

Cardiomegaly found in the 2019 Novel Coronavirus Disease (COVID-19): Analysis of 115 Patients

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Research note

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Abstract

Objectives

There is much evidence showing that most of the mortality and morbidity cases are observed in COVID-19 patients with cardiovascular diseases. Thus, the study on COVID 19 patients with cardiovascular diseases is required for their optimum management. The present study presents a preliminary report on the cardiomegaly of laboratory and CT findings of COVID-19 pneumonia in Iran. A total of 115 Patients with COVID-19 pneumonia hospitalized in (confirmed by CT scan and RT-PCR) Baghiyatallah hospital participated in the present study.

Results

Thirty-three of these patients (26.8%) had cardiomegaly detected by chest CT scan. Creatinine, Urea and CRP levels of patients significantly increased based on cardiovascular disease detection. In contrast, Sodium levels reduced to below the normal in patients with cardiomegaly. Despite respiratory illness as the first symptom of COVID-19, the role of other diseases such as cardiovascular disease requires further investigation.

Introduction

The outbreak of pneumonia resulting from novel coronavirus (COVID-19) was first reported from Wuhan, China, in December 2019 [1] In the following month, infections spread in China and other countries around the world. COVID-19 pneumonia had been confirmed in 4139794 patients in 215 countries [2]. Like other coronavirus forms, COVID-19 can cause acute respiratory distress syndrome (ARDS) [3].

Real-time reverse-transcription–polymerase-chain-reaction (RT-PCR) was currently administered [4]; however, recent studies reported the higher rate of false negatives of RT-PCR than that of computed tomography (CT) based on the findings relating to the coronavirus patients [5, 6] Thus, a chest CT examination has been recommended as a reliable method for confirmed clinical diagnosis [6, 7]. In addition, CT examination is helpful for monitoring the progression of disease and evaluating therapeutic efficacy [7].

In previous study, COVID-19 patients with bilateral ground-glass opacities (GGO) with or without crazy-paving pattern or consolidation, lymphadenopathy and pleural effusion were presented [8, 9] while in following studies, we observed cardiomegaly in patients. In this regard, we presented a preliminary report on the cardiomegaly of CT findings and laboratory data of COVID-19 pneumonia.

Materials And Methods

Patients

The participants of the present study included 115 Patients with confirmed COVID-19 pneumonia (CT and RT-PCR Confirmed) undergoing a chest CT scan during their hospitalization in Baqiyatallah hospital between February 20, 2020 and March 9, 2020 in Tehran, Iran. Based on the CT Finding, patients were divided into three groups including 1) with Cardiomegaly, 2) Calcification detected 3) without Cardiomegaly or Calcification.

The proposal of the study was approved by the Research Ethics Committee, Baghiyatallah University of Medical Sciences, Tehran, Iran (coded: IR.BMSU.RETECH.REC.1399.107).

CT Image Protocols and Analysis

The non-contrast chest CT scan was undertaken with the patient in the supine position, and scanning was performed at end inspiration and patients were instructed to hold breath to minimize motion artifacts. The main scanning parameters included tube voltage (120 kVp), automatic tube current modulation (30–70 mAs), pitch (0.99–1.22 mm), matrix (512 × 512), slice thickness (5 mm), and field of view (350 mm × 350 mm). Chest CT from cases was reviewed by two radiologists and physicists.

Laboratory results were obtained from the Baghiyatallah laboratory computer system.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics Software (version 26; IBM, New York, USA). Quantitative data were presented as mean ± standard error (SEM) A p-value of < 0.05 was defined as statistical significance. ANOVA and T-test were used to compare groups and means of two groups, respectively.

Results

Based on the CT Finding in 115 covid-19 patients who admitted to Baqiyatallah hospital, we designated three groups of patients in our study: 1) with Cardiomegaly, 2) Calcification detected 3) without Cardiomegaly or Calcification.

The clinical characteristics and laboratory results of all 115 COVID-19 patients of three groups are summarized Table 1.

Table 1: Clinical characteristics and laboratory findings of patients with COVID-19

	Without Cardiomegaly or Calcification (n = 78)	With Cardiomegaly (n = 33)	With Calcification (n = 19)
Age	54 ± 1.68	64.25 ± 1.7	66.00 ± 2.74
WBC(X10 ³ /ul)	5.85 ± 0.2	6.27 ± 0.38	4.99 ± 0.30
CRP (mg/L)	62.45 ± 4.32	79.07 ± 7.41	85.25 ± 9.48
ESR(mm/hour)	41.80 ± 3.09	47.29 ± 3.71	47.54 ± 4.49
Sodium(m Eq/L)	135.45 ± 0.33	133.32 ± 0.06 (L)	132.72 ± 0.75
Potassium (m Eq/L)	4.10 ± 0.06	4.11 ± 0.06	4.13 ± 0.08
Blood Urea Nitrogen (mg/dL)	13.58 ± 0.49	16.06 ± 1.03	22 ± 0.3.11
Creatinine (mg/dL)	1.11 ± 0.03	1.28 ± 0.07	1.19 ± 0.09
Mortality (%)	8.86	12.13	36.84
Comorbidities (%)			
Diabetes	8.75	3.03	0
Hypertension & cardio vascular disease	5.00	9.09	15.79
Kidney disease	0	3.03	10.53
ANY*	72	48.49	30.02

Data are mean ± SE or (%).

