"CORRELATION OF BLOOD PARAMETERS WITH OUTCOME IN COVID -19 POSITIVE PATIENTS"

Dissertation

By

Reg. No. BN0120005

Submitted to the
KLE Academy of Higher Education and Research,Belagavi, Karnataka

In partial fulfilment

of the requirements for the degree of

DOCTOR OF MEDICINE IN

PATHOLOGY

DEPARTMENT OF PATHOLOGY

JAWAHARLAL NEHRU MEDICAL COLLEGE,

BELAGAVI, KARNATAKA

JUNE/JULY-2023

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Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"CORRELATION OF BLOOD PARAMETERS WITH OUTCOME IN COVID-19 POSITIVE PATIENTS – HOSPITAL BASED CROSS SECTIONAL STUDY "**, is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

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LIST OF ABBREVIATIONS USED

CBC	-	Complete Blood Count
SARS-COV2	-	Severe Acute Respiratory Syndrome Coronavirus-2
CRP	-	C- Reactive Protein
NLR	-	Neutrophil Lymphocyte Ratio
PLR	-	Platelet Lymphocyte Ratio
ICTV	-	International Committee on Taxonomy of Viruses
RBD	-	Receptor-Binding Domain
ARDS	-	Acute respiratory distress syndrome
MERS	-	CoV- Middle East respiratory syndrome coronavirus
WHO	-	World Health Organisation
UTR	-	Untranslated Region
ORF	-	Open Reading Frame
NSPS	-	Nonstructural Proteins
ACE2	-	Angiotensin Converting Enzyme 2
RNA	-	Ribose Nucleic Acid
RdRp	-	RNA-dependent RNA polymerase
DAMPs	-	Damage Associated Molecular Patterns
ATP	-	Adenosine Triphosphate
ROS	-	Reactive Oxygen Species
SIRS	-	Severe Inflammatory Response Syndrome
MSOF	-	Multi System Organ Failure
VTM	-	Viral Transport Medium
BSL2	-	Biosafety Level 2
RT- PCR	-	Reverse transcription polymerase chain reaction
ELISA	-	Enzyme-linked immunosorbent assay

sTfR	-	Soluble Transferrin Receptor
SAA	-	Serum Amyloid A
LDL	-	Low Density Lipoprotein
DC	-	Dendritic Cells
G-CSF	-	Granulocyte Colony Stimulating Factor
HIV	-	Human Immunodeficiency Virus
ALC	-	Absolute Lymphocyte Count
EDTA	-	Ethylenediaminetetraacetic acid
nRBC	-	Nucleated RBC
WBC	-	White Blood Cells

ABSTRACT

TITLE - "Correlation of blood parameters with outcome in Covid -19 positive patients"

BACKGROUND - The coronavirus disease, also known as COVID-19, was first reported in Wuhan, Hubei, China in December 2019 and has rapidly evolved from an epidemic outbreak into a global pandemic infecting over thirteen million people worldwide. The SARS-COV2 virus has been identified as the causative agent. The first covid-19 case in India was reported on January 30, 2020, from Kerala, with a positive travel history to Wuhan. Covid-19 is a systemic viral infection that affects the hematopoietic system, haemostasis, and immune system. There is correlation between complete blood count (CBC) parameters, coagulation profile like D-dimer, biochemical markers (ferritin, CRP) and disease progression.

OBJECTIVES - To correlate blood parameter and inflammatory markers like D-dimer, Ferritin, C-Reactive Protein, Neutrophil Lymphocyte Ratio and lymphocyte count in survivors and non survivors of COVID-19 positive patients.

METHODOLOGY - The study is conducted by collecting 300 samples of COVID-19 confirmed cases admitted at Jawaharlal Nehru Medical College and KLEs Dr. Prabhakar Kore Hospital and MRC, Belagavi. D-Dimer, Ferritin, C Reactive Protein, Platelets and Neutrophil lymphocyte Ratio were determined using a standard coagulation analyser, blood parameter analyser and manual method of evaluation of parameters whenever required with standard protocol and reagents.

RESULTS – All Non-Survivor patients of Covid- 19 showed significantly increased D- dimer, Ferritin, C- Reactive Protein and Neutrophil Lymphocyte Ratio compared

to Survivor patients with P value < 0.05. Lymphocyte percentage was significantly reduced in Non-Survivors in comparison to Survivors with P value < 0.05.

CONCLUSION - Parameters like D- dimer, Ferritin, CRP, lymphocyte count and N/L Ratio all proved to be very helpful tool to differentiate severe from non-severe coronavirus disease. So we should use these parameters in all the patients on admission as they are cheap, sensitive, and reduces mortality if done early in the disease.

KEY WORDS - COVID-19, SARS-COV2, D-dimer, Ferritin, C-Reactive Protein, Neutrophil Lymphocyte Ratio and lymphocyte count

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INTRODUCTION

The coronavirus disease, also known as COVID-19, was first reported in Wuhan, Hubei, China in December 2019 and has rapidly evolved from an epidemic outbreak into a global pandemic infecting over thirteen million people worldwide. The SARS-COV2 virus has been identified as the causative agent. The first covid-19 case in India was reported on January 30, 2020, from Kerala, with a positive travel history to Wuhan.[3]

Covid-19 is a systemic viral infection that affects the hematopoietic system, haemostasis, and immune system. Following the Covid-19 outbreak, preliminary data revealed a link between complete blood count (CBC) parameters, coagulation profile like D-dimer, biochemical markers (ferritin, CRP) and disease progression.[1]

Both the neutrophil-lymphocyte ratio (NLR) and the platelet-lymphocyte ratio (PLR) have emerged as good indicators of subclinical systemic inflammation in a variety of diseases, including cancer, cardiovascular disease, and autoimmune inflammatory diseases. NLR have the advantage of being more stable than individual blood cell parameters. Various studies in the literature in Covid-19 have evaluated these, indicating an association with disease severity.[1]

It would be important to find whether the most routine and cost-effective tests, such as CBC, could aid in determining a patient's clinical status or predicting disease severity, resulting in better and more judicious allocation of medical resources, particularly in resource-limited settings. Furthermore, early and timely clinical intervention may reduce mortality.[3]

AIMS AND OBJECTIVE

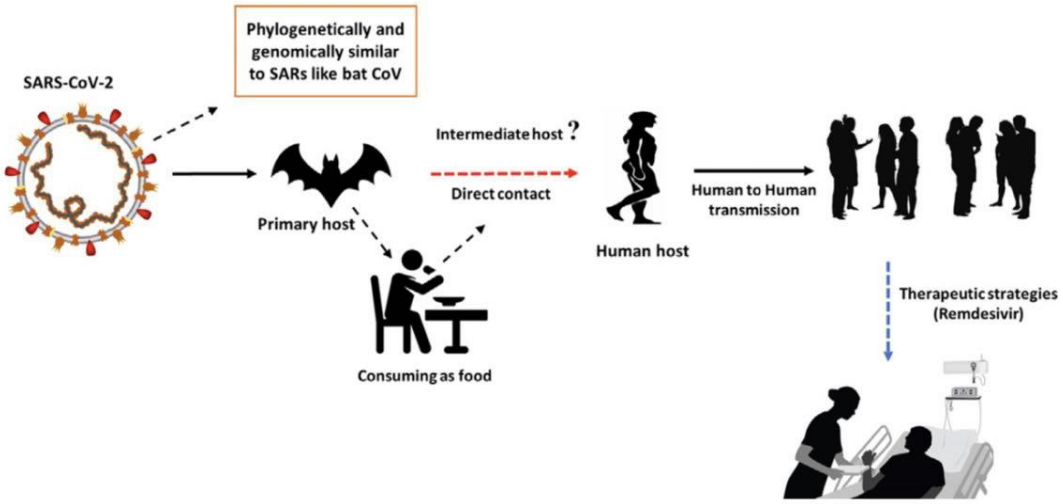
To correlate blood parameter and inflammatory markers like D- dimer, Ferritin, C-Reactive Protein, Neutrophil Lymphocyte Ratio and lymphocyte count in survivors and non survivors of COVID-19 positive patients.

REVIEW OF LITERATURE

EPIDEMIOLOGY

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the source of the coronavirus disease 19 (COVID-19), a highly contagious and pathogenic viral illness that caused a global pandemic and a shocking loss of life on a global scale. Since SARS-CoV-2 is phylogenetically related to severe acute respiratory syndrome-like (SARS-like) bat viruses, bats may be the major reservoir, according to genomic study.[2]

Fig 1:- Source of Covid-19[1]

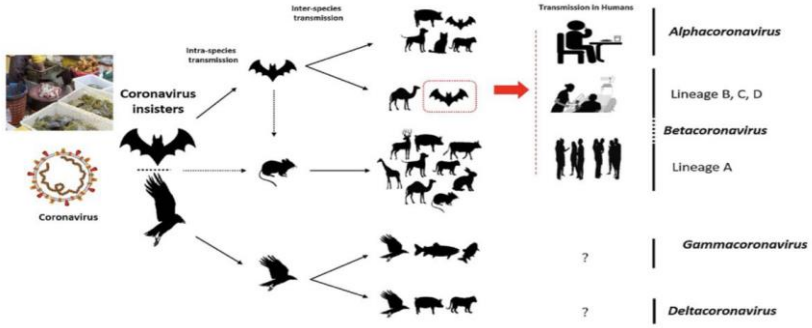


The family Coronaviridae in the Nidovirales order is where coronaviruses are classified. The coronavirus family is divided into four subgroups: alpha (α), beta (β), gamma (γ), and delta (δ). Corona is an acronym for the virus outside spikes, which resemble crowns.[1,3]

Prior to the 2002 SARS outbreak in Guangdong, China, which was brought on by the SARS-CoV, the world believed that coronavirus only infected animals. Ten

years later, the Middle East respiratory syndrome coronavirus (MERS-CoV), another virulent coronavirus, caused an endemic in Middle Eastern nations.[1,2]

Fig 2*:*- Different subtypes of Coronavirus and species they affect.[1]

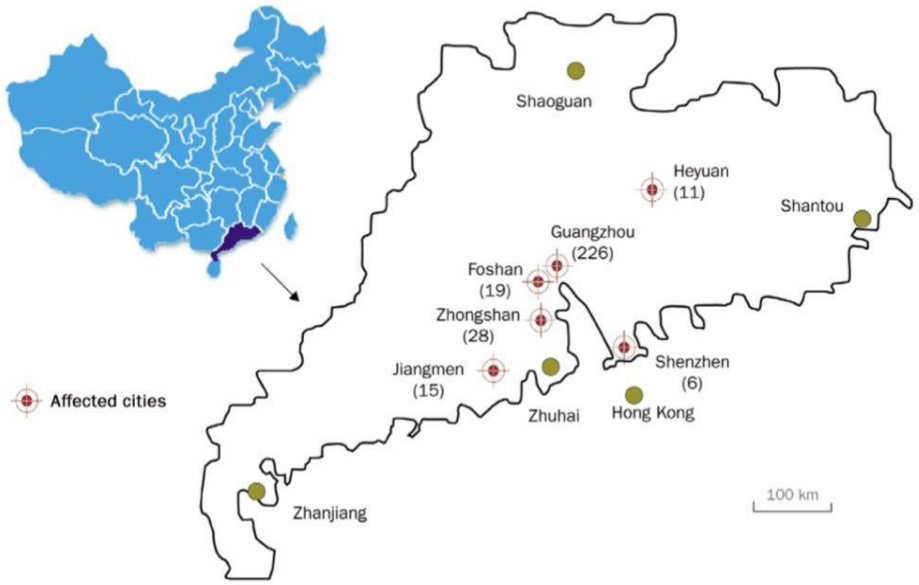


The novel virus was named as 2019 novel coronavirus (2019- nCov) by the Chinese researchers. The International Committee on Taxonomy of Viruses (ICTV) named the virus as SARS-CoV-2 and the disease as COVID-19.[3,4]

A genetic recombination event at the S protein in the RBD region of SARS-CoV-2 may have improved its transmission ability, explaining why SARS-CoV-2 has a greater transmission rate than SARS-CoV.[1]

In Guangdong province in 2003, a virus that causes Severe Acute Respiratory Syndrome (SARS) invaded the Chinese population. SARS-CoV was the name assigned to the virus, which was identified as a member of the Betacoronavirus subgroup. Patients who were infected showed signs of pneumonia and disseminated alveolar damage, which resulted in acute respiratory distress syndrome (ARDS). SARS first appeared in Guangdong, China, and then spread quickly over the world, infecting more than 8000 people and killing 776 of them.[2,3,5]

Fig 3:- SARS outbreaks in Guandong Province[2]



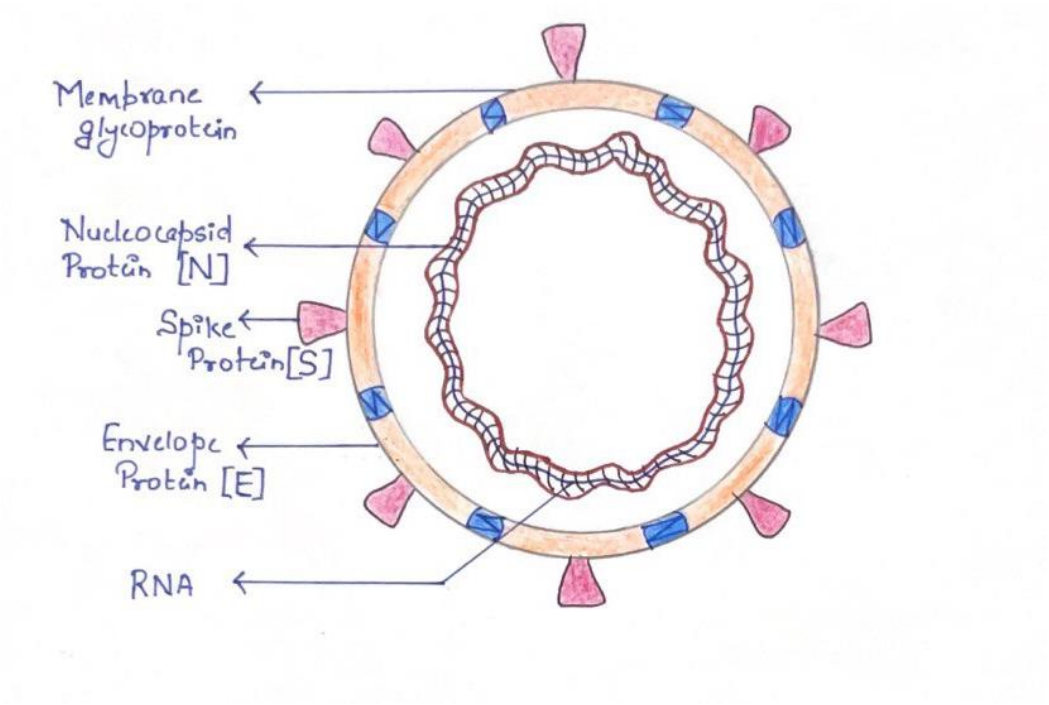
Two Saudi Arabian nationals were found to have additional coronavirus infection in 2012, ten years after the initial diagnosis. The Middle East Respiratory Syndrome Coronavirus was identified as the discovered virus, which was proved to be a coronavirus (MERS-CoV). According to the World Health Organization, the MERS coronavirus caused 838 fatalities and infected over 2428 people. MERS-CoV is a member of the beta-coronavirus subgroup and differs from other human-CoVs phylogenetically. Mild upper respiratory injuries serve as the starting point for MERSCoV infection, which progresses to cause serious respiratory disease. Patients with MERS-coronavirus infection experience pneumonia, ARDS, and renal failure, much as those with SARS-coronavirus.[3]

The Chinese government just alerted WHO before the end of 2019 about multiple cases of pneumonia with unknown etiologies. Scientists hypothesised that the virus propagation was aided by the Hunan seafood market in Wuhan. The Chinese National Health Commission provided more information regarding the outbreak and

indicated viral pneumonia on January 12, 2020. The virus was recognised as a new coronavirus from the sequence-based analysis of the patient isolates.[6]

Prior to the end of 2019, the Chinese government just informed WHO about several cases of pneumonia with uncertain etiologies. Scientists theorised that the Hunan seafood market in Wuhan contributed to the virus spread. On January 12, 2020, the Chinese National Health Commission announced that viral pneumonia was the cause of the outbreak. The sequence-based analysis of the patient isolates confirmed the virus as a novel coronavirus.[1]

Fig 4:- Coronavirus

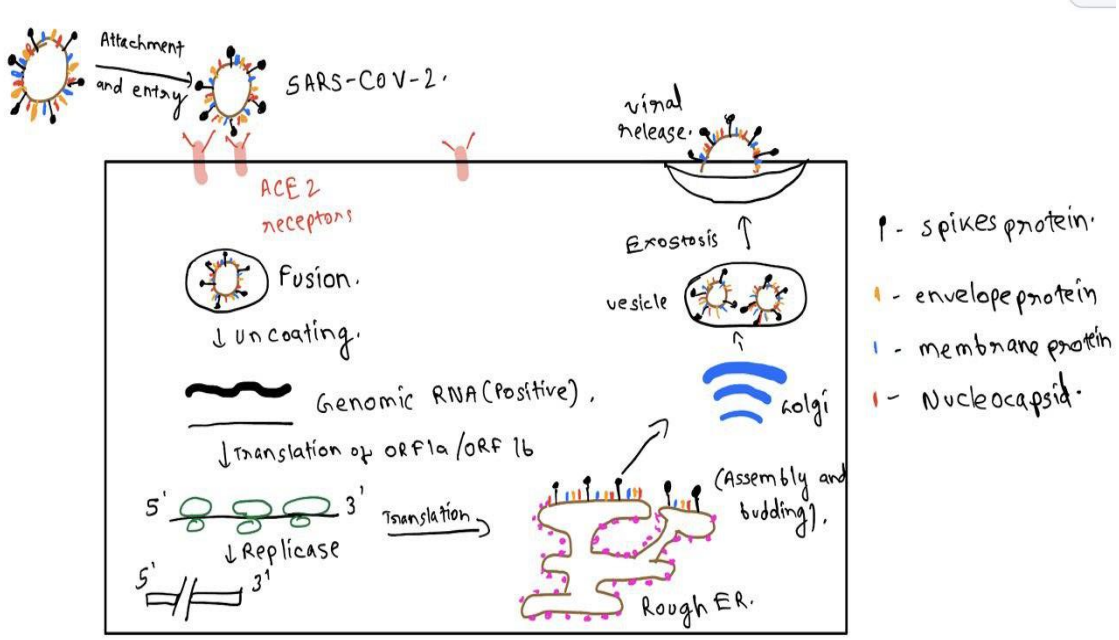


The genome structure of SARS corona virus- 2

The four genera of coronaviruses, which are the largest enclosed, single-stranded positive-sense RNA viruses, are Alphacoronavirus, Betacoronavirus, Gammacoronavirus, Deltacoronavirus.

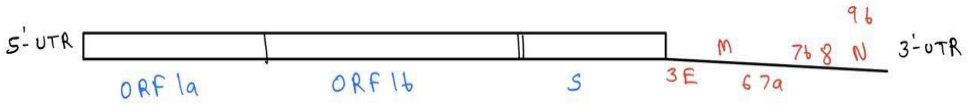
Beta- and alpha-coronaviruses typically affect mammals, while the other two predominantly affect birds.[7,8,9] Globally endemic human coronaviruses HCV 229E, NL63, OC43, and HKU1 only caused adult upper respiratory tract infections. The most serious strains that can result in acute respiratory distress syndrome (ARDS), which can result in patient fatalities, and lower respiratory tract infections are SARS-CoV, MERS-CoV, and SARS-CoV-2.[8,10]

Fig 5:-Life Cycle of Corona Virus



At this time, it has been determined that the SARS-CoV-2 virus is a brand-new positive-sense RNA virus that belongs to the Betacoronavirus genus in the Coronaviridae family.[11,12,13] The SARSCoV-2 genome has two untranslated regions (UTRs): a 5′-cap structure and a 3′-poly-A tail, and a single open reading frame (ORF) encoding a polyprotein, just as the SARS-CoV and MERS-CoV. The viral replicase 5′- orders the SARSCoV- 2 genome (ORF 1a and ORF1b)- structural proteins Spike (S), Envelope (E), Membrane (M), and Nucleocapsid (N) structural proteins -3′; a few accessory protein genes, including ORF 3a, 7, and 8, are inserted into structural protein genes.

