

Elderly Alzheimer's Patients Are More Vulnerable to COVID-19 Infection

- The research team led by Dr. Joo Jae-yeol of KBRI published the results in an international academic journal.

- It is the first study to highlight the vulnerability of Alzheimer's patients to the novel coronavirus (SARS-CoV-2) and is expected to be applied to infection diagnosis and prevention.

□ Korea Brain Research Institute (KBRI headed by Suh Pann-ghill) announced the discovery of the elevation of *Ace2* as a SARS-CoV-2 entry receptor gene expression in elderly patients with Alzheimer's by Dr. Joo Jae-yeol and Dr. Lim Key-hwan.

○ The research results were published in the online version of the *Journal of Infection* dated June 30, and the title and authors of the paper are as follows.

***Title:** Elevation of *Ace2* as a SARS-CoV-2 entry receptor gene expression in Alzheimer's disease

***Author:** Key-Hwan Lim(1st Author), Sumin Yang, Sung-Hyun Kim, Jae-Yeol Joo(Corresponding Author)

□ The novel coronavirus (SARS-CoV-2), which has put great strain on the world with the unprecedented scale of its spread, is reportedly hitting the elderly in their 70s and older the most dangerous. Especially, recent reports shown that older people who have chronic comorbidities such as chronic obstructive pulmonary has high mortality rate.

○ As such, KBRI's research team investigated the risk of SARS-CoV-2 infection in patients with Alzheimer's dementia through micro array data-set and total RNA sequencing (RNA-seq) in terms of perspective of brain disease.

□ The research team analyzed *ACE2* gene expression through Big Data containing the brain tissue and blood genomic information of elderly patients with Alzheimer's disease and genome-wide

association study and transcriptome analysis (RNA-seq). The research team discovered that the expression of the *ACE2** gene, which is a SARS-CoV-2 binding protein for cell entry, is elevated in the elderly with Alzheimer's disease groups compared to the elderly not suffering from the disease, while also confirming the same change in the brain tissue of the Alzheimer's disease model mice.

※ ACE2: Angiotensin-converting enzyme 2 used by the novel coronavirus as an entry receptor to penetrate the human cell

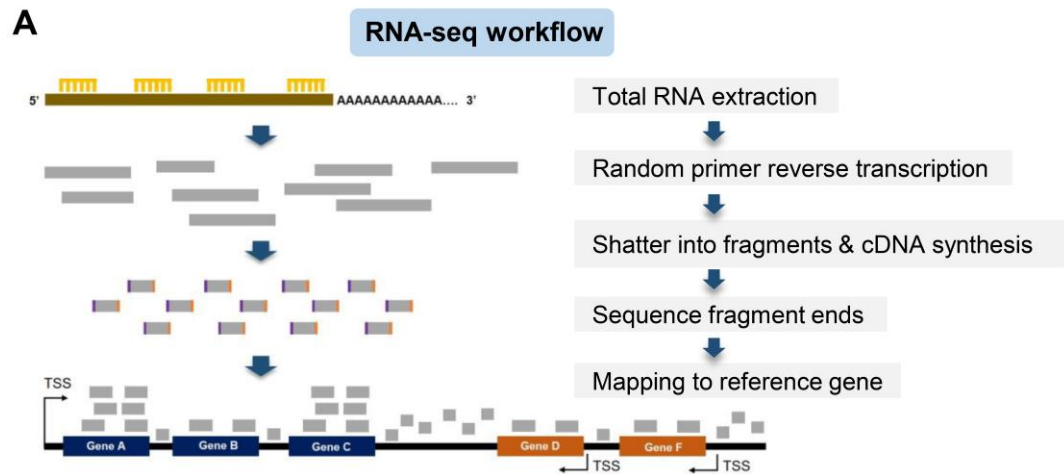
- Based on the genome analysis of Alzheimer's disease patient groups with early-stage, mild, and severe, it was identified that *ACE2* gene expression was gradually elevated along with the development of Alzheimer's disease. That means, as *ACE2* helps SARS-CoV-2 penetrate the human cell, its greater elevation can lead to greater infection risk.

- ☐ This study is significant in that it newly highlighted the interrelation between Alzheimer's disease and SARS-CoV-2 and proved the higher vulnerability of elderly Alzheimer's patients than the elderly without Alzheimer's. The results of this study are expected to be utilized as a new diagnosis method for the elderly with underlying degenerative brain diseases.

