SCO-Young Scientist Profile

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Details of research work carried out in S&T (*limit to 200 words*)

Coronavirus Disease 2019 (COVID-19) is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and has killed over 1,000,000 people around the world. It is impossible to create novel drugs against the coronavirus in a very short time. Therefore the best strategy is to find new antiviral uses from approved drugs.

Lopinavir originally approved as an anti-HIV drug, was reported to benefit SARS patients 17 years ago. However, it fails to reduce SARS-CoV-2 viral loads in COVID-19 patients though lopinavir significantly inhibit SARS-CoV-2 replication in vitro.

Recently, we compared pharmacokinetics profiles of these drugs and their capabilities of reducing viral load in clinical trials. According to scRNA sequencing analysis, we found that high expression of both angiotensin converting enzyme 2 (ACE2) and transmembrane Serine Protease 2 (TMPRSS2) made the lung and intestine vulnerable to SARS-CoV-2. Hydroxychloroquine, chloroquine and favipiravir, which were highly distributed to the lung, were reported to reduce viral loads in respiratory tract of COVID-19 patients. Conversely, drugs with poor lung distributions, including lopinavir/ritonavir, umifenovir and remdesivir, were insufficient to inhibit viral replication. We concluded here that the antiviral drugs should be distributed straight to the lung tissue for reducing viral loads in respiratory tract of COVID-19 patients.

Associated SCO-YSC Theme:

Thematic session-4: Combating COVID 19 and Emerging Pandemics Through Research and Innovation

Statement of Innovation ***(Brief information on new innovative ideas including startup / entrepreneurs- limit to 150 words)***

We noticed that ACE2 bound to the SARS-CoV-2 spike protein with ~15 nM affinity, which is ~10- to 20-fold higher than the binding capacity of ACE2 to SARS-CoV spike protein. This indicates that SARS-CoV-2 can enter lung much easier than SARS-CoV. Thus, the viral loads of SARS-CoV-2 might be much higher than viral loads of SARS-CoV in the lung tissue.

Therefore, it might be more effective if the anti-SARS-CoV-2 drugs could be distributed straight to or accumulate in the lung above other organs/tissues. Some antiviral drugs, like

LPV/r, might inhibit SARS-CoV-2 in the GI tract according to their distribution profiles. However, most of samples for viral RNA test were collected from nasopharyngeal swabs and oropharyngeal saliva in the clinical trials. To better evaluate antiviral drugs that target GI tract, the stool samples should also be collected for viral RNA test in the future.

Major awards/ Achievements ***(Upto 3 awards)***

Shenzhen Overseas High-Caliber Personal 2019~2004

Possible collaboration with SCO countries ***(limit to 100 words)***

We are interested in the application of complementary and alternative medicine on the antiviral research. Several antivirals approved by US FDA are originally from natural products, therefore leading to a strong interest to explore the novel compounds that can inhibit virus replication from natural products. Natural products have been used as complementary and alternative medicine in SCO countries for thousands of years. We would like to work with local collaborators on these herbs and identify their antiviral ingredients.

Key words ***(relevant to research work conducted as well as proposed innovation, 5-6 words)***

Coronavirus Disease 2019; drug repurposing; lung distribution; pharmacokinetics; antivirals