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Original Article

Assessment of Clinical Characteristics and Outcomes of COVID-19 Patients with Pericardial Effusion

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Abstract

Introduction: Evidence shows increased identification of cardiac involvement in patients with COVID-19 with a more critical prognosis. The study aimed to assess the outcomes of COVID-19 patients with pericardial effusion (PE) disease in comparison with a control group.

Methods: Sixty-One COVID-19 patients who were referred to Shariati hospital in Tehran, Iran, from June 2020 to June 2020 were included. The diagnosis of COVID-19 was according to WHO interim guidance. Eleven cases were with pericardial effusion, and two patients were with a diagnosis of tamponade and pericardial synthesis. Other forty-six Covid-19 cases were as the control group.

Results: The majority of patients (54.0%) were in the age group of 50–70 years. Also, 62.2% of cases were male. In PE group compared to non-PE group patients had ESR>50 mm/hour [13(86%) vs. 3(66%), P=0.045), hypernatremia [4(26%) vs. 1(2.1%) P=0.007]. In non-PE group compared to PE group patients had PCT>ULN (ug/L) [21(42) vs. 4(26.7), P=0.035]. There was no significant difference between results of lung CT scan (ground glass (GG), pericardial effusion, and pleural effusion) and tachypnea, positive RT-PCR, and lab in the mild PE group compared to the tamponade group. The incidence of shock (or SBP<100) was more in the mild PE group compared to the tamponade group (P=0.048). There was no significant difference in outcomes (all-cause mortality, discharge, ICU admission and duration, shock, MI intubation, and time of admission) between PE and non-PE groups and subgroups of PE (P>0.05).

Conclusion: The results showed pericardial effusion involvement could happen with COVID-19 patients even without differences in all-cause mortality, discharge, ICU admission and duration, MI, time of admission, and intubation. Although, there was a significant difference in hypernatremia and increased ESR level in the PE group. Also, our data provide some reassurance that PE is not a poor prognostic factor in COVID-19 infection.

Keywords: COVID-19, pericardial effusion, cardiac Tamponade.

Introduction

COVID-19, as pandemic disease, has imposed various burdens on global public health [1-3]. The clinical symptoms of COVID-19 infection are frequently identified by including fever, respiratory tract symptoms, cough, fatigue, sore throat, and complications associated with acute respiratory distress syndrome and pneumonia [3-5].

Viral infections are one of the prevalent causes of pericarditis (6). COVID-19 is mainly a respiratory disease and causes a systemic inflammatory response [7]. Evidence shows increased identification of cardiac engagement in COVID-19 cases with a more critical prognosis. The most common cardiac complications include acute myocardial injury, arrhythmias, acute myocarditis, and severe left ventricular dysfunction [7-8]. However, few studies reported associated life-threatening cardiac tamponade and large pericardial effusions [8-9]. COVID-19 caused an exaggerated systemic inflammatory response in patients; however, there is insufficient knowledge about details of this response [7]. It is possible that COVID-19, like other viral infections, causes an inflammatory response leading to pericarditis and subsequent effusion;

however, the exact mechanism is unknown [8]. Hemorrhagic effusions are observed in other inflammatory situations such as Dressler's syndrome, which is supposed to produce from an immune complex deposition and a consequent inflammatory cascade post-myocardial infarction. It is assumed that viruses generate pericardial inflammation by direct cytotoxic agents or immune-mediated mechanisms [9-10]. Cardiac Tamponade is a crucial differential to consider in deteriorating COVID-19 patients.

This study aimed to assess outcomes of COVID-19 patients with PE disease in comparison with a control group.

Methods

In this study, 61 COVID-19 patients who were referred to Dr. Shariati hospital in Tehran, Iran, from June 2020 to June 2020 were included. The diagnosis of COVID-19 was according to WHO interim guidance. COVID-19 cases were verified via two pressures such as RT-PCR (Reverse Transcription-Polymerase Chain Reaction) test and chest CT scan. The RT-PCR test was done on the throat and nose swab specimens. Chest CT scan clinically diagnosed based on ground glass pathognomonic features consistent with coronavirus pneumonia.

Eleven cases were with pericardial effusion, and two patients were with a diagnosis of tamponade and pericardial synthesis. Other forty-six Covid-19 cases were as the control group. We recorded symptoms, demographic data, medical history, laboratory test, and chest CT scan results of all patients. Also, transthoracic echocardiography (TTE) was done for all of them. The clinical outcomes (mortality, discharge, ICU admission and duration, shock, MI, time of admission, and intubation) were followed during the admission.

