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Original Research Article

A STUDY OF ELECTROCARDIOGRAM AND ECHOCARDIOGRAPHY PARAMETERS OF POST COVID-19 PATIENTS

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ABSTRACT

Background: Study of Electrocardiogram and Echocardiography parameters of post covid-19 patients.

Materials and Methods: This was a Cross Sectional study carried out in Department of Cardiology. This study was conducted at the Department of Cardiology out-patient section in GGH, Ongole, Prakasam district, Andhra Pradesh, India. This study was approved by the Institutional Ethical Committee of the Rajiv Gandhi Institute of Medical and Sciences [RIMS], Ongole. This study was carried out for a period of 6 months. The total of 500 post Covid-19 patients. Both In and Out patients with >18 and <60 and who develop cardiovascular diseases in 6 months, 1 year, and 1 ½ - 2 years after corona virus exposure were included in this study who are infected with SARS-COV-2.

Results: This study shows Predominance of Males over Females In our study 31-40 age group patients were commonly affected by Covid – 19. In this study we observed E.C.G and 2D ECHO parameters of Post Covid – 19 patients. Total 500 patients were evaluated. Among 302 people were found to be abnormal. The mean age of patients was 42.95±8.35 years. Tachycardia and Irregular Heart rhythm 88.56±23.0 were observed in our study. In current study we observed Short PR Interval, ST Segment Depression, Prolong R wave, Chamber Size, Sclerosis abnormalities were found. Patients who were affected with moderate- severe Covid-19 infection the presence of ST (or) T wave Inversion, Depression should be a concern for the occurrence of Cardiovascular disease in future. Patients with Severe Covid – 19 are at risk of Cardiac involvement in future. Periodic Cardiac assessment of these patients is essential.

Conclusion: ECG and 2D ECHO Cardiography investigations are prerequisite in the evaluation of cardiovascular disease. Our Study have shown some significant findings from ECG and 2D ECHO Cardiogram hence our study concludes that ECG and 2D ECHO Cardiography must consider as a important diagnostic tools for evaluation of cardiovascular disease in Covid – 19 patientsegies.

Keywords: COVID-19, ECG,2D ECHO Cardiography, ST Segment Depression, Prolong R wave.

INTRODUCTION

COVID-19, Global public health is facing a serious threat because of the coronavirus disease epidemicof 2019. COVID-19 is known as severe acute respiratory syndrome coronavirus 2 (SARSCoV-2), and it was first discovered and isolated in December 2019 in patients who were exposed at a seafood

market in Wuhan City, China. As with findings about Middle East respiratory syndrome coronavirus (MERS-CoV) and SARS-CoV-2 is thought to cross species to cause primary human infections. SARS-CoV-2 is Positive sense RNA viruses called coronaviruses have crown-like projections on their surface that are covered in spikes. The virus was named "crown- like" due to its morphological similarity to the solar coronavirus observed under an electron microscope. This appearance is brought on by spike like glycoprotein that viral surface radiates.[S] glycoprotein and transmembrane glycoprotein [M] are the two main envelope proteins. The S glycoprotein, an antigen that binds to the receptor which causes cellular fusion.[1-5] M glycoprotein plays a role in envelope formation and virion assembly.[1,2] The coronaviruses belong to four subfamilies they are Alpha, Beta, Gamma, Delta. Since the start of the pandemic SARS-CoV-2 has been identified, according to the WHO's epidemiological update Alpha (B.1.1.7) The initial variation of concern, as reported in the UK towards the end of December 2020, December 2020 saw the first reports of Beta (B.1.351) in South Africa. Gamma (P.1) Early in January 2021, reports from Brazil were made. Delta (B.1.617.2) December 2020 saw the first report of this in India. Omicron (B.1.1.529) November 2021 saw the first reports of it in South Africa.[6-9]

