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Prevalence and Impact of COVID-19 among Severe COPD Patients post Bronchoscopic Lung Volume Reduction Treatment with Endobronchial Valves

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Abstract
Background: The COVID-19 pandemic has a great impact on numberless aspects of our society. In our bronchoscopic lung volume reduction interventional program, we work with severe COPD patients on a daily basis. ***Objectives:*** We were interested in the prevalence and outcome of COVID-19, impact of the pandemic on daily life, and the vaccination coverage in our severe COPD patients who have been treated with one-way endobronchial valves. ***Method:*** A questionnaire, which consisted of questions related to the infection rate, treatment, and outcome of COVID-19 infections; feelings of anxiety related to the pandemic; adherence to preventive measures; and willingness to be vaccinated; was sent to our patients in June 2021. ***Results:*** The questionnaire was sent to 215 patients, and the response rate was 100%. The vaccination rate was 97% in our surveyed population. The majority of patients (63%) indicated that they were quite or very anxious to get infected with COVID-19. Twenty-five (11.5%) patients were diagnosed with COVID-19, with none of these patients having been vaccinated at the time of infection. The infection rate reported in this study is comparable to that of the general Dutch population. However, the hospital admission rate and mortality rates are higher. ***Conclusions:*** Our results show that the SARS-CoV-2 infection rate in severe COPD patients treated with endobronchial valves was comparable with the general population; however, the hospital admission and mortality rates were worse.

Introduction

The COVID-19 pandemic has a great impact on numberless aspects of our society. People were asked to isolate themselves repeatedly and recommended to avoid physical contact. Routine management and diagnosis of COPD was more difficult as a result of a reduction in outpatient consultations, pulmonary function tests, and limitations in the capacity for pulmonary rehabilitation and home care programs.

Currently, patients with COPD do not seem to have an increased risk of getting infected with SARS-CoV-2, which causes COVID-19, but this may reflect the effect of

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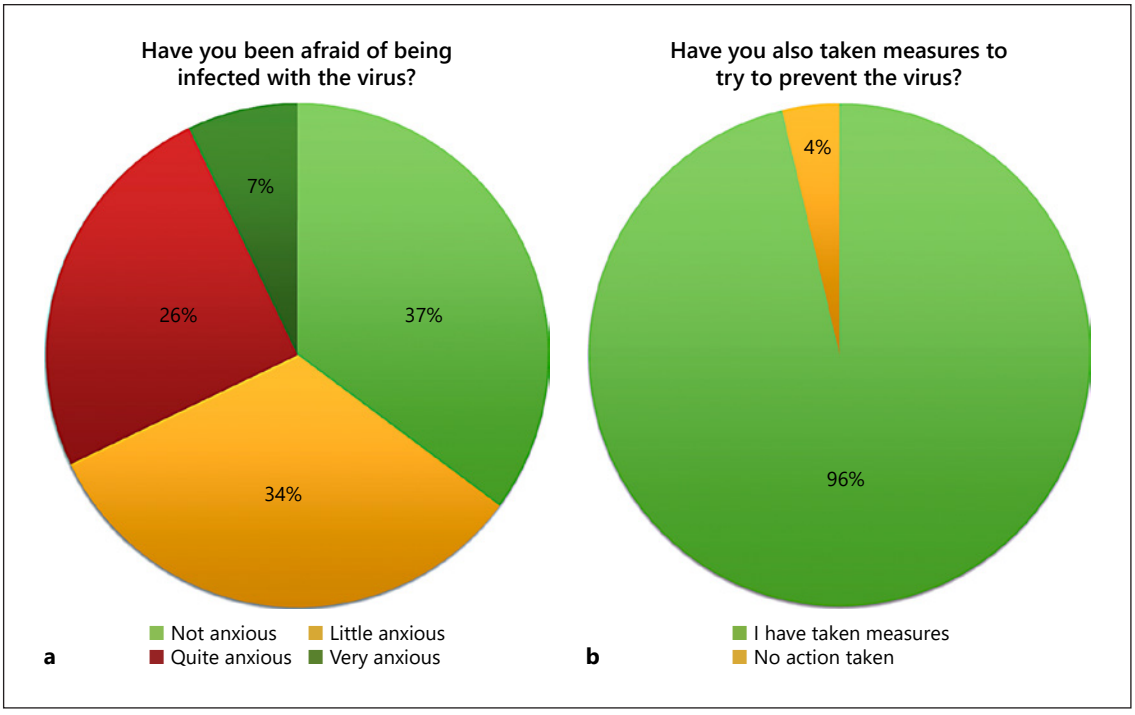

Fig. 1. a Outcome of the analysis of the survey regarding the question "Have you been afraid of being infected with the virus?" **b** Outcome of the analysis of the survey regarding the question "Have you also taken measures to try to prevent the virus?"

all protective strategies taken by these patients. Additionally, COPD is considered to increase the risk of hospitalization for COVID-19 and seems to be associated with an increased mortality rate [1–3].

In The Netherlands, until October 2021, around 2 million people (11.7% of the total population) have been infected with SARS-CoV-2 and 0.9% of the infected people died. The hospital admittance rate of infected patients is around 2.5–3% [4]. There are no specific data on the prevalence of COVID-19 in patients with COPD in The Netherlands or other countries.

In our bronchoscopic lung volume reduction interventional program, we work with severe COPD patients on a daily basis. We were interested in the prevalence and outcome of COVID-19, impact of the pandemic on daily life, and the vaccination coverage in our bronchoscopic lung volume reduction patients who have been treated with one-way endobronchial valves [5]. Since this is a group of patients who are usually very well aware of the risk of a poor outcome in case of a respiratory infection, we hypothesized that the adherence to COVID-19 preventive measures and the vaccination rate would be high and that the infection rate would be comparable to the general population, or even lower. In this report, we present the outcomes of our study.

