International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 28-06-2021, Accepted: 13-07-2021, Published: 28-07-2021
Volume 6, Issue 4, 2021, Page No. 449-455

Conspectus of Covid-19

D Shah[1], A Sherje[2*]
[1] Department of Quality Assurance, SVKM's Dr. Bhanuben Nanavati College of Pharmacy, University of Mumbai, Maharashtra, India
[2] Assistant Professor, Department of Pharmaceutical Chemistry and Quality Assurance, SVKM's Dr. Bhanuben Nanavati College of Pharmacy, Mumbai, Maharashtra, India

Abstract
Coronavirus disease 2019 (Covid-19) is the current pandemic that has kept the world at a standstill. This paper will attempt to help laymen understand this situation in a better way, this paper not only gives a basic understanding of, the transmission of viruses and how the virus interacts with the body and the bodily response towards it but also explains the covid-19 situation more thoroughly, giving the basic knowledge about coronaviruses, its classification, the origin of covid-19, transmission and symptoms, testing, therapies given, infectivity and epidemiology, vaccine candidates, the role of WHO. People need to scientifically understand the pandemic situation for their betterment and this paper will help them, they need to understand the situation better, so that fear-mongering stops. The most important thing is to show solidarity in this time of crisis.

Keywords: Covid-19, coronavirus, WHO, viruses, transmission

Introduction
This article serves a purpose to help understand coronaviruses, and the covid-19 pandemic in a simple way and also comprehend the basic concepts related to a virus. Understanding what exactly covid-19 is, such that all the myths and misinformation barriers are broken down. To make people more aware of the situation that has curtailed the entire globe [1].

Viruses [2, 3, 4]
A virus is a sub-microscopic infectious agent that has the capability of reproducing itself within the host cell.

Virus-cell interaction [5]
Viruses are pathogens whose replication completely depends on the host cell. Generally, the interaction between the virus and host can lead to, production of new virions, abortive infection latency, transformation. (Table1)

Table 1: Show possible range of interaction

Type of interaction or effect on cell	Result	References
Cytolytic, infection is productive	Virus formed	
Non-cytolytic (persistent) but infection is productive.	Virus formed	
Abortive (means replication cycle not completed), therefore infection is non-productive.	Virus not formed	
Abortive(steady state, means manipulation of virus in-vitro	Virus formed	
Latency(little or no viral gene expression)	Viral nuclei acid formed	
Transformation(host cell show properties of tumour cell because of selected expression of viral genome	Viral nuclei acid formed	5

Transmission [6]
For a virus to become active in a host, the route of transmission is responsible. There are many routes of transmission, the First being cell to cell transmission. Generally in cell to cell transmission, viruses transmit their virions or nuclei acid through intracellular connections between adjacent cells present in the host. In the case of plants and algae, this type of cell-to-cell transmission can be accomplished with the help of plasmodesmata (which is a cytoplasmic intracellular bridge that connects adjacent cells). Movement proteins are a special type of proteins encoded by viruses to overcome the physical barrier they receive due to the exclusive size of plasmodesmata so that the virions or nuclei acid can pass through it easily. While certain viruses use phloem vessels of xylem vessels to infect the host systemically. In the case of animal viruses cell to cell, transmission occurs either by diffusion (cell-free transmission through extracellular space) or direct cell to cell contact. In the case of cell-free transmission, the virions will travel through the bodily fluids to various tissues, for example, lymphatic vessels can act as a route for transmission from exposed surfaces like skin, respiratory mucosa directly into the animal body. Cell-free transmission helps to spread the virus easily by a long-distance within the animal body but cell to cell contact is more effective because here there are no restrictions by any physical barrier. So in cell to cell contact, the viruses can use pre-existing cell interfaces like neurological or immunological synapses or develop their transitory contact between the infected cell and target cell. The second being environmental transmission, in this many viruses, often survive in the environment when they are cast off from either infected cell or carrier host. In general, studying environmental transmission is of utmost importance from an epidemiological point of view. It would not be an overstatement to say that we humans are surrounded by viruses like generally a free virus has a projected, half-life of 48 hours. A virus can be transported via air, water, soil,

also through the urine, blood, saliva, feces of an infected person. But for a virus to survive it has to deal with many physical, chemical, biological factors. For example, many factors like temperature, PH, acidity, alkalinity, UV radiation, etc, have an impact on many viruses, certain viruses are still susceptible to these and certain viruses have become resistant to these factors, for example, viruses belonging to the families of myoviridae, podoviridae, can sustain fluctuation in temperature and remain infectious for several years. Like it is a general notion that enveloped viruses degrade faster or stay in the environment for a lesser time than naked viruses. Many times a vector or a non-host (like cockroaches or mosquitoes) can act as a carrier for the virus. The third being horizontal/vertical transmission, in horizontal/vertical transmission of the virus, varies on various complexities. Now in vertical transmission, the viruses vertically are passed from the mother to the child, while in horizontal transmission the viruses are transmitted within individuals either directly or indirectly. Direct transmission can be through air, water, food, or sexual, while indirect can be from a vector or an inanimate object (fomite meaning materials like utensils, clothes)

