Medicolegal Aspects of COVID-19: Microbial Terrorism

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Abstract

The entire World is going through hard times because of the emergence of new pandemic named Coronavirus or COVID-19. The virus originated from Wuhan and is spreading Worldwide. There are many questions arising regarding the origin of this fatal virus; whether it is natural or man-made. In the past years, many microorganisms were used as a bio-warfare agents for causing destruction. In 2001, anthrax attack took place in US by the use of bacteria, *Bacillus anthracis* which acted as a bioweapon and lead to number of deaths in Texas, US. This review summarises the origin, epidemiology, medico-legal aspectsand the recent researches of the virus indicating its nature of being manmade or a natural virus.

Keywords*:COVID-19, Identification, Epidemiology, Diagnosis, bioweapon.*

Introduction

A newly emerged virus in the year 2019, is named Corona Virus (2019-nCoV) by World Health Organisation (WHO). It was discovered in 1960 and firstly reported in December 2019 when tremendous number of pneumonia cases were reported in Wuhan, China. As a result, etiological research was carried out by the government of China for taking preventive measures to control this epidemic[1]. It is genomically analysed and suggested that a strain of CoV(2019 n-CoV) has been named as Severe Acute Respiratory Syndrome CoV-2 (SARS- CoV-2) recently. This viral infection was suspected to be zoonotic in origin[2]. Coronavirus causes infection in respiratory and intestinal tracts in humans and non-humans.

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In 2002-2003 serious upsurge of Severe Acute Respiratory disorder in Guandong province of China made it highly pathogenic to humans. Familial mass of pneumonia upsurge append to the evidence of pandemic COVID-19. The graph of this disease is reaching heights because of human to human transmission of this viral disease[3].

Infectious Bronchitis Virus (IBV) was the firstly discovered CoV in chickens and human CoVs causing respiratory diseases. Common cold in humans was caused by CoV-OC43 (HCoV-OC43). SARS CoV in 2002 was discovered after the arrival of HCoV-229E and HCoV-OC43. [6]

Diversity of Coronavirus:

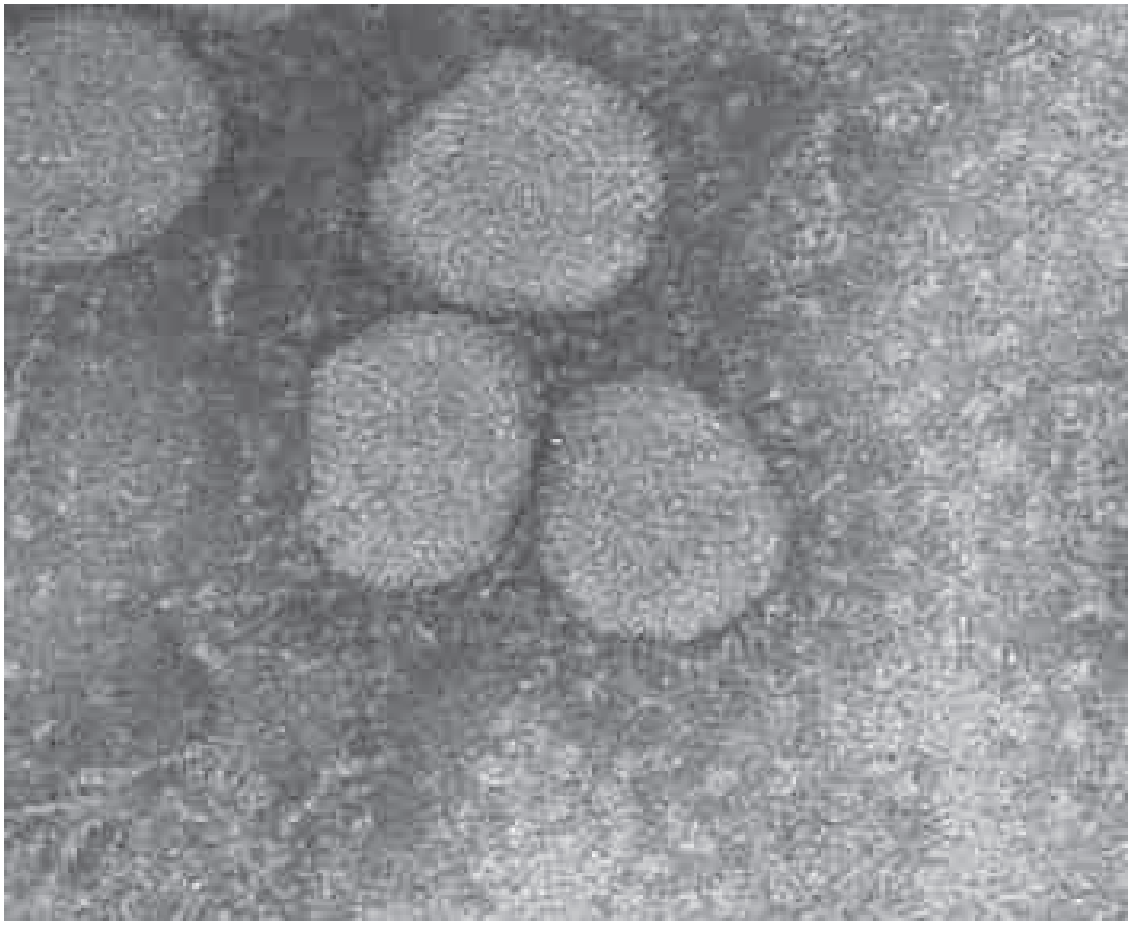
Coronavirus belongs to subfamily *coronavirinae* and member of *coronaviridae* family and order *Nidovirales* as given by the International Committee on Taxonomy of Viruses. According to the studies, it is found that four genera of this subfamily are there namely; Alphacoronavirus, Betacoronavirus, Gammacoronavirus and Deltacoronavirus. These subfamilies are designated on the basis of their genomic structure along with the

