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RESEARCH ARTICLE

CARDIAC INJURY IN MODERATE AND SEVERE COVID 19 PNEUMONIA PATIENTS: ROLE IN PROGNOSIS

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ABSTRACT

Background: Cardiac injury has now been an emerging complication of the ongoing pandemic of COVID 19. Increased risk of infection to the patients with cardiovascular disease were addressed in various studies however the risk of myocardial injury and subsequent complications and long term outcome after COVID 19 are of concern in coming years. **Aims and objective:** The aim of the study is to correlate the presence of cardiac injury and their clinical outcome in patients with moderate and severe COVID 19 pneumonia. **Methods and Methodology:** This was a prospective observational study done from March 2021 to July 2021, conducted in Chitwan Medical College and Teaching Hospital, Bharatpur, Nepal. Cardiac injury was defined by raised in cardiac biomarkers level, electrocardiographic changes and decrease in left ventricular ejection fraction. **Results:** In this study, total 44 patients were studied with a mean age of 54.59±12.58 years and age more than 50 years (72.7%) with male predominance (65.9%). Hypertension (29.5%) being the common risk factor in those patients. Significant difference was found in moderate and severe COVID 19 with WBC count, serum Potassium level, C-reactive protein, cardiac troponin I, D-Dimer (p<0.05). Sinus tachycardia was the most common ECG findings. Only 27.27% were able to transfer to ward, mortality during ICU stay observed in 47.72% of patients and 25% were discharged against the medical advice. There was significant difference in in-hospital mortality with the severity of COVID 19. **Conclusion:** Cardiac injury was common in patient with severe COVID 19 patients. Cardiac biomarkers as well as WBC count, serum potassium level, D-Dimer, CRP helps in prognosis of severity of COVID 19. Electrocardiogram (ECG) changes and in hospital mortality was observed more in severe COVID 19 patients.

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INTRODUCTION

The outbreak of the deadly virus since the beginning of December 2019 caused by Severe Acute Respiratory Syndrome corona virus 2 (SARS-CoV-2), also termed as COVID-19 by World Health Organization, has caused pandemic affecting millions of people worldwide (Esmaeil Mehraeen, 2020; Denis Doyen, 2021). It had been widely known to cause respiratory tract infections, however several studies shows that patient admitted in ICU with COVID 19 also had myocardial damage (Wang, 2020). About 12 to 30 % of patients with COVID 19 had myocardial injury causing myocarditis, arrhythmia, pericardial effusion, venous thromboembolism and even myocardial infarction which was associated with increased in hospital mortality (Shaobo Shi Mu Qin, 2020) This study was done to evaluate the presence of cardiac injury by various assessment combining ECG, cardiac biomarkers and left ventricular ejection fraction (LVEF) and in

hospital mortality in patients with moderate and severe COVID 19 pneumonia.

METHODS AND ANALYSIS

A prospective observational study was conducted on patients admitted with the diagnosis of moderate or severe COVID 19, admitted in the Intensive Care Unit (ICU) of Chitwan Medical College and Teaching Hospital, Bharatpur, Chitwan. Informed consent was taken from the patient. The study of total 44 patients age above 20 were enrolled who had COVID 19 confirmed by real time reverse transcriptase polymerase chain reaction (RT-PCR) assay of nasopharyngeal swabs. Severity of COVID was labeled according to the World Health Organization, COVID19: clinical guidance 2021. The patients diagnosed with mild COVID 19 and aged under 20 were excluded. At admission, detailed history and clinical evaluation with initial laboratory parameters, ECG was done.

ECG was recorded with 25mm/s and 1mm/mv calibration and 0.05-150 Hz setting. ECG parameters HR, PR interval (interval between beginning of P and end of R wave), presence/absence of ST-T changes, QT interval (interval from beginning of Q wave to end of T wave, corrected QT interval was measured using Bazett's formula), poor progression of R wave (yes/no) and low voltage ECG (yes/no) and presence of any type of arrhythmia was recorded. Bedside echocardiography was done to measure the left ventricular ejection Fraction (LVEF) by 2-dimension (2D), M- mode and eyeballing method. Myocardial injury was defined by the rise in cardiac biomarkers cTnI above the 99th percentile upper reference limit with new ECG changes or reduction in LVEF. Patients were grouped according whether they were able to transfer out to ward or were discharged against medical advice or expired during ICU stay. The study outcome was determined by patient trans-out to ward, in hospital mortality or discharged on medical advice. Duration of hospital stay in those patients was recorded in both groups of moderate and severe COVID 19.

RESULTS

In this study, out of 44 patients, mean age of patient was 54.59±12.58 years and age more than 50 years (72.7%) with male predominance (65.9%). Hypertension (29.5%) being the common risk factor in those patients.