*ANY: Without Comorbidities

The results of the present study showed that 33 [28.9%] patients had cardiomegaly (Fig. 1), 19 [16.52%] had calcification, 15 [78.94%] with Coronary arteries calcification, 2 [10.52%] with lung calcification and 1 (5.26%) with liver and kidney calcification of CT abnormalities. The appearance of cardiomegaly is observed in all patients with coronary calcification. Our data demonstrated that the Laboratory level of factors was associated with CT findings and heart failure of COVID-19 patients.

Table 2: Clinical characteristics and laboratory findings of patients with cardiomegaly and coronary calcification

	Cardiomegaly Without calcification Mean ± SE	Cardiomegaly With calcification Mean ± SE
HR	87.80 ± 4.81	94.17 ± 4.36
BP	109 ± 3.108/68 ± 2.83	125 ± 5.66/79 ± 3.44
Na (m Eq/L)	134.36 ± 1.21	132.44 ± 1.42
Potassium (m Eq/L)	4.21 ± 0.14	4.24 ± 0.18
Blood Urea Nitrogen (mg/dL)	15.80 ± 1.26	16.38 ± 2.49
Creatinine (mg/dL)	1.23 ± 0.12	1.27 ± 0.17

Table 2 displays the comparison of clinical characteristics of patients with cardiomegaly and coronary calcification as it shows, there are not significant differences between laboratory findings of the two groups.

Discussion

Novel coronaviruses can cause serious diseases such as pneumonia and progressive respiratory infections but it should not be a reason to neglect the cardiovascular problems. There is much evidence which suggests that most of the morbidity and mortality cases of novel coronavirus are related to cardiovascular disease [10, 11].

Based on the previous studies, viral infections such as influenza and their analogs can destabilize and worsen cardiac conditions. Cardiac complications are the secondary diseases of SARS-CoV and MERS-CoV (as an earlier coronavirus family) [10]. Moreover, Yu CM et al. reported cardiomegaly in 11% of patients with SARS[12]. In another study, cardiomegaly reported being observed in patients with COVID 19 [13]. Thus, we decided to evaluate the prevalence of cardiac diseases, specially cardiomegaly in COVID-19 patients. In the present paper, the biography, laboratory, clinical, and chest CT data of 115 patients hospitalized in Baqyatallah hospital were investigated. The results showed that the percentage of cardiovascular diseases and hypertension comorbidities in three groups (with Cardiomegaly, Calcification detection, without Cardiomegaly or Calcification) were 9.09%, 15.79% and 5%, respectively. Based on the recent reports, cardiovascular diseases and hypertension comorbidities in patients with COVID-19 is much higher [10]. The report showed that patients with COVID-19 are at high risk of having cardiovascular complications or mortality [14]. The data of the present study demonstrated that 48.49% of patients with cardiomegaly and 30.02% cardiomegaly with calcification did not report any comorbidities. It's worth noting that vascular calcification is a long-term process in which viral type has also been reported. But, it seems that patients who have not reported calcification were unaware of their disease.

Researchers found that C-reactive protein (CRP) is an inflammatory the predictor of heart disease [15, 16]. Other routine laboratory factors which provide useful prognostic information for heart failure included blood urea, nitrogen and creatinine [17–19]. The results of the present study demonstrated that CRP, blood urea nitrogen and creatinine levels significantly increased in patients with Cardiomegaly and Calcification compared to healthy groups (mild to severe trend).

The mechanism of novel corona-infected cardiovascular disease remained unknown. But the recent reports show the role of (ACE2) receptors in SARS-CoV-2 and COVID – 19 pathogenicity and their entry to the principally Type II alveolar cells [10, 11, 20].

The investigators have indicated the high expression of ACE2 in the heart and lung. Moreover,ACE2 is expressed in other organs such as vascular endothelium and kidney explaining the multi-organ dysfunction and can be found in SARS-CoV-2 infection [10, 11, 20].

In conclusion, preexisting cardiovascular disease may enhance vulnerability to COVID-19 and it can greatly affect the development and prognosis of pneumonia (Table 1: Mortality rate). Further, secondary damage of the virus on the cardiovascular system (short-term vs long-term cardiovascular effects) should not be forgotten. Therefore, therapists should pay attention to viral infection relating to cardiovascular diseases. The short time and longtime follow-ups of these patients are suggested.

Limitation

It is recommended to perform study in more centers and with larger sample size.

Abbreviations

COVID-19

Coronavirus Disease

ARDS

acute respiratory distress syndrome

RT-PCR

Real-time reverse-transcription–polymerase-chain-reaction

CT

computed tomography

GGO

ground-glass opacities

Declarations

Competing Interest

The authors declare that there are no conflicts of interest

Ethics approval and consent to participate

The study proposal was assessed and approved by Research Ethics Committee, Baghiyatallah University of Medical Sciences, Tehran, Iran; coded: IR.BMSU.RETECH.REC.1399.093. written consent was obtained from patients.

Availability of data and materials

Data are available upon request from corresponding author.

Consent for publication

Not applicable.

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Authors' contributions

Zeinab Shankayi; Reviewed CT, analyzed data and wrote the paper with support from F. Bahrami, T. Mohammadzadeh and A. Amini. F. Bahrami discussed the results and contributed to the final manuscript. Dr. Ghafari reviewed CT, support and provided critical feedback about CT scan. M.M Asadi, M.H. Mirashe, M. Sharti; Performed the data gathering and entering.

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Figures



a)



b)

Figure 1

a) Cardiomegaly and b) calcification in COVID-19 patients