Differentiating characteristics of asthmatic patients in the SARS-CoV2 infection

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Abstract

INTRODUCTION: The SARS-CoV-2 coronavirus pandemic has caused more than fifteen million infections worldwide. Our aim is to investigate the differentiating characteristics in asthmatic patients with SARS-CoV-2 infection in the community of Castilla la Mancha. METHODS: We used the Savana® software and its algorithm based on Big Data and artificial intelligence, performed a retrospective search of the diagnoses of COVID 19 and asthma in the digitized medical records with positive RT-PCR results for SARS-CoV-2, and analysed the demographic characteristics, comorbidities, hospitalization data and deaths. RESULTS: 6,310 patients with positive RT-PCR for SARS-CoV-2 were selected, of which 577 had a diagnosis of asthma with a prevalence of 9.14%. The mean age in SARS-CoV-2 (SC2) was 59 ±19 years of age and in SARS-CoV2-asthma (SC2-A) 55 ±20 years of age. SC2 included 2983 (41%) men and 3327 (59%) women, while SC2-A included 198 (31%) men and 379 (69%) women. High blood pressure (BP) was the most common comorbidity in both groups (51%). 2,164 SC2 (34.2%) and 131 SC2-A (22.7%) required hospitalization with an asthma prevalence of 6.05%. 250 SC2 (3.96%) and 21 SC2-A (3.64%) died. CONCLUSION: The prevalence of asthma in our SARS-CoV-2 positive RT-PCR population was 9.14% and 6.05% in hospitalized patients. HBP is the most frequent comorbidity in both groups, and smoking is the only one with significant differences, more frequent in asthmatics. Mortality is lower in patients with asthma

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INTRODUCTION

The pandemic due to the infection caused by the betacoronavirus called Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) that began in Wuhan, China in December 2019, causing the infectious disease COVID19 (1,2,3), surpassed fifteen million infections and more than six hundred thousand deaths globally (4), numbers that continue to rise. In severe cases, severe pneumonia and other complications that can be life-threatening for patients are common (1,2,3).

The first case diagnosed in the community of Castilla La Mancha was on March 1, 2020 and infections increased exponentially in the following weeks (5). The prognosis of SARS-CoV-2 infection worsens when comorbidities such as high blood pressure, chronic obstructive pulmonary disease, diabetes mellitus, cardiovascular disease, and obesity are associated (6,7).

There are communications that suggest that asthma may be a factor that determines the severity of the disease, compared to others that indicate that it does not imply an increased risk (6,8,9). Asthma is a chronic inflammatory disease of the airways, where different cells and inflammation mediators participate, with bronchial hyperresponsiveness and variable airflow obstruction, which is totally or partially reversible (10). The prevalence of asthma in Spain is estimated at 6.3% of the population (10). Differentiating an asthma exacerbation from SARS-CoV-2 pneumonia may be clinically difficult because the symptoms of dry cough and dyspnoea may be present in both (11). The prevalence of asthma in SARS-CoV-2 infection published in a cohort of hospitalized patients in Spain was 8.4% (12).

The Castilla la Mancha's health system is universal and provides medical care to all citizens. Using a new computer system (Savana®) that works on clinical reports generated in the Community, all the information is found in an accessible electronic medical record system. This system is a powerful tool for conducting epidemiological studies and has been used in this work to evaluate the epidemiology of COVID 19 and its association with asthma in our population.

The main objective of this study is to analyse how the SARS-CoV-2 infection has affected asthmatic patients in terms of prevalence, morbidity, hospitalization and mortality.

MATERIAL AND METHODS

For the analysis of information contained in electronic health records (EHR), we use Savana®, an artificial intelligence (AI)-enabled system based on natural language processing and neural networks, which combines computational skills with natural language processing by joining Big Data and AI approaches, capable of reusing information expressed in natural language in clinical reports. It does this by combining its channelling modules with, among others, sentence segmentation, tokenization, spell checking, acronym detection, expansion, negation, identification, and a multidimensional classification scheme that unites linguistic knowledge, statistical evidence, and the latest in continuous vector representations of words (13). The information that doctors write in the EHR during their daily practice generates large amounts of valuable information. Savana® maximizes this huge amount of data by dynamically exploiting it all in real time. It performs an immediate statistical analysis of all patients seen on the platform and provides relevant results for the input variables provided by the user (13,14). To ensure the privacy of all patients, Savana® anonymised the data.

From its implementation in January 2011 until July 2020, 260,810,000 EHR were generated belonging to 3,191,485 patients, which includes, in fact, the entire population of Castilla la Mancha.

