely in patients with COPD than in the corresponding control group (3.3% and 1.6% higher after eight years, respectively), and this figure was substantially greater (9.8% and 3.4%, respectively) in the subgroup of COPD patients with multiple/severe exacerbations, indicating that cumulative mortality increased with the severity of COPD [12].

Studies have shown that even a slight decline in lung function is a strong predictor of mortality risk: each 10% reduction in forced expiratory volume in one second (FEV_1) increases cardiovascular mortality by 28% [13]. Overall, CVD accounts for 20-30% of total mortality in patients with COPD, and these patients die from cardiac causes as frequently as from respiratory causes [5]. Specifically, mortality from COPD with secondary pulmonary hypertension increased significantly between 2003 and 2020, indicating a growing burden associated with this comorbidity [14].

These data convincingly demonstrate that COPD is not merely a comorbid condition but a powerful and independent amplifier of cardiovascular risk [15].

Chronic inflammation is considered a key link in the pathogenesis connecting COPD and CVD. Although inflammation primarily affects the pulmonary parenchyma, it leads to the release of pro-inflammatory cytokines and mediators, such as interleukin-6, tumor necrosis factor-alpha, and C-reactive protein (C-RP), into the systemic circulation [16]. These systemic inflammatory markers can directly contribute to the formation and progression of atherosclerotic plaques [16]. Specifically, elevated interleukin-6 levels are a potent stimulator of hepatic C-RP synthesis, and high concentrations of high-sensitivity C-RP (e.g., > 3 mg/L) are recognized indicators of increased cardiovascular risk [17]. While elevated IL-6 levels have been associated with higher mortality risk in patients with CVD, this marker does not show a direct association with arterial hypertension [18, 19].

Endothelial dysfunction (ED) is considered an early and key stage in atherogenesis and the pathogenesis of CVD [20]. ED is characterized by damage to the vascular wall and impaired vasodilatory capacity, which in turn promotes inflammation and thrombosis. Several factors have been identified that contribute to ED in COPD:

• Chronic inflammation. Elevated levels of pro-inflammatory mediators, such as interleukin-6, tumor necrosis factor-alpha, and C-RP, disrupt the expression of intercellular adhesion molecules, facilitating leukocyte migration across the endothelium and amplifying the inflammatory process [20].

• Oxidative stress. Elevated levels of reactive oxygen species lead to endothelial cell damage and a reduction in the bioavailability of nitric oxide (NO), a key vasodilator [20].

• Hypoxia. Chronic oxygen deficiency, characteristic of COPD, enhances the production of free radicals, contributes to endothelial dysfunction, and increases vascular resistance, which is one of the mechanisms leading to hypertension and its complications [21].

Several studies [22, 23, 24] indicate a significant increase in the risk of major cardiovascular events following COPD exacerbations.

It has been established that the cardiovascular risk is highest during the first 1-30 days after an exacerbation. Specifically, a meta-analysis by Pirera E. et al., 2025 [24] showed that the greatest risk occurs within 1-30 days post-exacerbation. This elevated risk declined over time but remained persistently higher for acute coronary syndrome (ACS) even one year after the acute exacerbation [24].

The EXACOS-CV study in Japan [25] found that the risk of acute coronary syndrome or arrhythmias remained significantly elevated for up to 180 days, while the risk of decompensated heart failure (HF) persisted for up to one year.

The EXACOS-CV study in Spain [26] demonstrated that the risk of severe cardiovascular events increased following moderate to severe COPD exacerbations compared with periods without exacerbations, with the highest rates observed during the first 1-7 days after the onset of exacerbation (HR, 10.10; 95% CI, 9.29-10.97) and remaining elevated for more than 365 days after exacerbation onset (HR, 1.65; 95% CI, 1.49-1.82).

Researchers consider the period immediately following an exacerbation to represent a critical window for clinical intervention and treatment optimization to prevent future cardiovascular events [24, 27, 28].

Guidelines from the European Society of Cardiology (ESC), such as the 2024 ESC Guidelines for the management of elevated blood pressure and hypertension [21, 28, 29], focus on reducing cardiovascular risk and adopting a personalized treatment approach. Emphasis is placed on comprehensive risk factor management rather than solely on blood pressure control.

ESC experts have recommended the use of cardiovascular risk assessment tools – SCORE2 (Systematic COronary Risk Evaluation 2) and, for older adults, SCORE2-OP (old person). Online calculators for SCORE2 and SCORE2-OP allow rapid estimation of cardiovascular event risk in individuals of any age across different geographic regions [21, 30].

