



# General pathogenetic links: Chronic heart failure and osteoporosis.

Nadirova Yulduz Isomovna

Assistant of the Department of Faculty and Hospital Therapy, Nephrology and Hemodialysis No2

Tashkent Medical Academy, Tashkent, Uzbekistan

**Bobosharipov** Gofurzhonovich **Feruzion** 

Assistant of the Department of Surgery

Tashkent Medical Academy, Tashkent, Uzbekistan

Human Fc gamma-receptor II alpha (FcyRIIA) Polymorphism has been linked with predisposition to susceptibility and/or severity degrees of several infectious diseases. To find if there is any link between these genetic polymorphisms and the intensity of the severe acute respiratory syndrome coronavirus-2 (SARS-Cov-2) disease. FcyRIIA polymorphism has been evaluated in the DNA extracts of 100 SARS-Cov-2 patients from Iraq. The participants included 74 mildly and moderately infected patients and 26 severely infected patients. A significant correlation was detected among FcyRIIA-131 polymorphism and severity of COVID-19, with higher frequency of FcyRIIA G/G 131 homozygote in severely infected individuals compared to that in the mildly/moderately infected patients in codominant and recessive mode; (p = 0.004 and p = 0.003), respectively. While AG and AA genotype could act as a protective factor. The outcomes demonstrate that FcyRIIA polymorphic genotype may affect the severity of the SARS-Cov-2

**Keywords:** 

chronic heart failure, osteoporosis, bone mineral density, bone metabolism

#### Introduction

In developed countries, the prevalence of chronic heart failure (CHF) varies from 1 to 12%, increasing in older age groups, especially after 65 years [1]. Heart failure (HF) is the most common cause of hospitalization among patients in this age group [2]. A total of >60 million people worldwide suffer from HF [3]. Osteoporosis (OP) is a common age-associated comorbidity in people with HF, affecting one in three women and one in four men aged >50 years [4]. HF is a syndrome that develops as a result of impaired ability of the heart to fill and/or empty, occurring in conditions of imbalance of vasoconstrictor and vasodilating

neurohormonal systems, and accompanied by insufficient perfusion of organs and tissues [5]. Most often, CHF is the outcome of arterial hypertension (AH) and coronary heart disease (CHD) caused by atherosclerosis. OP is a metabolic disease of the skeleton characterized by low bone mass and impaired microarchitecture. which lead development of fractures. At present, the results of many studies have confirmed the relationship increased vascular manifestations of subclinical atherosclerosis, and decreased bone mass [6, 7], and the detection of a high incidence of cardiovascular disease (CVD) in patients with osteoporotic

fractures necessitated specific screening of OP in cardiac patients [8]. The combination of OP or its complications (fractures) with CHF was previously explained by their independent simultaneous development with age, as well as a decrease in physical activity (PA), the use of vasoactive and diuretic drugs. However, current epidemiological and clinical evidence supports a relationship between the two conditions that cannot be explained by aging and the use of pharmacological drugs alone. The purpose of the scientific review was to analyze the literature data and search for common pathogenetic links of CHF and OP based on available clinical and experimental studies. The information presented in the review will allow physicians of a wide range of therapeutic specialties, especially therapists, cardiologists, rheumatologists and endocrinologists. familiarize themselves with current data on the interaction of CHF and low bone mass, as well as on the need to prevent osteoporotic fractures in patients with CHF.

#### Material and methods

A search of literature sources and analysis of publications in the PubMed, Medline, Web of Science and Cochrane Library databases was carried out, eLIBRARY.RU using the keywords "chronic heart failure", "heart failure", "osteoporosis", "bone mineral density", "bone metabolism", "low-energy fractures". The depth of the search was 20 years.

## Results of the study

In which the association of CHF with bone mineral density (BMD) was studied, they were combined into meta-analyses. In one of them, which included 6 clinical prospective and observational case-control studies patients with CHF and 243 patients without CHF), it was found that patients with CHF had lower skeletal BMD compared to patients without CHF, and the degree of BMD reduction correlated with the severity of the disease. 3 studies involved only men, the rest involved men and women. The BMD (T-score) of the whole skeleton in patients of functional classes I and II of CHF functional classes (FC) according to the classification of the New York Heart (NYHA New York Association Association) was -0.62 standard deviations

(SD), while in patients with CHF III, IV FC, the T-test was -0.87 SD. Similarly, the BMD of the femur in patients with FC III III AND IV was significantly lower than in patients with FC I and II, amounting to -1.07 vs -0.47 SD [9].

A large population-based cohort study was conducted in Canada, which included 45,509 patients (92% women): of these, 1,841 (4%) had recently developed CHF. Patients with CHF were significantly older, had a greater number of previous fractures and a lower total BMD of the proximal femur (T test -1.3 vs -0.9 SD)

At present, among domestic publications, there are single original studies concerning the study of the frequency and role of OP in patients with CHF and a significantly smaller number of patients. In one of them, in the group of men and women (n=201) with FC I-IV CHF developed in patients with hypertension and coronary artery disease. significantly more frequent development of spinal OP was observed than in the control group, and the severity of OP increased as the severity of CHF increased [12]. Another comparative prospective study included 70 outpatients with CHF and 40 patients with CVD but no CHF as a control group. Decreased BMD and bone metabolism disorders were significantly more common in CHF patients and were associated with the severity and duration of the underlying disease. Low BMD correlated with high levels of N-terminal fragment of brain natriuretic peptide precursor (NT-proBNP) and reduced renal function [13]. Thus, clinical and epidemiological studies show that CHF is often accompanied by a low BMD, a high risk of fractures, and, moreover, a 4-fold increase in the risk of any fracture requiring hospitalization compared to patients with other CVDs [15]. The most devastating complication of OP is hip fracture, which increases mortality in CHF. A prospective cohort study with a follow-up period of 11.5 years involved 5613 patients, among whom 1526 were diagnosed with CHF. Mortality after hip fracture in both men and women with CHF was 2 times higher compared to patients without a hip fracture

In part, the relationship between CHF and OP and fractures can be explained by a decrease in Phe, loss of muscle mass, and sometimes the

development of cachexia as HF progresses, which contributes to a deterioration in quality of life and an increase in the risk of falls. In addition, patients with severe CHF are often bedridden, deprived of insolation, which can lead to a decrease in cutaneous synthesis of vitamin D and the development of its insufficiency or deficiency. In cases of severe right ventricular failure accompanied by congestion in the liver and intestines, there may be a decrease in the synthesis of 25-hydroxyvitamin D (25(OH)D) and a decrease in the absorption of vitamin D in food.

### Conclusion.

In conclusion, it can be stated that further research on the relationship between CHF and OP is needed, since understanding the common mechanisms of the development of diseases will serve as a platform for preventive and therapeutic measures aimed at both conditions. Nevertheless, the data available to date indicate the need to pay attention to the problem of bone metabolism disorders in patients with CHF and take measures to reduce the risk of osteoporotic fractures. Screening for OP with modification of potential RFs, determination and correction of blood vitamin D levels, and appropriate prescription of drugs are important preventive measures in patients with CHF who have been taking cardiac drugs for a long time that adversely affect bone metabolism.

## Literature

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