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Research Article

Study on the Effects of Sars-Cov-2 Infection on the Hematological and Biochemical Parameters and Clinicopathological Correlation in the Evolution of Covid-19

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Abstract

The pandemic Covid-19 is caused by a single stranded RNA virus, SARS-CoV2 (Severe Acute Respiratory Syndrome Coronavirus 2). SARS CoV2 is one of the coronaviruses, primarily a respiratory infection with a significant impact on hematopoietic system and hemostasis. However, it is now learnt that Covid-19 also known to cause multisystem disorder with Kawasaki disease like fever in children. SARS-CoV-2 spreads via respiratory droplet and surface to human transmission via fomites where the virus can enter the mucus membrane of eyes, nose and mouth. Though asymptomatic/mild cases account for large number of cases, it is also postulated that the viral load is higher in pre-symptomatic cases compared to those with severe disease thereby making them most important overlooked viral shedders contributing to highly contagiousness of the infection. Therefore, early diagnosis of Covid-19 is critical for prevention and control of this pandemic and the clinical characteristics alone cannot define the diagnosis of Covid-19, especially for pre-symptomatic and asymptomatic patients.

Nuclei acid detection based approaches have become a rapid and reliable technology for detection of virus, and amongst them real time Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) is considered as the 'Gold standard' for the detection SARS-CoV-2. The real time RT-PCR has adequate sensitivity and high specificity in the diagnosis Covid-19 particularly the early infection. However, the important drawback with RT-PCR application is the risk of eliciting false-negative results which in the current pandemic can be perilous and a major impediment in the containment of outbreaks. It is reported that many 'suspected' cases with typical clinical characteristics of Covid-19 and diagnostic computed tomography (CT) images were not diagnosed with RT-PCR [15]. Thus, a negative result does not exclude the possibility of Covid-19 infection entirely and therefore should not be used as the only criterion in the management of Covid-19 cases.

We carried out a study to assess the effects of SARS-CoV-2 on the hematopoietic and biochemical profile which might provide for an alternative mechanism to diagnose Covid-19, particularly in hospital settings when patients are being evaluated in the Non-Covid zone of the hospital or in resource constraint settings where Nucleic Acid based tests are not readily available for the diagnosis of Covid-19. The study was carried out on individuals who were serving in an organization that generates physically fit and mentally robust individuals, thereby weeding out affection of any other confounding factors such as obesity, cardiovascular disease and other co-morbidities on the evolution of the disease. A total of 250 Covid-19 positive patients were evaluated hematologically and biochemically between June 2020 and October 2020.

The Complete Blood Count (CBC) of the Covid-19 patients revealed normal Total Leukocyte Count (TLC) in more than 90% of patients, Leukocytopenia in less than 5% of patients, Leukocytosis in about 05% of cases and Thrombocytopenia in 5% of cases. It is pertinent to note that majority of the patients, particularly those presenting early in the course of the disease as pre-symptomatic illness, initially presented with Relative Lymphocytosis on days 2 to 3 post sampling that yielded a positive result for Covid-19. The

Peripheral Blood Smear (PBS) confirmed the initial Relative Lymphocytosis with presence of characteristic Covicytes (Activated Lymphocytes) and Acquired Pseudo Pelger Huet Anomaly (APHA). With recovery, Covicytes gradually decrease in number but there is persistence of occasional covicytes which were observed in most patients who were assessed hematologically prior to discharge after being declared Covid-19 by RT-PCR testing. While the proportion of covicytes reduced as the patients recovered with improvement in symptomatology and waning viral loads, the Acquired Pseudo Pelger Huet anomaly in the neutrophils persisted for protracted periods of time and was appreciated in peripheral blood smear examination carried out when these Covid-19 recovered patients returned for blood evaluation for some other ailment weeks later.

The proposed approach also provides an alternative cheap and reliable Infection Prevention and Control mechanism in hospital settings for detecting Covid-19 cases amongst in-patients who were missed either during clinical assessment, if done cursorily or as RT-PCR false-negative cases. It will also enable efficient contact tracing, in the event of such patients being confirmed as Covid-19 positive cases. Correlation between Covicytes, APHA and inflammation associated markers such as CRP, LDH and Neutrophil to Lymphocyte Ratio (NLR) were also drawn. We analyzed that there is a linear correlation between lymphocyte decline, raised NLR, heightened inflammation markers and severity of infection.

Keywords: Pandemic; SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2); Covid-19; hematological assessment, hematological profile, Biochemical profile, Inflammatory markers, Relative lymphocytosis, Peripheral blood smear, Activated Lymphocytes, atypical lymphocytes, Covicytes, Acquired Pseudo Pelger Huet Anomaly (APHA), Quarantine, Isolation

Introduction

The pandemic Covid-19 is caused by a single stranded RNA virus, which was initially called at the outset as Novel Coronavirus 2019 and later rechristened by WHO with the now official name SARS-CoV2 (Severe Acute Respiratory Syndrome Coronavirus 2) as it bears almost 80% resemblance in its genome with another coronavirus SARS [11]. SARS CoV2 is one of the coronaviruses, of which 04 cause mild flu like illness while the remaining two being SARS (Severe Acute Respiratory Syndrome) virus and MERS (Middle East Respiratory Syndrome) virus. The genomic sequence data has revealed that the SARS-CoV-2 is a member of Betacoronavirus and belongs to the subgenus Sarbecovirus which also includes SARS-CoV while MERS-CoV belongs to a separate subgenus, Merbecovirus [10,11]. SARS-CoV2 infection causes coronavirus disease 2019 (Covid-19), primarily a respiratory infection with a significant impact on hematopoietic system and hemostasis leading to several Cardiovascular complications. However, it is now learnt that Covid-19 also known to cause multisystem disorder with Kawasaki disease like fever in children.

With the origin as an epidemic pneumonia in Wuhan in Hubei Province of China in Dec 2019, the Covid-19 spread rapidly throughout the world, evolving into a global pandemic. Epidemiological data suggests that SARS-CoV-2 had spread widely from the city of Wuhan in China after its Zoonotic transmission originating from bats via the Malayan pangolins [12,13]. Covid-19 was declared as Public Health Emergency of International Concern (PHEIC) on 30 Jan 2020 and with ensuing rapid global spread due to well established air connectivity with various countries across the continents. SARS-CoV2 epidemic was declared as a pandemic in Mar 2020. Covid-19 has a very large pattern of varied manifestations from respiratory symptoms to fever and other non-specific symptoms including headache, malaise, bodyache, nausea, vomiting, diarrhoea, red eye, loss of smell and taste, loss of appetite, myalgia, cardiac rhythm problems, cardiac failure, confusion, headache, seizures, Guillain Barre syndrome, fainting spells, deranged sugar profile and others. It has already affected more than 10% of the population worldwide. In India, with more than 11 lakh cases, more than 90% of affected people become symptomatic within 2 weeks of infection.

It spreads via human to human transmission via respiratory droplet and surface to human transmission via fomites where the virus can enter the mucus membrane of eyes, nose and mouth. Global sequence and epidemiological data reveal that the SARS-CoV2 has spread rapidly to all parts of the globe by its ability to use the human ACE2 receptor for cellular entry [9]. The attachment of SARS-CoV2 to the target cell is initiated by the interactions between the spike glycoprotein (S) and its cognate receptor, Angiotensin Converting Enzyme 2 (ACE2) receptors, which are found

widely distributed throughout human body including lungs, heart, muscle, kidney, blood vessels, CNS, liver and others [14]. Following the receptor engagement, SARS-CoV2 is processed by a plasma membrane associated type II transmembrane serine protease TMPRSS2, prior to membrane fusion which is essential to release the viral contents into the host cell cytosol. Once the virus enters the cell, it turns the cell into a factory, making millions of copies of itself which are then breathed or coughed out to infect others. Though asymptomatic/mild cases account for large number of cases, it is also postulated that the viral load is higher in pre-symptomatic cases compared to those with severe disease thereby making them most important overlooked viral shedders contributing to highly contagiousness of the infection. Therefore, early diagnosis of Covid-19 is critical for prevention and control of this pandemic and the clinical characteristics alone cannot define the diagnosis of Covid-19, especially for pre-symptomatic and asymptomatic patients.

Nuclei acid detection based approaches have become a rapid and reliable technology for detection of virus, and amongst them real time Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) is considered as the 'Gold standard' for the detection SARS-CoV-2. The real time RT-PCR has adequate sensitivity and high specificity in the diagnosis Covid-19 particularly the early infection. However, the important drawback with RT-PCR application is the risk of eliciting false-negative results which in the current pandemic can be perilous and a major impediment in the containment of outbreaks. It is reported that many 'suspected' cases with typical clinical characteristics of Covid-19 and diagnostic computed tomography (CT) images were not diagnosed with RT-PCR [15]. Thus, a negative result does not exclude the possibility of Covid-19 infection entirely and therefore should not be used as the only criterion in the management of Covid-19 cases. There are multitudes of factors that affect the RT-PCR test results and these can be in any of the pre-analytical, analytical and post analytical phases. Further, laboratory practices and personnel skill in technical and safety procedures also explain some of the false-negative results.

SARS-CoV2 is being acknowledged as a systemic infection and affects haematological parameters as well. The hallmark of SARS-CoV2 pathogenesis is the cytokine storm. It is revealed by various studies that plasma concentrations of IL-6, IL-1β, TNF-α, G-CSF, IP10 are very high in Covid-19 patients and even higher in Intensive Care Unit (ICU) patients than non-ICU patients. It is propounded in previous studies that this cytokine release syndrome in Covid-19 patients is responsible for the lymphopenia which has been related to significant decrease in T-lymphocytes (CD8 + T Cells) and positively correlates with in-hospital deaths and severity of illness [17-20].

Materials and Methods

Search strategy and selection criteria

The preferred reporting items for systematic review and meta-analysis protocols methodology was used in the search strategy. A systematic search was made in the following databases: PubMed/Medline/Embase/Cinah1/web of science from database inception until 31 Oct 2020. The search strings utilized were 'Coronaviridae'(terms), 'Coronavirus infections' (MESH terms), 'Coronavirus infections (All fields). After screening the aforementioned databases, the search was supplemented by reviews of references covering our topic of interest.

Population

The geographic scope of the investigation comprises of pan-India with individuals reporting from various states to the duty station and is akin to national investigation. The study is therefore representative of the overall burden of infection i.e including both high and low incidence areas.

Sampling

All individuals serving in the organisation and their dependents, reporting to duty station and are in the age group between 23 and 58 yrs. The individuals were initially screened at the screening kiosk set up at the Point of Entry with a set of screening questionnaire and then directed to the quarantine facility where they were quarantined for a period of 21 days adhering to strict quarantine protocol as per the WHO enunciated Quarantine protocol. Symptomatic individuals were referred to the Flu clinic where the patients were further evaluated for any complaints of fever, headache, body ache, malaise, cough and other features of Covid-19. Baseline investigations were carried out including Complete Blood Count, Peripheral blood smear, Renal function tests, Liver function tests and Urine routine & microscopy maintaining universal precautions. Individuals who are Suspect Covid-19 were admitted in the Suspect ward of the isolation facility of the hospital which was well segregated from the Covid-19 isolation facility. All individuals who were suspect Covid-19 underwent sampling with Nasopharyngeal and Oropharyngeal swabs for RT-PCR testing in a designated Sample Collection Centre of the hospital. The swabs were then inoculated into a viral transport media and transported under cold chain to ICMR approved VRDL (Viral Research and Diagnostic Laboratory) at a nearby Government hospital.

Individuals were also subjected to the RT-PCR testing for Covid-19 when they were found to be high-risk contacts during contact tracing of laboratory confirmed Covid-19 cases. In these cases, all such individuals were sampled for testing between day 7 and day 10 of coming in contact with a laboratory confirmed Covid-19 case or on developing symptoms of fever, nausea, vomiting, rhinorrhoea, cough and other respiratory symptoms, whichever was earlier.

The hospital had the advantage of investigating the patients at the very outset, in the pre-symptomatic stage of the disease, where the patients presented with minimal or no symptoms and signs of the disease. This early study of the patients with baseline investigations was very informative and helpful in detecting asymptomatic viral shedders who would otherwise have had managed to spread the disease in the environment defeating the very purpose of quarantine and also helping in the study of the evolution of Covid-19 and its impact on the hematopoietic system and hemostasis.

Inclusion criteria

All RT-PCR positive patients admitted in the Isolation facility of the peripheral mid-zonal military hospital. These individuals initially reported to the respiratory clinic or were quarantined in a quarantine facility. The patient categories were as under:

- All symptomatic individuals quarantined in the quarantine facility, who later turned positive for Covid-19 on RT-PCR testing.
- All high-risk contacts of lab confirmed cases sampled between day 7 and day 14 of coming in contact with Covid-19 positive case.
- All symptomatic Health Care Workers (HCW) working in the frontline Covid duties who turned Covid-19 positive by RT-PCR testing.
- All pregnant women approaching labour or within 5 days of expected date of delivery, who turned positive by RT-PCR testing.
- All individuals who were declared Covid-19 positive on being sampled on arrival at the airport.

Exclusion criteria

All Suspect Covid-19 individuals who turned negative with atleast two RT-PCR testings.

