Asthma and COVID-19 - A systematic review

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Short report

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Abstract

Background

Severe coronavirus disease-19 (COVID-19) presents with progressive dyspnea, which results from acute lung inflammatory edema leading to hypoxia. As with other infectious diseases that affect the respiratory tract, asthma has been cited as a potential risk factor for severe COVID-19. However, conflicting results have been published over the last few months and the putative association between these two diseases is still unproven.

Methods

Here, we systematically reviewed all reports on COVID-19 published since its emergence in December 2019 to May 18, 2020, looking into the description of asthma as a premorbid condition, which could indicate its potential involvement in disease progression.

Results

We found 169 articles describing the clinical characteristics of 36,072 patients diagnosed with COVID-19. Asthma was reported as a premorbid condition in only 655 patients accounting for 1.8% of all patients.

Conclusions

As the global prevalence of asthma is 4.4%, we conclude that either asthma is not a premorbid condition that contributes to the development of COVID-19 or clinicians and researchers are not accurately describing the premorbidities in COVID-19 patients.

Background

COVID-19 was first reported in December, 2019 in Wuhan, China, and rapidly spread across the globe (1). It has affected more than 8.9 million people and has led to the death of over 460 thousand as of June 21, 2020 (www.who.org). Severely affected patients present fever, dry cough, dyspnea, and fatigue, which are commonly associated with the development of pneumonia and acute respiratory distress syndrome (ARDS) (2). Advanced age, ischemic and congestive heart disease, hypertension, diabetes, and chronic obstructive pulmonary disease (COPD) are the most important independent predictors of death (2, 3). As with other infectious diseases affecting the lungs, asthma has been cited as a potential risk factor for severe COVID-19 (4-6); however, no previous study has addressed this specific question looking into all studies that described the clinical features of COVID-19 patients.

Here, we systematically reviewed all studies published on COVID-19 since its emergence in December 2019 to May 18, 2020, looking into the description of asthma as a premorbid condition and its putative association with severe progression of the disease. We show that out of 36,072 patients diagnosed with COVID-19 and having their premorbid conditions described, only 1,8% were reported as previously diagnosed with asthma.

Methods

This is a systematic review of the diagnosis of asthma as a premorbid condition in patients with COVID-19. The report was organized according to the Preferred Reporting Items for Systematic Reviews (7). Two authors, NFM and CPJ, independently identified cross-sectional and longitudinal studies published before May 18, 2020, that reported on the prevalence of asthma as a premorbid condition of severe COVID-19 by systematically searching PubMed-NCBI, Google Scholar, Scopus and Web of Science databases. As previously reported, PubMed-NCBI alone covers more than 90% of MEDLINE providing a widely accessible biomedical resource (8). For database searches, language of the article was restricted to English. Search terms included the following: *COVID-19 (COVID, COVID 19)* or *nCov* or *novel coronavirus* or *Sars-Cov-2* in the title and *clinical characteristics* or *asthma* anywhere in the text. Three authors, EM, EPA, and LAV, resolved eventual discrepancies by discussion and adjudication.

We found 459 articles that met the initial inclusion search criteria. All articles were assessed by authors and 290 were excluded (Supplementary Table 1) due to one or more of the following criteria: editorials; metanalyses; systematic reviews; commentaries; letters to the Editor; no description of patient's clinical characteristics or premorbid conditions; and main text in a language other than English. The remaining 169 articles were included in the study. Supplementary Table 2 depicts the details of all articles analyzed.

Two authors, NFM and CPJ, independently extracted the following data from each article using a standardized form: study design; number of patients with COVID-19; mention of any respiratory disease; number of patients with any respiratory disease; mention of asthma; number of patients with the previous diagnosis of asthma. The entire body of the articles was presented descriptively.

Results

Figure 1 is a schematic representation of search, inclusion and exclusion of articles. Our search criteria resulted in the identification of 459 articles that were pre-selected for detailed analysis resulting in the exclusion of 290 articles (Suppl. Table 1) due to one or more of the following reasons: editorials; metanalyses; systematic reviews; commentaries; letters to the Editor; no description of patient's clinical characteristics or premorbid conditions; and main text in a language other than English. The remaining 169 articles (Suppl. Table 2) described the clinical aspects of 36,072 COVID-19 patients. One hundred and seven studies mentioned the existence of other respiratory premorbidities except for asthma. Asthma was mentioned as a premorbid condition in only eighteen studies (Table 1). There was a total of 8,690 patients included in the studies mentioning asthma, of which 655 patients were previously diagnosed with asthma. In most of the studies describing other respiratory illnesses, COPD was the leading diagnosis.

Table 1
Details of the articles that mention asthma.