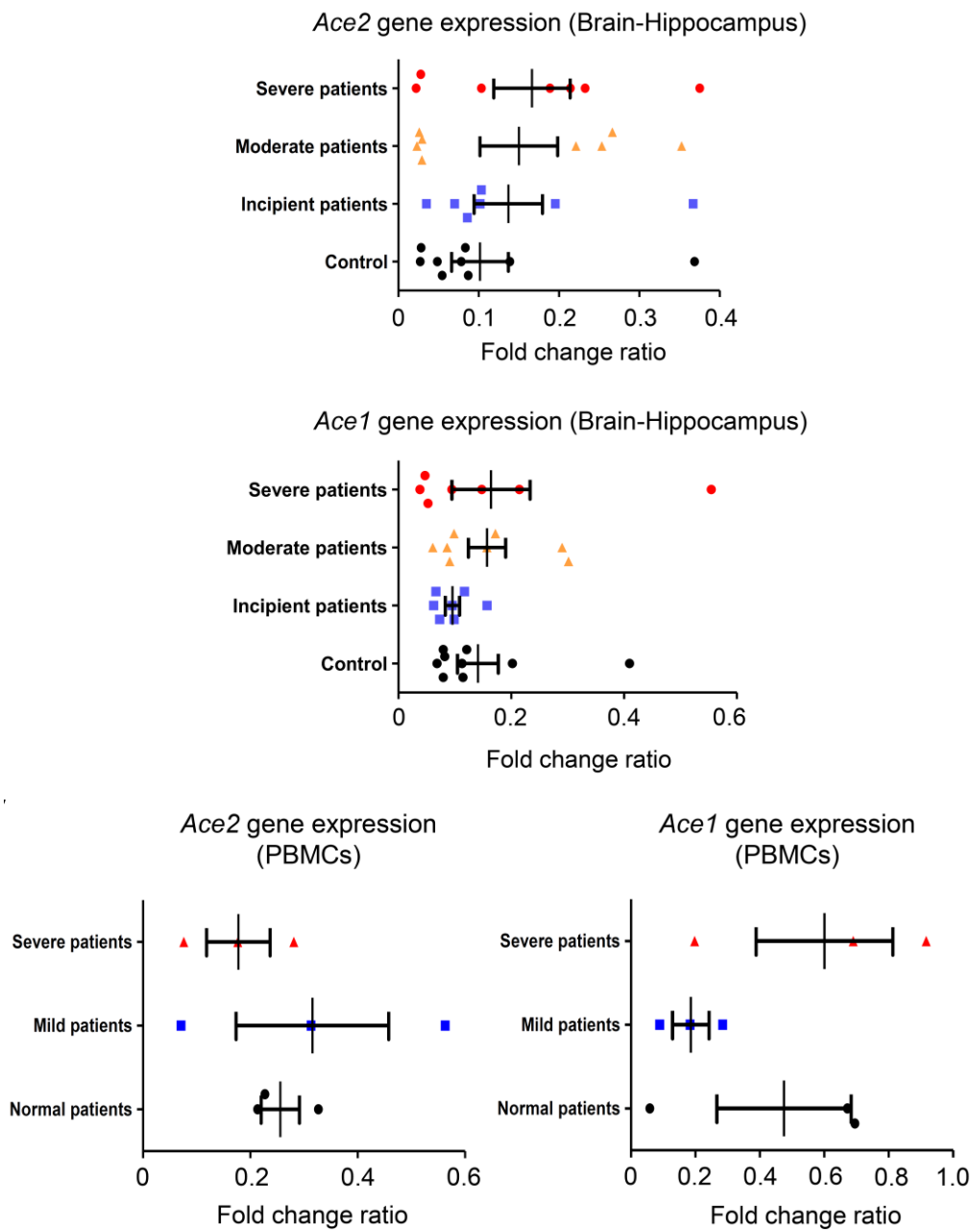
- ☐ Dr. Joo Jae-yeol, who led this study, said, "We are happy to be able to provide new information on the prevention of the transmission of the novel coronavirus as the national government-run research institute specializing in brain research. We advise that elderly patients with Alzheimer's take extra care for infection prevention and control of the novel coronavirus and that our society pay special attention to such patients."

- ☐ The research team has also discovered the *Ube2h* gene, which specifically elevates in Alzheimer's disease patient blood, early this year and has continually proposed diverse methods of Alzheimer's disease diagnosis and prevention of the transmission of the novel coronavirus based on follow-up studies.

- ☐ This research was conducted as a KBRI in-house project supported by the Ministry of Science and ICT (MSIT), the Basic Research Program of the National Research Foundation of Korea (NRF).



[Figure 1] Identification of SARS-CoV-2 receptor gene expression through RNA-sequencing



[Figure 2] Analysis of *Ace1* and *Ace2* gene expression profile from human brain tissue and peripheral blood mononuclear cells (PBMCs) in Alzheimer's disease patients. *Ace2* gene expression levels are elevated in the severe patient group compared to healthy group