Methodology

Sample size

A total of 250 patients were admitted between 20 Jun and 18 Oct 2020 in a peripheral mid-zonal Military Hospital and were tested Covid-19 positive by RT-PCR, which is considered the gold standard for the diagnosis of Covid-19. The list of patients with the symptomatology is as per the table 1. The samples collected were both Nasopharyngeal and Oropharyngeal swabs in the designated Sample Collection Centre of the hospital. The technique of collection and despatch employed was as under:

Ser No	Covid-19 positive patient	Date of Sample Collection	Symptoms	History of travel by Air	History of travel by Train	History of travel by Road
1	36 yr/Male	20-Jun-20	Mild	Yes	No	No
2	22 yr/Male	20-Jun-20	Mild	Yes	No	No
3	36 yr/Male	25-Jun-20	Mild	Yes	No	No
4	25 yr/Male	25-Jun-20	No	No	No	No
5	27 yr /Male	25-Jun-20	No	No	No	No
6	33 yr/Male	25-Jun-20	No	No	No	No
7	29 yr/Male	26-Jun-20	No	Yes	No	No
8	33 yr/Male	29-Jun-20	No	Yes	No	No
9	29 Yr/Male	29-Jun-20	No	No	No	No
10	38 Yr/Male	29-Jun-20	No	No	No	No
11	29 yr/Male	29-Jun-20	No	No	No	No

12	24yr/Male	29-Jun-20	No	No	No	No
13	27yr/Male	29-Jun-20	No	No	No	No
14	35yr/Male	29-Jun-20	No	No	No	No
15	27yr/Male	29-Jun-20	No	No	No	No
16	23yr/Male	29-Jun-20	No	Yes	No	No
17	38yr/Male	29-Jun-20	No	No	No	No
18	41yr/Male	01-Jul-20	Mild	Yes	No	No
19	28yr/Male	30-Jun-20	No	No	No	No
20	28yr/Male	03-Jul-20	No	No	No	No
21	42yr/Male	03-Jul-20	No	No	No	No
22	28yr/Male	03-Jul-20	No	No	No	No
23	26yr/Male	03-Jul-20	Mild	Yes	No	No
24	28yr/Male	08-Jul-20	Mild	Yes	No	No
25	37yr/Male	04-Jul-20	Mild	Yes	No	No
26	26yr/Male	08-Jul-20	No	No	No	No
27	28yr/Male	08-Jul-20	No	No	No	No
28	24yr/Male	08-Jul-20	No	No	No	No
29	26yr/Male	08-Jul-20	No	No	No	No
30	24yr/Male	08-Jul-20	No	No	No	No
31	34yr/Male	22-Jun-20	No	No	No	No
32	30yr/Male	08-Jul-20	No	No	No	No
33	49yr/Male	06-Jul-20	No	Yes	No	No
34	24yr/Male	09-Jul-20	Mild	No	No	No
35	29yr/Male	09-Jul-20	No	No	No	No
36	31yr/Male	09-Jul-20	No	No	No	No
37	23yr/Male	15-Jul-20	No	Yes	No	No
38	23yr/Male	15-Jul-20	Mild	No	No	No
39	28yr/Male	15-Jul-20	Moderate	Yes	No	No
40	35 yr/Male	20-Jul-20	Mild	No	Yes	No
41	25yr/Male	22-Jul-20	Mild	No	No	Yes
42	32yr/Male	19-Jul-20	Mild	Yes	No	No
43	30yr/Male	22-Jun-20	Mild	Yes	No	No
44	22yr/Male	22-Jul-20	Mild	Yes	No	No
45	42yr/Male	22-Jul-20	Mild	Yes	No	No
46	43yr/Male	23-Jul-20	No	Yes	Yes	No
47	33yr/Male	23-Jul-20	No	Yes	No	No
48	24yr/Male	29-Jul-20	Mild	No	No	Yes

49	24yr/Male	29-Jul-20	Mild	No	No	Yes
50	44yr/Male	29-Jul-20	Mild	Yes	No	Yes
51	39yr/Male	29-Jul-20	Mild	No	No	Yes
52	24yr/Male	29-Jul-20	Mild	No	No	No
53	26yr/Male	29-Jul-20	Mild	No	No	No
54	35yr/Male	28-Jul-20	Mild	Yes	No	Yes
55	30yr/Male	30-Jul-20	Mild	No	No	Yes
56	33yr/Male	01-Aug-20	Moderate	No	Yes	No
57	31yr/Male	01-Aug-20	Mild	No	No	Yes
58	31yr/Male	05-Aug-20	Mild	Yes	No	No
59	26yr/Male	05-Aug-20	Mild	Yes	No	No
60	26yr/Male	05-Aug-20	Mild	No	Yes	No
61	26yr/Male	05-Aug-20	Mild	Yes	No	No
62	26yr/Male	05-Aug-20	Mild	Yes	No	No
63	30yr/Male	05-Aug-20	Moderate	No	No	Yes
64	30yr/Male	05-Aug-20	Moderate	No	No	No
65	30yr/Male	04-Aug-20	Mild	No	Yes	No
66	29yr/Male	05-Aug-20	Mild	No	No	No
67	30yr/Male	05-Aug-20	Mild	Yes	No	No
68	30yr/Male	05-Aug-20	Mild	No	No	Yes
69	30yr/Male	05-Aug-20	Mild	No	Yes	No
70	30yr/Male	05-Aug-20	Mild	No	Yes	No
71	29yr/Male	05-Aug-20	Mild	Yes	No	No
72	30yr/Male	05-Aug-20	Mild	Yes	No	No
73	30yr/Male	05-Aug-20	Mild	No	No	No
74	32yr/Male	05-Aug-20	Mild	Yes	No	No
75	28yr/Male	05-Aug-20	Mild	No	Yes	No
76	35yr/Male	05-Aug-20	Mild	Yes	No	No
77	36yr/Male	03-Aug-20	Moderate	Yes	No	Yes
78	28yr/Male	09-Aug-20	Mild	Yes	No	Yes
79	36yr/Male	10-Aug-20	Mild	Yes	No	No
80	40yr/Male	10-Aug-20	Moderate	Yes	No	No
81	37 yr/Male	10-Aug-20	Mild	No	Yes	No
82	39 yr/Male	10-Aug-20	Moderate	No	Yes	No
83	36yr/Male	12-Aug-20	Mild	Yes	No	No
84	33 yr/Male	17-Aug-20	Mild	No	Yes	No

85	36yr/Male	17-Aug-20	Moderate	No	No	No
86	34yr/Male	17-Aug-20	No	No	No	Yes
87	34yr/Male	18-Aug-20	Mild	No	No	Yes
88	30yr/Male	17-Aug-20	Mild	Yes	No	Yes
89	26yr/Male	17-Aug-20	Mild	No	No	Yes
90	29yr/Male	20-Aug-20	No	Yes	No	No
91	35yr/Male	20-Aug-20	Mild	Yes	No	No
92	41yr/Male	20-Aug-20	Moderate	Yes	No	No
93	46yr/Male	22-Aug-20	Mild	No	No	Yes
94	32 yr/Male	24-Aug-20	Mild	Yes	No	No
95	30yr/Male	24-Aug-20	Mild	No	Yes	No
96	28 yr/Male	24-Aug-20	No	No	Yes	No
97	39yr/Male	24-Aug-20	Mild	Yes	No	No
98	32 yr/Male	24-Aug-20	Mild	No	Yes	Yes
99	31 yr/Male	24-Aug-20	Mild	No	Yes	Yes
100	33 yr/Male	24-Aug-20	Mild	Yes	No	No
101	45 yr/Male	24-Aug-20	Mild	Yes	No	No
102	41 yr/Male	25-Aug-20	Mild	No	Yes	Yes
103	32yr/Male	23-Aug-20	No	No	No	No
104	46 yr/Male	26-Aug-20	Moderate	Yes	Yes	No
105	40 yr/Male	26-Aug-20	Mild	No	No	No
106	45 yr/Male	26-Aug-20	Moderate	Yes	No	yes
107	40 yr/Male	26-Aug-20	Mild	Yes	No	No
108	35 yr/Male	26-Aug-20	Mild	No	Yes	No
109	37yr/Male	25-Aug-20	Mild	Yes	No	No
110	43 yr/Male	27-Aug-20	Mild	Yes	No	No
111	39 yr/Male	27-Aug-20	Mild	No	No	No
112	43yr/Male	27-Aug-20	Mild	No	Yes	No
113	38yr/Male	29-Aug-20	Moderate	Yes	No	No
114	36 yr/Male	29-Aug-20	Mild	Yes	No	No
115	28 yr/Female	29-Aug-20	Moderate	No	No	No
116	38yr/Male	29-Aug-20	Mild	No	Yes	No
117	35 yr/Male	29-Aug-20	Mild	Yes	Yes	No
118	28 yr/Male	29-Aug-20	Mild	Yes	No	Yes
119	32 yr/Male	29-Aug-20	Mild	No	No	No
120	38yr/Male	31-Aug-20	Mild	Yes	No	No
121	55yr/Male	28-Aug-20	Mild	Yes	No	Yes
122	25yr/Male	01-Sep-20	No	Yes	No	Yes
123	20yr/Male	31-Aug-20	Mild	No	No	Yes
124	55yr/Male	31-Aug-20	Mild	No	No	No
125	28yr/Male	31-Aug-20	Mild	Yes	No	No
126	25 yrs/Male	01-Sep-20	Mild	Yes	Yes	No

127	29yr/Male	01-Sep-20	Mild	No	Yes	No
128	31 yrs/Male	01-Sep-20	Mild	Yes	No	No
129	30 yrs/Male	02-Sep-20	Mild	No	No	No
130	38yr/Male	02-Sep-20	No	Yes	No	Yes
131	46yr/Male	03-Sep-20	No	No	Yes	No
132	25yr/Male	03-Sep-20	Mild	Yes	No	No
133	26yr/Male	03-Sep-20	Mild	No	Yes	Yes
134	47yr/Male	03-Sep-20	Mild	No	Yes	Yes
135	25 yr/Male	03-Sep-20	Mild	No	No	Yes
136	32 yr/Male	03-Sep-20	Mild	Yes	No	Yes
137	33 yr/Male	03-Sep-20	Mild	Yes	No	No
138	27 yr/Male	03-Sep-20	Mild	Yes	No	No
139	29yr/Male	03-Sep-20	Mild	No	Yes	No
140	25 yr/Male	03-Sep-20	Mild	No	No	No
141	31 yr/Male	03-Sep-20	Mild	Yes	No	No
142	26 yr/Male	03-Sep-20	Mild	No	No	No
143	26yr/Male	03-Sep-20	Mild	Yes	No	No
144	25yr/Male	05-Sep-20	Mild	Yes	Yes	No
145	41yr/Male	06-Sep-20	No	Yes	No	No
146	43 yr/Male	07-Sep-20	Mild	No	Yes	No
146	41yr/Male	07-Sep-20	Mild	Yes	No	No
147	29 yr/Male	07-Sep-20	Mild	Yes	No	Yes
148	32 yr/Male	07-Sep-20	Mild	No	Yes	No
149	33 yr/Male	07-Sep-20	Mild	Yes	No	No
150	36 yr/Male	07-Sep-20	Mild	No	No	No
151	27 yr/Male	08-Sep-20	Mild	Yes	No	No
152	33yr/Male	08-Sep-20	Mild	No	No	Yes
153	36yr/Male	08-Sep-20	Mild	No	No	Yes
154	29 yr/Female	08-Sep-20	Mild	No	No	No
155	42 yr/Male	08-Sep-20	Mild	No	No	No
156	28 yr/Male	08-Sep-20	Mild	Yes	No	No
157	31 yr/Male	08-Sep-20	Mild	Yes	Yes	No
158	37 yr/Male	07 Sep 20	Mild	Yes	No	No
159	34 yr/Male	10-Sep-20	Mild	Yes	No	Yes
160	33 yr/Female	07-Sep-20	Mild	No	No	No
161	28 yr/Female	10-Sep-20	Mild	No	No	No
162	39 yr/Male	11-Sep-20	Mild	No	Yes	Yes
163	40 yr/Male	12-Sep-20	Mild	No	No	Yes
164	43yr/Male	13-Sep-20	Mild	Yes	No	No
165	57yr/Male	14-Sep-20	Mild	Yes	No	No
166	31yr/Male	14-Sep-20	No	Yes	No	No
167	33yr/Male	14-Sep-20	Mild	Yes	Yes	No

168	42 yr/Male	14-Sep-20	Mild	Yes	No	No
169	45 yr/Male	14-Sep-20	Mild	Yes	No	No
170	39 yr/Male	14-Sep-20	Mild	Yes	No	No
171	35 yr/Female	16-Sep-20	Moderate	No	No	No
172	39 yr/Male	16-Sep-20	Mild	No	No	Yes
173	41yr/Male	16-Sep-20	Mild	Yes	No	No
174	30yr/Male	17-Sep-20	Mild	Yes	No	Yes
175	33yr/Male	17-Sep-20	No	Yes	No	No
176	32yr/Male	17-Sep-20	Mild	No	Yes	Yes
177	45 yr/Male	22-Sep-20	Mild	No	No	No
178	30Yr/Male	22-Sep-20	Mild	No	No	No
179	35yr/Male	21-Sep-20	Mild	Yes	No	Yes
180	28yr/Male	25-Sep-20	Mild	Yes	Yes	No
181	46yr/Male	25-Sep-20	No	Yes	No	No
182	39 yr /Male	25-Sep-20	Mild	Yes	No	No
183	28yr/Male	26-Sep-20	No	Yes	No	No
184	32 yr/Male	26-Sep-20	Mild	No	No	No
185	30yr/Male	27-Sep-20	No	Yes	No	No
186	30yr/Male	28-Sep-20	Mild	No	No	No
187	29 yr/Male	29-Sep-20	Mild	Yes	No	No
188	31yr/Male	29-Sep-20	Mild	No	Yes	No
189	40 yr/Male	30-Sep-20	Mild	Yes	No	No
190	37 yr/Male	30-Sep-20	Mild	Yes	Yes	No
191	35 yr/Male	30-Sep-20	Mild	Yes	No	No
192	36 yr/Male	30-Sep-20	Mild	Yes	No	No
193	48yr/Male	30-Sep-20	Moderate	Yes	No	No
194	33 yr/Male	01-Oct-20	Mild	No	Yes	No
195	31 yr/Male	01-Oct-20	Mild	No	Yes	No
196	29 yr/Male	01-Oct-20	Mild	Yes	Yes	No
197	32yr/Male	04-Oct-20	No	Yes	No	No
198	40yr/Male	05-Oct-20	Mild	No	No	Yes
199	39yr/Male	05-Oct-20	Mild	No	No	Yes
200	31yr/Male	05-Oct-20	Mild	No	No	Yes
201	38yr/Male	05-Oct-20	Mild	No	No	Yes
202	40yr/Male	07-Oct-20	Mild	No	No	No
203	40yr/Male	07-Oct-20	Mild	Yes	No	No
204	22yr/Male	07-Oct-20	No	No	No	Yes
205	37yr/Male	08-Oct-20	Moderate	Yes	No	No
206	32 yr/Male	10-Oct-20	Mild	Yes	No	No
207	35 yr/Male	10-Oct-20	Mild	Yes	No	No
208	39 yr/Male	10-Oct-20	Mild	Yes	Yes	No
209	30 yr/Male	10-Oct-20	Mild	Yes	No	No
210	33 yr/Male	10-Oct-20	Mild	Yes	No	Yes

