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Temperature Dependence and Survivorship of COVID 19: "Myth or Fact"

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***Abstract*– A novel Coronavirus, 2019-nCoV, has been identified as the cause of an outbreak of respiratory illness that originated in Wuhan, China, and which has spread to several other countries around the world. Assessment of the risks posed by severe acute respiratory syndrome (SARS) Coronavirus (SARS-CoV) on surfaces requires data on survival of this virus on environmental surfaces and on how survival is affected by environmental variables ph, temperature, relative humidity etc. Scientists are racing to identify the source of the Coronavirus that is causing havoc around the world. Three weeks ago, Chinese scientists suggested, on the basis of genetic analyses, that the scaly, ant-eating pangolin was the prime suspect. In this review we will summarize the current knowledge on whether the virus is really temperature dependent and whether the virus needs an intermediate host as a living or non living particle to survive before it gets transmitted to the one and only susceptible host i.e Human.**

***Keywords*– Type II pneumocytes, robustness, angiotensin- converting enzyme 2 (ACE2), SARS (severe acute respiratory syndrome), MERS (Middle East respiratory syndrome, Pangolins, Masked palm civet).**

I. INTRODUCTION

The COVID-19 virus was known earlier as 2019-nCoV. As of 12 February 2020, WHO reported 45,171 cases and 1115 deaths related to COVID-19 . COVID-19 is similar to Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) virus in its pathogenicity, clinical spectrum, and epidemiology. Comparison of the genome sequences of COVID-19, SARS-CoV, and Middle East Respiratory Syndrome Coronavirus (MERS-CoV) showed that COVID-19 has a better sequence identity with SARS-CoV compared to MERS CoV. (1)

Coronaviruses are a group of related viruses that cause diseases in mammals and birds. In humans, Coronaviruses cause respiratory tract infections that can be mild, such as some cases of the common cold (among other possible causes, predominantly rhinoviruses), and others that can be lethal, such as SARS, MERS, and COVID-19. The genome size of Coronaviruses ranges from approximately 27 to 34 kilobases, the largest among known RNA viruses. (2)Symptoms in other species vary: in chickens, they cause an upper respiratory tract disease, while in cows and pigs they cause diarrhea. SARS corona virus (SARS- CoV) uses angiotensin- converting enzyme 2 (ACE2) as a receptor and primarily infects ciliated bronchial epithelial cells and type II pneumocyte, (Epithelial cells that line the lung alveoli; are round and produce surfactants to lower the surface tension of water and allow the membrane to separate, thereby increasing the capability to exchange gases) were transmitted directly to humans from market civets and viruses are thought to have originated in bats .(3,4) Coronaviruses constitute the subfamily Orthocoronavirinae, in the family Coronaviridae, order Nidovirales, and realm Riboviria. They are enveloped viruses with a positive-sense single-stranded RNA genome and a nucleocapsid of helical symmetry. This subfamily consists of four genera — Alphacoronavirus, Betacoronavirus, Gammacoronavirus and Deltacoronavirus— on the basis of their phylogenetic relationships and genomic structures. The Alphacoronaviruses and Betacoronaviruses infect only mammals. (22, 23) Alphacoronaviruses and Betacoronaviruses usually cause respiratory illness in humans and gastroenteritis in animals. (5) On the basis of current sequence databases, all human Coronaviruses have animal origins.

1. Does CORONAVIRUS really is TEMPERATURE DEPENDENT ??

Studies have been reported that at high temperature Viruses are not able to survive but according to studies reported a viruses do need an intermediate host to ultimate transfer it to the human host from natural reservoir. We hypothesize that the direct progenitor was produced by recombination within bats and then transmitted to farmed civets or another mammal, which then transmitted the virus to civets by faecal–oral transmission. When the virus- infected civets were transported to Guangdong market, the virus spread in market civets and acquired further mutations before spillover to humans. (6,7, 8)

Masked palm civets were considered to be a likely vector of SARS.(9) The masked palm civet is distributed from

the northern parts of the Indian Subcontinent, especially the Himalayas, ranging eastwards cross Bhutan, Bangladesh, Myanmar, Thailand, Peninsular Malaysia, Laos, Cambodia, Vietnam to China. It is also found on Borneo, Sumatra, Taiwan, Japan, and the Andaman and Nicobar islands. According to this information it can survive in extreme low temperature like Himalyas and high temperature like Bhutan, Bangladesh etc. So we can state that it has nothing to do with the temperature as the intermediate host can survive at all temperatures from extreme cold to moderate and extreme high temperature region. (10)

Also the deaths in Italy as per the ,current count is 6,820 till 24th March 2020, shows that persons are continuously being affected very rapidly being the current temperature 14C still the virus is continuously spreading rapidly, which shows that it has nothing to do with temperature.(11)

2. SURVIVAL Needs a Living Intermediate Host OR Non Living Surface???????

Transmission of a virus is dependent not only on its interaction with a host, but on its interaction with the environment outside of the host. Viruses outside a host may be regarded as inert particles, and, possessing no intrinsic metabolism, they do not require any nutrients to persist. Nonetheless, they possess a degree of robustness which allows them to remain infectious during the various conditions that they may encounter between one host and another. The longer a virus can survive outside a host, the greater are its chances for transmission. (12, 13) These chances will be affected by various environmental conditions and factors as heat, moisture, and pH. These and other factors will vary in presence and extent among different environments. The virus lives longest on plastic and steel, surviving for up to 72 hours. But the amount of viable virus decreases sharply over this time. It does poorly on copper, surviving four hours. On cardboard, it survives up to 24 hours, which suggests packages that arrive in the mail should have only low levels of the virus — unless the delivery person has coughed or sneezed on it or has handled it with contaminated hands.