phylogenetic relationship[4].

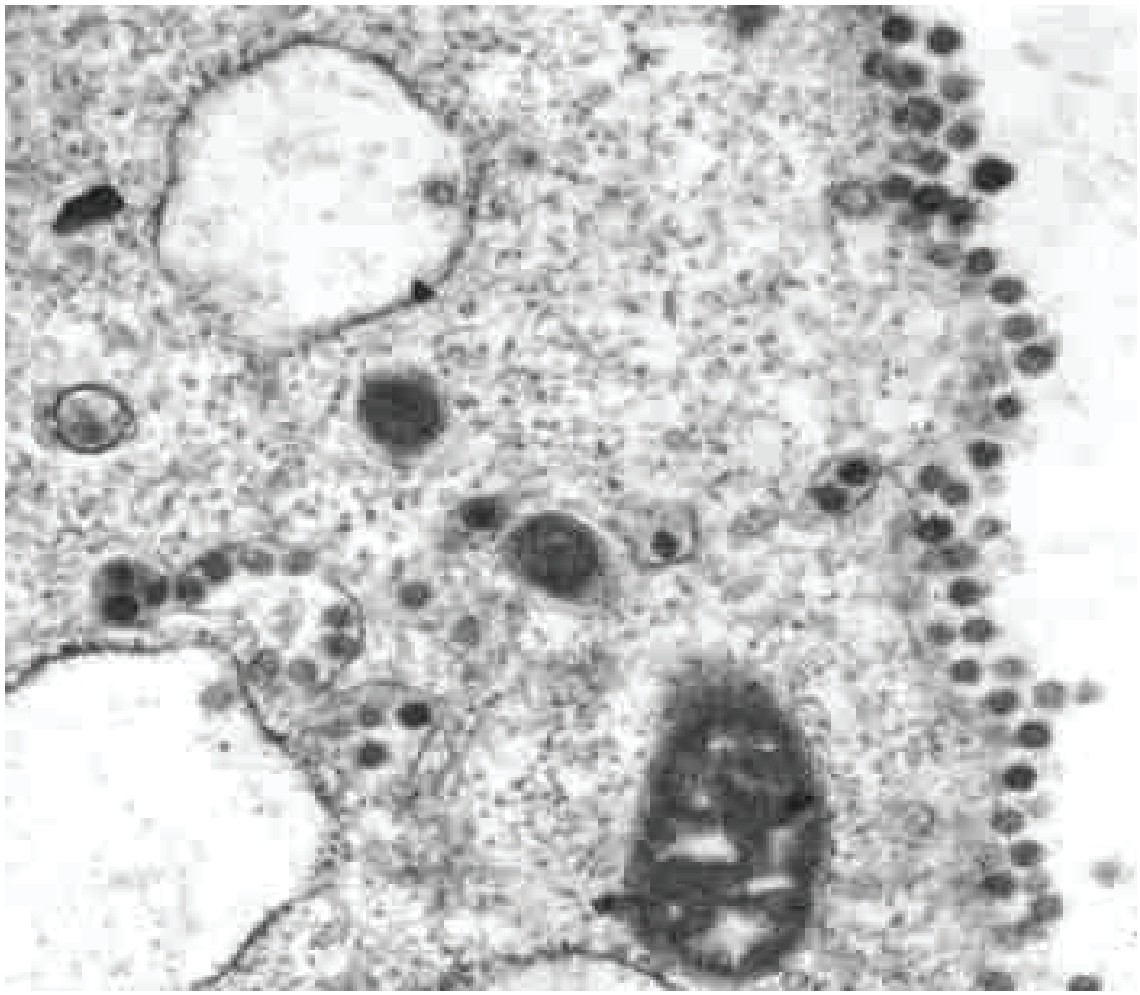
Respiratory illness and gastroenteritis are caused by alpha and betacoronaviruses in humans and animals. A study claimed that Betacononavirus infects only mammals. Gamma and Delta coronaviruses affects the bird species but some of them are reported fatal for mammals also. These two genera of coronavirus induce mild upper respiratory diseases in immuno-competent host.[5]

