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Characteristics of Radiological Features and Laboratory Parameters in Patients with COVID-19 Pneumonia during Second Phase of Pandemic in Nepal: A Retroprospective Study

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Abstract

Objectives: The country Nepal was badly hit in second phase of epidemic due to highly transmitted Delta and Delta plus variant. The aim of this study was to investigate the different characteristics of chest HRCT, X-Ray and abnormalities in laboratory parameters of COVID-19 patients during second phase of epidemic.

Methods: COVID-19 Patients were admitted to COVID ward, Bharatpur Cancer Hospital. Patients underwent for Chest X-Ray or HRCT and laboratory tests for further evaluation were retrospectively analyzed. Patient without pneumonia were excluded from study. Statistical analysis was performed to evaluate the characteristics of Group-A (laboratory parameters with HRCT) and Group-B (laboratory parameters with X-Ray).

Results: A total number of 116 patients (72 males and 44 females, age range 3-90 years) were admitted to COVID ward. A total number of 67 patients in which 55 patients (Group A) and 12 patients (Group B) were included in the study. Different laboratory test were evaluated for all those 67 patients. In our study, typical and atypical appearances of HRCT was Ground-Glass Opacities (GGO), Crazy Paving, Consolidation, Bronchiectasis, Multifocal GGO, Bronchiectasis, Collapse and Fibrotic. In group A, CT severity of 11, 18 and 26 were mild, moderate and severe respectively. In Group B, 6 patients were mild and 6 were moderate. There were alteration in laboratory tests i.e., platelets, WBC, neutrophil, lymphocytes, eosinophil, monocyte, CRP, Glucose, Bilirubin Total, Bilirubin Direct, ALT, AST, and LDH were 43%, 40%, 85%, 89%, 42%, 74%, 95%, 61%, 10.9%, 14.5%, 85%, 63%, and 100% respectively.

Conclusion: There were mostly typical Ground-Glass-Opacities (GGO) appearances in HRCT chest with some atypical appearances. There was elevation in Neutrophil, CRP, Glucose, ALT, AST, and LDH whereas low counts in platelets, WBC, lymphocyte, eosinophil, and monocyte. Statistical correlation was found between laboratory analyses and amount of damaged lung. We concluded that symptomatic patients even with negative RT-PCR should be considered as COVID-19 patients if CT and biochemical tests are positive.

Keywords: COVID-19; SARS-CoV-2; RT-PCR; Biochemical Laboratory test

Introduction

First identified case of COVID-19 (named by WHO of Corona Virus Disease 2019) was found in Wuhan China which is an infectious disease caused by Severe Acute Respiratory Syndrome Corona Virus (SARS-CoV-2). Worldwide total diagnosed case of COVID-19 was 456,908,767 patients, global total death due to this disease was reported 6,041,077 till date March 14, 2022 [1]. It is increasing day by day worldwide. Some countries maintain the disciplined life style according to COVID-19 protocol and it seems that there is control of infection rate and death rate due to COVID-19 in those countries. Some countries are still badly affected and both the infection rate and death rate are too high.

The most common symptoms of COVID-19 are fever, dry cough, fatigue and other symptoms that are less common and may affect some patients include loss of smell or taste, nasal, headache, conjunctivitis, congestion, muscle or joint pain, sore throat, nausea or vomiting, different types of skin, rash, diarrhea and chills or dizziness [2]. Research study already reported that symptoms of patient with severe COVID-19 disease include loss of appetite, shortness of breath, confusion, persistent pain, high temperature (above 38°C) and other less common symptoms are irritability, reduced consciousness (sometimes associated with seizures), sleep disorder, depression, anxiety, more severe and rare neurological complications such as brain inflammation, strokes, nerve damage, and delirium [2]. These are not only all the possible symptoms. Center for Disease Control and Prevention (CDC) is continuing updating more and more about COVID-19. There are several studies reported that older age population, heart disease patient, lung disease patient and diabetic patient seems to be at higher risk for developing more serious complications due to COVID-19 illness [3]. It is concluded by many literatures that there are majority of asymptomatic COVID-19 patients. One literature concluded that about 15.6% of confirmed COVID-19 patients are asymptomatic [4]. It was also reported that nearly 50% of the patients with no symptoms at detection time will develop symptoms later and asymptomatic COVID-19 patients could have laboratory inaccuracy and swab collection techniques, storage of collected swab may be used as screening strategies to identify asymptomatic infection [4].

National government data showed that country Nepal is also badly hit by COVID-19. According to data updated by government of Nepal, total diagnosed case of COVID-19 was 977937 patients, total death

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due to this disease was reported 11950 and total 961070 patient were recovered in Nepal till date March 14, 2022 [5].

According to the different world official guidelines, patients infected with SARS-COV-2 virus must be went for nasopharyngeal or oropharyngeal RT-PCR swab test and Chest X-ray imaging for first step and for the further detail evaluation, HRCT chest and biochemical laboratory test are recommended in case of discrepancy between clinical and radiographic characteristics [6].

There are several studies which have reported that the sensitivity of nasopharyngeal or oropharyngeal Real-Time Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) swab test applied to respiratory tract specimens are only 60% to 70% due to different technical reasons (reagents, sample transport conditions, etc.), intrinsic limitations like viral load in different anatomic sites and sampling procedures [7-9].

Some patients whose double-swab RT-PCR test was negative but had all the other symptoms positive for COVID-19, went for HRCT chest and diagnosed as an interstitial COVID pneumonia. This condition may complicate the management of patients suspected of COVID-19 infection so it is mandatory to evaluate other supporting diagnostic tool which help to differentiate COVD-19 infected and not infected patients.

There are several studies reported an outline of the most typical laboratory abnormalities parameters found in patients infected with SARS-COV-2 virus [10,11]. One retrospective study concluded that there is strong correlation between radiological characteristics (HRCT chest findings) and altered laboratory test results in COVID-19 patients [12]. One another study reported that biochemical laboratory parameters like serum ferritin and D-dimer levels found high in the CT-positive COVID-19 patients and it was moderate positive correlation with CT severity. The author suggested that D-dimer and ferritin levels measured were consideration to predict radiological severity [13].

Recently, several studied suggested that there is strong impact of types of SARS-COV-2 virus variant on all testing tools. One article reported on SARS-CoV-2 variant and its impact on diagnostic testing and author suggested that the ability of some molecular diagnostic assays to diagnose the Variant of Concern (VOC) may be affected by the mutations [14]. According to the press report on June 21, 2021 of Ministry of Health and Population of Nepal (MOHP), a total number of 48 double swab method confirmed COVID-19 positive samples were collected from different national laboratory of various region of country with various age group from May 9, 2021 to June 3, 2021. All the samples sent to WHO identified Center for Excellence in Geonomics, The Institute of Genomics and Integrative Biology (IGIB) for genomic sequencing of circulation of SARS-COV-2 variants in Nepal. Final result of testing concluded that among the 48 sample, one sample (2.08%) was diagnosed as an Alpha Variant (B.1.1.7) and 47 samples (97.91%) were diagnosed as a Delta Variant (B.1.617.2). Among all 47 samples, which were diagnosed as a Delta Variant, 9 samples (18.75%) were diagnosed as addition K417N mutation named as AY.1 Variant of Concern (VOC) [15]. According to second press release on July 27, 2021 of MOHP regarding circulation of different SARS-COV-2 variants in Nepal, total number of 47 double swab method confirmed COVID-19 positive samples were collected from different national laboratory of various region of country with various age group from May 29, 2021 to July 16, 2021 and sent for genomic sequencing to same center. Final result of testing concluded that all the 47 samples (100%) were diagnosed as a Delta Variant (B.1.617.2) and some samples were diagnosed as additional K417N mutation named as AY.1 Variant of Concern (VOC). Ministry of Health and Population Nepal additionally suggested that these prominent variants which are found in Nepal, are highly infectious and may infected all age groups people [15].

The aim of our study to evaluate the characteristics of Chest X-Ray, characteristics of HRCT Chest and abnormalities in laboratory biochemical parameters and their correlation during second phase of COVID-19 pandemic when there is circulation of Delta variant (B.1.617.2) and additionally mutated Delta variant (K417N) variant was prominent. Our aim of study was also to evaluate impacts of variants on the characteristics of Chest X-Ray, characteristics of HRCT Chest and abnormalities in laboratory biochemical parameters.

Methods

Study population: This retrospective and observational study was performed at the Department of Radio-diagnosis, Imaging and Nuclear Medicine of BP Koirala Memorial Cancer Hospital Bharatpur Nepal.

The study included consecutive symptomatic patients with suspected COVID-19 interstitial pneumonia who underwent chest HRCT and Chest X-Ray at Department of Radio-diagnosis, Imaging and Nuclear Medicine from May 16th to June 21st, 2021. Laboratory findings of each patient were collected from Hospital Information System (HIS) of hospital. HRCT Chest and Chest X-Ray were performed for the clinical evaluation and correlation.

In order to select chest HRCT scans for analysis, our exclusion criteria were:

a. Patient with negative chest HRCT for COVID-19 interstitial pneumonia;

b. Patient with negative chest X-Ray interstitial pneumonia;

c. Patient with any other laboratory test positive for other viral or bacterial infection.

d. Lack of complete reports (Missing of Laboratory parameters etc.)

Patients included in the study were categorized in 2 groups: patients evaluated with HRCT chest and laboratory findings (group A) and patients evaluated with Chest X-Ray and laboratory findings (group B).

CT protocol: Non-enhanced chest HRCT scan was performed in supine position, during inspiratory breath-hold, from the apex to the lung bases with multidetector scanner 64 slices (NeoSoft 64i Model, NeoSoft Company, China). Low-dose HRCT acquisition was executed as follows: tube voltage, 120 kV; automatic tube current control (40-90 mAs) was used; pitch, 1; collimation, 0.1 mm. Image data sets were reconstructed with 1 mm slice thickness.

HRCT protocol was used for image acquisition 1 mm collimation at 2 cm intervals in full inspiration, Measure field of view, High spatial frequency reconstruction algorithm, Full inspiration, Mediastinum Window 440 width, level 40, Lung Window 1400 width, level -700, lung filter 10/20 (NeoSoft 64i) and less than 1 second gantry rotation (depends on MAS selected).

Analysis of CT images: Two highly skilled and experience radiologists reviewed the CT images independently and resolved discrepancies by consensus. All images were viewed on both lung (width, 1400 Hounsfield Unit [HU]; level, -700 HU) and mediastinal (width, 440 HU; level, 40 HU) settings. The presence or absence of following features was recorded: Ground-Glass Opacities (GGO), Crazy Paving, Consolidation, Bronchiotasis, Multifocal GGO, Consolidation, Collapse, Fibrotic and multiple of above in one.