As August 15, 2020, COVID-19 is a pandemic brought on by the severe acute respiratory syndrome coronavirus 2 (SARSCoV-2). The virus has infected over 20.9 million people and killed 760 633 people globally.It was reported that the COVID-19 death rate was approximately 3.4% for all patients, 1.4% for those without underlying disease, and 13.2% for those with pre-existing cardiovascular disease.[3] Cardiovascular comorbidities range in frequency among COVID-19 inpatients from 17.1% to 59.6%, and the mortality rate for patients with pre-existing hypertension or CVD is 1.42 and 3.15 times higher, than that of patients without such conditions. The clinical presentation of COVID-19 varies and can include from an infection with no symptoms to multiple organ failure and even death.[4-6]

Cardiovascular Complications in Covid-19:

During the infection, thromboembolic events such arterial thrombosis, pulmonary embolism, and deep vein thrombosis (DVT) have been reported often.[49,50]Up to 25% of patients in the intensive care unit (ICU) experienced venous thromboembolisms, and it was discovered that PEs were more common in COVID-19 acute respiratory distress syndrome (ARDS) patients than in ARDS patients from other causes. Chest discomfort, dyspnea, dysrhythmia, and acute left ventricular failure are among the symptoms. A study of 2736 SARS-CoV-2 patients in the United States discovered that up to 36% had increased troponin levels early in the disease. Pre-existing coronary artery disease, cerebrovascular disease, and chronic heart failure were all associated with an increased risk of myocardial damage. Elevated troponin levels during hospitalization were also linked to an increased likelihood of necessitating ventilation, fatal ventricular arrhythmias, and a 59.6% mortality rate.Furthermore, those with pre-existing cardiovascular conditions, such as persistent hypertension, were more likely to develop HF. Heart failure patients are more likely to experience thromboembolic events, ARDS, severe hypotension, and mortality. The death rate of 77 SARSCoV-2-positive patients in a Spanish hospital who developed acute HF was 46.8%. COVID-19 may show significant overlap with signs and symptoms of cardiovascular problems such as dyspnea and chest discomfort.

Furthermore, cardiovascular problems have been seen to develop often during the disease's progression.

As a result, cardiovascular consequences should always be addressed, particularly in more severe COVID-19 cases requiring hospitalization. Patients who have underlying cardiovascular co-morbidities may need to be followed more closely. These individuals were found to be more likely to require hospitalization, ICU admission, and to have poorer mortality outcomes. The various and frequent cardiovascular consequences seen in a respiratory infection like COVID-19, as well as the predominance of those with cardiovascular comorbidities, point to the disease's complexity. We will now look at the various pathophysiological reasons underlying these cardiovascular problems.

Pathophysiology

Once the virus has entered, its RNA genome is released into the cytoplasm, viral proteins are created by transcription and translation, and the viral genome is duplicated, resulting in an increase in viral load. The major histocompatibility complex (MHC) presents the viral antigen in the cell, and cytotoxic T cells identify it later. This functional receptor has been found to be highly expressed in pulmonary epithelial cells, as well as in other organ systems such as the heart, kidneys, bladder, and ileum. Clinical data indicate thatCOVID-19 patients may have had heightened inflammatory reactions prior to infection.

Such fast viral multiplication causes blood vessel leakage as well as the death of endothelium and epithelial cells. Consequently, pro-inflammatory mediating cytokines and chemokinesare observed to be triggered. It is found the ACE-2 receptors are strongly localized on the apical side of pneumocytes. SARS-CoV-2 enters these cells and kills the receptors that are there. Three essential components make up the innate immune system of the airway passage: epithelial cells, which act as the first barrier, dendritic cells, and macrophages, which aid in thwarting the virus until adaptive immunity takes effect. Patients reported higher plasma concentrations of IL 6, IL 10, G-CSF,

MCP1, MIP1α, and TNF-α.Upregulation of pro-inflammatory cytokines, often known as a "cytokine

storm," has been linked to multi-organ failure, Heart &lung injury, and the development of severe COVID-19.

Aim and Objectives

Aim:

Study of Electrocardiogram and Echocardiography parameters of post covid-19 patients

Objective:

- To study relation of SARS-COV-2 infection and prevalence of cardiovascular disease.
- To study ECG changes in SARS-COV-2 infected patients.
- To study 2D ECHO parameters in SARS-COV-2 infected patients.

MATERIALS AND METHODS

Study Design: This was a Cross Sectional study carried out in Department of Cardiology.