Fig 6:- Genomic structure of Coronavirus



About two thirds of the coronavirus genome is made up of the ORF1a and ORF1b genes, which together code for 16 nonstructural proteins (nsps). The remaining one third of the genome is made up of accessory and structural proteins.[13]

The pathogenesis of SARS-CoV served as a model for the pathogenesis of SARSCoV-2, which was thought to infect human cells by attaching to its cellular receptor, angiotensin converting enzyme 2 (ACE2).[7]

The SARS-CoV-2 spike protein has two sections, the S1 subunit and S2 subunit, each of which has 1253 amino acids. About 75% of the amino acids in the spike protein were same between SARS-CoV-2 and SARS-CoV. S1 domain is typically associated with receptor binding, whereas S2 domain is associated with cell membrane fusion. S1 has an N-terminal domain (NTD) similar to SARS-CoV and a receptor-binding domain (RBD) that includes a core domain and an exterior subdomain (ESD). Fusion peptide (FP) and the first and second heptad repeats (HR) are the three functional domains found in S2[7]. The affinity between the viral RBD and ACE2 of human cells determines whether or not SARS-CoV-2 may combine with host cells. When RBD binds to the receptor, the S2 undergoes a conformational shift that allows three functional domains to help fuse the membrane.[15]

A number of significant residues in the SARS-CoV-2 RBD interact well with human ACE2. Most of the RBD residues that interact with ACE2 are completely conserved. Except for a few non-critical amino acids in the HR1 region, SARS-CoV-2 and SARS-CoV have identical function domains. The fact that the SARS-CoV-2 HR1 and HR2 domains can merge with one another to create 6-HB in accordance with SARS-fusion CoV process provides yet another compelling argument in favour of ACE2 acting as a receptor of cells. However, some investigations hypothesised that SARS-CoV-2 had a lower affinity for ACE2 than SARS-CoV.[7]

On the other hand, it was discovered by deciphering the cryo-EM structure of the SARS-CoV-2 spike protein that SARS-CoV-2 had a 10- to 20-fold higher affinity for binding to ACE2 than SARS-CoV. In many different types of cells, including human cells, the ACE2 protein served as an entry receptor for SARS-CoV-2, but not in cells lacking ACE2. It was also unable to use the coronavirus receptors

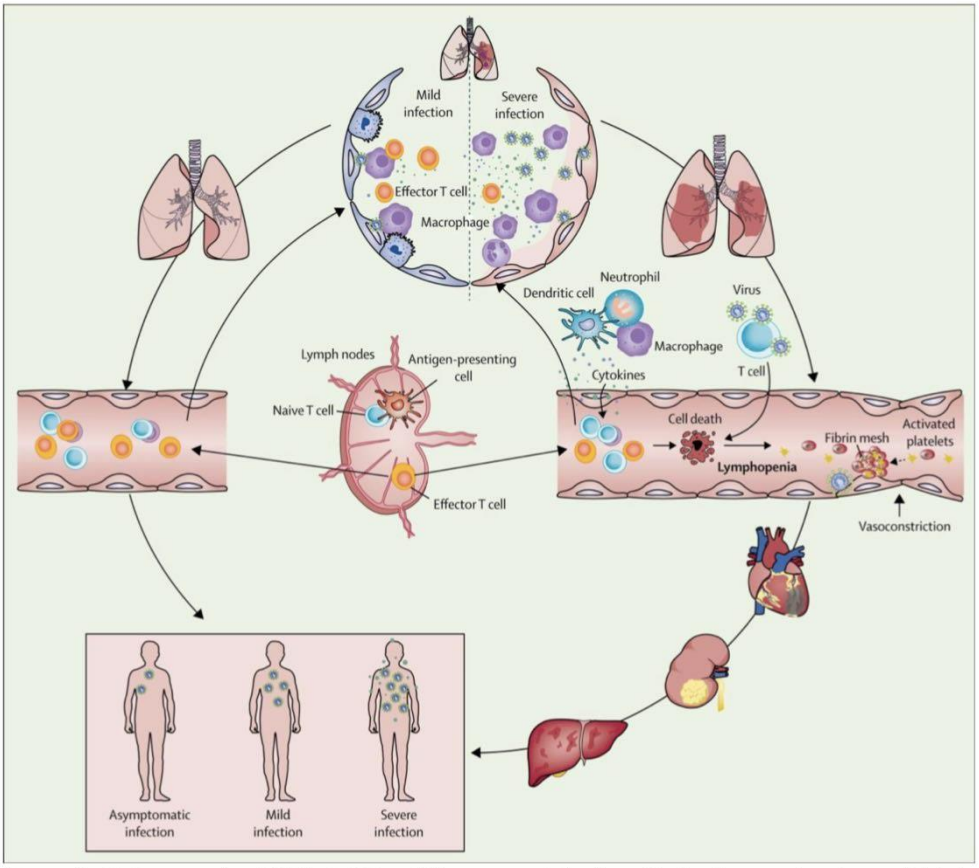
aminopeptidase N and dipeptidyl peptidase. Overall, the data is strong enough to prove that human ACE2 is the mechanism through which SARS CoV-2 infects cells.[7]

COVID-19 PATHOGENESIS

TRANSMISSION ROUTE

Human-to-human contact, such as inhalation or contact with infectious droplets, is how SARS-CoV-2 is mostly spread. In addition, there is evidence for an oral faecal route.[17]

Fig 7:- Pathogenesis of SARS CoV-2[16]



Pulmonary Droplets

Respiratory droplets can be produced by people in a variety of ways, such as when they breathe, talk, sneeze, or cough. Humans naturally produce droplets primarily made of water, but they can also contain a variety of other cell types, including immunological and epithelial cells, physiological electrolytes like Na+ and K+, and infectious pathogens. Different sized droplets can be communicated. Respiratory droplets are defined as larger than 5 mm diameter drops that primarily become caught in the upper respiratory tract and fall quickly to the ground due to gravity. As a result, respiratory droplets can only travel a certain limited of distance.[18]

The term "droplet nuclei" refers to droplets smaller than 5 mm that have the capacity to enter the bronchi and alveoli of the lower respiratory tract. Droplet nuclei, as opposed to respiratory droplets, can float in the air for prolonged periods of time, allowing them to travel farther than one metre.[19]

Direct transmission, which includes coughing, sneezing, and droplet inhalation, and contact transmission, which involves coming into touch with oral, nasal, and eye mucous membranes, are the two most prevalent ways that SARS-CoV-2 can spread. The majority of ways that COVID-19 is spread between humans, according to recent studies, are through respiratory droplets and direct contact.[20]

Fecal Oral Route

The virus in faecal particles spreads from one person's mouth to another person's mouth via the fecal-oral pathway. Poor hygiene and inadequate sanitation are two major contributors to disease transmission.[21]

Gastrointestinal symptoms and proof of viral RNA or a live infectious virus being present in the faeces have both been documented in several case studies. The receptor that allows the virus to enter cells, the ACE2 protein, is also expressed in the glandular cells of the gastric, duodenum, and rectal epithelia. SARS-CoV-2 was found in the faeces of a significant percentage of patients who also had diarrhoea, vomiting, nausea, and abdominal pain. Numerous researchers have suggested a fecal-oral pathway after discovering viral evidence in the digestive system.[22]

Viral Entry

Viral infections depend on the virus getting into cells so it can take over the host cell's biological machinery, multiply, and then release a tonne of viral copies. Viruses must pass the cell membrane barrier in order to start an infection.[23]

ACE 2

Angiotensin-Converting Enzyme-2 (ACE2) is a host protein that SARS-CoV-2 virions employ to enter particular cells. Although mRNA has been discovered in other organs such the heart, arteries, and kidney, ACE2 is abundantly prevalent in human epithelia in the lungs and small intestine. Cardiomyopathy, pulmonary damage, and kidney dysfunction can all result from ACE2 loss. There is a direct connection between the intestinal microbiota and the innate immunity that may be related to the ACE2 receptor, according to molecular crosstalk between the ACE2 receptor's function and intestinal amino acid homeostasis.[24]

Cytoplasmic entrance

SARS-CoV-2 has two routes to enter cells: directly through the plasma membrane or indirectly through endosomes. A protein known as spike glycoprotein trimmer is expressed by the virion membrane . The S1 region of this spike has a receptor binding area that interacts to the extracellular domain of ACE2 with high affinity in both entrance mechanisms.[16]

The S1 portion of the virus binds to the ACE2 receptor when it enters the body through an endosome and moves the ACE2-viral complex there. The spike protein is activated in the endosome by the endosomal acid protease cathepsin L, which splits the protein into S1 and S2. The S2 protein causes the release of the virus into the

cytoplasm by joining the membranes of the endosome and the virus. The Type II Transmembrane Serine Protease (TMPRSS2) can also activate the spike protein by binding to the ACE2 receptor, which starts the fusion of the viral membrane and the plasma membrane. The virus can immediately release the RNA into the cytoplasm for reproduction. Since the plasma membrane fusion entrance does not alter the number of ACE2 receptors, it is less likely to cause host antiviral immunity. Less ACE2 receptors exist on the cell surface in the endosomal pathway because ACE2 is translocated following viral entry; immune cells notice this and the host cells undergo apoptosis as a result. As a result, viral replication is more effective when the membranes fuse directly.[25,26]

Replication of the Coronavirus

As soon as the viral RNA enters the host cell, it interferes with cell reproduction to create new virus particles that can infect other cells. There are four steps in this- translation of the viral replication apparatus, genome replication, viral structural proteins are translated, the assembling of virion.

The viral genome is first revealed in the cytoplasm when the viral RNA is released into the host cell. The translation of ORF1a and ORF1b results in the production of pp1a and pp1b viral replicase polyproteins. The Papain- and 3C-like proteases (PIpro- and 3CLPRO), which are encoded by ORF1a-b, cleave the polyproteins. 16 non-structural proteins are produced as a result; NSP1–11 are encoded in ORF1a, while NSP12–16 are encoded in ORF1b.[16]

The RNA replicase transcription complex is made up of these replicase-transcriptase proteins as well as proteins from other viruses and perhaps even cellular

proteins (RdRp). This complex controls transcription and replication to produce negative sense RNA.[27]

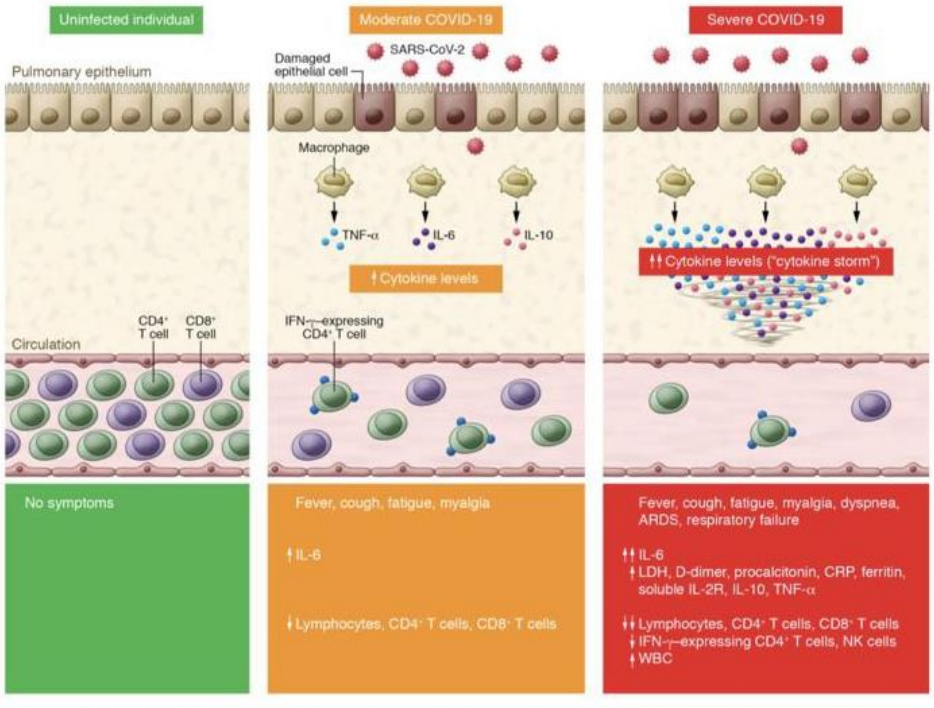
In order to create positive sense genomic RNA (gRNA) and subgenomic RNA, negative sense RNA intermediates are produced (sgRNA). The (+) strand gRNA is used by the RdRp as a template to create the next virus particle's genome.[16]

Through transcription, sgRNAs are translated into structural proteins, including spike (S), envelope (E), membrane (M), and nucleocapsid (N) proteins, which collectively make up the new viral particles. A nucleoprotein complex is created when the nucleocapsid protein and (+) strand genomic RNA are joined. Spike, envelope, and membrane proteins also enter the endoplasmic reticulum. The proteins combine to form a full virus particle in the endoplasmic-Golgi apparatus complex and are exocytotically transported from primary cells to extracellular areas. More virus particles are produced as a result of the mature virions ability to infect fresh target cells.[27]

The Cytokine Storm

The immune system reacts once the virus has replicated and entered the host.

Fig 8:- Cytokine Storm[30]



Early onset of the infection

Early fast viral replication may result in pyroptosis, a type of programmed cell death dependent on caspase-1, in epithelial and endothelial cells. Damage Associated Molecular Patterns (DAMPs), such as nucleic acids and ATP, are released during pyroptosis. IL-6, IP-10, macrophage inflammatory protein 1 (MIP1), MIP1 and MCP1 are pro-inflammatory cytokines and chemokines that are formed when DAMPs are identified by nearby endothelium, epithelial, and alveolar macrophages. To the infection site, these pro-inflammatory cytokines and chemokines draw monocytes, macrophages, and T cells. These cells create a pro-inflammatory feedback loop by encouraging further inflammation.[28]

Healthy immune response

Dendritic cells in the lymph node have recruited virus-specific T lymphocytes, which are drawn to the infection site by the first inflammation. They get rid of the infected cells and stop the virus from spreading. These people neutralising antibodies can prevent viral infection. By using phagocytosis, alveolar macrophages eliminate apoptotic cells and viruses that have been neutralised. These procedures cause the virus to be cleared up with little lung damage, which ultimately leads to recovery.[28]

Dysfunctional immune response

In a defective immune response, the early onset results in greater immune cell accumulation in the lungs, which increases the production of pro-inflammatory cytokines and harms the structure of the lungs. Additionally, neutrophils are drawn to the infection site by cytokines and go there. There, they release reactive oxygen species (ROS) and proteases in an effort to kill the virus.[29]

Although this eliminates the virus, it also harms the nearby tissue, escalating the inflammation. A massive amount of cytokines are created as a result of this unchecked inflammation, creating a cytokine storm. Damage to multiple organs could result from the cytokine storm spreading via the blood to other organs. Additionally, B cells are drawn to the virus and create non-neutralizing antibodies to neutralise it; nonetheless, this leads to antibody-dependent enhancement of the SARS-CoV-2 infection.[29, 30]

COVID-19 symptoms

Immune cells are drawn in and the SARS-CoV-2 infection in the lung recedes, leading to recovery, in the majority of SARS-CoV-2 infected people. Common cold-like symptoms including a cough, breathing problems, and fever are typically all that are present. However, as previously mentioned, some people experience a defective immune response, which sets off a cytokine storm that causes widespread lung inflammation. These cytokines can travel through the blood to damage multiple organs, usually the cardiac, hepatic, and renal systems.[16]

Symptoms of mild SARS- CoV- 2 infection

Coughing, difficulty in breathing and fever are the main symptoms of a mild infection and are primarily brought on by the body's immune reaction to the virus. DAMPs are detected by immune cells as the virus multiplies in a host cell, and IL-1, IL-6, and TNF- are released as a result.

These cytokines enter the bloodstream and multiply in the endothelial cells, which increases capillary permeability and results in vasodilation. As a result, plasma

spills into the alveoli and interstitial space, putting pressure on the alveoli. Surfactant, a substance involved in lowering the surface tension in the lung, will migrate out of the alveoli. The alveoli collapse as a result of increased surface tension. Breathing difficulties is caused by alveoli collapse, which reduces gas exchange and increases breathing work.[31]

When the alveolar cells are destroyed, dead cells, fluid, protein buildup, macrophages, and neutrophils begin to gather in the middle of the alveoli. This also affects gas exchange, which causes hypoxia and alveolar collapse. When this buildup of debris begins to deteriorate, creating the cough, the patient will also begin coughing up this debris.[30]

When cytokines, such as IL-6, created at the site of the infection travel through the blood to the Central Nervous System, it results in fever (CNS). A fever is caused when the hypothalamus detects elevated cytokine concentrations and releases prostaglandins like PGE2 to raise body temperature.[32]

Due to collapsing alveoli and the accumulation of fluid and debris, there will be less oxygen in the blood (PO2), which will inhibit the chemoreceptors ability to exchange gases. In order to compensate for the low PO2 and ensure that the patient's important organs receive enough oxygen, this will set off a reflex and excite the sympathetic nervous system (SNC), which will raise the patient's heart rate.[16]

Patients who have a mild infection will have the infection cleared, averting a cytokine storm, and there won't be any serious lung damage brought on.

Symptoms of severe SARS CoV- 2 infection

The aforementioned chain of events also occurs in individuals with severe SARS-CoV-2 infections, and the person will first display comparable symptoms such a cough, fever, and difficulty in breathing. However, the infection in the lungs is so bad that cytokines travel throughout the body because the T cells and macrophages are unable to eliminate it. Systemic Inflammatory Response Syndrome (SIRS), a heightened immune response by the body to the infection, will result from this.[33]

Acute phase reactants, which are direct mediators of the subject's broad autonomic, haematological, immunological, and endocrine changes, are released during SIRS.

Despite the fact that SIRS is designed to be defensive—to identify and destroy the source—the uncontrolled cytokine storm can cause a significant inflammatory cascade, which can result in organ malfunction or even death. Increased capillary permeability in the systemic circulation results from the inflammation spreading throughout the circulatory system. The blood volume will start to decline as fluid begins to leak out and gather in the gaps between tissues. Additionally, the infection will cause vasodilation, which will lower peripheral resistance. Hypotension will arise from a drop in blood pressure brought on by a decrease in peripheral resistance as well as a reduction in blood volume. Multisystem organ failure may result from hypotension since it will reduce the amount of blood flowing to various organs (MSOF).[16, 35]

The immune suppression phase, which is followed by the pro-inflammatory phase, is another risk. There is a greater risk of bacterial infection and it is

characterised by a decrease in peripheral lymphocyte numbers. Numerous SARS-CoV-2 patients have been shown to have lymphopenia.[16, 36]

Diagnosis of COVID-19

It is advised to collect a sample within seven days of the onset of symptoms in order to diagnose COVID-19. Sputum, bronchoalveolar lavage, tracheal aspirate, transtracheal aspirate, and nasopharyngeal swabs from upper respiratory tract samples can all be utilised for diagnosis. The rates of identifying the agent may differ among these sample types. According to the research done thus far, the sample types with the highest sensitivity for the agent's detection include bronchoalveolar lavage and tracheal aspirate. The rate of factor detection in these sample types is approximately 90%, compared to 60% in samples taken from the upper respiratory tract.[38, 39]

The nasopharyngeal and oropharyngeal swabs should be obtained simultaneously and deposited in the same viral transport medium (VTM) in patients with asymptomatic or mild symptoms in order to boost the test's sensitivity. In our nation, joint sample collecting was done in this fashion. If only one sample is to be collected, a nasopharyngeal swab sample is advised. If the doctor decides it's necessary, further samples can be taken, including blood, urine, and faeces.[37]

Measures to be Taken for Biosafety During Sampling

During sample collection, it is mandatory to wear PPE, a N95 mask, disposable gloves, a clean, full-body, long-sleeved romper, and eye protection (goggles or a face shield). Special sampling cabinets have been made for this purpose.[37]

Sample Transfer to an Authorized Laboratory

The General Directorate of Public Health has authorized laboratories to diagnose COVID-19. These labs are the ones that adhere to biosecurity, team, and equipment standards. Samples are sent to these laboratories from external facilities in triple carrying containers.[40]

A screw-capped, durable plastic tube serves as the main container for the viral delivery medium (VTM). The swap is broken and left in this tube once the subject has been sampled. It is intended to fit one swap into each of these tubes. These tubes should have patient information written on them. These tubes should have their surfaces cleaned with 70% ethanol, placed in a plastic bag that can be closed, and then allowed to bleed into a secondary container.[40]

The secondary container needs to be liquid-tight, leak-proof, and impact-resistant. In the event of a leak, there must be enough absorbent material to cover the principal tube and completely absorb the spilled liquid. To stop shaking, the secondary container needs to be fixed with an exterior package.[37]

Sender and receiver contact information, as well as a UN3373 label indicating category B contagious chemicals, shall be shown on the tertiary container.[40]

Preparing the Samples for the Analysis

Opening samples as they arrive at the lab in the class II biosafety cabinet at the biosafety level 2 (BSL2) laboratory (BSC).

PCR-based diagnostics are being developed by institutions all over the world for quick and precise SARS-CoV-2 testing. The inactivation of the virus in the viral transport medium and the isolation of the viral nucleic acid constitute the first stage of these assays.[37]

The benches must be cleaned with 70 percent ethanol, 2 percent glutaraldehyde, 100–1000 ppm sodium hypochlorite, or other disinfectants after the sample preparation procedures are complete.

Testing Procedures for COVID-19 Diagnosis

Several test techniques are available for viral pathogens that cause infectious illnesses. In the diagnostic laboratories, several of these are frequently used, including virus isolation in cell or tissue cultures, electron microscopy, immune fluorescent applications, nucleic-acid amplification assays, sequencing techniques, serological test methods for antigen or antibody detection, and immune chromatographic tests.[47]

The gold standard diagnostic method for a viral infection is virus isolation in cell culture. This approach must be used in Biosafety Level-3 Laboratories, and it takes at least a few days to see results. As a result, applying this technique in an outbreak situation is inappropriate. Similar to that, electron microscopy is difficult to operate, time-consuming to prepare samples, and expensive to install and run.[37]

Immunofluorescent analysis is a frequently used technique for viral infections, although as of yet, a trustworthy, focused methodology with high sensitivity has not been created. All of these findings imply that in order to diagnose SARS-CoV-2 in an outbreak situation, quick, stable, affordable, and simple-to-use technologies are needed.[47]

Nucleic Acid Based Methods

Isolation of RNA

Using a commercially available kit, the viral RNA from each specimen or from the culture supernatant is extracted to begin the molecular diagnosis of SARS-CoV-2. The time lost during this stage is the nucleic acid amplification tests biggest drawback in a pandemic. In as little as five hours, even a fully automated isolation/extraction equipment can isolate a nucleic site from 100 samples. For a pandemic process where thousands of samples need to be examined daily, more workable and efficient methods are required.[37]

Use is made of the Bio-Speedy COVID-19 transfer tube created by the Bioeksen Company and the Ministry of Health. The transport medium created using RNA Shield technology also lyses the virus and stabilises the viral RNA that has been released. As a result, amplification can be produced directly from this liquid without requiring a second procedure. Additionally, viral RNA separation from samples obtained under viral transit settings is accomplished using Bio-Speedy vNAT Viral Nucleic Acid Buffer and Bio-Speedy Viral Nucleic Acid Kit.[37]

Real-time, Reverse Transcriptase PCR

With previously developed probe and primers, the Real Time Reverse Transcriptase Polymerase Chain Reaction (RT-qPCR) specifically targets the genomic areas encoding envelope (E), RNA dependent RNA polymerase (RdRp), and nucleocapsid (N)14. To determine the similarities and differences between an isolate's

genetic makeup and the original strain from Wuhan, China, qPCR is followed by whole genome sequencing.