Savana® carried out the search in the entire population, extracting data from primary care, specialized care, hospitals and emergency departments, until July 2020, detecting COVID19 diagnoses, and in this group, patients diagnosed with asthma. For this study, we considered it appropriate to include only patients who tested positive for SARS-CoV-2 with reverse transcriptase polymerase chain reaction (RT-PCR) and analysed demographic characteristics, hospitalization data, comorbidities (high blood pressure, dyslipidaemia, diabetes mellitus, smoking), and mortality.

RESULTS

A total of 6,310 patients were diagnosed with SARS-CoV-2 infection, confirming their positivity by RT-PCR. 577 were diagnosed with asthma, resulting in a prevalence of 9.14%. The mean age of SARS-CoV-2 (SC2) patients was 59 ±19 years and of asthmatic SARS-CoV-2 (SC2-A) 55 ±20 years. Among SC2 2,983, (41%) were men, while 3,327 (59%) women, among SC2-A 198, (31%) were men, while 379 (69%) were women. In the analysis of comorbidities we found the following data when analysing SC2/SC2-A: High blood pressure 3239 (51%) / 296 (51%), dyslipidaemia 2283 (36%) / 216 (37%), diabetes mellitus 1641 (26%) / 142 (25%) and smoking 873 (14%) / 103 (18%) (Table I).

Hospitalization was required for 2,164 (34.2%) SC2 and 131 (22.7%) SC2-A, with a prevalence of 6.05% of hospitalised asthmatics. The mean age of hospitalized patients was 68±17 years in SC2 and 64±17 years in SC2-A. Gender distribution in SC2 was 912 (42%) women, and 1,252 (58%) men, and in SC2-A 79 (60%) women and 52 (40%) men. The average hospital stay was 5.5 days for both groups. In these hospitalizations there were 10 deaths (7.6%) in SC2-A and 203 in SC2 (9.3%). The analysed comorbidities presented the following SC2/SC2-A figures: High blood pressure 1,253 (58%)/ 73 (56%), dyslipidaemia 761 (35%)/49 (37%) diabetes mellitus 574 (27%)/ 27 (21%)/, and smoking 137 (6%) / 9 (7%) (Table II)

Deaths in the SC2 population were 250 (3.96%), with an average age of 73±12 years, 158 (63%) men and 92 (37%) women, who presented 200 (80%) arterial hypertension, 137 (55%) dyslipidaemia, 110 (44%) diabetes mellitus and 45 (18%) smoking. In the SC2-A population there were 21 (3.64%) deaths, with an average age of 71±10 years, being 10 (52%) men and 11 (52%) women and associating 16 (76%) high blood pressure, 14 (67%) dyslipidaemia, 5 (24%) diabetes mellitus, and 5 (24%) smoking (Table III).

DISCUSSION

Our cohort is one of the first studies in Europe to describe the prevalence of infection, hospitalization and morbidity/mortality of asthmatic patients with SARS-CoV-2 infection.

The prevalence of infections in our asthmatic population is 9.14% similar to that obtained in a review of patients hospitalized with COVID 19 in Spain (12). In the study by *Chibba et al.* , the prevalence of SARS-CoV-2 infection in asthmatic patients in the Chicago, Illinois area, requiring hospitalization or not was 14.4% (6). These data suggest that the prevalence may vary by geographical area. In both groups (SC2/SC2-A) the average age is in the range of 50-60 years. There is a higher percentage of women in infected patients with asthma, in those requiring hospitalization, and in deaths. In SC2, hospitalization and death occurred more frequently in men (Tables II and III).

Mortality is lower in SC2-A. The average age in both groups is similar in a range of 71-73 years.

Of the analysed comorbidities, high blood pressure is the most common in both groups, dyslipidaemia and diabetes mellitus are similar in proportion, and smoking is more common in asthmatics. It is important to stress that these comorbidities may increase the risk of a more severe form of SARS-CoV-2 infection (7,17) and therefore increase mortality, although data analysis only found statistical significance with smoking.

There is controversy in the literature as to whether asthma is a comorbidity that increases the risk of a more severe form of SARS-CoV2 infection (8,9,15,16,23). The data from our study shows that there is lower mortality in the asthmatic population. A possible explanation is based on the fact that one of the targeted mechanisms of entry of the virus into the host cell is through the angiotensin converting enzyme 2 (ACE2) receptor, a process dependent on the TMPRSS2 protease, allowing the adhesion of the spike protein and performing the fusion between the virus and the membrane cells (19, 20, 21, 23). The possibility of a reduced expression of genes related to this receptor has been assessed in asthmatic patients. In the study by *Radzikowska et al.* , no difference was found between the expression of ACE2 in asthmatic patients with the general population (19). *Peters et al.* measured the expression of ACE2 and TMPRSS2 genes in sputum from asthmatic patients and found no difference compared with the general population, but when associating other variables such as male gender, black race, and a history of diabetes mellitus, their expression may show an increase (20). The use of inhaled corticotherapy in asthma, which is very widespread in our environment, could have a protective effect by decreasing the expression of the ACE2 receptor and the TMPRSS2 protein, although more studies are needed to prove this (20,21). To date, the recommendations for the asthmatic patient is to maintain their treatment trying to achieve the best therapeutic adherence (24).