Qualitative variables were presented by frequency, and percent and quantity variables were presented by mean, Standard Deviation (SD), median, and IQR. Data were compared between groups via the Chi-2 test and Fisher exact test. Statistical analyses were conducted by the SPSS-20 software. A P-value of<0.05 was regarded as statistically significant.

Results

Sixty-one patients were included. The median age was 56 (46–65) years. The majority of patients (54.0%) were in the age group of 50–70 years. Also, 62.2% of cases were male. The pericardial effusion group included 13 adult patients (73% male) who had an average age of 57 years. There were no differences between the pericardial effusion group and the control group (non-PE group) regarding age and gender (Table 1). The characteristics of the patients on admission are present in Table 1. The most common comorbidities in pericardial effusion group compare to the non-PE group were malignancy and chemotherapy [6(40%) vs. 1(2%)] and in nonPE group were HTN [3(20%) vs. 21(42%)], HF [1(6.7%) vs. 5(10%)], IHD [1(6.7%) vs. 8(16%)]. PE group had higher rate of dyspnea (67% vs. 66%), cough (53.7% vs. 24%), myalgia (40% vs. 26%), palpitation (20% vs 6%), chest pain (33% vs. 14%), SBP<100(20% vs. 10%) than nonPE group. Drug hx. in PE group Compared to the non-PE group had less consumption of ASA and corticosteroids (13.3 % vs. 44%) and (6.7% vs. 10%) respectively. In PE group compared to non-PE group patients had ESR>50 mm/hour [13(86%) vs. 3(66%), pv=0.045), hypernatremia [4(26%) vs. 1(2.1%) P=0.007]. In non-PE group compared to PE group patients had PCT> ULN(ug/L) [21(42) vs. 4(26.7), P=0.035]. Lung CT scan findings in the PE group were included in ground glass pattern (P=0.6), pleural effusion (P=0.3), and pericardial effusion (P=0.2). There was no significant difference between results of lung CT scan (ground glass (GG), pericardial effusion, and pleural effusion) and tachypnea, positive RT-PCR, and lab in mild PE group compared to Tamponade group.

The incidence of shock (or SBP<100) was more in the mild PE group compare to the tamponade group (P=0.048). There was no significant difference in outcomes (mortality, discharge, ICU admission and duration, shock, MI intubation, and time of

admission) between PE and non-PE groups (table 3) and subgroups of PE (Table 4) (P>0.05).

Table 1: Clinical characteristics on admission.

Items	PE	Non-PE	P-value
Patient, n/N (%)	13(21.3%)	48(78.7%)	
SEX Male female	 11(84.6%) 2(15.38%)	 27(54%) 23(46%)	0.24
AGE <50 50-70 >70	 3(23%) 9(69.23%) 1(7.69%)	 16(32%) 26(52%) 8(16%)	0.78
DM	0 (%)	20(40%)	
HTN	3(20%)	21(42%)	
IHD	1(6.7%)	8 (16%)	
HLP	0	4 (8%)	
CABG	0	1(2%)	
HF	1(6.7%)	(10%)	
malignancy	6(40%)	1(2%)	
cirrhosis	0	2(4%)	
chemotherapy	6(40%)	1(2%)	
rheumatology	0	4(8%)	
fever	5(33.3%)	17(34%)	
Dyspnea	10(66.7%)	33(66%)	
Palpitation	3(20%)	3(6%)	
cough	8(53.7%	12(24%	
chill	4(26.6%	13(26%	
Sore throat	1(6.6%	4(8%	
Abdominal pain	1(6.7%	5 (10%	
weakness	4(26.7%	18(36%	
arthralgia	0	2(4%)	
Chest pain	5 (33.3%)	7(14%	
myalgia	6(40%)	13(26%	
diarrhea	0	1(2%	
headache	1(6.7%)	3(6%)	
asymptomatic	1(6.7%)	1(2%)	
SO2 sat. SO2 sat<93% SO2 sat >93%	 7(53.8) 6(46.15)	 32(64) 16(32)	0.3
SBP <100 100-140 >140	 3(20) 9(69.23%) 1(6.7)	 5(10) 28(56) 15(30)	0.15
myocarditis	0	1(2%)	
DHx.			

ASA	2(13.3)	22(44)	
BB	5(33.3)	12(24)	
ACEi	1(1.6%)	7(14%)	
ARB	3(20)	13(26%)	
Anticoagulant	1(6.7)	3(6)	
CCB(DH)	3(20)	7(14)	
Diuretic(furosemide)	6(40)	13(26)	
corticosteroid	1(6.7)	5(10)	
Kaletra	4(26.7)	16(32)	
HCQ	11(73.3)	29(58)	
vasoconstrictor	3(20)	12(24)	
PR <60 60-100 >100	 1(6.7) 3(23) 9(60)	 2(4) 26(52) 19(38)	
RR <30 >30	 12(92.3) 1(6.7)	 41(82) 7(14)	0.4
T <37.3 >37.3	 10(76.9) 3(20)	 34(68) 14(28)	0.5
ESR mm/hour <50 >50	 0 13(86)	 11(22) 33(66)	0.045*
CRP (mg/L) <10 >10	 1(6.7) 12(92.3)	 8(16) 36(72)	0.2
BNP (ng/L) <100 100-400 >400	 2(13.3) 2(13.3) 1(6.7)	 9(18) 5(10) 11(22)	0.5
Pct (ug/L)>ULN	4(26.7)	21(42)	0.035*
RT-PCR positive	5(33.3)	24(48)	0.5
Hb <10 >10	 8(61.5) 5(8.46)	 10(20) 37(74)	
K+ >5.5 mmol/L, n/N (%) K+ < 3.5 mmol/L, n/N (%)	2 -	1 -	0.078
Na+>145 mmol/L, n/N (%) Na+<135 mmol/L, n/N (%)	4(26) 3(20)	1(2.1) 7(14)	*0.007
neutropenia	0	9(18)	0.3
lymphopenia	6(40)	22(44)	0.3
Ferritin Male female	 1 1	 8 8	 0.7 0.034

PE: Pericardial effusion, ACEI indicates angiotensin-converting enzyme inhibitor, Calcium Channel Blocker (CCB), ARB, angiotensin II receptor blocker; dihydropyridine (DH), beta-blocker (BB), Diuretic (furosemide), IHD ischemic heart disease, Diabetes Mellitus (DM), hypertension (HTN), hyperlipidemia (HLP), heart failure (HF), Coronary Artery Bypass Graft (CABG), HCQ hydroxychloroquine, systolic blood pressure (SBP), C-Reactive Protein (CRP), Chronic Kidney Disease (CKD), RT-PCR Reverse transcription-polymerase chain reactionSpO2, oxyhemoglobin saturation, PR pulse rate, RR respiratory, T temperature, Pct procalcitonin, brain natriuretic peptide (BNP), Erythrocyte Sedimentation Rate (ESR), myocardial infarction (MI).

Table2: Characteristics of PE subgroups.

Clinical characteristics on admission	Mild PE	Tamponade	P-Value
Patients n/N%	13(86)	2(13)	
Lung CT scan findings GG Bilateral Unilateral	 9 1	 2 0	0.6
Pleural effusion No Bilateral unilateral	 5 1 4	 0 0 2	0.3
Pericardial effusion in lung CT Scan No Mild Moderate	 6 3 1	 0 1 1	0.2
EF <40 40-50 >50	 1 4 5	 0 1 1	0.79
RT-PCR	3	0	0.2
SBP <100 100-140 >140	 2 9 0	 0 1 1	0.048
RR <30 >30	 10 1	 2 0	0.6
PR <60 60-100 >100	 4 7 11	 0 2 2	0.3
Lab. test			
ESR	10	2	
pct	5	2	0.3
Na+>145 mmol/L, n/N (%) Na+<135 mmol/L, n/N (%)	2	1	0.5
K<3.5 k>5.5	3	0	-
BNP <100 100-400 >400	 1 1 1	 0 1 0	0.53
PE Pericardial effusion, SBP, systolic blood pressure, RT-PCR Reverse transcription-polymerase chain reactionSpO2, CRP c-reactive protein, oxyhemoglobin saturation, PR pulse rate, RR respiratory, T temperature, Pct procalcitonin, BNP brain natriuretic peptide, MI myocardial infarction, T temperature, BNP brain natriuretic peptide, ESR Erythrocyte sedimentation rate, Pct procalcitonin, GG ground glass			

In the PE and non-PE group frequency of discharge was 8 (61.5%) and 37(74%) cases (P=0.2). The most duration of admission was 7-14 days in both PE and non-PE groups [6(40%) vs. 21(42%), P=0.7]. ICU admission was more frequent in PE group [7(46.7%) vs.17 (34%), P=0.3] and the most ICU duration was less than 7 days in PE group [14 (28%) vs. 2(15.3%), P=0.3]. Intubation was more frequent in PE group [5(33.3%) vs. 11(22%), P=0.5].

