

Covid-19 Outbreak and its Microbiological Prospective

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BACKGROUND

Covid-19 which started as an outbreak from Wuhan, China in December, 2019 was declared as Public Health Emergency in 30th January 2020, and pandemic on 11th March, 2020 by World Health Organization (WHO). Many microbiologists and scientists are conducting research on its structure, virulence, prevention and management to get the answers to some pertinent questions related to Covid-19. Here is an interview with one of the senior microbiologists of Nepal,

Prof. Dr. Bharat Mani Pokhrel started his career from Institute of Medicine, Tribhuvan University. Dr. Pokhrel is Post Doc. Fulbright Scholar in Microbiology and one of the pioneer microbiologist in Nepal. Professor Pokhrel is an Academician of Nepal Academy of Science & Technology (NAST). And retired from, Tribhuvan University Teaching Hospital after 39 years of his successful tenure. He has published more than 150 research articles in national as well as international scientific medical journals. Currently Professor Pokhrel is an Academic advisor to KAHS, Jumla.

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Q1. Being the pioneer Microbiologist and Scientist, could you please let the public know what the Covid-19 is?

Corona virus disease 19 (Covid-19) is a novel disease caused by a new virus that belongs to the family Corona viridae. The interim name given to this virus is Covid-19 by WHO which was reported from Wuhan China in December, 2019 which is causing pandemic today. This is a single stranded positive sense RNA virus, almost spherical (80-120 nm), having helical nucleocapsid, lipid bilayer membrane with envelope, which is composed of a membrane protein. It has club shaped spikes originated from envelope. The spikes also known as peplomers which are rich in glycoprotein and they look like crown, thus name given- Corona virus. The receptor for these crown shaped peplomers is Angiotension Converting Enzyme-2 (ACE-2), present on the surface of Type 2 pneumocytes in lungs. These receptors are also present in cardiac cells, liver cells and also in kidney cells. Covid 19 has 96 % genetic similarities with SARS-Corona virus (SARS-CoV). SARS-CoV is believed to be transmitted from bat to civets to human which was prevalent in china in 2002-3 and bat to camel to human in a case of Middle East Respiratory Syndrome Corona Virus (MERS-CoV) which was prevalent in middle-east in 2012-15. Covid-19 is believed to be transmitted from bat to Pangolin to human (not proved yet).

Currently, the International Committee for Taxonomy of Viruses has given the name to Covid-19 in 11 Feb. 2020, is Severe Acute Respiratory Syndrome Corona Virus-2 (SARS-CoV-2). Since this is the mutation of SARS Corona virus which has 96% genetic similarities with SARS Corona Virus based on sequence analyses of RNA.

Q.2 What might be the initial and late sign and symptoms? How this disease is transmitted?

The most common and early sign and symptoms are Fever (more than 100.4 degree Fahrenheit), Dry Cough, Dyspnea, Malaise, Headache, and Body ache. The late sign and symptoms are Acute Respiratory Distress Syndrome (ARDS), Pneumonia, and other symptoms related to other systems.

It is transmitted principally through droplet infection between SARS- CoV-2 infected person to healthy person. Transmission through direct contact with infected person/s and also fomite transmission by touching freshly contaminated materials with SARS- CoV-2 virus then touching to mouth, nose, and eyes with hand have been the mode of entry of virus into the respiratory tract.

In brief, once the virus enters to respiratory tract through droplet infection between man to man in a maximum distance of 1-2 meters ,will reach to lungs through respiratory air way. Since, Type-2 pneumocytes contain ACE-2 which will bind it via crown shaped peplomere. The surfactant which is covering alveoli in the lung also helps to colonize the virus in to the lung. Once virus is internalized in to the cell, it will reach to Golgi apparatus through messenger RNA and replicate there. As many

virus particles replicate, process of exocytosis will take place. After this, these damaged alveoli cause inflammatory response, as a result IL-1, IL-6, TNF Alfa are secreted. There will be accumulation of fluid resulting consolidation of lungs as well as accumulation of fluid between alveoli (interstitial fluid) resulting Acute Respiratory Distress Syndrome (ARDS) and pneumonia. As a result, they cannot perform their job perfectly to exchange gases (O₂ and CO₂). About 80% will recover and 20% may require artificial supplement of Oxygen and may even require Ventilator. Out of which approximately 2- 3% may die due to pneumonia, heart, liver and kidney failure. Elderly people with hypertension, diabetes, immune-compromised disorders, and immunosuppressive therapy are more vulnerable.

Q3. Now the entire world is scared about the highly contagious and deadly virus. How is such a virus borne, although it is often classified as border line organism (neither living nor nonliving)?

Yes, it is often classified as borderline organism as it can only reproduce inside living cell by using the cellular machinery. I would not like to call them as nonliving since they have family, genus, and species. New virus comes from old virus through mutation as per Charles Darwin's theory. SARS-CoV-2 is one of the examples.

Q4. If so, how can we kill (make inactive) such a borderline organism?

Covid-19 is sensitive to lipid soluble substances like Soap, Alcohol, Acid, Ether, Chloroform, Detergent, Sodium hypochloride, and Chlorine, can easily disintegrate its envelope.

Unfortunately, we do not have any molecules so far to destroy this virus in vivo (inside the body). It is claimed that Anti-malarial drug, Anti-retroviral compound, Anti Ebola drug be useful. But it is not proved till date.

Q.5. Is there any laboratory to diagnose any viral disease in Nepal?

There are a few laboratories to diagnose viral diseases in Nepal, but NOT all types of viral diseases. Currently, Government of Nepal has established laboratories in all provinces of Nepal to diagnose SARS CoV-2 with the help of rRT-PCR. The test can be performed in 17 different places in Nepal. Public Health Laboratory (PHL), Kathmandu is leading to the rest as reference laboratory in Nepal.

Q.6 How does RDT differ from PCR and which is more reliable test for the diagnosis COVID?

The RDT (Rapid Diagnostic Test): This test is done in patients' blood to detect the antibodies that are produced by the body against Covid19 infection. These antibodies may be IgM or IgG type. IgM

starts appearing after 7-10 days of infection whereas IgG after 2-3 weeks of infection. It cannot detect virus. It gives guide lines to come into conclusion also to perform further tests in order to diagnose the disease, and for further planning for the prevention and control of Covid-19. RDT positive means person has tested the virus.

Reverse Transcriptase Real time Polymerase Chain Reaction (rRT- PCR) can detect presence of even few numbers of viruses in our body. Hence, PCR is diagnostic and more reliable than RDT. However, Collection of sample is very very important. It is said that the chances of detection of virus by rRT-PCR in throat swab low (about 65%), compared to nasal swab (about 90%). Sputum or bronchoscopy specimen is the gold standard almost 100% chances to detect virus.

PCR is time consuming requires expensive reagents, equipment, expert manpower, specially designed laboratory to perform RT-PCR test. Therefore, RDT is done initially as screening test. The results of any laboratory test must be interpreted based on clinical findings of a patient.

Q7. Can a person cured from novel corona virus get it again?

Though person infected once with Covid-19 makes antibodies in his/her blood, so, it is likely that a recovered patient develops some amount of immunity but there is no certainty that re-infection does not occur.

Q8. Can an asymptomatic person spread the virus?

Respiratory droplets expelled by someone who is coughing are the main medium for the disease to be transmitted. Therefore, the risk of transmission of Covid-19 from asymptomatic person is there.

Q9. Why is it not affecting Nepalese people? Are we immune enough to fight against it?

So far, there are no indigenous cases in Nepal. Preventive measures currently being used are very effective as instructed by Government of Nepal. On the other hand, genetic issue might be there to fight against this virus. However, we need to conduct research to find whether the particular ethnic group is immune or susceptible and also to evaluate immunity power.

Q10. Is Nepal in a better situation than other countries? Or, are we being less vigilant??

Yes, I agree that Nepal is still in a better position than other countries. Government is trying its' best to control Covid-19.

Q11. Even the so-called powerful and most scientifically developed countries have not been able to control its spread and thousands of their citizens are being killed by this virus. Is this the way nature take revenge from human?

Sorry, I do not know. Viral infections are usually highly contagious. It cannot be called as the revenge of nature to human.

Q12. As of now, the incidence of this disease is seen more in the developed countries than developing and underdeveloped ones. What do you think could be the possible reason for this?

In my opinion, virus equally affects all people. It does not matter whether the person belongs to developed or underdeveloped countries, rich or poor. However, the fact is the person with other co-morbid disease like hypertension, diabetes, immune-compromised disorders, person under immunosuppressive therapy and elderly people are likely to be affected more. Immunity power of a person has the key role.

We are aware of the fact that the virus seems to be originated from Wuhan, China. People from developed countries like to travel different places for their holiday. As per the current scenario-USA, Italy and Spain are the most affected countries and are also popular holiday destinations. We can relate the fact through mode of transmission, more people means more transmission. In addition to that we should not forget that the old aged populations in developed countries are much more than underdeveloped countries.

Perhaps, the people of underdeveloped countries are more immune compared to people of developed countries. Since, there is high prevalence of several communicable diseases and they are exposed to a variety of microbes, they might have gained tolerance power against such microbes. This is just a speculation thought.

COVID-19 has entered in some of the communities of Nepal. We have still time to prevent. But if we lack the right strategies we might face more miserable scenarios. It is totally dependent on us.

Q13. Is lockdown needed in Nepal? There are the voices against it. What is your opinion? Are there any alternatives?

Social distancing is the only solution to break the chain of its spread globally not only in Nepal. There is no definitive management and vaccine to prevent it. However, the public need to be more aware about importance of social distancing, hand washing and respiratory hygiene for the prevention and control of Covid-19.

Q14. What are your suggestions to the public to prevent themselves from transmission of this disease?

Hand washing with soap and water or using alcohol based sanitizer, physical distancing, and avoiding social gathering are essential practice to prevent the infection. Following points are to be considered:

- Maintain physical hygiene, stop touching nose, mouth, eyes with hands.

- Proper disposal of used masks, tissue paper, handkerchief
- Use of PPE (Personal Protective Equipment) like masks, gloves etc. when needed.
- People must cover mouth and nose while sneezing and coughing.
- Always eat well cooked meat.
- Be away from animals and birds.

(IN ONE SENTENCE: SOAP, WATER AND COMMON SENSE ARE THE BEST WAY TO PREVENT SARS-CoV-2)

Q15. Last but not the least, could you please give some tips to the young scientists to find the possible solution of this problem for mankind.

Scientists should be engaged to produce vaccine to prevent SARS- CoV-2. They may work on any one of the following areas to prevent SARS-CoV-2;

- To block ACE-2, which is a receptor for SARS -CoV-2
- To destroy SARS- CoV-2 in vivo
- To interfere formation of endosomal package
- To promote production of Natural Killer Cells in vivo, which will destroy the virally infected cells.

Thank You

[This session was interviewed by Dr Kapil Amgain, an Executive Editor of Journal of Karnali Academy of Health Sciences, Jumla. This is an electronic conversation dated on 3rd April, 2020.]