

## VOICE OF THE EXPERT

Dr Babasaheb V. Tandale is one of the most well-known and respected epidemiologists of India. Currently he is working as scientist F at the National Institute of Virology, Pune. He has got numerous international publications on public health over the last fifteen years. As the coronavirus pandemic swept the globe, the urgent need for a rational scientific voice was felt by all physicians. In that scenario, we could think of no better name in India to be a source of authentic and up-to-date information than Dr Tandale. This is an interview of Dr Tandale, which is exclusively available for the readers of JIMA. The interview was conducted online by Prof Jyotirmoy Pal and Dr Rudrajit Paul in the last week of March, 2020.



Dr Tandale, on behalf of JIMA, we welcome you to this interview. We would be asking a few questions on the Covid-19 epidemic.

### 1. What is the molecular nature of the coronavirus?

The coronaviruses are a large family of viruses. The emergence of 2019 novel coronavirus (2019-nCoV) since 31 December 2019 in Wuhan City in Hubei Province of China has been detected in unusual cases of pneumonia (Novel Coronavirus Pneumonia, NCP). The virus has been officially named as the SARS-CoV-2 by the International Committee on Taxonomy of Viruses (ICTV). The novel coronavirus disease has been named as the Coronavirus Disease (COVID-19) by the WHO. SARS-CoV-2 is the third beta-coronavirus after earlier SARS in 2003 and MERS in 2012.

The SARS-CoV-2 virus is spherical and hence looks like a crown, therefore the name 'coronavirus' (corona means crown). It is enveloped, positive-stranded RAN virus with nucleocapsid. The genomic structure is organized as +ssRNA of approximately 30kb in length, thereby making it the largest know RNA virus. The size of virus spike protein is 180 kDa with two subunits. It helps in virus receptor binding with the ACE2 receptor. The SARS-CoV-2 has > 95% homology with bat coronaviruses and > 70% similarity with the SARS-CoV-1.

### 2. Is this new coronavirus a zoonotic disease?

#### Editorial note:

1. There are some rumours doing the rounds in social media regarding certain types of food. We would like to stress that coronavirus is not transmitted via food. All types of food, if properly prepared, are safe.
2. This is the reason for social distancing.
3. The hospital wards where coronavirus infected patients are housed needs to be cleaned properly. Bedside furniture may be a temporary reservoir of the virus.

### if so, please explain

The new coronavirus is zoonotic disease at the first emergence. The beta-coronaviruses are originated mostly from bats. The transmission to humans is usually through the intermediate hosts like palm civet cats in the Guangdong province of China for SARS in 2003 and camels in case of MERS in 2012.

However, it is not yet clear which the intermediate host of the SARS-COV-2 is. Pangolins have been postulated to be intermediate hosts due to close match of genomic sequences. The environmental samples from Huanan sea food market provided link to emergence. The first few cases had history of exposure history with the market.

### 3. How did this virus enter human species?

It is not yet clear which the intermediate host of the SARS-COV-2 is. Pangolins have been postulated to be intermediate hosts. However, absence of exposure to the market in a few earlier cases indicated the likely human-to-human transmission. The environmental samples from Huanan sea food market provided link to emergence. The first few cases had history of exposure history with the sea food market. The recent transmission is solely contributed by human-to-human.

### 4. What is the infectivity of this virus?

The SARS-CoV-2 virus has moderate to high infectivity in relation to the earlier known beta-coronaviruses like SARS and MERS. The transmission is very efficient and higher than earlier viruses. This virus is easily transmitted, infects during asymptomatic and pre-symptomatic periods and has maximum infection rate among close contacts. The basic reproduction number for SARS-CoV-2 is ranging between 1.5 3.5. It means that an infected individual leads to transmission of infection in 2-4 people in close contacts. Therefore, the transmission is much efficient and sustained in close contacts leading to rapid spread.

### 5. How long can this virus survive in the environment?

The SARS-CoV-2 is stable in environment and is similar to earlier SARS. Although the most of transmission events are associated with close contacts due to droplet transmission, aerosols (<5 um) could be important in a limited settings with lower temperatures and higher humidity levels due to air conditioning. The aerosols may have viability for over 3 hours. The viability of virus on different surfaces is also significantly higher than earlier SARS. It remains viable on cardboard for 24 hours, on copper for 72 hours, on steel and plastics could be longer, almost for 5-7 days. The fomites are also reported to be important for transmission of SARS-CoV-2 virus.