Study site: This study was conducted at the Department of Cardiology out-patient section in GGH, Ongole, Prakasam district, Andhra Pradesh, India.

Study approval: This study was approved by the Institutional Ethical Committee of the Rajiv Gandhi Institute of Medical and Sciences [RIMS], Ongole.

Study period: This study was carried out for a period of 6 months.

Study population: The total of 500 post Covid-19 patients.

Study selection criteria

Inclusion criteria: Both In and Out patients with >18 and <60 and who develop cardiovascular diseases in 6 months, 1 year, and 1 ½ - 2 years after corona virus exposure were included in this study who are infected with SARS-COV-2.

Patients who are willing to accept informed consent form.

Exclusion criteria

H/O Congenital Heart Disease, H/O. Existing Coronary Artery Disease, H/O Valvular Heart disease, H/O cardiomyopathy, Hyperlipidaemia, pregnant women and patients with Hypertension, Type2 Diabetes, Thyroid abnormalities, Chronic Kidney Disease.

- Patients who are not willing to accept informed consent form.

Data collection

Data collection was initiated after necessary permissions were obtained from the hospital and concerned departments. Questionnaires were the main medium of data collection. Participants various demographic details were collected in the demography session included in the questionnaire. Data was collected from questionnaire. Knowledge and adherence data was collected directly from the patients by doing ECG and 2D ECHO parameters.

Study procedure: A Cross Sectional study was conducted among the subjects with Post Covid-19 patients in the Cardiology department in GGH. We will collect post covid-19 patients who develop cardiovascular disease in 6 months, 1 year, and 1 ½ - 2 years after exposure of SARS-COV-2. In this study we are performing ECG and 2D ECHO parameters to evaluate cardiovascular disease in SARS-COV-2.The data was collected by using well designed proforma according to the criteria and data was analyzed.

The questionnaire: Questionnaire was the main tool for data collection. The entire Questionnaire was divided into Nine parts - demographic variables as well as knowledge assessment questions and adherence assessment questions. The formal part was used to record participants various demographic characteristics such as age, education, occupation. The later was the main session to assess the knowledge and adherence to methotrexate.

The 9 categories are:

- Demographic details of Post Covid-19 patients
- Clinical features in Post Covid
- Treatment in Post Covid-19
- Social Habits
- Past Medical History
- Family History
- History of Present illness
- ECG and 2D ECHO parameters
- Provisional Cardiovascular Disease.

RESULTS

Distribution of Patients Based on Poor R Wave

Out of Total 500 Population visited to the Hospital maximum 12 numbers were found to be V2 with 2.4% followed by 1.2% with 6 number were found to be V3 and V4 with 1% followed by 5 number were found to be V1 with 5 number were found to be V1 with 0.6% followed by 3 number were found to be V5 were observed.

Table 1: Categorization based on Poor R -Wave

Poor R- Wave	Number	Percentage
V1	5	1
V2	12	2.4
V3	6	1.2
V4	6	1.2
V5	3	0.6
V6	4	0.8

Distribution of Patients Based on Prolonged R Wave

Out of Total 500 Population visited to the Hospital maximum 4 number were found to beV1, V2, V3 with 0.8% followed by 0.6% followed by 3 number were found to be V4 with 0.2% followed by 1 number were found to be V5 and V6 were observed.

Table 2: Categorization based on Prolonged R Wave

Prolonged R- Wave	Number	Percentage
V1	4	0.8
V2	4	0.8
V3	4	0.8
V4	3	0.6
V5	1	0.2
V6	1	0.2

Distribution of Patients Based on Chamber Morphology

Out of Total 500 Population visited to the Hospital maximum 433 numbers were found to be normal with 86.6% followed by 13.4% were found to be abnormal with 67 numbers were observed.