Host response to a virus [7]

The human immune system is a complex system that works in multiple ways to fight against various pathogens, so for basic understanding, the immune system shows a response to any pathogen depending on how it infects and replicates within the host. The immune system shows two kinds of response an immediate innate response and a slower adaptive response.

Innate immunity: This system forms the first line of defence against any threats to our body, various cells, molecules and barriers form a rapid response team against any pathogen. Three basic things are associated with innate immunity they are, it is always ready to react, broad-spectrum i.e. it recognises pathogen associated molecular pathways (PAMPS), rather than a specific pathogen and consistency (reacts invariably to repeated exposure).Innate immunity consists of, barrier tissue which are the first line of defence to any treat since these are the tissues are present at sites on the body, which is constantly in interaction with the environment. For example, keratin on the skin, mucus at mucosal barrier. Key cells includes cells present in the tissues and leukocytes (like neutrophils, monocytes and other cells like dendritic cells, mast cells and macrophages), the receptors present on these cells are responsible for identifying the PAMPS and all these cells have a key functions to destroy or ingest the pathogen. Interference of RNA is also an innate defence against viruses, it is a complex mechanism. This complex mechanism degrades the viral mRNA such that it doesn't cause viral protein production within the host cell. Then there is adaptive immunity, this system of immunity has higher specificity and is more powerful than innate immunity against invading pathogens. Adaptive immunity includes b-cell based humoral immunity and T-cell based cellular immunity. Three things to remember about adaptive immunity are specificity, recognition of self- adaptive immunity has the ability to characterize between harmful foreign materials and harmless foreign materials and memory. Lymphocytes are the special cells of adaptive immunity, T-cells and B-cells are the two type of lymphocytes. For a better understanding on adaptive immunity response, understanding the concept of humoral and cellular immunity is needed. Humoral immunity is basically based on B-cells, B-cells they produce antibodies, these antibodies are the special proteins that bind or attach to many different types of protein molecules. Theses antibodies have similar structural component, they contain the antigen recognition site and a constant region (this region is different for each of the various isotypes of antibodies like IgG,IgA,IgM,IgE,IgD) .These isotypes they have the ability to perform numerous diverse functions. Like IgG, IgM, IgA these antibodies they bind to the antigen and prevent it from interacting with the molecules or cells this process is called neutralization. There is complement fixation (which is performed by IgG and IgM) where antibodies produce complement proteins, which bind to the surface of the pathogen, this assists in opsonisation. Opsonisation is the process where the surface of pathogen is coated with molecules, which are then identified by the immune cells and are ingested. IgG and IgM are detected during immunity testing, So IgM are produced within a few weeks of infection, that is why its presence can indicate acute infection while IgG helps us indicate if infection has occurred to us in the past. There is a unique way the body can remember any attack through pathogens is by Memory B-cells, these cells will become re-activated if similar kind of pathogen is invading the body. T-cell based cellular immunity is another branch of adaptive immunity, the antibodies that are formed by the b-cell they generally attack the protein molecules of the invading pathogen, while T-cells they attack the peptide molecules of specific pathogen, majorly T-cells the attack invading viruses. For basic understanding we just need to know that there are two types of T-cells, one is CD8+ (Killer T-cells / or cytotoxic T lymphocytes) and another one is CD4+ (effector cells/ helper T-cells).Now the CD8+ they in general travel around the body and kill all the cells, that contain viral or pathogen peptide, while the CD4+ are called as helper T-cells which, they activate other immune cells to execute their function, CD4+ T cells have different types like Th1, Th2, Thf, Th17, and regulatory T cells (T-regs), all these subtypes they enhance the ability of other immune cells (macrophages, eosinophils etc) to fight against invading viruses and Then there is memory T-cells these remember the specific microbe and on its re-attack get re-activated to eliminate them.

Coronaviruses [8]

Understanding about Coronaviruses and the latest pandemic that has kept millions at home. Coronaviruses are broad spectrum animal and human viruses, where the virions are enveloped and spherical in shape, and each particle is encircled by a corona which are the bulbous distant end enclosing the virion.