211	35 yr/Male	10-Oct-20	Mild	Yes	Yes	No
212	32 yr/Male	10-Oct-20	Mild	No	Yes	No
213	40yr/Male	10-Oct-20	Mild	Yes	No	No
214	24yr/Male	10-Oct-20	Mild	No	Yes	No
215	25yr/Male	10-Oct-20	Mild	Yes	No	Yes
216	29 yr/Male	10-Oct-20	Mild	Yes	No	Yes
217	31 yr/Male	10-Oct-20	Mild	Yes	No	Yes
218	30 yr/Male	10-Oct-20	Mild	Yes	No	Yes
219	32 yr/Male	10-Oct-20	Mild	Yes	No	Yes
220	27 yr/Male	10-Oct-20	Mild	Yes	No	Yes
221	33yr/Male	10-Oct-20	Mild	No	Yes	No
222	25yr/Male	11-Oct-20	No	Yes	No	No
228	32 yr/Male	10-Oct-20	Mild	Yes	No	No
229	30 yr/Male	10-Oct-20	Mild	No	Yes	No
230	29 yr/Male	10-Oct-20	Mild	Yes	No	No
231	27 yr/Male	10-Oct-20	Mild	Yes	No	No
232	28 yr/Male	10-Oct-20	Mild	Yes	No	No
233	31 yr/Male	10-Oct-20	Mild	Yes	No	No
234	32 yr/Male	12-Oct-20	Mild	No	Yes	No
235	27yr /Male	13-Oct-20	Mild	No	No	Yes
236	41yr/Male	13-Oct-20	Mild	Yes	No	No
237	24yr/Male	14-Oct-20	Mild	Yes	No	No
238	23yr/Male	14-Oct-20	Mild	Yes	No	Yes
239	21yr/Male	14-Oct-20	Mild	Yes	No	Yes
240	24yr/Male	14-Oct-20	Mild	Yes	Yes	No
241	25yr/Male	15-Oct-20	Mild	Yes	No	No
242	26yr/Male	16-Oct-20	Mild	No	No	No
243	43yr/Male	16-Oct-20	Mild	Yes	No	No
244	27yr/Male	16-Oct-20	Mild	No	No	Yes
245	32 yr/Male	16-Oct-20	Mild	No	Yes	No
246	41 yr/Male	16-Oct-20	Mild	Yes	No	No
247	44yr/Male	16-Oct-20	Mild	No	No	Yes
248	30yr/Male	17-Oct-20	Moderate	Yes	No	No
249	28yr/Male	17-Oct-20	Mild	Yes	No	No
250	42yr/Male	17-Oct-20	Mild	Yes	No	No

Table 1: The list of all Covid-19 positive patients admitted in the hospital between Jun 20 and Oct 20.

Collection of Nasopharyngeal swab

With the patient's head tilted back to 70^0, a nasopharyngeal swab is inserted into the nostril to reach the depth till a resistance is felt when the swab is left in situ for a few seconds to absorb secretions and by gently rotating, the swab is removed. The tip of the swab is then placed into the VTM and the rest of the applicator stick is cut. The cap of the lid is then tightly screwed and sealed with the Paraffin paper. The VTM vial is then labelled with the details of the patient and the SRF (Special requisition form) identity generated online with the RT-PCR application.

Collection of oropharyngeal swab

With the tongue of the patient held away by a tongue depressor, the posterior oropharyngeal wall and the tonsillar pillars are swabbed by a sweeping motion. Without touching the soft palate and the tongue, the swab is gently retrieved and the tip of the swab is then placed in the VTM and the rest of the applicator stick is cut. The cap of the lid is then tightly screwed and sealed with the Paraffin paper. The VTM vial is then labelled with the details of the patient and the SRF (Special requisition form) identity generated online with the RT-PCR application.

Packaging of the containers

The VTM vials are covered using adsorbent material and the vials are packaged by Triple packing, comprising of plastic containers and zip-lock pouch. Completing the Referral form the containers were dispatched to the ICMR approved Viral Research and Diagnostic Laboratory maintaining adequate cold chain in the form of ice box with the containers surrounded by hard frozen gel packs.

Specimens collected

Whole blood samples were collected in EDTA, sodium fluoride and sterile vacutainers while urine samples were collected in sterile, single use, disposable containers as per the laboratory and biosafety guidelines found in the WHO Laboratory Biosafety Manual, 3rd edition. Laboratory procedures involving sample manipulation were carried out in a biosafety cabinet.

Specimen collection

All blood samples were collected from the patients admitted in Isolation facility. All those involved in specimen collection and transportation to the laboratory were trained in safe specimen handling practices and spill decontamination procedures and Infection Prevention and Control measures.

Definition of various terms

Duty station

Refers to the Military Station where Military garrivalison and units are established along with the Military Hospital.

Quarantine

Quarantine of persons is limitation of activities of or the separation of such well persons who are not ill but who may have been exposed to an infectious agent or disease, with the objective of monitoring their symptoms and ensuring the early detection of cases. It applies to individuals coming from a disease affected area to an area where the disease has not occurred. A designated area, referred to Quarantine (Q) facility, was earmarked wherein all individuals with history of travel from Covid hotspot or contact with suspected/confirmed Covid-19 case in the last 14 days were lodged. All such individuals were quarantined for a total duration of 21 days in small cohorts of 05 persons only within whom any interaction was allowed.

Isolation

Isolation refers to separation, for the period of communicability, of infected persons from others in such places and under such conditions, as to prevent or limit the direct or indirect transmission of the infectious agent from those infected to those who are susceptible or who may spread the agent to others. It applies to individuals having symptoms/signs/of the disease under question and requires medical care in a health care setting. A designated facility was created within the hospital premises wherein all laboratory confirmed Covid-19 cases were admitted and treated. All Covid-19 positive patients were treated in the facility till they tested negative either by RT-PCR or by Rapid Antigen Test. The testing was carrivalied out after 10 days of the initial sample that yielded a positive result or after 03 days of clinical recovery, whichever is later.

Suspect case

Any patient with acute respiratory illness/fever with atleast one symptom/sign of respiratory disease eg: cough, shortness of breath AND with no other etiology that fully explains the clinical presentation AND a history of travel to or residence in a country/area/territory reporting local transmission of Covid-19 disease during the 14 days prior to the onset of symptoms.

OR

A patient with acute respiratory illness AND having been in contact with Confirmed Covid-19 case in the last 14 days prior to the onset of symptoms.

OR

A patient with severe acute respiratory infection (fever and atleast one sign/symptom of respiratory disease eg: cough, shortness of breath) AND requiring hospitalization AND with no other etiology that fully explains the clinical presentation.

Confirmed case

A person with laboratory confirmation of Covid-19 infection irrespective of clinical signs and symptoms.

Contact

A contact is a person who has experienced any one of the following exposures during the 2 days before and the 14 days after the onset of symptoms of a probable or confirmed case:

- Face to face contact with a probable or confirmed case within 1 meter and for atleast 15 minutes.
- Direct physical contact with a probable or confirmed Covid-19 case
- Direct care of a patient with probable or confirmed Covid-19 disease without using recommended Personal Protective Equipment (PPE).
- Other situations as indicated by local risk assessments.

High-risk contacts

Refers to any person who has had any of the following:

- Touched body fluids of the patient (respiratory tract secretions, blood, vomit, saliva, urine, faeces).
- Had direct physical contact with the body of the patient including physical examination without PPE
- Touched or cleaned the linen, clothes or dishes of the patient
- Lives in the same household as the patient
- Been in close proximity (within 1 meter) of the confirmed case without precautions
- Been a passenger in close proximity (within 1 meter) for more than 6 hours, in a conveyance with a symptomatic person who later tested positive for Covid-19.

Low risk contacts

Refers to any person who has:

- Shared the same space (same class for school/worked in the same room/office) and not having high-risk exposure to confirmed case of Covid-19.
- Travelled in same environment (bus/train/flight/any mode of transit) but not having a high-risk exposure.

Laboratory biosafety

The laboratory procedures included haematological assessment by semi-automated hematanalyser and Peripheral Blood smear examination, biochemistry panel by semi-automated analyser and urine examination by semi-automated analyser and urine microscopic examination. All examinations were performed based on risk assessment and only by personnel with demonstrated capability, in strict observance of all relevant protocols at all times. All specimens intended for hematology and biochemistry analyses were handled as per standard guidelines without additional measures as per WHO Laboratory Biosafety Manual, 3rd edition.

When handling and processing specimens, including blood for serological testing and urine for microscopy, laboratory practices and procedures that are basic to Good Microbiological Practice and Procedure (GMPP) were followed. The Point of Care (POC) assays were carrivalied out on a bench without employing a biosafety cabinet but ensuring universal precautions and in a well-ventilated area free of clutter. Area and surface disinfection were carrivalied out using disinfectants with proven activity against enveloped viruses, including Sodium hypochlorite (bleach: for example, 1000 parts per million (ppm) (0.1%) for general surface disinfection and 10,000 ppm (1%) for disinfection of sample spills: 70% ethanol: 0.5% Hydrogen peroxide. Particular attention was paid to not only to the selection of the disinfectant but also the contact time, dilution, shelf-life and expiry date after the working solution was prepared.

Haematological and biochemistry parameters

The haematological and biochemical profiles of patients admitted in the Isolation ward are as depicted in the tables 2 and 3 daywise. Asymptomatic and those with mild to moderate disease were assessed following both Universal and Covid precautions.

SI NO	Date of Investigation	Haemoglobin	Total Leukocyte count	Polymorphs (%)	Lymphocyte (%)	Monocyte (%)	Eosinophils (%)	Platelet count (per cmm)
1	06 Jun20	14.2	4000	55	38	2	5	160000
	23-Jun-20	13.5	4000	52	40	3	5	150000
	28-Jun	14.9	4800	55	37	3	5	229000
2	21-Jun	14.8	4800	45	45	3	7	216000
	23 Jun20	15.5	5500	50	42	3	5	221000
	28 Jun20	15.4	7200	38	58	2	2	247000

3	26 Jun20	17.3	7200	42	48	3	7	185000
	28 Jun 20	17.5	8300	50	38	5	7	194000
4	27 Jun20	17.6	4500	53	36	4	7	180000
5	28 Jun20	16.4	6700	50	41	4	5	150000
6	28 Jun20	16.1	5200	50	38	5	7	187000
7	28 Jun20	16.3	6100	50	40	3	7	295000
8	29 Jun20	13.3	9900	60	35	2	3	150000
9	29 Jun20	13.5	4100	76	13	5	6	160000
10	30 Jun20	17.2	7100	60	34	4	2	195000
11	1 Jul 20	15.8	7400	69	27	2	2	222000
12	1 Jul 20	16.1	2900	28	65	5	2	150000
13	1 Jul 20	15	5100	40	54	2	4	177000
14	1 Jul 20	15.6	5800	45	45	4	6	253000
15	1 Jul 20	14.5	6400	40	50	2	8	210000
16	1 Jul 20	14.9	5100	61	30	3	6	244000
17	1 Jul 20	16.3	4800	40	50	3	7	150000
	3 Jul 20	16.1	4700	42	55	2	1	150000
	6 Jul 20	16.1	4200	40	50	3	7	175000
18	1 Jul 20	15.2	8600	42	50	3	5	391000
19	1 Jul 20	16.8	5200	50	40	3	7	258000
20	1 Jul 20	18.9	6800	50	30	4	16	237000
	2 Jul 20	18	6200	56	32	4	8	206000
	4 Jul 20	18.4	5900	48	45	4	3	223000
	5 Jul 20	17.6	5100	50	45	3	2	221000
	6 Jul 20	18.1	4400	50	40	2	8	220000
	9 Jul 20	18.2	6100	52	40	3	5	275000
21	3 Jul 20	14.5	9200	78	20	1	1	190000
22	4 Jul 20	20	8000	50	44	4	2	225000
	5 Jul 20	15.1	8000	54	42	2	2	268000
	8 Jul 20	14.9	6100	57	32	5	6	210000
23	5 Jul 20	15.3	7300	61	32	3	4	167000
24	5 Jul 20	16	6900	64	30	3	3	197000
25	7 Jul 20	15.6	9700	45	44	5	6	158000
26	7 Jul 20	15.9	5800	60	36	3	1	150000
	14-Jul	14.6	3000	47	48	3	2	150000
	15 Jul 20	14.6	2300	58	36	4	2	150000
	15 Jul 20	14.5	3000	70	27	1	2	162000
	17-Jul	13.9	3600	63	30	3	4	160000
	18-Jul	14.3	3200	48	45	5	2	164000
	19-Jul	14.5	3800	50	45	3	2	169000
	20-Jul	14.3	3500	38	58	3	1	214000
	21-Jul	14.8	3500	35	58	4	3	268000

