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Systematic review and meta-analysis

A Systematic Review and Meta-Analysis on role of Asthma on Mortality rate of Patients with COVID-19

Authors

1. **Dr Avineet Kaur,** MDS
Senior Lecturer, Department of Periodontology and Oral Implantology
Swami Devi Dyal dental college and hospital (Haryana), India

2. **Dr Avneet Singh Setia**, MBBS MS
Senior Resident, Department of Surgery
Sri Guru Ram Das Institute of Medical Sciences and Research Amritsar (Punjab)

3. **Dr Akanksha Kashyap,** MDS
Senior Lecturer, Department of Periodontology
Babu Banarasi Das College Of Dental Sciences, Lucknow(Uttar Pradesh)

4. **Dr Harnoor Singh Sandhu,*** MBBS (**Corresponding author)**
Emergency medical officer, Department of Emergency
Gian sagar medical hospital Banur , Rajpura (Punjab)
harnoor775@gmail.com

5. **Dr Iqra Khilji**, BDS
Medical officer (Dental), Hazrat Haleema Maternity and General Hospital
Garewal chowk , Malerkotla(Punjab)

6. **Dr Kanwar shabaz Singh Sandhu**, MBBS
Junior resident, Department of Surgery
Adesh Medical College and Hospital Mohri , Ambala(Haryana)

Abstract

Purpose: This meta-analysis and systematic review was conducted to highpoint the current literature and establish data relating the mortality of coronavirus disease 2019 (COVID-19) in patients with and without asthma.

Search criteria: The Scopus, Embase, PubMed, medRxiv. org and Google Scholar databases were explored for studies associating the clinical results with and without asthmatic patients diagnosed with COVID-19. Mortality data were summarizing with the Mantel-Haenszel OR with 95% CI in a random-effects model. Five retrospective studies encountered the inclusion criteria. A meta-analysis of data from 1181 asthmatic patients and 8,847 nonasthmatic patients specified that the presence of asthma had no extensive consequence on mortality rate (OR = 0.96; 95% CI 0.70–1.30; I^2 = 0%; p = 0.79).

Result: Results were steady in a sensitivity analysis. A descriptive examination of other clinical outcomes selected no modification in the duration of hospitalization and the risk of intensive care unit (ICU) transfer between asthmatic and nonasthmatic patients.

Conclusion: Asthma may not upsurge the mortality of COVID-19.

Keywords: Asthma, covid-19, mortality

Introduction

Coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It was first identified in December 2019. Since then, COVID-19 has quickly infected patients in various countries worldwide [1]. Patients with this disease usually shows symptoms like fatigue, fever, sore throat, dry cough, and breathing difficulty [2]. Majority may presents with pneumonia with characteristic findings on chest computed tomography (CT) [3]. Several clinical studies have recognized diabetes mellitus, hypertension, chronic obstructive pulmonary disease, obesity and cardiovascular disease as risk aspects for worsening the condition with COVID-19 [4, 5].

Asthma is a collective pulmonary disease, upsetting around 8–9% of the population of the USA [6]. It is well recognized that viral infections can result in to stimulation of asthma [7]; however, it is still uncertain whether asthma results to an increased vulnerability to COVID-19 or worsening of clinical outcomes [8]. Zhang et al. [9] described from his study that allergic diseases and asthma are not risk factors for the growth of COVID-19 infection. Nevertheless, the US Centers for Disease Control and Prevention (CDC) has directed that moderately to severely asthmatic patients may have a higher risk of COVID-19, while there is no present suggestion to support that statement [10].

Since SARS-CoV-2 mainly affects the lungs, there is a necessity to understand whether chronic respiratory diseases like asthma increase the mortality of COVID-19 patients. Therefore, this systematic review and meta-analysis was done to discover the literature and organize data associating the mortality of COVID-19 patients with and without asthma.

Materials and methods

Inclusion criteria

This study included both peer-reviewed and non-peer-reviewed studies, comparative studies on clinical outcomes of asthmatic patients with those of nonasthmatic patients diagnosed with COVID-19. The exclusion norms were; studies not separating the cohort into asthmatics and nonasthmatics; studies not reporting clinical outcomes, studies with smaller than ten patients in the asthmatic group, case reports, case series, and review articles, and studies in other than English language.

