



Cardiovascular outcomes and Dental care of COVID-19: a systematic review and met analysis

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Abstract

Background and aim: The aim of this study was to investigate the relationship between cardiovascular disease, Dental care and COVID-19.

Method: In this systematic review and meta-analysis study, all English-language full-text articles published in international databases that listed the words COVID-19, SARS-COV-2, patients with COVID-19, Cardiovascular in PubMed, Scopus, Science Direct databases, Embase were reviewed between January 2019 and May 2022. Data analysis was performed using STATA.V16 software.

Result: According to result Patients with cardiovascular disease are directly related to the progression of Covid-19 disease 1.07 (OR; 95% CI 0.89 to 1.26; p=0.00). Mortality rate is directly related to cardiovascular disease and in these patients the mortality rate is higher (OR; 95% CI 0.57 to 1.17; p=0.00).

Conclusion: The findings of the present study indicate that patients with cardiovascular disease are associated with an increased risk of Covid-19 disease severity and death.

KeyWords: coronavirus disease 2019, COVID-19, Cardiovascular

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Introduction

December 29, 2019 an anonymous case of pneumonia was reported in Wuhan, China, which was clinically very similar to viral pneumonia. Shortly after the investigation, the World Health Organization named the mysterious virus Covid-19, and the International Committee for Classification of Viruses named it SARS-CoV-2 (1, 2). The virus is a coated virus with a single-stranded ribonucleic acid genome that uses the angiotensin-2-converting enzyme cell receptor to enter target cells. Covid-19 is said to be a chimeric virus between bat coronavirus and coronavirus of unknown origin(3). As of 25 May 2022, there have been 524,339,768 confirmed cases of COVID-19,

11,811,627,599 vaccine doses have been administered reported to World Health Organization(4). The virus is mainly propagated in the upper respiratory tract; but at the same time, it can lead to lesions in this area by tending to cells located in the lower respiratory tract and proliferating in these areas (3). Clinical symptoms are mild in about four-fifths of patients with the disease, and severe symptoms are seen in less than 15% of patients. In 5% of cases, the patient's condition worsens, which is associated with respiratory failure, infectious shock and failure in other organs of the body (5). The aim of this study was to investigate the relationship between cardiovascular disease, Dental care and COVID-19.

including 6,281,260 deaths and a total of

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Method

This study is a systematic review and meta-analysis (The PRISMA guide was used for this study) that was conducted in 2022. Searches in PubMed, Scopus, Science Direct databases, Embase were conducted to identify related articles from January 2019 to May 2022. The search terms "Coronavirus 2019", "COVID-19", " Cardiovascular ", "Cardiovascular Infections", "Cardiovascular Abnormalities", "Models, Cardiovascular", "Cardiovascular Diseases", "Heart Disease Risk Factors", "Myocardial Infarction", "Cardiology" were used, which were adjusted based on the mesh term. All articles were reviewed and the extracted data were categorized.

Inclusion and exclusion criteria

RCT studies, cohort studies and Observational studies; Patients with cardiovascular disease, mortality rate and severe COVID-19 outcome. Letter studies to the editor, without full text, review studies, laboratory and in-vitro studies were not included in the study.

The "data extraction form" designed by the researchers based on the purpose of the research was used to review the articles. The form included sections such as author name, year of publication, Number of Patients with cardiovascular disease, number of patients, age of patients and outcome. Data analysis was performed using STATA.V16 software. I² index test was used to evaluate the level of heterogeneity (I²< 50% = low levels, 50<I²< 75% = moderate and I²>75% = high levels). 95% confidence interval on the odds ratio were done with fixed effect model and Mantel-Haenszel method.

Result

The initial search result was 713 articles, of which 195 were deleted due to lack of inclusion criteria; of the articles, 84 were deleted due to reprints in other journals and duplication. Of the remaining 434 articles, after deleting articles in accordance with the exclusion criteria (230 articles), the full text of 204 articles that met the inclusion criteria were prepared and reviewed, 188 studies that were not in line with the purpose of the study were removed 16 articles were included in the study. The flowchart of the review and entry stages of the papers is shown in Figure 1.

