EVALUATION OF RIGHT VENTRICULAR DIASTOLIC IMPAIRMENT IN MODERATE AND SEVERE COPD THROUGH THE PULSED DOPPLER METHOD COMPARED WITH TISSUE DOPPLER IMAGING

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Abstract: Objectives: The objective of this paper was to highlight the presence of the right ventricular diastolic dysfunction in the patients with COPD, GOLD stage II and III, by two comparative methods, the pulsed Doppler at the level of the tricuspid diastolic flow (classical method) and the Tissue Doppler Imaging method (TDI). Method: The clinical trial was conducted on a group of 61 patients with COPD chosen among those who addressed the Pneumonifiștiologie Hospital of Sibiu, aged between 44 and 78 years old. In terms of the degree of functional respiratory impairment, 38 were diagnosed with COPD GOLD stage I, and 23 with GOLD stage III. The patients who presented a difficult ultrasound display were excluded from study, as well as those in which we could not register any valid echocardiographic measurements. Results: The patients with COPD have frequently impaired diastolic function, as evidenced both by the classical method and by the TDI method, the patients showing an early subclinical alteration of the right ventricular diastolic function. The TDI method, less used in the current practice, has a complementary role, especially in evaluating the patients with severe hyperinflation.

INTRODUCTION

The problem of the existence of the right ventricular diastolic dysfunction in the patients with COPD is intensively studied. They have frequently early subclinical diastolic function, as evidenced both by the classical method and by the TDI method. Right ventricular diastolic dysfunction represents an important echocardiographic parameter in assessing the chronic pulmonary heart, as its relaxation impairment is an element of reserved prognosis.

PURPOSE

The objective of this study was to evaluate the right ventricular diastolic dysfunction in the patients with COPD GOLD stage II and III, comparatively assessed by the classical method of interrogating the tricuspid diastolic flow and through the TDI method at the level of the right ventricle basal segments.

METHODS

The trial was conducted on a group of 61 patients with COPD chosen among those who addressed the Pneumonifiștiologie Hospital of Sibiu, aged between 44 and 78 years old. Regarding the degree of functional respiratory impairment, 38 were diagnosed with COPD GOLD stage II and 23 with GOLD stage III. Transthoracic echocardiography assessed the presence of pulmonary hypertension, the chronic Cor Pulmonale suggestive elements and the left ventricular damage. The patients with left ventricular failure, atrial fibrillation or valvular disease were not included in the study. The patients presenting a difficult ultrasound display and where we could not make any valid echocardiographic measurements were also excluded from the study.

The right ventricular diastolic function was evaluated by assessing the diastolic tricuspid diastolic flow pattern, respectively by the E/A ratio calculated with the help of the pulsed Doppler echocardiography - normal values of E 43 +/- 11cm/s, A 31 +/- 10 cm/s, E/A normal ration above 1.(1)

The assessment of the RV diastolic dysfunction by the TDI technique is also an easy method, less used in the current practice. Through the pulsed Doppler method, we performed the interrogation of the basal segment of the right ventricle at the level of its lateral wall. We obtained two diastolic velocities, Et
CLINICAL ASPECTS

and At. The evaluation of the right ventricular relaxation impairment was made by:
- the E/Et ratio, a value above 6 having a sensitivity of 79% and a specificity of 76% in detecting the right atrial pressure above 10 mmHg.(2,3)
- the evaluation by the Tissue Doppler method, at the level of the tricuspid annulus of the myocardial velocities (pulsed Doppler for low velocity); Et normal value 14.5 + / - 3.5 cm / sec.(2,3)
- predominantly diastolic flow in the hepatic veins suggesting a pseudonormal filling.(3)

Figure no. 1. Pulsed Doppler evaluation of diastolic tricuspid flow

Figure no. 2. TDI assessment of the RV basal segment velocities

RESULTS

An increased frequency of the RV diastolic dysfunction in the patients with severe COPD (20 patients - 86.95%), as against those with moderate COPD (21 patients - 55.26%) can be observed. In order to check a possible association between the right ventricular diastolic dysfunction, the COPD stage and the pulmonary arterial systolic pressure (PASP), we applied the \( \chi^2 \) test and we found a significant correlation between the stage of COPD and the presence of the diastolic dysfunction \( \chi^2 \) test, \( p = 0.024 \). Linear correlation analysis was applied in order to calculate the Pearson correlation coefficient. As a result, we obtained statistically significant correlations of the right ventricular dysfunction assessed by the E/A ratio with SPAP and FEV (weak and inverse correlation).

In our study, there was only a weak and inverse statistical correlation between the presence of the diastolic dysfunction and the pulmonary function impairment level.

Regarding the correlation between the right ventricular diastolic dysfunction with the systolic pulmonary arterial pressure, we also observe a weak and reverse correlation, that is at the same time with the COPD progression and increased PASP, right ventricular relaxation abnormalities also occur.

In our study, we analyzed the contribution of the TDI echocardiographic method in diagnosing the right ventricular diastolic dysfunction.

Figure no. 3. Correlation chart of the right ventricular diastolic dysfunction with FEV \( (p = 0.015, r = -0.433) \)

Figure no. 4. The correlation chart of the right ventricular diastolic dysfunction with SPAP \( (p = 0.046, r = -0.303) \)

The right ventricular diastolic dysfunction by the TDI method was diagnosed in 32 patients (84.2%) with stage II COPD and in 16 patients (69.6%) with COPD stage III.

Between the percentage of those with RV diastolic dysfunction in COPD stage II and those in stage III, the differences are not significant (Z test, \( p = 0.152, \alpha = 0.05 \)).

With the help of the statistical analysis, the presence of the right ventricular diastolic dysfunction was assessed by the E/A classical method, compared with the Tissue Doppler method for diagnosing the presence of elevated filling pressures in the right heart. The results are comparatively emphasized. Thus, a satisfactory sensitivity of 83% has been obtained, but only a modest specificity of 62% regarding the TDI method.

Figure no. 5. ROC curve and AUC for the echocardiographic parameters for the assessment of the right ventricular diastolic dysfunction. The area under the ROC curve is AUC = 69.4\%

Thus, there is a good sensitivity but a low specificity of the Tissue Doppler echocardiographic parameters, as against those measured by the classical method in the evaluation of the right ventricular diastolic dysfunction. As a result, the TDI
method for the assessment of the right ventricular diastolic function cannot replace the conventional Doppler technique in the current practice. It may be useful only as a complementary method in the patients with pronounced hyperinflation, being able to identify the presence of the RV diastolic dysfunction in the patients where the classical method is negative.

DISCUSSIONS

In our study, the presence of the right ventricular diastolic dysfunction in the patients with moderate and severe COPD is increasingly encountered, both by the classical method and by the TDI method. The tissue Doppler is a sensitive diagnostic method in assessing the right ventricular diastolic function as against the conventional echocardiography.

CONCLUSIONS

In the group of the studied patients, diagnosed with moderate and severe COPD, without clinical signs of chronic Cor Pulmonale, we increasingly identified the presence of the right ventricular diastolic dysfunction, both by the classical technique and by the TDI method. Pulsed tissue Doppler echocardiography is a reliable diagnostic method, useful in determining the RV dysfunction, especially in the early detection of the RV dysfunction, which may have an important impact on the treatment applied and prognosis. The TDI method, less used in the current practice, has a complementary role, especially in evaluating the patients with severe hyperinflation.

REFERENCES