Search strategy

In present study an electronic search on the Scopus, Google Scholar, PubMed, Embase, and MedRxiv.org database for peer-reviewed article which encounters our inclusion criteria were encompassed. The last search was performed on August 25, 2020. Three independent investigators carried out the database search using the following keywords in several combinations: asthma, COVID, COVID-19, Coronavirus, and SARS-CoV-2. The full texts of relevant articles were taken-out and evaluated based on the inclusion measures.

Data Extraction

A data abstraction form was used to extract the following details: authors, demographic data, study type, publication year, country of origin, comorbidities and smoking, history of corticosteroid use, number of patients hospitalized, and study outcomes. The primary outcome of consideration was to evaluate the mortality of COVID-19 patients with asthma versus nonasthmatics. All other outcomes reported by the encompassed studies were examined descriptively. For evaluating the risk of bias, the risk of a bias assessment tool for nonrandomized studies (RoBANS) was used [11].

Statistical Analysis

The software Review Manager (RevMan, version 5.2; Nordic Cochrane Centre [Cochrane Collaboration], Copenhagen, Denmark; 2014) was used for the meta-analysis. Mortality data were brief with the Mantel-Haenszel OR with 95% CI in a random-effects model. When the OR was stated in the included study, the data was directly collected; otherwise, the OR was calculated using the meta-analysis software itself by entering the number of deaths and the sample size. Heterogeneity was considered using the I^2 statistic. I^2 values of 25–50% represented a low heterogeneity, values of 50–75% represented a medium heterogeneity, and values >75% represented substantial heterogeneity.

Results

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses)[12] was used in the study. A total of 342 unique records were identified. After a full-text analysis, a total of five studies encountered the inclusion criteria [13-17]. The characteristics of the studies included in this review are presented in Table 1. All 5 were published after peer review and no preprints were included in this study. The author's judgment of the risk of bias in the included studies is presented in online supplementary Table 1. Two studies reported data from the USA [14, 17], 1 reported data from Spain, Korea, and France [13, 15, 16]. A total of 767 asthmatic patients were compared with 8,234 nonasthmatic patients in the included studies. None of the studies reported statistically significant differences in the age of the study cohorts. Three reported data on other comorbidities. [14] The same study also reported a higher number of patients with obesity and current smokers in the asthmatic cohort. In 2 studies [13, 16], all patients in both groups were hospitalized, while in another 2 [14, 17] both hospitalized and nonhospitalized patients were included in the study groups. Three studies [13, 16, 17] described data on the number of intubated patients, with none recording significant alterations between the study groups. The use of corticosteroids in the asthma group was varied from 4.34 to 45.45%.

Table-1: Details of included studies

Included Studies	Country	Sample size		Age		Smoking condition		Hospitalized		Intubated	
		Y	N	Y	N	Y	N	Y	N	Y	N
Barroso et al [13]	Spain	11	178	57.7±14.6	68±13	1	18	11	178	2	30
Chhiba et al [14]	USA	220	1306	40-70	40-70	10	43	115	738	NR	NR
Lee et al [15]	Korea	686	6586	20-60	20-60	NR	NR	163	27	NR	NR
Grandbastien et al [16]	France	23	83	49-69	56-72	1	5	23	83	21	1
Mahdavinia et al [17]	USA	241	694	18-65	18-65	NR	NR	73	224	3	56

Y- with asthma N- without asthma

Consequences

Mortality data was defined by four studies [13-15, 17]. A meta-analysis of data from 1181 asthmatic patients and 8,847 nonasthmatic patients designated that occurrence of asthma had no substantial result on mortality (OR = 0.96; 95% CI 0.70–1.30; I^2 = 0%; p = 0.79) (Table-2). The results of the compassion investigation are presented in Table 3. There was no change in the implication of the results after the singular omission of the included studies.