Specifications [9, 10]

Understanding the classification, basic structural properties and genome of coronaviruses. Coronaviruses are part of family coronaviridae (order is Nidovirales) this family consist of further sub-families called coronavirinae and torovirinae.

Now the coronavirinae is further sub divided into alpha, beta, delta and gamma coronaviruses. (Fig1)

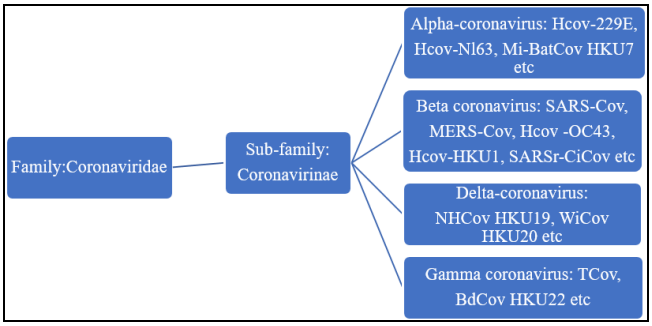

Fig 1: Showing the family and sub-family of human Coronaviruses

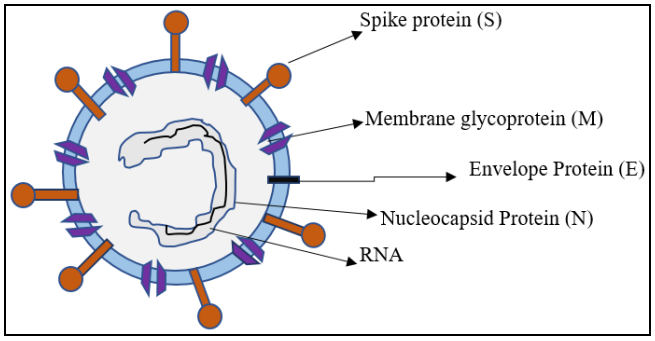

Fig 2: Structure of Coronavirus

Structure of coronavirus [12]

The size of virion is around 80-220 nm and these virions are made up of three to four structural proteins they are Glycoprotein S Nucleocapsid Protein (N), Transmembrane glycoprotein (M), Transmembrane protein E and another Enveloped protein hemagglutinin-esterase.(Fig.2). It contains a linear plus single stranded RNA (ssRNA) which is about 30 kb, possibly the largest RNA viral genome, and the size of virion is about 80 to 220 nm [9].

Covid -19

Origin

The virus originated from Wuhan, China (Hubei province) and Wuhan being one of the most densely populated city having a population of 11 million. So on 31st December 2019, 27 cases of pneumonia of unknown origin were identified near the Wuhan's Huanan Seafood wholesale market, this market is famous for selling all kind seafood and variety of live animal species including bats,snakes etc . A 55 – year old individual must have contracted the virus even before the first case was officially declared and also one of the articles in lancet claiming that onset of symptoms were seen in one patient on 1st Dec 2019 [16].

Basic interaction of sars-cov-2 with the body [10, 11, 14]

The SARS-CoV-2, 30 kb genome encodes proteases and an RNA-dependent RNA polymerase (RdRp) as well as several structural proteins. The SARS-CoV-2 virion consists of a helical capsid formed by nucleo-capsid (N) proteins bound to the RNA genome and an envelope made up of membrane (M) and envelope (E) proteins, coated with trimeric spike (S) proteins. Now the S protein is the one that binds to ACE2 (Angiotensin converting enzyme), ACE2 is found on the plasma membrane mainly of lung type II alveolar cells, small intestine and also on the endothelial cell and smooth muscle cell of most organs. After binding, the host serine protease TMPRSS2 cleaves the viral S, allowing viral entry. A strong type I interferon antiviral response and CD4+ and CD8+ T cell immune response is seen against SARS-COV-2. Now if a person has a robust immune system, the immune system will fight against the virus and maybe that's how a majority of people are asymptomatic. Now in many cases there is a delayed antiviral level leading to cytokine storm (in this condition what happens is that there is an increase in the level of inflammatory cytokines which are interleukin IL-1, IL-6, IL-12 and this situation has lead to respiratory failure in many cases), such a condition can be seen in moderate to severe cases, while in mild to moderate cases we can see lymphopenia (where there is a decrease in lymphocytes due to either infection of lymphocytes or suppression of bone marrow by antiviral response. That each case is different and need to analyse each condition because all the people around the globe have a immune system that is different.