The qPCR approach is very sensitive and specific for the detection of SARS CoV-2 since it is generally accepted that the cycle threshold (Ct) above 37 was regarded to be negative.[41]

Many different businesses have created RT-PCR based assays for the detection of SARS-CoV-2. RNA dependent RNA polymerase (RdRp) is the target of the Bio-Speedy COVID-19 RT-qPCR detection kit. The various recommendations advised taking into account ct values up to the 37th cycle for discrimination of the positive cases.[41]

The internal control is one of the kit's most crucial elements. The internal control of this kit uses the human RNAase P gene as a target, and utilizing swap, you can verify that the sample was obtained correctly and that the transport circumstances and nucleic acid separation were suitable.[37]

Fig 9:- Rt- PCR[37]

Isolation of a virus

The virus isolation procedure is the industry standard for characterising viruses and aims to get clean isolates of live viruses by in vitro cell culture propagation. The virus isolation for SARS CoV-2 is carried out in Vero E6 cell cultures grown in Minimum Essential Medium.[41]

D- dimer

The successive actions of three enzymes—thrombin, factor XIIIa, and plasmin—lead to the formation of the D-dimer antigen, a distinctive hallmark of fibrin breakdown. First, thrombin breaks down fibrinogen to create fibrin monomers, which then polymerize and act as a template for the synthesis of factor XIIIa and plasmin. Second, plasma factor XIII linked to fibrin polymers is activated by thrombin to create factor XIIIa, the active transglutaminase. Covalent linkages between D-domains in the polymerized fibrin are created by factor XIIIa. Finally, the crosslinked

fibrin is broken down by plasmin, releasing fibrin breakdown products and revealing the D-dimer antigen. After the fibrin clot has been broken down by plasmin, D-dimer antigen can be found on fibrin degradation products produced from soluble fibrin.[42]

Specific monoclonal antibodies are required for "D-dimer antigen" detection.

The epitope on breakdown products of factor XIIIa-crosslinked fibrin is measured by one of several techniques in contemporary commercial D-dimer assays.[48] All experiments make use of monoclonal antibodies that recognise an epitope that is only found in the fibrin fragment D domain that has been crosslinked by factor XIIIa and not in fibrinogen degradation products or fibrin degradation products that have not been crosslinked.[49]

First Generation

The DD-3B6 antibody-coated latex beads were used in the first generation of D-dimer assays on plasma.[50] The D-dimer epitope was identified and described in this experiment. It was discovered to be a distinct area of the D-domain that experienced a conformational shift during covalent ligation by factor XIIIa, becoming reactive with the monoclonal antibody after plasmin breakdown. [51] Latex agglutination assays depend on fibrin breakdown products having enough bivalent D-dimer antigen to start agglutination. It wasn't that precise.

ELISA Approach

Prior to the development of latex agglutination assays, enzyme-linked immunosorbent assay (ELISA) procedures were created for research purposes. These procedures relied on antibody capture of the D-dimer antigen on the plate, followed

by tagging of the antigen with an antibody detection system for fibrin-related antigen. Although this assay format was quite sensitive, it took longer to execute.[52]

Detection of Fluorescence Endpoints

The sensitivity and specificity of the assays using the fluorescent endpoint detection technology were comparable, and they had the added benefits of speed and a broad linear range that could detect D-dimer levels as low as 0-1000 ng/mL. Currently, this method is employed in the majority of places.[53]

Tests for whole blood agglutination

Subsequently, less complex whole blood agglutination tests were created, allowing for quick clinical decision-making with a little requirement for high-tech laboratory equipment.[42]

COVID-19 and D-Dimer

The Virchow triad, which includes hypercoagulability, endothelial damage, and venous stasis, defines the cardinal inducers of thrombus formation. Mechanisms linked to this trio are directly or indirectly involved in conditions that predispose to thrombosis.[54]

The SARS-CoV-2 infection pathogenetic pathways include the attachment of the virus envelope glycoprotein to ACE2. Alveolar epithelial, endothelial, intestinal epithelial, and other tissues cells can be found to contain ACE2. The extreme pro-coagulative condition may be explained by the intrinsic preference for vascular endothelial cells and the damage that results from it, as well as by the intense activation of inflammatory responses and coagulation pathways. This puts patients

with severe COVID-19 at risk for systemic micro-thrombotic changes and may provide a partial explanation for the constant rates of multi-organ failure, DIC, and based on the involvement of lung structures, ARDS.[43]

D-dimer is a thrombin and active coagulation-related indirect marker. It is actually produced when the fibrinolytic enzyme plasmin breaks down fibrin to break up clots, and it serves as a mirror image of the endovascular thrombotic processes.[43]

Serum Ferritin

Serum ferritin levels are frequently measured as indications of iron status despite the fact that ferritin is intended to be a cellular mechanism in humans for storing iron rather than transferring it. However, over a wide range of normal and depleted iron levels, the soluble transferrin receptor (sTfR): log ferritin ratio (sTfR Index) probably offers a superior indication of body iron. This is because inflammation can induce a large increase in serum ferritin levels. During viral infections, the level of ferritin in the blood rises and may be a sign that the virus is replicating. Patients with severe COVID-19 have also been documented to have elevated ferritin levels as a result of a cytokine storm.[44]

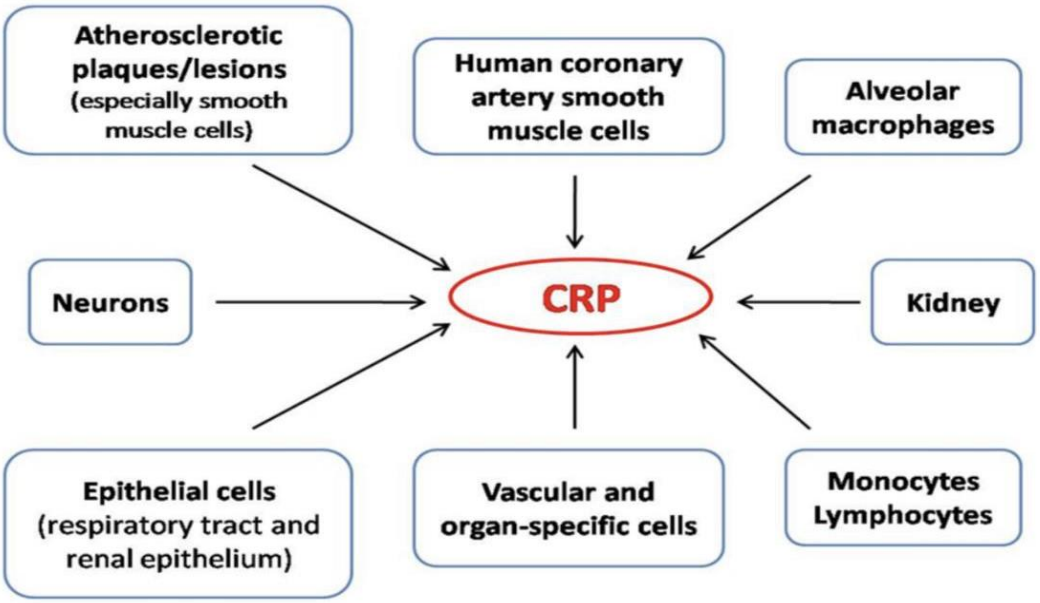
Numerous inflammatory cytokines are rapidly produced during the cytokine storm in COVID-19, including IL-6, TNF-alpha, IL-1 beta, IL-12, and IFN-gamma, which induce ferritin secretion from hepatocytes, Kupffer cells, and macrophages. Multiple organ damage is the result of the unchecked and defective immune response linked to macrophage activation, hyperferritinemic syndrome, and thrombotic storm.[44]

C Reactive Protein

The human body contains numerous locations where CRP is made. In reaction to IL-6, the liver produces it. Human serum amyloid A (SAA) protein and CRP are produced in Hep 3B cells by activated monocyte products, but not by IL-1, TNF-, or certain hepatocyte stimulating factor preparations. Additionally, non-hepatic cells like neurons, atherosclerotic plaques, monocytes, Kupffer cells, and lymphocytes make it in very small amounts.[45]

Even before the synthesis of particular IgM or IgG, the inducible protein CRP, which is produced in response to an inflammatory stimulus, attaches to pathogens and activates the complement to increase opsonization and clearance. The assembly of a C3 convertase is started by CRP attached to a multivalent ligand through the conventional pathway, which results in the presentation of the ligand with opsonic complement fragments. Acute inflammatory responses and membrane damage are not mediated by CRP started complement activation because the protein, however, does not favour the production of a C5 convertase. It has been demonstrated that the protein causes human alveolar macrophages and peripheral blood mononuclear cells to produce IL-1 alpha, IL-1 beta, TNF- alpha, and IL-6. Furthermore, it has been shown that both soluble and immobilized CRPs facilitate the uptake of native low density lipoprotein (LDL) by macrophages. Additionally, membrane-associated neutrophil serine protease, which cannot be up-regulated, may use CRP as a substrate. On the other hand, the breakdown of CRP results in tiny bioactive peptides that are soluble and limit a lot of neutrophils pro-inflammatory and tissue-damaging potential.[45]

Fig 10:-Extrahepatic sites of CRP production[45]

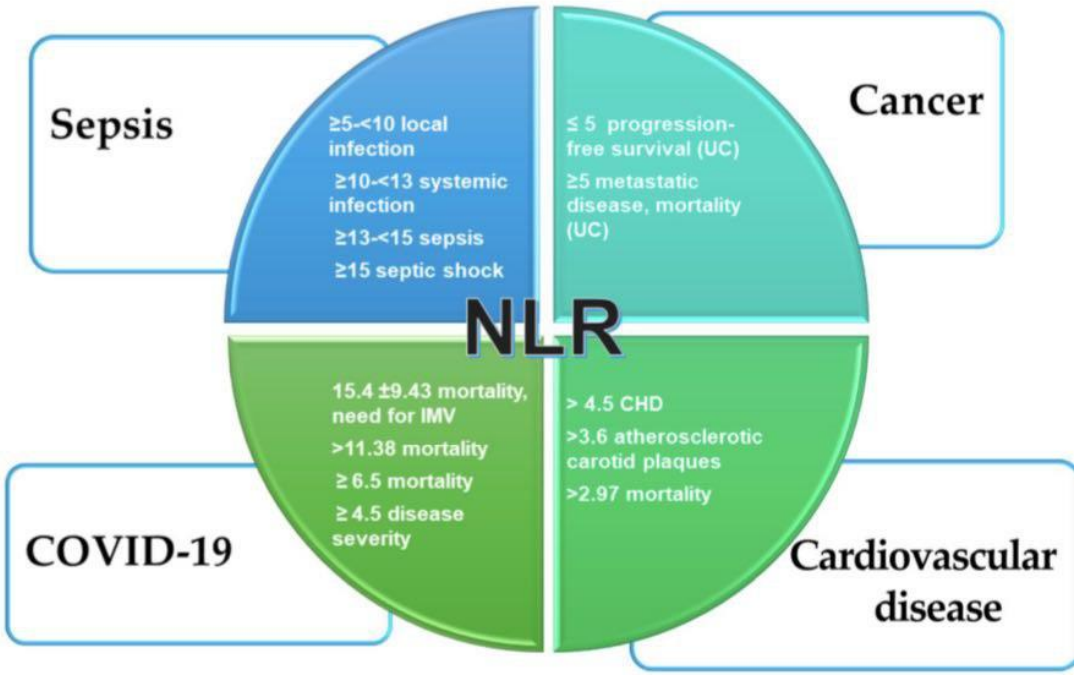


Neutrophil Lymphocyte Ratio and Monocyte Lymphocyte Ratio

The neutrophil-to-lymphocyte ratio (NLR) is a biomarker that combines two parts of the immune system: the innate immune response, which is mostly caused by neutrophils, and the adaptive immune response, which is helped by lymphocytes.

Neutrophils are the first line of defense against invading pathogens. They do this through different processes, such as chemotaxis, phagocytosis, release of reactive oxygen species (ROS), granular proteins, and making and releasing cytokines. Neutrophils also play an important regulatory role in adaptive immunity, and they are the main effector cells during a systemic inflammatory response (SIRS). As regulators of innate immunity, neutrophils recruit, activate, and programme other immune cells. They do this by secreting a variety of pro-inflammatory and immunomodulatory cytokines and chemokines that help other immune cells, like dendritic cells (DCs), B cells, NK cells, CD4, CD8, and T cells, as well as mesenchymal stem cells, recruit and perform their effector functions. [57]

Fig 11:- NLR importance in different diseases[46]



An isolated rise in neutrophil count and, as a result, an elevated NLR can be seen in bacterial or fungal infection, acute stroke, myocardial infarction, atherosclerosis, severe trauma, cancer, complications after surgery, and any condition that causes tissue damage that turns on SIRS. This is because neutrophils and other inflammatory cells cause an inflammatory state during the early hyperdynamic phase of an infection. SIRS is linked to stopping neutrophils from dying off, which makes neutrophil-mediated killing stronger as part of the body's natural response. So, NLR is

often marked by a rise in the number of neutrophils and a drop in the number of lymphocytes. [58]

NLR could also tell who would die in the general population. NLR was linked to higher overall mortality and to specific causes of death, such as heart disease, chronic lower respiratory diseases, influenza/pneumonia, and kidney diseases. On the other hand, there were no significant links between NLR and death from cancer, cerebrovascular disease, accidents, or diabetes. Also, the Rotterdam study showed that NLR levels were independently and significantly linked to a higher risk of death from all causes. The early increase in NLR (6 h) after acute physiological stress could make NLR a better indicator of acute stress than other laboratory parameters (e.g., white blood cell count, bacteremia, C-reactive protein, CRP). Other than that, lymphocytes (B cells, T cells that are CD4-positive, CD4/CD8-negative, or CD8-positive, and natural killer T cells) are especially important for adaptive immunity. They provide an antigen-specific response that is controlled by the major histocompatibility complex (MHC) class I. Immune system responses to viruses, tumour cells, atopy, and SIRS all involve lymphocyte activity. Lower NLR is usually linked to good prognostic factors in every field, which shows that the immune system is still in balance. [46]

Karakonstantis et al. found that a "false" increase in NLR could be caused by age, exogenous steroid intake, endogenous sexual hormones, active haematological disorders like leukaemia, cytotoxic or granulocyte colony stimulating factor (G-CSF) chemotherapies and HIV. [59]

Acute trauma Stress on the mind Homeostasis between these two parts of the immune response is often fragile; it can be changed by many things that are either healthy or unhealthy. Endogenous cortisol and catecholamines, for example, may be

two of the most important things that cause NLR. High levels of cortisol are known to raise the number of neutrophils while lowering the number of lymphocytes. Endogenous catecholamines, like epinephrine, can also cause a drop in the number of white blood cells and lymphocytes. There may also be a role for cytokines and other hormones. So, confounders must be taken into account in order to give NLR alteration the right clinical meaning. [46]

Lymphopenia

The lack of lymphocytes affected the health of COVID-19 patients. The mean ALC level at admission was linked to COVID-19 mortality. A higher degree of lymphopenia was significantly linked to the severity of the disease. Each mortality or degree of COVID-19 severity was linked independently with the grades of lymphopenia (severe lymphopenia, ALC 500/mm3; moderate lymphopenia, ALC 500–1000/mm3; no lymphopenia, ALC 1000/mm3). [57]

It is well known that cytotoxic lymphocytes like cytotoxic T lymphocytes and natural killer cells are important for maintaining immune homeostasis and inflammatory response to control viral infection. Previous research has linked the spread of a viral infection to a process called apoptosis or functional exhaustion of cytotoxic lymphocytes .The COVID-19 infection would cause too many pro-inflammatory cytokines to be made, which would cause the disease to get worse, stay disordered, and cause a lot of lymphocytes to die. Since severe COVID-19 disease was linked to a high level of lactic acid in the blood, it is likely that hyperlactacidemia, which stops lymphocytes from working, is also linked to severe COVID-19 infection. New drugs that target lymphocyte proliferation or apoptosis (IL-

7 or PD-1/PD-L1 inhibitors) and have a mechanism that works to restore lymphocytes could be worth trying for people with a severe case of COVID-19.[59]

Lymphopenia could be a key parameter if researchers want to make a risk model for COVID-19 in the future. Also, people with severe lymphopenia should be looked at for early hospitalisation and treatment options that are already available. lymphopenia was linked to the severity and death of COVID-19 patients, even after confounding factors were taken into account. Also, the level of lymphopenia was strongly linked to the need for oxygen supplementation. Also, lymphopenia had a clear effect on bad survival outcomes in every subgroup whose key criteria could be linked to lymphopenia. [58]

Complete blood counts are easy to do and don't cost much. Lymphopenia could be used as a prognostic tool in a primary care clinic to predict the severity and poor prognosis of COVID-19. So, it could be a useful biomarker in Covid-19.

Platelet Lymphocyte ratio

The platelet-to-lymphocyte ratio (PLR) is an easily obtainable ratio from complete blood count (CBC) panels. Recently, it has been proposed as a better indicator of inflammation when compared to white blood cell count (WBC) alone. Increased PLR has been observed in patients with chronic inflammatory conditions like autoimmune diseases, rheumatic disorders, cancers, and diabetes. Various studies have indicated a correlation between elevated PLR and mortality in acute pulmonary embolism, advanced cancers, and gynecological malignancies.[60]

Similarly, inflammation is central to the pathogenesis of COVID-19 and the progress of inflammation or dysfunctional immune response has been associated with

severe COVID-19 disease. It is therefore conceivable that patients with a Pre-existing chronic inflammatory state will be susceptible to severe COVID-19 disease. PLR on admission and examined the outcome of COVID-19 disease (severity and mortality) and the ability of PLR to predict progression to severe COVID-19 disease.[60]

PLR as a marker of pre-existing pro-inflammatory or chronic inflammatory state can be used as a predictor of COVID 19 disease progression [60]

Platelets play a crucial role in the inflammatory response particularly at the endothelium injury and can be activated even in response to proinflammatory cytokine or infectious factors without any vascular damage. The interaction between circulatory leukocytes and proinflammatory cytokine activity of platelets leads to the release of cytokines. Direct viral invasion of the hematopoietic cells or bone marrow stromal cells, injury of pulmonary endothelial cells leading to activation, and aggregation of platelets resulting into thrombus may lead to alteration of platelets and megakaryocytes. [60]

The activated platelets not only augments lymphocyte adhesion to the endothelium, orients the lymphocytes towards endothelial veins of various inflammatory sites but also release the platelet factor-4 to hinder the agglutinin-A, thereby impeding lymphocyte generation.

The abundancy of ACE 2 receptors in lymphocytes makes vulnerable to SARS-COV-2 invasion, acute tissue sequestration similar to previous outbreaks of the severe acute respiratory syndrome, increased utilization by the elevated interleukin-6 or SARS-COV-2 mediated direct stimulation of NLRP3 inflammasome resulting in pyroptosis in lymphocytes may predispose significant lymphocytopenia. Probably, a

more severe lymphopenia than thrombocytopenia leading results in an elevated PLR.[60]

Platelets

Platelets play an important role in inflammatory signalling as well as in infectious response. By combining thrombotic and immune recruitment functions, platelets may help focus haemostasis and immune responses against potential infectious agents to prevent microbial invasion. Platelets interact directly with viruses via a variety of receptors, including Toll-like receptors. While platelets are capable of engulfing and aggregating pathogens, their microbial killing potential is limited. Platelets and their released products have been variably reported to suppress viral infection and support virus persistence, depending on the particular infection. Platelets also appear to play a role in recruiting and activating circulating leukocytes to the endothelial surface, leading to white blood cell diapedesis. The interactions between endothelial cells, platelets, and leukocytes play a critical role in the procoagulant effect of viral infections. Thrombocytopenia, platelet secretion, and interactions with leukocytes may have either injurious or protective immune consequences in viral infections like COVID-19.[60]

Several mechanisms of COVID-19-associated thrombocytopenia have been posited.This could be purely consumptive, particularly related to endothelial damage and platelet aggregate formation in the lung, but marrow suppression and immune clearance are also possible contributors. Platelets are being consumed to form pulmonary thrombi, with a possible anti-infective effect, to prevent viremic spread via the bloodstream.

METHODOLOGY

Source of data : Jawaharlal Nehru Medical College and Research Centre and Hospital and KLE's Dr. Prabhakar Kore Hospital's free Haematology Laboratory and Hi-Tech Haematology Laboratory.

Ethical Consideration : Ethical clearance was obtained and approved by Ethical Committee of Jawaharlal Nehru Medical College and Research Centre. Patients with confirmed COVID 19 Positive test were taken. Laboratory test results were communicated to the respective responsible clinicians working at COVID 19 care and treatment centre of Jawaharlal Nehru Medical College and Research Centre. All the personal information obtained from the study participant were kept confidential.

Study period:

1st January to 31st December 2021.

One year prospective(1st January to 31st December 2021) will be considered for this study.

Study Population : Patients admitted to Covid Ward at KLE's Dr. Prabhakar Kore Hospital between the study period. The patient's details were obtained from the requisition forms and the haematological parameters were obtained from the blood samples received over the period of 1st January 2021 to 31st December 2021.

INCLUSION CRITERIA:

Adult Patients positive for Covid 19 by RT-PCR.

Sample size: 300

DATA COLLECTION:

The present study is conducted by collecting the samples of COVID-19 confirmed cases admitted at Jawaharlal Nehru Medical College and KLEs Dr. Prabhakar Kore Hospital and MRC, Belagavi. The diagnosis of the patients by positive results on Real Time RTPCR Assay of nasopharyngeal swab samples for SARS CoV2 or typical pattern on Chest CT scan in clinical laboratory of the Institute. The clinical outcome was monitored from 1st January 2021 to 31st December 2021.

The samples for blood parameters and inflammatory markers were collected on admission. D-Dimer, Ferritin,CRP, Platelets and N/L Ratio were determined using a standard coagulation analyser, blood parameter analyse and manual method of evaluation of parameters whenever required with standard protocol and reagents. Relevant data has been extracted from electronic health records using a standardized form. Demographic, Medical history and outcome data were obtained from patients medical records. After an overnight fast, venous blood samples were obtained from patients. Tests were performed within 2 hours of sample collection using a standard analyser in accordance to hospital laboratory policy. The institute laboratories follow the Quality Assurance system in India. The reference range of all the coagulation parameters is accordance with the normal reference values in Free Haematology Laboratory and Hi-Tech Laboratory Guidelines.