Citation	Title	DOI	Mention to respiratory disease except from asthma	Number (%) respiratory disease except from asthma	Mention of asthma	Number (%) asthma patients	Number COVID-19 patients
Aretz M, et al. 2020	Characteristics and Outcomes of 21 Critically Ill Patients With **COVID-19** in Washington State	10.1001/jama.2020.4326	Yes	COPD: 7 (33.3%)	Yes	2 (9.1%)	21
Bhatraju PK, et al. 2020	**Covid-19** in Critically Ill Patients in the Seattle Region — Case Series	10.1056/NEJMoa2004500	Yes	COPD: 1 (4%)	Yes	3 (12.5%)	24
Chao JY, et al. 2020	Clinical Characteristics and Outcomes of Hospitalized and Critically Ill Children and Adolescents with **Coronavirus Disease 2019 (COVID-19)** at a Tertiary Care Medical Center in New York City	10.1016/j.jpeds.2020.05.006	No	-	Yes	11 (24.4%)	46
Duanmu Y, et al. 2020	Characteristics of Emergency Department Patients With **COVID-19** at a Single Site in Northern California: Clinical Observations and Public Health Implications	10.1111/acem.14003	Yes	COPD: 1 (10%)	Yes	10 (10%)	100
Fan J, et al. 2020	The epidemiology of reverse transmission of **COVID-19** in Gansu Province, China.	10.1016/j.tmaid.2020.101741	Yes	COPD: N/A	Yes	N/A	37
Ferguson J, et al. 2020	Characteristics and Outcomes of Coronavirus Disease Patients under Nonsurge Conditions, Northern California, USA, March-April 2020	10.3201/eid2608.201776	Yes	COPD: 10 (13.9%) same patients with asthma	Yes	10 (13.9%)	72
Fernandéz R, et al. 2020	**COVID-19** in Solid Organ Transplant Recipients: A Single-Center Case Series From Spain	10.1111/ajt.15929	No	-	Yes	1 (5.55%)	18

Citation	Title	DOI	Mention to respiratory disease except from asthma	Number (%) respiratory disease except from asthma	Mention of asthma	Number (%) asthma patients	Number COVID-19 patients
Gold JAW, et al. 2020	Characteristics and Clinical Outcomes of Adult Patients Hospitalized With **COVID-19** - Georgia, March 2020	10.15585/mmwr.mm6918e1	Yes	COPD: 16 (5.2%)	Yes	32 (10.5%)	305
Lechien JR, et al. 2020	Clinical and Epidemiological Characteristics of 1,420 European Patients With Mild-To-Moderate **Coronavirus Disease 2019**	10.1111/joim.13089	Yes	Respiratory insufficiency 10 (0.7%)	Yes	93 (6.5%)	1420
Li X, et al. 2020	Risk factors for severity and mortality in adult **COVID-19** inpatients in Wuhan	10.1016/j.jaci.2020.04.006	Yes	COPD: 17 (3.1%)	Yes	5 (0.9%)	548
Merza MA, et al. 2020	**COVID-19** outbreak in Iraqi Kurdistan: The first report characterizing epidemiological, clinical, laboratory, and radiological findings of the disease.	10.1016/j.dsx.2020.04.047	Yes	Bronchitis: 2 (13.3%) same patients with asthma	Yes	2 (13.3%)	15
Richardson S, et al. 2020	Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With **COVID-19** in the New York City Area.	10.1001/jama.2020.6775	Yes	COPD: 287 (5.4%)	Yes	479 (9%)	5700
Sultan I, et al. 2020	The Role of Extracorporeal Life Support for Patients With COVID-19: Preliminary Results From a Statewide Experience	10.1111/jocs.14583	No	-	Yes	N/A	10
Wang X, et al. 2020	Nosocomial Outbreak of **2019 Novel Coronavirus** Pneumonia in Wuhan, China	10.1183/13993003.00544-2020	No	-	Yes	2 (5.7%)	35

Citation	Title	DOI	Mention to respiratory disease except from asthma	Number (%) respiratory disease except from asthma	Mention of asthma	Number (%) asthma patients	Number COVID-19 patients
Yao Q, et al. 2020	Retrospective Study of Risk Factors for Severe **SARS-Cov-2** Infections in Hospitalized Adult Patients	10.20452/pamw.15312	Yes	Pulmonary disease (bronchiectasis, COPD or asthma): 3 (2.8%)	Yes	3 (2.8%) same patients with other pulmonary diseases	108
Zhang JJ, et al. 2020	Clinical characteristics of 140 patients infected with **SARS-CoV-2** in Wuhan, China	10.1111/all.14238	Yes	COPD: 2 (1.4%)	Yes	0	140
Zhang L, et al. 2020	Clinical Characteristics of **COVID-19**-infected Cancer Patients: A Retrospective Case Study in Three Hospitals Within Wuhan, China	10.1016/j.annonc.2020.03.296	Yes	COPD: 1 (3.5%) same patient with asthma	Yes	1 (3.5%)	28
Zhou X, et al. 2020	Clinical Characteristics of **Coronavirus Disease 2019 (COVID-19)** Patients With Hypertension on Renin-Angiotensin System Inhibitors	10.1080/10641963.2020.1764018	Yes	COPD:3 (2.7%)	Yes	1 (0.9%)	110

Thus, according to current COVID-19 clinical records, 7.5% of patients included in articles describing the clinical characteristics of COVID-19 patients and citing asthma were previously diagnosed with asthma (Fig. 2A). If all studies providing any clinical description of COVID-19 comorbidities are taken into consideration, asthma was present in only 1.8% of patients (Fig. 2B).

