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Editorial

SARS-CoV-2 and ACE2 nexus

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India had forced upon itself a complete lockdown for almost 2 months since March 2020 to fight against an unseen enemy—Severe acute respiratory syndrome Corona virus 2 (SARS-CoV-2). Now with restrictions being lifted almost completely across the entire nation, the number of new coronavirus cases has seen a steep rise along with an increase in mortality rate. Research being done across the nations has shown that corona virus disease 2019 (COVID-19) infection causes serious consequences in elderly, those with metabolic and chronic disorders like hypertension, diabetes mellitus, renal diseases, hyperlipidemia, etc.

Since the renin-angiotensin system (RAS) is involved in these patients, drugs which can modulate this system are now being considered as the drug of choice in COVID-19 patients and also used for prevention of any vascular complications in such cases **[1]**.

The dynamic control of vascular function is known to be regulated by different regulatory proteins and peptides included in renin-angiotensin system. The RAS is not only involved in blood pressure homeostatic mechanisms, it also regulates sodium levels and blood volume in the body. While it is known that angiotensin-I is converted to angiotensin-II by angiotensin converting enzyme (ACE), the role of angiotensin converting enzyme 2 (ACE2) which metabolizes Angiotensin-I to Ang 1-9 and Angiotensin-II to Ang 1-7 has been recently elucidated **[2]**.

ACE2 enzyme belongs to a family of dipeptidyl carboxypeptidases. It is expressed by most of the tissues in the body with greater expression in renal, cardiac and pulmonary tissues; and in vascular endothelial cells **[3]**.

SARS-CoV-2 is an example of a single-stranded RNA virus which has the capability to enter the host cell due to the presence of S-protein (envelope spike glycoprotein). This same protein is also responsible for transmitting the disease from one host to another. It causes reduction in expression of ACE2 thereby increasing chances of lung injury **[4,5]**, increased formation of atherosclerotic plaques **[6]**, increased incidence of cardiac fibrosis **[2]**, diabetic and hypertensive nephropathy **[6]**.

Due to the widespread location of ACE2 in different tissues like lungs, kidney, blood vessels, intestine, the symptomatology of COVID-19 infection also differs; varying from pneumonia, bronchitis to gastrointestinal illness.

Another interesting observation regarding COVID-19 infection is the relatively protective effect of circulating ACE2 levels in females compared to males. Higher expression of tissue ACE2 in males; and negative correlation of ACE2 activity with body mass index (BMI), estrogen levels and pulse pressure in females is one of

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the reasons why incidence of COVID-19 infection in females has been less. There is also enough evidence to show that in children the incidence of COVID-19 infection is less compared to adults; this too has been subjected to higher levels of circulating ACE2 in children **[7]**.

Therapeutic strategies adopted against SARS-CoV-2 targets ACE2 receptor since it has been proved to be the entry point for the coronavirus to gain access to body tissues. Neutralizing antibodies present in convalescent sera against the SARS protein also offers protection against COVID-19 infection **[8]**. However a statement issued in public interest by American Heart Association (AHA) stating that there is no strong evidence to prove harm or benefit of ACE-inhibitors or angiotensin-I receptor blockers has provide some relief to medical practitioners across nations **[9]**.

As far as clinical trials on corona vaccine are concerned, COVID-19 vaccine, developed by US drug biotech firm Moderna, triggered an immune response in people, and has also prevented the development of lung infections in mice. Similar trials in monkeys have also showed promising results. Yet it would be another 12-18 months before the corona vaccines be actually available and be useful to patients infected with this deadly virus **[10]**. India became fifth country to isolate the SARS-CoV-2 when National Institute of Virology (NIV), Pune, a premier constituent institute of Indian Council on Medical Research (ICMR), New Delhi retrieved the virus from the affected patient's sample. This has put India on path of developing vaccine against this highly infectious virus.

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References

1. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, Cheng Z, Yu T, Xia J, Wei Y, Wu W, Xie X, Yin W, Li H, Liu M, Xiao Y, Gao H, Guo L, Xie J, Wang G, Jiang R, Gao Z, Jin Q, Wang J, Cao B. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020 Feb 15; 395(10223):497-506. PMID: 31986264 DOI: 10.1016/S0140-6736(20)30183-5
2. Tikellis C, Thomas MC. Angiotensin-Converting Enzyme 2 (ACE2) is a key modulator of the renin angiotensin system in health and disease. Int J Pept. 2012; 2012:256294. PMID: 22536270 DOI: 10.1155/2012/256294
3. ACE2 angiotensin I converting enzyme 2 [Homo sapiens (human)] [Internet]. Bethesda (MD): National Center for Biotechnology Information, U.S. National Library of Medicine; 2020. Available from: https://www.ncbi.nlm.nih.gov/gene/59272
4. Yan R, Zhang Y, Li Y, Xia L, Guo Y, Zhou Q. Structural basis for the recognition of SARS-CoV-2 by full-length human ACE2. Science. 2020 Mar 27; 367(6485):1444-1448. PMID: 32132184 DOI: 10.1126/science.abb2762
5. Kuba K, Imai Y, Rao S, Gao H, Guo F, Guan B, Huan Y, Yang P, Zhang Y, Deng W, Bao L, Zhang B, Liu G, Wang Z, Chappell M, Liu Y, Zheng D, Leibbrandt A, Wada T, Slutsky AS, Liu D, Qin C, Jiang C, Penninger JM. A crucial role of angiotensin converting enzyme 2 (ACE2) in SARS coronavirus-induced lung injury. Nat Med. 2005 Aug; 11(8):875-9. PMID: 16007097 DOI: 10.1038/nm1267
6. Simões e Silva AC, Silveira KD, Ferreira AJ, Teixeira MM. ACE2, angiotensin-(1-7) and Mas receptor axis in inflammation and fibrosis. Br J Pharmacol. 2013 Jun; 169(3):477-92. PMID: 23488800 DOI: 10.1111/bph.12159
7. Ciaglia E, Vecchione C, Puca AA. COVID-19 infection and circulating ACE2 levels: Protective role in women and children. Front Pediatr. 2020 Apr 23; 8:206. PMID: 32391299 DOI: 10.3389/fped.2020.00206
8. Casadevall A, Pirofski LA. The convalescent sera option for containing COVID-19. J Clin Invest. 2020 Apr 1; 130(4):1545-1548. PMID: 32167489 DOI: 10.1172/JCI138003
9. Bozkurt B, Kovacs R, Harrington B. Joint HFSA/ACC/AHA Statement Addresses Concerns Re: Using RAAS Antagonists in COVID-19. J Card Fail. 2020 May; 26(5):370. PMID: 32439095 DOI: 10.1016/j.cardfail.2020.04.013
10. Callaway E. Coronavirus vaccine trials have delivered their first results - but their promise is still unclear. Nature. 2020 May; 581(7809):363-364. PMID: 32433634 DOI: 10.1038/d41586-020-01092-3