

**Evaluation of left ventricular systolic and diastolic function
in ICU patients with chronic obstructive pulmonary disease**

Thesis

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Summary

Introduction

Chronic obstructive pulmonary disease (COPD) is a common entity in clinical practice. Development of right ventricular hypertrophy and eventual right side heart failure is also common in such patients. However, some disturbance in left ventricular (LV) function has been observed by several workers among such patients.

Objectives

The aim of this study was to assess the cardiac changes secondary to chronic obstructive pulmonary disease (COPD) and to evaluate LV systolic and diastolic function by echocardiography in critically ill COPD patients.

Patients and methods

The study included 35 patients with COPD who were admitted to medical ICU with mean age of 54.7 years, 30 patients (85.7%) of them were males. The study also included 25 healthy individuals as a control group with mean age of 52.8 years , 18 patients (72%) of them were males. We found that there was no statistical difference between the two groups (case and control) regarding gender and age. Patients with history of chronic lung disease other than COPD, hypertension , DM , any primary cardiac disease, any systemic disease that can cause pulmonary hypertension, were excluded from the study.

All patients were examined and subjected to the following:

1. all patients underwent the following procedures: resting ECG tracing, clinical assessment.
2. Routine investigations, including complete blood count, blood urea, serum creatinine, and other laboratory investigations , as needed.

3. all patients were investigated by spirometry to confirm the severity of COPD and evaluated according to GOLD as follows:

- Stage III (Severe): 30% \leq post bronchodilator FEV1 $<$ 50% predicted
- Stage IV (Very severe): post bronchodilator FEV1 $<$ 30% predicted or $<$ 50% predicted plus chronic respiratory failure.

4. All patients subjected to complete transthoracic echo Doppler study and TDI .Echocardiograms should be recorded at rest using ACUSON CV70 Echo-Doppler machines equipped with a 2.5\3.25-MHZ annular array transducer .

The following views were obtained:

- 1- Parasternal long and short axis.
- 2- Apical 4,5 and 2 chambers.

1. Assesment of LV function:

– Measurement of LV EF by M-mode by measurement of LV systolic and diastolic dimensions obtained through long-axis parasternal approach in M-mode projection, and also by simpson's method for calculation of LV function

(EF).

– LV diastolic filling patterns determined by the mitral inflow pulsed wave Doppler examination. In the apical 4-chamber view, the Doppler sample volume placed in the middle of LV inflow tract 1 cm below the plane of mitral annulus at the mitral leaflet tips, where maximal flow velocity in early and late diastole were recorded .The diastolic parameters were measured from at least three beats and defined as follows: E-wave, (early maximal transmitral flow velocity;) A-wave, (peak velocity during atrial contraction in late diastole;) and ratio between the early peak transmitral flow velocity (E) and late peak atrial systolic velocity (A) [E/A ratio]. The early diastole (Em) and atrium systole (Am) mitral valve

annular velocity was measured at the lateral wall of the left ventricle, by pulsed wave tissue Doppler.

2.Assesment of RV function:

– The right ventricular systolic pressure (RVSP) will be obtained from the velocity of tricuspid regurgitation.CVP or RA pressure was added to the pressure gradient between the right ventricle and right atrium,(obtained from Tricuspid regurgitation velocity) . As pulmonary stenosis was excluded in all patients, it was agreed that the RVSP value obtained, related to the pulmonary artery pressure.

Results:

We observed the very high prevalence of left ventricular diastolic dysfunction among this severe cateogory of COPD patients as the percentage of LVDD among COPD patients was (88.6%) compared to control group (24%). we found statistical significant difference as regards LA diameter with high value among COPD patients [LA was 3.61 ± 0.44 cm (mean \pm SD) among cases versus 3.3 ± 0.57 cm (mean \pm SD) among control (p-value 0.02)] . We also found statistical significant lower levels of mean and SD of SWT, PWT, LVEDD, LVESD, E-wave and E/A ratio as measured by conventional echocardiography and E' measured by TD study among COPD patients compared to the control [SWT was 1.04 ± 0.17 cm versus 1 ± 0.73 cm (p-value<0.001), PWT was 1 ± 0.13 cm versus 0.73 ± 0.18 cm (p-value <0.001) , LVEDD was 3.4 ± 0.6 cm versus 4.9 ± 0.52 cm (p-value 0.002), LVESD was 2.8 ± 0.43 cm versus 3.12 ± 0.34 cm (p-value 0.001), E-wave was 0.6 ± 0.2 m/s versus 1.12 ± 1.5 m/s (p-value 0.04), E/A ratio was 0.85 ± 0.39 versus 1.3 ± 0.46 (p-value <0.001), E' was 0.12 ± 0.06 m/s versus 0.17 ± 0.05 m/s (p-value 0.001)] . it was found that patients with COPD had more significant increase in RVD and RVSP [$(3.25 \pm 0.91$ cm) ,(50.9 \pm 16.1 mmHg) respectively] compared to the control group [$(2.28 \pm 0.35$ cm),(28.3 \pm 5.8 mmHg) respectively]. On the other hand, TAPSE and S' tricuspid were significantly lower among

cases (21.5 ± 5.5) , (0.11 ± 0.02 m/s) respectively compared to the control group (29.3 ± 2.6), (0.15 ± 0.02 m/s) respectively. In our study ,we compared PFT results with some echocardiographic results in COPD cases we found that some correlations was statistically significance as positive correlation between PEFr1 and LVEDD, Others were not statistically significance as EFV1 and all other right and left echo parameters.

FEV1 had a sensitivity of 74.2% and specificity of 50% at a cut off value 44.5% predicted with overall accuracy 64% in predicting LV diastolic dysfunction among COPD patients .

FVC had a sensitivity of 71% and specificity of 50% at a cut off value 71% predicted with overall accuracy 77.4% in predicting LV diastolic dysfunction among COPD patients .

FEV1/FVC had a sensitivity of 87.1% and specificity of 50% at a cut off value 67% predicted with overall accuracy 54% in predicting LV diastolic dysfunction among COPD patients .

PEFR had a sensitivity of 64.5% and specificity of 50% at a cut off value 27.5% predicted with overall accuracy 56% in predicting LV diastolic dysfunction among COPD patients.

RVSP had a sensitivity of 83.9% and specificity of 85.3% at a cut off value 31mmHg predicted with overall accuracy 76.5% in predicting LV diastolic dysfunction among COPD patients.

Conclusion: In COPD patients LV diastolic function is significantly impaired, while systolic LV function is well preserved.