Discussion

Asthma is a highly prevalent, chronic, non-communicable disease that affects up to 4.4% of the world's population (http://www.globalasthmareport.org; https://www.who.int/news-room/q-a-detail/asthma). Its recurrent nature leads to frequent hospitalizations and high mortality, ranging from 2 to 4/100,000 (9). Respiratory viruses can trigger asthma exacerbations, which can increase the severity of the infectious condition (10). In the past, coronaviruses have been implicated as triggers of asthma exacerbations (11, 12). However, as for the new coronavirus, SARS-CoV-2, there is still controversy regarding the putative role of asthma as a premorbid that could worsen disease progression.

Here, we evaluated all studies on COVID-19 published since its emergence up to May 18, 2020. We showed that asthma was described as a premorbid condition in only 1.8% of all patients. These numbers are far less than expected considering the prevalence of asthma in the world (http://www.globalasthmareport.org; https://www.who.int/news-room/q-a-detail/asthma). Thus, asthma does not seem to be an important premorbid condition in COVID-19 patients; or, conversely, it could be a protective factor, as previously proposed (13). The findings herein reported could be an epidemiological truth that should be further explored in mechanistic studies or could be due to the fact that researchers are not properly investigating and describing the premorbidities in COVID-19 patients. Whatever the reasons, the medical community should be aware of the implications of missing the diagnosis of a potentially severe respiratory disease such as asthma that could worsen the prognosis of COVID-19 patients.

Declarations

Ethics approval and consent to participate.

The study does not require ethical approval because the systematic review is based on published research and the original data are anonymous.

Consent for publication.

Authors are the sole responsible for the publication of this study.

Availability of data and materials.

Data are available upon request.

Competing interests.

Authors have no competing interests to declare.

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Authors' contributions.

NFM and CPJ performed article search and first round of inclusions. EM, EPA and LAV performed second round of inclusion. LAV and NFM performed statistics analysis. LAV and NFM wrote the manuscript. All authors read manuscript and provided approval.

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Figures

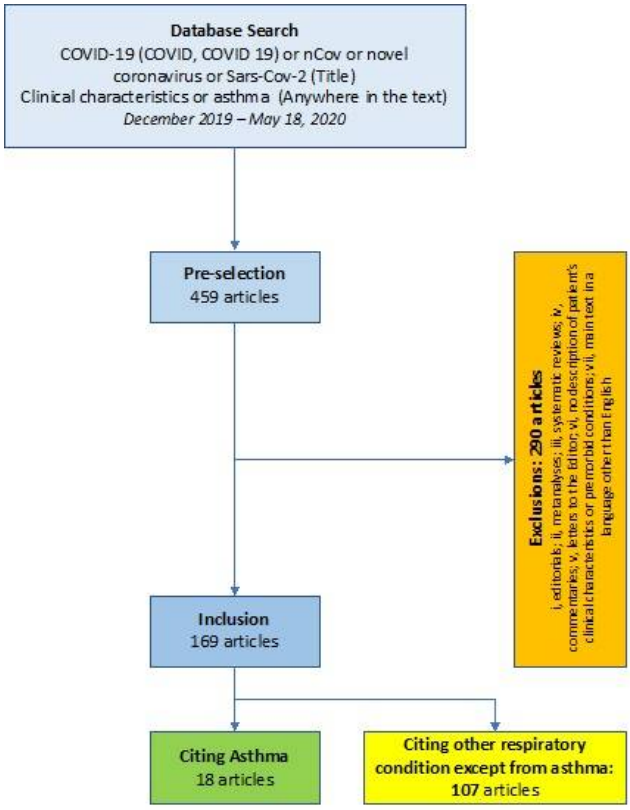

Figure 1

Schematic representation of search, exclusions and inclusions of articles.

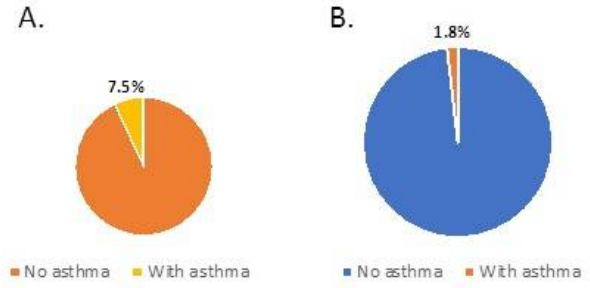

Figure 2

Graphic representation of the proportion of patients with previous diagnosis of asthma among COVID-19 patients included in studies citing asthma (A) and among all COVID-19 patients described up to May 18, 2020 (B).