Table 1. Overall Demographic characteristics of patients with Moderate and Severe COVID 19 Pneumonia (n=44)

Characteristics	Frequency(n)	Percent (%)
Age (years)		
<50	12	27.3
50	32	72.7
Mean±SD	54.59±12.58	
Gender		
Female	15	34.1
Male	29	65.9
Smoking		
Yes	2	4.5
No	42	95.5
Co morbidity		
DM	10	22.7
HTN	13	29.5
Outcome		
Transfer to ward	12	27.27
Expire	21	47.72
Lama	11	25
Severity		
Moderate	16	36.36
Severe	28	63.64

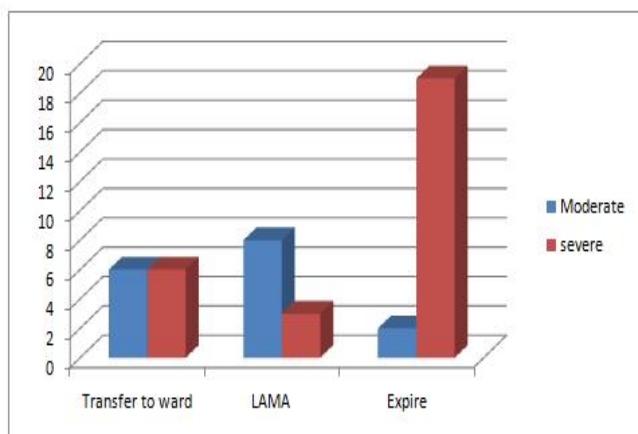


Figure 1. Association between the severities of COVID 19 with clinical outcome

Most of the patients were non smokers (95.5%). Only 27.27% were able to transfer to ward, mortality during ICU stay observed in 47.72% of patients and 25% were discharged against the medical advice whose further outcome was not known. According to WHO criteria for severity, severe COVID 19 pneumonia observed in 63.64% of patients and rest with moderate severity (Table 1). As illustrated in table 2, there was a significant relationship between the severity of COVID 19 Pneumonia in terms of WBC count, serum Potassium level, C-reactive protein and cardiac troponin I, D-Dimer (p<0.05). Table 3 summarizes the measured ECG parameters at baseline. Comparison of ECG parameters done with the severity of COVID 19. Sinus tachycardia was observed in total 19 patients with 68.4% in severe COVID patients and sinus bradycardia observed in total 8 patients where 6(75%) patients were from severe group. ECG changes like poor progression of R wave, low voltage ECG, ventricular premature beats(VPBs), Atrial fibrillation, ventricular tachycardia, Ventricular fibrillation and asystole were observed more in severe COVID 19 group as compared to moderate COVID 19. There was a significant difference noted of asystole in both groups (p<0.05). Left ventricular ejection fraction (LVEF) ranging from 30-50% was 63.6% vs. 36.4% in severe and moderate COVID 19 group respectively. Furthermore, patient were categorized and analyzed according to the outcome of transfer out to ward, leave against medical advice (LAMA) or expired during hospital stay. 6 patients each with moderate and severe COVID 19 pneumonia were able to transfer out to ward from ICU, however 19 patients with severe COVID and 2 patients with moderate COVID were expired during ICU stay. 8 and 3 patients were discharged on LAMA with moderate and severe COVID 19 pneumonia respectively. There was a significant difference in clinical outcome between moderate and severe COVID 19 pneumonia (p<0.05).

DISCUSSION

Association of cardiac injury with COVID 19 has been shown in various studies where preexisting cardiovascular disease may have exacerbated the severity of COVID 19. Potential risk factors for the in hospital mortality was older age, presence of comorbidity, rise in cardiac biomarkers and elevation in inflammatory markers (Shaobo ShiMu Qin, 2020; Huang, 2020; Guo, 2020; Fan, 2020) In A systematic review and meta analysis done by LingHua Fu al (2021) and Fangwei Zou *et al.* (2020) cardiac injury was common in hospitalized patients and was associated with advanced age and increase risk of all cause mortality. In our study, mean age of patient was 54.59±12.58 years with male patient of 65.9% which was similar in systematic and meta-analysis study done by Mehrbod Vakhshoori *et al.* (2020) where mean age of patient was 56.6 ± 33.4 years (males: 54.3%). Various studies had hypertension as most common risk factor followed by diabetes mellitus and ischemic heart disease. In our study hypertension was observed in 29.5% of patients. In a study done by Fabio Angeli *et al.* (2020), Jia He *et al* (2020) Francesca Mai (Francesca Mai, 2020) stated that there was dynamic changes in ECG like ST-T changes, Atrial Fibrillation, tachy-brady syndrome and changes consistent with pericarditis in patients with COVID 19 pneumonia. In our study, ECG changes were observed in both groups of moderate and severe COVID 19 pneumonia patients but more in severe group as compared to moderate COVID 19 group.