Another tool is the updated and improved American Heart Association (AHA) scale, which uses eight key life principles (Life's Essential 8 – LE8). It allows assessment not only of cardiovascular risk but also the effectiveness of both pharmacological and non-pharmacological interventions [31].

In the study by Lloyd-Jones D. M. et al., 2022 [31], which included 19,774 participants representing a U.S. population of 145.2 million individuals aged over 20 years, the overall prevalence of COPD was found to be 4.5%. The authors reported that the LE8 score was inversely associated with COPD (adjusted odds ratio = 0.169; 95% CI: 0.115-0.249).

The overall LE8 score was inversely correlated with spirometric indicators of COPD and with nicotine exposure. The researchers noted that smoking cessation plays a crucial role in maintaining optimal cardiovascular health and reducing the burden of COPD [32, 33].

A higher total score on the LE8 scale was inversely associated not only with the prevalence of COPD but also with all-cause mortality in patients with COPD [32, 34, 35].

Khan S. S. et al., 2023 [36] published an enhanced American Heart Association risk prediction tool (PREVENT) for cardiovascular events among U.S. adults aged 30-79 years without known cardiovascular disease. The sample included data from the medical records of 3,281,919 U.S. residents and captured the occurrence of atherosclerotic cardiovascular disease or heart failure among participants between 1992 and 2017. Predictors included traditional risk factors (smoking, systolic blood pressure, cholesterol levels, use of antihypertensive drugs or statins, and diabetes) as well as estimated glomerular filtration rate. Models were sex-specific, race-neutral, age-stratified, and adjusted for the competing risk of non-cardiovascular death. Over a mean follow-up of (4.8 ± 3.1) years, 211,515 cardiovascular events were recorded. This risk model demonstrated good prognostic value in the general population as well as in demographic and cardio-renal-metabolic subgroups (e.g., obesity, diabetes, and chronic kidney disease) [36].

Thus, existing cardiovascular risk (CVR) assessment tools have certain limitations, particularly in the presence of comorbidities, highlighting the need for further refinement and consideration of additional risk factors for the development of cardiovascular disease and its complications [36, 37]. One such marker is serum galectin-3 (Gal-3) [38]. Zhao X. et al. (2024), in a meta-analysis including twelve case-control studies, found significantly higher serum Gal-3 levels in patients with COPD compared to controls without COPD ($P < 0.001$) [38]. The meta-analysis also demonstrated higher serum Gal-3 levels in patients experiencing COPD exacerbations compared to those with stable COPD ($P < 0.001$). Participant age and sex did not significantly affect the results (P for subgroup differences > 0.05) [38].

Among other biomarkers for risk stratification, high-sensitivity cardiac troponin T (hs-cTnT) has been highlighted. This biomarker reflects myocardial injury and shows a stronger correlation with cardiopulmonary function indicators – such as forced expiratory volume in one second (FEV_1) and 6-minute walk distance – compared to other markers, including galectin-3 (Gal-3) [37, 39]. It is considered more sensitive for assessing cardiac function and predicting cardiovascular risk, particularly in patients with COPD [37, 39]. For instance, Neukamm A. et al. (2026), in a prospective cohort study including 275 patients from the outpatient clinic of Akershus University Hospital and the Glittre Pulmonary Rehabilitation Clinic [39], evaluated COPD severity and cardiovascular risk factors, as well as recorded all-cause mortality over a mean follow-up of 2.8 years. The authors found frequent elevation of hs-cTnT levels in patients with stable COPD without overt cardiovascular disease, which was also associated with increased mortality, independent of COPD severity and other cardiovascular risk factors [39].

Studies indicate that elevated fibrinogen levels serve as a marker for future cardiovascular events. For example, MacLeod M. et al. (2023) conducted a cohort study in patients with COPD exacerbations in London from 1995 to 2022 to assess the prognostic value of plasma fibrinogen levels (≥ 3.5 g/L vs. < 3.5 g/L) for future cardiovascular risk in COPD patients [40]. The researchers found that the risk of acute cardiovascular events (myocardial infarction or stroke) was higher among those with baseline fibrinogen levels ≥ 3.5 g/L compared to < 3.5 g/L (HR 4.46; 95% CI: 1.63-12.25; $P = 0.004$) [40]. The authors concluded that fibrinogen level may serve as a useful biomarker of cardiovascular risk in COPD [40].

In another study [41], it was found that in patients with COPD, the risk of acute cardiovascular events was 4.46 times higher when plasma fibrinogen levels were ≥ 3.5 g/L. The researchers noted that plasma fibrinogen levels increased as FEV_1 decreased, demonstrating a significant inverse correlation between plasma fibrinogen and predicted FEV_1. However, no significant association was found between fibrinogen levels and mortality [41]. The authors concluded that elevated plasma fibrinogen may serve as an indicator of COPD severity and a poor prognostic factor for disease progression [41].