Data collection and data analysis

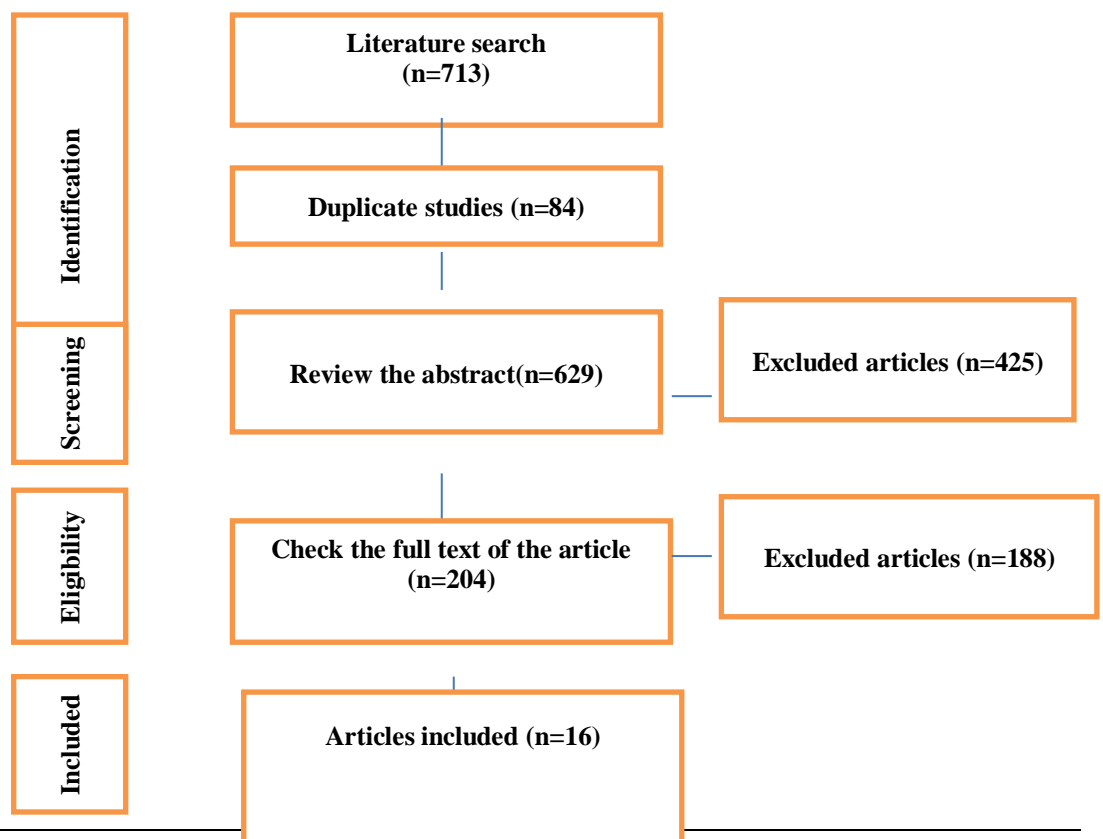


Figure 1. PRISMA flowcharts**Characteristics**

Sixteen studies that evaluate cardiovascular outcomes of COVID-19 were included in the study. The Number of participants a total 14135 (Table 1). 1315 Patients were with cardiovascular disease, 666 Severe cardiovascular disease and 570 Non-severe cardiovascular.

Risk of bias

According to Newcastle-Ottawa Scale (NOS), all studies had low risk of bias (Table 2). In statistics, the Newcastle-Ottawa scale is a tool used for assessing the quality of non-randomized studies included in a systematic review and/or meta-analyses(6).

Table1. Summary of selected studies data

No.	Study. Years	Study design	Number of Patients	cardiovascular disease patients	Severe	Non-severe
1	Rodriguez et al., 2021(7)	Retrospective observational study	8950	730	367	284
2	Zhan et al., 2020 (8)	Retrospective observational study	405	156	77	79
3	Chen et al., 2020 (9)	Retrospective observational study	145	1	1	0
4	Cocconcelli et al., 2020 (10)	Retrospective observational study	102	60	25	35
5	Cen et al., 2020 (11)	Retrospective observational study	1007	65	34	31
6	Li et al., 2020 (12)	Retrospective observational study	544	34	28	6
7	Goyal et al., 2020 (13)	Retrospective observational study	393	54	25	29
8	Huang et al., 2020 (14)	Retrospective observational study	202	5	1	4
9	Wan et al., 2020 (15)	Retrospective observational study	135	7	6	1
10	Shu et al., 2020 (16)	Retrospective observational study	571	12	3	9
11	Zhang et al., 2020 (17)	Retrospective observational study	140	12	8	4
12	Yang et al., 2020 (18)	Retrospective observational study	200	11	1	10
13	Wang et al., 2020	Retrospective	59	13	10	3