The images were analyzed according to CT severity score tool. The numbers of involved lung lobes were registered. The lobes of lung division were identified as the upper lobe (above the level of the carina), middle lobe (between carina and infra-pulmonary vein), and lower lobe (below the level of the infra-pulmonary vein). The axial allocation, were classified as peripheral (prevalent in the outer third of the lung) or central (predominant in the inner two-third). The allocation patterns were classified as diffuse when a clear predominant cranio-caudal or axial distribution was absent.

Chest X-Ray PA view protocol and analysis: Chest X-Ray PA view was conducted by positioned the x-ray source so that the X-Ray enters through the posterior portion (back) of the body and exits out of the anterior portion (front) of the body, where the beam is detected with detector. To obtain chest PA view, the patient should stand facing to an x-ray detector. A standard distance from radiation source to the body part should be 6 feet or 2 m.

The exposure should be made at full inspiration and should show 2 inch above the shoulder joint, both costophrenic angles and the lower parts of the diaphragm should be visible. The both lungs and vertebra should be visible behind the heart shadow. Two highly skilled and experience radiologists reviewed the X-Ray images independently and resolved discrepancies by consensus. For the analysis of chest X-Ray, we didn't use any specific tool. We just used visual infected percentages of lung area and categorized as a) less than 25% infected lung as Mild b) less than 50% infected lung as moderate and c) more than 50% as severe.

Analysis of laboratory findings: There is COVID-19 RT-PCR laboratory in our hospital laboratory with highly specialized and modern equipment i.e., Quantum 3 and 5 Model RT-PCR laboratory equipment with 96-well of Thermo-Scientific Company. The protocol of RT-PCR assays targeting the RNA-dependent RNA polymerase (RdRp), Nucleocapsid (N) and Envelope (E) genes of SARS-CoV-2. All three RdRp, N and E genes were considered according to COVID-19 Prevention and Control Guideline from National Public Health Laboratory Nepal [16]. The cut off value of RT-PCR Ct value is 34 to distinguish positive and negative amplifications. Patients with all three positive RdRp, Positive N gene and Positive E genes were reported as SARS-CoV-2 infected patients. If patients tested RT-PCR negative but have all the related symptoms of COVID-19, were sent for further investigation like CT scan and other laboratory blood investigations to confirm it.

RT-PCR results of all patients were retrospectively evaluated and the patient with only 1 positive nasopharyngeal swab was identified as "positive" and patients with 2 negative swabs as "negative."

Complete blood counts, biochemical parameters, and variables reflecting hepatic and renal functions on admission and data of follow-up laboratory tests during hospital stay were collected for each patient, including hemoglobin, leukocytes, platelets, neutrophil, lymphocytes, monocyte, eosinophil, basophil, C-Reactive Protein (CRP), Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), blood urea, blood glucose random (R), sodium, potassium, Lactate Dehydrogenase (LDH) and serum Creatinine.

The considerations of normal and abnormal laboratory parameters of blood tests at this hospital are as follows (Table 1):

Statistical analysis: We followed chest CT severity score tool for assessing severe COVID-19 using the classification of European Society of Radiology-European Society of Thoracic Imaging (ESR-ESTI) [17]. The damage to lung lobe was measure in percentage. Each lobe of lung was given maximum CT severity score 5 according to percentage of lung lobe damage due to COVID pneumonia. The percentage of lung lobe damage and CT severity score was given as <10% for 1, 10% to 25% for 2, 25% to 50% for 3, 50% to 75% for 4 and >75% for 5 (Figure 1).

The Chest CT severity score calculated according to above tool. The severity of COVID patients were evaluated according to final CT score. If the total calculated CT score was less than 8, severity was diagnosed as mild. Similarly, if the total calculated score is in between 8 to 15 and above 15, severity was moderate and severe respectively (Table 2).

Descriptive statistics of all included patients variables are summarized as counts and percentages. We performed one sample t-test to find out significant of altered laboratory parameters and independent t-test compare the HRCT severity (Mild, Severe) with various performed laboratory parameters. We also performed Pearson correlation of CT severity score (1-25) with various altered laboratory parameters to evaluate significance of correlation between them.

SN	Laboratory parameters	Normal reference value
1	Hemoglobin	13-17 g/dl
2	Platelets	1,50,000-4,00,000/cumm
3	WBC	4,000-10,000/cumm
4	Neutrophil	40%-80%
5	Lymphocyte	20%-40%
6	Eosinophil	01%-06%
7	Monocyte	02%–10%
8	CRP	Positive/Negative
9	Glucose Random	50–130 mg/dl
10	Creatinine	0.6-1.3 mg/dl
11	Urea	15–40 mg/dl
12	Sodium	136–145 mmol/L
13	Potassium	3.5–5.1 mmol/L
14	Bilirubin Total	0.2-1.0 mg/dl
15	Bilirubin Direct	0.0-0.2 mg/dl
16	SGOT AST	15-37 U/L
17	SGPT ALT	14-63 U/L
18	LDH	81-234 U/L

Table 1: Showing normal reference value of laboratory parameters.

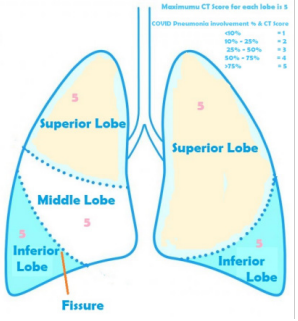

Figure 1: Showing CT severity scoring tool protocol.

CT Score	Severity
<8	Mild
8-15	Moderate
>15	Severe

Table 2: Chest CT score verses severity.

We analyzed the percentage of abnormalities in laboratory parameters count of both groups (Group A and Group B). All statistical analyses were conducted using IBM SPSS Statistics 25 version.

Results

Patient's populations

A total number of 116 patients (72 males and 44 females, age range 3-90 years, mean age 51.34 years) with RT-PCR swab test positive for COVID-19 were admitted to COVID ward at BP Koirala Memorial Cancer Hospital Bharatpur, Nepal from May 16th to June 21st, 2021, during second phase of COVID-19 pandemic. All the patients were evaluated either by chest X-Ray or chest HRCT at Department of Radio-diagnosis, Imaging and Nuclear Medicine and different laboratory parameters at Department of Pathology. Total numbers of 142 isolation beds are available at COVID Isolation Ward (General Beds-106, HDU Beds-26, ICU Beds-8 and Ventilator Beds-2) at our hospital. During the study period, total 22 patients died, 87 patients recovered from COVID-19 and discharged from COVID ward till date June 21st, 2021. Remaining 7 patients also recovered and discharged later. The outflows of SARS-COV-2 infected patients to COVID ward on daily basis from May 16th to June 21st, 2021 are summarized in Table 3.

The common symptoms of patients were headache, body ache, muscle pain, stomach upset, nausea, fever and red eyes, etc. The major symptoms were pneumonia especially in adults. There were some rare symptoms like rashes, bluish discoloration of the fingers and toes, bleeding from the nose, confusion state and brain fog. We observed a lot more drastic drop in oxygen levels including silent hypoxia and the second wave is seeing a lot more symptomatic cases. The main cause of death was reported due to silent hypoxia (happy hypoxia) in COVID-19 patients in this hospital. The descriptive statistics of gender and age of total patients are summarized in Table 4 and frequency of number of COVID-19 patients with age group summarized in Table 5. Age group analysis of total COVID-19 patients showed that all age group of populations are infected with SARS-CoV-2 virus during second phase of pandemic in Nepal. The highest infected age groups were 30-40 years (16.38%), 40-50 years (12.93%), 50-60 years (27.58%) and 60-70 years (18.10) whereas the lowest age group was 00-10 years (1.72).

Only 67 patients out of total 116 were included in study due to incomplete or missing different data availability. A total number of 67 patients in which 55 patients (Group A) evaluated with High Resolution Computed Tomography (HRCT) scans and 12 patients (Group B) evaluated with Chest X-Ray for interstitial pneumonia, were included in the study. The reason behind making group B was some clinically stable patients were evaluated with chest X-Ray. Clinically unstable and sever patients were evaluated with HRCT chest. Different laboratory parameters including biochemistry and hematology blood tests reports were evaluated for all those 67 patients. Statistical characteristics of age and gender of both groups are summarized (Tables 6 and 7).

HRCT chest features and analysis

HRCT chest of SARS-CoV-2 infected patients were reported as following features Ground-Glass Opacities (GGO), Crazy Paving, Consolidation, Bronchiotasis, Multifocal GGO, Consolidation, Collapse, Fibrotic and multiple of above in one. In this study, we found all typical and some atypical appearances of COVID-19 interstitial pneumonia in HRCT chest i.e., Ground-Glass Opacities (GGO) (27.27%), GGO with Crazy Paving (29.09%), GGO with Consolidation (12.72%), GGO with crazy paving with consolidation (3.63%), Crazy paving with Bronchiotasis (1.81%), Multifocal GGO (5.45%), Consolidation (5.45%), GGO with Bronchiotasis (1.81%), Collapse (1.81%), GGO with Fibrotic (7.27%) and GGO with Fibrotic with crazy paving (3.63%). Among the 55 patients HRCT chest appearances, Highest number of 16 patients HRCT chest appearances were Ground-glass opacities with crazy paving (29.09%) and 15 HRCT chest appearances were only Ground-glass opacities (27.27). HRCT chest scan features of all 55 COVID patients are summarized in Table 8 and some typical and some atypical appearances HRCT chests of COVID-19 patients are shown in Figure 2.