Another cardiovascular risk factor in patients with COPD is the N-terminal pro-brain natriuretic peptide (NT-proBNP), which is commonly used in clinical practice to assess the severity of heart failure [42]. Su X. et al. (2023), in a meta-analysis including 29 studies with

8,534 participants, found that NT-proBNP is a biomarker that exhibits significant variation at different stages of COPD [42]. Fluctuations in NT-proBNP levels may reflect the severity of pulmonary hypoxia and inflammation, as well as cardiovascular stress in patients with COPD [42]. Therefore, assessing NT-proBNP levels in COPD patients can aid in making informed clinical decisions.

Fractional exhaled nitric oxide (FeNO) is an acceptable and non-invasive marker for assessing eosinophilic airway inflammation. Keeratichananont W. et al., 2024 [43], found that patients with COPD and high FeNO levels exhibited worse clinical outcomes (exacerbations, hospitalizations, and all-cause mortality) compared to those with low FeNO levels. The authors concluded that FeNO may serve as a useful biomarker for predicting clinical outcomes in COPD patients [43]. However, the small sample size (18 patients with high FeNO versus 42 patients with low FeNO) limits definitive conclusions regarding the use of this marker for prognosis based solely on its values and highlights the need for further research.

Another cardiovascular risk marker is elevated C-reactive protein (C-RP), which has been associated with more than a twofold increased risk of mortality among individuals with a history of COPD compared to those without COPD [44].

There is a moderate amount of evidence from heterogeneous studies suggesting the value of serum C-RP and procalcitonin in differentiating bacterial from non-bacterial COPD exacerbations [45]. However, the association between bacterial COPD exacerbations and elevated levels of IL-1β, IL-6, myeloperoxidase, and neutrophil elastase in sputum remains controversial [45].

DISCUSSION

Arterial hypertension is one of the most common comorbidities in patients with COPD, with prevalence estimates ranging from 28% to over 50%, depending on the studied population and diagnostic criteria [4]. COPD significantly impacts cardiovascular risk. Specifically, cardiovascular disease accounts for 20-30% of total mortality in patients with COPD, and these patients die from cardiac causes as frequently as from respiratory causes [5].

It has been demonstrated that cardiovascular risk (CVR) increases during COPD exacerbations, with the highest risk observed within the first 1-30 days following an exacerbation [24, 25, 26].

ESC experts have recommended using CVR assessment tools – SCORE2 and, for older adults (old person – OP), SCORE2-OP – for patients with arterial hypertension or dyslipidemia [21]. Unfortunately, there is a lack of studies evaluating CVR using these scales specifically in patients with COPD.

The most extensively studied tool in patients with COPD is the LE8 scale, which allows assessment not only of cardiovascular risk (CVR) but also of adherence to both non-pharmacological and pharmacological risk-reduction strategies. The overall LE8 score was inversely correlated with spirometric indicators of COPD and with nicotine exposure. Researchers emphasize that smoking cessation plays a crucial role in maintaining optimal cardiovascular health and reducing the burden of COPD [32, 33]. A higher total score on the LE8 scale demonstrated an inverse correlation not only with the prevalence of COPD but also with all-cause mortality in patients with COPD [32, 34, 35].

The enhanced American Heart Association risk prediction tool for cardiovascular events (PREVENT) demonstrates good prognostic value in the general population of U.S. adults aged 30-79 years without known cardiovascular disease, as well as in patients with obesity, diabetes, and chronic kidney disease [36]. However, studies evaluating cardiovascular risk using the PREVENT scale specifically in patients with COPD are lacking.

Existing cardiovascular risk (CVR) scales and their corresponding online calculators are primarily recommended for use in patients with arterial hypertension and dyslipidemia; however, they have certain limitations in patients with COPD.

Additional risk factors commonly observed in both COPD and hypertension (e.g., Gal-3, NT-proBNP, hs-cTnT, C-RP, plasma fibrinogen, etc.) also warrant attention and further investigation in the context of these comorbid conditions.

A high cardiovascular risk (CVR) score serves as a rationale for implementing both non-pharmacological and pharmacological preventive measures [46, 47]. These preventive strategies have been primarily developed for patients with hypertension [21]. Currently, there is a lack of evidence-based recommendations for CVR prevention in patients with comorbid conditions, particularly those with dyslipidemia and COPD, highlighting the need for further research.

CONCLUSIONS

1. The results of this study demonstrate that COPD is not merely a comorbidity but a strong and independent amplifier of cardiovascular risk in patients with hypertension.