Transmission and symptoms [11, 12, 13]

Almost everyone around the globe know that transmission is majorly through respiratory droplets and aerosolized means that major route is airborne but it can also be due to fomite, faecal-oral, blood-borne, mother to child and animal to human transmission according to WHO. The incubation period of covid-19 is between 2-14 days and the symptoms that can be seen are fever 87.9% (44% at time of diagnosis) dry cough 67.7%, fatigue 38.1%, sputum production 33.4%, dyspnea(shortness of breath) 18.6%,myalgia/arthralgia(pain in muscles) 14.8%, sore throat 13.9%,headache 13.6%, chills 11.4%, nausea/vomiting 5%, nasal congestion 4.8% and diarrhoea 3.7% . Other symptoms that can also be seen with the above symptoms are conjunctivitis Skin rashes Ear infection Back pain Neck pain Anosmia (loss of smell) and ageusia (loss of taste).

Epidemiology and infectivity

Epidemiology in basic term means the distribution of a disease condition among the population. Total number of cases worldwide are 23.7 million and counting, with 17.1 million recovered and 0.8 million deaths. There are 6.6 million active cases still around the globe out of which 6.5 million have mild symptoms (99%) and the rest 1% is critically ill. 17.1 million are the closed cases out of which 16.3 million are recovered (95%) and 0.8 million deaths (5%) and the number will keep increasing and decreasing depending on the number of cases. Understanding about the infectivity, to understand this we need to know about reproductive number (denoted by R0/pronounced as R-zero) basically the number denoted by this, is the average number or expected number of people that an infected person can spread the virus till the he/she is infected. It helps us establish whether a virus outbreak can lead to a epidemic/pandemic or whether it will become extinct (R0 >1 then epidemic and R0 <1 outbreak will become obsolete). R0 can provide us information herd immunity as well (R0-1/R0 is the fraction of individual that will have to be infected to establish herd immunity).The infection fatality rate (also known as death rate) tells us about how the true severity of the disease.

$$\text{IFR (\%)} = \frac{\text{Number of deaths}}{\text{Number of infected individuals}} \times 100$$

According to WHO the IFR should be around 3.4% and according to Centres of disease control is around 0.26% -1

%. The case fatality rate, helps in determining the severity among detected cases, reliable CFR can help determine how deadly the outbreak is.

$$\text{CFR (\%)} = \frac{\text{Number of deaths from the disease}}{\text{Number of deaths from disease} + \text{Number of recovered from disease}} \times 100$$

The CFR rate around the various continents are as follow Asia 1.30%,Europe 2.29%, Australia 3.03%, North America 2.25%, South America 2.27%.[17, 18, 19, 20]
(To be noted that these rates depend upon the population, age factor, testing done, number of people infected and all these numbers are statistically derived so cannot be 100% accurate. The data of number cases and IFR and CFR is from march2020-july 2021)

Detection or testing
The detection or testing of Sars-cov-2 can be done using many methods, and all these methods have different specificity. The different techniques used are RT-PCR (Reverse Transcription Polymerase Chain Reaction) which is gold standard of testing (molecular testing), isothermal amplification assays, antigen testing, ct-scans, and antibody testing (serological testing),CRISPR-based diagnostic tests, NAAT (Nuclei acid amplification test) .Within antibody testing there is Rapid diagnostic test,ELISA (Enzyme-linked immunosorbent assay), CLIA (Chemi-luminescent Immunoassay), LFIA(Lateral flow immunoassay) [21].Among all the testing RT-PCR test is being used as a gold standard test for detection of Sars-cov-2, while all other testing are being now pushed into action due to the low accuracy of RT-PCR test, low accuracy means that the test has higher chances to show false positive or false negative result depending on sensitivity and specificity of the test done on the population. Three things to understand from RT-PCR test, the first being RT(Reverse Transcription), then second being PCR (polymerase chain reaction) and third is RT-PCR that is the actual test what is carried out to detect Coronavirus [21, 22]. Reverse transcription is the opposite of normal transcription, in this process, RNA is used as a template to synthesis cDNA (complementary DNA) using reverse transcriptase enzyme as a catalyst. Polymerase chain reaction is a technique used to amplify segment of DNA of interest and make a lot of copies of it, this amplification helps in detection of viruses and bacteria. RT-PCR, is a method used to detect coronavirus, since the virus contains ssRNA, this ssRNA needs to be converted to DNA fragments using PCR technique, this conversion of RNA to DNA is done using reverse transcriptase enzyme (a RNA dependent DNA polymerase), this test for the laymen is called the swab test, where sample is taken either from the nose or mouth of the concerned person. One of the main reason for false positive or negative is that conventional PCR requires post-amplification by electrophoresis in which the sample in which the vial is kept needs to be opened and there is always a minute chance that the lab environment can get affected generating false positive results. Real time RT-PCR is being used which is an upgraded version of the conventional RT-PCR, the former differs from the latter, because there is one step involved in real time RT-PCR test for amplification and detection and post amplification is not needed in real time RT-PCR, which makes it a bit accurate than conventional but there are many limitations. Once tested for covid-19 with real time RT-PCR, there are generally four parts the test contains patient information, doctors information, test information,result. The main being the Result of the test, whether the patient tested is positive or negative, if positive then need to check the CT value (which is cycle threshold value),generally higher CT value indicates lesser viral load, which means that if your CT value is high, then you are less likely to be critically infected with the virus, the standard for CT value is 33, so if the CT value is below 33 then you are a Covid-19 positive patient but if CT value above 33 then you will be tested as negative. But this CT value still is a debatable issue, many scientist and doctors believe that CT value cannot help determining viral load in a patient [21, 22, 23].