Structure of Coronavirus:

This newly popped SARS-CoV-2 is a Single-stranded RNA having spherical structure consisting of spike proteins. Coronavirus is alleged so because word corona is derived from *latin* word *corona* which means 'crown'. The virus has a royal crown like appearance when it is observed under an electron microscope. CoV is protected by a lipid bilayer and consist of certain proteins namely, spike (S) protein, Nucleocapsid (N) protein, Membrane (M) protein, Envelope (E) protein and haemagglutinin esterase (HE).[7]This haemagglutinin esterase protein increases the admittance and pathogenicity of the coronavirus. SARS – CoV- 2 has identical structure as that of coronavirus including other constituents like poly-proteins, nucleoproteins,membrane proteins like RNA polymerase. Other enzymes present in this virus include helicase, glycoprotein, accessory proteins, 3-chymotrypsin – like protease. It is studied that SARS – CoV-2 having spike protein consist of 3-D structure. [6]



(a)



(b)

Figure1. (a) and (b) Microscopic view of Coronavirus.

Source: Department of Microbiology, The University of Hong Kong and the Government Virus Unit, Department of Health, Hong Kong SAR China.

Identification of COVID-19:

Coronavirus is a contagious disease, it is imperative to find the root cause of this epidemic. Dr. Zhengli Shi also known as "Bat Women" from the Wuhan Institute of Virology and Biosafety was one big suspect in this matter. She was suspected of being a creator of this virus. She was working on an experiment with her colleagues in which she did mutation of amino acid so that it get compatible to SARS virus. Moreover, she had published many articles related to SARS virus.[7]

On 3rd February, 2020,Dr. Zhengli Shi claimed that Wuhan virus is of bat origin.

Liu et al detected SARS-CoV from Pangolin lung samples (2020). According to their study, dead Malayan Pangolins were carrying genomic as well as Darwinism evidence of presence of identical CoV like that of SARS-CoV-2 namely Pangolin (Co-V). Pangolin CoV showed most identical features with SARS-CoV-2 beside RaTG13.[8]

RNA – Sequencing was performed on the lung samples of Pangolins. Furthermore, genomic characteristics of Pangolins were studied to find out the origin. Last but not the least, the researchers made a phylogenetic relationship in between the suspected animal species like Pangolin – CoV (from pangolin) RaTG13(from rodents), SARS – CoV-2.[8]

Secondly, bats are also considered as a probable species for the origin of this COVID – 19. The study

depicted that 96% of whole genome sequencing was identical between SARS – CoV- 2 and CoV of bats. Hence, bats species also came in the list of hosts of zoonotic viruses such as Nipah and Hendra virus. These hosts seldom show any clinical symptoms. The overall nucleotide sequence identity between SL – CoV Rp3 (bat) and SARS CoV Tor 2 was 92%. [9]

The current database sequence suggests that all human coronavirus have zoonotic origin. SARS – CoV, HCoV – NL63, HCoV – 229E, MERS - CoV originated from bat species. [10]

Physiochemical Properties:

Virus particle is an oval shaped and diameter varying from 60 to 100 nm (approx.) SARS – CoV and MERS – CoV together give information regarding physiochemical properties of CoVs. Ultraviolet light or heating at 56 degrees for 30 minutes inactivates SARS – CoV- 2. This virus is also sensitive to chemicals like peracetic acid, chloroform, 75% ethanol, diethyl ether. This virus remains for 72 hours on surface like plastic and stainless steel[11].

Genomic Variation

Earlier, a study depicted that largest RNA among all viruses is of coronavirus containing approx. 27-30 kb. Six to seven regions are present in a genome of virus and all of them are well organised. Each region consist of one or more open reading fragment and they are separated by junction sequence containing signals. These signals aid in transcription of multiple sub-genomic mRNA's. [12]

A recent study has described that RNA genome of CoV is second largest in RNA viruses, largest genome is of Planarian Secretory Cell Nidovirus (PSCNV). It consists of 41.1 kilo base genome size. Structural along with the Non-structural proteins are coded by viral RNA. [13] There is no interferences of recombinant events. RNA virus is unstable and hence continuous scrutiny of SARS–CoV-2 spreading human to non-humans is very imperative for controlling the disease.

In the entire genome of Wuhan-Hu-1 coronavirus (WHCV), single strain of SARS – CoV-2 is of 29.9 kb. Moreover, the studies have suggested that genome of CoVs contain fluctuating numbers of open reading frames (ORFs) ranging from 6-11. The positive sense RNA of SARS-CoV and MERS-CoV shows genomes of 27.9 kb and 30.1 kb respectively. [13]

High mutation ratses characterise all RNA viruses, evolution of CoVs and transmission from one species to another. Results and analysis by various researchers have proved that SARS and MERS- CoVs have emerges from ancestral CoVs nurtured by bats. It has been reported that animals are considered as intermediate hosts and humans are terminal hosts.[5]

Epidemic to Pandemic

On December 29,2019 four patients of an acute respiratory syndrome were reported in Wuhan city of China. Wuhan Health Commission (WHC) reported that there is linkage of this virus with that of local seafood market. The Wuhan Institute of Virology of China claimed that out of 33, 585 environmental samples contained coronavirus nucleic acid depicting that this virus have emerged from the wild animals from that local market[15].

In China, there were 11791 confirmed cases of corona virus and 17988 suspected cases in 34 cities of China (as on 31st January,2020). 213 deaths were reported globally since then.This epidemic was converted into pandemic when the virulentdiseaseaffected 19 more countries all over the world.

COVID-19 was regarded as contagious disease. The identification, diagnosis, clinical course, management of this viral disease was done when this disease affected the US province. Globally, the positive cases as on February 16, 2020 were 51,857 in 25 countries as claimed by World Health Organization[14].

