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Role of Nanomedicine in Novel Corona Virus Pandemic: A Perspective

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ABSTRACT

Novel Corona virus (COVID-19) pandemic has affected numerous lives worldwide. This constant transmission of a novel coronavirus and its ability to rapidly spread from human to human has prompted scientists to develop new approaches for the treatment of COVID-19. Nanotechnology is an emerging field that can be implicated to battle against the COVID-19.Nanomedicine could be a significant theranostic means to fight against CoVs and the host cells. Nanoparticles which are embedded with viral antigens or antibodies show promising results against the SARS-CoV-2 and the re-emerging CoV. Through this communication, it is suggested that nanoparticles may play an important role at different stages of COVID-19 pathogenesis, considering their inhibition potential in the initial attachment and membrane fusion during viral entry and infected cell protein fusion. Furthermore, nano encapsulated drugs may be more efficient in activating intracellular mechanisms to cause irreversible damage to viruses and inhibition of viral transcription, translation and replication.

KEY WORDS: COVID-19, SARS-COV-2, NANOTECHNOLOGY, NANOMEDICINE.

INTRODUCTION

Nanomedicine impacts all fields of medicine and has been considered as an essential instrument for novel diagnostics, medical imaging, nano-therapeutics, vaccines and to develop biomaterials for regenerative medicine, (Tani et al 2020). Soft nanomaterials derived from polymers (polymeric nanoparticles), lipids (lipid-solid nanoparticles, nanostructured lipid carriers, liposomes), surfactants (microemulsion, nanoemulsions, liquid crystals) and proteins (protein nanoparticles) have been applied in nano medicine, especially for drug delivery. The magnitude of interactions between nanomaterial and tissues / biological molecules is the base for their use for various medical applications (Patra et al 2018). Drug-based nanoparticles have been developed for decades, and several are under clinical trials for cancer, neurodegenerative, inflammatory, cardiovascular and infectious diseases, although only few of them are approved for human use (Cui and Shi, 2019). The improvement of biopharmaceutical, pharmacokinetic and pharmacodynamics aspects of drug loading is the main tool of soft nanomaterials. Also, nanoparticles can promote specific drug targeting (passive or active targeting) and controlled drug-release rate, thereby, affecting the efficacy and safety of the treatment. Besides soft and metal nanoparticles have been applied in Nano medicine, mainly due to their various antimicrobial activities (antibacterial, antifungal, anti-parasitic and antiviral).

Due to the emergence of pathogenic bacteria resistant to antimicrobials, several studies have reported the efficacy of the nanotechnology-based antimicrobial therapy.

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Similarly, the occurrence of new viruses and their heterogeneity has also demanded innovative therapies. This way, considering specific targeting, nanotechnology opens a new avenue for antiviral therapy. The strategy of using nanoparticles to combat SARS-CoV-2 could involve mechanisms that effect the entry of the virus into the host cell until their inactivation. The blockage of the viral surface proteins may lead to virus inactivation, so targeted nanoparticles, specific to virus expressed proteins could reduce the viral internalization (Kerry et al 2019).

Metal nanoparticles have shown the ability to block viral attachment to the cell surface, leading to the inhibition of viral internalization and thereby impairing the viral replication during viral entry. Nanoparticles composed of titanium (Ti), silver (Ag), gold (Au) and zinc (Zn) have already shown results against the HIV, influenza virus, herpes simplex virus, respiratory syncytial virus, transmissible gastroenteritis virus, monkey pox virus and Zika virus .The mechanism of action is based on the nanoparticles binding onto the viral envelope or its protein, impairing the interaction with the host cell. The efficacy of the treatment is related to the size, shape and the surface charge of the nanoparticles, however, safety measures must be taken regarding the concentration to avoid cytotoxicity of host cells, (Zhao et al 2020).

Organic nanoparticles have been used for delivering antivirals such as zidovudine, acyclovir, dapivirine and efavirenz, with the aim to improve drug bioavailability and promote efficient drug delivery and targeted antiviral activity, (Devaux,2020). The main limitations of antivirals are the lack of specific targeting, resulting in cytotoxicity of the host cell, which can be addressed by organic nanoparticles. The versatility of nanoparticles makes them tunable vectors for virus targeting and specific drug delivery. Antimicrobial drugs have been tested in clinical trials for COVID-19, such as chloroquine, lopinavir, ritonavir, ribavirin and remdesivir which have demonstrated promising results against SARS-CoV-2 (Li et al,2020). Nano encapsulation of antimicrobial drugs may contribute to the development of safer treatments for COVID-19 and other viral diseases.

Although it is well-established that nanotech-based drug-delivery systems improve existing therapeutics in medicine, their application in viral diseases is underexplored and underused, as observed in the SARS-CoV-2 pandemic. Nanostructured systems can impact diagnosis, since they can improve the detection, sensitivity and increase the signal amplification specificity in polymerase chain reaction analysis; and prophylaxis as adjuvants for vaccines, as well as therapeutics for COVID-19 through the targeting of antiviral drugs,
(Uskokovic, 2020).

In conclusion, through this communication, it is suggested that nanoparticles may play an important role at different stages of COVID-19 pathogenesis, considering their inhibition potential in the initial attachment and membrane fusion during viral entry and infected cell protein fusion. Furthermore, nano encapsulated drugs may be more efficient in activating intracellular mechanisms to cause irreversible damage to viruses and inhibition of viral transcription, translation and replication.

Conflict of Interest: Nil

REFERENCES

Cui J, Li F, Shi ZL (2019). Origin and evolution of pathogenic coronaviruses. Nat Rev Microbiol. .17:181-92

Devaux CA, Rolain J-M, Colson P, Raoult D (2020). New insights on the antiviral effects of chloroquine against coronavirus: what to expect for COVID-19? Int J Antimicrob Agents. 105938

Kerry RG, Malik S, Redda YT, Sahoo S, Patra JK, Majhi S (2019). Nano-based approach to combat emerging viral (NIPAH virus) infection. Nanomedicine 18, 196–220.

Li H, Liu S, Yu X, Tang S, Tang C (2020). Coronavirus disease 2019 (COVID-19): current status and future perspective. Int. J. Antimicrob. Agents 55, 105951

Patra JK, Das G, Fraceto LF et al (2018). Nano based drug delivery systems: recent developments and future prospects. J. Nanobiotechnology 16, 1–33

Tani R, Tobaiqy M, Al Faraj A (2020). Optimizing use of theranostic nanoparticles as a life-saving strategy for treating COVID-19 patients. Theranostics ; 10(13):5932-5942

Uskokovic V (2020). Why have nanotechnologies been underutilized in the global uprising against the coronavirus pandemic?. Nanomedicine (Lond). doi:10.2217/nnm-2020-0163

Zhao W, Zhong Z, Xie X, Yu Q, Liu J (2020). CT scans of patients with 2019 novel Coronavirus (COVID-19) pneumonia. Theranostics. .10:4606-13