

# EVOLUTIONARY AND PROGNOSTIC PARTICULARITIES IN PATIENTS WITH COPD, CHRONIC COR PULMONALE AND COVID-19

NICOLETA – ALINA POPA<sup>1</sup>, ADINA – MARIETA SIPOS<sup>2</sup>, MIRCEA IOACHIM POPESCU<sup>3</sup>

<sup>1,2</sup>Municipal Hospital of Oradea, <sup>3</sup>County Clinical Emergency Hospital of Oradea

**Keywords:** COPD, chronic cor pulmonale (CCP), infection with coronavirus, prognostic

**Abstract:** Chronic obstructive pulmonary disease (COPD) is a chronic disease of the respiratory airways due to the partially reversible obstruction of the airflow caused by an abnormal inflammatory response to toxic substances, most often to cigarette smoke.(1) COVID-19 is a mild to severe respiratory disease caused by a coronavirus from the genus Betacoronavirus.(2) Patients with COPD have a major risk of COVID-19 infection. Treating patients with COPD, chronic cor pulmonale and COVID-19 is a current challenge.

## INTRODUCTION

COPD, CCP and COVID-19 are associated with a decrease in the quality of life, and increased morbidity and mortality. An important complication in the evolution of COPD is the chronic cor pulmonale-CCP.

The evolution and prognosis of these patients are greatly tied to risk factors, seeking medical attention early on from the onset of the first symptoms, clinical and paraclinical data, as well as treatment that is applied as promptly as possible. The major risk factor for COPD is smoking cigarettes, and the index for packs / year is very important in this regard.(3)

As secondary risk factors, we can list: genetic factors, a history of childhood respiratory illness, pollution, occupational respiratory noxious matter (mineral dust), passive smoking. COPD is a slow process that develops progressively, with the major complication of chronic cor pulmonale.

Infection with COVID-19 in patients with COPD can be fatal, the diagnosis of the form of COVID19 infection being influenced most of the time by the degree of severity of COPD.

## AIM

The aim of this study is to shed light on the major impact of COVID-19 infection in what concerns patients with COPD and chronic cor pulmonale.

## MATERIALS AND METHODS

Between December 2020 and June 2021, 126 patients with COPD, chronic cor pulmonale and COVID-19 infection were assessed at “Dr. Gavril Curteanu” Municipal Clinical Hospital of Oradea, in the extended Pneumology Department. The systemic inflammation caused by COVID-19 worsens the pre-existing hypoxia that these patients suffer from.

Hypoxia, respiratory acidosis, hydroelectrolytic and mineral imbalances represent a considerable arrhythmogenic substrate for those affected by COPD, chronic cor pulmonale and COVID-19 infection. Hypoxia, hypercapnia, oxidative stress, hypoxia-inducible factor 1 lead to pulmonary vasoconstriction, pulmonary hypertension and, subsequently,

right ventricular hypertrophy, followed by diastolic dysfunction.(4) Pro-fibrotic remodeling of the atrial tissue is promoted, which increases the risk of cardiac arrhythmia in these patients.

## RESULTS

The study was divided into 2 sub-studies:

1. The role of inflammatory biomarkers in patients with COPD, chronic cor pulmonale and COVID-19 infection.
2. The evolution and prognosis of patients with COPD, chronic cor pulmonale and COVID-19 after pharmacological therapy that is undergone as promptly as possible.

We assessed the influence of high inflammatory biomarker values C Reactive Protein (CRP), Lactate dehydrogenase (LDH), ferritin, fibrinogen on the severity of COPD and COVID-19 infection, as well as on the number of days of hospitalization.(5,6)

The first stage of the study contains the percentage of COPD cases in relation to the total number of admissions to the extended Pneumology 2 department of the “Dr. Gavril Curteanu” Municipal Clinical Hospital of Oradea throughout the December 2020 – May 2021 period of time.