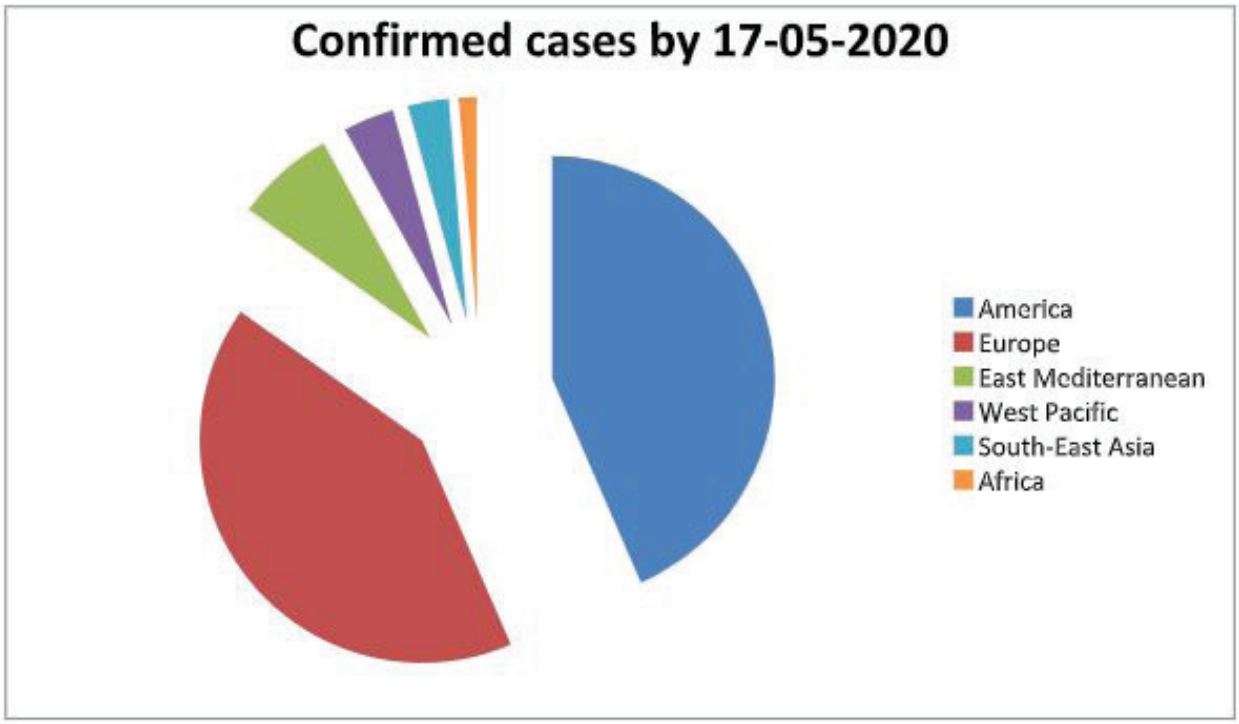


Figure 2. Confirmed cases of COVID-19 till May 17, 2020

Source: WORLD HEALTH ORGANIZATION (WHO)

IS COVID-19 A BIOLOGICAL WEAPON?

In the past years, many microorganisms have been reported which have caused pandemic in the world. These microbes include; Plague, Salmonella, Anthrax, H5N1.

COVID-19 is just one more epidemic which is spreading worldwide like a forest fire. The main reason behind this is that it spread by human to human transmission hence, it is regarded as contagious in nature. Recent researches suggested that this virus is contagious even when the person do not show any symptom.

The similarity between all the epidemics is that they are global and cause widespread destruction all around. One cannot deny the fact that these epidemics go hand in hand with globalization and has barbarous effect on the economy, trade and tourism.

This pandemic has been originated from Wuhan and affected the entire world. People are looking for the reasons for the outbreak of these epidemics.

It is sceptical that this deadly coronavirus affected the world in short time span. It can be opined that SARS-Cov-2 is a man-made virus. *Virola* virus was not a man-made, it undergone certain mutations and then got transferred into humans. So, it might be possible that COVID-19 might be a genetically modified virus or it may be a recombinant virus. [18]

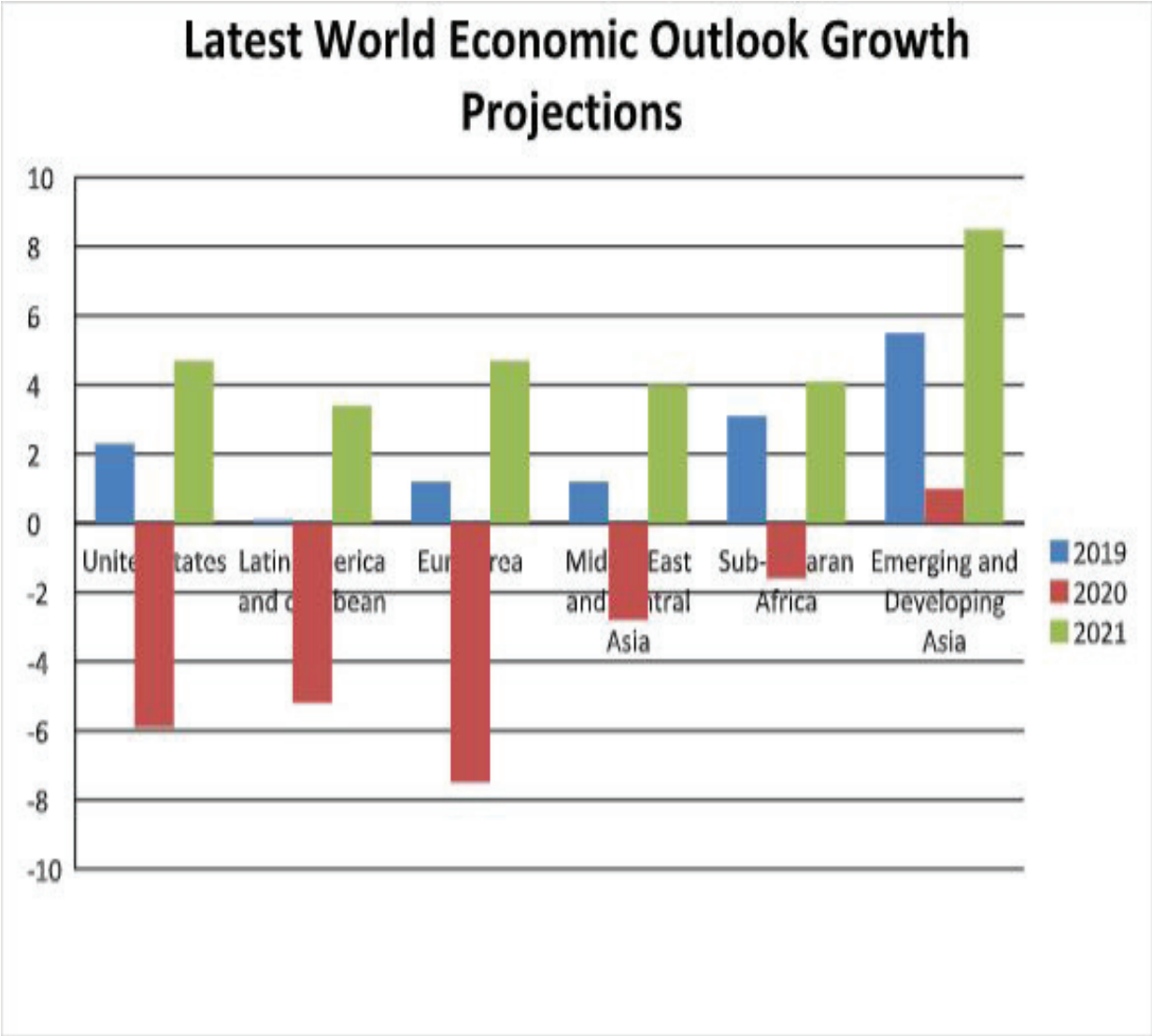


Figure 3. Graph depicting GDP of various countries.

Source: International Monetary Fund (IMF)

	2019	2020	2021
United States	2.3	-5.9	4.7
Euro Area	1.2	-7.4	4.7
Latin America and The Caribbean	0.1	-5.2	3.4
Sub-Saharan Africa	3.1	-1.6	4.1
Middle East and Central Asia	1.2	-2.8	4.0
Emerging and Developing Asia	5.5	1.0	8.5
WORLD	2.1	-3.0	5.8

Source: International Monetary Fund (IMF)

Clinical Analysis:

Yelin et al., used pooling approach for standard RT-qPCR for evaluation of COVID-19. The researchers used swabs from nostrils, throat for the analysis. Pooling works in conjugation with RT-qPCR but it gives 10% false negative results. [16].