Table-2: Sensitivity investigation

Excluded studies	Effect size
Barroso et al 13	OR=0.92, 95% CI 0.63-1.28; I^2= 5%; p=0.72
Chhiba et al 14	OR=1.03, 95% CI 0.68-1.32 ; I^2=0% , p=0.92
Lee et al [15]	OR=2.63 , 95% CI 0.49-2.28, I^2= 17%, *p=0.73*
Mahdavinia et al [17]	OR=0.97, 95% CI 0.57-1.23, I^2=0%, *p=0.53*

The details of outcomes assessed with the involved studies shown in Table 3. Three studies [13, 16, 17] estimated the duration of hospitalization between the two groups, and no study described extended hospital stay with asthma. Data on the risk of intensive care unit (ICU) transfer was informed

by 2 studies [13, 16] and none of them state any significant alteration between asthmatics and nonasthmatics. Mahdavinia et al. [17] deliberated the risk of acute respiratory distress syndrome in both cohorts and reported no statistically substantial variance; however, they establish a significantly continued duration of intubation in asthmatics. Chhiba et al. [14] described no alteration in the risk of hospitalization between asthmatics and nonasthmatics. Lee et al concluded from their study that asthma was not a potential risk factor for respiratory failure or mortality among all COVID-19 patients. [15]

Table-3: outcomes evaluated with the included studies

Research	**Study out come**
Barroso et al [13]	Hospitalization duration along with asthma was 9.7±14 days and 10.9±9.6 without asthma, it was statistically not significant difference among both the groups.
Chhiba et al [14]	Risk of hospitalization with asthma was associated with increased risk (RR=0.9 95% CI 0.7)
Lee et al [15]	ICU care rates in the asthma group were significantly higher (3.9% vs. 2.4%, $P = 0.022$) than in the non-asthma group (OR = 2.63, $P = 0.043$) it was due to higher age of asthma group
Grandbastien et al [16]	No significant difference between patients with and without asthma in terms of severity (length of stay, maximal oxygen flow needed, noninvasive ventilation requirement, and intensive care unit transfer) (OR-1.61 95% CI 0.058-0.45)
Mahdavinia et al [17]	Asthma was independently associated with prolonged duration of intubation for coronavirus disease 2019.

Discussion

Upon investigation of data from an inadequate number of studies, our findings specify that asthma may not raise the mortality of patients with COVID-19. A descriptive investigation of further limited evidence proposes that asthma as a comorbidity may not have a significant role in continuation of the hospital stay or an increase in the risk of ICU transfer.

The growing number of COVID-19 cases has intimidated the healthcare setups worldwide. Numerous countries information have shown that the occurrence of a comorbidity expressively increases the number of deaths in patients with COVID-19 [18-20]. Kim et al. [18], in their findings of 2,491 COVID-19 patients, designated that patients with 3 or more underlying conditions had a 1.3 times upper risk of ICU admission and a 1.8 times higher risk of in-hospital mortality.

Upon systematic examination of the literature, we found only 5 studies carrying out a head-on comparison of outcomes in asthmatics versus nonasthmatics. A collective investigation of data designated that the presence of asthma did not significantly increase the odds of death as compared to patients without asthma. The finding of our meta-analysis was stable on sensitivity analysis, with no change in the significance of exclusion of any of the included studies.

Data from previous SARS epidemics have produced contrasting results in terms of the influence of asthma on the outcomes of such respiratory infections. Studies on the 2003 SARS epidemic have stated that asthmatics had a condensed susceptibility to the coronavirus with a good overall prognosis [21]. On the other hand, data from the 2009 H1N1 pandemic indicates that asthma was connected with more severe disease and an improved need for intrusive ventilation [22]. Likewise, Mendy et al. [23], in a report of 689 patients, found higher odds of disease severity (OR = 3.11; 95% CI 1.67–5.80) in asthmatics over nonasthmatics. Standard data of patients with and without asthma was, nevertheless, not

available from these studies. Izquierdo et al found that asthma patient with COVID-19 were older and at increased risk due to comorbidity-related factors. [24]

Our review has some confines such as; data was obtained only from an incomplete number of studies in this review. Conversely, our study presents the meta-analysis analyzing the influence of asthma on outcomes of COVID-19 patients. Preliminary data specify that asthma as a comorbidity may not increase the mortality of COVID-19. Data on the influence of asthma on the risk of hospitalization, the duration of hospitalization, the prerequisite of ICU admission, and disease severity is still too inadequate to draw any strong conclusions. Further studies with a greater sample size are essential to establish strong evidence.

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