Laboratory Analysis : Venous blood were collected by nurses working in the COVID 19 care and treatment unit. 5 ml blood in EDTA and 3ml in 2.7 ml concentrated Sodium Citrate anticoagulated tube were collected for analysis of blood parameters and inflammatory markers. The sample were collected on

hospital admission.

Normal Range:-

1. **N/L Ratio- 1-4**
2. **Lymphocyte- 20-40%**
3. **D- dimer- < 200 ng/mL**
4. **Ferritin- 29-322 ng/mL**
5. **CRP- < 10 mg/L**

Blood Count by Mindray BC-6800

Automated Haematology Analyzer

Fig 14:- Mindray automated haematology analyser

Purpose:

To increase workflow efficiency and provide accurate results every time and eventually increase the laboratories productivity.

Primary sample

K_2EDTA blood

Type of container

Lavender top vacutainer(EDTA)

Sample Storage: 2-8^{0}C

Sample and equipment requirement

1. 2 mL of EDTA blood
2. Sample holding cassette.

Procedure:

1. Load the blood sample into the cassette provided by the company.
2. When the cassette is full, load it into the analyzers processing unit.
3. Then select/ check the processing mode whether it has to be the Primary or the secondary mode.
4. The primary mode is the fully automated mode where the analyzer transports the sample and does the mixing and aspirates 200 μL of sample and processes it.

5. The Secondary mode or the Open vial mode is used only to process emergency/ STAT samples and samples with a low volume, the cap has to be removed when processing in open vial mode. On this mode the analyzer stops a previous analysis and immediately processes the sample that has been fed. A separate aspiration probe is provided for the OV mode which aspirates 150 μL of sample.

Blood Count by Beckman coulter DxH 900Automated Haematology Analyzer

Purpose: This procedure provides the instructions necessary for performing a complete blood count (CBC), White Blood Cell (WBC) differential, Nucleated Red Blood Cell (NRBC) count, Reticulocyte count (Retic) and Body Fluids Cell count (TNC, RBC) on the UniCel DxH 900 Coulter Cellular Analysis System.

On the DxH 900, the complete blood count, the CBC, is the fundamental analytical test that evaluates the three main cellular components: White Blood Cells, Red Blood Cells, and Platelets. The WBC differential, also a fundamental test, identifies and enumerates the percent and absolute number (% & #) of the white bloods cells and nucleated Red Blood Cells present in whole blood. The complete Retic count, an analytical test, evaluates red cell production and maturity. The analysis of body fluids identifies and enumerates total nucleated cells (WBC and others) and RBC and assists with the identification of reactive, infectious or malignant processes. The DxH 900 CBC and body fluids analyses are based on the Coulter Principle. The WBC differential, NRBC and Reticulocyte analyses use VCSn technology. The CBC with WBC differential, NRBC, Reticulocyte and Body Fluid counts are for in vitro diagnostic use in screening patient populations found in clinical laboratories.

Primary sample

K_2EDTA blood

Type of container

Lavender top vacutainer (EDTA)

Sample Storage: 2-8^{0}C

Sample and equipment requirement

1. 2 mL of EDTA blood
2. Sample holding cassette.

D-Dimer

Analyser used :

ACL TOP 500/550 coagulation system analyser

Fig 12:- ACLTOP 550

Fig 13:- ACL TOP 500

Sample Requirement: 3ml blood in 2.7 ml Sodium Citrate concentrate anticoagulation tube.

Principle:

D-Dimer is contained in the soluble derivatives form from plasma degradation of Factor XIII a cross linked fibrin (XDP). The D-Dimer latex reagent is a suspension of polystyrene latex particles of uniform size coated with a monoclonal antibody highly specific for the D-Dimer domain included in fibrin soluble derivatives. When a plasma containing D-Dimer is mixed with a latex reagent and the reaction buffer included in the D-Dimer kit, coated latex particles agglutinate. The degree of agglutination is directly proportional to the concentration of D-Dimer in the sample and is determined by measuring the decreasing of the transmitted light at 405 nm caused by the aggregates (Turbidimetric immunoassay).

Sample Storage:

1 day at 2-80^{0}C

Procedure:

When sample testing is initiated, the instrument automatically pipettes the sample and reagents sequentially, mixes them and measures the reaction by Coagulometric(turbidimetric) method. The results are displayed on the LCD monitor and are sent to the host computer.

Reference range: <200ng/ml

Ferritin

PRINCIPLE:

The Elecsys Ferritin assay uses two monoclonal mouse antibodies to form the sandwich complex in the assay. Total duration of assay: 18 minutes.

1. 1st incubation: 10 µL of sample, a biotinylated monoclonal ferritin-specific antibody, and a monoclonal ferritin-specific antibody labelled with a ruthenium complex react to form a sandwich complex.

3. 2nd incubation: After addition of streptavidin-coated microparticles, the complex becomes bound to the solid phase via interaction of biotin and streptavidin.

4. The reaction mixture is aspirated into the measuring cell where the microparticles are magnetically captured onto the surface of the electrode. Unbound substances are then removed with ProCell M. Application of a voltage to the electrode then induces chemiluminescent emission which is measured by a photomultiplier.

5. Results are determined via a calibration curve which is instrument-specifically generated by 2-point calibration and a master curve provided via the reagent bar code.

Serum or heparinized plasma collected using standard sampling tubes or tubes containing separating gel.

CALCULATION:

The Cobas 601 system automatically calculates the ferritin concentration of each sample. When using Decrease mode, the analyser automatically applies the on board dilution factor before displaying the result.

Fig 15:- Cobas 601 for calculation of Ferritin

INTERPRETATION:

Expected Values:

Male:

29 – 322 ng/mL

Female:

29 – 322 ng/mL

CRP

INTENDED USE:

Immunoturbidimetric assay for the in vitro quantitative determination of CRP in human serum and plasma on Roche/Hitachi cobas c systems.

PRINCIPLE:

Particle enhanced immunoturbidimetric assay. Human CRP agglutinates with latex particles coated with monoclonal anti-CRP antibodies. The aggregates are determined turbidimetrically.

SPECIMEN:

Serum or heparinized plasma collected using standard sampling tubes or tubes containing separating gel. Separate the serum or plasma from the clot or cells promptly.

PROCEDURE NOTES:

Results are reported to the nearest tenth in mg/dL.

CALCULATIONS:

The Cobas 501 system automatically calculates the C-Reactive Protein concentration of each sample.

Fig 16:- Cobas 501 for calculation of CRP

INTERPRETATION:

Expected value: <10 mg/dL

The Blood Parameters and inflammatory markers hence analysed , if within the normal range were considered normal. Increase or decrease from the normal range were considered Prolonged / High or Shortened / Low respectively. All the laboratory tests and interpretation were done following the manufactures recommendation and standard operating procedures set out by the Laboratories.

Data Analysis: The obtained data is coded and entered in Microsoft Excel. Analysis is done using a SPSS 20 software. Descriptive statistics were studied using unpaired-t test. The normal and abnormal distributive quantitative variable is compared using the unpaired t- test. The results are given as the mean +/- Standard deviation, Median or Number percentage wherever appropriate. Data is analysed using Windows 10.

RESULTS

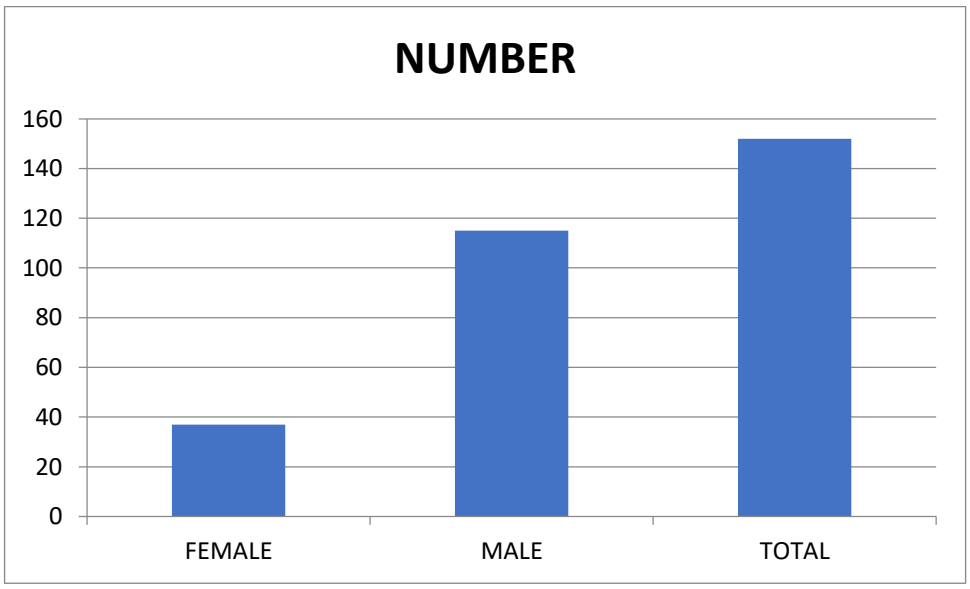
Baseline characteristics of patients:

A total of 300 patients are studied during the study period from 1st January 2021 to 31st December 2021 who were admitted in COVID 19 Care ward in KLE's Dr. Prabhakar Kore Hospital who met the inclusion criteria for this study.

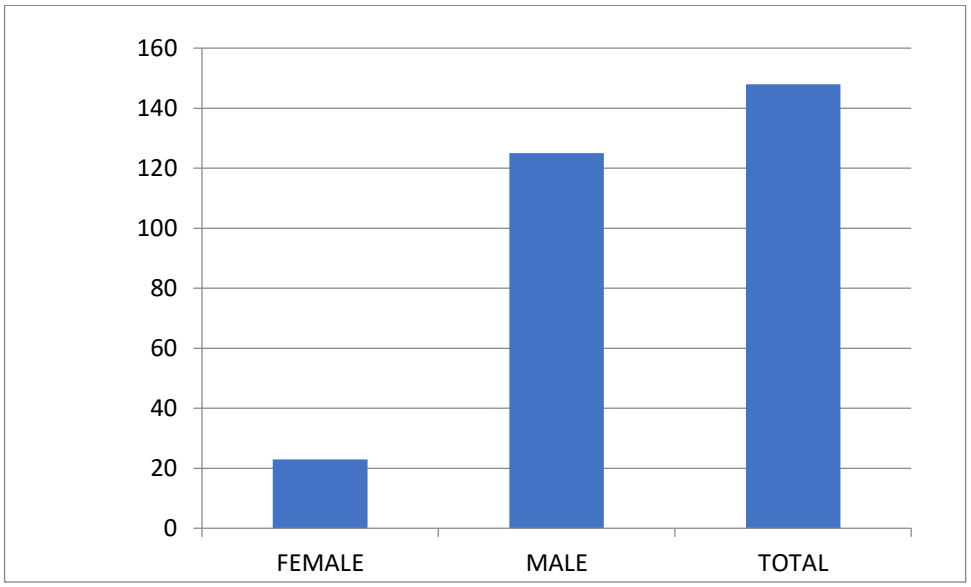
Table 1 :- Percentage gender distribution of sample

	SURVIVORS		NONSURVIVORS	
GENDER	NUMBER	%	NUMBER	%
FEMALE	37	24.34	23	15.54
MALE	115	75.65	125	84.46
TOTAL	152	100.00	148	100.00

Graph 1:- Gender Distribution for Survivors



Graph 2:- Gender Distribution For Non Survivors



In survivors out of total 152, 37 were females and 115 were males and in non survivors out of total 148, 23 were females and 125 were males.

For non survivors maximum population was under between 70-79 years and no casualties were seen in 20-29 years age group.

For survivors maximum population was between 50-59 years and least were more then 90 years.

IN THE FOLLOWING TABLES p VALUE IS CALCULATED USING STUDENT'S UNPAIRED t TEST

ABBREVIATIONS:	NS -NOT SIGNIFICANT	S - SIGNIFICANT	VS - VERY SIGNIFICANT	HS - HIGHLY SIGNIFICANT

Table 2 :- Mean age in survivors and non survivors

	SURVIVORS				NONSURVIVORS					
	MEAN	S.D.	MIN	MAX	MEAN	S.D.	MIN	MAX	p VALUE	INFERENCE
AGE	50.34	17.28	20	85	64.93	12.09	32	90	< 0.0001	HS

Total patients considered for study is 300. Mean age for Survivors is 50.34 years and mean age for non survivors in 64.93 years.

Table 3 :- Comparison of different parameters in survivor and non survivor

	SURVIVORS				NONSURVIVORS					
	MEAN	S.D.	MIN	MAX	MEAN	S.D.	MIN	MAX	p VALUE	NFERENCE
d-Dimer ng/ml	876.19	1357.18	102	6702	1914.51	1694.50	103	7028	< 0.0001	HS
Platelets x10^3 /uL	235.32	83.64	2.29	439	237.04	281.38	38	2610	0.9570	NS
Hb g/dL	13.10	2.24	7.3	18.3	13.05	2.04	8.5	18	0.8808	NS
TLC1 x10^3	11.98	27.36	4.1	251	12.56	7.58	2.6	47.1	0.8524	NS
NEUTROPHIL %	70.12	13.92	41	95	84.08	10.06	62	98	< 0.0001	HS
Lymhocyte %	21.75	12.20	2	48	10.88	8.31	1	34	< 0.0001	HS
N/L Ratio	6.13	7.68	0.85	47.5	15.63	15.85	1	94	< 0.0001	HS
Ferritin microgram/ Litre	379.23	405.48	4	2000	886.66	895.10	46.52	4583	< 0.0001	HS
CRP (value) milligram/Litre	19.48	6.63	5.4	57	208.70	176.20	9.3	874	< 0.0001	HS

Analysis of blood parameters and biochemical profiles showed that D- dimer level ($p < 0.05$) was significantly higher in non survivors compared to survivors. However there was no significant increase seen in platelets ($p > 0.05$), haemoglobin ($p > 0.05$) and total leucocyte count ($p > 0.05$).Also neutrophil percentage ($p<0.05$) was increased considerably in non survivors. Neutrophil lymphocyte ratio($p<0.05$) is significantly increased in patients dyeing later.

Ferritin($p<0.05$) is another significant biochemical marker which shows increased level in non survivors. C- Reactive protein($p<0.05$) is lower in survivors compared to non survivors.

COMPARISON OF THE TWO GROUPS ONLY FOR MALES:

Table 4:- Mean age of males in survivors and non survivors

	SURVIVORS (n=115)				NONSURVIVORS (n=125)					
	MEAN	S.D.	MIN	MAX	MEAN	S.D.	MIN	MAX	p VALUE	INFERENCE
AGE	52.03	17.13	20	85	53.51	12.47	32	90	< 0.0001	HS

Total of 240 males were considered for the study, out of which 52.03 years is mean for survivors and 53.51 years is mean for non survivors.

Table 5:- Comparison of different parameters among survivor and non-survivor in males.

	SURVIVORS				NONSURVIVORS					
	MEAN	S.D.	MIN	MAX	MEAN	S.D.	MIN	MAX	p VALUE	NFERENCE
d-Dimer ng/ml	876.19	1357.18	102	6702	1914.51	1694.50	103	7028	< 0.0001	HS
Platelets $x10^3$ /uL	235.32	83.64	2.29	439	237.04	281.38	38	2610	0.9570	NS
Hb g/dL	13.10	2.24	7.3	18.3	13.05	2.04	8.5	18	0.8808	NS
TLC $x10^3$	11.98	27.36	4.1	251	12.56	7.58	2.6	47.1	0.8524	NS
NEUTROPHIL %	70.12	13.92	41	95	84.08	10.06	62	98	< 0.0001	HS
Lymhocyte %	21.75	12.20	2	48	10.88	8.31	1	34	< 0.0001	HS
N/L Ratio	6.13	7.68	0.85	47.5	15.63	15.85	1	94	< 0.0001	HS
Ferritin microgram/ Litre	379.23	405.48	4	2000	886.66	895.10	46.52	4583	< 0.0001	HS
CRP (value) milligram/Litre	19.48	6.63	5.4	57	208.70	176.20	9.3	874	< 0.0001	HS

In the study of different haematological parameters it is found that D- dimer($p<0.05$), Neutrophil percentage($p<0.05$), Neutrophil Lymphocyte ratio($p<0.05$) are significantly higher in non survivors compared to survivors.

Biochemical markers like Ferritin($p<0.05$) and C- Reactive Protein($p<0.05$) are also increased significantly in Non survivors compared to survivors.

Platelets($p> 0.05$) , Haemoglobin($p> 0.05$) and Total leucocyte count($p> 0.05$) are not significantly different between survivors and non survivors.

COMPARISON OF THE TWO GROUPS ONLY FOR FEMALES:

Table 6:- Mean age of females in survivors and non survivors

	SURVIVORS (n=37)				NONSURVIVORS (n=23)					
	MEAN	S.D.	MIN	MAX	MEAN	S.D.	MIN	MAX	p VALUE	INFERENCE
AGE	43.59	16.66	22	72	67.60	8.83	55	81	0.0003	HS

Out of 60 females in study population 43.59 years is the mean age for survivors and 67.60 years is the mean age for non survivors.

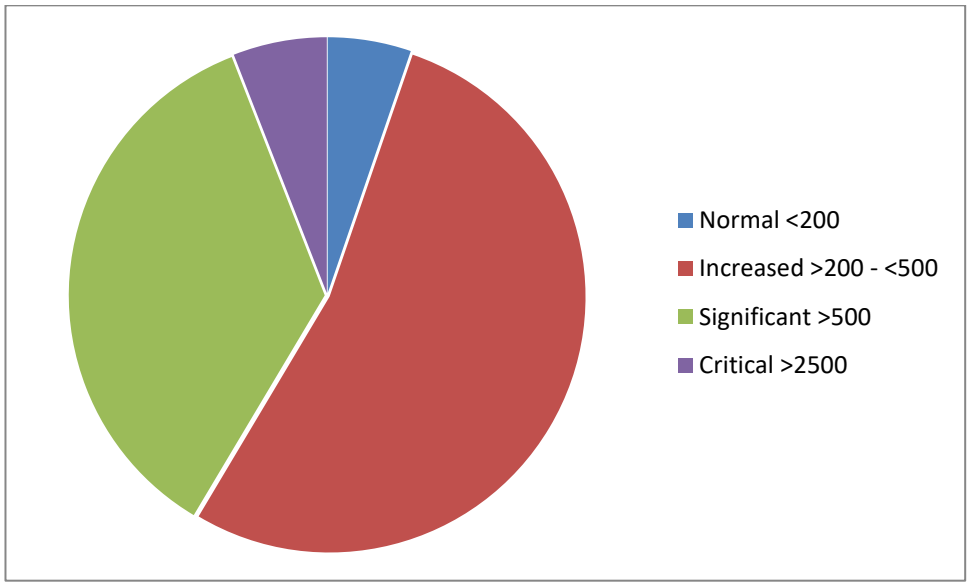
Table 7- Comparison of different parameters among survivor and non-survivor in females.

	SURVIVORS				NONSURVIVORS					
	MEAN	S.D.	MIN	MAX	MEAN	S.D.	MIN	MAX	p VALUE	INFERENCE
d-Dimer ng/ml	569.12	365.38	140	1451	998.10	689.40	328	2568	0.0436	S
Platelets $x10^3$ /uL	248.06	82.77	25	392	446.90	762.22	107	2610	0.2906	NS
Hb g/dL	12.65	1.96	9.2	15.5	11.21	0.93	9	12.1	0.0402	S
TLC $x10^3$	7.65	2.86	4.9	16.3	9.29	2.94	4.7	13	0.1657	NS
NEUTROPHIL %	64.94	12.03	49	89	80.20	8.94	68	94	0.0019	VS
Lymhocyte %	26.35	10.67	7	42	13.80	7.45	5	28	0.0031	VS
N/L Ratio	3.29	2.72	1.17	12.71	8.30	5.78	2.43	18.8	0.0051	VS
Ferritin microgram/ Litre	228.40	193.42	4	608.1	743.70	1371.59	80.2	4583	0.1351	NS
CRP (value) milligram/Litre	18.63	4.49	11	25	197.25	214.66	28	772	0.0019	VS

In the study population it is found that D- dimer($p<0.05$) , haemoglobin($p<0.05$) , neutrophil percentage($p<0.05$), neutrophil lymphocyte ratio($p<0.05$) are significantly higher in non survivors compared to survivors. C- reactive protein($p<0.05$) is very high in non-survivors compared to survivors.

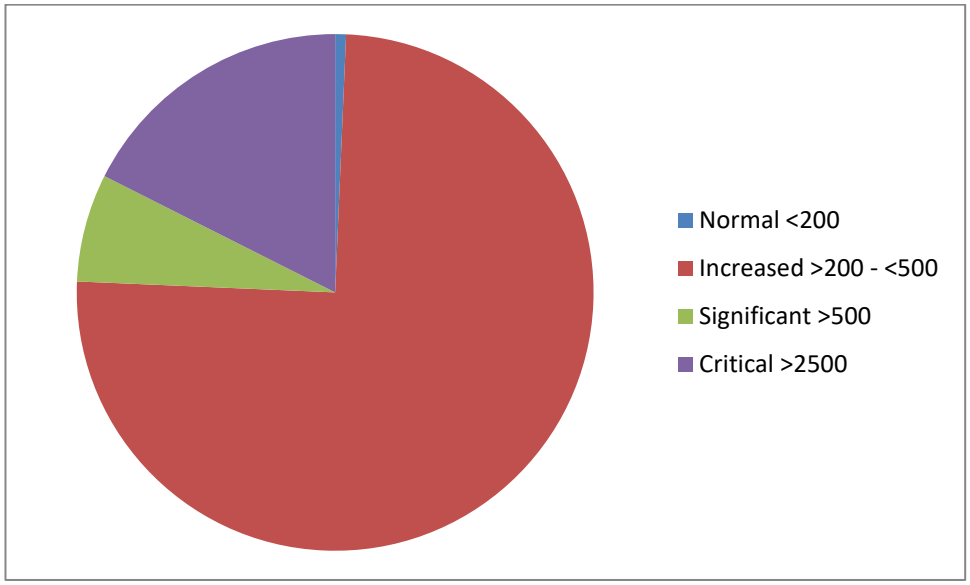
The parameters of platelets($p> 0.05$) , total leucocyte count($p> 0.05$) and serum ferritin levels($p> 0.05$) are not significantly increased in non survivors compared to survivors.