Muhammad Farooq along with his co-worker Abdul Hafeez used radiographs for the analysis and claimed that chest X-rays of patients infected by COVID-19 depicted certain abnormalities in radiography. [17]

Hence, Laboratory detection of this virus included certain clinical findings like genome sequencing, RT-PCR technique and Serological methods like Enzyme Linked Immunosorbent Assay (ELISA). This method was based on SARSr - CoVRp3 nucleocapsid protein and was created to ascertain the immunoglobulins IgM and IgG. But the drawback came out when this test gave false positive results among human beta-coronavirus genus.[18]

Vaccines And Drugs:

The viruses which are affecting the world severely with devastating effects include Ebola virus, Nipah virus, Zika virus have started a race of exploring and designing of new vaccines, drugs, therapeutics to get cure of these diseases.

Many drugs and agents are detected under clinical trial by following adequate protocols but efficacy has not yet established for any drug therapy.

Remdesivir:

It is an antiviral drug manufactured by Gilead sciences. It inhibits the replication of virus and this drug is proved commendable for MERS infected rats and monkeys.

Favilavir:

Favilavir is the first drug approved for coronavirus in China. It is licensed as an experimental drug and research is still going on for the effectiveness of this drug.

Liponavir; Ritonavir:

This drug is HIV Protease inhibitor. It supresses the coronavirus activity by binding with an enzyme which help in coronavirus replication.

COVID-19 convalescent Plasma:

The blood Plasma samples accumulated from patients retrieved from the viral disease which mightconsist of antibodies against SARS-CoV-2.

Hydrochloroquine:

Hydrochloroquine is an anti-malarial drug. Clinical trials performed in China showed potency and pertinent protection by this drugs countering COVID-19 linked pneumonia.

Immune System Booster:

Vitamin C and B6 are recommended for enhancing the immunity. Vitamin B6 is important to sustain biochemical reactions. Vitamin E also act as an antioxidant and helps in fighting against infections.

Currently, no such drug, vaccine has been made to cure COVID-19. [19]

Medicolegal Repercussion:

The people infected by the coronavirus were kept under check to ascertain the symptoms caused by this disease. A study done in Wuhan, China revealed that the major symptoms at the inception of illness was fever. 98% of the sufferers were suffering from acute fever. 76% of affected people were having cough. Fatigue was also a parameter which was proved as a major symptom. More than half of the patients were suffering from dyspnea.[20] Other Symptoms which were rarely present included headache, diarrhoea and haemoptysis.[21]

In a study performed in hospitals of Wuhan proposed that hospital related transmission of s2019-nCoV was doubtful in 41% of patients and mortality rate came out to be 4.3%. Adults and infants were subjected more to this viral disease and required ICU care.[22] Currently no vaccine has been made to cure this contagious disease, the safest way to get rid of this disease is to avoid viral exposure.[5]

Wuhan Coronavirus: Manmade or Recombinant

Wuhan coronavirus is strangely identical to 2 bat; ZC45 and ZXC21 as revealed by a study. Recombination

has to take place twice during evolution of Wuhan coronavirus. The ancestor bat corona virus had to acquire through recombination with SARS like coronavirus. [20]

On 2nd January,2020 Director General of Wuhan Institute of Virology released a notice regarding the strict prohibition and disclosure of any information regarding this disease. There were number of news and articles published against Wuhan Institute of Virology regarding origin of coronavirus from this lab. [7]

Through all the news and instances COVID-19 doesn't seem to be a natural virus. There are lots of queries and conjectures on its mutation and manmade interventions.

Conclusion

COVID-19 has proved to be the threatening virus. It is a pandemic which is spreading devastation all over the world. There are many controversies regarding the origin and spreading of this disease. The world is facing severe crisis due to fall in economic GDP and globalisation along with high fatality rate.

COVID-19 might be a Bio-warfare agent which has caused gigantic demolition in the world.

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