27	7 Jul 20	15.8	4800	40	52	4	4	152000
28	7 Jul 20	15.6	9400	45	50	3	2	160000
29	7 Jul 20	16.7	5900	60	34	3	3	159000
30	8 Jul 20	15.6	6400	50	42	5	3	177000
31	9 Jul 20	13.8	12300	78	16	2	4	214000
32	12 Jul 20	14.9	7100	55	38	3	4	165000
	13 Jul 20	14.2	7800	67	26	3	4	175000
	14-Jul-20	14.8	9400	65	29	2	4	151000
	15 Jul 20	14.8	6800	65	27	3	5	186000
	20-Jul	14.3	5800	45	49	4	2	254000
	21-Jul	14.6	8400	48	45	3	4	347000
33	14-Jul	16.9	8100	50	40	4	6	176000
34	14 Jul 20	15	5400	60	35	3	2	302000
	08-Aug	15.2	5400	25	69	3	3	150000
35	14 Jul 20	15.7	7300	36	49	3	12	201000
	18-Jul	15.8	9100	32	54	2	12	279000
36	14 Jul 20	14	3200	67	30	2	1	150000
	15 Jul 20	14.3	3800	60	36	3	1	150000
	20-Jul	14.2	3600	50	46	3	1	153000
37	14 Jul 20	16.1	7300	53	38	4	5	182000
	18-Jul	15.9	9100	52	34	4	10	187000
38	18-Jul	16.7	9300	48	45	4	3	166000
39	18-Jul	15.3	5000	35	60	2	3	156000
40	22-Jul	16.2	5800	52	38	4	6	195000
41	24-Jul	18.9	7600	44	49	4	3	150000
	02-Aug	17.9	9800	50	39	5	6	152000
	04-Aug	16.2	9900	50	40	3	7	150000
42	24-Jul	18.6	5500	41	50	4	5	170000
43	24-Jul	16.6	9600	68	27	2	3	248000
44	28-Jul	17.5	4800	25	68	3	4	168000
45	28-Jul	15	5200	60	33	3	4	150000
	29-Jul	15.3	5300	58	34	4	4	150000
	30-Jul	16.6	10000	68	24	3	5	176000
	31-Jul	15.1	8600	67	23	4	6	231000
	01-Aug	15.4	10000	67	24	4	5	239000
	02-Aug	15.4	11300	54	37	4	5	200000
	03-Aug	15.7	12300	67	28	2	3	331000
	04-Aug	14.8	10600	63	30	3	4	278000
	05-Aug	14.6	8100	58	31	3	8	249000
	06-Aug	14.4	7600	58	32	3	7	297000
	07-Aug	14	7000	50	41	3	6	304000
	08-Aug	14	5800	40	55	3	2	275000
	09-Aug	14.5	6500	44	46	3	7	336000

46	29-Jul	15.2	7100	44	49	3	4	150000
47	29-Jul	16.2	7700	56	37	4	3	216000
	10-Aug	16	5600	30	64	3	3	150000
48	30-Jul	14.3	4400	54	35	5	6	204000
49	31-Jul	15.4	6900	53	40	3	4	254000
50	31-Jul	13.2	7900	54	36	4	6	236000
51	31-Jul	17.3	3800	39	50	4	7	186000
52	31-Jul	16.3	6600	61	33	2	4	267000
53	31-Jul	14.6	3800	49	41	4	6	153000
	06-Aug	14.4	5600	54	38	3	5	196000
54	01-Aug	17.2	7000	40	49	5	6	219000
55	01-Aug	15.8	6400	42	37	3	18	209000
56	02-Aug	18.5	5400	54	37	4	5	196000
	04-Aug	17.8	9200	61	31	3	5	186000
57	03-Aug	17.2	5800	54	37	3	6	186000
58	03-Aug	17.3	6700	61	32	3	4	15000
59	06-Aug	15.2	5900	62	29	3	6	164000
60	06-Aug	15	4500	41	52	3	4	150000
61	06-Aug	12.4	4400	41	52	2	5	150000
62	06-Aug	15.3	6400	58	34	5	3	150000
63	06-Aug	14.2	5200	59	35	3	3	150000
64	06-Aug	13	2400	45	49	4	2	100000
	10-Aug	13	3200	50	45	3	2	150000
65	06-Aug	15	8000	66	30	2	2	150000
66	07-Aug	15.3	5000	43	50	3	4	150000
67	07-Aug	14.7	6300	65	31	3	1	150000
68	07-Aug	16	5300	48	46	2	4	161000
69	08-Aug	15.3	5000	32	60	2	6	164000
70	08-Aug	16.8	5600	34	60	4	2	167000
	11-Aug	16.4	5500	42	50	2	6	185000
71	08-Aug	15.9	4500	41	47	2	10	167000
72	09-Aug	16	8600	56	35	4	5	193000
73	09-Aug	15.7	6900	35	58	3	4	150000
74	09-Aug	16.1	4200	38	55	4	3	211000
75	09-Aug	17	6700	50	44	4	2	150000
76	09-Aug	16.7	9300	36	44	4	16	150000
77	09-Aug	12.6	8500	53	37	3	7	150000
78	10-Aug	16.1	7900	32	35	3	30	150000
79	11-Aug	12.6	3600	30	64	2	4	193000
80	11-Aug	15	5600	38	53	3	6	150000
81	11-Aug	14.3	4100	42	50	3	5	164000
82	11-Aug	16.1	5600	40	50	4	6	251000
83	11-Aug	15.3	6100	40	52	4	4	182000

84	11-Aug	16.1	5600	40	50	4	6	251000
85	12-Aug	14.7	6600	21	51	3	25	150000
86	12-Aug	15.4	8900	31	37	3	29	157000
	18-Aug	15.4	11900	32	43	3	22	221000
87	13-Aug	16.4	4600	42	50	4	4	150000
88	17-Aug	16.1	5300	70	20	3	7	168000
89	18-Aug	15.8	7300	52	39	3	6	158000
90	18-Aug	15.2	5700	51	42	2	5	150000
91	18-Aug	16	7800	58	33	3	6	190000
92	18-Aug	13.9	4600	54	42	3	1	154000
93	19-Aug	15.1	7700	49	40	5	6	250000
94	19-Aug	16	5900	35	59	4	2	172000
95	20 Aug 20	13.8	5500	65	29	3	3	150000
96	21 Aug 20	13	4300	75	18	3	4	153000
97	22 Aug 20	15.4	6700	66	23	5	6	185000
98	22 Aug 20	16.9	6400	57	34	4	5	150000
99	22 Aug 20	13	8700	85	10	2	3	181000
100	24 Aug 20	14.3	7700	41	49	4	6	150000
	25 Aug 20	13.5	6700	42	49	3	6	176000
101	25 Aug 20	14.4	7300	78	11	5	6	234000
102	25 Aug 20	16.9	7700	48	44	4	4	271000
103	26 Aug 20	18	7100	56	35	4	5	230000
104	26 Aug 20	14	4300	52	37	5	6	221000
105	26 Aug 20	17.8	7100	52	42	3	3	224000
106	26 Aug 20	13.7	5800	40	48	2	10	193000
107	26 Aug 20	18	8600	60	34	2	4	255000
108	26 Aug 20	16	3200	53	42	2	3	189000
109	26 Aug 20	16.5	6500	49	40	5	6	237000
110	26 Aug 20	16.4	5900	72	17	4	7	266000
111	26 Aug 20	16	4600	34	61	3	2	200000
112	26 Aug 20	17.6	7100	56	34	4	6	255000
113	26 Aug 20	13.7	7500	63	29	3	5	189000
114	26 Aug 20	14.5	3700	39	54	4	3	186000
115	26 Aug 20	15.8	6900	43	51	3	3	202000
116	26 Aug 20	16.7	4800	32	60	3	5	284000
117	26 Aug 20	13.7	6300	51	38	5	6	186000
118	27 Aug 20	17.2	4800	55	35	4	6	257000
119	27 Aug 20	14.8	3400	60	29	5	6	152000
120	28 Aug 20	17.7	8100	38	54	4	4	100000
121	28 Aug 20	16.4	3100	21	68	3	8	186000
122	28 Aug 20	11.9	5900	57	37	3	3	60000
123	28 Aug 20	17.2	6500	58	34	2	6	245000
124	28 Aug 20	17.2	6400	30	60	2	8	186000

125	28 Aug 20	13.8	3300	65	28	3	4	179000
126	29 Aug 20	13.3	6600	55	37	3	5	345000
127	29 Aug 20	15.5	2300	70	28	1	1	186000
128	29 Aug 20	14	6200	60	30	3	7	232000
129	29 Aug 20	16.1	4000	42	37	4	7	160000
	30 Aug 20	16.1	4100	34	60	3	3	156000
130	29 Aug 20	13.9	9600	60	33	2	5	188000
131	30 Aug 20	12.6	6300	59	30	5	6	377000
132	30 Aug 20	11.2	4600	52	37	5	6	80000
133	30 Aug 20	14.1	8600	75	20	2	3	169000
134	30 Aug 20	13.9	10500	64	28	3	5	208000
135	30 Aug 20	18.4	4400	55	34	5	6	172000
136	30 Aug 20	15.9	9700	67	24	4	5	231000
137	30 Aug 20	15.3	4900	72	19	4	5	154000
138	30 Aug 20	15.5	4500	54	35	5	6	234000
139	31 Aug 20	12.8	7200	55	37	3	5	365000
140	31 Aug 20	15.3	4500	50	40	4	6	151000
141	31 Aug 20	15.7	4600	37	58	3	2	248000
142	31 Aug 20	15.5	8700	60	30	3	7	215000
143	31 Aug 20	14.3	10900	60	32	2	6	268000
144	31 Aug 20	14.8	6700	62	30	3	6	251000
145	31 Aug 20	15.2	4600	74	20	2	4	150000
146	31 Aug 20	17.9	4000	50	40	3	7	160000
147	31 Aug 20	11.4	5200	55	36	4	5	80000
148	31 Aug 20	14.7	3300	57	32	5	6	150000
149	31 Aug 20	14.9	3800	49	40	5	6	164000
150	31 Aug 20	15.6	7700	58	33	4	5	150000
151	31 Aug 20	11	4900	65	20	5	10	150000
152	31 Aug 20	13	3800	50	40	3	7	161000
153	31 Aug 20	13.2	7800	55	37	3	5	296000
154	31 Aug 20	12.2	5700	65	30	2	3	178000
155	31 Aug 20	12.5	7500	32	46	4	18	245000
156	01 Sep 20	13.7	4200	62	31	2	5	201000
157	01 Sep 20	14.7	4300	39	57	2	2	310000
158	01 Sep 20	14.8	6000	62	28	3	7	255000
159	01 Sep 20	13.3	10600	60	35	2	3	222000
160	01 Sep 20	15.2	4300	53	40	3	4	150000
161	01 Sep 20	17.3	3800	40	52	4	4	100000
162	01 Sep 20	15.6	4600	40	52	4	4	188000
163	01 Sep 20	15.9	5400	39	50	4	7	213000
164	01 Sep 20	13.1	6100	54	37	3	6	440000
165	01 Sep 20	15.7	8400	55	38	2	5	155000

166	01 Sep 20	14.8	2900	39	50	3	8	150000
167	01 Sep 20	14.8	3200	44	44	5	7	216000
168	01 Sep 20	14.3	8700	68	23	4	5	158000
169	01 Sep 20	15	7200	65	30	1	4	313000
170	02 Sep 20	15.3	4400	38	51	5	6	186000
171	02 Sep 20	13.1	8500	50	40	3	7	193000
172	02 Sep 20	15.1	9100	70	25	2	3	321000
173	02 Sep 20	13.5	6100	38	58	3	1	403000
174	02 Sep 20	14.9	4000	53	42	3	2	203000
175	02 Sep 20	17.1	5000	60	32	2	6	150000
176	02 Sep 20	16.6	7800	70	19	5	6	158000
177	02 Sep 20	15.7	4800	35	60	3	2	181000
178	02 Sep 20	13	3200	50	45	3	2	150000
179	03 Sep 20	12.2	9000	55	38	3	4	110000
180	03 Sep 20	10.8	5700	64	29	3	4	150000
181	03 Sep 20	11.6	5000	52	38	2	8	222000
182	03 Sep 20	15	9900	69	23	3	5	344000
183	03 Sep 20	15	7500	50	42	3	5	296000
184	03 Sep 20	16.4	5400	54	36	4	6	171000
185	03 Sep 20	15.1	7500	52	37	5	6	150000
186	04 Sep 20	14.5	10900	71	21	3	5	350000
187	04 Sep 20	16.9	3400	68	25	3	4	177000
188	04 Sep 20	13.6	5900	60	29	5	6	387000
189	04 Sep 20	12.6	4100	50	38	2	10	150000
190	04 Sep 20	16.7	6000	34	61	2	3	150000
191	04 Sep 20	17.6	6100	40	50	3	7	174000
192	04 Sep 20	15.8	6700	56	33	5	6	223000
193	04 Sep 20	16.8	7200	38	46	2	14	277000
194	04 Sep 20	16.2	4900	38	52	4	6	185000
195	04 Sep 20	13.7	3900	30	64	3	3	188000
196	04 Sep 20	15.2	5500	41	50	2	7	162000
197	04 Sep 20	16	5700	32	58	3	7	158000
198	05 Sep 20	15.1	10600	71	22	3	4	424000
	06 Sep 20	15.6	9500	62	30	3	5	380000
	07 Sep 20	15.2	9200	60	33	3	4	438000
	08 Sep 20	15.9	10200	62	33	2	3	443000
	09 Sep 20	15.3	9700	64	29	3	4	385000
199	06 Sep 20	16.4	6600	73	18	4	5	250000
	07 Sep 20	16.2	6100	69	22	4	5	326000
	08 Sep 20	16.9	7900	66	26	3	5	324000
	09 Sep 20	17.6	7000	67	24	4	5	417000
	11 Sep 20	18.3	7500	52	38	4	6	410000
	05 Sep 20	16.5	6400	75	17	3	5	209000