Graph 3:- Comparison of D- dimer in Values in Survivors



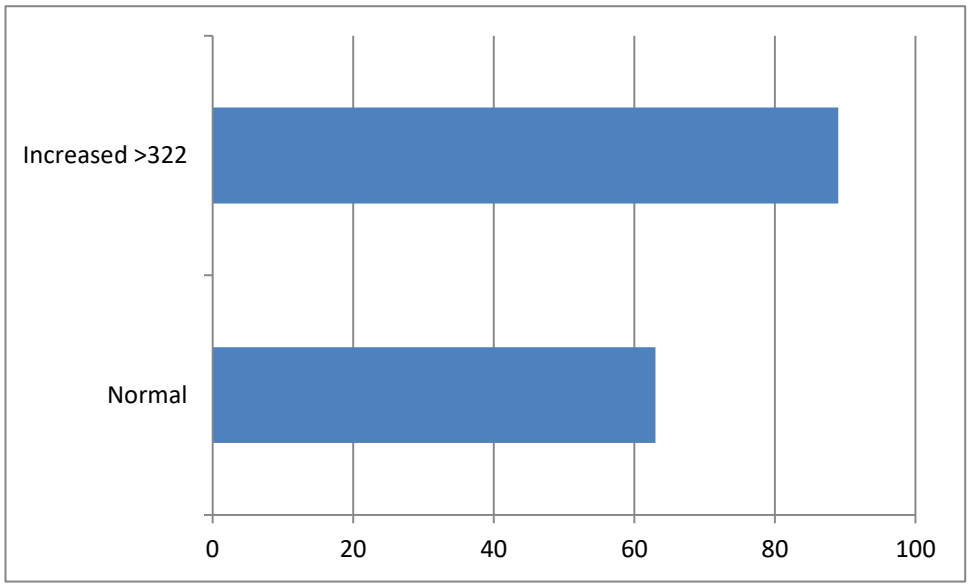
Normal level of d-Dimer is seen in 8 out of 152 patients(5.26%) .140(92.10%) patients showed increased D- dimer level. Those requiring hospitalization(> 500 ng/mL) were 54(35.52%) and those critical(d-Dimer> 2500ng/mL) were 9 patients(5.92%).

Graph 4:- Comparison of D- dimer in Values in Non Survivors



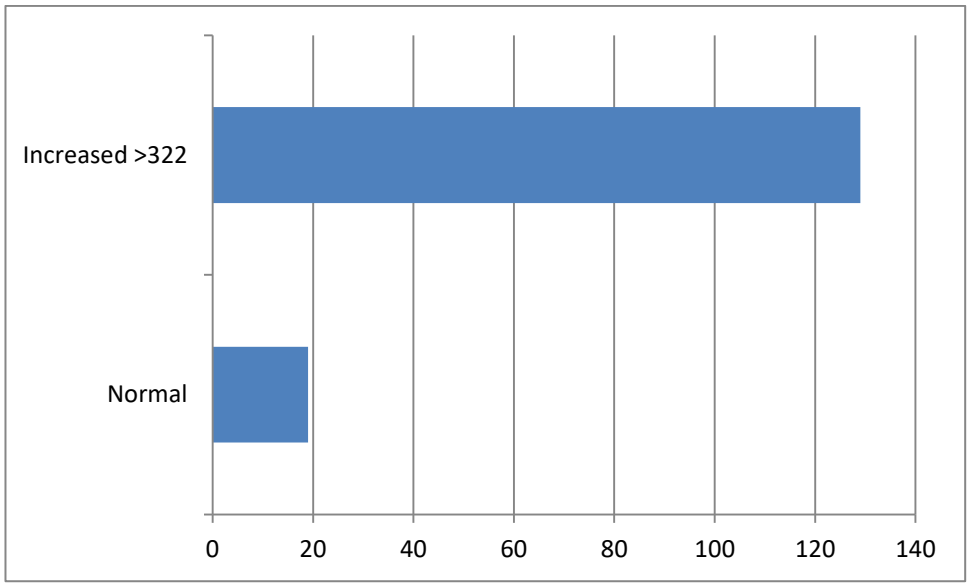
Only one patient (0.67%) in Non- survivors(148 Patients) is having normal levels of d-Dimer. Rest all patients are showing increased d-Dimer level. Patients usually require hospitalization if D- dimer level goes above 500 ng/mL which in the study is being shown by 10 patients(6.75%) .Critical level is when D- dimer level goes above 2500 ng/mL which is shown by 26 patients(17.56%) .

Graph 5:- Increased level of ferritin in Survivors (Normal <322 ng/mL)



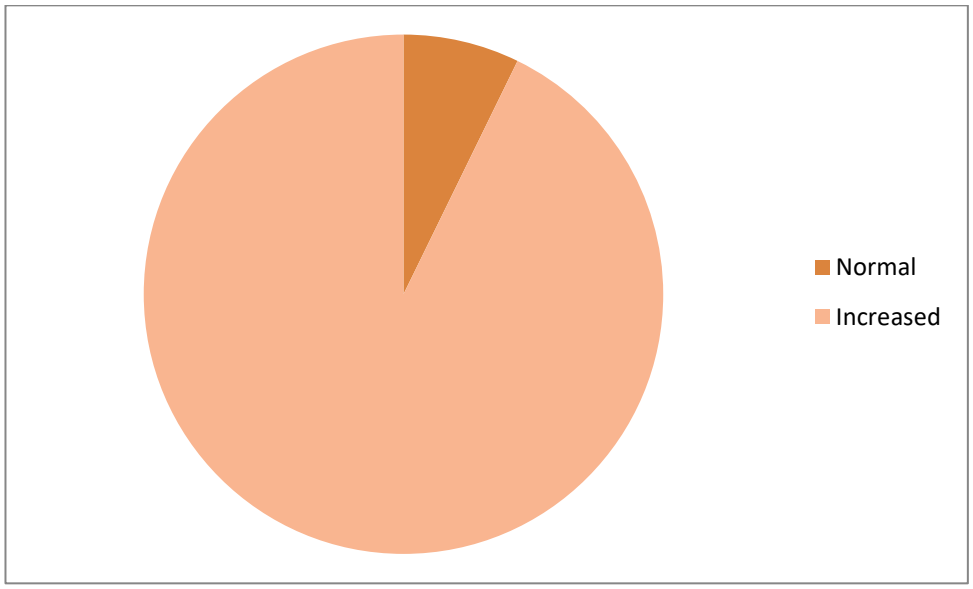
Out of total 152 survivors 89 patient (58.55%) showed increased Ferritin level and 63 patients (41.44%) showed normal Ferritin level.

Graph 6:- Increased level of ferritin in Non Survivors (Normal <322 ng/mL)



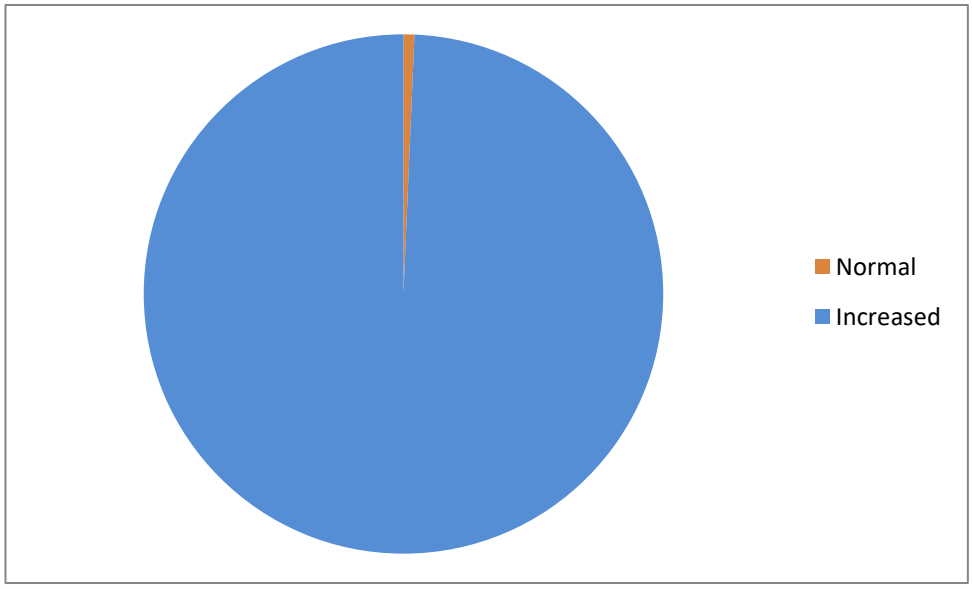
Out of 148 Non Survivor patients 29 Patients(19.59%) had normal Ferritin level whereas those having Ferritin level more than 322 ng/mL were 129 Patients(87.16%).

Graph 7:- CRP levels in Survivors



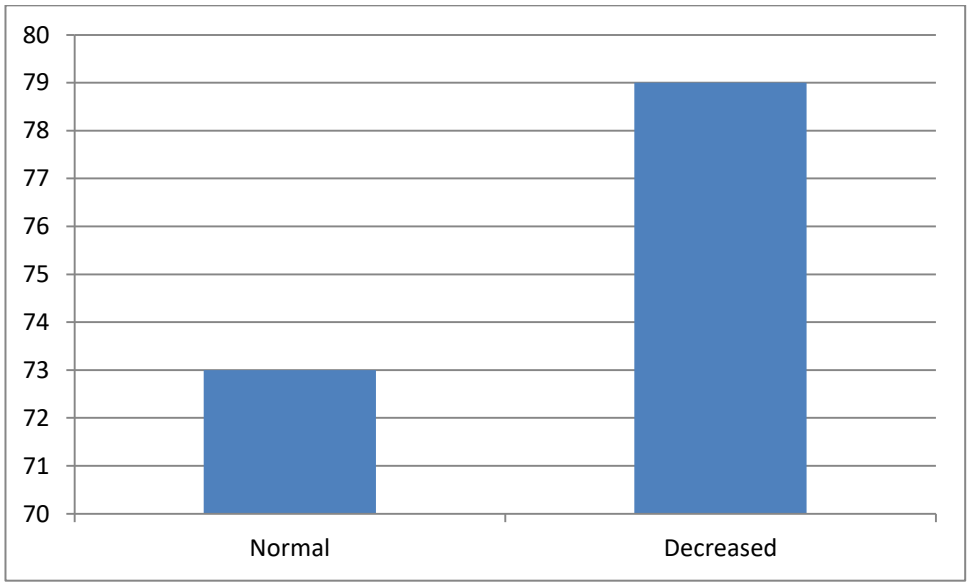
Out of 152 patients survived, only 11 patients(7.23%) showed normal CRP level and 141 patients(92.76%) were having high level of CRP.

Graph 8:- CRP level in Non Survivors



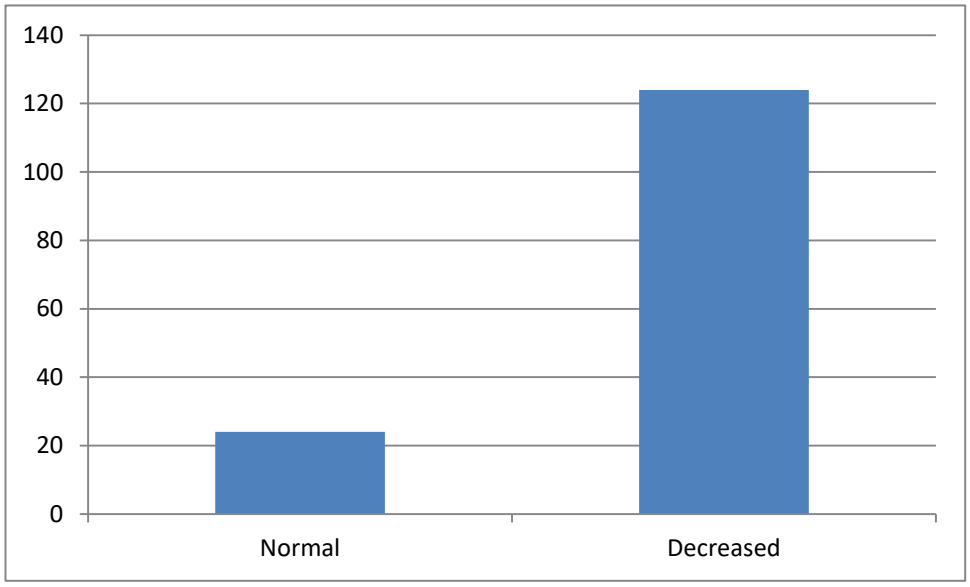
In Non Survivors out of 148 patients, only one patient(0.67%) showed normal level of CRP.147 patients(99.32%) showed increased level of CRP.

Graph 9:- Lymphocyte count in Survivors



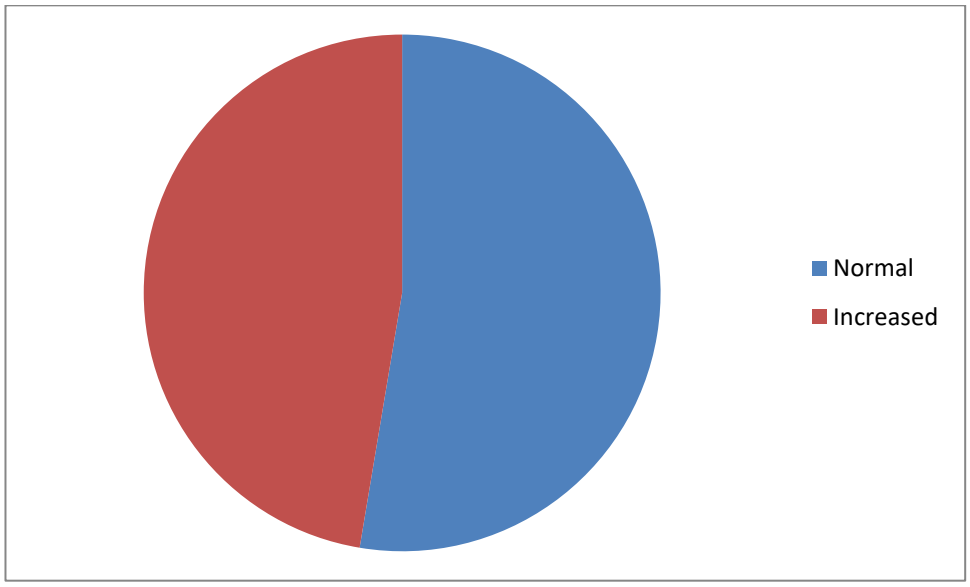
Lymphopenia in survived patients is seen in 79 patients(51.97%). And normal Lymphocyte count is seen in 73 patients(48.02%).

Graph 10:- Lymphocyte Count in Non Survivors



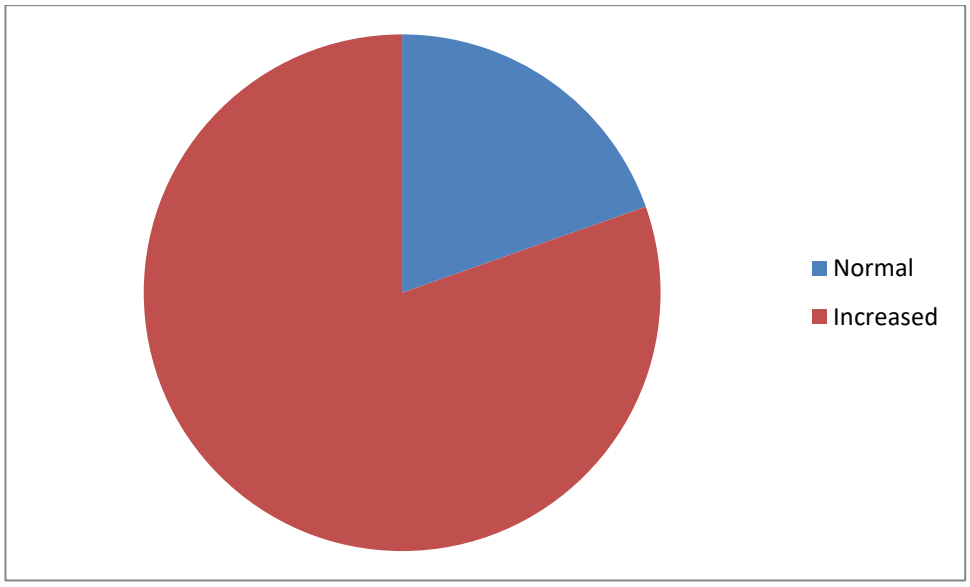
Lymphopenia in Case of Non Survivors is seen in 124 out of 148 patients(83.78%) and normal lymphocyte count is seen in just 24 patients(16.21%).

Graph 12:- Neutrophil Lymphocyte Ratio in Survivors



72 patients out of 152 patients (47.36%) showed increased N/L Ratio and 80 patients (52.63%) showed normal N/L Ratio.

Graph 13:- Neutrophil Lymphocyte Ratio in Non Survivors



Out of 148 Non Survivors, 119(80.40%) showed increased N/L Ratio whereas 29 patients(19.59%) showed normal N/L Ratio.

DISCUSSION

With more than 6 million deaths worldwide as of March 2022, Coronavirus Disease 2019 (COVID-19), the highly contagious viral illness brought on by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has had a devastating impact on the world's demographics and is emerging as the most significant global health crisis since the influenza pandemic of 1918. SARS-CoV-2 spread quickly throughout the world when the first instances of this primarily respiratory viral illness were initially recorded in Wuhan, Hubei Province, China, in late December 2019. As a result, the World Health Organization (WHO) declared it a worldwide pandemic on March 11, 2020. Since being deemed a global pandemic, COVID-19 has devastated numerous nations and wreaked havoc on numerous healthcare systems. Due to protracted closures brought on by the pandemic, many people have lost their jobs, which has had a negative ripple impact on the world economy. SARS-CoV-2 continues to wreak havoc around the world that are primarily attributed to the emergence of mutant variants of the virus. Despite significant advancements in clinical research that have improved understanding of SARS-CoV-2 and the management of COVID-19, limiting the ongoing spread of this virus and its variants has become a matter of increasing concern.

SARS-CoV-2, like other RNA viruses, is susceptible to genetic evolution with the emergence of mutations over time, resulting in mutant forms that may have distinct properties from its ancestral strains. This is true even when SARS-CoV-2 adapts to its new human hosts. Several SARS-CoV-2 variations have been identified throughout this epidemic, however only a small number of these are regarded as variants of concern (VOCs) by the WHO due to their effects on public health around the world. According to the WHO's most current epidemiological update, five SARS-CoV-2 VOCs have been discovered since the start of the pandemic

Alpha (B.1.1.7): It was seen in the UK in late December 2020.

Beta (B.1.351): First identified in December 2020 in South Africa.

Gamma(P.1): First identified in Brazil in early January 2021.

Delta (B.1.617.2): First case identified in December 2020.

Omicron (B.1.1.529): First case in November 2021 in South Africa

The emergence of these new SARS-CoV-2 variants poses a threat to undo the significant progress made so far in containing the spread of this viral illness, despite the unprecedented speed of vaccine development against the prevention of COVID-19 and robust global mass vaccination campaigns, including vaccine boosters.

In present study of patients it was seen that patients not able to survive after Coronavirus infection are mostly more than mean age of 64 years.

Compared to females, males were having severe coronavirus infection and they require hospitalization more frequently. Even mortality was more common in males compared to females. Similar findings were seen with study by Yongsheng Huang et al.[62]

Table 8:- Study by Youngsheng et al.[62]

	Survivors	Non survivors
Females	319(59.5%)	43(30.7%)
Total	536	140

Different haematological parameters which were increased in non survivors more than survivors were D- dimer which showed mean of 876.19 ng/mL in survivors compared to non survivors where mean was 1914.51 ng/mL. Lymphocyte mean value was 21.75% in

survivors compared to 10.88 % in non survivors.Neutrophil Lymphocyte Ratio mean in survivors was 6.13 compared to mean of survivors which was 15.63.

Our study findings were similar to Studies done by Mehmet Ozdin et al.[63] who found D-dimer level mean as 1070 ng/mL in non severe patients and in severe patient it was 1990 ng/mL. Even for lymphocyte they found for survivors lymphocyte percentage was 20 % and for non survivors it was 10 %.NLR of survivors in their study was 5.3 and for non survivors it was 11.18 which is similar to the our study.

Table 9:- Study by Mehmet Ozdin et al.[63]

Table 1. Statistical data of the survivor and nonsurvivor patient groups.

Parameters	Total (n=511)	Survivors (n=480)	Nonsurvivors (n=31)	p
Age, years (IR)	67 (22)	67 (22)	74 (13)	0.007
Female, n (%)	219 (42.9)	204 (93.2)	14 (6.8)	0.521
Male, n (%)	292 (57.1)	276 (94.5)	16 (5.5)	
D-Dimer (IR), µg FEU/L	1090 (2270)	1070 (2129)	1990 (7513)	0.005
PT (IR), s	12.70 (2.15)	12.6 (2.10)	13.3 (2.1)	0.014
INR (IR)	1.17 (0.20)	1.17 (0.21)	1.22 (0.19)	0.028
NEU (IR), K/µL	5.73 (6.24)	5.51 (6.15)	8.54 (7.05)	0.001
LYM (IR), K/µL	0.99 (0.98)	0.99 (0.96)	0.64 (0.84)	0.037
NLR (IR)	5.99 (10.23)	5.3 (9.59)	11.18 (16.58)	0.000
HGB (IR), g/dL	11.9 (2.70)	11.9 (2.70)	11.5 (2.40)	0.691
HCT (IR), %	37.10 (8.10)	37.3 (8.13)	36.2 (7.40)	0.644
PLT (IR)	207 (130.5)	207 (129.75)	229 (138)	0.758

IR: interquartile range; FEU/L: fibrinogen equivalent units/Liter; PT: prothrombin time; INR: international normalized ratio; NEU: neutrophil; LYM: lymphocyte; NLR: neutrophil-lymphocyte ratio; HGB: hemoglobin; HCT: hematocrit; PLT: platelet.