Descriptive statistics of CT severity scores of all 55 patients (Group A) are summarized in Table 9. Maximum CT severity score 25 was also found in one patient and in 15 patients have CT severity score more than 20. Among total 55 patients HRCT, CT severity score of 11 (20%) patients had less than 8, 18 (32.7%) patients had in between 8 to 15 and 26 (47.3%) patients had more than 15. CT severity score and CT severity are

SN	Date	New admission	Pts. in ICU	Pts. in ventilator and HFNC	Pts. in HDU	Pts. in general bed Pts. in general bed	Total Pts.	Total death	Discharge
1	May 16, 2021	20	0	0	0	19	19	1	0
2	May 17, 2021	14	3	0	0	28	31	2	0
3	May 18, 2021	12	4	2	23	12	41	2	0
4	May 19, 2021	8	6	2	25	12	43	3	3
5	May 20, 2021	4	6	2	25	12	43	2	2
6	May 21, 2021	9	6	0	19	23	48	0	4
7	May 22, 2021	10	7	0	10	36	53	1	4
8	May 23, 2021	6	7	0	18	34	59	0	0
9	May 24, 2021	2	8	0	26	22	56	1	4
10	May 25, 2021	0	8	0	24	18	51	0	5
11	May 26, 2021	1	8	0	2	35	45	2	5
12	May 27, 2021	4	8	0	2	26	44	2	3
13	May 28, 2021	2	7	0	4	32	43	1	2
14	May 29, 2021	4	6	0	4	29	43	1	3
15	May 30, 2021	0	7	0	6	25	38	0	5
16	May 31, 2021	0	5	0	5	23	30	0	8
17	June 01, 2021	6	8	0	5	16	29	0	7
18	June 02, 2022	0	5	0	5	18	28	0	1

19	June 03, 2023	1	7	0	5	17	29	0	0
20	June 04, 2024	2	4	0	5	17	26	1	4
21	June 05, 2025	0	3	0	6	12	21	1	4
22	June 06, 2026	0	3	0	6	10	19	1	1
23	June 07, 2027	0	0	0	6	9	15	1	3
24	June 08, 2028	2	1	0	5	10	16	0	1
25	June 09, 2029	0	1	0	5	9	15	0	1
26	June 10, 2030	0	1	0	4	7	12	0	3
27	June 11, 2031	3	1	0	4	9	14	0	1
28	June 12, 2032	0	1	0	4	9	14	0	0
29	June 13, 2033	1	2	0	4	9	15	0	0
30	June 14, 2034	0	0	0	0	11	11	0	4
31	June 15, 2035	0	2	0	3	6	11	0	0
32	June 16, 2036	1	1	0	2	6	9	0	3
33	June 17, 2037	1	1	0	2	5	8	0	2
34	June 18, 2038	3	1	0	4	4	9	0	2
35	June 19, 2039	0	1	0	4	4	9	0	0
36	June 20, 2040	0	0	0	4	3	7	0	2
37	June 21, 2041	0	0	0	2	5	7	0	0
Total		116					7	22	87

Table 3: Showing new admission, total number of patients in ward, total death, and total discharge at COVID ward during the study. Note: Pts.: Patients; ICU: Intensive Care Unit; HFNC: High-Flow Nasal Cannula Oxygenation; HDU: Highly Dedicated Unit.

Total patients number		116
	Frequency	Percent%
Male	72	62.1
Female	44	37.9
Statistics of Age		
Mean		51.34
Median		53.5
Std. Deviation		17.588
Variance		309.321
Range		87
Minimum		3
Maximum		90
Percentiles	25	39
	50	53.5
	75	62

Table 4: Statistics total patients.

Age group (Years)	**Total number of patients**	**Percentages (%)**
00-10	2	1.72
Oct-20	4	3.45
20-30	9	7.76
30-40	19	16.38
40-50	15	12.93
50-60	32	27.58
60-70	21	18.1
70-80	9	7.76
80-90	5	4.31
Total	116	100

Table 5: Number of patients in age groups.

Age		
Total Patients		55
Mean		52.76
Median		53.00
Mode		58
Std. Deviation		16.190
Variance		262.110
Range		70
Minimum		20
Maximum		90
Percentiles	25	41.00
	50	53.00
	75	62.00
Gender		
	Frequency	Percentage (%)
Male	32	58.2
Female	23	41.8

Table 6: Age and gender statistics (Group A).

Age		
Total Patients		12
Mean		50.42
Median		55.50
Mode		55a
Std. Deviation		18.058
Variance		326.083
Range		71
Minimum		3
Maximum		74
Percentiles	25	41.00
	50	55.50
	75	58.75
Gender		
	Frequency	Percentage (%)
Male	6	50.0
Female	6	50.0

Table 7: Age and gender statistics (Group B).

SN	HRCT appearances	Total patients	Percentages (%)
1	GGO	15	27.27
2	GGO+Crazy Paving	16	29.09
3	GGO+Consolidation	7	12.72
4	Crazy Paving+Bronchiectasis	1	1.81
5	Multifocal GGO	3	5.45
6	Consolidation	3	5.45
7	GGO+Crazy Paving +Consolidation	2	3.63
8	GGO+Bronchiectasis	1	1.81
9	Collapse	1	1.81
10	GGO+Fibrotic	4	7.27
11	GGO+Fibrotic+Crazy Paving	2	3.63
	Total	55	100

Table 8: HRCT appearances of COVID patients.

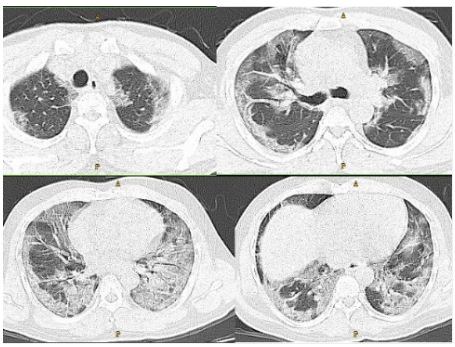

Figure 2: Showing common HRCT chest features of COVID-19 patients admitted to COVID Isolation Ward, (1) GGO (2) GGO with crazy paving (3) GGO with consolidation (4) Multifocal GGO (5) Consolidation (6) GGO with crazy paving and consolidation (7) GGO with fibrotic (8) GGO with consolidation changes (9) Collapse left lung.

	Total Patients	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
HRCT Score	55	24	1	25	13.65	0.994	7.369	54.304

Table 9: Descriptive statistics CT severity score of all 55 patient (Group A).

Severity	CT Score group	Frequency	Percent	Valid Percent	Cumulative Percent
Mild	<8	11	20.0	20.0	20.0
Moderate	8-15	18	32.7	32.7	52.7
Sever	>15	26	47.3	47.3	100.0
Total		55	100.0	100.0	

Table 10: HRCT severity score and CT severity.

summarized in Table 10.

Cases

Some examples of mild and severe COVID-19 cases encountered to department of radio-diagnosis, imaging and nuclear medicine are shown in Figures 3-6. First case (Figures 3A-3C), 35 years male COVID positive patient (RT-PCR positive with interstitial pneumonia) admitted to COVID ward on 16th May, 2021. On the same day, HRCT and laboratory blood tests were done. HRCT chest was positive interstitial pneumonia with mild severity with CT severity score 2, GGO appearance diagnosed on 16th May, 2021 (Figure 3A). Second follow up HRCT was done on 27th May, 2021 which shows reduction in chest infection (Figure 3B) and third follow up on 7th June 2021 (Figure 3C) which shows huge reduction in chest infection. Patient totally recovered COVID-19 and discharged from COVID ward after that.

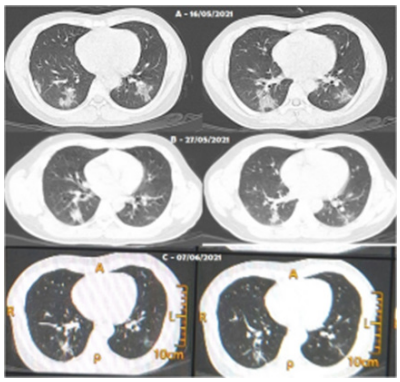

Figure 3: Showing HRCT of 35 years male COVID positive patient with mild severity with CT severity score 2, GGO appearance, 3A first HRCT on 16th May, 2021, 3B second follow up on 27th May, 2021 and third follow up on 7th June 2021. Patient totally recovered and discharged from COVID ward after that.

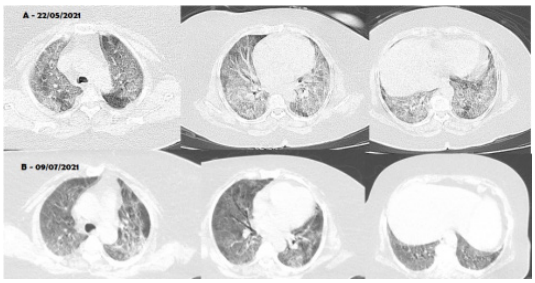

Figure 4: Showing HRCT of 60 years female COVID positive patient with CT severity score was 23 reported as Severe, GGO appearance with crazy paving, 4A first HRCT on 22nd May, 2021, and 4B second follow up on 9th June, 2021. Patient totally recovered and discharged from COVID ward after that.

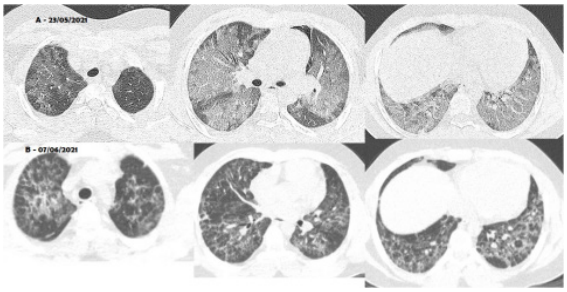

Figure 5: Showing HRCT of 20 years male COVID positive patient with CT severity score was 22 reported as Severe, GGO appearance with crazy paving, 4A first HRCT on 23rd May, 2021, and 4B second follow up on 7th June, 2021. Patient totally recovered and discharged from COVID ward after that.

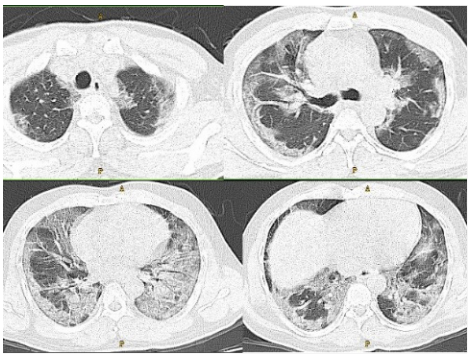

Figure 6: Showing HRCT of 45 years male COVID positive patient with CT severity score was 20 reported as Severe, GGO appearance with crazy paving, HRCT on 16th May, 2021, with silent hypoxia (SPO2 was 65). Patient became worse and death later.

Second case (Figure 4), 60 years female COVID positive patient (RT-PCR positive with interstitial pneumonia) admitted to COVID ward on 22nd May, 2021. On the same day, HRCT and laboratory blood tests were done. HRCT chest was positive interstitial pneumonia with severe severity with CT severity score 23, GGO with crazy paving appearance diagnosed on 22nd May, 2021 (Figure 4A). Second follow up HRCT was done on 9th June, 2021 which shows huge reduction in chest infection (Figure 4B). Patient totally recovered COVID-19 and discharged from COVID ward after that.

Third case (Figure 5), 20 years male COVID positive patient (RT-PCR positive with interstitial pneumonia) admitted to COVID ward on 23rd May, 2021. On the same day, HRCT and laboratory blood tests were done. HRCT chest was positive interstitial pneumonia with worse severity with CT severity score 22, GGO with crazy paving appearance diagnosed on 23rd May, 2021 (Figure 5A). Second follow up HRCT was done on 7th June, 2021 which shows magnificent reduction in chest infection (Figure 5B). Patient totally recovered COVID-19 and discharged from COVID ward after that.

Fourth case (Figure 6), 45 years male COVID positive patient (RT-PCR positive with interstitial pneumonia) admitted to COVID ward on 16th May, 2021. On the same day, HRCT and laboratory blood tests were done. HRCT chest was positive interstitial pneumonia with worse severity with CT severity score 20, GGO with crazy paving appearance diagnosed on 16th May, 2021. Second follow up HRCT was done on 7th June, 2021 which shows magnificent reduction in chest infection. Patient had silent hypoxia (SPO2 was 65). Patient became worse and death later.