Table 3: Categorization based on Chamber Morphology

Chamber Morphology	Number	Percentage
Abnormal	67	13.4
Normal	433	86.6

Distribution of Patients Based on Left Ventricular Systolic Function

Out of Total 500 Population visited to the Hospital maximum 341 numbers were found to be normal with 68.2% followed by 31.8% were found to be abnormal with 159 numbers were observed**.**

Table 4: Categorization based on Left Ventricular Systolic Function

Lv Systolic Function	Number	Percentage
Abnormal	159	31.8
Normal	341	68.2

Distribution of Patients Based on Right Ventricular Systoli Function

Out of Total 500 Population visited to the Hospital maximum 480 numbers were found to be normal with 96% followed by 4% were found to be abnormal with 20 numbers were observed

Table 5: Categorization based on Right Ventricular Systolic Function

Rv Systolic Function	Number	Percentage
Abnormal	20	4
Normal	480	96

Distribution of Patients Based On Sclerosis

Out of Total 500 Population visited to the Hospital maximum 459 numbers were found to be normal with 91.8% followed by 8.2% were found to be abnormal with 41 numbers were observed.

Table 6: Categorization based on Sclerosis

Sclerosis	Number	Percentage
Abnormal	41	8.2
Normal	459	91.8

Distribution of Patients Based On Left Ventricular Hypertrophy [LVH]

Out Of Total 500 Population Visited To The Hospital Maximum 396 Numbers Were Found To Be Normal With 79.2% Followed By 20.8% Were Found To Be Abnormal With 104 Numbers Were Observed.

Table 7: Categorization Based On Left Ventricular Hypertrophy

Left Ventricular Hypertrophy	Number	Percentage
Abnormal	104	20.8
Normal	396	79.2

Distribution of Patients Based On Regional Wall Motion Abnormality [Rwma]

Out Of Total 500 Population Visited To The Hospital Maximum 403 Numbers Were Found To Be Normal With 80.6% Followed By 19.4% Were Found To Be Normal With 97 Numbers Were Observed. The Results Are Presented In Table-40.

Table 8: Categorization Based On Regional Wall Motion Abnormality

Regional Wall Motion Abnormality	Number	Percentage
Abnormal	97	19.4
Normal	403	80.6

Distribution of Patients Based On Chamber Dimensions

Out Of Total 500 Population Visited To The Hospital Maximum 400 Number Were Found To Be Normal With 80.6% Followed By 19.4% Were Found To Be Normal With 97 Number Were Observed. The Results Are Presented In Table-41.

Table 9: Categorization Based On Chamber Dimensions

Chamber Dimensions	Number	Percentage
Abnormal	100	20
Normal	400	80

Distribution of Patients Based On Valvular Morphology

Out Of Total 500 Population Visited To The Hospital Maximum 359 Number Were Found To Be Normal With 71.8% Followed By 28.2% Were Found To Be Abnormal With 141 Number Were Observed. The Results Are Presented In Table- 30.

Table 10: Categorization Based On Valvular Morphology

Valvular Morphology	Number	Percentage
Abnormal	141	28.2
Normal	359	71.8

Distribution of Patients Based On Ejection Fraction

Out Of Total 500 Population Visited To The Hospital Maximum 70 Numbers Were Found To Be Mild [14%] With 41-49 Age Group Followed By 69 Numbers Were Found Faire [13.8%] With 5055 Age Group Followed By 69 Numbers Were Found Fair [13.8%] With 50-55 Age Group Followed By 9 Numbers Were Found Moderate [8%] With 40-30 Age Group Followed By 15 Numbers Were Found Severe [3%] With [<30] Age Group Were Observed. Average Mean Was Found To Be 52.87 And Standard Deviation Was Found To Be 8.72.

Table 11: Categorization Based On Ejection Fraction

Ejection Mildfraction	Age Groups	Number	Percentage
Fair	50-55	69	13.8
Mild	41-49	70	14
Moderate	40-30	40	8
Severe	[<30]	15	3

Distribution of Patients Based On Aortic Jet Velocity [AJV]

Out Of Total 500 Population Visited To The Hospital Maximum 431 Numbers Were Found To Be Normal With 86.2% Followed By 13.8% Were Found To Be Abnormal With 69 Numbers Were Observed. Average Mean Was Found To Be 115.56 And Standard Deviation Was Found To Be 15.62.

Table 12: Categorization Based On Aortic Jet Velocity

Aortic Jet Velocity	Number	Percentage
Abnormal	69	13.8
Normal	431	86.2

Distribution of Patients Based On Tricuspid Regurgitation Jet Velocity[TRJV]

Out Of Total 500 Population Visited To The Hospital Maximum 440 Numbers Were Found To Be Normal With 88% Followed By 12% Were Found To Be Abnormal With 60 Numbers Were Observed. Average Mean Was Found To Be 2.35 And Standard Deviation Was Found To Be 0.94.

Table 13: Categorization Based On Tricuspid Regurgitation Jet Velocity

Tricuspid Regurgitation Jet Velocity	Number	Percentage
Abnormal	60	12
Normal	440	88

Distribution of Patients Based On Right Ventricular Systolic Function[RVSP]

Out Of Total 500 Population Visited To The Hospital Maximum 398 Numbers Were Found To Be Normal With 79.6% Followed By 20.4% Were Found To Be Abnormal With 102 Numbers Were Observed. Average Mean Was Found To Be 28.16 And Standard Deviation Was Found To Be 6.54.

Table 14: Categorization Based On Right Ventricular Systolic Function

Right Ventricular Systolic Function	Number	Percentage
Abnormal	102	26
Normal	398	74

Distribution of Patients Based On Pulmonary Valve Jet Velocity

Out Of Total 500 Population Visited To The Hospital Maximum 370 Numbers Were Found To Be Normal With 74% Followed By 26% Were Found To Be Abnormal With 130 Numbers Were Observed. Average Mean Was Found To Be 102.20 And Standard Deviation Was Found To Be 10.69.

Table 15: Categorization Based On Pulmonary Valve Jet Velocity

S. No	Pulmonary Valve Jet Velocity	Number	Percentage
1	Abnormal	130	26
2	Normal	370	74

Distribution of Patients Based On Severity of Post Covid-19

Out Of Total 500 Population Visited To The Hospital Maximum 215 Numbers Were Found To Be Severe [SARS-COV-2] Infection [43%] Followed By 176 Numbers Were Found To Be Moderate Infection [35.2%] Followed By 109 Numbers Were Found To Be Mild Infection [21.8%] Were Observed Based Clinical Features In COVID-19. The Results Are Presented In Table-48.

Table 16: Categorization Based On Severity Of Post Covid-19

Severity	Number	Percentage
Mild	109	21.8
Moderate	176	35.2
Severe	215	43

DISCUSSION

The Present Study Is Attempt To Know The Current Status Of Electrocardiogram And Echocardiographic Parameters Of Post Covid – 19 In Tertiary Care Hospital In Ongole Region Of Andhra Pradesh.Based On Age Wise Characterization, 31-40 Age Group Patients Were Most Commonly Affected By Covid – 19 Followed By 41-50 Years. Our Study Was Supported By I.E., Campbell Et Al., (2020).[1] In Present Study, Among 500 People 266 Are Males And 234 Were Females With An Average Mean [42.95 ± 8.35] Our Study Was Supported By Various Studies I.E., Helms, J Et Al., (2020).[2]

In Our Study Fever Is The Most Commenst Symptom Fever [363(72.6%)] Followed By Cold [293 (58.4%)], Cough [280(56%)], SOB [215(43%)] Were Observed It Is Observed That Fever [99 (85.3%)], Dry Cough [61 (52.6%)], Chest Discomfort [50 (43.1%)] Cui, S.; Et Al., (2020).[3]

In Our Study 478 [95.6%] Patients Received Oral Antibiotics, 163[32.6%] Patients Received Oral Steroids. In Severe Patients, Parenteral Antibiotics Was Given To 13 of Cases.It Is Observed That 112 (96.6%) Patients Received Antibiotic Treatment, 12 (10.3%) Patients Received Oral Steriods, Systemic Corticosteroid Was Given To 47.4% Of Cases I.E., Lala, A.; (2020) 5

In Our Study 112[22.4%] Were Tachycardia, 24[4.8%] Were Bradycarida With Average Mean [88.56 ± 23.01] Are Observed.It Is Observed That Sinus Tachycardia In 18 (16.9%), Sinus Bradycardiain One (0.9%) Similar Studies Conducted By Other Researches In Which It Is Identified That Tachycardia Was More Common I.E.,Shi, S.; (2020).[6] In Our Study 52[10.4%] Were Irregular Heart Rhytm, 448 [89.6%] Were Regular Heart Rhythm. It Is Observed That Irregular Rhythm Abnormalities Were Seen In 9 Patients (2.9%).

In Present Study, Short PR Interval Is Detected Among 46 Patients [9.2%] As Per Statistical Analysis There Was Strong Clinical Association Evidence (P< 0.05, Using Chi – Square Test). This Was In Accordance To A Study Of Others I.E.,Huang, C.(2019),[10] stated That PR <120 Ms (Short PR Interval) Was Detected In 10 (4%) Patients.

In Present Study, ST Segment Depression Is Detected Among 54 Patients [10.8%] As Per Statistical Analysis There Was Strong Clinical Association Evidence (P< 0.05, Using Chi – Square Test). This Was In Accordance To A Study Of Others. Statedsattar, N.; (2020).[11] That (ST Depression, *N* = 27 [28%]. ST-T Segment Changes Were Observed In 17 (15.7%) Patients. In Our Study Prolong R Wave Abnormality Was Observed Among Other Findings With 17 Patients [3.4%] As Per Statistical Analysis There Was Strong Clinical Association Evidence (P< 0.05, Using Chi – Square Test).

In Our Study Common ECG Findings Are Short PR Interval [46 (9.2%)], Prolong PR Interval [59(11.8%)], Short QRS Complex [36(7.2%)], Widen QRS Complex [41(8.2%)], Short QT Interval [25(5%)], Prolong QT Interval [22(4.4%)], ST Segment Elevation [31(6.2%)], ST Segment Depression [54(10.8%)], T Wave Inversion [86(17.2%)], T Wave Tall [37(7.4%)], Poor R Wave [36(7.2%)], Prolong R Wave [17(3.4%)] Were Observed.[8,9] In Our Study The Mean Values And Respective Standard Deviations Of The Echocardiographic Parameters Were As Follows: Ejection Fraction [52.87 ± 8.72], Aortic Jet Velocity [115.56 ±15.62], Tricuspid Regurgitation Jet Velocity [2.35 ±0.94], Right Ventricular Systolic Function [28.16 ± 6.54], Pulmonary Valve Jet Velocity [102.20 ± 10.69] Were Observed.[10] In Present Study Chamber Size Was Detected Among 67 Patients [13.4%], Sclerosis Was Detected Among 41 Patients [8.2%].As Per Statistical Analysis There Was Strong Clinical Association Evidence (P< 0.05, Using Chi – Square Test).

In Our Study Common ECHO Findings Are Chamber Size [67(13.4%)], Left Ventricular Systolic Function [159(31.8%)], Right Ventricular Systolic Function [20(4%)], Scelerois [41(8.2%)], Left Ventricular Hypertrophy [104(20.8)], Left Ventricular Regional Wall Motion [97(19.4%)], Dimensions [100(20%)], Valvular Morphology [141(28.2%)] Were Observed.[11]

In Our Study Fair LVEF Was Observed In 50-55 Age Group In 69 Patients (13.8%), Mild LVEF Was Observed In 41-49 Age Group In 70 Patients (14%), Moderate LVEF Was Observed In 40-30 Age Group In 40 Patients (8%), Severe LVEF Was Observed In ≤30 Age Group In 15 Patients (3%) Was Observed.[12,13]

In Present Study While No Significant Difference Was Observed In The QRS Complex [P=0.629], QT Interval [P= 0.823], and T Wave [P=0.423]. As Per Statistical Analysis, There Was No Strong Clinical Association Between These (P >0.05, Using Chi – Square Test).

CONCLUSION

ECG And 2D ECHO Cardiography Investigations Are Prerequisite In the Evaluation Of Cardiovascular Disease. Our Study Have Shown Some Significant Findings From ECG And 2D ECHO Cardiogram Hence Our Study Concludes That ECG And 2D ECHO Cardiography Must Consider As A Important Diagnostic Tools For Evaluation Of Cardiovascular Disease In Covid – 19 Patients.

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