We consider the limitations of our study to be retrospective and that it does not consider other variables that could influence the results, besides, the basic treatment of each asthmatic patient has not been assessed. The laboratory data that determine, to some extent, the evolution and severity of the SARS-CoV-2 infection have not been measured either. It is possible that there is a selection bias, as there is more surveillance of asthmatic patients, who are assumed to be more vulnerable, than on the general population and more RT-PCR determinations are made on them.

CONCLUSION

Our study shows a prevalence of asthma in the total number of SARS-CoV-2 infections in the Community of Castilla la Mancha of 9.14% and a hospitalization rate of 6.05%. High blood pressure is the most associated comorbidity analysed in both groups (SC2/SC2-A). We found a difference in mortality, being lower in asthmatics, although due to the small number of patients in this group, it does not reach statistical significance. More studies are needed to conclude whether asthma is a factor that increases the severity of the SARS-CoV-2 infection.

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TABLES

Table I: Characteristics of SARS-CoV-2 patients

	SARS-COV-2	SARS-COV-2 and Asthma	
Total patients	6310	577	
Mean age	59 ±19	55 ±20	MD 4±19 (CI 2,3;5,6 p<0,001)[1]
Gender (woman)	3327 (59%)	379 (66%)	OR 1,72 (CI 1,4;2) p<0,001[2]
Mortality	250 (3,96%)	21 (3,64%)	OR 1.00 (CI 0,6;1,7) p=0,03[2]
HBP	3239 (51%)	296 (51%)	OR 1.00 (CI 0,8;1,1) p=0,98[2]
Dislypdaemia	2283 (36%)	216 (37%)	OR 1.00 (CI 0,8;1,2) p=0,54[2]
DM	1641 (26%)	142 (25%)	OR 1,10 (CI 0,7;1,3) p=0,46[2]
Smoking	873 (14%)	103 (18%)	OR 1,35 (CI 1,1;1,6) p=0,008[2]

MD: Mean difference, OR: Odds Ratio, CI: Confidence Interval, HBP: High Blood Pressure, DM: Diabetes mellitus, 1: Student's T-Test 2: Chi-square test

Table II: Characteristics of SARS-CoV-2 patients who required hospitalization

	SARS-CoV-2	SARS-CoV-2 and Asthma	
Total patients	2164 (34,2%)	131 (22,7%)	OR 0,56 (CI 0,46:0,59) p<0,001[2]
Mean Age	68±17	64±17	MD 4 (CI -1;-7) p < 0,01[1]
Gender (woman)	912 (42 %)	79 (60%)	OR 2,09 (CI 1,46:2,99) p<0,001[2]
Mortality	203 (9,3%)	10 (7,6%)	OR 0,81 (CI 0,41;1,55) p=0,50[2]
HBP	1253 (58%)	73 (56%)	OR 0,92 (CI 0,64;1,30) p=0,62[2]
Dislypidaemia	761 (35%)	49 (37%)	OR 1,10 (CI 0,76;1,59) p=0,60 [2]
DM	574 (27%)	27 (21%)	OR 0,72 (CI 0,47;1,11) p=0,13[2]

Smoking	137 (6%)	9 (7%)	OR 1,09 (CI 0,54:2,19) p=0,81[2]

MD: Mean difference, OR: Odds Ratio, CI: Confidence Interval, HBP: High Blood Pressure, DM: Diabetes mellitus, 1: Student's T-Test 2: Chi-square test

Table III: Mortality in patients with SARS-CoV-2 infection

	SARS-CoV-2	SARS-CoV-2 and Asthma	
Total patients	250 (3,96%)	21 (3,64%)	OR 1 (CI 0,6;1,7) p=0,03[2]
Mean Age	73±12	71±10	OR 2 (CI -3,3; 7,3) p= 0,45[2]
Gender (woman)	92 (37 %)	11 (52%)	OR 1,89 (CI 0,77:4,62) p=0,15[2]
HBP	200 (80%)	16 (76%)	OR 0,80 (CI 0,28;2,29) p=0,67 [2]
Dislypidaemia	137 (55%)	14 (67%)	OR 1,65 (CI 0,64;4,23) p=0,29[2]
DM	110 (44%)	5 (24%)	OR 0,40 (CI 0,14;1,12) p=0,07[2]
Smoking	45 (18%)	5 (24%)	OR 1,42 (CI 0,50:4,09) p=0,51[2]