2. The currently updated cardiovascular risk assessment tools are recommended for use primarily in patients with elevated blood pressure and hypertension, but there is a lack of studies supporting the application of these tools in patients with concomitant COPD.

Prospects for future research. The results of this study highlight the need for further investigation and refinement of comprehensive cardiovascular risk (CVR)

assessment in patients with COPD and dyslipidemia or hypertension. Promising areas include research on both non-pharmacological and pharmacological prevention and management of CVR in patients with comorbid conditions, particularly those with COPD and dyslipidemia. Additional risk factors common to both COPD and hypertension (e.g., Gal-3, NT-proBNP, hs-cTnT, C-RP, plasma fibrinogen, etc.) also influence prognosis and warrant further study in this comorbid population.

COMPLIANCE WITH ETHICAL REQUIREMENTS

The article utilized publicly available publications from open databases such as PubMed/MEDLINE, articles containing original data, systematic reviews and meta-analyses, as well as published guidelines and recommendations from international medical societies, which are cited in the text. No proprietary clinical research data requiring ethical committee approval were used in preparing this article. The work was conducted in accordance with the uniform requirements developed by the International Committee of Medical Journal Editors (ICMJE). All sources are properly cited, and plagiarism or data fabrication is excluded. This work did not employ artificial intelligence for text generation, data analysis, or image creation. All content was prepared by the authors, who bear full responsibility for its accuracy, originality, and adherence to ethical standards.

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The study was funded by the authors' own resources. The authors declare no conflict of interest or financial interests that could be interpreted as influencing the results or interpretation of the manuscript. All authors have given their consent for the publication of the manuscript.

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Резюме

КАРДІОВАСКУЛЯРНИЙ РИЗИК У ПАЦІЄНТІВ З ХРОНІЧНИМ ОБСТРУКТИВНИМ ЗАХВОРЮВАННЯМ ЛЕГЕНЬ Й ПІДВИЩЕНИМ АРТЕРІАЛЬНИМ ТИСКОМ ТА АРТЕРІАЛЬНОЮ ГІПЕРТЕНЗІЄЮ

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Вступ. Смертність від серцево-судинних захворювань становить 20-30% від загальної смертності у пацієнтів із хронічним обструктивним захворюванням легень, що обумовлює необхідність оцінки у них кардіоваскулярного ризику.

Мета. Проаналізувати сучасні наукові публікації і визначити особливості кардіоваскулярного ризику та методів його оцінки для визначення прогнозу у пацієнтів з хронічним обструктивним захворюванням легень і підвищеним артеріальним тиском та артеріальною гіпертензією.

Матеріали та методи. Пошук літературних джерел здійснювався серед публікацій у відкритих базах PubMed/ MEDLINE, Web of Science, Scopus та Google Scholar і оцінювався за загальноприйнятими критеріями всіма авторами.

Результати. Аналіз досліджень свідчить, що хронічне обструктивне захворювання легень суттєво впливає на показники кардіоваскулярного ризику, істотно збільшуючи ці показники перші 1-30 днів після загострення. В статті розглянуто прогностичну цінність сучасних шкал оцінки показників кардіоваскулярного ризику – SCORE2 (score – оцінка), для пацієнтів похилого віку (old person – OP) – SCORE2-OP, шкала оцінки 8 найважливіших життєвих принципів (Life's essential 8 – LE8) та шкала прогнозування ризику серцево-судинних захворювань (Predicting Risk of Cardiovascular Disease EVENTs – PREVENT™). Існуючі шкали і відповідні онлайн калькулятори кардіоваскулярного ризику рекомендовані для застосування передусім при підвищеному артеріальному тиску та артеріальній гіпертензії, проте вони мають свої обмеження в пацієнтів з хронічним обструктивним захворюванням легень. Інші фактори ризику, зокрема, галектин-3, С-реактивний протеїн, фібриноген та інші також потребують уваги і подальших досліджень при сполученні цих захворювань.

Висновки. Результати цього дослідження демонструють, що хронічне обструктивне захворювання легень є не просто супутнім захворюванням, а потужним і незалежним фактором підвищення серцево-судинного ризику у пацієнтів з артеріальною гіпертензією. Сучасні шкали оцінки кардіоваскулярного ризику рекомендовані для застосування передусім в пацієнтів з підвищеним артеріальним тиском та артеріальною гіпертензією, проте бракує досліджень та рекомендацій, які обґрунтовують застосування цих шкал для визначення прогнозу в пацієнтів з супутнім хронічним обструктивним захворюванням легень.

Ключові слова: **хронічне обструктивне захворювання легень, підвищений артеріальний тиск, артеріальна гіпертензія, кардіоваскулярний ризик**

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