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	(19)	observational study				
14	Xie et al., 2020 (20)	Retrospective observational study	733	108	64	44
15	Ishii et al., 2020 (21)	Retrospective observational study	345	23	6	17
16	Khalil et al., 2020 (22)	Retrospective observational study	204	24	10	14

Table 3. Bias assessment (NOS tool)

Number of study	Selection (5 score)				Comparability (2 score)	Outcome (2 score)		Total score
	representative sample	Sample size	Non respondents	Ascertainment of the exposure	Based on design and analysis	Assessment of outcome	Statistical test	
Rodriguez et al., 2021(7)	*	*	*	*	*	*	*	*****
Zhan et al., 2020 (8)	*	*	*	*	**	*	*	*****
Cocconcelli et al., 2020 (10)	*	*	*	-	**	*	*	*****
Cen et al., 2020 (11)	*	*	*	**	**	*	*	*****
Xie et al., 2020 (20)	*	*	*	*	*	*	*	*****
Chen et al., 2020 (9)	*	*	*	*	*	*	*	*****
Wan et al., 2020 (15)	*	*	*	*	*	*	*	*****
Shu et al., 2020 (16)	*	*	*	*	*	*	*	*****
Zhang et al., 2020 (17)	*	*	*	**	**	*	*	*****
Ishii et al., 2020 (21)	*	*	*	*	*	*	*	*****
Huang et al., 2020 (14)	*	*	*	-	**	*	*	*****
Li et al., 2020 (12)	*	*	*	**	*	*	*	*****
Goyal et al., 2020 (13)	*	*	*	*	*	*	*	*****
Yang et al., 2020 (18)	*	*	*	*	*	*	*	*****
Khalil et al., 2020 (22)	*	*	*	-	**	*	*	*****
Wang et al., 2020 (19)	*	*	*	**	*	*	*	*****

Odds ratio was 1.07 (OR; 95% CI 0.89 to 1.26; p=0.00) and I² was 8.49% showed low heterogeneity (p=0.36) (Figure 2). According to result Patients with cardiovascular disease are directly related to the progression of Covid-19 disease (p=0.00). Odds ratio was 0.87 (OR; 95% CI 0.57 to 1.17; p=0.00) and I² was 7% showed high heterogeneity (p=0.00) (Figure 3). These findings showed that mortality rate is directly related to cardiovascular disease and in these patients the mortality rate is higher (p=0.00).

Discussion

According to the study, arrhythmia and sudden cardiac arrest are the most common manifestations of Covid-19. Heart palpitations have been reported to be the main symptom of Covid-19 disease in patients without fever or cough(23).



Study	CVD		No-CVD	
	events	No-events	events	No-events
Chen et al., 2020	1	0	42	102
Huang et al., 2020	3	3	10	25
Shu et al., 2020	3	9	23	536
Zhang et al., 2020	8	4	50	78
Zhan et al., 2020	77	79	71	178
Cocconcelli et al., 2020	25	35	6	36
Cen et al., 2020	34	31	253	689
Li et al., 2020	28	6	241	269
Goyal et al., 2020	25	29	105	234
Yang et al., 2020	1	10	28	161
Wan et al., 2020	6	1	34	94
Rodriguez et al., 2021	367	284	103	241

Overall
 Heterogeneity: $I^2 = 8.49\%$, $H^2 = 1.09$
 Test of $\theta = \theta$: $Q(11) = 12.02$, $p = 0.36$
 Test of $\theta = 0$: $z = 11.61$, $p = 0.00$

Fixed-effects Mantel-Haenszel model

Figure 2. Forest plot showed cardiovascular disease and severe COVID-19

Study	CVD		No-CVD	
	events	No-events	events	No-events
Rodriguez et al., 2021	11	1	24	80
Zhan et al., 2020	13	2	41	135
Wang et al., 2020	10	3	31	15
Xie et al., 2020	64	44	330	295
Chen et al., 2020	17	6	96	154
Ishii et al., 2020	6	17	17	305
Khalil et al., 2020	10	14	48	148