MD: Mean difference, OR: Odds Ratio, CI: Confidence Interval, HBP: High Blood Pressure, DM: Diabetes mellitus, 1: Student's T-Test 2: Chi-square test

GRAPHICS

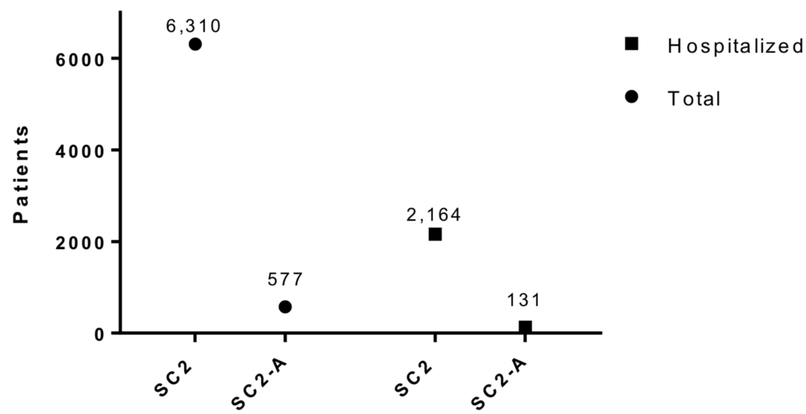

Fig.1 Total analized patients with RT-PCR positive for SARS-CoV-2.
SC2: SARS-CoV-2 SC2-A: SARS-CoV-2 and asthma

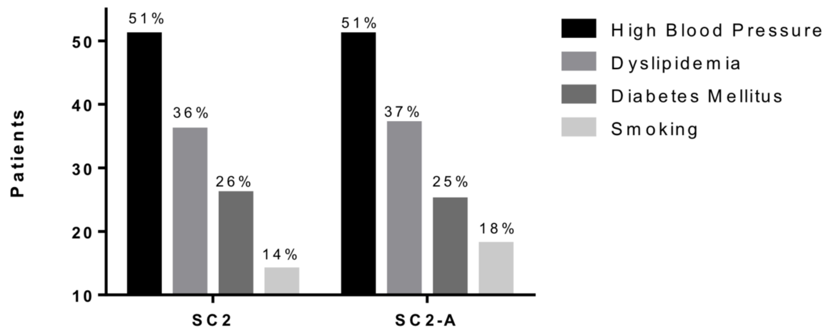

Fig.2 Proportion of present comorbidities in total patients.
SC2: SARS-CoV-2 SC2-A: SARS-CoV-2 and asthma

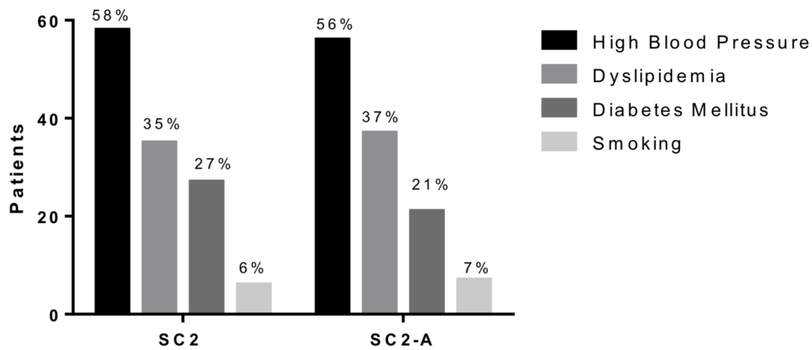

Fig.3 Proportion of present comorbidities in hospitalized patients.
SC2: SARS-CoV-2 SC2-A: SARS-CoV-2 and asthma

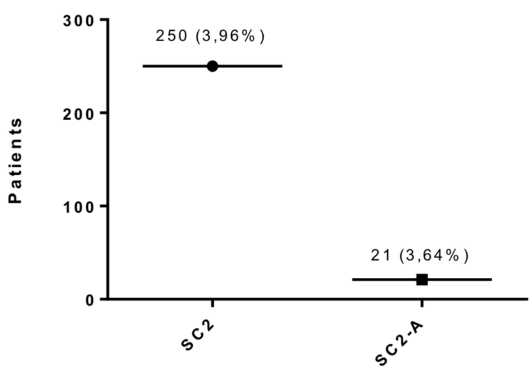

Fig.4 Deaths in the total analized population with RT-PCR SARS-CoV-2 positive.
SC2: SARS-CoV-2 SC2-A: SARS-CoV-2 and asthma