**Table no. 1. Ratio between the number of COPD cases to the total number of admissions**

	TOTAL	COPD
Number	489	126
Percentage	80 %	20 %

Of the total admitted, 126 presented COPD, as a percentage 20%. COPD increase the risk of complications associated with COVID.

The risk of infection with Coronavirus for COPD patients is very high, and, during this pandemic, spirometry is difficult to perform, all patients with respiratory symptoms are mandatorily investigated for an infection with the as well.

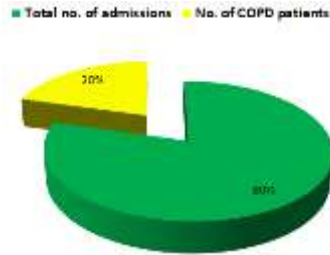
A differential diagnosis of the symptoms caused by a COVID-19 infection and the symptoms present in COPD is

<sup>3</sup>Corresponding author: Mircea Ioachim Popescu, Str. Libertății, Nr. 4, Oradea, România, E-mail: procardia\_oradea@yahoo.com, Phone: +40722 240170  
Article received on 07.06.2021 and accepted for publication on 27.08.2021

## CLINICAL ASPECTS

important.

**Figure no. 1. The percentage of COPD cases in relation to the total number of admissions**



*Results regarding the demographic factors:*

- The age of the patients

**Table no. 2. The proportions of COPD patients**

AGE	NUMBER	PERCENTAGE
41-50 years old	8	6.34 %
51-60 years old	48	38.09 %
61-70 years old	53	42.06 %
71-80 years old	10	7.94 %
> 80 years old	7	5.56 %
<b>TOTAL</b>	<b>126</b>	<b>100 %</b>

The case incidence increases along with age, most patients are aged 60 to 80.

- The sex of the patients

**Table no. 3. The men / women ratio**

SEX	NUMBER	PERCENTAGE
<b>WOMEN</b>	<b>48</b>	<b>38.09 %</b>
<b>MEN</b>	<b>78</b>	<b>61.91 %</b>

61.91% of all cases was represented by patients of the male sex, due to their susceptibility to develop COPD, according to the data in the specialized literature.

- Environment

**Table no. 4. Distribution of patients depending on environment**

ENVIRONMENT	NUMBER	PERCENTAGE
RURAL	98	77.77 %
URBAN	28	22.23 %

With respect to their environment, we can see an increased incidence among the patients who live in the rural area

- The distribution of COPD cases depending on age and sex.

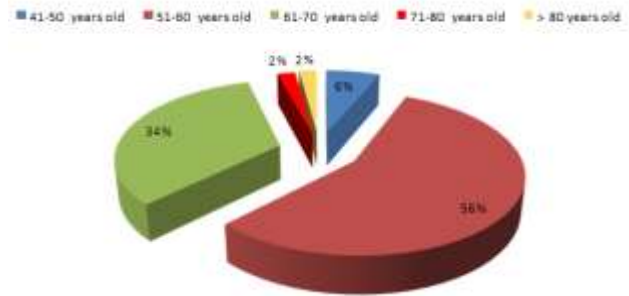
**Table no. 5. Distribution of patients depending**

Age	Men	Women	Men %	Women %
41-50 years old	5	3	6 %	6 %
51-60 years old	21	27	27 %	56 %
61-70 years old	37	16	47 %	33 %
71-80 years old	9	1	12 %	2 %
> 80 years old	6	1	8 %	2 %
<b>Total</b>	<b>78</b>	<b>48</b>	<b>100 %</b>	<b>100 %</b>

**Figure no. 2. Distribution of men based on age**



**Figure no. 3. Distribution of women based on age**



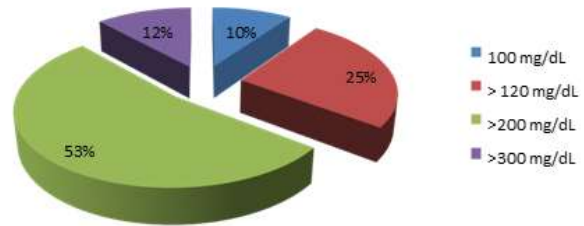
The incidence of increased cases in the age category can be observed in the age group of 61-70 ages. COPD is more frequent in men. WHO expects that by 2030, COPD will be the 3th cause of mortality In the world, the most affected are men (47%).