200	06 Sep 20	16.5	5900	50	39	5	6	205000
201	06 Sep 20	14.3	7900	50	36	5	9	174000
202	07 Sep 20	14.4	4600	36	52	4	8	162000
203	07 Sep 20	13.2	6100	62	27	5	6	206000
204	08 Sep 20	15	8800	50	39	5	6	263000
205	08 Sep 20	16.5	6100	40	49	5	6	214000
206	08 Sep 20	15.3	3200	42	47	5	6	168000
207	08 Sep 20	14.9	8400	54	37	4	5	258000
208	08 Sep 20	15.1	6900	52	36	5	7	215000
209	08 Sep 20	16.6	6800	50	42	2	6	217000
210	08 Sep 20	12.8	5200	43	44	3	10	150000
211	08 Sep 20	14.7	5300	34	53	4	9	158000
212	09 Sep 20	15.1	7600	52	37	5	6	259000
213	09 Sep 20	15	8100	50	41	4	5	252000
214	09 Sep 20	15.4	4500	51	38	5	6	150000
215	09 Sep 20	16.1	3800	42	46	5	7	150000
216	09 Sep 20	16.1	8100	54	37	4	5	191000
217	09 Sep 20	15	6700	60	31	4	5	181000
218	09 Sep 20	15.1	4700	46	45	4	5	162000
219	09 Sep 20	13.2	4900	38	51	5	6	159000
220	10 Sep 20	14.7	8200	63	32	2	3	346000
221	10 Sep 20	14.6	13600	67	24	4	5	322000
222	10 Sep 20	15.8	4100	54	34	5	7	157000
223	10 Sep 20	16.2	15500	79	17	2	2	281000
224	10 Sep 20	16.9	6400	54	34	5	7	222000
225	10 Sep 20	15.4	4600	46	43	5	6	216000
	11 Sep 20	16.2	4800	40	51	4	5	196000
	14 Sep 20	15.7	5600	45	43	2	10	255000
226	11 Sep 20	14.5	4500	60	34	2	4	210000
227	11 Sep 20	15.1	15300	80	15	2	3	291000
228	11 Sep 20	18.3	7500	52	38	4	6	410000
229	11 Sep 20	14.5	8100	62	30	3	5	288000
230	11 Sep 20	15.1	9700	50	42	3	5	250000
231	11 Sep 20	15.3	9500	68	25	2	5	318000
232	11 Sep 20	13	5000	54	37	4	5	221000
	11 Sep 20	12.8	9600	73	22	2	3	184000
233	12 Sep 20	16.5	9400	26	46	4	24	238000
234	12 Sep 20	13.5	6700	88	10	1	1	200000
235	12 Sep 20	14.5	9800	62	29	4	5	239000
236	12 Sep 20	15.3	13400	76	19	2	3	284000
237	12 Sep 20	16	4500	50	39	5	6	228000
238	12 Sep 20	14.3	9300	62	29	4	5	327000
239	12 Sep 20	15.9	4200	50	39	5	6	192000

240	13 Sep 20	13.9	7500	54	35	5	6	212000
241	13 Sep 20	13.8	7300	63	28	4	5	351000
242	13 Sep 20	16	6600	54	36	4	6	243000
243	13 Sep 20	16.1	11500	49	40	5	6	273000
244	13 Sep 20	13.2	5000	60	31	4	5	230000
245	13 Sep 20	13.9	3800	44	45	5	6	159000
246	13 Sep 20	12	4300	64	25	5	6	459000
247	14 Sep 20	12.4	7700	52	34	5	9	150000
248	14 Sep 20	14.6	9000	50	40	3	7	238000
249	14 Sep 20	16.3	9900	50	40	4	6	242000
250	14 Sep 20	13.3	7000	60	30	3	7	370000
251	14 Sep 20	13.5	6000	60	32	3	5	211000
252	14 Sep 20	12	7000	83	15	1	1	150000
253	15 Sep 20	13.1	6600	54	35	5	6	443000
254	15 Sep 20	15.7	5700	46	45	4	5	254000
255	15 Sep 20	16.2	9400	55	34	5	6	268000
256	15 Sep 20	14.7	6400	58	33	4	5	237000
257	15 Sep 20	12.8	6000	50	40	4	6	247000
258	15 Sep 20	16.4	12000	86	8	2	4	328000
259	15 Sep 20	15.6	5100	60	32	3	5	174000
260	15 Sep 20	13.5	7200	35	58	4	3	262000
261	16 Sep 20	13.9	10100	58	31	5	6	447000
262	16 Sep 20	14.7	5900	50	39	5	6	237000
263	16 Sep 20	15.2	7400	58	33	4	5	216000
264	16 Sep 20	15.7	10000	65	26	4	5	288000
265	16 Sep 20	13.1	8100	61	29	4	6	237000
266	17 Sep 20	13.1	8900	68	25	2	5	250000
267	17 Sep 20	13.4	15800	79	14	3	4	538000
268	18 Sep 20	15.6	4400	40	50	3	7	170000
269	18 Sep 20	13.7	5000	50	40	3	7	152000
270	18 Sep 20	13.4	14000	78	26	2	4	510000
271	17 Sep 20	7	4700	56	39	2	3	150000
	18 Sep 20	8.2	4900	78	15	2	5	170000
	19 Sep 20	9.1	6300	71	25	2	2	172000
	20 Sep 20	9.2	5500	53	40	2	5	168000
	21 Sep 20	9.3	5800	53	38	4	5	225000
272	19 Sep 20	13	9100	70	25	2	3	165000
273	19 Sep 20	13	4000	50	40	3	7	165000
274	20 Sep 20	13.3	9600	40	51	3	6	275000
275	20 Sep 20	13.6	4100	40	50	4	6	175000
276	20 Sep 20	16	6600	60	30	4	6	210000
277	20 Sep 20	14.4	8500	55	38	2	5	165000

278	20 Sep 20	12.4	15000	75	21	1	3	160000
279	21 Sep 20	12.8	10900	83	13	2	2	304000
280	21 Sep 20	12.4	4000	60	35	2	3	160000
	22 Sep 20	12.8	4000	40	50	3	7	165000
	23 Sep 20	12.5	4500	46	48	3	3	150000
	24 Sep 20	8.5	7200	70	25	2	3	160000
	24 Sep 20	9.1	6700	70	22	4	4	175000
	25 Sep 20	8.1	1700	52	42	3	3	183000
	26 Sep 20	8.5	4900	56	37	4	3	192000
	27 Sep 20	9.4	5000	54	39	3	4	191000
281	24 Sep 20	16	4700	50	45	2	3	182000
282	24 Sep 20	16.1	8000	51	40	4	5	152000
283	24 Sep 20	16.7	6300	40	49	3	6	180000
284	27 Sep 20	15	5300	54	37	4	5	187000
285	27 Sep 20	15.4	3400	54	40	2	4	222000
286	27 Sep 20	14.4	4700	49	38	4	9	154000
287	28 Sep 20	16.2	13100	35	38	3	24	255000
288	28 Sep 20	9.7	6300	56	37	3	4	210000
289	29 Sep 20	14.4	6200	52	43	3	2	185000
290	29 Sep 20	14.8	8100	48	44	2	6	192000
291	29 Sep 20	9.4	6800	62	31	2	5	209000
292	29 Sep 20	13.1	5000	55	40	2	3	160000
293	29 Sep 20	17	8800	34	41	3	22	255000
294	01 Oct 20	16.5	5000	38	45	4	13	162000
295	01 Oct 20	13.2	5700	62	32	3	3	192000
296	01 Oct 20	14.5	5600	66	30	2	2	150000
297	01 Oct 20	15	6200	58	36	3	3	189000
298	02 Oct 20	14.2	4700	42	50	3	5	150000
299	02 Oct 20	12.2	4000	54	42	3	3	180000
300	02 Oct 20	15.2	7200	55	38	2	5	152000
301	03 Oct 20	13.2	4200	37	55	3	5	229000
302	03 Oct 20	16.4	4400	35	58	3	4	352000
303	03 Oct 20	15.8	6800	30	55	2	13	29700
304	05 Oct 20	13	8300	64	30	2	4	198000
305	05 Oct 20	15	7000	38	57	2	3	176000
306	07 Oct 20	15.8	5500	55	40	3	2	150000
307	07 Oct 20	14.4	4500	49	43	3	5	375000
308	07 Oct 20	16.9	4700	47	44	3	6	368000
309	07 Oct 20	17	16600	70	22	3	5	238000
310	07 Oct 20	20.1	9200	40	48	3	9	250000
311	07 Oct 20	17.6	5600	32	58	3	7	202000
312	09 Oct 20	13.2	4700	50	44	2	4	246000

313	09 Oct 20	14.1	4400	44	52	2	2	150000
314	09 Oct 20	13.9	6300	44	48	4	4	150000
315	09 Oct 20	15.9	4900	50	42	3	5	176000
316	09 Oct 20	15.2	4900	36	58	2	4	194000
317	10 Oct 20	16.9	5400	50	44	2	4	255000
318	10 Oct 20	15.2	6700	63	30	3	4	150000
319	10 Oct 20	15.1	4500	60	32	3	5	395000
320	11 Oct 20	17.6	7000	50	41	3	6	262000
321	11 Oct 20	15.8	7800	36	58	3	3	171000
322	11 Oct 20	14.6	6500	40	52	3	5	184000
323	11 Oct 20	15.2	4000	42	52	2	4	150000
324	11 Oct 20	13.6	5600	35	55	3	7	150000
325	11 Oct 20	14.6	6700	49	46	3	2	159000
326	11 Oct 20	15.1	5300	40	55	3	2	165000
327	11 Oct 20	14.5	5400	38	58	2	2	100000
328	11 Oct 20	14.1	4400	49	45	3	3	150000
329	11 Oct 20	14.4	2600	55	36	2	7	150000
330	11 Oct 20	15.7	4300	40	54	3	3	150000
331	12 Oct 20	16.8	5600	32	54	4	10	333000
332	12 Oct 20	15.9	4700	32	60	3	5	154000
333	12 Oct 20	12.9	6300	57	34	3	6	198000
334	12 Oct 20	14.9	8600	50	41	3	6	251000
335	12 Oct 20	14.8	6900	63	29	2	6	189000
336	12 Oct 20	14.7	8700	46	44	4	6	356000
337	12 Oct 20	16.4	4800	55	39	2	4	160000
338	12 Oct 20	17.1	5600	47	45	3	5	203000
339	12 Oct 20	15.7	6700	50	45	2	3	318000
340	12 Oct 20	16.2	7100	48	44	2	6	170000
341	12 Oct 20	12.7	3800	62	30	3	5	220000
342	12 Oct 20	17	7800	55	37	3	5	259000
343	13 Oct 20	13.2	6400	53	42	3	2	150000
344	14 Oct 20	14.5	7900	86	10	2	2	150000
345	14 Oct 20	14.1	5600	55	35	3	7	169000
346	14 Oct 20	15	5200	55	38	3	4	150000
347	14 Oct 20	16.6	4200	39	54	3	4	150000
348	14 Oct 20	14.9	7700	35	60	3	2	272000
349	14 Oct 20	16.8	6900	48	42	3	7	222000
350	14 Oct 20	15.2	6400	40	55	2	3	263000
351	14 Oct 20	12.5	6800	55	38	2	5	186000
352	14 Oct 20	15.5	6300	38	54	4	4	200000
353	14 Oct 20	14	6300	54	40	2	4	150000
354	14 Oct 20	13.9	3400	54	40	4	2	150000
355	14 Oct 20	17.1	6200	50	40	3	7	245000

356	14 Oct 20	17.6	5700	50	42	3	5	240000
357	14 Oct 20	17.2	6000	51	40	3	6	243000
358	15 Oct 20	12	8100	80	15	3	2	150000
359	15 Oct 20	15.1	4000	45	50	2	3	150000
360	15 Oct 20	16.3	6000	40	52	4	4	191000
361	15 Oct 20	14.2	5600	43	50	2	5	165000
362	15 Oct 20	16.8	4100	38	55	4	3	150000
363	16 Oct 20	16.8	5600	36	52	2	10	150000
364	16 Oct 20	16.3	7500	50	40	3	7	191000
365	16 Oct 20	12.9	6800	70	25	3	2	150000
366	16 Oct 20	16.5	5700	37	56	2	5	150000
367	17 Oct 20	12.8	7100	70	24	2	4	16500
368	17 Oct 20	15.3	4200	50	45	3	2	150000
369	18 Oct 20	14.8	6100	40	54	3	3	150000
370	18 Oct 20	11.6	11900	85	10	2	3	204000
371	18 Oct 20	15.9	6300	50	41	3	6	206000
372	18 Oct 20	12.5	9500	76	20	2	2	176000
373	18 Oct 20	14.3	8600	50	42	3	5	227000
374	18 Oct 20	15.7	4000	48	46	2	4	181000
375	18 Oct 20	16.6	3200	38	55	4	3	166000
376	18 Oct 20	15.2	8200	60	34	2	4	177000
377	18 Oct 20	15	7500	40	53	2	5	220000
378	18 Oct 20	13	6100	55	37	3	5	210000
379	18 Oct 20	17	7100	55	38	2	5	171000
380	18 Oct 20	16.2	7600	50	40	4	6	185000

Table 2: The haematological profile of Covid-19 positive patients admitted in the hospital between Jun 20 and Oct 20.

SI No	Date of Investigation	RBS (mg/dl)	Urea/Creatinine (mg/dl)	TC/TG/LDL/HDL (mg/dl)	Total Bilirubin/ Direct Bilirubin (mg/dl)	LDH	CRP, PT/APTT/INR
1	20 Jun20		35/1.3		0.8/0.5	248	
	23 Jun20		30/1.0	163/142/96/40	0.9/0.4	275	CRP-NEGATIVE, PT-13/17, INR-1.30
	28 Jun20	79	31/1.1	169/96/103/46	0.7/0.4	264	CRP-NEGATIVE, PT - 13/17, INR-1.32, APTT-30/32
2	21 Jun20		34/1.2		0.8/0.5		
	23 Jun20		32/1.1		0.8/0.5	279	CRP- NEGATIVE
	28 Jun20	84	32/1.1	154/100/90/44	0.7/0.3	245	CRP-NEGATIVE
3	26 Jun20		32/1.1	181/163/108/40	0.9/0.5	239	CRP- NEGATIVE

4	27 Jun20	92	34/1.2	172/89/114/40	0.7/0.3	220	
5	28 Jun20	69	33/1.1	149/79/93/40	0.6/0.3	246	CRP- NEGATIVE, PT-13/16, INR-1.21, APTT-30/32
6	28 Jun20	80	29/1.0	223/136/155/40	0.7/0.3	325	CRP-NEGATIVE, PT-13/15, INR-1.12, APTT-30/31
7	28 Jun20	106	34/1.2	177/110/113/42	0.6/0.2	318	CRP-NEGATIVE
	29 Jun20	91/125	32/1.1				
8	29 Jun20	95	35/1.2	175/142/106/40	0.8	320	CRP-NEGATIVE
9	29 Jun20	101	31/1.1	149/80/95/38	0.6/0.4	306	CRP-NEGATIVE
10	30 Jun20	76	33/1.1	130/70/80/36	0.7/0.4	512	CRP-NEGATIVE, PT-13/19, INR-1.42 , APTT-30/36
11	01 Jul 20	96	28/1.0	196/92/139/38	0.7/0.3	339	CRP-NEGATIVE
12	01 Jul 20	70	31/1.1	184/110/121/41	0.8	425	CRP- NEGATIVE
13	02 Jul 20	82	29/1.1	187/130/120/41	0.7	328	CRP- NEGATIVE
14	02 Jul 20	98	30/1.1	264/110/206/36	0.9	315	CRP- NEGATIVE
15	02 Jul 20	81	28/1.0	189/190/117/34	0.6	310	CRP- NEGATIVE
16	02 Jul 20	90	33/1.1	195/138/126/41	0.6	227	CRP- NEGATIVE
17	02 Jul 20	61	31/1.1	159/70/105/40	0.7	450	CRP- NEGATIVE
	03 Jul 20	78	28/1.0	139/76/87/36	0.7/0.3	470	
18	03 Jul 20	84	36/1.2	191/134/122/42	0.8	297	CRP- NEGATIVE
19	03Jul 20	62	26/0.8	191/140/123/40	0.7	281	CRP- NEGATIVE
20	03 Jul 20	82	33/1.2	194/200/118/36	0.6/0.2	410	CRP-NEGATIVE
21	03 Jul 20	104	27/1.0	220/136/154/38	0.7/0.4	574	CRP-NEGATIVE
	03 Jul 20			220/136/154/38			
22	04 Jul 20	95	27/0.9	149/150/83/36	08/0.3	342	CRP- NEGATIVE
	13 Jul 20		32/1.1		0.7/0.3		
	14 Jul 20					466	CRP- NEGATIVE
23	05 Jul 20	59	32/1.2	194/130/128/40	2.1/1.1	236	CRP- NEGATIVE
24	05 Jul 20	78	34/1.2	197/138/131/38	0.9/0.4	390	CRP-NEGATIVE
25							

26	07 Jul 20	72	33/1.2	192/136/124/41	0.9/0.4	342	CRP-NEGATIVE
	15 Jul 20		28/0.9		0.8/0.3	518	CRP-NEGATIVE
	17 Jul 20	62	31/1.1	130/82/75/38	0.6/0.2	517	
	18 Jul 20		29/1.1				CRP-POSITIVE
27	07 Jul 20	65	37/1.3	202/118/136/42	0.8/0.3	404	CRP-NEGATIVE
28	07 Jul 20	68	26/0.8	186/138/116/42	0.9/0.4	386	CRP-NEGATIVE
29	07 Jul 20	76	30/1.1	176/110/116/38	0.8/0.4	462	CRP-NEGATIVE
29	08 Jul 20						
30	09 Jul 20	100	31/1.1	247/110/189/36	4.1/1.9	370	CRP –NEGATIVE,
31	13 Jul 20		32/1.1		0.7/0.3		
	14 Jul 20					466	CRP-NEGATIVE
	15 Jul 20		29/1.0		0.7/0.3	433	CRP-NEGATIVE
32	14 Jul 20	67	32/1.2	156/90/94/44	0.6/0.2	346	CRP-NEGATIVE
33	14 Jul 20	69	29/1.0	188/110/124/42	0.8/0.3	356	CRP-NEGATIVE
	15 Jul 20	74	36/1.3	159/90/101/40	1.3/0.7		
34	14 Jul 20	64	31/1.2	197/130/131/40	0.9/0.4	390	CRP-NEGATIVE
	16 Jul 20	69	32/1.2	198/128/130/42	0.8/0.3	334	CRP-NEGATIVE
35	15 Jul 20		33/1.2		0.8/0.4	405	CRP-NEGATIVE
36	14 Jul 20	62	36/1.2	236/150/168/38	0.8/0.4	401	CRP-NEGATIVE
	18 Jul 20	84	30/1.1	224/160/156/36	0.7/0.3	272	CRP-NEGATIVE
37	18 Jul 20	78	31/1.1	169/140/101/40	0.8/0.4	417	CRP-NEGATIVE
38	18 Jul 20	64	34/1.2	176/132/109/40	0.7/0.3	340	CRP-NEGATIVE
39	22 Jul 20	68	34/1.3	163/116/99/40	0.8/0.3		CRP-NEGATIVE
40	24 Jul 20	78	24/0.8	163/98/103/40	1.0/0.3		CRP-NEGATIVE
41	24 Jul 20	76	32/1.1	138/120/73/42	0.8/0.3		CRP-NEGATIVE
42	24 Jul 20	92	23/1.0	175/181/100/38	0.7/0.4		CRP-NEGATIVE

43	28 Jul 20	78	31/1.1	179/130/111/42	1.0/0.4		CRP-NEGATIVE
44	28 Jul 20	102	27/0.9	134/96/74/40	0.7/.04		CRP-POSITIVE
45	29 Jul 20	84	29/1.0	199/134/132/40	0.7/0.3		CRP-NEGATIVE
46	29 Jul 20	140	34/1.3	278/498/144/34	0.6/0.2		CRP-NEGATIVE
	31 Jul 20	69	31/1.2	228/138/163/37	0.9/0.4		
47	30 Jul 20	78	35/1.2	140/110/78/40	0.7/0.3		CRP-NEGATIVE
48	31 Jul 20	83	30/0.9	180/94/123/38	0.8/0.3		CRP-NEGATIVE
49	31 Jul 20	72	32/1.0	182/146/115/37	1.0/0.4		CRP-NEGATIVE
50	31 Jul 20	82	34/1.0	178/134/111/40	0.8/0.3		CRP-NEGATIVE
51	31 Jul 20	92	29/0.9	225/174/150/40	0.7/0.3		CRP-NEGATIVE
52	31 Jul 20	74	34/1.0	195/143/126/40	0.9/0.4		CRP-NEGATIVE
53	01 Aug 20	81	29/1.1	172/120/106/42	0.7/0.3		CRP-NEGATIVE
54	01 Aug 20	86	34/1.2	200/140/134/38	0.9/0.4		CRP-NEGATIVE
55	03 Aug 20	83	31/1.2	188/150/120/38	0.6/0.2		
56	03 Aug 20	72	34/1.3	174/110/114/38	0.5/0.2		
57	06 Aug 20	76	31/1.0	199/198/125/34	0.8/0.3		CRP-NEGATIVE
58	06 Aug 20	76	36/1.3	148/110/90/36	0.7/0.3		CRP-NEGATIVE
59	06 Aug 20	70	33/1.1	150/160/80/38	0.6/0.3		CRP-NEGATIVE
60	06 Aug 20	74	32/1.2	200/135/133/40	0.6/0.2		CRP-NEGATIVE
61	06 Aug 20	100	36/1.3	176/110/112/42	0.8/0.3		CRP-NEGATIVE
62	06 Aug 20	69	32/1.3	134/90/76/40	0.8/0.4		CRP-NEGATIVE
63	06 Aug 20	64	34/1.3	178/200/104/34	0.6/0.2		CRP-NEGATIVE
64	07 Aug 20	62	29/1.0	177/150/109/38	1.5/0.7		CRP-NEGATIVE
65	07 Aug 20	64	34/1.2	194/150/128/36	0.8/0.3		CRP-NEGATIVE

66	07 Aug 20	67	32/1.1	218/146/152/36	0.9/0.4		CRP-NEGATIVE
68	08 Aug 20	74	36/1.3	159/90/101/40	1.3/0.7		CRP-NEGATIVE
69	08 Aug 20	62	29/1.1	174/100/120/34	0.8/0.3		CRP-NEGATIVE
70	08 Aug 20	62	34/1.3	223/140/155/40	0.6/0.2		CRP-NEGATIVE
71	08 Aug 20	64	30/1.2	222/196/146/36	0.5/0.2		CRP-NEGATIVE
72	09 Aug 20	78	29/1.0	200/126/136/38	0.7/0.3		CRP-NEGATIVE
73	09 Aug 20	100	30/1.1	160/92/102/39	0.8/0.3		CRP-NEGATIVE
74	09 Aug 20	105	32/1.0	189/114/129/37	0.9/0.4		CRP-NEGATIVE
75	09 Aug 20	65	29/1.0	212/101/153/38	0.8/0.3		CRP-NEGATIVE
76	09 Aug 20	90/176	33/1.0	176/110/114/40	0.6/0.2		CRP-NEGATIVE
77	09 Aug 20	61	34/1.2	194/90/139/37	1.4/0.8		CRP-NEGATIVE
78	10 Aug 20	69	31/1.2	228/138/163/37	0.9/0.4		CRP-NEGATIVE
79	10 Aug 20	62	29/1.1	182/128/117/39	1.2/0.7		CRP-NEGATIVE
80	11 Aug 20	65	28/1.0	129/78/68/35	0.8/0.3		CRP-NEGATIVE
81	11 Aug 20	69	32/1.2	136/90/83/35	0.7/0.3		CRP-NEGATIVE
82	11 Aug 20	68	36/1.3	165/100/109/36	0.7/0.3		CRP-NEGATIVE
83	11 Aug 20	67	29/0.9	142/90/86/38	0.8/0.3		CRP-NEGATIVE
84	13-Aug	60	29/1.1	208/136/140/40	0.9/0.4		CRP-NEGATIVE
86	17-Aug		28/0.9		0.7/0.3		
87	18-Aug	73	29/1.1	183/119/121/38	0.8/0.3		CRP-NEGATIVE
88	18-Aug	86	31/1.2	168/100/109/39	0.7/0.3		CRP-POSITIVE
89	18-Aug	79	27/1.0	191/175/120/36	0.9/0.4		CRP-NEGATIVE
90	18-Aug	77	26/0.9	176/99/118/38	0.8/0.3		CRP-NEGATIVE
91	19-Aug	91	29/1.1	192/132/126/39	1.0/0.5		CRP-NEGATIVE
92	19-Aug	82	27/1.0	176/140/108/40	0.8/0.2		CRP-NEGATIVE
93	01-Oct	94	29/1.1	161/98/110/35	0.8	245	CRP-NEGATIVE
94	01-Oct	92	30/1.2	136/103/78/35	0.8	355	CRP-POSITIVE
95		89	29/1.2	156/201/77/38	0.8	288	CRP-NEGATIVE

96	01-Oct	94	30/1.2	126/98/71/35	0.7	276	CRP-NEGATIVE
97		92	28/0.9	186/139/118/40	0.8	237	CRP-NEGATIVE
99	03-Oct	98	18/0.6	165/126/104/35	0.8	226	CRP-NEGATIVE
100	03-Oct	91	27/0.9	189/156/119/38	0.8	288	CRP-NEGATIVE
101	03-Oct	81	29/0.8	172/139/106/38	0.8	302	CRP-NEGATIVE,
102	05-Oct	94	30/0.8	163/136/100/36	0.8	302	CRP-NEGATIVE
103	05-Oct	106	30/1.2	129/102/73/35	0.8	298	CRP-NEGATIVE
104	07-Oct	83	30/1.2	148/112/90/35	0.8	434	CRP-NEGATIVE
105	07-Oct	90	28/0.9	165/135/103/35	0.8	382	CRP-NEGATIVE
106	07-Oct	102	25/0.8		0.9	310	CRP-NEGATIVE
107	07-Oct	88	25/0.8	172/163/101/38	0.9	457	CRP-NEGATIVE
108	07-Oct	94	30/0.8	148/110/90/36	0.9	327	CRP-NEGATIVE
109	09-Oct	92	29/1.0	163/125/103/35	0.8	298	CRP-*POSITIVE*
110	09-Oct	95	28/0.9	175/142/110/36	0.9	302	CRP-NEGATIVE
111	09-Oct	101	30/1.0	166/139/100/38	0.8	325	CRP-NEGATIVE
112	09-Oct	85	29/1.0	158/142/91/38	0.8	310	CRP-NEGATIVE
113	09-Oct	98	25/0.8	175/145109/36	0.8	295	CRP-NEGATIVE
118	11-Oct	89	30/1.1	177/130/113/38	0.8	301	CRP-NEGATIVE
119	11-Oct	88	28/0.9	163/129/100/37	0.8	325	CRP-NEGATIVE
120	11-Oct	93	28/0.9	188/163/115/40	0.8	296	CRP-NEGATIVE
121	11-Oct	102	32/1.3	172/137/106/38	0.8	302	CRP-NEGATIVE
122	11-Oct	90	28/0.9	172/160/99/41	0.8	325	CRP-NEGATIVE
123	11-Oct	97	25/0.8	186/139/118/40	0.7	298	CRP-NEGATIVE
124	11-Oct	92	25/0.8	160/132/93/40	0.7	298	CRP-NEGATIVE
125	11-Oct	88	25/.08	160/129/99/35	0.7	237	CRP-NEGATIVE
126	11-Oct	92	28/0.9	172/137/104/40	0.8	310	CRP-NEGATIVE
127	11-Oct	95	28//1.0	174/128/112/36	0.7	302	CRP NEGATIVE
128	12-Oct	90	24/0.7	158/132/96/36	0.8	310	CRP-NEGATIVE
129	12-Oct	88	30/1.0	158/126/96/36	0.8	318	CRP-NEGATIVE
130	12-Oct	92	28/0.9	188/151/119/38	0.8	275	CRP-NEGATIVE
131	12-Oct	85	25/0.8	162/137/94/40	0.8	336	CRP-NEGATIVE
132	12-Oct	75	24/0.8	162/126/94/35	0.9	302	CRP-NEGATIVE
133	12-Oct	92	28/0.9	165/131/98/40	0.8	325	CRP-NEGATIVE
134	12-Oct	91	28/0.9	148/130/82/40	0.8	198	CRP-NEGATIVE
135	12-Oct	78	30/1.0	160/128/99/35	0.9	309	CRP-NEGATIVE
136	12-Oct	91	28/0.9	188/161/115/40	0.8	302	CRP-NEGATIVE
137	12-Oct	88	25/0.8	172/136/104/40	0.7	302	CRP-NEGATIVE