Clinical course and diagnosis and management [13]
The severity of covid-19 goes from pre-symptomatic to critically ill patients. For those who are exposed to the virus the onset of symptom can occur within 4 to 5 days at an average, about 1% of patients will get critically-ill which might lead to acute respiratory distress syndrome (ARDS) or multiple organ failure, while CDC has claimed that children have a very mild clinical course .Common laboratory findings of patients show lymphopenia (In most cases), leukopenia, increase in C-reactive protein levels, D-dimer levels.The management of patients, those that are asymptomatic can isolate themselves for about 14 days to just assure that there is no development of symptoms. Those showing symptoms can also isolate themselves for 14 days at their home, but if severe conditions like hypoxia, respiratory failure or ARDS occur, the patient needs to get hospitalized. For those who are 60 and above, already immunocompromised or with co-morbid conditions like diabetes, cancer,heart ailments etc need to be more cautious than others since they are at more risk.

Prevention and treatment [15]
For prevention there is lockdown, wearing a N95 mask, social distancing, practice frequent hand washing respiratory etiquette.But these prevention techniques are not enough. Typically the lockdown in nations haven't worked, it has led to more devastation than prevention, with people going job-less, economic depression and people struggling to make ends meet. Wearing a mask is also a debatable issue, because N95 mask has a pore size of 300nm while the virus size is between 80-220 nm, masks can provide certain prevention but not completely, so people are still at risk, and logically mask should only be worn by those who are infected and healthcare personnel not the general public, and off-course those who work in a crowded area.

Alternatives
Following the norms setup by respective government is up to the people, but here are some common ways which can help boost immunity and can even prevent the encounter with the virus physical exercise and yoga daily for 1 hour. Having a proper balanced diet and not depending on packed food items for the time being, try eating heated food rather than cold stored food. Optimizing circadian rhythm (these are natural internal processes of living beings like sleep-wake cycle, (body- temperature cycle etc). Taking vitamins and essential minerals either through natural sources or by supplements. Last but not the least is removing the fear of this virus, fear can compromise not only your physical

health but mental health, so the best way is to spiritually heal yourself, try calming yourself even in such a time, show solidarity and not overthink and have faith.

Treatment

Allopathy, Ayurveda and homeopathy treatment have been given to many covid-19 patients, trial therapies have been suggested by WHO and national health care authorities of various nations, monitoring of oxygen level and blood reports play an important part in deciding the treatment to be given, depending on how critical the patient condition is the treatment is given (Table 2 and table 3),. Ayurveda being one of the oldest branch of medicinal science and homeopathy being an holistic approach where it deals with treating the body as a whole rather than focusing on a diseased part. Department Of AYUSH of India has recommended many medicinal plant extracts for Covid-19 (Table 4). A review by Girija *et al*, where ayurvedic treatment had been given to cure a 43 year old banker staying in New York (having no major co-morbid condition) who showed all the common symptoms of covid-19 that being fever (lasted for a week), fatigue, cough, lose of smell and taste and abdominal pain. The patient by the 16th day had almost recovered, only the sense of smell and taste had partially recovered which were also restored in a few days (Table 5).