Chest X-Ray analysis

A total number of 12 clinically stable COVID-19 patients were evaluated with chest X-Ray. There was no death reported in this group (Group B). Only rough analysis of chest X-Ray was done, we didn't use any specific tool. We just used visual infected percentages of lung area and categorized as a) less than 25% infected lung as Mild b) less than 50% infected lung as moderate and c) more than 50% as Severe. The Group B is very small in sample size and 6 (50%) patients' chest X-Ray infection severity were mild and remaining 6 patients' chest X-Ray infection severity were moderate. Statistical analyses of severity seen in chest X-Ray of all patients are summarized in Table 11.

Laboratory parameters

Laboratory parameters of all COVID-19 patients admitted to COVID

ward like complete blood counts, biochemical parameters, and variables reflecting hepatic and renal functions on admission and data of follow-up laboratory tests during hospital stay were done for each patient. Main laboratory parameters which were included in our study were hemoglobin, leukocytes, platelets, neutrophil, lymphocytes, monocyte, eosinophil, basophil, C-Reactive Protein (CRP), Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), blood urea, blood glucose Random (R), sodium, potassium, Lactate Dehydrogenase (LDH) and serum Creatinine.

The detailed of laboratory parameters results (Group A) are tabulated in Table 12. The abnormalities found in laboratory tests i.e., hemoglobin, platelets, leukocytes (WBC), neutrophil, lymphocyte, eosinophil, monocyte, C-Reactive Protein (CRP), Glucose Random (R), Urea, Creatinine, Sodium, Potassium, Bilirubin Total, Bilirubin Direct, Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and Lactate Dehydrogenase (LDH) were 20%, 43%, 40%, 85%, 89%, 42%, 74%, 95%, 61%, 29%, 10%, 1.8%, 1.8%, 10.9%, 14.5%, 85%, 63%, and 100% respectively. There was decline in following laboratory parameters counts i.e., hemoglobin, platelets, leukocytes (WBC), lymphocytes, eosinophil, monocyte. Among the total 55 patients, 95% patients with positive C-Reactive Protein (CRP) were found. There was elevation in following laboratory parameters counts found i.e., Neutrophil, C-Reactive Protein (CRP), Glucose Random (R), Urea, Creatinine, Bilirubin Total, Bilirubin Direct, Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and Lactate Dehydrogenase (LDH). We thought alteration in following laboratory tests i.e., hemoglobin, urea, Creatinine, sodium and potassium may be acceptable.

One Sample t-test of all laboratory parameters (Group A) with average reference test value was conducted and the results are summarized in Table 13. There were significant differences found in most laboratory parameters.

The laboratory test results of Group B patients are summarized in Table 14. The abnormalities found in laboratory tests i.e., hemoglobin, platelets, leukocytes (WBC), neutrophil, lymphocyte, monocyte, Glucose Random (R), Urea, Creatinine, Sodium, Potassium, Bilirubin Total, Bilirubin Direct, Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and Lactate Dehydrogenase (LDH) were 58.3%, 50.0%, 50.0%, 33.3%, 25.0%, 66.7%, 41.7%, 33.0%, 25.0%, 0%, 0%, 8.3%, 8.3%, 91.7%, 25.5%, and 100% respectively. There was significant decline in following laboratory parameters counts i.e., hemoglobin, platelets, leukocytes (WBC), lymphocytes, monocyte. There was elevation found in following laboratory parameters counts i.e., Glucose random (R), Urea, Creatinine, Bilirubin Total, Bilirubin Direct, Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and Lactate Dehydrogenase (LDH).

One Sample t-test of all laboratory parameters (Group B) with average reference test value were conducted with the help of IMB SPSS 25 version and the results are summarized in Table 15. There were significant

	Frequency	Percent	Valid Percent	Cumulative Percent
Mild	6	50.0	50.0	50.0
Moderate	6	50.0	50.0	100.0
Total	12	100.0	100.0	

Table 11: Percentage severity of Group B patients.

Laboratory Parameters	Total Patients	Normal	High or Low	Abnormal (%)
Hemoglobin	55	44	Low-11	20%
Platelets	55	31	Low-24	43%
WBC	55	33	Low-22	40%
Neutrophil	55	8	High-47	85%
Lymphocyte	55	6	Low-49	89%
Eosinophil	55	13	Low-42	42%
Monocyte	55	14	Low-41	74%
CRP	55	3	High-52	95%
Glucose	55	21	High-34	61%
Urea	55	39	High-16	29%
Creatinine	55	49	High-06	10.90%
Sodium	55	54	High-01	1.80%
Potassium	55	54	High-01	1.80%
Bilirubin Total	55	49	High-06	10.90%
Bilirubin Direct	55	47	High-08	14.50%
SGOT AST	55	8	High-47	85.50%
SGPT ALT	55	20	High-35	63.60%
LDH	55	0	High-55	100%

Table 12: Abnormalities in laboratory parameters (Group A).

Laboratory Parameters	Total Patients	Sample Test Mean	Reference Test Value	t-Value	Degree of Freedom (df)	Sig. (2-tailed) (p-Value)	95% Confidence Interval of the Difference
Hemoglobin	55	12.502	15	-9.671	54	0.000	-3.0160 to -1.980
Platelets	55	213408.33	275000	-3.802	54	0.000	-94073.73 to -29109.62
WBC	55	13201.82	5500	2.106	54	0.040	369.50 to 15034.13
Neutrophil	55	81.24	60	12.116	54	0.000	17.72 to 24.75
Lymphocyte	55	15.16	30	-15.126	54	0.000	-16.80 to -12.87
Eosinophil	55	0.47	03	-18.130	54	0.000	-2.81 to -2.25
Monocyte	55	1.91	06	-24.841	54	0.000	-4.42 to -3.76
CRP	55	1.95	1	30.594	54	0.000	0.88 to 1.01
Glucose	55	188.62	90	6.089	54	0.000	66.15 to 131.09
Urea	55	37.96	27	3.260	54	0.002	4.22 to 17.71
Creatinine	55	0.8296	0.70	3.059	54	0.003	0.0447 to 0.2146
Sodium	55	134.34	140	-6.904	54	0.000	-7.2956 to -4.0120
Potassium	55	4.1844	3.8	3.900	54	0.000	0.1868 to 0.5820
Bilirubin Total	55	1.1955	0.2	2.020	54	0.048	0.0077 to 1.9832
Bilirubin Direct	55	0.4076	0.11	1.208	54	0.232	-0.1964 to 0.7916
SGOT AST	55	107.49	26	2.179	54	0.034	6.51 to 156.47
SGPT ALT	55	106.22	35	3.230	54	0.002	27.01 to 115.43
LDH	55	597	157	11.375	54	0.000	362.63 to 517.81

Table 13: One sample t-test of all laboratory parameters with average test value (Group A). Note: 2-tailed significant value was conducted at the 0.05.

Laboratory Parameters	Total Patients	Normal	High or Low	Abnormal (%)
Hemoglobin	12	5	Low-7	58.3%
Platelets	12	6	Low-6	50.0%
WBC	12	6	Low-5 High-1	50%
Neutrophil	12	12	Low-5 High-1	33.3%
Lymphocyte	12	9	Low-3	25%
Monocyte	12	4	Low-8	66.7%
Glucose	12	7	High-5	41.7%
Urea	12	8	High-4	33%
Creatinine	12	9	High-3	25%
Sodium	12	12	High-0	0%
Potassium	12	12	High-0	0%
Bilirubin Total	12	11	High-1	8.3%
Bilirubin Direct	12	11	High-1	8.3%
SGOT AST	12	1	High-11	91.7%
SGPT ALT	12	9	High-3	25%
LDH	12	0	High-12	100%

Table 14: Abnormalities in laboratory parameters (Group B).

Laboratory Parameters	Total Patients	Sample Test Mean	Sample Test Mean	t-Value	Degree of Freedom (df)	Sig. (2-tailed) (p-Value)	95% Confidence Interval of the Difference
Hemoglobin	12	11.808	15	-4.342	11	0.001	-4.809 to -1.574
Platelets	12	138416.67	275000	-7.629	11	0.000	-175986.00 to –97180.67
WBC	12	18033.33	5500	0.956	11	0.360	-16325.24 to 41391.90
Neutrophil	12	65.92	60	0.758	11	0.465	-11.27 to 23.11
Lymphocyte	12	21.83	30	-3.781	11	0.003	-12.92 to -3.41
Monocyte	12	1.33	06	-32.833	11	0.000	-4.98 to -4.35
Glucose	12	113.33	90	1.699	11	0.117	-6.89 to –53.56
Urea	12	35.75	27	1.256	11	0.235	-6.58 to 24.08
Creatinine	12	2.9583	0.70	1.176	11	0.264	-1.9681 to 6.4848
Sodium	12	134.86	140	-3.785	11	0.003	-8.1148 to –2.1469
Potassium	12	3.93	3.8	1.082	11	0.302	-0.1344 to 0.3944
Bilirubin Total	6	0.7233	0.2	3.835	5	0.012	0.2023 to 1.0244
Bilirubin Direct	5	0.22	0.11	1.117	4	0.327	-0.1754 to 0.4114
SGOT AST	12	57.75	26	4.822	11	0.001	17.2585 to 46.2415
SGPT ALT	12	58.66	35	2.399	11	0.035	1.9500 to 45.3833
LDH	12	616	157	8.411	11	0.000	339.56 to 580.27
High-12	High-12	High-12	High-12	High-12	High-12	High-12	High-12

Table 15: One sample t-test of all laboratory parameters with average test value (Group B). Note: 2-tailed significant value was conducted at the 0.05.

differences found in most of laboratory parameters. Besides that, due to the small sample sizes in group B, significant may not present great impact.

Correlations and regression

There was two different correlation technique conducted for Chest CT severity with all laboratory parameters (Group A). a) Compare mean Independent Samples t-test for Chest CT interstitial pneumonia severity (correlation of nominal variables with scale variables) with all laboratory parameters, b) Pearson Correlation t-test for Chest CT severity score (correlation of scale variables with scale variables) with all laboratory parameters. For the correlation of Chest X-Ray pneumonia severity, compare mean Independent Samples t-test with all laboratory parameters (correlation of nominal variables with scale variables) was conducted.

Chest CT severity (Mild, Severe) was compared with all laboratory parameters by using compare mean Independent Samples t-test which is summarized in Tables 16,17. The result showed overall a good correlation of chest CT interstitial pneumonia severity with most of laboratory parameters. There was significant correlation of Chest CT interstitial pneumonia severity with following laboratory parameters i.e., platelets, leukocytes (WBC), neutrophil, lymphocytes, monocyte, glucose Random (R), Bilirubin total, Bilirubin direct, Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and Lactate Dehydrogenase (LDH) in Group A patients.

Chest CT interstitial pneumonia severity score (1-25) was compared with all laboratory parameters by Pearson Correlation test which is summarized in Table 18. The result showed overall a greater correlation of Chest CT interstitial pneumonia severity with most of laboratory parameters. There was significant correlation of Chest CT interstitial pneumonia severity with following laboratory parameters i.e., platelets, leukocytes (WBC), neutrophil, lymphocyte, monocyte, glucose Random (R), Bilirubin Total, Bilirubin Direct, Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and Lactate Dehydrogenase (LDH) in Group A patients.

The logistic linear regression of chest CT severity score of interstitial pneumonia with all parameters were conducted and the results are summarized in Table 19 (Regression Collinearity Diagnostics of all laboratory parameters with CT Severity Score), Table 20 (Regression Coefficients of all laboratory parameters with CT Severity Score), Table 21 (Regression Collinearity Correlations of all laboratory parameters with CT Severity Score) and Table 22 (Regression Collinearity Covariances of all laboratory parameters with CT Severity Score). Overall results present that there is correlation between chest CT severity of interstitial pneumonia and altered laboratory test results i.e., platelets, leukocytes (WBC), neutrophil, lymphocytes, monocyte, glucose Random (R), Bilirubin Total, Bilirubin Direct, Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and Lactate Dehydrogenase (LDH) in Group A patients.

The graphical presentation of normal P-P Plot of regression Standardized Residual with dependent variable CT severity Score is shown in Figure 7A and graph of Scatterplot of regression with Dependent Variable CT Score is shown in Figure 7B. We realized that study sample size is not big but somehow results shown that there is correlation between chest CT severity of interstitial pneumonia and altered laboratory test results.

For the correlation of Chest X-Ray pneumonia severity, compare mean Independent Samples t-test with all laboratory parameters was conducted and results are summarized in Tables 23,24. In our study, we only included mild and moderate COVID-19 patients with clinically stable in group B. Although sample size was also very small only 12, that is the reason, there is little bit weak correlation seen between Chest X-Ray pneumonia severities, compare mean Independent Samples t-test with all laboratory parameters. But we strongly suggest that if sample size will big, there will

	HRCT Severity	N	Mean	Std. Deviation	Std. Error Mean
Hemoglobin	Mild	11	11.427	1.6493	0.4973
	Severe	26	12.465	1.9964	0.3915
Platelets	Mild	11	266909.82	150760.360	45455.959
	Severe	26	214648.08	120476.587	23627.403
WBC	Mild	11	7763.64	4269.256	1287.229
	Severe	26	19673.08	38560.794	7562.394
Neutrophil	Mild	11	77.27	9.941	2.997
	Severe	26	80.42	16.843	3.303
Lymphocyte	Mild	11	19.91	6.978	2.104
	Severe	26	14.08	7.929	1.555
Eosinophil	Mild	11	1.00	1.549	0.467
	Severe	26	0.58	1.027	0.201
Monocyte	Mild	11	2.27	1.737	0.524
	Severe	26	1.54	0.706	0.138
Glucose	Mild	11	169.82	74.853	22.569
	Severe	26	190.85	116.540	22.855
Urea	Mild	11	43.82	45.963	13.858
	Severe	26	37.08	14.824	2.907
Creatinine	Mild	11	0.9536	0.55929	0.16863
	Severe	26	0.7523	0.20806	0.04080
Sodium	Mild	11	133.2000	10.66637	3.21603
	Severe	26	134.1508	4.68992	.91977
Potassium	Mild	11	4.3073	0.49713	0.14989
	Severe	26	4.2358	0.72571	0.14232
Bilirubin Total	Mild	11	3.3464	8.08281	2.43706
	Severe	26	.6038	0.19785	0.03880
Bilirubin Direct	Mild	11	1.5391	4.02996	1.21508
	Severe	26	.1158	0.05300	0.01039
SGOT AST	Mild	11	241.82	616.678	185.935
	Severe	26	80.50	59.805	11.729
SGPT ALT	Mild	11	149.09	311.308	93.863
	Severe	26	104.96	127.465	24.998
LDH	Mild	11	586.45	342.731	103.337
	Severe	26	636.62	303.932	59.606

Table 16: Correlation of CT severity with laboratory parameters (Group A).

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Hemoglobin	EVA	.055	.816	-1.516	35	0.138	-1.0381	.6847	-2.4282	.3519
	EVNA			-1.640	22.744	0.115	-1.0381	.6329	-2.3482	.2720
Platelets	EVA	.894	.351	1.119	35	0.271	52261.741	46705.259	-42554.976	147078.459
	EVNA			1.020	15.676	0.323	52261.741	51229.858	-56523.527	161047.010
	EVA	2.690	.110	-1.014	35	0.318	-11909.441	11750.650	-35764.528	11945.647
	EVNA			-1.552	26.414	0.132	-11909.441	7671.164	-27665.719	3846.838
	EVA	2.690	.110	-1.014	35	0.318	-11909.441	11750.650	-35764.528	11945.647
	EVNA			-1.552	26.414	0.132	-11909.441	7671.164	-27665.719	3846.838
Neutrophil	EVA	0.714	0.404	-0.576	35	0.568	-3.150	5.465	-14.245	7.945
	EVNA			-0.706	30.844	0.485	-3.150	4.460	-12.249	5.948
Lymphocyte	EVA	0.539	0.468	2.114	35	0.042	5.832	2.759	0.232	11.432
	EVNA			2.229	21.361	0.037	5.832	2.616	0.397	11.267
Eosinophil	EVA	1.117	0.298	0.981	35	0.333	0.423	0.431	-0.453	1.299
	EVNA			0.832	13.869	0.420	0.423	0.509	-0.669	1.515
Monocyte	EVA	3.653	0.064	1.849	35	0.073	0.734	0.397	-0.072	1.540
	EVNA			1.355	11.424	0.202	0.734	0.542	-0.453	1.921
Glucose	EVA	1.884	0.179	-0.550	35	0.586	-21.028	38.238	-98.655	56.599
	EVNA			-0.655	28.879	0.518	-21.028	32.121	-86.734	44.678
Urea	EVA	4.998	0.032	0.680	35	0.501	6.741	9.919	-13.396	26.879
	EVNA			0.476	10.891	0.643	6.741	14.160	-24.463	37.945
Creatinine	EVA	2.040	0.162	1.614	35	0.116	0.20133	0.12475	-0.05193	0.45458
	EVNA			1.160	11.190	0.270	0.20133	0.17350	-0.17975	0.58241
Sodium	EVA	5.733	0.022	-0.381	35	0.706	-0.95077	2.49757	-6.02111	4.11958
	EVNA			-0.284	11.672	0.781	-0.95077	3.34497	-8.26165	6.36011
Potassium	EVA	0.052	0.820	0.297	35	0.768	0.07150	0.24042	-0.41658	0.55958
	EVNA			0.346	27.288	0.732	0.07150	0.20670	-0.35239	0.49540
Bilirubin Total	EVA	11.203	0.002	1.764	35	0.087	2.74252	1.55515	-0.41460	5.89963
	EVNA			1.125	10.005	0.287	2.74252	2.43737	-2.68790	8.17294
Bilirubin Direct	EVA	11.504	0.002	1.837	35	0.075	1.42332	0.77496	-0.14993	2.99657
	EVNA			1.171	10.001	0.269	1.42332	1.21512	-1.28409	4.13073
SGOT AST	EVA	9.188	0.005	1.345	35	0.187	161.318	119.947	-82.187	404.823
	EVNA			0.866	10.080	0.407	161.318	186.305	-253.351	575.987
SGPT ALT	EVA	3.189	0.083	0.619	35	0.540	44.129	71.299	-100.616	188.874
	EVNA			0.454	11.446	0.658	44.129	97.135	-168.651	256.910
LDH	EVA	0.224	0.639	-0.442	35	0.661	-50.161	113.481	-280.540	180.218
	EVNA			-0.420	17.008	0.679	-50.161	119.296	-301.844	201.522

Note: *EVA: Equal Variances Assumed; *EVNA: Equal Variances Not Assumed; 2-tailed significant value was conducted at the 0.05.

Table 17: Correlation of CT severity with laboratory parameters of group A (Independent Samples t-Test).

Laboratory Parameters	Total Patients	Pearson Correlation	Sig. (2-tailed)
Hemoglobin	55	0.038	0.781
Platelets	55	0.053	0.703
WBC	55	0.2.1	0.140
Neutrophil	55	0.044	0.750
Lymphocyte	55	0.261	0.054
Eosinophil	55	0.061	0.659
Monocyte	55	0.316	0.016
Glucose	55	0.006	0.963
Urea	55	0.019	0.893
Creatinine	55	0.241	0.077
Sodium	55	0.108	0.433
Potassium	55	0.053	0.699
Bilirubin Total	55	0.261	0.054
Bilirubin Direct	55	0.264	0.051
SGOT AST	55	0.093	0.499
SGPT ALT	55	0.008	0.956
LDH	55	0.100	0.466

Note: Correlation is significant at the 0.05 level (2-tailed).

Table 18: Pearson Correlation of CT severity score with Laboratory Parameters (Group A).

Model	DM	EV	CI	Variance Proportions																
				Cn	Hb	Pts	WBC	Nt	Lph	Es	Es	Gl	Ur	Ct	Sd	Pt	BT	BD	AST	ALT	LDH
1	1	11.586	1.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	1.866	2.492	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3	1.628	2.668	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
	4	0.920	3.549	0.00	0.00	0.00	0.09	0.00	0.00	0.13	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5	0.869	3.652	0.00	0.00	0.01	0.10	0.00	0.00	.09	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6	0.320	6.016	0.00	0.00	0.02	0.01	0.00	0.00	0.05	0.26	0.14	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
	7	0.228	7.126	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.34	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	8	0.206	7.507	0.00	0.00	0.35	0.00	0.00	0.00	0.02	0.01	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.03
	9	0.151	8.747	0.00	0.00	0.09	0.00	0.00	0.02	0.04	0.00	0.12	0.11	0.01	0.00	0.00	0.00	0.00	0.00	0.07	0.02
	10	0.073	12.621	0.00	0.01	0.26	0.29	.00	0.03	0.13	0.00	0.00	0.02	0.04	0.00	0.00	0.00	0.00	0.06	0.04	0.27
	11	0.049	15.372	0.00	0.01	0.04	0.01	0.00	0.11	0.11	0.00	0.01	0.27	0.04	0.00	0.01	0.00	0.00	0.24	0.06	0.03
	12	0.041	16.830	0.00	0.05	0.02	0.00	0.01	0.02	0.01	0.18	0.19	0.05	0.12	0.00	0.01	0.00	0.00	0.03	0.12	0.25
	13	0.030	19.521	0.00	0.03	0.01	0.03	0.00	0.19	0.27	0.12	0.00	0.11	0.48	0.00	0.00	0.00	0.00	0.11	0.08	0.02
	14	0.021	23.412	0.00	0.04	0.10	0.00	0.00	0.05	0.01	0.01	0.05	0.03	0.01	0.00	0.82	0.00	.00	0.01	0.02	0.19
	15	0.008	37.477	0.01	0.82	0.01	0.00	0.04	0.06	0.08	0.01	0.00	0.23	0.13	0.02	0.11	0.00	.00	0.01	0.01	0.02
	16	0.002	79.706	0.02	0.03	0.07	0.39	0.71	0.42	0.01	0.05	0.05	0.00	0.03	0.24	0.02	0.03	0.03	0.22	0.36	0.03
	17	0.001	103.331	0.01	0.00	0.00	0.00	0.11	0.01	0.03	0.02	0.05	0.01	0.02	0.00	0.01	0.95	0.95	0.21	0.17	0.04
	18	0.001	147.518	0.96	0.00	0.00	0.06	0.12	0.06	0.00	0.00	0.00	0.14	0.12	0.73	0.01	0.01	0.01	0.07	0.04	0.04

Table 19: Regression collinearity diagnosticsa of all laboratory parameters with CT severity score.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	Correlations				Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-11.368	30.967		-0.367	0.716	-74.113	51.378					
	Hemoglobin	0.00	0.588	0.086	0.562	0.577	0.577	1.522	0.038	0.092	0.067	0.606	1.650
	Platelets	-7.008E-6	0.000	-0.114	-0.730	0.470	0.000	0.000	-0.053	-0.119	-0.087	0.578	1.730
	WBC	6.006E-6	0.000	0.022	0.094	0.926	0.000	0.000	0.201	0.015	.011	0.254	3.932
	Neutrophil	0.198	0.203	0.350	0.979	0.334	-0.212	0.609	0.044	0.159	0.116	0.111	9.037
	Lymphocyte	-0.414	0.300	-0.409	-1.378	0.177	-1.022	0.195	-0.261	-0.221	-0.164	0.161	6.213
	Eosinophil	2.398	1.461	0.336	1.641	0.109	-0.563	5.359	-0.061	0.261	0.195	0.337	2.969
	Monocyte	-3.222	0.864	-0.534	-3.727	0.001	-4.973	-1.470	-0.316	-0.522	-0.443	0.690	1.450
	Glucose	-0.016	0.009	-0.259	-1.719	0.094	-0.035	0.003	0.006	-0.272	-0.205	0.622	1.609
	Urea	0.008	0.082	0.027	0.099	0.922	-0.159	0.175	-0.019	0.016	0.012	0.183	5.479
	Creatinine	-5.863	5.524	-0.250	-1.061	0.295	-17.056	5.331	-0.241	-0.172	-0.126	0.255	3.923
	Sodium	0.184	0.183	0.151	1.002	0.323	-.188	0.555	0.108	0.162	0.119	0.620	1.612
	Potassium	0.906	1.367	0.090	0.663	0.512	-1.864	3.677	-0.053	0.108	0.079	0.769	1.300
	Bilirubin Total	-8.224	4.885	-4.078	-1.683	0.101	-18.123	1.675	-0.261	-0.267	-0.200	0.002	414.607
	Bilirubin Direct	15.645	9.816	3.879	1.594	0.119	-4.244	35.533	-0.264	0.253	0.190	0.002	418.580
	SGOT AST	-0.025	0.013	-0.941	-1.902	0.065	-0.052	0.002	-0.093	-0.298	-0.226	0.058	17.279
	SGPT ALT	0.044	0.021	0.984	2.080	0.044	0.001	0.088	0.008	0.324	0.247	0.063	15.811
	LDH	-0.003	0.005	-0.129	-0.637	0.528	-0.014	0.007	0.100	-0.104	-0.076	0.343	2.917

Note: a. dependent variable: HRCT score.

Table 20: Regression coefficients of all laboratory parameters with CT severity score.

Model			LDH	Gl	BD	Pt	Sd	Mc	WBC	Hb	Ct	Es	Pt	Nt	ALT	Ur	Lph	AST	BT
1		LDH	1.000	0.152	0.147	-0.282	0.037	0.210	-0.047	0.052	0.005	0.119	0.323	0.238	0.000	-0.160	0.313	-0.105	-0.147
		Gl	0.152	1.000	-0.170	-0.106	0.160	0.169	-0.087	-0.043	0.091	-0.029	0.072	-0.265	-0.346	-0.284	-0.049	0.326	0.171
		BD	0.147	-0.170	1.000	-0.078	-0.072	-0.158	-0.131	0.041	-0.204	0.150	0.107	0.137	0.273	0.126	-0.045	-0.332	-0.999
		Pt	-0.282	-0.106	-0.078	1.000	0.102	-0.045	-0.088	0.123	-0.156	-0.042	-0.187	-0.183	-0.095	0.200	-0.205	0.080	0.074
		Sd	0.037	0.160	-0.072	0.102	1.000	-0.150	-0.101	-0.043	0.246	-0.002	0.149	-0.097	-0.114	-0.348	-0.139	0.011	0.071
		Mc	0.210	0.169	-0.158	-0.045	-0.150	1.000	0.259	-0.110	-0.064	-0.294	-0.057	0.083	-0.153	0.072	0.319	0.146	0.157
		WBC	-0.047	-0.087	-0.131	-0.088	-0.101	0.259	1.000	-0.058	0.161	-0.277	-0.453	0.605	0.279	-0.074	0.684	-0.217	0.130
		Hb	0.052	-0.043	0.041	0.123	-0.043	-0.110	-0.058	1.000	-0.301	-0.173	0.162	-0.318	-0.162	0.329	0.004	0.162	-0.037
	Correlations	Ct	0.005	0.091	-0.204	-0.156	0.246	-0.064	0.161	-0.301	1.000	0.284	-0.063	0.234	0.206	-0.534	-0.043	-0.335	0.200
		Es	0.119	-0.029	0.150	-0.042	-0.002	-0.294	-0.277	-0.173	0.284	1.000	0.101	0.208	0.293	-0.301	-0.439	-0.264	-0.150
		Pts	0.323	0.072	0.107	-0.187	0.149	-0.057	-0.453	0.162	-0.063	0.101	1.000	-0.214	-0.096	-.146	-0.196	0.130	-0.104
		Nt	0.238	-0.265	0.137	-0.183	-0.097	0.083	0.605	-0.318	0.234	0.208	-0.214	1.000	0.737	-0.256	0.597	-0.631	-0.136
		ALT	0.000	-0.346	0.273	-0.095	-0.114	-0.153	0.279	-0.162	0.206	0.293	-0.096	0.737	1.000	-0.071	0.324	-0.886	-0.269
		Ur	-0.160	-0.284	0.126	0.200	-0.348	0.072	-0.074	0.329	-0.534	-0.301	-0.146	-0.256	-0.071	1.000	0.139	-0.082	-0.125
		Lph	0.313	-0.049	-0.045	-0.205	-0.139	0.319	0.684	0.004	-0.043	-0.439	-0.196	0.597	0.324	0.139	1.000	-0.314	0.045
		AST	-0.105	0.326	-0.332	0.080	0.011	0.146	-0.217	0.162	-0.335	-0.264	0.130	-0.631	-0.886	-0.082	-0.314	1.000	0.330
		BT	-0.147	0.171	-0.999	0.074	0.071	0.157	0.130	-0.037	0.200	-0.150	-0.104	-0.136	-0.269	-0.125	0.045	0.330	1.000

Note: Hb: Hemoglobin; Pts: Platelets; Nt: Neutrophil; Lph: Lymphocytes; Es: Eosinophil; Mc: Monocyte; Gl: Glucose; Ur: Urea; Ct: Creatinine; Sd: Sodium; Pt: Potassium; BT: Bilirubin Total; BD: Bilirubin Direct.

Table 21: Regression collinearity correlations of all laboratory parameters with CT severity score. Dependent variable: HRCT score.

Covariances	LDH	2.721E-5	7.325E-6	.008	-.002	3.523E-5	.001	-1.584E-8	.000	.000	.001	1.619E-8	.000	5.431E-8	-6.853E-5	.000	-7.205E-6	-.004
	Gl	7.325E-6	8.571E-5	-.015	-.001	.000	.001	-5.152E-8	.000	.005	.000	6.419E-9	.000	-6.823E-5	.000	.000	3.966E-5	.008
	BD	.008	-.015	96.347	-1.045	-.129	-1.337	-8.219E-5	.234	-11.067	2.147	1.010E-5	.273	.057	.102	-.133	-.043	-47.893
	Pt	-.002	-.001	-1.045	1.870	.026	-.054	-7.691E-6	.099	-1.179	-.084	-2.458E-6	-.051	-.003	.022	-.084	.001	.493
	Sd	3.523E-5	.000	-.129	.026	.034	-.024	-1.188E-6	-.005	.249	-.001	2.612E-7	-.004	.000	-.005	-.008	2.711E-5	.064
	Mc	.001	.001	-1.337	-.054	-.024	.747	1.435E-5	-.056	-.306	-.371	-4.755E-7	.014	-.003	.005	.083	.002	.664
	WBC	-1.584E-8	-5.152E-8	-8.219E-5	-7.691E-6	-1.188E-6	1.435E-5	4.108E-9	-2.172E-6	5.700E-5	-2.595E-5	-2.789E-10	7.865E-6	3.813E-7	-3.916E-7	1.316E-5	-1.828E-7	4.060E-5
	Hb	.000	.000	.234	.099	-.005	-.056	-2.172E-6	.346	-.979	-.148	9.167E-7	-.038	-.002	.016	.001	.001	-.107
	Ct	.000	.005	-11.067	-1.179	.249	-.306	5.700E-5	-.979	30.519	2.295	-3.358E-6	.263	.024	-.243	-.071	-.024	5.395
	Es	.001	.000	2.147	-.084	-.001	-.371	-2.595E-5	-.148	2.295	2.135	1.412E-6	.062	.009	-.036	-.193	-.005	-1.073
	Pts	1.619E-8	6.419E-9	1.010E-5	-2.458E-6	2.612E-7	-4.755E-7	-2.789E-10	9.167E-7	-3.358E-6	1.412E-6	9.212E-11	-4.161E-7	-1.957E-8	-1.157E-7	-5.647E-7	1.639E-8	-4.875E-6
	Nt	.000	.000	.273	-.051	-.004	.014	7.865E-6	-.038	.263	.062	-4.161E-7	.041	.003	-.004	.036	-.002	-.135
	ALT	5.431E-8	-6.823E-5	.057	-.003	.000	-.003	3.813E-7	-.002	.024	.009	-1.957E-8	.003	.000	.000	.002	.000	-.028
	Ur	-6.853E-5	.000	.102	.022	-.005	.005	-3.916E-7	.016	-.243	-.036	-1.157E-7	-.004	.000	.007	.003	-8.831E-5	-.050
	Lph	.000	.000	-.133	-.084	-.008	.083	1.316E-5	.001	-.071	-.193	-5.647E-7	.036	.002	.003	.090	-.001	.066
	AST	-7.205E-6	3.966E-5	-.043	.001	2.711E-5	.002	-1.828E-7	.001	-.024	-.005	1.639E-8	-.002	.000	-8.831E-5	-.001	.000	.021
	BT	-.004	.008	-47.893	.493	.064	.664	4.060E-5	-.107	5.395	-1.073	-4.875E-6	-.135	-.028	-.050	.066	.021	23.867

Table 22: Regression Collinearity Covariancesa of all laboratory parameters with CT Severity Score. Dependent Variable: HRCT Score. Note: Hb-Hemoglobin; Pts-Platelets; Nt-Neutrophil; Lph-Lymphocytes; Es-Eosinophil; Mc- Monocyte; Gl-Glucose; Ur-Urea; Ct-Creatinine; Sd-Sodium; Pt-Potassium; BT-Bilirubin Total; BD-Bilirubin Direct.