### **6. Is the molecular nature of this virus conducive to vaccine preparation? what is the frequency of mutation?**

The virus spike protein is the most important structure of the virus that helps virus to adhere to the receptor ACE2. It is therefore very important glycoprotein for pathogenesis and immunity. Thus, it is possible to develop vaccines targeting spike protein. However, the mutations in the spike protein may lead to short-term immunity and the possibility of reinfections.

### **7. Are there any molecular barriers to anti-viral drug development?**

The antiviral development usually targets three aspects. These include direct antiviral effects, inhibition of virus entry and replication, and enhancement of host immune response. Generally, nucleoside analogues like Ribavirin and alpha-n1, alpha-n3 and beta-1a interferons have been reported to inhibit coronaviruses in vitro. Additionally, lopinavir and ritonavir have also been reported with minimal beneficial effect against SARS-CoV-2. Remdesivir has also been seen promising with inhibition in vitro, however clinical trials evidence of its effect is pending. Chloroquine has also been shown to inhibit virus in vitro.

### **8. Is there multi-systemic involvement in this infection?**

Most of COVID-19 patients present with pneumonia. However, there is wide variation in clinical presentations, with spectrum wider than earlier coronaviruses. In addition to respiratory involvement primarily, including very mild to severe features like ARDS, multiple systems may get involved. Gastrointestinal, musculoskeletal, neurological, hematologic, cardiac, hepatic, renal and other major organ systems involvement is reported. Multi-organ failure has been reported in terminal phases of illness leading to complications and mortality.

### **9. Why does ARDS develop so fast in this infection?**

The pathogenic mechanisms are complex. It is reported that excessive immune reaction in host could be the likely mechanism. This is broadly labelled as 'cytokine storm'. It leads to extensive tissue damage due to pro-inflammatory cytokine, interleukin-6, produced by activated leucocytes. This could lead to multiorgan dysfunction associated with cytokine release syndrome commonly labelled

as acute systemic inflammatory syndrome. The pathogenic mechanism is postulated to be the dysfunction of surfactant producing cells in alveoli leading to distress.

### **10. Is there a cytokine storm in coronavirus infection? If so, what is the effect?**

Yes. Most of the cases are reported with 'cytokine storm' in septic phase. The excessive immune reaction in the host that leads to extensive tissue damage, sloughing of parenchyma, accumulation of debris in alveoli and dysfunction of surfactant producing cells hampering maintenance of critical respiratory function.

### **11. Is there lasting immunity to this infection? Can anyone be affected a 2nd time?**

The immunity following natural infections is usually short-term. The immune response in asymptomatic and non-severe stages, specific adaptive immune response is required to eliminate virus and prevent disease progression. The immune response is influenced by various factors including the general host health and response mechanisms. The second response induces innate inflammation in lungs mediated by macrophages and granulocytes. Therefore, general good health may not work for severe lung disease manifestations. Some patients return virus positive and some may even relapse. There are a few reports of reinfections following earlier recovery.

### **12. Is this virus temperature sensitive? Will it diminish in summer?**

The SARS-CoV-2 virus is enveloped virus and is reported to be sensitive to sunlight, high temperature and humidity. However, being a novel virus, it is difficult to predict the effect. It seems to be difficult to have the decrease in transmission with higher summer temperatures in India due to high rates of survival on most surfaces with 8-10 days on dry surfaces, use of humidifiers and air conditioning, transmission associated mostly among close contacts, and the completely susceptible population with no immunity against the SARS-CoV-2 virus. Considering the transmission reported in warmer summer climates during the current ongoing pandemic, it seems to indicate that summer may not play a role in decreased transmission. As is seen earlier, the pandemics don't follow seasonal patterns observed in common outbreaks.

*Dr Tandale, we thank you immensely for your time. We are sure our readers will be delighted to hear from you. We hope to talk with you again in future.*

*Dr. Babasaheb V. Tandale, MD  
Scientist F and Group Leader, Epidemiology Group, ICMR-NIV Pune*