The values of patients' inflammatory biomarkers at admission are presented in the table below.

**Table no. 6. Inflammatory biomarkers**

Biomarker	Number	Percentage
C-reactive protein>100 mg/dL	102	80.95 %
Ferritin> 300 mg/L	97	76.98 %
LDH > 240 U/L	88	69.84 %
Fibrinogen >400 mg/dL	67	53.17 %
Procalcitonin>0,5 ng/dL	45	35.71 %

**Figure no. 4. The percentages forCRP values**



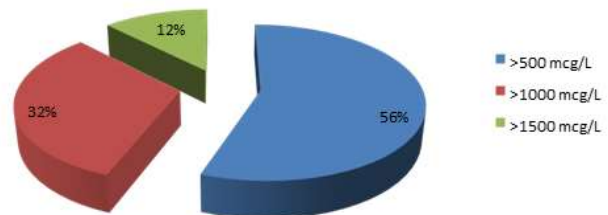
Upon the admission of patients, a balance sheet of the inflammatory biomarkers was made.

There were analysed: C Reactive Protein, lactate dehydrogenase, ferritin, fibrinogen, procalcitonin, and monitored in dynamics. Elevated values of inflammatory biomarkers were observed in patients with complications.

Out of the 126 patients included in the study, 102 patients displayed high c-reactive protein values, of whom 54 patients displayed values exceeding 200 mg/dL, which is 53%, while the ones exceeding values of other 300 mg/dL were 12 in number, representing 12%.

Values over 120 mg/dL were found in a number of 26 patients, which amounts to 25%.

**Figure no. 5. The percentages for the ferritin values**



Out of the 97 patients with ferritin that exceeded normal values (NV=300 mcg/L), 54 patients displayed values of over 500 mcg/L, amounting to 56%, 31 patients had values of over 1000 mcg/L with 32%, while 12 patients displayed very high

## CLINICAL ASPECTS

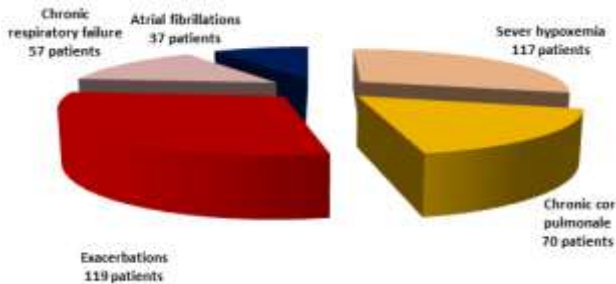
values of over 1,500 mcg/L, with 12%.

Ferritin with increased values over 500 mcg/L, was present in a large number of patients(56%).

### *Results after studying the complications:*

In what concerns complications due to COPD, these remain a continuous challenge for clinicians, as these patients have a very high risk of premature death, both because of the disease itself, as well as the complications.

**Figure no. 6. COPD complications**



In the previous figure, we can highlight the increased number of patients with chronic cor pulmonale, a 55.55% percentage, while over 90% of cases was represented by patients with severe hypoxemia and exacerbations. Atrial fibrillation is also caused by COPD, with 29.36% for a number of 37 patients.

The period of hospitalization is part of the study parameters, thus, we have had patients whose hospital stay was 14-days long, but also patients who needed a longer stay.

**Table no. 7. Distribution in relation to the number of days of hospitalization**

Period of hospitalization	14 days	>14 days
Number	42	84
Percentage	33.33 %	66.66 %

Many patients were hospitalized over 14 days, due to complications, a percentage of 66.66%, that is a number of 84 patients.