Table 2: Clinclal information of covid-19 patients

	Mild	Moderate	Severe	Reference
Clinical Criteria				24-32
SPO2	> 94 % In Room Air	90 - 94 % in room air	90% in room air	
RR	< 24 / min	24 — 30	> 30	
	No Pneumonia	Pneumonia +	Pneumonia ++	
Chest Criteria				
	Normal or < 25 %	25%-75%	75 % to 100%	
	Grade I	Grade II /III	Grade IV	
Laboratory Findings (Expected)				
NLR	<3.2	>3.2	>5.5	
CRP	<40	40 — 125	>125	
Ferritin	< 500	> 500	> 800	
D-Dimer	+< 0.5	> 0.5	> 1.0	
LDH	< 300	300 — 400	› 400	
IL6	<4.8	5 —50	>80	
LFT	Normal	Slight Derangement	Moderate Derangement	

Table 3: Allopathy treatment for covid-19 patients

	Mild	Moderate	Severe	References
Routine	T.paracetamol 500mg TDS Anti tussives SOS T.Vitamin C 500mg OD T.Zinc 50mg BD C. Pantoprazole 20mg BD	T.paracetamol 500mg TDS Anti tussives SOS T.Vitamin C 500mg OD T.Zinc 50mg BD C.Pantoprazole 20mg BD	T.paracetamol 500mg TDS Anti tussives SOS T. Vitamin C 500mg OD T. Zinc 50mg BD Inj. Pantoprazole 40mg IV OD	26-32
Antibiotics	T. Azithromycin 500 mg OD x 5 Days (or) T. AmoxClav 625 mg BD If T. Azithromycin is Contraindicated in Elderly > 60 yrs.	T. Azithromycin 500 mg OD x 5 Days + Inj Ceftriaxone 1 gm IV BD If secondary bacterial Infection suspected	T. Azithromycin 500 mg OD x 5 Days+ inj. Piptaz 4.5 mg/ Inj.meropenarn 500mg, IV TDS If secondary bacterial Infection suspected	
Steroids	Not required	Inj.Dexamethasone 6mg IV OD x5days or Inj Methyl prednisolone 60mg Iv x5 days	Inj.Dexamethasone 6mg IV BD x10days or Inj Methyl prednisolone 80mg Iv x10 days	
Cytokine storm		Inj.Tocilizumab 400mg(Max 800mg) slow IV over 100ml NS over 1hour Repeat dose after 12 hours, Contraindication- In active infection, TB, hepatitis	Inj.Tocilizumab 400 mg(Max 800mg) slow IV over 100ml NS over 1hour Repeat dose after 12 hours, Contraindication- In active infection, TB, hepatitis	

(RR: Respiratory rate; NLR: Neutrophil to lymphocyte ratio; CRP: C- reactive protein; LDH: Lactic acid Dehydrogenase; LFT: Liver Function Test; TDS: Thrice daily; BD: Twice daily; OD: Once daily; SOS: Emergency; IV: Intravenous; Inj: Injection; TB: Tuberculosis; T: Tablet)

Table 4: Ayurveda and homeopathy treatment for covid-19

Medicinal plant	Medical Practice	Recommended Dosage	Effective Against	Reference
Tinospora cordifolia (samshamani vati)	Ayurveda	Twice daily (BD) for 14 days	Fever	33-34
Andrograhis paniculate (Nilavembu kudineer)	Siddha	BD for 14 days	Fever and cold	
Cydonia oblonga (Behidana)	Unani	BD for 14 days	Antioxidant, immuno-modulator	
Arsenicum album 30	Homeopathy	Daily once in empty stomach for 3 days (Should be repeated after 1 month till the infection persist, If	Effective against SARSCoV-2, immunemodulator.	

		working then take for 15 days twice daily)		
Anuthaila (sesame oil)	Ayurveda	2 drops in each nostril daily morning	Respiratory infections	
Atropa belladonna	Homeopathy	-	Asthma and chronic lung diseases	

Table 5: Ayurveda medication given to patient

Medication	Day	For	References
Sudarsana Churna- 4 tablets (2 gms) in room temperature water TD	1-13	Fever	35
Talisadi Churna-1tsp with honey TD	1-13	Fever	
Dhanwantara Gutika- 2 tablets TD	1-13	Fever	
Vidaryadi Ghritam -15 ml BD	14-30	When afebrile	