Even yongsheng Huang et al.[62] results were similar to present study. D- dimer in survivors in their study was 440 ng/mL and for non survivors it was 1550 ng/mL.

Present study finding was also similar to Patrícia Oliveira Cunha Terra et al.[67] who found D-dimer in survivors to be 1570 ng/mL and for non survivors it was 2170 ng/mL. Lymphocyte percentage in survivors was 11.11% in their study and for non survivors it was 7.40%. NLR for survivor was 7.43 and for non survivors it was 12.63.

Table 10 :- Study by Patrícia Oliveira Cunha Terra et al.[67]

	Survivor (80)	Non-survivor (39)	*P* value
Hemoglobin (female: 12.4-16.1 g/dL; male: 13.9-17.7 g/dL)	12.78 ± 2.17	12.51 ± 1.91	.52
Neutrophil (*N*: 1.7-7.2 × 10^3/μL)	7.2 (1.9-16.9)	10.0 (1.3-16.2)	.052
Lymphocyte (*N*: 1.07-3.12 × 10^3/μL)	0.9 (0.2-9.7)	0.8 (0.1-2.6)	.13
NLR[a]	7.43 (0.43-31.8)	12.63 (2.6-115)	.001
Platelet (*N*: 166-389 × 10^3/μL)	246.10 ± 88.11	253.50 ± 99.05	.68
Fibrinogen (*N*: 200-393 mg/dL)	705 (407-1200)	631 (353-1078)	.02
D-dimer (*N*: ≤0.5 μg/mL)	1.57 (0.28-20.00)	2.17 (0.27-20.00)	.03
C-reactive protein (*N*: <1.0 mg/dL)	16.18 ± 9.39	16.45 ± 9.26	.88
Ferritin (*N*: 22-322 ng/mL)	1264 (116.9-4368)	1073 (71.8-8250)	.17

Table 11 :- Comparison of D-dimer, lymphocyte count and Neutrophil lymphocyte ratio in different studies

	Survivors			Non Survivors		
Study	**NLR**	**Lymphocyte percentage**	**D-dimer**	**NLR**	**Lymphocyte percentage**	**D-dimer**
Our Study	6.13	21.75	876 ng/mL	15.63	10.88	1695 ng/mL
Mehmet Ozdin et al.	5.3	15.23	1070 ng/mL	11.18	6.97	1990 ng/mL
Patricia Terra et al.	7.4	11.11	1570 ng/mL	12.6	7.4	2170 ng/mL
Adekunle Alagbe et al.	10.06	12.26		17.52	7.81	

Biochemical markers like ferritin and CRP also proved useful to distinguish Patients likely to become critical compared to non-severe Patients. Mean ferritin levels in survivors value was 379.23 microgram/Litre and for non survivors it was far more 895.10 microgram/Litre. CRP was also less in survivors (mean-19.48 milligram/Litre) compared to non survivors(mean-

208.70 milligram/Litre).Many studies supported present study like study done by Jenifer Gomez- Pastora et al.[64] showed Ferritin in survivors to be 337.4 microgram/Litre and in non survivor to be 800.4 microgram/ Litre.

Table 12:- Study by Jenifer Gomez- Pastora et al.[64]

Table 1
Ferritin levels on hospital admission among patients with non-severe and severe COVID-19 disease (and survivors and non-survivors).

					Non-severe disease				Severe disease				
Hospital	Timeline	Sample size	COVID-19 diagnosis	Severity classification	N	Avg. age	Comor-bidity	Avg. ferritin (μg/L)	N	Avg. age	Comor-bidity	Avg. ferritin (μg/L)	P value
Tongji Wuhan China	Late Dec to Jan 27, 2020	21	RT-PCR assay for respiratory specimens	NHCCguidelines	10	52	20%	337.4	11 (4 died)	61	46%	1598.2	0.049

Sibtain Ahmed ed al.[65] in their studies found that mean Ferritin level in survivor to be 357.5 microgram/Litre and in non survivor to be 828.5 microgram/Litre.

Table 13 :- Study by Sibtain Ahmed ed al.[65]

Table 1
Case details and ferritin in Severe Vs Non-Severe group.

	Severe Cases (n = 86) M:F (60:26)	Non-Severe Cases (n = 71) M:F (48:23)	Mann-Whitney's *U-test (p-value)*	Binary logistic regression *(p-value)*
Age in years (Median IQR)	59.5 (52-70)	54 (39-68)	0.528	0.01
Length of hospital stay in days (Median IQR)	13 (8-20)	8 (4-12)	0.001	0.002
Ferritin in ng/mL (Median IQR)	828.5 (428.5-1306.7)	357.5 (198.91098)	0.005	0.002

$P < 0.05$ statistically significant and $P < 0.01$ highly significant.

Table 14:- Comparison of Ferritin in different studies

Study	Ferritin	Ferritin
Our Study	379.23 microgram/Litre	895.10 microgram/Litre
JeiferGomez Pastora et al.	337.4 microgram/Litre	800.4 microgram/Litre
Sibtain Ahmed et al.	357.5 microgram/Litre	828.5 microgram/Litre

Levels of haemoglobin, platelet and total leucocyte count were similar in survivors and non survivors as seen with other studies done by Mehmet Ozdin et al.[63] who in their study found mean platelet in survivor and non-survivor to be 207 and 229 respectively. They found haemoglobin in survivor and non-survivor to be 11.9 and 11.5. Yongsheng Huang et al.[62] also found similar results with total leucocyte count in survivor and non survivor as normal with mean of 4870 and 6500 respectively. Platelet count in survivor and non survivor to be 182 and 134 respectively. Haemoglobin level to be 12.9 g/dL in survivors and 12.6 g/dL in non survivors.

Table 15:- Study by Mehmet Ozdin et al[63]

Table 1. Statistical data of the survivor and nonsurvivor patient groups.

Parameters	Total (n=511)	Survivors (n=480)	Nonsurvivors (n=31)	p
Age, years (IR)	67 (22)	67 (22)	74 (13)	0.007
Female, n (%)	219 (42.9)	204 (93.2)	14 (6.8)	0.521
Male, n (%)	292 (57.1)	276 (94.5)	16 (5.5)	
D-Dimer (IR), µg FEU/L	1090 (2270)	1070 (2129)	1990 (7513)	0.005
PT (IR), s	12.70 (2.15)	12.6 (2.10)	13.3 (2.1)	0.014
INR (IR)	1.17 (0.20)	1.17 (0.21)	1.22 (0.19)	0.028
NEU (IR), K/µL	5.73 (6.24)	5.51 (6.15)	8.54 (7.05)	0.001
LYM (IR), K/µL	0.99 (0.98)	0.99 (0.96)	0.64 (0.84)	0.037
NLR (IR)	5.99 (10.23)	5.3 (9.59)	11.18 (16.58)	0.000
HGB (IR), g/dL	11.9 (2.70)	11.9 (2.70)	11.5 (2.40)	0.691
HCT (IR), %	37.10 (8.10)	37.3 (8.13)	36.2 (7.40)	0.644
PLT (IR)	207 (130.5)	207 (129.75)	229 (138)	0.758

IR: interquartile range; FEU/L: fibrinogen equivalent units/Liter; PT: prothrombin time; INR: international normalized ratio; NEU: neutrophil; LYM: lymphocyte; NLR: neutrophil-lymphocyte ratio; HGB: hemoglobin; HCT: hematocrit; PLT: platelet.

Table 16:- Study done by Yongsheng Huang et al.[62]

laboratory findings:					
Median PaO2:FIO2 ratio		3.4 (2.4–5.1)	1.5 (1.0–2.2)	4.0 (2.8–5.2)	<0.01
WBC, * 10^9/L		5.0 (3.9–6.7)	6.5 (4.5–10.3)	4.87 (3.79–6.20)	0.006
	>10.0	58/676 (8.6%)	39/140 (27.9%)	19/536 (3.5%)	<0.01
	<4.0	184/676 (27.2%)	25/140 (17.9%)	159/536 (29.7%)	<0.01
Neutrophil count, * 10^9/L		3.42 (2.30–4.98)	4.9 (3.2–9.0)	3.18 (2.25–4.49)	<0.01
Lymphocyte count, *10^9/L		1.02 (0.68–1.38)	0.64 (0.44–0.99)	1.09 (0.77–1.45)	<0.01
	< 1.5	524/676 (77.5%)	116/140 (82.9%)	408/536 (76.1%)	0.09
Platelet count, *10^9/L		178.0 (134.0–224.3)	134.0 (107.5–184.5)	182.0 (143.0–231.0)	<0.01
Haemoglobin level, g/dl		128.0(119.8–140.0)	126.0 (112.5–138.5)	129.0 (121.0–140.0)	0.024
D-dimer, mg/L		0.53 (0.25–1.21)	1.55 (0.61–8.88)	0.44 (0.23–0.91)	<0.01
	≥ 0.5	331/636 (52.0%)	99/119 (83.2%)	232/517 (44.9%)	<0.01
CRP, mg/L		2.05 (0.45–5.47)	8.40 (3.80–87.90)	1.33 (0.34–3.93)	<0.01
	≥10	95/646(14.7%)	64/127 (50.4%)	31/519 (6.0%)	<0.01
PCT, ng/ml		0.06 (0.04–0.10)	0.22 (0.08–0.52)	0.05 (0.04–0.08)	<0.01
	≥0.5	42/606 (6.9%)	33/119 (27.7%)	9/487 (1.8%)	<0.01
LDH, U/L		194.0 (153.0–273.0)	377.0 (236.0–512.0)	182.0 (147.0–235.0)	<0.01
	≥250	191/614 (31.1%)	93/126 (73.8%)	98/488 (20.1%)	<0.01
AST, U/L		24.0 (17.5–36.2)	38.0 (28.0–47.1)	21.3 (17.0–32.3)	<0.01
	>40	148/659 (22.5%)	61/125 (48.8%)	87/534 (16.3%)	<0.01
ALT, U/L		21.0 (13.3–33.8)	25.2 (16.2–35.5)	19.7 (13.0–33.7)	0.64
CK, U/L		77.0 (48.0–139.0)	137.7(64.3–264.0)	73.2 (45.9–123.4)	<0.01
Creatinine, umol/L		65.0 (52.0–78.4)	78.3 (60.7–106.2)	63.0 (51.3–75.7)	<0.01

D- dimer Values proves to be very significant marker in showing that any patient having values more than 2500 ng/mL are in more risk for collapsing to coronavirus. As we can see from our study D- dimer values more than 500 ng/mL and getting hospitalized are not progressing to severe coronavirus.so D-dimer is important marker in looking for prognosis of the patient. Also D- dimer level is more in males compared to females. Suggesting males are more prone to severe coronavirus.

Ferritin level is increased in both survivors and non survivors ,but number of patients in non survivors showing increased Ferritin level are far more compared to survivors. Suggesting Ferritin to be important parameter to check severity of coronavirus.

CRP is normal in 11 patients out of 152 patients in survivors of coronavirus and is normal in just 1 out of 148 patients in non survived patients.

Lymphocytes are used to fight with coronavirus that is why more severe the disease is more lymphopenia will be observed. This conclusion is very evident from the study.

Neutrophil Lymphocyte Ratio is increased in 80% non-survivor patients and it is increased in 47% of survived patients suggesting it is very sensitive marker to check severe coronavirus disease.

CONCLUSION

COVID-19 is a pandemic that need maximum address even today because we are just steps away from another wave of coronavirus. Though mass vaccination have reduced the dearth of coronavirus to drastic level. Still we need to be prepared for coronavirus disease. Separating severe from non-severe Covid disease is very important to reduce mortality caused by coronavirus.

Parameters like D- dimer, Ferritin, CRP, lymphocyte count and N/L Ratio all proved to be very helpful tool to differentiate severe from non-severe coronavirus disease. So we should use these parameters in all the patients on admission as they are cheap, sensitive, and reduces mortality if done early in the disease.

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ANNEXURE I – CONSENT FORM

Date:
Dr.
Post Graduate,
Department of Pathology,
JNMC Belagavi

To,
Dr. Roopa M Bellad
The Chairman
JNMC Ethics Committee
KAHER Belagavi

Subject: Request for waiver of individual consent for prospective study of blood parameters in covid 19 positive patients.

Respected Madam,

This is to inform you that we would like to conduct a one year one year prospective study for the study of blood parameters of covid 19 positive patients and their inflammatory markers. We request you to provide the Ethical clearance with waiver of individual consent for the same. The synopsis is attached with the application.

Kindly do the needful.

Your's faithfully

Guide,

ANNEXURE II –

PREPARATION AND STAINING OF PERIPHERAL SMEAR

Purpose: To make good peripheral smear

Clinical significance: A stained blood smear helps to study abnormal morphology of RBCs WBCs and platelets thus enabling the diagnosis of different anaemias, leukemias, platelet abnormalities etc.

Sample requirement:

- EDTA Blood– Sample
- Finger prick sample

Requirements:

- Leishman's stain
- Buffer(pH 7)
- Glass slide
- Spreader

Reagents preparation:

Leishman's stain:

Powdered stain - 0.2g

Methyl alcohol - 100ml

Buffer (pH 7):

Sodium dihydrogen phosphate - 3.76g

Potassium dihydrogen phosphate - 2.10g

Distilled water- 1000ml

Store at room temperature

Principle:

The polychromatic staining solution (Wright's stain) contains methylene blue and eosin. Methanol acts as a fixative and also as a solvent. The basic and acidic dyes induce multiple colours when applied to cells. The basic dye colours the acidic component of cells i.e the nucleus blue, whereas the acidic dye colours basic component of cells i.e cytoplasm pink. The neutral components are stained by both dyes.

Procedure:

I. Smear preparation:(Two slide or Wedge method):

1. Place a clean, dust free slide on firm flat surface. Put a small drop of blood (2-3 mm) 1cm from one end of the slide.
2. Take a second glass slide of width 4mm less than the total slide width (spreader).
3. Place the edge of the spreader against the surface of the first slide at an angle of 30^0.
4. Draw it backwards till it touches the blood drop. Allow blood to spread along the spreading edge.
5. Push the spreader forward with uniform motion at a moderate speed, forming a thin smear.
6. Air dry the smear and label with a diamond pencil the unique identification number

Note: A well made smear is tongue-shaped, smooth at the end, contains no lines extending across or down through the film and it should show no spaces or holes in the smear.

II. Staining (Wright's stain):

Place the air dried smear on a staining rack (2 parallel glass rods 5 cm apart).

1. Using a marked Pasteur pipette, cover the entire smear with 10-15 drops of undiluted Wright's stain.
2. Allow to stain for one minute.
3. Add equal volume of buffer until a metallic scum appears on the surface.
4. Allow to stain for 10 minutes.
5. Wash off the stain with gentle stream of tap water.
6. Air dry.

Note: Poor staining makes the blood film blue, pink or too dark

III. Examination of the film:

Examine first under low power. In an ideal smear, three zones will appear:

a) thick area (head)

b)body

c)thin area(tail)

ANNEXURE III – MASTER CHART
MASTER CHART FOR SURVIVED PATIENTS

S.No	Name	IP No	Date of Admission=(DD/MM/YYYY)	Age	Sex	Time to hospital from symptom onset (Days)	DATE OF INVESTIGATION	d-Dimer ng/ml	Platelets $x10^3$ /uL	Hb g/dL	TLC $x10^3$	NEUTROPHIL %	Lymhocyte %	N/L Ratio	Ferritin microgram/ Litre	CRP (value) milligram/ Litre	Outcome
1	Mallikarjun Shilasangi	1024932	10-Jul-2021	49	M	5	10-Jul-2021	>5000	122	13.5	6.7	77	19	4.0526316	651	13	Survived
2	Chinnappa Kabbaligar	1023058	13-Sep-2021	74	M	5	13-Sep-2021	938	174	12.4	9.8	79	15	5.2666667	267	12	Survived
3	Rajashri Bali	1021470	21-Aug-2021	48	F	4	21-Aug-2021	344	289	14.5	5.1	62	33	1.8787879	44.6	13.7	Survived
4	Sardar Mulla	1024346	30-Sep-2021	78	M	2	30-Sep-2021	590	174	16	21.6	94	3	31.333333	1115	57	Survived
5	Vijay Manjrekar	1024283	29-Sep-2021	72	M	1	29-Sep-2021	150	274	14.3	9	73	18	4.0555556	316.4	5.4	Survived
6	Anand Sogalad	1023950	24-Sep-2021	55	M	5	24-Sep-2021	872	353	15.5	5.16	71	18	3.9444444	606	18.6	Survived
7	Sagar Desai	1021418	21-Aug-2021	42	M	2	21-Aug-2021	924	295	12.2	11.6	88	8	11	450	20	Survived
8	Ashoak Sawadatti	1023907	24-Sep-2021	67	M	2	24-Sep-2021	517	135	12.1	14.2	89	7	12.714286	1002	26	Survived
9	Shivaputtra Biradar	1024635	10-Apr-2021	52	M	4	10-Apr-2021	346	143	14.5	4.8	83	11	7.5454545	917	13	Survived
10	Rayappa Katti	1020024	31-Jul-2021	60	M	5	31-Jul-2021	363	289	10	4.3	59	31	1.9032258	56.86	7	Survived
11	Gaurav Deshpande	1022622	09-Jul-2021	39	M	3	09-Jul-2021	147	168	13.3	8.7	59	31	1.9032258	74.25	24	Survived
12	Mahadevi Sadalagi	1022763	09-Sep-2021	70	– M	1	09-Sep-2021	897	251	10.8	8.5	75	12	6.25	338	20	Survived
13	Umesh Dandur	1024049	25-Sep-2021	50	M	7	25-Sep-2021	248	246	14.6	10.2	78	13	6	414	22	Survived
14	Sanjay	1021264	18-Aug-2021	43	M	4	18-Aug-2021	498	385	9.3	14.2	95	3	31.666667	777.9	17	Survived
15	Apporva Deshpande	1022375	09-Apr-2021	30	M	3	09-Apr-2021	531	337	11.3	10.6	72	19	3.7894737	27.38	14	Survived
16	Meenakshi Patil	1021495	22-Aug-2021	75	M	4	22-Aug-2021	181	227	11.7	6.6	68	22	3.0909091	412	22	Survived
17	Rudraappa Patil	1022667	09-Jul-2021	59	M	3	09-Jul-2021	>5000	137	13.7	10	90	7	12.857143	137	24	Survived
18	Rajashekara Hiremath	1022797	09-Sep-2021	64	M	2	09-Sep-2021	120	250	14.5	4.1	82	14	5.8571429	133	22	Survived
19	Sashwat Porwal	1018721	14-Jul-2021	25	M	2	14-Jul-2021	205	235	15.6	10.6	64	23	2.7826087	217.6	20	Survived
20	Shaila Raddi	1022636	09-Jul-2021	54	M	5	09-Jul-2021	308	418	10.3	10.1	78	14	5.5714286	102	18	Survived
21	Nazir Ahmad	1018431	07-Oct-2021	74	M	2	07-Oct-2021	456	169	7.3	7.6	62	12	5.1666667	104	14	Survived
22	Laxman Nimbergi	1021041	15-Aug-2021	33	M	4	15-Aug-2021	996	178	13.5	4.9	67	13	5.1538462	98	12	Survived
23	Arjun Bhumereddy	1019405	22-Jul-2021	24	M	3	22-Jul-2021	125	268	14.8	4.9	49	42	1.1666667	88	10	Survived
24	Vinaykumar Kumbar	1052184	10-Jul-2021	52	M	5	10-Jul-2021	644	122	13.5	3.1	77	19	4.0526316	145.5	44.6	Survived
25	Basavraj Avaradi	1051865	13-Sep-2021	48	M	5	13-Sep-2021	685	174	12.4	13.5	79	15	5.2666667	88.7	20	Survived
26	Pundalik Dongare	1051608	21-Aug-2021	50	M	4	21-Aug-2021	790	289	14.5	5.6	62	33	1.8787879	158	28.4	Survived
27	Madhuja Nathbuwa	1051286	30-Sep-2021	29	F	2	30-Sep-2021	780	174	16	5.6	94	3	31.333333	150	10.5	Survived
28	Smita Naragund	1051379	29-Sep-2021	41	F	1	29-Sep-2021	280	274	14.3	5.1	73	18	4.0555556	78.48	8.1	Survived
29	V. Prakash Babu	1050982	24-Sep-2021	41	M	5	24-Sep-2021	1099	353	15.5	12.4	71	18	3.9444444	588.1	25.2	Survived
30	Raghunath Belgaonkar	1051829	21-Aug-2021	48	M	2	21-Aug-2021	729	295	12.2	12.3	88	8	11	969.9	38.9	Survived
31	Vinod Uppin	1051878	24-Sep-2021	64	M	2	24-Sep-2021	281	135	12.1	7.8	89	7	12.714286	308.2	9	Survived
32	Sandhya Yallur	1051391	10-Apr-2021	36	F	4	10-Apr-2021	165	143	14.5	5.4	83	11	7.5454545	269.8	18.4	Survived
33	Shivbasappa Murod	1051885	31-Jul-2021	33	M	5	31-Jul-2021	411	289	10	13	59	31	1.9032258	572.7	10.7	Survived
34	Bhimappa Nagai	1051132	09-Jul-2021	65	M	3	09-Jul-2021	402	168	13.3	11	59	31	1.9032258	532	17	Survived
35	Mahantesh Somashekar	1051448	09-Sep-2021	32	M	1	09-Sep-2021	228	251	10.8	5.3	75	12	6.25	636.2	15.2	Survived
36	Praveen Badami	1051394	25-Sep-2021	33	M	7	25-Sep-2021	370	246	14.6	10.5	78	13	6	789.5	16.4	Survived
37	Chinnamma Bogur	1051219	18-Aug-2021	43	F	4	18-Aug-2021	1402	385	9.3	12.6	95	3	31.666667	450.6	14.2	Survived