Table 2: Relationship of severity of COVID -19 in terms of Lab parameters and Length of hospital stay

WHO Covid 19 Severity:	Moderate	Severe	t-value	p-value
SPO2(%)	78.13±16.05	72.57±17.49	1.04	0.29
Hb(gm/dl)	12.70±2.08	11.98±1.78	1.21	0.23
WBC(/cumm)	11400±6941	15904±6993	-2.06	0.046*
S.Creatinine(mg/dl)	0.97±0.88	1.58±1.49	-1.51	0.137
Na+(mmol/L)	138.8±5.11	140.32±4.70	-1.029	0.309
K+(mmol/L)	3.88±0.69	4.67±1.35	-2.14	0.015*
CRP(mg/dl)	52.83±30.12	129.37±77.01	-3.52	<0.001*
D-Dimer(mg/dl)				
0-1	2(40)	3(60)		
1 to 2	5(83.3)	1(16.7)	6.92	0.031#
>2	9(27.3)	24(72.7)		
cTnI(ng/ml)	0.161±0.54	0.960±1.26	-2.39	0.021*
Length of hospital stay(days)	15.63±8.90	15.43±7.14	0.08	0.93

Spo2: oxygen Saturation, Hb: Hemoglobin, WBC: white blood cell count, Na+: Serum Sodium, K+: Serum Potassium, CRP: C-Reactive Protein, cTnI: cardiac troponin I.*Statistically significant at 5% level of significance, p-value was calculate using independent t test. #p value calculated using chi square test.

Table 3. Relationship between severity of COVID -19 with Electrocardiographic findings and LVEF

Variables	COVID		T-Test	p-value
	Moderate	Severe		
Heart rate(bpm)	94.81±2.23	98.07±22.26	-0.467	0.64
PR(ms)	143.13±15.11	138.46±15.53	0.98	0.33
QTc(ms)	432±26.85	427.25±21.99	0.75	0.45
			Chi-square test	p-value
Sinus Tachycardia				
Yes	6(31.6)	13(68.4)	0.331	0.75
No	10(40)	15(60)		
Atrial fibrillation				
Yes	-	3(100)	1.84	0.29
No	16(39)	25(61)		
Sinus Bradycardia				
Yes	2(25)	6(75)	0.54	0.46
No	14(38.9)	22(61.1)		
Poor progression Rwave				
Yes	-	1(100)	0.585	0.44
No	16(37.2)	27(62.8)		
Low voltage ECG				
Yes	-	2(100)	1.197	0.274
No	16(38.1)	26(61.9)		
Ventricular premature beats(VPB)				
Yes	-	1(100)	0.585	0.44
No	16(37.2)	27(62.8)		
Ventricular tachycardia				
Yes	-	4(100)	2.514	0.113
No	16(40)	24(60)		
Ventricular Fibrillation				
Yes	1(12.5)	7(87.5)	2.4	0.12
No	15(41.7)	21(58.3)		
Asystole				
Yes	1(8.3)	11(91.7)	5.6	0.018*
No	15(46.9)	17(53.1)		
LVEF(%)				
30-50%	4(36.4)	7(63.6)	0.02	0.95
>50%	12(36.4)	21(63.6)		

PR: PR interval, *Statistically significant at 5% level of significance.

Table 4. Association between severities of COVID-19 with clinical outcome

COVID	Outcome			Chi-square	P-value
	Transfer to ward	Expire	Lama		
Moderate	6(37.5)	2(12.5)	8(50)	13.78	0.001*
Severe	6(21.4)	19(67.9)	3(10.7)		

*Statistically significant at 5% level of significance

Raised cardiac biomarker (Troponin I) is the independent predictor of cardiac injury and a in hospital mortality risk factor (Li, 2020; Anwar Santoso, 2021). There was a significant difference in severity of COVID 19 in respect to troponin. Mean duration of hospital stay was 15.63±8.90 days in moderate COVID 19 and 15.43±7.14 days in severe COVID 19 group however in hospital mortality (67.9%) was observed

in severe COVID 19 pneumonia patients which was similar previous studies.

CONCLUSION

Cardiac injury was common in COVID 19 patients with advanced age and underlying comorbidity.

Early diagnosis, evaluation of cardiac biomarkers and ECG changes helps in identification of severity of COVID 19 and predicts the prognosis of disease outcome.

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