Table 6: Covid-19 vaccine developers

covid-19 Vaccine developer	Route of administration	Clinical Stage	
University of Oxford/AstraZeneca	IM	Phase 4	
CanSino Biological Inc./Beijing Institute of Biotechnology	IM	Phase 4	
Gamaleya Research Institute	IM	Phase 3	
Sinovac	IM	Phase 4	
Wuhan Institute of Biological Products/Sinopharm	IM	Phase 3	
Beijing Institute of Biological Products/Sinopharm	IM	Phase 3	
Moderna/NIAID	IM	Phase 4	
BioNTech/Fosun Pharma/Pfizer	IM	Phase 4	
Anhui Zhifei Longcom Biopharmaceutical/Institute of Microbiology, Chinese Academy of Sciences	IM	Phase 3	
CureVac AG	IM	Phase 3	References 36
Institute of Medical Biology, Chinese Academy of Medical Sciences	IM	Phase 3	
Research Institute for Biological Safety Problems, Rep of Kazakhstan	IM	Phase 2/3	
Inovio Pharmaceuticals/ International Vaccine Institute	ID	Phase1/2	
Osaka University/ AnGes/ Takara Bio	IM	Phase 2/3	
Cadila Healthcare Limited	ID	Phase 3	
Genexine Consortium	IM	Phase 1/2	
Bharat Biotech	IM	Phase 3	
Janssen Pharmaceutical Companies	IM	Phase 3	
Novavax	IM	Phase 3	
Kentucky Bioprocessing, Inc	IM	Phase 1/2	
Arcturus/Duke-NUS	IM	Phase 2	
ReiThera/LEUKOCARE/Univercells	IM	Phase 2/3	

Vaccination [55]

According to WHO there are 101 vaccine candidates that are in the clinical trial phases and 184 vaccine candidates in pre-clinical development. Clinical trial means human trials. Vaccines are being rolled out at exponential rate worldwide. (Table 5)

Conclusion

Covid-19 has captured the entire world in a cage, no one expected such a situation. Now the need of the hour is to work on the post-covid era majorly, this will be like a stepping stone in the history of the planet. Because what has happened has affected millions, but post-covid era needs to be a better era for our future generations, where we can provide them facilities which can help them curb such a situation in a better manner.There are multiple factors that have to be worked upon, because this pandemic has showed that globally we need to up our game and need to fight harder. Firstly we need improve our health-care sector as we can see many have lost their life due lack of health- care facilities. We need world governments to invest more on health-care more in the remote areas, where even basic health care facilities are not available, from now on we need to invest in all the countries irrespectively on health care matters. Simultaneously we need to invest more in research and development in all the countries as there is no medicine that can completely cure this disease, there are just trials that are taking place on group of people, so we need world governments and people to come together to fight such a situation. Secondly, People need do their own research, ask more questions, and need to be more aware of the situation rather than depending on others. Experts can be also go wrong with such a situation, so people need to research on their own along with experts guidance so people are prepared for the situation better. Thirdly, this pandemic has shown that in the time of crisis people do stand up for each other, the solidarity shown during this pandemic needs to be continued and magnified, solidarity is the only thing that will make post-covid era a better era to live in .At present economy is shattered, people have lost their jobs, and it has indeed been a tough time for all, but this situation is definitely going to change because time is the best healer, the only thing we all can do is to have faith and believe in ourselves. In conclusion Covid-19 is not only a health crisis but also emotional and financial crisis, covid-19 has hampered development of many nations, this pandemic is like a wave, has a lot of negative impact in form of untimely deaths, damaging immune system, affecting people mentally, weakening the economy globally, creating fear but this crisis also has a positive impact in form of solidarity. The decision taken in this dark period by the world leaders are going to be pivotal for our future, all these decisions going to create history.