	X-ray Severity	N	Mean	Std. Deviation	Std. Error Mean
Hemoglobin	Mild	6	10.067	2.2491	.9182
	Moderate	6	13.550	1.3867	.5661
Platelets	Mild	6	140000.00	50521.283	20625.227
	Moderate	6	136833.33	76828.163	31364.966
WBC	Mild	6	30516.67	64479.746	26323.746
	Moderate	6	5550.00	2633.439	1075.097
Neutrophil	Mild	6	54.33	35.212	14.375
	Moderate	6	77.50	6.950	2.837
Lymphocyte	Mild	6	22.50	8.289	3.384
	Moderate	6	21.17	7.305	2.982
Monocyte	Mild	6	1.33	.516	.211
	Moderate	6	1.33	.516	.211
Glucose	Mild	6	108.17	54.068	22.073
	Moderate	6	118.50	44.626	18.219
Urea	Mild	6	22.33	4.844	1.978
	Moderate	6	49.17	28.722	11.726
Creatinine	Mild	6	4.5383	9.53746	3.89365
	Moderate	6	1.3783	.62637	.25571
Sodium	Mild	6	135.4933	4.00343	1.63439
	Moderate	6	134.2450	5.61784	2.29347
Potassium	Mild	6	3.7383	.51289	.20939
	Moderate	6	4.1217	.17233	.07035
Bilirubin Total	Mild	2	.5700	.05657	.04000
	Moderate	4	.8000	.48076	.24038
Bilirubin Direct	Mild	2	.1350	.00707	.00500
	Moderate	3	.2900	.31177	.18000
SGOT AST	Mild	6	51.1667	14.51092	5.92406
	Moderate	6	64.3333	28.80741	11.76057
SGPT ALT	Mild	6	68.1667	32.96918	13.45961
	Moderate	6	49.1667	35.58886	14.52909
LDH	Mild	6	658.33	170.472	69.595
	Moderate	6	575.50	213.918	87.332

Table 23: Correlation of Chest X-Ray severity with Laboratory Parameters (Group B).

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								575.50	Lower	Upper
Hemoglobin	EVA	.065	.804	-3.229	10	.009	-3.4833	1.0787	-5.8868	-1.0798
	EVNA			-3.229	8.321	.011	-3.4833	1.0787	-5.9542	-1.0125
Platelets	EVA	3.461	.092	.084	10	.934	3166.667	37538.795	-80474.980	86808.314
	EVNA			.084	8.643	.935	3166.667	37538.795	-82289.658	88622.992
WBC	EVA	5.677	.038	.948	10	.366	24966.667	26345.691	-33735.191	83668.525
	EVNA			.948	5.017	.387	24966.667	26345.691	-42689.417	92622.750
Neutrophil	EVA	20.159	.001	-1.581	10	.145	-23.167	14.652	-55.814	9.481
	EVNA			-1.581	5.389	.170	-23.167	14.652	-60.029	13.695
Lymphocyte	EVA	.757	.405	.296	10	.774	1.333	4.510	-8.717	11.383
	EVNA			.296	9.845	.774	1.333	4.510	-8.738	11.405
Monocyte	EVA	.000	1.000	.000	10	1.000	.000	.298	-.664	.664
	EVNA			.000	10.000	1.000	.000	.298	-.664	.664
Glucose	EVA	.121	.735	-.361	10	.726	-10.333	28.621	-74.104	53.438
	EVNA			-.361	9.653	.726	-10.333	28.621	-74.416	53.750
Urea	EVA	3.046	.112	-2.257	10	.048	-26.833	11.891	-53.329	-.338
	EVNA			-2.257	5.284	.071	-26.833	11.891	-56.913	3.247
Creatinine	EVA	5.302	.044	.810	10	.437	3.16000	3.90204	-5.53428	11.85428
	EVNA			.810	5.043	.455	3.16000	3.90204	-6.84476	13.16476
Sodium	EVA	.029	.868	.443	10	.667	1.24833	2.81625	-5.02666	7.52333

	EVNA			.443	9.037	.668	1.24833	2.81625	-5.11847	7.61514
Potassium	EVA	5.259	.045	-1.735	10	.113	-.38333	.22089	-.87551	.10884
	EVNA			-1.735	6.115	.132	-.38333	.22089	-.92138	.15472
Bilirubin Total	EVA	3.984	.117	-.636	4	.559	-.23000	.36140	-1.23342	.77342
	EVNA			-.944	3.161	.412	-.23000	.24369	-.98363	.52363
Bilirubin Direct	EVA	9.204	.056	-.667	3	.553	-.15500	.23241	-.89463	.58463
	EVNA			-.861	2.003	.480	-.15500	.18007	-.92863	.61863
SGOT AST	EVA	.773	.400	-1.000	10	.341	-13.16667	13.16835	-42.50759	16.17426
	EVNA			-1.000	7.384	.349	-13.16667	13.16835	-43.97970	17.64636
SGPT ALT	EVA	.004	.952	.959	10	.360	19.00000	19.80544	-25.12928	63.12928
	EVNA			.959	9.942	.360	19.00000	19.80544	-25.16413	63.16413
LDH	EVA	.171	.688	.742	10	.475	82.833	111.670	-165.984	331.651
	EVNA			.742	9.525	.476	82.833	111.670	-167.675	333.341
*EVA-Equal Variances Assumed; *EVNA-Equal Variances Not Assumed.										

Table 24: Correlation of Chest X-Ray severity with Laboratory Parameters of Group B (Independent Samples t-Test).

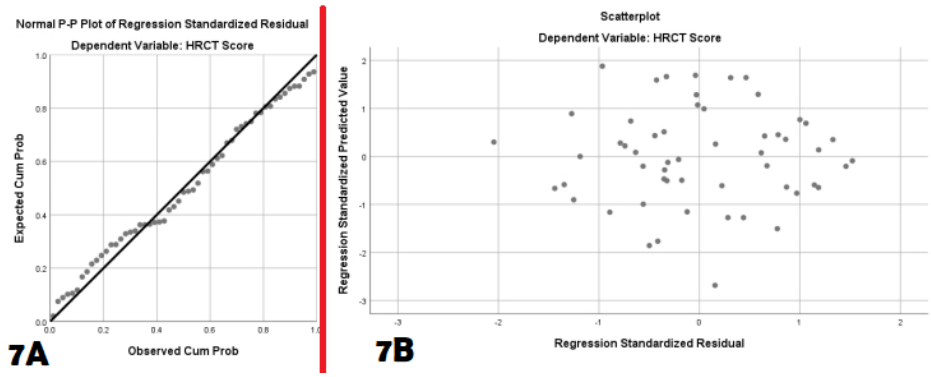

Figure 7: 7A-Graph Normal P-P Plot of Regression Standardized Residual (Dependent Variable: CT Score) and 7B-Graph of Scatterplot of regression (Dependent Variable: CT Score).

be strong correlation between lung volume pneumatic severity and altered parameters.

Discussion

The fear of COVID-19 of under developed country like Nepal is threatening to general public as well as health workers. There was highest transmission rate of SARS-CoV-2 virus recorded during second phase of pandemic in Nepal. The continually increasing number of suspected SARS CoV-2 virus infection to people is overwhelming medical staffs. As we know, an early diagnosis is the main key for prognosis as well as control the infection rate. In Nepal, highly transmission rated Delta Variant (B.1.617.2) and additional mutated delta variant K417N mutation named as AY.1 Variant of Concern (VOC) was prominent during second phase of COVID-19 pandemic [15].

According to the COVID-19 diagnostic guidelines, double swab RT-PCR test by collecting swab from upper or lower respiratory specimens' method is the gold standard for clinical COVID-19 diagnosis and it is easy to conduct in hospital laboratories [18]. In spite of gold standard test, there are some limitations with a RT-PCR sensitivity and the sensitivity rate of RT-PCT test for SARS-CoV-2 was reported to be around 60% [7,19]. In one research study, the author concluded that there is an inverse correlation between the number of false negatives and the sampling timing i.e., different period of the disease development with a median false negative rate of 39% on the day of symptom onset, evaluating the accuracy of different respiratory specimens in the laboratory diagnosis and monitoring the viral shedding of SARS-CoV-2 infections [20].

The false negative results of RT-PCR test of SARS-CoV-2 virus create a problem to a group of patients without a definitive diagnosis and it create difficult to manage the problem. There was a clinical trial study which reported that 308 among 1014 patients with suspected chest HRCT reports for SARS-CoV-2 viral pneumonia. Among them, 147 patients whose RT-PCR samples were negative considered as highly likely cases, considering the clinical characteristics [21].

There are several studies have shown alterations in some laboratory parameters with greater frequency in patients with SARS-CoV-2 virus infection i.e., LDH, D-dimer, CRP, Lymphocyte and fibrinogen [9,22,23]. In present study, our aim was to find out characteristics of Chest HRCT features, chest X-Ray features and abnormalities in laboratory parameters findings of COVID-19 patients with interstitial pneumonia. Additionally in this retrospective study, we correlate between chest CT alterations severity and laboratory parameters to find additional supportive tool of diagnosis to assist in the diagnosis and management of highly suspicious patients of SARS-CoV-2 infection [15].