38	Kumarswamy Mahalingappa	1051877	09-Apr-2021	57	M	3	09-Apr-2021	1308	337	11.3	10.1	72	19	3.7894737	448.7	38.8	Survived
39	Gurupad Shivannavar	1051251	22-Aug-2021	47	M	4	22-Aug-2021	1045	227	11.7	16.2	68	22	3.0909091	620.9	17.6	Survived
40	Narmada Jadhav	1051879	09-Jul-2021	59	F	3	09-Jul-2021	956	137	13.7	19.52	90	7	12.857143	1235	15	Survived
41	Pundalik Patil	1051627	09-Sep-2021	46	M	2	09-Sep-2021	1015	250	14.5	17.9	82	14	5.8571429	1515	15	Survived
42	Madhusudan Choudary	1050964	14-Jul-2021	51	M	2	14-Jul-2021	1020	235	15.6	14.2	64	23	2.7826087	952.2	53.4	Survived
43	Shivakka Pagashetti	1052021	09-Jul-2021	52	M	5	09-Jul-2021	750	418	10.3	10	78	14	5.5714286	786	50.2	Survived
44	Rajaram Yadav	1051867	07-Oct-2021	53	M	2	07-Oct-2021	752	169	7.3	9.4	62	12	5.1666667	151.2	10.5	Survived
45	Sujata Jathar	1051852	15-Aug-2021	53	F	4	15-Aug-2021	1001	178	13.5	9.9	67	13	5.1538462	1051	48.2	Survived
46	Kallavva Kamble	1051428	22-Jul-2021	64	M	3	22-Jul-2021	5200	268	14.8	19.3	49	42	1.1666667	138	29.8	Survived
47	Ishwar Padennavar	1051430	18-Sep-2021	43	M	5	18-Sep-2021	1026	436	15.4	8.6	88	6	14.666667	625	46.5	Survived
48	Sanjay Karguppikar	1051956	19-Aug-2021	57	M	3	19-Aug-2021	1008	288	13.4	6.4	60	27	2.2222222	452.7	7.6	Survived
49	Veeraktayya Salimath	1051881	10-Jul-2021	69	M	3	10-Jul-2021	1035	202	12.3	8.7	67	21	3.1904762	902	18	Survived
50	Sheela Hipparagi	1051817	29-Jul-2021	48	F	3	29-Jul-2021	1484	291	10.8	12.1	64	20	3.2	2296	29	Survived
51	Manjula Ganesh Patil	1051886	24-Aug-2021	37	F	8	24-Aug-2021	700	245	10.3	11.3	77	19	4.0526316	800	36	Survived
52	Doddakallappa	1036826	22-Jul-2021	78	M	3	22-Jul-2021	850	252	14.8	7.2	49	42	1.1666667	810.02	9	Survived
53	Mudakappa Itagi	6078015	14-Aug-2021	65	M	3	14-Aug-2021	827	151	14.8	5.9	49	42	1.1666667	828.8	9.3	Survived
54	Shantavva Madar	1052167	23-Aug-2021	35	M	1	23-Aug-2021	1010	223	13	9.05	54	21	2.5714286	640	8	Survived
55	Vinay Bankar	1051954	13-Oct-2021	48	M	2	13-Oct-2021	3000	261	17.6	18	79	17	4.6470588	800	37	Survived
56	Mallikarjun Gaddikeri	1051793	08-Jun-2021	41	M	4	08-Jun-2021	4705	186	11.1	24	76	19	4	947	37.3	Survived
57	Mahadev Dundappa	6082182	10-Aug-2021	65	M	2	10-Aug-2021	790	216	7.4	7.7	82	11	7.4545455	952	54	Survived
58	Mallikarjun Basavant	1051793	16-Aug-2021	41	M	3	16-Aug-2021	1398	197	14.8	8.6	49	42	1.1666667	647	26	Survived
59	Ramacharan Ganpat Patil	1050816	21-Aug-2021	30	M	3	21-Aug-2021	816	392	9.8	8.9	54	23	2.3478261	1432	8	Survived
60	Praveen Gunake	1052258	29-Sep-2021	30	M	3	29-Sep-2021	1010	182	14.8	10.9	49	42	1.1666667	400	14	Survived
61	Santosh Kanago	1052169	08-Dec-2021	45	M	3	08-Dec-2021	638	2.29	14.8	7.6	57	34	1.6764706	350	16	Survived
62	Ashok Savasuddi	1050851	25-Jul-2021	56	M	3	25-Jul-2021	899	260	14.8	11	60	38	1.5789474	350	26	Survived
63	Rahul Kenawadekar	1052483	09-Aug-2021	42	M	3	09-Aug-2021	452	250	12	12.1	65	22	2.9545455	386	18	Survived
64	Vijaylakshmi Patil	1050880	10-Apr-2021	42	F	7	10-Apr-2021	316	235	13	13.5	71	21	3.3809524	408	36	Survived
65	Shobha Karki	1052259	07-May-2021	45	F	7	07-May-2021	506	259	13.5	9.6	84	10	8.4	602	38	Survived
66	Shrimanti Kamati	1051749	21-Sep-2021	83	F	5	21-Sep-2021	675	178	13.8	6.9	74	18	4.1111111	195	50	Survived
67	Nitin Godase	1051955	27-Aug-2021	42	M	4	27-Aug-2021	862	222	12.1	8.7	92	4	23	596	52	Survived
68	Gangabai Biradar	1050879	27-Aug-2021	70	F	5	27-Aug-2021	568	183	13.8	8.6	90	5	18	178	36	Survived
69	Suresh Mulimani	1051854	18-Sep-2021	67	M	3	18-Sep-2021	329	164	10	4.5	91	4	22.75	163.5	22	Survived
70	Siddappa Koujalgi	1051264	08-Jul-2021	50	M	2	08-Jul-2021	343	219	11.1	4.8	75	20	3.75	497.5	15.3	Survived
71	Malagouda Patil	1050949	23-Jul-2021	47	M	5	23-Jul-2021	350	161	14.1	11.8	70	25	2.8	502	18.8	Survived
72	Vinayak Honnungar	1051968	16-Sep-2021	36	M	2	16-Sep-2021	308	203	10.11	5.8	74	19	3.8947368	385	18	Survived
73	Shidaramayya Hiremath	1052247	28-Sep-2021	58	M	5	28-Sep-2021	443	25	11.4	6.8	70	29	2.4137931	523.5	22	Survived
74	Mahantesh Patil	1050954	28-Aug-2021	41	M	1	28-Aug-2021	754	191	12.1	5.9	57	35	1.6285714	651	38	Survived
75	Varsha Desai	1052261	09-Oct-2021	33	F	5	09-Oct-2021	852	187	12.8	10	88	9	9.7777778	350	10	Survived
76	Pushpa Kulkarni	1051241	15-Oct-2021	80	F	1	15-Oct-2021	280	156	9.5	8.6	95	2	47.5	268	15	Survived
77	Malhari Kulkarni	1051212	08-Oct-2021	36	F	3	08-Oct-2021	658	260	12.7	9.5	77	17	4.5294118	480	35	Survived

78	Leenet Prasad	1051246	29-Sep-2021	60	M	2	29-Sep-2021	775	229	13	10.5	53	36	1.4722222	550	40	Survived
79	Anand Gudagudi	1051270	23-Sep-2021	40	M	2	23-Sep-2021	680	278	15.5	11.5	89	7	12.714286	430	45	Survived
80	Balasab Mirje	1051641	30-Sep-2021	61	M	1	30-Sep-2021	547	222	11.6	9.5	70	24	2.9166667	460	45	Survived
81	Riya Medekar	1051966	21-Sep-2021	34	F	5	21-Sep-2021	422	227	18.2	9.8	75	14	5.3571429	488	46	Survived
82	Irraya Hiremath	1051869	14-Aug-2021	67	M	8	14-Aug-2021	755	340	14.6	6.5	73	20	3.65	486	50	Survived
83	Waheeda Hawaldar	1051732	20-Aug-2021	65	F	5	20-Aug-2021	845	217	15.4	9.6	93	5	18.6	466	42	Survived
84	Geeta Dandin	1052160	23-Sep-2021	38	F	3	23-Sep-2021	748	200	12.9	10.5	69	23	3	526	35	Survived
85	Bapusaheb Patil	1051392	23-Sep-2021	73	M	4	23-Sep-2021	804	203	14.7	11.2	75	19	3.9473684	261	45	Survived
86	Pulakeshi Basapure	1051629	26-Sep-2021	56	M	3	26-Sep-2021	654	311	18.3	12.6	80	13	6.1538462	287	28	Survived
87	Yuvaraj Marad	1023483	18-Sep-2021	57	M	5	18-Sep-2021	570	436	15.4	13.5	88	6	14.666667	203	11	Survived
88	Jayashree Iyer	1021292	19-Aug-2021	23	F	3	19-Aug-2021	660	288	13.4	9.4	60	27	2.2222222	200	15	Survived
89	Kishan Rao	1024867	10-Jul-2021	60	M	3	10-Jul-2021	390	202	12.3	11.3	67	21	3.1904762	202	20	Survived
90	Chinmay CS	1019869	29-Jul-2021	26	F	3	29-Jul-2021	1247	291	10.8	9.8	64	20	3.2	214	22	Survived
91	Preema Hubbali	1021570	24-Aug-2021	56	F	8	24-Aug-2021	759	245	10.3	5.9	77	19	4.0526316	327	25	Survived
92	Ashna Singh	1019413	22-Jul-2021	27	F	3	22-Jul-2021	250	252	14.8	4.9	49	42	1.1666667	80	14	Survived
93	Mahesh Yaradal	1020943	14-Aug-2021	48	M	3	14-Aug-2021	503	151	14.8	4.6	49	42	1.1666667	80	14	Survived
94	Venkanna Katti	1021531	23-Aug-2021	54	M	1	23-Aug-2021	487	223	13	5.7	54	21	2.5714286	107	16	Survived
95	Shankar Laxman	1025361	13-Oct-2021	61	M	2	13-Oct-2021	250	261	17.6	10.3	79	17	4.6470588	48	13	Survived
96	Sujata Madiwal	1020424	08-Jun-2021	45	F	4	08-Jun-2021	319	186	11.1	9.3	76	19	4	13.95	15	Survived
97	Bhairu Patil	1024956	10-Aug-2021	60	M	2	10-Aug-2021	502	216	7.4	18.3	82	11	7.4545455	114	16	Survived
98	Nutan Chavan	1020649	16-Aug-2021	54	F	3	16-Aug-2021	250	197	14.8	4.9	49	42	1.1666667	86	18	Survived
99	Padmawati Rangan	1021443	21-Aug-2021	27	F	3	21-Aug-2021	702	392	9.8	9.7	54	23	2.3478261	324	22	Survived
100	Amol Khankachan	1023840	29-Sep-2021	26	M	3	29-Sep-2021	500	182	14.8	4.9	49	42	1.1666667	996	14	Survived
101	Mahadevi Savanur	1020811	08-Dec-2021	41	M	3	08-Dec-2021	217	2.29	14.8	4.9	57	34	1.6764706	80	21	Survived
102	Meghna Shrma	1019609	25-Jul-2021	24	M	3	25-Jul-2021	250	260	14.8	4.9	60	38	1.5789474	80	18	Survived
103	Kamala	1054889	14-Aug-2021	58	F	4	14-Aug-2021	329	164	10	4.5	91	4	22.75	163.5	22	Survived
104	Amit Motawani	1022727	09-Aug-2021	25	M	3	09-Aug-2021	401	250	12	7.5	65	22	2.9545455	356	21	Survived
105	Bhuwaneshwari Math	1024639	10-Apr-2021	44	F	7	10-Apr-2021	448	235	13	6.8	71	21	3.3809524	306	25	Survived
106	Sandeep Sangoram	1017707	07-May-2021	45	M	7	07-May-2021	548	259	13.5	10	84	10	8.4	357	27	Survived
107	Prakash Mote	1023711	21-Sep-2021	71	F	5	21-Sep-2021	338	178	13.8	6.7	74	18	4.1111111	608.1	22	Survived
108	Vijay Patil	1021836	27-Aug-2021	59	M	4	27-Aug-2021	1532	222	12.1	16.1	92	4	23	542	25	Survived
109	Shandayala Toroji	1021845	27-Aug-2021	52	M	5	27-Aug-2021	>5000	183	13.8	20.4	90	5	18	210.7	11.5	Survived
110	Rao Sahab	1023488	18-Sep-2021	64	M	3	18-Sep-2021	775	164	10	9.8	91	4	22.75	2000	19	Survived
111	Nangawa Kochargi	1020455	08-Jul-2021	60	M	2	08-Jul-2021	282	219	11.1	5.1	75	20	3.75	264	18	Survived
112	Suresh Bhate	1019426	23-Jul-2021	65	M	5	23-Jul-2021	746	161	14.1	7.2	70	25	2.8	429	22	Survived
113	Shankar Rao	1023326	16-Sep-2021	85	M	2	16-Sep-2021	661	203	10.11	11.4	74	19	3.8947368	61.46	18	Survived
114	Parwati Sangannavar	1024174	28-Sep-2021	60	F	5	28-Sep-2021	472	25	11.4	8.1	70	29	2.4137931	22.4	25	Survived
115	Suvarna	1055755	09-Aug-2021	48	F	6	09-Aug-2021	401	250	12	7.5	65	22	2.9545455	356	21	Survived
116	Tabrez Khan	1021407	28-Aug-2021	20	M	1	28-Aug-2021	250	191	12.1	7.6	57	35	1.6285714	21	12	Survived
117	Gulab Mulani	1022906	09-Oct-2021	78	M	5	09-Oct-2021	6702	187	12.8	6.6	88	9	9.7777778	1254	19	Survived
118	Shankar Patil	1025516	15-Oct-2021	82	M	1	15-Oct-2021	864	156	9.5	10.8	95	2	47.5	192.8	20	Survived
119	Vaman Rao	1020680	08-Oct-2021	70	M	3	08-Oct-2021	400	260	12.7	7.2	77	17	4.5294118	276	22	Survived

120	Dhanamma Shetty	1024333	29-Sep-2021	26	F	2	29-Sep-2021	140	229	13	5.2	53	36	1.4722222	151.9	11	Survived
121	Shubash Nandgauda	1023878	23-Sep-2021	72	F	2	23-Sep-2021	1451	278	15.5	8.1	89	7	12.714286	532	18	Survived
122	Shiva Linga	1024370	30-Sep-2021	54	M	1	30-Sep-2021	386	222	11.6	6.7	70	24	2.9166667	125	15	Survived
123	Ramachandra Patil	1023727	21-Sep-2021	60	M	5	21-Sep-2021	6675	227	18.2	9.3	75	14	5.3571429	1152	18	Survived
124	Ashoak Korishetti	1020944	14-Aug-2021	39	M	8	14-Aug-2021	437	340	14.6	72	73	20	3.65	2000	22	Survived
125	Anand Basappa	1021397	20-Aug-2021	56	M	5	20-Aug-2021	1519	217	15.4	251	93	5	18.6	214	24	Survived
126	Murli Dhar	1023886	23-Sep-2021	59	M	3	23-Sep-2021	605	200	12.9	7.1	69	23	3	359	16	Survived
127	Mruti Gurav	1023858	23-Sep-2021	66	M	4	23-Sep-2021	588	203	14.7	7.9	75	19	3.9473684	661	23	Survived
128	Shivappa Melavanki	1024081	26-Sep-2021	70	M	3	26-Sep-2021	1617	311	18.3	8	80	13	6.1538462	640.1	25	Survived
129	Ashwani Patil	1024337	29-Sep-2021	30	M	3	29-Sep-2021	162	214	10.2	5.6	41	48	0.8541667	79	18	Survived
130	Shantilal Vohra	1022372	09-Apr-2021	70	M	2	09-Apr-2021	785	236	10.2	6	63	23	2.7391304	456	21	Survived
131	Kalappa Rajenewar	1023275	15-Sep-2021	75	M	3	15-Sep-2021	>5000	224	11	6.6	58	32	1.8125	107.8	22	Survived
132	Ganga Bai	1023734	21-Sep-2021	58	F	2	21-Sep-2021	260	229	13.1	8.1	76	17	4.4705882	432.8	18	Survived
133	Hema Morkar	1019966	30-Jul-2021	36	F	4	30-Jul-2021	856	348	14.8	4.9	49	42	1.1666667	80	17	Survived
134	Balgauuda	1056140	16-Jul-2021	48	M	2	16-Jul-2021	652	382	10.6	6.5	50	38	1.3157895	278	14	Survived
135	Pruthvi Raj	1019037	17-Jul-2021	32	M	5	17-Jul-2021	102	183	15.6	6.9	54	40	1.35	289	18	Survived
136	Shankargouda	1055781	29-Jul-2021	56	M	4	29-Jul-2021	725	187	12.7	5.9	77	20	3.85	247	28	Survived
137	Smita Kutre	1023978	25-Sep-2021	45	M	4	25-Sep-2021	478	235	14	11	85	7	12.142857	323.7	24	Survived
138	Mahantesh	1022559	06-Sep-2021	49	M	3	06-Sep-2021	996	229	14.8	4.9	63	20	3.15	80	24	Survived
139	Namita Prakash	1019554	24-Jul-2021	28	M	3	24-Jul-2021	546	387	15	6.7	54	40	1.35	89	26	Survived
140	Ruhikesh Deshpandey	1018960	16-Jul-2021	30	M	4	16-Jul-2021	260	439	13.9	6.5	50	38	1.3157895	278	14	Survived
141	Sudakar Khobri	1019276	21-Jul-2021	36	M	7	21-Jul-2021	242	248	17.5	6.6	88	8	11	594.3	12	Survived
142	Rupa Kamble	1019504	23-Jul-2021	22	F	3	23-Jul-2021	390	210	9.2	6.8	57	37	1.5405405	4	14	Survived
143	Akawwa Desurkar	1019491	23-Jul-2021	23	M	5	23-Jul-2021	203	319	11.2	7.5	57	39	1.4615385	21.2	27	Survived
144	Mahantesh Hiremath	1019294	21-Jul-2021	57	M	2	21-Jul-2021	288	166	14.3	10.1	69	27	2.5555556	454.4	28	Survived
145	Somshekhar Hoti	1019830	29-Jul-2021	35	M	2	29-Jul-2021	412	176	13.9	5.7	56	33	1.6969697	573	22	Survived
146	Chandrahas Virnekar	1019960	30-Jul-2021	70	M	3	30-Jul-2021	250	398	13.4	13.8	54	33	1.6363636	719.5	21	Survived
147	Saira Bainu	1025257	10-Dec-2021	46	F	2	10-Dec-2021	789	345	11.7	16.3	74	16	4.625	456	22	Survived
148	Kondawal Shiwamani	1020431	08-Jun-2021	27	M	3	08-Jun-2021	265	287	14.8	6.2	49	42	1.1666667	80	28	Survived
149	Nagesh Desai	1019553	24-Jul-2021	35	M	5	24-Jul-2021	335	232	14.8	6.3	47	46	1.0217391	704	24	Survived
150	Vijay Yadav	1019545	24-Jul-2021	52	M	5	24-Jul-2021	725	187	12.7	5.9	77	20	3.85	247	28	Survived
151	Anil Shindey	1019047	18-Jul-2021	65	M	10	18-Jul-2021	362	285	11.7	6.3	78	18	4.3333333	349.4	30	Survived
152	Dyanesh Morkar	1019822	29-Jul-2021	50	M	3	29-Jul-2021	321	3.67	13.6	7.8	83	10	8.3	1577	21	Survived

ANNEXURE III – MASTER CHART - MASTER CHART FOR NON-SURVIVED PATIENTS

S.No	Name	IP No	Date of Admission=(DD/MM/YYYY)	Age (years)	Sex	Time to hospital from symptom onset (Days)	DATE OF INVESTIGATION	d-Dimer ng/ml	Platelets x10^3 /uL	Hb g/dL	TLC x10^3	NEUTROPHIL %	Lymhocyte %	N/L Ratio	Ferritin microgram/ Litre	CRP (value) milligram/Litre	Outcome
1	Niruthi Morkar	1019822	24-Aug-21	74	M	7	24-Aug-21	948	127	17.5	20.4	89	7	12.71428571	1349	21	Died
2	Rudrappa Tanvashi	1019401	22-Jul-21	69	M	6	22-Jul-21	572	191	14.5	12.1	91	6	15.16666667	387	24	Died
3	Mangala Shetti	1019733	27-Jul-21	72	F	3	28-Jul-21	562	261	12.1	6.3	79	12	6.583333333	4583	178	Died
4	Jayashree Tipanawar	1013634	06-May-21	51	M	4	06-May-21	4589	63	10.8	4.4	77	11	7	3980	147	Died
5	Shaikh aftulla	1019721	27-Jul-21	64	M	10	28-Jul-21	5000	152	12.1	12.6	91	7	13	421	210	Died
6	Iragouda Patil	1021469	21-Aug-21	85	M	3	21-Aug-21	4521	255	11.8	10.3	94	2	47	212	169	Died
7	Vijayalaxmi Pramaj	1022318	09-Mar-21	66	F	7	03-Sep-21	1346	107	11.5	12	89	6	14.83333333	915	210	Died
8	Sarojni Khot	1022362	09-Mar-21	58	M	3	03-Sep-21	400	315	11.1	11	91	6	15.16666667	106	147	Died
9	Vishwanath Hatapaki	1021169	17-Aug-21	70	M	3	17-Aug-21	280	192	12	4.2	65	22	2.954545455	810	169	Died
10	Hamichand Chavan	1021530	22-Aug-21	57	M	5	23-Aug-21	>5000	108	14.1	21.1	94	2	47	943	27	Died
11	Naseen Mulgani	1019598	25-Jul-21	60	M	3	25-Jul-21	854	182	12.6	14.5	83	13	6.384615385	441.6	210	Died
12	Basavani Hanji	1020782	12-Aug-21	82	M	5	08-Dec-21	725	166	11.4	13	80	16	5	78.79	326.7	Died
13	Nanda Ghasati	1021922	28-Aug-21	58	F	2	28-Aug-21	723	145	10.4	12	94	5	18.8	156	71	Died
14	Patreppa Munoli	1020039	31-Jul-21	73	M	3	31-Jul-21	1023	95	13.9	23.5	72	18	4	858	124	Died
15	Dannamma Kavali	1022367	09-Mar-21	75	M	3	09-Mar-21	676	120	10.8	4.3	72	19	3.789473684	256	192	Died
16	Basavraj Tummarguddi	1020295	08-Apr-21	59	M	2	08-May-21	1254	112	10.4	5.4	63	24	2.625	231	124	Died
17	Vithal Naik	1020750	08-Nov-21	64	M	5	08-Nov-21	5000	180	13.2	14.7	93	4	23.25	1014	26	Died
18	Savitri Naik	1022733	09-Aug-21	70	M	4	09-Sep-21	103	376	10.3	9.8	64	20	1	104	11.5	Died
19	Suresh Rao	1020523	08-Aug-21	71	M	2	08-Aug-21	290	147	13.6	5.5	82	13	6.307692308	344	88.5	Died
20	Jayant Chougle	1019616	25-Jul-21	83	M	4	25-Jul-21	1043	195	15.6	10.2	87	7	12.42857143	1186	9.3	Died
21	Jagdeesh Khot	1022407	04-Sep-21	67	M	3	09-Apr-21	1320	200	12.6	16.4	95	3	31.66666667	269	25	Died
22	Mahananda Katti	1021629	24-Aug-21	73	F	3	24-Aug-21	360	164	11.3	6.3	74	21	3.523809524	80.2	102	Died
23	Shrishail Uppin	1023926	24-Sep-21	72	M	7	24-Sep-21	419	214	12.5	12.4	90	8	11.25	3669	652	Died