References

1. Crawford Dorothy. Viruses: A Very Short Introduction. New York: Oxford University Press, 2011, 4. ISBN 978-0199574858.
2. Cann Alan. Principles of Molecular Virology (5 ed.). London: Academic Press, 2011. ISBN 978-0123849397
3. Katherine J Wu. (15 April). "There are more viruses than stars in the universe. Why do only some infect us? – More than a quadrillion individual viruses exist on Earth, but most are not poised to hop into humans. Can we find the ones that are?". National Geographic Society. Retrieved 18 May 2020, 2020.
4. Levinson W. Review of medical microbiology and immunology (Thirteenth edition.). New York: McGraw-Hill. Chicago, 2014.
5. Norval M. Virus-cell interaction. Medical microbiology (Eighteenth Edition), 24 May. Available from, 2012, 82-96. https://doi.org/10.1016/B978-0-7020-4089-4.00022-6.
6. Fermin G. Host Range, Host–Virus Interactions, and Virus Transmission. Viruses Available from, 2018, 101-134. https://doi.org/10.1016/B978-0-12-811257-1.00005-X
7. Harvard Edu. Immunity. [Internet] Available at: https://onlinelearning.hms.harvard.edu/hmx/immunity/
8. Lee FEH, Treanor JJ. Viral Infections. Murray and Nadel's Textbook of Respiratory Medicine,2016, 527-556.e15. doi:10.1016/b978-1-4557-3383-5.00032-4
9. Burrell CJ, Howard CR, Murphy FA. Coronaviruses. Fenner and White's Medical Virology, 2017, 437–446. doi:10.1016/b978-0-12-375156-0.00031-x.
10. Coleman CM, Frieman MB. Coronaviruses: important emerging human pathogens. J. Virol,2014:88:5209-5212.
11. Graham RL, Donaldson EF, Baric RS. A decade after SARS: strategies for controlling emerging coronaviruses. Nat. Rev. Microb,2013:11:836-848.
12. Pyrc K, Berkhout B, van der Hoek L. The novel human coronaviruses NL63 and HKU1. J. Virol,2007:81:3051-3057.
13. Oberfeld B, Achanta A, Carpenter K, Chen P, Gilette NM, Langat P, *et al*. SnapShot: COVID-19, Cell, 2020. doi: https://doi.org/10.1016/j.cell.2020.04.013.
14. Andersen KG, Rambaut A, Lipkin WI, Holmes EC, Garry RF. The proximal origin of SARS-CoV-2. Nat. Med. Published online March 17, 2020. 10.1038/s41591-020-0820-9. CDC (2020). Coronavirus Disease 2019 (COVID-19), 2020.
15. Centers for Disease Control and Prevention, https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management patients.html
16. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, *et al*. Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia. N. Engl. J. Med,2020:382:1199-1207.
17. Estimating Mortality from covid 19. [Internet] Available at: https://www.who.int/news-room/commentaries/detail/estimating-mortality-from-covid-19
18. Coronavirus cases. Worldometer. [Internet] Available at:https://www.worldometers.info/coronavirus/coronavirus-cases/
19. Mortality risk covid. [Internet] Available at: https://ourworldindata.org/mortality-risk-covid
20. COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University
21. Overview of Molecular Diagnostic Techniques and Instrumentation Daniel H. Farkas, Carol A. Holland
22. Bernard PS, Wittwer CT: Real-time PCR technology for cancer diagnostics. Clin Chem,2002;48:1178-1185.
23. Bustin SA. Absolute quantification of mRNA using real-time reverse transcription–polymerase chain reaction assays. J Mol Endocrinol,2000:25:169-193.
24. Zhang M, Xiao E, Liu J, Cai Y, Yu Q. An emerging marker predicting the severity of COVID-19: Neutrophil-Lymphocyte Count Ratio, Research Square, 2020. DOI:10.21203/rs.3.rs-28850/v1.
25. Qin C, Zhou L, Hu Z, Zhang S, Yang S, Tao Y. Dysregulation of immune response in patients with COVID-19 in Wuhan, China. Clinical Infectious Diseases, 2020. DOI:10.1093/cid/ciaa248
26. Ruan Q, Yang K, Wang W, Jiang L, Song J. Clinical predictors of mortality due to COVID-19 based on an analysis of data of 150 patients from Wuhan, China. Intensive Care Medicine, 2020. doi:10.1007/s00134-020-05991-x.
27. Phelan AL, Katz R, Gostin LO. The novel coronavirus originating in Wuhan, China: challenges for global health governance. JAMA; published online Jan 30, 2020. DOI:10.1001/jama.2020.1097.
28. Huang C, Wang Y, Li X, *et al*. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet,2020:395:497-506.
29. Zhang C, Shi L, Wang F-S. Liver injury in COVID-19: management and challenges. The Lancet Gastroenterology & Hepatology, 2020. doi:10.1016/s2468-1253(20)30057-1.
30. Rayner CR, *et al*. 25 March. Optimizing COVID-19 candidate therapeutics: Thinking Without Borders. Clinical and Translational Science, 2020. https://doi.org/10. 1111/cts.12790. n/a(n/a)
31. Wang P, *et al*. The SARS-CoV-2 outbreak: diagnosis, infection prevention, and public perception. Clin. Chem, 2020c. https://doi.org/10.1093/clinchem/hvaa080
32. World Health Organisation, Coronavirus Disease WHO Report 41, (01 March 2020), 2019.
33. Vellingiri B, Jayaramayya K, Iyer M, *et al*. COVID-19: A promising cure for the global panic, Science of the Total Environment Available from, 2020. https://doi.org/10.1016/j.scitotenv.2020.138277
34. AYUSH Ministry of Health Corona Advisory – D.O. No. S. 16030/18/2019 – NAM; dated: 06th March, 2020.
35. Girija P, Sivan N, Ayurvedic Treatment of COVID-19/ SARS-CoV-2: a case report, Journal of Ayurveda and Integrative Medicine, https://doi.org/10.1016/j.jaim.2020.06.001.
36. Draft Landscape of covid 19 candidate vaccines. [Internet] Available at: https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines