Does Covid-19 infection cause atrial conduction disorders?

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Abstract

Background: There have been case reports showing that Covid-19 infection caused arrhythmic cases but the pathogenesis is unclear. The relationship between atrial conduction times, PwD and PwPD with atrial tachyarrhythmias have been demonstrated in some studies. We investigate the effect of different clinical presentations of Covid-19 infection on these parameters ,in this study. Methods: We divided the patients who infected with Covid-19 into three groups according to CT and PCR test results. P-max, P-min, PwD and PwPD were calculated in the ECGs of these patients prior to start of treatment. Results: P-max was significantly higher in Group-1 than in Group-2 and Group-3. P-min was significantly lower in Group-1 than in Group 3. PwD was significantly higher in Group-1 compared to Group-2 and Group-3, and it is significantly higher in Group-2 than Group-3. While PwPD was significantly higher in Group-1 than in Group-2 and Group-3. Conclusion: Patients with pneumonia with PCR positivity seem to have the highest risk of atrial tachyarrhythmia that is why that group may benefit most from strict ECG follow-up. Keywords: Covid-19 infection , P-wave dispersion , ECG , P wave peak time, Atrial Arrhythmias Abbreviations: PCR: real-time polimeraz chain reaction, CT: Computerized Tomography, P-min: Shortest P-wave duration, P-max: Longest P-wave duration, PwD: P-wave Dispersion, PwPD: P-wave peak duration.

INTRODUCTION

Covid-19 infection has become a pandemic by show up in Wuhan city of China and spreading all over the world. More than 4,7 million people was infected by the virus, and it caused more than 300,000 deaths by 20 May 2020 [1]. Although the infectious agent has been previously known, effects of this novel kind virus on humans have not been clearly demonstrated. The dark parts in the pathogenesis protect its secret. While initially thought to be progressing only with pneumonia, case reports emerged that it causes myocarditis, arrhythmia problems, coagulopathy, and microembolics [2,3,4,5]. Drugs with proarrhythmic effects are frequently used in the treatment of Covid-19 in our country and in the world [6,7,8]. In our country, anticoagulant therapy has been added to patients in accordance with the national guidelines[8]. Anticoagulant therapy is thought to reduce the mortality and morbidity of patients[8,9,10]. This suggests that the possible procoagulant or arrhythmic condition affects patients.

Rt-PCR and chest CT are used in the diagnosis of Covid-19 disease. The PCR test is seen as the most widely used and most reliable method. But the sensitivity of the PCR test is around 65%. Chest CT is widely used too. However, radiological imaging may have difficulty in clearly distinguishing other viral and atypical pneumonias. In our hospital, we apply both chest CT and rt-PCR in accordance with the national guidelines[8].

Atrial fibrillation is a frequent pathological arrhythmia among elderly people and patients who have comorbid chronic illnessand it is one of the most common causes of thromboembolism. Some diseases or conditions have been shown to trigger paroxysmal atrial fibrillation. Infectious diseases are the leading causes. It has been shown in some case reports that patients with Covid-19 infection have atrial and ventricular tachyarrhythmias. The value of the longest P-wave duration (P-max), P-wave dispersion (PwD) and P-wave Peak duration(PwPD) in demonstrating the function of the atrial conduction system and showing the risk

of paroxysmal atrial fibrillation have been demonstrated in many studies(11,12,13,14). In this study, we evaluated these parameters by dividing patients into groups with the most common clinical presentations of known Covid-19 infection in patients. As a result, we aimed to predict which patients among these groups may have highest risks of developing arrhythmic problems more frequently based on these parameters.

METHODS

Patients selection

Patients who applied to Tatvan State Hospital between the ages of 15 and 90 were included in the study. Patients who came with Covid-19 infection were divided into three groups according to their diagnostic status. In determining these groups, the decision was made according to the results of chest Computarized Tomography (CT) and real time PCR. Since the false negative results, patients with two negative PCR results were considered negative. Possible wrong results were tried to be minimised in this way. In the CT evaluation, the results were based on the reports made by radiologists, compatible with Covid-19 pneumonia according to national and international guidelines. Patients whose CTs are compatible with Covid-19 pneumonia and positive PCR tests were included in the Group 1. Patients in Group 2 were composed of patients whose CT results did not monitor pneumonia but the performed PCR tests was Covid-19 positive. Patients in Group 3 were composed of patients whose CT results were compatible with Covid-19 pneumonia but had negative PCR tests.

Demographic Data

Demographic data of patients; age, gender, comorbid vascular, cardiac, renal, pulmonary, diabetes diseases were noted.

Laboratory and Biochemistry Data

The results of the hemoglobin(Hb), White Blood Cells (WBC), Platelet(Plt), urea, creatine, Alaninaminotransferaz (ALT), Asetilaminotransferaz (AST), C-Reactive Protein(CRP) and troponin tests of the patients which had been examined prior to any treatment were recorded.

Electrocardiographic Parameters

Twelve lead ECGs were obtained with 10 mm/mV amplitude and 25 mm/s rate with standard lead positions in a supine position. ECGs were manually measured before PCR test results. Heart rate, PR interval time, QRS interval duration calculated and noted. The duration measurements of the P wave have been determined as the duration from the beginning of the P wave to the end of the P wave and the duration from the beginning of the P wave to the end of P wave on the leads with the longest (P-max) and shortest (P-min) P wave. PwD was calculated by finding the difference between P-max duration and P-min duration. The time from the start of the P wave to the peak of the P wave is calculated and PwPD found.

STATISTICAL ANALYSIS

Values are expressed as the mean ± standard deviation (SD). Categorical data were compared using χ^2 analysis. SPSS-23 Statical analysis software IBM was used for statistical analysis. Normality of the variables was tested with Kolmogorov-Smirnov method. Comparison among the three groups was performed using a one-way analysis of variance (ANO-VA). Levene statics test was performed in evaluation of variance homogeneity. Scheffe test was used in variance homogeneous parameters, Tamhane and Games-Howell test in non-homogeneous parameters. Kruskal-Wallis test was used for variables that did not show normal distribution. Man-whitney U test used for the parameters in which difference detected in each other on the Kruskal-wallis test.Statistically significant p value was considered lower than 0,05.

RESULTS

Demographic Information

38 patients in Group 1, 36 patients in Group 2, 33 patients in Group 3. The average age of the patients in Group 1 was 49.3 ± 15.5, in group 2 was 38.5 ± 16.4 and in group 3 determined as 42.6 ± 18.4. While there was no significant difference between the group-1 and group-3 and between the 2.and 3. groups, there was a significant difference between the 1. and 2. groups ($p < 0.05$). There was no significant difference between the groups in terms of coronary artery disease (CAD), chronic renal insufficiency (CRI), diabetes mellitus (DM), hypertension (HT), heart failure (HF) and chronic obstructive pulmonary diseases (COPD). The demographic characteristics of the study subjects were summarised in Table I.

Laboratory and Biochemistry Tests Results

There wasn't significant difference between the groups in terms of Hb, Plt, urea, creatin, ALT, AST and troponin levels. WBC value was significantly higher in Group 3 than Group 2 ($p < 0.05$). But WBC values was not significant between the Group 1 and 2 and not significant between group 1 and 3. CRP level was significantly higher in Group 3 than Group 1 and Group 2 ($p < 0.05$). But there was no significant difference between the group 1 and 2 in the levels of CRP. The results of laboratory and biochemistry tests are summarised in Table II.

Electrocardiographic Parameters

There wasn't significant difference between patients' heart rates, PR interval durations, and QRS interval durations. P-max duration was significantly higher in Group 1 than in Group 2 and Group 3 ($p < 0.05$), and there was no significant difference between Group 2 and Group 3. The duration of P-min was significantly lower in Group 1 than in Group 3 ($p<0,05$), and there wasn't significant difference between Groups 1 and 2 and between Group 2 and Group 3. P wD was significantly higher in Group 1 compared to Group 2 and Group 3, and significantly higher in Group 2 than Group 3. While PwPD was significantly higher in Group 1 than Group 2 and Group 3 ($p<0,05$), there wasn't significant difference between Group 2 and Group 3. The results of electrocardiographic analysis are summarised in Table III.

DISCUSSION

In Covid-19 infection, susceptibility to arrhythmia and thrombotic conditions have been demonstrated. The underlying pathophysiology of this condition is unclear. Changes in atrial conduction duration and changes in P wave durations have been shown to trigger paroxysmal atrial fibrillation. Paroxysmal atrial fibrillation and atrial arrhythmias can both increase the frequency of thrombotic events and create diastolic dysfunction. In this study, P-max, PwD and PwPD values were highest in patients with positive Covid-19 PCR test and among whom CT compatible with Covid-19 pneumonia. PwD was found to be longer among patients with positive Covid-19 PCR test compared to patients with negative PCR, even if there was no infiltration in the lung. In patients with positive PCR test; patients demonstrating infiltration in CT had higher PwD than patients whose CT non-compatible with Covid-19 pneumonia. In the light of these findings, patients with positive PCR test and pneumonia have the highest risk for developing atrial arrythmias. PCR positivity increases P wave times. Based on this finding, PCR positivity is one of the predictable results that may increase susceptibility to atrial arrythmias.

In the guidelines, anticoagulation may cause a decrease in mortality and morbidity in patients, therefore it is recommended to be used for patients. However, these patients have been shown to be prone to increased bleeding and have side effects in anticoagulation. There is limited information about which patients will be recommended as a priority and which patients will benefit most. In addition, even if pneumonic infiltration is not shown in CT, it can be concluded that patients with proven Covid-19 infection by PCR tests have increased susceptibility to atrial arrhythmias compared to patients with negative PCR test results. In the light of this information, patients with pneumonia with PCR positivity seem to be the group that have the highest risk of atrial tachyarrhythmia thats why that group may benefit most from anticoagulation and strict ECG follow-up. Even if pneumonic infiltration is not observed in CT of patients with PCR positivity, it seems that these medications may benefit more compared to patients with negative PCR results with Covid-19 compatible infiltration.

CONCLUSIONS

In Covid-19 infected patients, especially those with Covid-19 pneumonia in CT ; P-max, PwD and PwPD were longer than in other patients, this difference persists in patients with CT negative, and as a result, it shows an increased susceptibility to atrial arrhythmias in these patients. Based on this, it is thought that anticoagulation and strict ECG monitoring may be beneficial in these patients.

STUDY LIMITATIONS

In this study, we measured the Pmax, Pmin, and PwPD manually since we did not have an automated measurement system for these variables.

There is a difference in WBC and CRP values in blood results obtained from patients. The difference is thought to be due to the fact that the blood test in the first application of the patients is taken into consideration and each patient's disease development is applied at different times of the illness. Since the false negative results, patients who were found to have negative PCR tests 2 times were considered as PCR negative patients. Possible wrong results were tried to be minimised in this way.

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Table-I Demographic Charecteristics

Number of patients
Age
Male patients
Female patients
HT (%)
DM (%)
CAD (%)
HF (%)
COPD (%)
CRI (%)

Values are mean±standard deviation unless stated. *= p<0,05 vs. group 2.But analyses between group 2 and 3 is not signif

TABLE II Hematology and Biochemistry

Number of patients
Hemoglobin (g/dl)
Platelets (*1000 u/L)
WBC (10ˆ9/L)
Urea (16-43 mg/dl)
Creatin (0,8-13 mg/dl)
ALT (0-45 U/L)
AST (0-35 U/L)
Troponin (0-42,9 pg/ml)
CRP (0-5 mg/L)

Values are mean ± standard deviation unless stated. [a]:p<0,05 vs. Group 2,but not significant with group 1.Analyses betwee

TABLE III Electrocardiographic data

Number of patients
HR(ms)
PR(ms)
P max(ms)
P min(ms)
PwD(ms)
PwPD(ms)
QRS(ms)

Values are mean ± standard deviation unless stated. [a]p<0,05 vs. Group 2 and Group 3,?p<0,05 vs Group 3, [c] :p<0,05 vs.

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