Methods

We developed a questionnaire, which consisted of questions related to the infection rate, treatment, and outcome of COVID-19 infections; feelings of anxiety related to the pandemic; adherence to preventive measures; and willingness to be vaccinated. We sent this questionnaire to all patients who underwent bronchoscopic lung volume reduction with endobronchial valves between September 2016 and June 2021 in the University Medical Center Groningen, The Netherlands, and who still had the valves implanted. In case of no response to the questionnaire, we approached the patient once more to ask to complete the questionnaire. Patient characteristics and pulmonary function data were obtained from the latest available visit to our hospital post valve treatment. All patients gave written informed consent to be registered in the Dutch national EBV treatment registry (BREATHE-NL: NCT02815683) and gave additional written informed consent to use this COVID-19 questionnaire data [6].

Results

The questionnaire was sent to 215 patients (June 2021), and we received 215 questionnaires (response rate: 100%) (October 2021). In June 2021, we were aware of 2 patients who had died because of COVID-19 (no questionnaires were sent), and therefore our total study population included 217 patients. Patient characteristics (N = 217) were as follows: 71% female, mean age 65 ± 7 years, body mass index 24 ± 4 kg/m^2, forced expiratory volume in 1 s 33 ± 12% of predicted, and a residual volume 196 ± 48% of predicted.

The majority of patients (63%) indicated that they were quite or very anxious to get infected with COVID-19 (Fig. 1a). Almost every patient (96%) has taken at least one preventive measure (Fig. 1b). The following preventive measures were taken: no physical contact with persons outside their household (90%), no shopping (54%), no physiotherapy training (42%).

Twenty-five (11.5%) patients were diagnosed with COVID-19, with none of these patients having been vaccinated at the time of infection. Four patients (1.8%) had a suspected COVID-19 infection, but this was not confirmed by a test. Of the 25 patients who were diagnosed with COVID-19, 10 (40%) patients did not require additional medical treatment. In the other patients, treatment consisted of corticosteroids, antibiotics, and/or supplemental oxygen. Ten (42%) patients were admitted to the hospital (median stay 33, range 2–40 days. Of these, 3 patients were admitted to the ICU, of which two needed invasive ventilation. Two (8%) patients died as a result of COVID-19. Eleven (44%) patients indicated they fully recovered from COVID-19, 4 (16%) patients are largely recovered, and 8 (32%) patients indicated that they still have COVID-19-related complaints, such as increased shortness of breath, fatigue, and/or decreased physical condition.

Starting from January 8, 2021, the COVID-19 vaccination was offered to residents of The Netherlands. Among our surveyed patients, 94.9% had received the vaccination at the time of the questionnaire (Pfizer-BioNTech 56%, Moderna 10%, and AstraZeneca 34%), 1.9% had scheduled their vaccination appointment, and 3.3% indicated that they do not want to be vaccinated.

Discussion

The infection rate reported in this study is comparable to that of the general Dutch population. However, the hospital admission rate and mortality rates are higher. This is in line with earlier reports [4]. Of note, none of the COVID-19-infected patients were vaccinated at the time of infection.

As we expected, the vaccination rate was very high in our surveyed population (97% vaccinated or scheduled for vaccination). This is higher than the vaccination rate in both the entire adult Dutch population (85%) and those over 50 years of age (88–93%) [4]. Additionally, the vast majority of patients indicated that they adhered to one or more of the preventive measures. In a significant number of our patients, the physiotherapy training had been discontinued, which in the context of social distancing is understandable [7]. However, since exercise training is associated with increased physical activity and deconditioning may lead to increased dyspnoea, we believe this is a concerning development for patients with severe COPD [8, 9]. Most patients indicated they were quite or very anxious with regard to the COVID-19 pandemic, which is comparable to the findings of an observational study in the UK investigating 160 patients with COPD under control of a secondary care clinic, where 26% of patients indicated that they were much more anxious about their COPD during the lockdown [10].

The strength of our study is that we had a maximum response rate to our questionnaire. However, there are some limitations. First of all, data we collected on COVID-19 are self-reported and not extracted from a medical file. Furthermore, the group of patients who had COVID-19 was relatively small, and most patients became infected before they were vaccinated. There were no data available about the infections and the admission in hospital before and after the vaccination. Finally, since most patients became infected before they were vaccinated, the hospital admission and mortality rate may not be applicable to the current situation. However, it does emphasize the importance of preventive measures and vaccination in patients with severe COPD.

Conclusion

Our results show that the SARS-CoV-2 infection rate in severe COPD patients treated with endobronchial valves was comparable with the general population; however, the hospital admission and mortality rates were worse. This emphasizes the importance of preventive measures and vaccination in this patient group which shown by our results most patients are well aware of.

Statement of Ethics

METc University Medical Center Groningen did not require an additional approval for this study and therefore this was waived. All patients gave written informed consent to be registered in the Dutch national EBV treatment registry (BREATHE-NL: NCT02815683) and gave permission to use collected data for research, and they also gave additional written informed consent to use this COVID-19 questionnaire data.

Conflict of Interest Statement

Karin Klooster, Jorine Hartman, David Koster, and Marlies van Dijk have no conflicts. Dirk-Jan Slebos is an investigator, physician advisor, and consultant for Pulmonx Corp., CA, USA.

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Author Contributions

Karin Klooster contributed to project design, analysing the data, and writing. Jorine Hartman, David Koster, and Marlies van Dijk have no conflicts, and Dirk-Jan Slebos contributed to project design and writing.

Data Availability Statement

All data generated or analysed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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