Equine*Review*

Introduction: For this edition of the Equine Review we thought it may be interesting to look at some papers published over the last few months relating to SARS-CoV-2 (COVID-19) with new findings in the SARS-CoV-2 genome, a review of treatment options and the role of masks as protective measures against virus transmission.

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Structural and functional basis of SARS-CoV-2 entry by using human ACE2

The arrival of this novel coronavirus and the subsequent pandemic is a public health emergency. In order to understand how the virus infects a patient one needs to understand its genome. This virus is designated severe acute respiratory syndrome coronavirus 2 (SARS)-CoV-2 by the International Committee on Taxonomy of Viruses. This virus is the seventh coronavirus causing human diseases; coronaviruses are proven to cross the species barrier affecting human (zoonosis), and SARS-CoV-2 has been isolated in animals. However, despite all the studies being carried out on this virus the transmission path, the natural host and intermediate adaptive species if any, remain unidentified. The study by Wang and co-workers (2020) demonstrated that SARS-CoV-2 uses the ACE2 receptor to enter human cells (Wang et al. *Cell*. 2020; doi: 10.1016/j.cell.2020.03.045). This finding has generated some discussion about whether ACE inhibitors and/or angiotensin-receptor blockers could be a potential treatment for COVID-19 or, conversely, worsen the disease. Among the seven coronaviruses discovered, only three of them are shown to use this receptor for cell entry in humans. The structural information of the SARS-CoV-2 obtained in this study should help to identify inter-species transmission route(s) by characterising the interactions of SARS-CoV-2 with receptors of different species.

Pharmacologic Treatments for Coronavirus Disease 2019 (COVID-19) A review

The review by Saunders and coworkers (2020) summarises all possible treatment options for patients with SARS-CoV-2 infection (Sanders et al. *JAMA*. 2020; doi: 10.1001/jama.2020.6019). Currently, there is no evidence from randomised trial studies of any potential therapy improving outcome of suspected or confirmed patients with SARS-CoV-2. However, potential therapies are likely to be those that target the lifecycle of the virus, and additionally, viral entry and immune regulation pathways.

Drugs which have previously been used to treat SARS-CoV and Middle East respiratory syndrome coronavirus (MERS-CoV) have been tested in SARS-CoV-2 patients with inconsistent efficacy. Chloroquine and hydroxychloroquine, known for treating malaria, appear to block viral entry into cells in vitro. However, despite all the studies in progress, no high-quality evidence exists to justify their use.

At present, the cornerstone in management of patients with SARS-CoV-2 remains in supportive care, ranging from symptomatic management to full intensive care and respiratory support. The three main supportive therapies which are important to mention are: corticosteroids; immunomodulatory agents; and immunoglobulin therapy. Corticosteroids are utilised to decrease the inflammatory response in the lungs. Monoclonal antibodies directed against key inflammatory cytokines is a potential adjunctive therapy, however, there is still a lack of randomised of clinical trials to prove efficacy in infected patients. Immunoglobulin therapy is another potential adjunctive therapy; this therapy would, in theory, be of primary benefit within the first 7 to 10 days of infection, at the peak of viraemia, when the primary immune response has not yet occurred. Some uncontrolled data about its use in SARS-CoV-2 critically ill patients have just been published, but more investigation is needed in order to achieve better plasma preparations with protective antibodies against SARS-CoV-2.

The most effective long-term strategy to prevent future outbreaks would be the development of a vaccine providing protective immunity. However, it is likely going to be a considerable time before this can be enacted. Despite the speed and volume of clinical trials launched to investigate potential therapies to combat SARS-CoV-2, no therapies have been demonstrated to be effective to date.

Role of mask/respirator protection against SARS-CoV-2

Are facemarks effective? Smereka (2020) addresses this question (Smereka. *Anesth Analg*. 2020; doi: 10.1213/ANE.0000000000004873). There are different kinds of masks available, which differ primarily in their maximum internal leakage rate limit. 'Surgical masks' are designed to protect against droplets or particles with a diameter of greater than 100 microns; however the SARS-CoV-2 virus is 100 times smaller than the pore diameter. Therefore, surgical masks cannot act as a barrier against SARS-CoV-2. The use of other masks or respirators is controversial, and it is not clear if they should be worn in all situations or just in high-risk circumstances. It is also worth noting that the respirator masks (N95) increase the resistance to inhalation and the longer they are used for, the more difficult breathing becomes because of absorbed particles. Interestingly the effectiveness of the respirator decreases with the increase of carbon dioxide and water vapour between the respirator and the face. With each inhalation/exhalation the relative concentrations of carbon dioxide and water increase, making the respirator ineffective over time and therefore they need to be replaced regularly. In conclusion, wearing surgical masks when facing clients with SARS-CoV-2 is inefficient and does not confer protection. Nevertheless it is perceived by members of the public as an increased level of protection. To effectively reduce transmission N95 masks or similar need to be considered. EQ