The new Coronavirus that emerged from a seafood market in Wuhan, China, likely originated in bats and then jumped to an “intermediate host” before infecting humans, World Health Organization officials said Tuesday. Scientists are running tests on various animals, but have so far not found the host responsible for the outbreak, Dr. Sylvie Briand, head of WHO’s Global Infectious Hazard Preparedness division, told reporters at a news conference at the agency’s headquarters in Geneva..In the search for the animal source or sources of the Coronavirus epidemic in China, the latest candidate is the pangolin, an endangered, scaly, ant-eating mammal that is imported in huge numbers to Chinese markets for food and medicine. (14, 15) It is also far from clear whether the pangolin is the animal that passed the new virus to humans. Bats are still thought to be the original host of the virus. The team searched DNA and protein sequences isolated from pangolin tissues for ones similar to SARS-CoV-2. The researchers identified protein sequences in sick animals' lungs that were 91% identical to the human virus' proteins.(16) Moreover, the receptor binding domain of the spike protein from the pangolin Coronavirus had only five amino acid differences from SARS-CoV-2, compared with 19 differences between the human and bat viral proteins. This evidence points to the pangolin as the most likely intermediate host for the new Coronavirus (16) Palm civets turned out to be an intermediate host of SARS and camels an intermediate host of MERS. In both outbreaks, researchers eventually found that the origin of the virus was in bats, where the virus could live without sickening the animals. From bats, the viruses seem to have jumped to intermediate hosts and then to people. Linfa Wang, who studies bat viruses at Duke-NUS Medical School in Singapore says it seems that bats have developed special immune systems, Their bodies make molecules that other mammals don't have, which help repair cell damage. And their systems don't overreact to infections, which keeps them from falling ill from the many viruses they carry (and also prevents conditions like diabetes and cancer). This shows that it's not always the virus itself but the body's response to the virus that can make us sick, explains Wang. (17,18,19)
The above information shows that viruses didn’t become ubiquitous by being wimps: From the rhinoviruses that cause the common cold to the new Coronavirus that has spread across the world, they are able to survive on surfaces far away from the living cells that they need in order to reproduce. How long they can lurk before a living organism comes along to infect depends on the kind of surface and the properties of the virus. (20, 21)

II. CONCLUSION

Understanding the stability of viruses in different temperature is important in understanding transmission of novel infectious agent . While health experts agree warmer weather is a factor in containing the outbreak, they stress the outcome of each country's response may depend on how robust its healthcare infrastructure is, how quickly those tools are deployed, and how proactive citizens are .Viruses do not replicate outside living cell but infectious virus may persist on contaminated environmental surfaces and the duration of persistence of viable virus is affected markedly by temperature and humidity. Contaminated surfaces are known to be significant vectors in the transmission of infections in the hospital setting as well as the community. It is widely accepted that many viruses have existed in their natural reservoirs for a very long time. The constant spillover of

viruses from natural hosts to humans and other animals is largely due to human activities, including modern agricultural practices and urbanization. Therefore, the most effective way to prevent viral zoonosis is to maintain the barriers between natural reservoirs and human society, in mind of the 'one health' concept.

REFERENCES

[1]. J Gastroenterol Hepatol. 2020 Mar 25. doi: 10.1111/jgh.15047. [Epub ahead of print] Covid-19 and the Digestive System. Wong SH1,2, Lui RN1,2, Sung JJ1,2. PMID: 32215956 DOI:10.1111/jgh.15047

[2]. Sexton NR, Smith EC, Blanc H, Vignuzzi M, Peersen OB, Denison MR (August 2016). "Homology-Based Identification of a Mutation in the Coronavirus RNA-Dependent RNA Polymerase That Confers Resistance to Multiple Mutagens". Journal of Virology. 90 (16): 7415–28. doi:10.1128/JVI.00080-16. PMC 4984655. PMID 27279608. CoVs also have the largest known RNA virus genomes, ranging from 27 to 34 kb (31, 32), and increased fidelity in CoVs is likely required for the maintenance of these large genomes (14).

[3]. Li, W. H. et al. Angiotensin- converting enzyme 2 is a functional receptor for the SARS coronavirus. Nature 426, 450–454 (2003).