Overall
 Heterogeneity: $I^2 = 78.56\%$, $H^2 = 4.66$
 Test of $\theta = \theta$: $Q(6) = 27.99$, $p = 0.00$
 Test of $\theta = 0$: $z = 5.65$, $p = 0.00$

Fixed-effects Mantel-Haenszel model

Figure 3. Forest plot showed cardiovascular disease and COVID-19 mortality

According to the study, arrhythmia and sudden cardiac arrest are the most common manifestations of Covid-19. Heart palpitations have been reported to be the main symptom of Covid-19 disease in patients without fever or cough(24). In a cohort study of 138 patients with Covid-19 in Wuhan, China, cardiac arrhythmias were reported in 17% of all patients, 44% of whom were in the intensive care unit, but the type of arrhythmia was not recorded(25).According to

the present meta-analysis findings, a direct correlation was observed between the increase in disease severity and mortality of patients with cardiovascular diseases. Sudden in-hospital and out-of-hospital cardiac arrest have also been reported in patients with Covid-19(25, 26). On the other hand, studies show that in patients with Covid-19, acute myocardial damage is observed(27). Acute myocardial injury and other cardiovascular diseases are directly related to increased mortality in COVID-19 patients(28, 29). However, since arrhythmias, such as atrial and ventricular tachycardia and fibrillation, can be caused by myocardial injury or other systemic causes such as fever, sepsis, hypoxia, and electrolyte disturbances, and the exact contribution of Covid-19 to cardiac arrhythmias remains unclear. Covid-19 virus enters the cells of the lungs as well as the heart and arteries through the enzyme angiotensin-converting hormone 2(30). It has been shown that protein spikes on the surface of SARS-CoV-2 virus are ten to twenty times more likely than those of SARS-CoV-1, which became prevalent in 2003(31). ACE2 is the homologue of the angiotensin converting enzyme, which converts angiotensin II to angiotensin 1 to 7, thereby reducing the vasoconstriction produced by the renin-angiotensin system(32). The use of angiotensin converting enzyme inhibitors and angiotensin receptor blockers is common in cardiovascular disorders (hypertension, coronary artery disease, congestive heart failure)(33). However, ACE2 appears to play a protective role against acute lung injury. In a mouse model, binding of CoV-SARS spike protein to ACE2 decreased ACE2, which resulted in increased angiotensin II and ultimately increased pulmonary vascular permeability, pulmonary edema, and decreased lung function. Losartan is being investigated for possible reduction of lung injury in inpatients and outpatients with Covid-19(34). Dental treatment is well known a bioaerosol generating procedures and might have a higher risk of getting microbes infection. It is recommended to perform minimally invasive procedures during the COVID-19 crisis. The retreat course of infection control is necessary for dental health care team to rouse and maintain the standard operating procedures again. A review article demonstrated that COVID-19 could be detected in saliva specimen by real-time reverse transcription polymerase chain reaction.9 The prophylactic antimicrobial mouth rinses such as

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chlorhexidine gluconate, cetylpyridinium chloride, povidone-iodine, or hydrogen peroxide are suggested to decrease viral load in aerosols and drops before dental treatment. The application of rubber dam is also important to reduce infectious microbe contamination from saliva, serum, and blood. The use of high volume evacuation is highly recommended to efficiently reduce bioaerosols in the clinic environment.

At present, almost all major studies have emphasized not adding or stopping angiotensin converting enzyme inhibitors, angiotensin receptor blockers, or other renin angiotensin-aldosterone system antagonists, unless there is evidence of their potential benefit or harm in clinical settings. Crohn's disease does not take long to turn into a pandemic. Over the course of late December 2019, studies have shown that cardiovascular comorbidities are more common in patients with Covid-19 and that these patients are at greater risk for complications and mortality; However, it is not yet clear whether cardiovascular diseases pose a separate risk or whether they are associated with other factors such as age and sex. Lifestyle-preventable risk factors such as high blood pressure, hyperlipidemia, diabetes and obesity can predispose people to premature myocardial infarction. Metabolic syndrome, which is caused by insulin resistance, is also one of these factors.

Conclusion

The findings of the present study indicate that patients with cardiovascular disease are associated with an increased risk of Covid-19 disease severity and death. Therefore, these patients should be evaluated for Covid-19 disease. To confirm the evidence of the present study, it is better to conduct studies with a larger sample size.

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