Several studies reported that CT has a vital role for diagnosis and

follow up management of patients with COVID-19 pneumonia. One study reported that the sensitivity of chest HRCT for COVID-19 pneumonia was 91% (95% CI, 85-96%) [12]. In this study, we found all typical and some atypical appearances of COVID-19 interstitial pneumonia in HRCT chest i.e., Ground-Glass Opacities (GGO) (27.27%), GGO with Crazy Paving (29.09%), GGO with Consolidation (12.72%), GGO with crazy paving with consolidation (3.63%), Crazy paving with Bronchiotasis (1.81%), Multifocal GGO (5.45%), Consolidation (5.45%), GGO with Bronchiotasis (1.81%), Collapse (1.81%), GGO with Fibrotic (7.27%) and GGO with Fibrotic with crazy paving (3.63%). We also evaluate the treatment response of most of the patients with chest CT outcome.

In the 5th edition of the guideline of diagnosis and treatment in Hubei China, HRCT chest is already adopted as a diagnostic tool for COVID-19 pneumonia due to its high sensitivity [24]. It is strongly recommended by Fleischner Society that diagnosis of COVID-19 interstitial pneumonia in COVID-19 patients with moderate to severe lung severity may be presumed based on chest HRCT findings even though RT-PCR is negative for SARS-COV-2 virus [25,26]. There are several research studies reported regarding crucial laboratories parameters for COVID-19 patients' diagnosis and prognosis. One of the retro prospective studies reported that Lymphocytopenia, C-Reactive Protein (CRP), Lactate Dehydrogenase (LDH), D-dimer, and fibrinogen increased levels occurred in most COVID-19 patients [12]. In present study, we also evaluated the laboratory parameters and result for the abnormalities found in laboratory tests i.e., hemoglobin, platelets, leukocytes (WBC), neutrophil, lymphocytes, eosinophil, monocyte, C-Reactive Protein (CRP), Glucose Random (R), Urea, Creatinine, Sodium, Potassium, Bilirubin Total, Bilirubin Direct, Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and Lactate Dehydrogenase (LDH) were 20%, 43%, 40%, 85%, 89%, 42%, 74%, 95%, 61%, 29%, 10%, 1.8%, 1.8%, 10.9%, 14.5%, 85%, 63%, and 100% respectively. There was significant decrease in following laboratory parameters counts i.e., platelets, leukocytes (WBC), lymphocytes, monocyte and elevation in following laboratory parameters test counts i.e., CRP, Glucose Random (R), Urea, Creatinine, Bilirubin Total, Bilirubin Direct, Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and Lactate Dehydrogenase (LDH). Abnormalities in biochemical sodium and potassium were not significant.

In an observational cross-sectional study Simone Canovi reported that lung lesions probably employ a vital role in COVID-19 pathogenesis and clinical orientations [23]. In our study, we also correlated the radiological lung pneumatic severity with different biochemical laboratory parameters, correlation p-Value-0.05. We also found there was strong correlation with some biochemical parameters like CRP, LDH, WBC, Lymphocytes, Neutrophil and ALT. With some parameters, there was average correlation like glucose, platelets, monocyte, AST, Bilirubin Total, Bilirubin Direct, Urea and creatinine. There was poor correlation with sodium and potassium level. Our study suggests that there is correlation between severity of CT lung parenchyma severity and abnormal laboratory parameters.

Limitation of study

A limitation of CT is the possibility of having some false positive cases because the CT imaging features of COVID-19 pneumonia are like those of other viral pneumonia. However, the evaluation of clinical symptoms and laboratory biochemical parameters can reduce the possibility of false positivity. However, this study had some other limitations. It is a retrospective study with very small sample size and conducted at single center. We specially would like to mention about alteration in hemoglobin level. Some of the patient had history of chemotherapy and highly prominent to low hemoglobin level due to chemotherapy. Further large sample study needed to evaluate either blood hemoglobin level affect by SARS-CoV-2 virus or not? There was another concern biochemical test, random blood glucose level in which our record shown 61% SARS-CoV-2 virus infected patients with elevated. The elevation of glucose level was seen after one or two weeks after infection and seen in most of the severe patients. Further large sample study needed to evaluate either blood glucose level affect by SARS-COV-2 virus or not? Some studies also suggest that there may be elevation of blood glucose level occurred due to SARS-COV-2 virus infection [27]. D-dimer and ferritin test records were not included in our study due to lack of complete data.

Conclusion

In conclusion, we think that in case of high clinical suspicion of COVID-19, patients should not be ruled out based on RT-PCR test alone and the clinical and epidemiologic situation should be carefully considered.

In this study, we found all typical and some atypical appearances of COVID-19 interstitial pneumonia in HRCT chest i.e., Ground-Glass Opacities (GGO) with Crazy Paving or Consolidation or Bronchiotasis or Consolidation or Fibrotic and Collapse.

There was decrease in following laboratory parameters counts i.e., hemoglobin, platelets, leukocytes (WBC), lymphocyte, eosinophil, monocyte. Among the total 55 patients, 95 % patients with positive C-Reactive Protein (CRP) were found. There was elevation in following laboratory parameters counts i.e., Neutrophil, C-Reactive Protein (CRP), Glucose random (R), Bilirubin Total, Bilirubin Direct, Alanine aminotransferase (ALT), Aspartate Aminotransferase (AST), and Lactate Dehydrogenase (LDH). Abnormalities in following laboratory tests i.e., urea, creatinine, sodium and potassium may be acceptable.

Statistical correlation was found between laboratory analyses and amount of damaged lung in CT scan i.e., volume of lung damage was strongly associated with altered laboratory test results. These altered laboratory parameters can be used as an adjunctive diagnostic tool in patient with double negative RT-PCR test and highly suspicious clinic and chest CT scan features.

In addition, it is safe to suggest that a symptomatic patient with classic CT of COVID-19 and abnormal Biochemical lab findings should be treated as COVID 19 patients even after two negative RT-PCR tests.

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Conflicts of interest statement and funding

The authors declared that they have no conflicts of interest in this paper.

Advances in knowledge

COVID-19 may cause elevation of glucose level after few weeks after infection in severely infected patients.

Ethics declarations

Conflict of interest

The authors declare that they have no competing interests.

Ethics approval and consent to participate

It is a retrospective study so ethics approval and consent of participants are not applicable.

Consent for publication

Not applicable

References

1. Coronavirus resource center, Jons Hopkins University of Medicine. 2021.
2. COVID-19 Symptoms, Coronavirus Disease, World Health Organization (WHO).
3. Symptoms, COVID-19, Centers for Disease Control and Prevention (CDC).
4. Jingjing He, Yifei Guo, Richeng Mao, Jiming Zhang (2021) Proportion of asymptomatic coronavirus disease 2019: A systematic review and meta-analysis. J Med Virol . 93: 820-830.
5. Covid-19 update portal, Ministry of Health and population, Government of Nepal. 2021.
6. Kooraki S, Hosseiny M, Myers L, Gholamrezanezhad A (2020) Coronavirus (COVID-19) outbreak: what the department of radiology should know. J Am Coll Radiol 17:447–51.
7. Yang Y, Yang M, Shen C, Fuxiang W, Jing Y, et al. (2020) Evaluating the accuracy of different respiratory specimens in the laboratory diagnosis and monitoring the viral shedding of 2019-nCoV infections. medRxiv.
8. Wang Y, Kang H, Liu X, Tong Z (2020) Combination of RT-qPCR testing and clinical features for diagnosis of COVID-19 facilitates management of SARS-CoV-2 outbreak. J Med Virol 92:538-539.
9. Corman VM, Landt O, Kaiser M, Richard M, Adam M, et al. (2020) Detection of 2019 novel coronavirus (2019-nCoV) by real-time RT-PCR. Euro Surveill 25:2000045.
10. Lippi G, Plebani M (2020) Laboratory abnormalities in patients with COVID-2019 infection. Clin Chem Lab Med 58:1131–1134. [Pubmed]
11. Mardani R, Vasmehjani AA, Zali F, Gholami A, Nasab SDM et al. (2020) Laboratory parameters in detection of COVID-19 patients with positive RT-PCR; a diagnostic accuracy study. Arch Acad Emerg Med;8:e43.
12. Orlacchio A, Gasparrini F, Roma S, Ravà, MS; Salvatori E, et al. (2021) Correlations between chest-CT and laboratory parameters in SARS-CoV-2 pneumonia. Medicine 100 :pe25310.
13. Yilmaz, R. Sabirli, M. Seyit, Ozen M, Oskay A, et al (2021) Association between laboratory parameters and CT severity in patients infected with COVID-19: a retrospective, observational study. Am. J. Emerg. Med 42:110-114. [Pubmed]
14. Nam K, Miller C, Waldman S (2021) The SARS-CoV-2 Variant and its Impact on Diagnostic Testing on Coronavirus.
15. Press release on Covid-19 update portal, Ministry of Health and population, Government of Nepal.
16. Guidelines-for-SARS-CoV-2-PCR-laboratories IN National Public Health Laboratory.
17. Chen A, Karwoski RA, Gierada DS, Bartholmai BJ, Koo CW, et al. (2020) Quantitative CT analysis of diffuse lung disease. Radiographics.40:28-43.
18. East M, Committee I, States M (2020) Laboratory Guidelines for the Detection and Diagnosis of COVID-19 Virus Infection Sample collection and proper shipment Laboratory testing.
19. Li J, Ye G, Chen L, Wang J, Li Y. (2020) Analysis of false-negative results for 2019 novel coronavirus nucleic acid test and related countermeasures. J Lab Med 12:E006.
20. Kucirka L, Lauer S, Laeyendecker O, Boon D, Lessler J, et al. (2020) Variation in false negative rate of rt-pcr based sars-cov-2 tests by time since exposure. Ann Intern Med 173:262-267.
21. Liu Y, Yang Y, Zhang C, Huang F, Wang F, et al. (2020) Clinical and biochemical indexes from 2019-nCoV infected patients linked to viral loads and lung injury. Sci China Life Sci 63:364-374.
22. Tang N, Li D, Wang X, Sun Z (2020) Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia. J Thromb Haemost 18:844-847.
23. Canovi S, Besutti G, Bonelli E, Lotti V, Ottone M, et al. (2021) The association between clinical laboratory data and chest CT findings explains disease severity in a large Italian cohort of COVID-19 patients. BMC Infect Dis 21: 157.
24. Diagnosis and Treatment. (2020) Protocol for Novel Coronavirus Pneumonia. Version 7.
25. Rubin GD, Ryerson CJ, Haramati LB, Sverzellati N, Kanne JP, et al. (2020) The role of chest imaging in patient management during the COVID-19 pandemic: a multinational consensus statement from the fleischner society. Chest 296:172-180.
26. Orlacchio A, Roma S, Minieri M, Legramante JM, Grelli S, et al. (2020) Our Experience in COVID-19. Radiology Brief Communications Blog.
27. Chen J, Wu C, Wang X, Yu J, Sun Z (2020) The Impact of COVID-19 on Blood Glucose: A Systematic Review and Meta-Analysis". Front Endocrinol 11:732.]