[4]. Qian, Z. et al. Innate immune response of human alveolar type II cells infected with severe acute respiratory syndrome- coronavirus. Am. J. Respir. Cell. Mol. Biol. 48, 742–748 (2013)

[5]. Woo, P. C. et al. Discovery of seven novel mammalian and avian coronaviruses in the genus deltacoronavirus supports bat coronaviruses as the gene source of alphacoronavirus and betacoronavirus and avian coronaviruses as the gene source of gammacoronavirus and deltacoronavirus. J. Virol. 86, 3995–4008 (2012).This paper describes coronavirus origins by phylogenetic analysis.

[6]. Nagy, P. D. & Simon, A. E. New insights into the mechanisms of RNA recombination. Virology 235, 1–9 (1997).

[7]. Rowe, C. L. et al. Generation of coronavirus spike deletion variants by high- frequency recombination at regions of predicted RNA secondary structure. J. Virol. 71, 6183–6190 (1997).

[8]. Chinese, S. M. E. C. Molecular evolution of the SARS coronavirus during the course of the SARS epidemic in China. Science 303, 1666–1669 (2004).This paper describes the genetic evolution of human SARS- CoV during SARS outbreaks

[9]. Duckworth, J.W.; Timmins, R.J.; Chutipong, W.; Choudhury, A.; Mathai, J.; Willcox, D.H.A.; Ghimirey, Y.; Chan, B. & Ross, J. (2016). "Paguma larvata". IUCN Red List of Threatened Species. IUCN. 2016: e.T41692A45217601. Retrieved 30 October 2018.

[10]. World Chelonian Trust (2002). Palm Civets (Paguma larvata) and SARS World Chelonian Trust, California

[11]. Novel Coronavirus (2019-nCoV) situation reports - World Health Organization (WHO) Content source: National Center for Immunization and Respiratory Diseases (NCIRD), Division of Viral Diseases

[12]. Lopman, B.A., Reacher, M.A., van Duijnhoven, Y., Hanon, F.-X., Brown, D. and Koopmans, M. (2003) Viral gastroenteritis outbreaks in Europe. Emerg. Inf. Dis. 9, 90–96.

[13]. Mead, P.S., Slutsker, L. and Dietz, V. (1999) Food-related illness and death in the United States. Emerg. Inf. Dis. 5, 607–625.

[14]. Xiao, K. et al. Preprint on bioRxiv https://doi.org/10.1101/2020.02.17.951335 (2020)

[15]. Zhang, T., Wu, Q. & Zhang, Z. Preprint on bioRxiv https://doi.org/10.1101/2020.02.19.950253 (2020)

[16]. Chengxin Zhang, Wei Zheng, Xiaoqiang Huang, Eric W. Bell, Xiaogen Zhou, Yang Zhang. Protein Structure and Sequence Reanalysis of 2019-nCoV Genome Refutes Snakes as Its Intermediate Host and the Unique Similarity between Its Spike Protein Insertions and HIV-1. Journal of Proteome Research, 2020; DOI: 10.1021/acs.jproteome.0c00129

[17]. Ge, X.Y.;Wang, N.; Zhang,W.; Hu, B.; Li, B.; Zhang, Y.Z.; Zhou, J.H.; Luo, C.M.; Yang, X.L.;Wu, L.J.; et al. Coexistence of multiple coronaviruses in several bat colonies in an abandoned mineshaft. Virol. Sin. 2016, 31, 31–40. [CrossRef] [PubMed]

[18]. Wang, L.F.; Cowled, C. Bats and Viruses: A New Frontior of Emerging Infectious Diseases; JohnWiley Sons Inc.: Hoboken, NJ, USA, 2015

[19]. He, B.; Zhang, Y.; Xu, L.; Yang,W.; Yang, F.; Feng, Y.; Xia, L.; Zhou, J.; Zhen,W.; Feng, Y.; et al. Identification of diverse alphacoronaviruses and genomic characterization of a novel severe acute respiratory syndrome-like coronavirus from bats in China. J. Virol. 2014, 88, 7070–7082. [CrossRef] [PubMed]

[20]. Sexton DJ, et al. The common cold in adults: Treatment and prevention. https://www.uptodate.com/contents/search. Accessed Jan. 4, 2018.

[21]. How long do bacteria and viruses live outside the body? NHS Choices. https://www.nhs.uk/chq/Pages/how-long-do-bacteria-and-viruses-live-outside-the-body.aspx. Accessed Jan. 4, 2018

[22]. de Groot RJ, Baker SC, Baric R, Enjuanes L, Gorbalenya AE, Holmes KV, Perlman S, Poon L, Rottier PJ, Talbot PJ, Woo PC, Ziebuhr J (2011). "Family Coronaviridae". In King AM, Lefkowitz E, Adams MJ, Carstens EB, International Committee on Taxonomy of Viruses, International Union of

Microbiological Societies. Virology Division (eds.). Ninth Report of the International Committee on Taxonomy of Viruses. Oxford: Elsevier. pp. 806–28. ISBN 978-0-12-384684-6.

[23]. International Committee on Taxonomy of Viruses (2010-08-24). "ICTV Master Species List 2009—v10" (xls).