138	12-Oct	86	29/1.0	162/118/103/35	0.8	307	CRP-NEGATIVE
139	14-Oct	86	31/1.2	172/139/109/35	0.8	302	CRP-NEGATIVE
140	14-Oct	110/152	20/0.6	180/142/116/35	0.8	301	CRP-NEGATIVE
141	14-Oct	92	28/0.9	186/142/121/36	0.8	198	CRP-NEGATIVE
142	14-Oct	90	25/0.8	165/137/99/38	0.8	301	CRP-NEGATIVE
143	14-Oct	88	28/0.9	143/126/83/35	0.9	270	CRP-NEGATIVE
144	14-Oct	97	26/0.8	165/142/101/35	0.9	302	CRP-NEGATIVE
145	14-Oct	91	35/1.2	175/139/103/40	0.8	302	CRP-NEGATIVE
146	14-Oct	81	24/0.8	155/131/96/35	0.8	302	CRP-NEGATIVE
147	14-Oct	91	28/1.0	169/126/107/36	0.8	275	CRP-NEGATIVE
148	14-Oct	90	32/1.2	165/142/100/36	0.8	307	CRP-NEGATIVE
149	14-Oct	87	30/1.1	149/130/86/37	0.9	325	CRP-NEGATIVE
150	14-Oct	83	25/0.8	160/142/95/36	0.8	276	CRP-NEGATIVE
151	14-Oct	81	28/0.9	171/139/108/35	0.8	216	CRP-NEGATIVE
152	14-Oct	80	24/0.7	162/136/100/36	0.8	274	CRP-NEGATIVE
153	15-Oct		28/0.9	183/142/114/40	0.8	312	CRP-NEGATIVE
154	15-Oct	89	25/0.8	149/120/87/38	0.7	275	CRP-NEGATIVE
155	15-Oct	79	29/1.0	163/130/101/36	0.8	303	CRP-NEGATIVE
156	15-Oct	88	28/0.9	172/39/109/35	0.8	236	CRP-NEGATIVE
157	15-Oct	83	29/1.0	166/142/99/38	0.9	321	CRP-NEGATIVE
158	16-Oct	90	27/0.9	176/135/113/36	0.8	265	CRP-NEGATIVE
159	16-Oct	89	25/0.8	159/126/95/38	0.8		CRP-NEGATIVE
160	16-Oct	89	25/0.8	189/149/121/38	0.8	326	CRP-NEGATIVE
161	16-Oct	91	25/0.8	176/138/112/36	0.8	266	CRP-NEGATIVE
164	18-Oct	79	30/0.8	160/126/98/37	0.8	326	CRP-NEGATIVE
165	18-Oct	103	28/.9		0.8	276	CRP-POSITIVE
166	18-Oct	86	30/0.8	198/165/129/36	0.8		
167	18-Oct	86	28/0.9	139/126/78/35	0.9	307	CRP-NEGATIVE
168	18-Oct	92	27/1.0	186/139/120/38	0.8	276	CRP-NEGATIVE
169	18-Oct	88	28/0.9	156/139/88/40	0.8	263	CRP-NEGATIVE
170	18-Oct	92	29/1.0		0.8	226	CRP-NEGATIVE
171	18-Oct	89	31/1.2		0.8	296	
172	18-Oct	92	30/1.0		0.8	216	

Table 3: The biochemical profile of Covid-19 positive patients admitted in the hospital between Jun 20 and Oct 20.

Abbreviations: RBS: Random Blood Sugar; TC: Total Cholesterol; TG: Triglycerides; LDL: Low Density Lipoproteins; HDL: High Density Lipoproteins; LDH: Lactate Dehydrogenase; CRP: C-Reactive Protein; PT: Prothrombin Time; APTT: Activated Thromboplastin Time; INR: International Normalized Ratio.

Results

The Complete Blood Count (CBC) of the Covid-19 patients revealed normal Total Leukocyte Count (TLC) in more than 90% of patients, Leukocytopenia in less than 5% of patients, Leukocytosis in about 05% of cases and Thrombocytopenia in 5% of cases. It is pertinent to note that majority of the patients, particularly those presenting early in the course of the disease as pre-symptomatic illness, initially presented with Relative Lymphocytosis on days 2 to 3 post sampling that yielded a positive result for Covid-19 with Differential Leukocyte Count (DLC) of lymphocytes being 45 to 55% (52% on average) and Total Leucocyte Count (TLC) of 3,500 – 4,200/cmm. The TLC started declining on days 4 to 5 reaching a nadir around day 6 with predominance of neutrophils due to lymphopenia in actuality. The TLC normalized by day 8 either with symptomatic improvement, which was observed with majority of our sample population or with worsening of symptoms. 04% of the sample population showed increase in TLC which reached the maximum of 16,000/cmm. Such patients also showed presence of other inflammatory markers such as positivity for C-Reactive protein (CRP).

The Peripheral Blood Smear (PBS) confirmed the initial Relative Lymphocytosis in days 2 to 3 post sampling that yielded a positive result for Covid-19 with presence of characteristic Covicytes. The latter are activated T-lymphocytes which are further classified as Downey type I, type II and type-III depending on blastoid, monocytoid and plasmacytoid morphology. These Covicytes exhibit nucleomegaly, round to oval to lobulated sometimes eccentric nuclei, irregular nuclear contours, coarsely granular chromatin and abundant basophilic cytoplasm. The large blastoid Covicytes have basophilic cytoplasm with nuclei showing multiple prominent nucleoli which are rimmed by condensed chromatin. Some cells show cytoplasmic vacuolations. Bizarre nuclear shapes and irregular chromatin distribution were also encountered. However, there was overall increase in cell size with no increase in nuclear cytoplasmic ratio. A few Covicytes revealed amphophilic cytoplasmic granules. The number of Covicytes gradually increased with the disease progression and correlated with their symptomatology. The proportion and pleomorphism increased with severity of the symptoms. The Covicytes diminished in number by days 9 to 10 post sampling while a few still persisted following testing negative for Covid-19. Large granular lymphocytes with oblong eccentric nuclei, coarsely granular chromatic and abundant cytoplasm with heterogenous azurophlic granules were also noted.

The Peripheral Blood Smear examination also revealed presence of Acquired Pelger Huet Anomaly (APHA) in majority of the patients. These pelgeroid neutrophils demonstrate hypolobated nuclei with two lobed nuclei connected by a thin strand of chromatin. Review of outpatient medications revealed no definite evidence of medications reported to be associated with APHA. Inpatient medications were also not pertinent as the peripheral blood studied were drawn during hospital admission before the initiation of any treatment. Occasional neutrophils showing prominent apoptotic changes were also noted. It was also noted that the proportion of these neutrophils with APHA increased with disease progression and diminished as the patients recovered from the illness.

The Platelet Counts too showed changes with gradual decline in the count reaching a nadir between days 3 and 4. However, overt thrombocytopenia with a platelet count of 1,00,000/cmm was noted in only 04 of our patients. Peripheral blood smear revealed presence of adequate number of platelets in most cases with scattered platelet clumps. However, there was platelet anisocytosis which grew markedly as the disease progressed exhibiting maximum between days 5 and 6 post sampling correlating with a minimum platelet count of 1,00,000/cmm on smears. Megathrombocytes were noted whose numbers increased between days 6 and 7 post sampling.

The markers of inflammation namely C-reactive protein (CRP) and Lactate dehydrogenase (LDH) were also studied amongst the study population and they correlated well with severity of disease. The CRP was assessed qualitatively while LDH assessment was quantitative with definite serological values. CRP positivity and high values of LDH were documented with patients with moderate symptomatology, elderly age group and those with other comorbidities such as Diabetes mellitus, Hypertension, Obesity, etc.

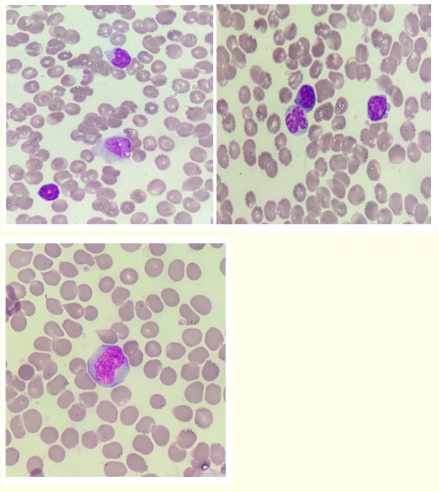

Figure 1: Activated lymphocytes (Covicytes) exhibiting blastoid and monocytoid morphology.

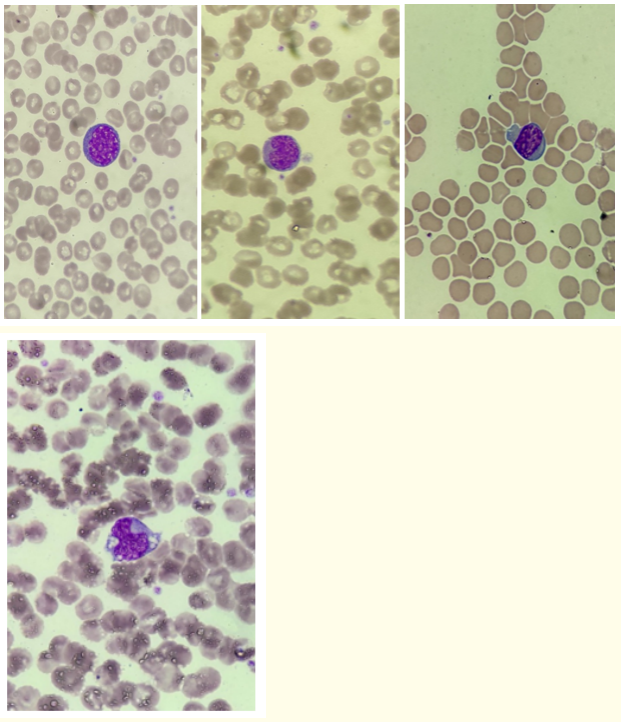

Figure 2: Covicytes exhibiting Blastoid morphology.

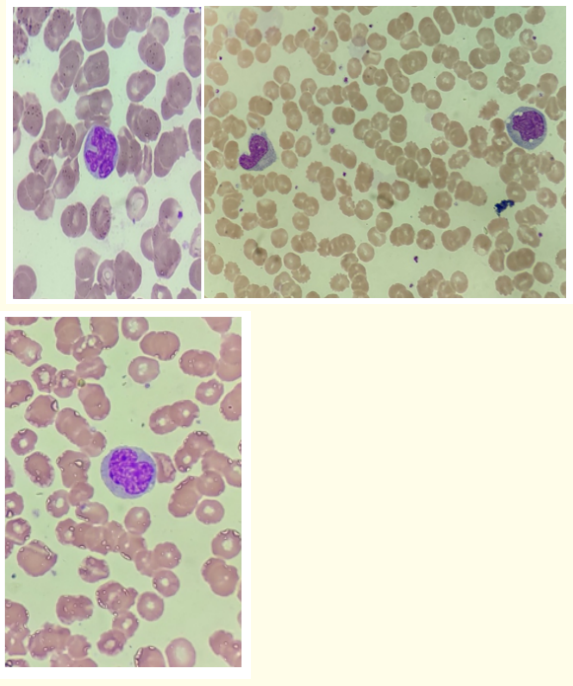

Figure 3: Covicytes with nucleomegaly, irregular nuclear contours and basophilic cytoplasm.

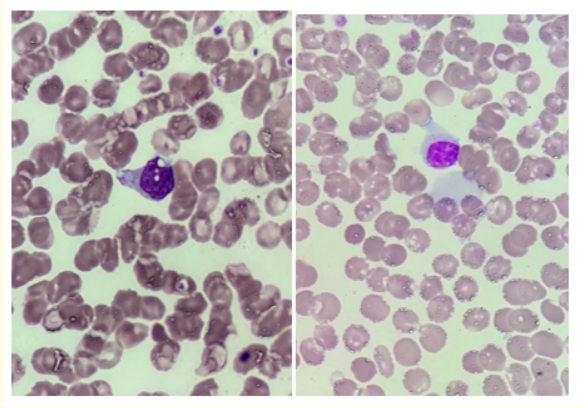

Figure 4: Covicytes with nucleomegaly, nuclear indentation, coarsely granular chromatin and flowy, granular cytoplasm.

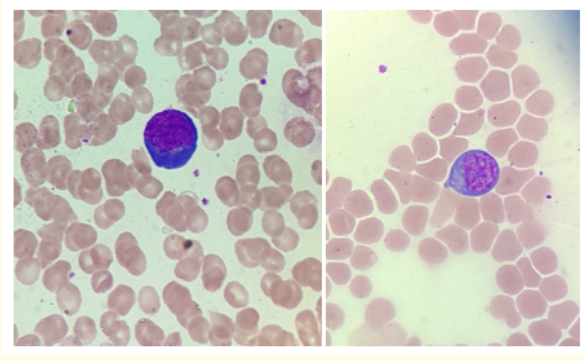

Figure 5: Covicytes with plasmacytoid morphology.

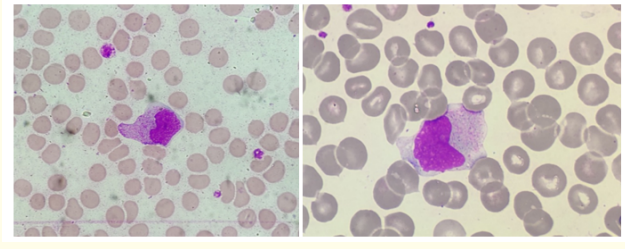

Figure 6: Large granular lymphocytes.

