Summary

Background

Heart failure is a progressive chronic disease affecting up to 10% of the population over the age of 70 in developed countries. It is associated with frequent hospitalizations and a poor prognosis. One of the main symptoms reported by patients with heart failure is dyspnea. Pulmonary ultrasound provides insight into the abnormalities of the patient's respiratory and circulatory systems, being a valuable adjunct to subject and physical examination. It is useful in diagnosing the cause of dyspnea in patients with severely impaired left ventricular (LV) systolic function. However, little is known about its relationship to symptoms in patients with preserved or mildly impaired LV systolic function. IGFBP-7 – an insulin-like growth factor-binding protein 7, is a novel biomarker associated with the development of heart failure through its remodeling pathway.

Purpose of the study

The purpose of this study was to evaluate the usefulness of transthoracic lung ultrasound as a rapid diagnostic method for confirming the cardiac cause of dyspnea and identifying heart failure patients with preserved (HFpEF) or mildly impaired (HFmrEF) LV systolic function, and to determine the correlation between lung ultrasound images and classical (NT-proBNP) and novel (IGFBP-7) markers of heart failure and echocardiographic exponents of HF. In addition, we evaluated the significance of the number of B-lines on lung ultrasonography and IGFBP-7 levels as a prognostic factor in a group of patients with HFpEF and HFmrEF hospitalized for exacerbation of heart failure symptoms.

Material and methods

The study was conducted in a group of 143 patients hospitalized between 2018 and 2020 at the Department of Cardiology of the Medical University in Bialystok and the Department of Cardiology of the SPZZOZ in Ostrow Mazowiecki, who were admitted to the hospital because of dyspnea and, as a result of the diagnostics performed, diagnosis of heart failure with preserved or mildly impaired LV ejection fraction was made. All patients had a transthoracic echocardiogram and blood samples taken, in which NT-proBNP levels and IGFBP-7 levels were determined. Patients had a transthoracic lung ultrasound (LUS) at admission and again at discharge for the purpose of searching of ultrasonographic signs of heart failure.

Results and conclusions

Assessment of the number of B-lines on lung ultrasonography at admission was characterized by high diagnostic value indicating exacerbation of heart failure symptoms, both in patients with HFpEF and HFmrEF. There were no statistically significant differences in IGFBP-7 levels between the two study groups. There were no statistically significant differences in the number of B-lines in LUS at admission in patients with EF ≥ 50% and with EF 41-49% (19.55±17.11

vs. 19.72±17.67, p=0.95). In contrast, the difference between the number of B-lines on admission and at hospital discharge with a marked reduction during hospitalization reached statistical significance in both the group with HFpEF (19.55±11.1 on admission vs. 15.54±13.95 at discharge, $p < 0.001$) and HFmrEF (19.72±17.67 on admission vs. 15.91±15.1 at discharge, $p < 0.001$). Patients hospitalized for more than 3 days had statistically significantly more B-lines in LUS at admission. The number of B-lines on lung ultrasound did not affect the rate of rehospitalization. Patients who died during the 24-month follow-up had significantly more B-lines in the LUS, both at hospital admission and at discharge. The number of B-lines $\geq$ 14 with high test sensitivity indicated an increased risk of death during the follow-up period. IGFBP-7 levels had no significant effect on duration of hospitalization, risk of rehospitalization and mortality in the study patient population.