**Table no. 8. The ratio between the deaths and the total number of hospitalizations**

Total number of COPD, CCP, COVID-19 patients	126	100%
Number of deaths	57	45.23%

## DISCUSSIONS

Chronic cor pulmonale is one of the severe complications of COPD, which actually represents the development of right heart failure, secondary to COPD-induced pulmonary hypertension. Treatment of airflow obstruction and hypoxemia is very important in cases of chronic cor pulmonale.(7) Timely diagnosis of chronic cor pulmonale is of major importance for the management, evolution and prognosis of COPD. The high-specificity and sensitivity imaging test which confirms the presence of chronic cor pulmonale is the transthoracic or transesophageal cardiac ultrasound.(8)

The inflammatory markers characterize the inflammation of the respiratory airways in COPD, as well as the systemic inflammation in COVID-19.

This study aimed to determine the role of these inflammatory biomarkers in the evolution and prognosis of patients with COPD, Chronic cor pulmonale and COVID-19.

The patients were closely monitored throughout their hospitalization, which was at least 14 days long. The inflammatory biomarkers measured at a maximum interval of 2 days played a major role in closely monitoring the patients. We thus noticed that patients with high CRP and ferritin values had

an unfavourable evolution, resulting in their death.

There were a number of 57 deaths among the studied sample of patients, who presented associated severe comorbidities.

Being a retrospective study, it aimed to explore the way in which the COVID 19 pandemic influenced evolution, prognosis, quality of life, psychological factors and social factors, in people with COPD.

It is known that patients with COPD, CCP, are prone to frequent viral exacerbations, epidemiological studies suggest that people are more exposed to coronavirus infection. Deaths were more frequent in patients who developed complications: respiratory acidosis, hyposomnia, hypersomnia.

There are not many studies performed during the pandemic in COPD patients. This study reveals a small mortality regarding COPD. The cause of deaths being the complications developed in a COVID context.

The evolution of the patients was closely monitored after their infection with COVID-19.(9,10) This study is about the COPD experience during the pandemic. It is a unique for patient with COPD.

## CONCLUSIONS

COPD is a major risk factor for the development of Chronic cor pulmonale. COVID-19 infection in this category of patients promoted major systemic imbalances: hyperinflation, marked hypoxia, hypercapnia, respiratory acidosis, systemic bacterial infections, consequently, profoundly altered inflammatory biomarkers.

The healing percentage related to the patients depended on the form of COVID infection, the degree of COPD, the risk category for the exacerbation of COPD, as well as the standard, updated treatment applied as promptly as possible.

## REFERENCES

1. The Merk Manual, Twentieth Edition; 2018.
2. Postma DS, Bush A, van den Berger M. Risk factors and early origins of chronic obstructive pulmonary disease. *Lancet*; 2015.
3. WHO-Chronic Cor Pulmonale Report of an Expert Committee Circulation; 1963.
4. [http://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-\(copd\)](http://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-(copd)). Accessed on 21 June 2021.
5. Duvoix A, Dickens J, Imram H, et. Al-Blood fibrinogen as a biomarker of chronic obstructive pulmonary disease. *T thoarax*; 2013.
6. Fattouh M, Alkady O. Inflammatory biomarkers in chronic obstructive pulmonary disease, *Egyptian Journal of Chest Diseases and Tuberculosis*; 2014.
7. Bartolome RC, et al. Inflammatory Biomarkers Improve Clinical Prediction of Mortality in Chronic Obstructive Pulmonary Disease, *Am Journal Respir Crit Care Med*; 2012.
8. Augusti A, Eduards LD, Rennards SI. Persistent systemic inflammation is associated with poor clinical outcomes in COPD- Biomarkers in clinical Practice; 2012.
9. Global Initiative for Chronic Obstructive Lung Disease: Global Strategy for The Diagnosis, Management and Prevention Of Chronic Obstructive Pulmonary Disease 2021 report.
10. Ulmeanu R, Mihălțan FD, Oancea C. Recomandări de diagnostic și tratament în Bronhopneumopatia Cronică Obstructivă [Diagnosis and Treatment Recommendations for Chronic Obstructive Brocnhopneumopathy], *Medical Publishing House*; 2019.