24	Shankar Chougle	1022264	09-Feb-21	60	M	4	02-Sep-21	1352	378	17.3	47.1	94	1	94	1013	231	Died
25	Naganath Kodakany	1022671	09-Jul-21	39	M	4	07-Sep-21	2145	38	15.4	9.8	64	32	2	1212	245	Died
26	Uday Revankar	1023965	24-Sep-21	70	M	3	24-Sep-21	644	225	16.1	8.1	86	11	7.818181818	1434	169	Died
27	Rohit Shinde	1051416	24-Aug-21	28	M	7	24-Aug-21	1049	127	17.5	5.1	89	7	12.71428571	595.5	244.6	Died
28	Ashok Kamble	1051689	22-Jul-21	65	M	6	22-Jul-21	1090	191	14.5	15.5	91	6	15.16666667	538.7	220	Died
29	Nagappa Sullad	1051916	27-Jul-21	56	M	3	28-Jul-21	1195	261	12.1	7.6	79	12	6.583333333	608	228.4	Died
30	Dileep Salunke	1051967	06-May-21	46	M	4	06-May-21	1185	63	10.8	7.6	77	11	7	600	210.5	Died
31	Somappa Sonnad	1051164	27-Jul-21	45	M	10	28-Jul-21	685	152	12.1	7.1	91	7	13	528.48	208.1	Died
32	Dhanaji Jadhav	1051495	21-Aug-21	34	M	3	21-Aug-21	1504	255	11.8	14.4	94	2	47	1038.1	225.2	Died
33	Bahaddur Dalawai	1051825	09-Mar-21	53	M	7	03-Sep-21	1134	107	11.5	14.3	89	6	14.83333333	1419.9	238.9	Died
34	Parwati Jamakhandi	1050723	09-Mar-21	68	F	3	03-Sep-21	686	315	11.1	9.8	91	6	15.16666667	758.2	209	Died
35	Arun Yellurkar	1051940	17-Aug-21	45	M	3	17-Aug-21	570	192	12	7.4	65	22	2.954545455	719.8	218.4	Died
36	Devendra Lamani	1050819	22-Aug-21	37	M	5	23-Aug-21	816	108	14.1	15	94	2	47	1022.7	210.7	Died
37	Revayya Mathad	1052228	25-Jul-21	40	M	3	25-Jul-21	807	182	12.6	13	83	13	6.384615385	982	217	Died
38	Jahirabbas Dodamani	1052053	12-Aug-21	35	M	5	08-Dec-21	633	166	11.4	7.3	80	16	5	1086.2	215.2	Died
39	Zuje Minaj	1052560	28-Aug-21	45	F	2	28-Aug-21	775	145	10.4	12.5	94	5	18.8	1239.5	216.4	Died
40	Lohit Badami	1052067	31-Jul-21	35	M	3	31-Jul-21	1807	95	13.9	14.6	72	18	4	900.6	214.2	Died
41	Kamu Kempi	1051482	09-Mar-21	65	F	3	09-Mar-21	1713	120	10.8	12.1	72	19	3.789473684	898.7	238.8	Died
42	Shettappa Baleshgol	1051784	08-Apr-21	74	M	2	08-May-21	1450	112	10.4	18.2	63	24	2.625	1070.9	217.6	Died
43	Uma Patil	1052238	08-Nov-21	55	F	5	08-Nov-21	1361	180	13.2	21.52	93	4	23.25	1685	215	Died
44	Ningavva Pujeri	1050868	09-Aug-21	60	M	4	09-Sep-21	1420	376	10.3	19.9	64	20	1	1965	215	Died
45	Anususya Ronad	1051783	08-Aug-21	62	F	2	08-Aug-21	1425	147	13.6	16.2	82	13	6.307692308	1402.2	253.4	Died
46	Ratnaprabha Sadekar	1051950	25-Jul-21	72	M	4	25-Jul-21	1155	195	15.6	12	87	7	12.42857143	1236	250.2	Died
47	Patreppa Wali	1051158	04-Sep-21	71	M	3	09-Apr-21	1157	200	12.6	11.4	95	3	31.66666667	601.2	210.5	Died
48	Revappa Jodatti	1051785	24-Aug-21	65	M	3	24-Aug-21	1406	164	11.3	11.9	74	21	3.523809524	1501	248.2	Died
49	Akkamahadevi Koti	1051703	24-Sep-21	70	F	7	24-Sep-21	5605	214	12.5	21.3	90	8	11.25	588	229.8	Died
50	Meera Patil	1051853	09-Feb-21	60	F	4	02-Sep-21	1431	378	17.3	10.6	94	1	94	1075	246.5	Died
51	Mallanna Hosmani	1051708	09-Jul-21	58	F	4	07-Sep-21	1413	38	15.4	8.4	64	32	2	902.7	207.6	Died

52	Rayappa	1051925	24-Sep-21	46	M	3	24-Sep-21	1440	225	16.1	10.7	86	11	7.818181818	1352	218	Died
53	Parasharam kolekar	1051733	09-Nov-21	35	M	3	11-Sep-21	1889	238	12.4	14.1	62	32	1.9375	2746	229	Died
54	Uday Patil	1052062	09-May-21	44	M	4	05-Sep-21	1105	69	13.4	13.3	94	3	31.33333333	1250	236	Died
55	Chandrakant Naik	1051899	09-Aug-21	42	M	2	08-Sep-21	1255	459	12.5	9.2	89	9	9.888888889	1260.02	209	Died
56	Shivaji Kanade	1053801	25-Jul-21	41	M	3	25-Jul-21	1232	183	8.5	7.9	90	5	18	1278.8	209.3	Died
57	Sanjay Mohire	1051481	08-Aug-21	55	M	8	08-Sep-21	1415	147	14.1	11.05	81	16	5.0625	1090	208	Died
58	Yallavva	1052179	09-Aug-21	75	M	1	08-Sep-21	3405	232	12.8	20	97	2	48.5	1250	237	Died
59	Gangadhar Gokanvi	1052881	25-Jul-21	44	M	4	26-Jul-21	5110	184	10.8	26	89	6	14.83333333	1397	237.3	Died
60	Murughesh Harihar	1052183	15-Sep-21	44	M	7	16-Sep-21	1195	169	14.3	9.7	75	20	3.75	1402	254	Died
61	Parappa Jabin	1051868	15-Sep-21	47	M	2	15-Sep-21	1803	140	13.9	10.6	76	21	3.619047619	1097	226	Died
62	Suresh Khirai	1051047	21-Aug-21	46	M	4	21-Aug-21	1221	234	13	10.9	88	9	9.777777778	1882	208	Died
63	Tohindas	1052528	29-Aug-21	14	M	7	29-Aug-21	1415	132	13.5	12.9	95	4	23.75	850	214	Died
64	Prashant Patil	1052539	16-Aug-21	34	M	2	16-Aug-21	1043	261	12	9.6	86	11	7.818181818	800	216	Died
65	Nagesh Kulkarni	1052550	27-Aug-21	78	M	11	28-Aug-21	1304	236	13.3	13	90	4	22.5	800	226	Died
66	Basangouda Patil	1052553	21-Aug-21	63	M	5	21-Aug-21	857	208	16.7	14.1	95	2	47.5	836	218	Died
67	Dattatraya Jinagar	1052569	15-Aug-21	36	M	20	15-Aug-21	721	419	15.7	15.5	71	19	3.736842105	858	236	Died
68	Srikanth Bhuvanageri	1050688	31-Aug-21	26	M	5	31-Aug-21	911	107	10.1	11.6	93	5	18.6	1052	238	Died
69	Vivek Malshet	1051290	20-Aug-21	66	M	2	20-Aug-21	1080	135	17.1	8.9	81	14	5.785714286	645	250	Died
70	Vasant Metri	1051297	13-Aug-21	55	M	3	13-Aug-21	1267	140	14.7	10.7	86	6	14.33333333	1046	252	Died
71	Balaasaheb Sutar	1051403	08-Nov-21	45	M	5	08-Nov-21	973	179	11.8	10.6	73	22	3.318181818	628	236	Died
72	Vivek Somashekar	1051493	27-Jul-21	29	M	4	27-Jul-21	734	121	15.4	6.5	76	19	4	613.5	222	Died
73	Mallanna Hosmani	1051708	22-Aug-21	58	F	3	23-Aug-21	748	257	11.8	6.8	90	6	15	947.5	215.3	Died
74	Maruti Pandhari	1051782	29-Aug-21	33	M	5	29-Aug-21	755	203	9.3	13.8	93	6	15.5	952	218.8	Died
75	Shankar Chougala	1052467	18-Aug-21	64	M	3	19-Aug-21	713	208	13.4	7.8	87	7	12.42857143	835	218	Died
76	Manoj Togale	1052480	13-Aug-21	44	M	4	13-Aug-21	848	267	12.3	8.8	64	32	2	973.5	222	Died
77	Vinay Bankar	1051954	24-Aug-21	48	M	3	25-Aug-21	1159	203	15.2	7.9	87	10	8.7	1101	238	Died
78	Manjunath Patil	1052482	29-Aug-21	42	M	3	30-Aug-21	1257	248	11.7	12	92	4	23	800	210	Died
79	Mallappa Kanade	1052513	19-Aug-21	38	M	5	20-Aug-21	685	205	14	10.6	89	7	12.71428571	718	215	Died

80	Sanjay Patil	1052520	09-Nov-21	47	M	3	11-Sep-21	1063	292	13.4	11.5	73	8	9.125	930	235	Died
81	Malappa Kanade	1052513	22-Aug-21	38	M	7	22-Aug-21	1180	428	11.5	12.5	95	3	31.66666667	1000	240	Died
82	Jayashree Patil	1052554	13-Sep-21	57	F	2	14-Sep-21	1085	206	10.9	13.5	71	18	3.944444444	880	245	Died
83	Basavaraj Kudachi	1052559	02-Aug-21	80	M	3	02-Aug-21	952	131	10.5	11.5	78	12	6.5	910	245	Died
84	Basavaraj Hulajatti	1052715	08-Nov-21	46	M	4	08-Nov-21	827	300	9	11.8	74	18	4.111111111	938	246	Died
85	Shivanand Maddani	1052770	19-Sep-21	46	M	3	19-Sep-20	1160	167	17.2	8.5	90	6	15	936	250	Died
86	Bharat Kumar Doshi	1050970	09-Nov-21	46	M	5	09-Nov-21	1250	220	13.9	11.6	97	2	48.5	916	242	Died
87	Shobha Joshi	1051166	08-Sep-21	67	F	6	09-Sep-21	1153	447	18	12.5	76	5	15.2	976	235	Died
88	Pavan Sortur	1051746	13-Aug-21	30	M	6	13-Aug-21	1209	220	15.3	13.2	84	12	7	711	245	Died
89	Sandhya Rawoorker	1052125	22-Aug-21	52	F	3	23-Aug-21	1059	139	13.4	14.6	98	1	49	737	228	Died
90	Mahadev Maruti	1022916	09-Nov-21	50	M	3	11-Sep-21	1392	238	12.4	6.7	62	32	1.9375	308	649.8	Died
91	Mahadev Mageppa	1022462	09-May-21	51	M	4	05-Sep-21	1349	69	13.4	20	94	3	31.33333333	2318	321	Died
92	Shanaka Balikai	1022738	09-Aug-21	63	M	2	08-Sep-21	1482	459	12.5	10.3	89	9	9.888888889	413	214	Died
93	Noorjahan	1019602	25-Jul-21	68	M	3	25-Jul-21	5000	183	8.5	19	90	5	18	737.9	214	Died
94	Chandrakant Mali	1020598	08-Aug-21	49	M	8	08-Sep-21	937	147	14.1	4.7	81	16	5.0625	1349	96	Died
95	Sangayya	1066931	08-Nov-21	52	F	4	08-Nov-21	1267	140	14.7	10.7	86	6	14.33333333	1046	252	Died
96	Ramappa Kagawade	1022740	09-Aug-21	74	M	1	08-Sep-21	>5000	232	12.8	16.7	97	2	48.5	499	54	Died
97	Dadu Shetti	5783029	25-Jul-21	73	M	4	26-Jul-21	1205	1,84,	10.8	14.1	89	6	14.83333333	1791	46	Died
98	Govind Salunkhe	1023296	15-Sep-21	66	M	7	16-Sep-21	573	169	14.3	2.6	75	20	3.75	847.6	54	Died
99	Sangeeta Deshpande	1023272	15-Sep-21	52	M	2	15-Sep-21	1217	140	13.9	10.9	76	21	3.619047619	516.7	218.6	Died
100	Nanda Jangale	1021459	21-Aug-21	56	M	4	21-Aug-21	765	234	13	14.7	88	9	9.777777778	923	140	Died
101	Jaganath Hanmathgad	1021997	29-Aug-21	71	M	7	29-Aug-21	660	132	13.5	11.3	95	4	23.75	271	14	Died
102	Indumati Jirankali	1021081	16-Aug-21	66	F	2	16-Aug-21	328	2610	12	9.7	86	11	7.818181818	82.91	28	Died
103	Vishwanath Karachi	1021843	27-Aug-21	84	M	11	28-Aug-21	898	236	13.3	13	90	4	22.5	385.3	29	Died
104	Vishwanath Bellad	1021421	21-Aug-21	64	M	5	21-Aug-21	7028	208	16.7	29.7	95	2	47.5	1507	123	Died
105	Irshad Naik	1021050	15-Aug-21	32	M	20	15-Aug-21	871	419	15.7	18	71	19	3.736842105	759	158	Died
106	Adiveppa Kadamani	1022051	31-Aug-21	65	M	5	31-Aug-21	346	107	10.1	17	93	5	18.6	2000	142	Died
107	Anil Chougale	1021386	20-Aug-21	36	M	2	20-Aug-21	2789	135	17.1	14.4	81	14	5.785714286	645	254	Died

108	Manohar Munagi	1020930	13-Aug-21	68	M	3	13-Aug-21	3214	140	14.7	15.8	86	6	14.33333333	632.4	214	Died
109	Vivekanand	1064333	09-Nov-21	72	M	4	09-Nov-21	1153	447	18	12.5	76	5	15.2	976	235	Died
110	Basaveshawar Channavar	1020766	08-Nov-21	56	M	5	08-Nov-21	187	179	11.8	6.4	73	22	3.318181818	229	216	Died
111	Tammanna Kore	1019711	27-Jul-21	77	M	4	27-Jul-21	431	121	15.4	5.16	76	19	4	1015	299	Died
112	Mahadevi Patanshetti	1021514	22-Aug-21	65	F	3	23-Aug-21	1528	257	11.8	13	90	6	15	432	228	Died
113	Jaysingh Desai	1021972	29-Aug-21	69	M	5	29-Aug-21	509	203	9.3	4.3	93	6	15.5	904	241	Died
114	Mallikarjun Puthane	1021262	18-Aug-21	68	M	3	19-Aug-21	>5000	208	13.4	16.1	87	7	12.42857143	2000	316.5	Died
115	Mahadev Minache	1020855	13-Aug-21	81	M	4	13-Aug-21	4568	267	12.3	7.8	64	32	2	46.52	300	Died
116	Annasaheb Bagewadi	1021636	24-Aug-21	61	M	3	25-Aug-21	350	203	15.2	9.4	87	10	8.7	1341	314	Died
117	Ishwar Kankanwadi	1021950	29-Aug-21	58	M	3	30-Aug-21	1327	248	11.7	8.6	92	4	23	529	252	Died
118	Arunkumar Katti	1021326	19-Aug-21	57	M	5	20-Aug-21	4258	205	14	6.2	89	7	12.71428571	1133	250	Died
119	Appasaheb Kolaki	1022949	09-Nov-21	84	M	3	11-Sep-21	1580	292	13.4	22.7	73	8	9.125	567	299	Died
120	Sangeeta Kurale	1021523	22-Aug-21	52	M	7	22-Aug-21	4500	428	11.5	34.5	95	3	31.66666667	317	214	Died
121	Shantavva Patil	1023099	13-Sep-21	81	F	2	14-Sep-21	1245	206	10.9	12.1	71	18	3.944444444	320.6	127.5	Died
122	Indarchand Oswal	1020115	02-Aug-21	78	M	3	02-Aug-21	2687	131	10.5	20	78	12	6.5	322	128	Died
123	Padmavati Ranavath	1020763	08-Nov-21	60	F	4	08-Nov-21	2568	300	9	9	74	18	4.111111111	256.3	214	Died
124	Raghoba Malik	1023505	19-Sep-21	90	M	3	19-Sep-20	>5000	167	17.2	8.1	90	6	15	1290	241	Died
125	Sanjay Ginde	1022988	09-Nov-21	60	M	5	09-Nov-21	1193	220	13.9	14.6	97	2	48.5	615	217	Died
126	Shekargouda Patil	1022752	08-Sep-21	38	M	6	09-Sep-21	1258	447	18	39.8	76	5	15.2	347	256	Died
127	Altaf Hussain	1020910	13-Aug-21	59	M	6	13-Aug-21	2587	220	15.3	7.8	84	12	7	1566	200.4	Died
128	Shidagouda Patil	1021528	22-Aug-21	70	M	3	23-Aug-21	968	139	13.4	9.8	98	1	49	2574	189	Died
129	Appasaheb Naik	1023093	13-Sep-21	70	M	4	13-Sep-21	781	402	10.3	12.3	98	1	49	1658	154	Died
130	Sharada Mahajan	1022908	10-Sep-21	55	F	7	09-Oct-21	666	217	11.3	4.7	68	28	2.428571429	450	42	Died
131	Laxman Anagolkar	1020525	08-Aug-21	50	M	4	08-Aug-21	2879	135	14.4	9.8	68	29	2.344827586	3037	212.6	Died
132	Uday Fadipatil	1020446	08-Jun-21	46	M	4	06-Aug-21	4568	408	11.9	6.3	85	11	7.727272727	2157	210.3	Died
133	Shivanand Sannaik	1021029	15-Aug-21	75	M	3	15-Aug-21	>5000	102	13.8	7.9	87	11	7.909090909	810	208.9	Died
134	Amar Tibile	1023170	14-Sep-21	47	M	3	14-Sep-21	1141	184	15.1	12.3	89	7	12.71428571	847	198	Died
135	Sheetal Neelagouder	1023297	15-Sep-21	49	M	5	16-Sep-21	2147	47	13.1	11.6	89	7	12.71428571	758.9	301.8	Died

135	Sheetal Neelagouder	1023297	15-Sep-21	49	M	5	16-Sep-21	2147	47	13.1	11.6	89	7	12.71428571	758.9	301.8	Died
136	Udaykumar Desai	1021203	18-Aug-21	60	M	4	18-Aug-21	1301	195	12.3	8.3	62	34	1.823529412	258	228.7	Died
137	Sidharaya Patil	1021494	22-Aug-21	81	M	3	22-Aug-21	2145	131	13.7	3.9	74	21	3.523809524	513	245.2	Died
138	Yallappa Madagannavar	1023059	13-Sep-21	77	M	4	13-Sep-21	999	464	12.6	16	84	8	10.5	387	47	Died
139	Subhash Hooli	1020214	08-Mar-21	74	M	3	08-Mar-21	517	347	12.7	14	82	12	6.833333333	305	114.4	Died
140	Balaram Dhangawade	1020620	08-Sep-21	54	M	3	08-Sep-21	1608	246	11.8	12	91	6	15.16666667	325.2	85.7	Died
141	Laxman Hongekar	1020695	08-Oct-21	70	M	2	08-Oct-21	2314	278	11.9	13.1	91	5	18.2	254	58	Died
142	Prabhavati Kale	1023607	20-Sep-21	63	M	3	20-Sep-20	881	133	12.1	21	94	4	23.5	489	787	Died
143	Balagouda Patil	1024541	10-Feb-21	80	M	4	10-Feb-21	>5000	78	15.8	6.8	95	3	31.66666667	214	771	Died
144	Bhupal Badachi	1023176	14-Sep-21	70	M	4	14-Sep-21	4987	185	13.9	7.4	90	8	11.25	457	874	Died
145	Shantadevi Kore	1024729	10-May-21	80	F	3	10-Jun-21	655	202	11.8	7.8	77	13	5.923076923	161	772	Died
146	Annappa Patanshetti	1024059	26-Sep-21	79	M	4	26-Sep-21	1458	348	15.4	11.8	90	6	15	161	214	Died
147	Manohar Gawade	1022971	09-Nov-21	57	M	5	09-Nov-21	673	96	13.7	14.2	96	2	48	254	217	Died
148	Krishna Kutre	1019824	28-Jul-21	58	M	2	28-Jul-21	1237	285	13.6	10.3	91	5	18.2	2254	200	Died