Table 3: Outcomes of patients with PE and non-PE groups.

outcomes	PE	Non-PE	
Discharge	8(61.5)	37(74)	0.2
death	5(33.3)	9(18)	0.2
Duration admission <7 7-14 >14	 2(15.3) 6(40) 5(33)	 14(28) 21(42) 12(24)	0.7
ICU admission	7(46.7)	17(34)	0.3
ICU duration <7 7-14 >14	 4(26.6) 3(20) -	 8(16) 5(10) 4(8)	0.3
intubation	5(33.3)	11(22)	0.5
SBP<100 (Shock)	6(40)	10(20)	0.1
MI	1(6.7)	2(4)	0.7
* Fisher's exact test			

Table 4: Outcomes of patients with subgroups of PE.

Outcomes	Mild PE	Tamponade	PV
Prognosis Discharge Death	 7 4	 1 1	 0.7
ICU admission	5	2	0.19
ICU duration <7 7-14	2 3	2 0	0.14
Duration admission <7 7-14 >14	2 4 5	0 1 0	0.46
Intubation	4	1	0.7
* Fisher's exact test			

Discussion

COVID-19 disease is a global pandemic that has spread quickly and globally. Extra pulmonary manifestations are mostly complications reported in the studies; however, pericardial involvement reports are infrequent [8-9, 12].

The study assessed the features and results of COVID-19 cases with pericardial effusion disease, and also we compared their results with non-pericardial effusion cases. Our main results are that pericardial effusion involvement may happen with COVID-19 patients even without differences in all-cause mortality, discharge, ICU admission and duration, MI, time of admission, and intubation. Although, there was a significant difference in hypernatremia and increased ESR level in the PE group. Also, there was a significant difference in shock in the subgroup of PE.

In the current study, the shock (SBP<100mmhg) was a significantly higher prevalence in patients with PE than non-PE, and this result has been confirmed in other case reports [7, 9, 12]. Although, there was no significant difference between mild PE and tamponade. It may be due to earlier diagnosis of cardiac tamponade than pericardial synthesis and consideration of other types of shock in the mild PE group.

The present study showed that patients with PE had a higher baseline prevalence of a past medical history of malignancy and chemotherapy. Although, one of two cases that were diagnosed as cardiac tamponade had a medical history of metastatic lung cancer and chemotherapy in the last ten days. According to the previous study, the most common of these malignancies are lung carcinomas [11].

The current research is extremely confirmed regarding the evidence that Covid-19 patients and non-PE were more commonly treated with anti-inflammatory drugs such as aspirin and corticosteroids. Based on the previous case reported data with PE, it was legitimate to assume that a relationship may exist between the PE group and the incidence of all-cause mortality, discharge, ICU admission and duration, shock, MI intubation, and time of admission [9].

Patients in the PE group had ESR>50 mm/hour and hypernatremia compared to the non-PE group. Sodium and ESR levels were not reported in the previous case reports studies [9, 13].

Hypokalaemia and hypernatremia are also common in SARS-CoV-2 infection [7, 14]. The pathogenesis of the virus and the subsequent secondary hyperaldosteronism caused by increased angiotensin -II levels might be responsible for the outcome [7, 12]. Whereas in this research, there was no significant difference in hypokalemia between the PE group and non-PE which, maybe because of the small size of the sample.

The current results present some reassurance that PE is not related to the poor results of COVID-19 hospitalizations in patients with PE.

Conclusion

The results showed pericardial effusion involvement could happen with COVID-19 patients even without differences in all-cause mortality, discharge, ICU admission and duration, MI, time of admission, and intubation. Although, there was a significant difference in hypernatremia and increased ESR level in the PE group. Also, the results provide some reassurance that PE is not a poor prognostic factor in COVID-19 infection.

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Conflict of Interest Disclosures

The authors declared no potential conflict of Interest.

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Authors' Contributions

All authors pass the four criteria for authorship contribution based on the international committee of medical journal editors (ICMJE) recommendations.

Ethical Statement

This study was approved by ethical committee of Tehran University of medical sciences, Tehran, Iran.

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