Discussion and Conclusion

We are currently facing the largest global health emergency in the decades in the form of devastating outbreak of Covid-19. With

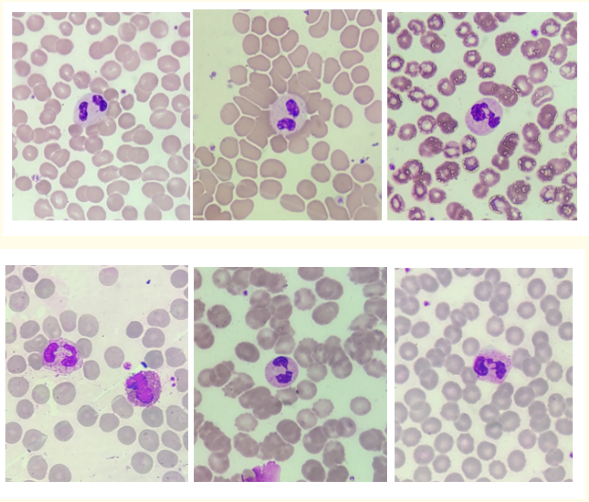

Figure 7: Morphological appearance of the Neutrophils exhibiting Acquired Pseudo Pelger-Huet Anomaly on Peripheral Blood Smear with Leishman stain under 1000x magnification.

the pandemic proceeding unabated, it will be very critical to determine the exposed and/or infected people, especially those with asymptomatic or very mild forms of the disease who are overlooked source of viral shedding and likely to act inadvertently as the major transmitters of the disease. It is already brought out in various other studies previously that the viral loads are inversely correlated with disease severity and that greater viral loads are seen in mild Covid-19 disease (1). In this study we used a systematic approach to study individuals who are asymptomatic or with mild to moderate disease at the very early stages of the disease in terms of their haematological, biochemical and minimal serological parameters so as to assess the evolution of the disease affecting these parameters.

We chose to study the haematological indices and biochemical parameters as they are the common laboratory investigations performed on patients admitted to the hospitals with fever and also these are readily available in resource constraint milieu such as this peripheral mid-zonal hospital location. Blood counts often provide clues regarding the diagnosis and complications of infectious disease, guiding the clinicians to arrive at suitable diagnosis and formulating treatment protocols. There is limited literature on the study of peripheral smear findings in Covid-19. One such study reveals the presence of APHA, prominent abnormal granulation, left shift in granulocytes, abnormal platelet morphology, apoptotic cells and reactive lymphocytes [26]. Pelger Huet anomaly is a benign hereditary condition resulting from mutations in the Laminin B receptor (LBR) and is characterized by the presence of hyposegmented neutrophils with dense chromatin. There are acquired causes of this anomaly and these include Myelodysplastic Syndrome, infections such as tuberculosis, HIV/AIDS, Influenza A, infectious mononucleosis, Parvovirus and drugs like immune-suppressive agents and antibiotics [27]. The APHA is not reported to be associated with SARS-CoV infection.

Currently, the Real Time RT-PCR assay is the gold standard method in the detection of SARS-CoV-2. However, with sensitivity of RT-PCR in the diagnosis of Covid-19 is only 60-70%, a significant number of false negative cases have been reported which could have been due to problems with sample collection and transportation, RNA extraction, presence of enzyme inhibitors and the RT-PCR method per se. The accuracy of viral RNA swabs also depends on the site and quality of sampling. It is postulated that the sensitivity of RT-PCR is around 93% for broncho-alveolar lavage, 72% for sputum, 63% for nasal swabs and only 32% for throat swabs. The accuracy also depends on the stage of the disease and the degree of viral replication or clearance [21-23]. Gene targets being employed also affect the sensitivity of the test and higher sensitivities are achieved when multiple genes are used in combination [24,25]. Several studies on coronaviruses testing have estimated that RT-PCR diagnostic tests yield a rate of 41% false negatives [2-4]. False-negatives carrivaly substantial risks of spreading the infection in the community. In hospital, such patients may even be transferred inadvertently into non-covid-19 wards leading to the spread of hospital acquired Covid-19 infection amongst the other in-patients and health care workers who in turn risk spreading to other vulnerable individuals [16]. In such instances, haematological assessment with proper interpretation of peripheral blood evaluation can guide the clinicians in the presumptive diagnosis of such missed cases and application of appropriate Infection Prevention and Control measures for the containment of further spread of the infection and design of institutional protocols.

We have also brought out in the study that much of the patients who were initially asymptomatic particularly those tested as part of the contact tracing, later developed mild to moderate symptoms in the form of fever, running nose, sore-throat, cough and a mild drop in the peripheral blood oxygen saturation. So the proportion of asymptomatic patients in our study population was relatively low compared to that revealed as 40-45% by various other studies [6,7]. However, such asymptomatic carriers, to whatever degrees

their numbers might be, serve as 'silent spreaders' who warrant attention as part of disease prevention and control. These relatively low numbers of asymptomatic carriers did not show apparent Covid-19 related changes in any of the biochemical or hematological parameters including on the peripheral blood smear study. Similar findings were revealed in previous studies which revealed that the asymptomatic carriers had a longer duration of viral shedding than the symptomatic Covid-19 patients, further highlighting the importance of contact tracing and disease surveillance [8].

It is amply clear from our study that the majority of Covid-19 patients initially present with Relative Lymphocytosis. The definition of relative Lymphocytosis is an increase in the differential count of white blood cell of more than 40% in the presence of normal absolute white cell count. Studies have revealed that the initial increase in lymphocytes in peripheral blood in Acute Covid-19 is due to the activation of T-lymphocytes in response to SARS-CoV-2 virus [5]. Most asymptomatic patients, probably due to robust T-cell immunity, clear the virus with minimal or no symptomatology. However, those with mild to moderate disease, exhibit initial Relative Lymphocytosis similar to the asymptomatic patients but later there is development of lymphopenia and in a few instances leukocytopenia as well.

The peripheral blood smear too showed similar findings with increase in the number and pleomorphism of activated T-lymphocytes, Covicytes and Acquired Pelger Huet Anomaly (APHA) in the neutrophils as the disease progressed with increase in clinical severity and worsening of symptomatology to a point where there occurs an increase in the proportion of neutrophils leading to an increase in the Neutrophil to Lymphocyte ratio. With recovery, covicytes gradually decrease in number but there is persistence of occasional covicytes which were observed in most patients who were assessed hematologically prior to discharge after being declared Covid-19 by RT-PCR testing. While the proportion of covicytes reduced as the patients recovered with improvement in symptomatology and waning viral loads, the Acquired Pseudo Pelger Huet anomaly in the neutrophils persisted for protracted periods of time and was appreciated in peripheral blood smear examination carried out when these Covid-19 recovered patients returned for blood evaluation for some other ailment weeks later. The presence of activated lymphocytes in the peripheral blood smear is the hallmark of some infections such as infectious mononucleosis, Bordetella pertussis, hanta virus and varying numbers of these can also be seen autoimmune disorders and malignancies (28, 29, 30). Our study showed a spectrum of activated lymphocytes in the peripheral blood and has been described as Covicytes.

The above follows the covicytes are ephemeral while the APHA in neutrophils are more enduring and persist for a relatively longer duration of time. The corollary is that the presence of covicytes along with APHA in neutrophils can serve as a surrogate marker of SARS-CoV-2 infection permitting a presumptive diagnosis of Covid-19. The findings also allow isolation of such suspect patients for further confirmation by RT-PCR or any other diagnostic test thereby precluding the spread of infection. The above method also provides an alternative cheap and reliable Infection Prevention and Control mechanism in hospital settings for detecting Covid-19 cases amongst in-patients who were missed either during clinical assessment, if done cursorily or as RT-PCR false-negative cases. It will also enable efficient contact tracing, in the event of such patients being confirmed as Covid-19.

Correlation between Covicytes, APHA and inflammation associated markers such as CRP, LDH and Neutrophil to Lymphocyte Ratio (NLR) were also drawn. We analysed that there is a linear correlation between lymphocyte decline, raised NLR, heightened inflammation markers and severity of infection.

This study enrolled individuals of an organisation who are generally considered physically fit and hence the study population did not suffer from any significant co-morbidities which could otherwise have deleterious effect on the course of the disease, as seen in the general population wherein people with co-morbidities like obesity, hypertension, cardiovascular disease, Diabetes mellitus, Chronic obstructive pulmonary disorder and others which adversely affect the outcome. Hence, the sample comprised of physically robust individuals weeding out all the confounding variables which could affect the natural course of the disease.

Ethical Approval

Informed consent was obtained from the patients for publication of this paper and accompanying images.

Declaration of Interests

The authors declare that they have no known competing financial interests or personal relationship that could have appeared to influence the work reported in this paper.

Morphological findings in Peripheral blood Smear in Covid-19 patients admitted in the isolation facility of this hospital between June 2020 and Oct 2020.

Varied morphological appearance of the Activated lymphocytes on Peripheral Blood Smear with Leishman stain under 1000x magnification.

Bibliography

1. Kimon V Argyropoulos., *et al*. "Association of initial viral load in SARS-CoV-2 patients with outcome and symptoms". *The American Journal of Pathology* 190.9 (2020): 1881-1887.

2. Wang C., *et al*. "A novel coronavirus outbreak of global health concern". *Lancet* 395 (2020): 470-473.

3. Wikramaratna P., *et al*. "Estimating false negative detection rate of SARS-CoV-2 by RT-PCR". *Euro Surveillance* 25.50 (2020): 2000568.

4. Li D., *et al*. "False negative results of Real-Time Reverse Transcriptase Polymerase Chain Reaction for Severe Acute respiratory Syndrome Coronavirus 2: Role of Deep learning based CT diagnosis and Insights from two cases". *Korean Journal of Radiology* (2020): 505-508.

5. TakayuSekine., *et al*. "Robust T cell immunity in convalescent individuals with asymptomatic or mild Covid-19". *Cell* 183.1 (2020): 158-168.e14.

6. Qiu J. "Covert coronavirus infections could be seeding new outbreaks". *Nature* (2020).

7. Jiao Zhang., *et al*. "Asymptomatic carriers of Covid-19 as a concern for disease prevention and control". *BioScience Trends* 14.3 (2020): 206-208.

8. Quan-Xin Long., *et al*. "Clinical and immunological assessment of asymptomatic SARS-CoV-2 infections". *Nature Medicine* (2020).

9. Hoffmann M., *et al*. "SARS-CoV-2 cell entry depends on ACE2 and TMPRSS2 and is blocked by clinically protease inhibitor". *Cell* 181 (2020): 271-280.

10. LU R., *et al*. "Genomic characterization and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding". *Lancet* 395 (2020): 565-574.

11. Zhu N., *et al*. "A novel Coronavirus from patients with pneumonia in China, 2019". *The New England Journal of Medicine* 382 (2020): 727-733.

12. Chinazzi M., *et al*. "The effect of travel restrictions on the spread of the 2019 novel coronavirus (Covid-19) outbreak". *Science* 368 (2020): 395-400.

13. Zhang T., *et al*. "Probable pangolin origin of SARS-CoV-2 associated with Covid-19 outbreak". *Current Biology* 30 (2020): 1946-1351.

14. Hamming I., *et al*. "Tissue distribution of ACE2 protein, the functional receptor for SARS coronavirus. A first step in understanding SARS pathogenesis". *The Journal Pathology* 203.2 (2004): 631-637.

15. Wang Y., *et al*. "Combination of RT-qPCR testing and clinical features for diagnosis of Covid-19 facilitates management of SARS-CoV-2 outbreak". *Journal of Medical Virology* 92.6 (2020): 538-539.

16. Nacoti M., *et al*. "At the epicentre of the Covid-19 pandemic and humanitarian crises in Italy: changing perspectives on preparation and mitigation". (2020).

17. Huang C., *et al*. "Clinical features of patient infected with 2019 novel coronavirus in Wuhan, China". *Lancet* 395.10223 (2020): 497-506.

18. Chen N., *et al*. "Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia I Wuhan, China: a descriptive study". *Lancet* 395.10223 (2020): 507-513.

19. Wang D., *et al*. "Clinical characteristics of 138 Hospitalized patients with 2019 Novel coronavirus-infected pneumonia in Wuhan, China". *JAMA* 323.11 (2020): 1061-1069.

20. Wu C., *et al*. "Risk factors associated with Acute Respiratory Distress Syndrome and Death in patients with Coronavirus disease 2019 Pneumonia in Wuhan, China". *JAMA Internal Medicine* 80.7 (2020): 934-943.

21. Wang W., *et al*. "Detection of SARS-CoV-2 in different types of clinical specimens". *JAMA* 323.18 (2020): 1843-1844.

22. Sethuram N., *et al*. "Interpreting diagnostic tests for SARS-CoV-2". *JAMA* 323.22 (2020): 2249-2251.

23. Wolfel R., *et al*. "Virological assessment of hospitalized patients with Covid-19". *Nature* 581 (2020): 465-469.

24. Vogels CBF., *et al*. "Analytical sensitivity and efficiency comparisons of SARS-CoV-2 qRT-PCR assays". *medRxiv* (2020).

25. Chan JF., *et al*. "Improved molecular diagnosis of Covid-19 by the novel, highly sensitive and specific Covid-19 RdRp/Hel real time Reverse Transcription Polymerase Chain Reaction assay validated in vitro and with clinical specimens". *Journal of Clinical Microbiology* 58.5 (2020): e00310-320.

26. Zini G., *et al*. "Morphological anomalies of circulating blood cells in Covid-19". *American Journal of Hematology* 95.7 (2020): 870-872.

27. Dusse LM., *et al*. "Acquired Pelger-Huet: what does it really mean?" *ClinChimActa* 411 (2011): 1587-1590.

28. George TI. "Malignant or benign leucocytosis". *Hematology ASH Education Program* 2012 (2012): 475-484.

29. Klein E., *et al*. "Epstein-Barr virus infection in humans: from harmless to life endangering virus-lymphocyte interactions". *Oncogene* 26.9 (2007): 1297-1305.

30. Koster F., *et al*. "Rapid presumptive diagnosis of hantavirus cardiopulmonary syndrome by peripheral blood smear review". *American Journal of Clinical Pathology* 116 (2001): 665-672.

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