ECRONICON OPEN ACCESS

EC PHARMACOLOGY AND TOXICOLOGY

Mini Review

Copper or its Compounds as Antiviral Agent against COVID-19: A Hypothesis

Naveen Dhingra*

Department of Bioscience, School of Liberal Arts and Science, Mody University of Science and Technology, Rajasthan, India

***Corresponding Author:** Naveen Dhingra, Department of Bioscience, School of Liberal Arts and Science, Mody University of Science and Technology, Rajasthan, India.

Received: May 20, 2021; **Published:** September 29, 2021

Abstract

The novel corona virus, also known as severe acute respiratory syndrome coronavirus 2, has rapidly spread all over the world. Various reports suggested number of drugs could be potential target for the treatment of COVID-19 although the effectiveness of all these drugs have not yet fully evaluated. Copper shows viricidal activities which involved various fundamental mechanisms viz. Oxygen transcription, hematopoiesis, energy generation, cellular metabolism and signal transduction. Copper and its complexes could be potential drug target as an antiviral agent against corona virus.

Keywords: *COVID-19; Copper; Antiviral*

Introduction

The novel corona virus also known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) the etiological agent of the (Corona Virus Disease 2019) COVID-19 has rapidly spread all over the world as such a condition that WHO declared it as pandemic. The emergency that the world is facing today requires urgent and effective measures and treatment against corona virus [1]. At present there are no available vaccines and drugs that can prevent effectively the infection with corona virus (COVID-19). Various reports suggested number of drugs could be potential targets for the treatment of COVID-19 although the effectiveness of all these drugs have not yet fully evaluated. Chloroquine and hydroxychloroquine were found to inhibit the infection of cells by SARS-CoV-2 *in vitro.* In *in vitro* studies remdesivir was found to be effective against SARS and MERS. Interferon-β1 appears to be more sensitive for MERS-CoV than SARS-CoV. Ribavirin plus Interferon gave mixed results against MERS. Lopinavir/Ritonavir, protease inhibitors are found to be effective against SARS-CoV-1 both *in vitro* and human studies. Favipiravir, a polymerase inhibitor showed broad spectrum antiviral activity against influenza, arenavirus, bunyavirus and filovirus. Case report of aerosolized interferon α suggested benefit in MERS. Tocilizumab was found to reduce fever and oxygen requirement in COVID-19 [2-4].

Many FDA approved drugs have been tried and are being tried for the treatment of COVID-19 but the results are still not encouraging. In the given editorial in place of synthetic and other drugs we have discussed about the effect of copper on covid-19 with its possible mechanism.

Copper as antiviral agent

Copper has been involved in various fundamental mechanisms *viz*. Oxygen transcription, hematopoiesis, energy generation, cellular metabolism and signal transduction [5]. Copper exhibits diverse biochemical actions as a constituent of various exogenously administered compounds in humans. Copper has potent virucidal properties. Regulation of copper metabolism and copper enzyme system that is needed for certain critical enzymes to function in the body might disrupts due to copper toxicity in virus. It has been reported that neutralization of various infectious viruses could be possibly due to use of copper oxide containing devices [6]. It has been reported that human corona virus was inactivated on copper brasses and alloys at very low concentration [7].

Copper surface could help in reduction of transmission of respiratory viruses from contaminated surfaces. Various laboratory studies have revealed that copper alloys have demonstrated antiviral activity. Reports suggests that murine norovirus (MNV) and human norovirus that are resistant to environmental stress are destroyed on copper and copper alloy surfaces. Human corona virus 229E was found to be inactive on brass which contains 70% copper and the rate of inactivation is directly proportional to the percentage of copper. Reports have suggested that HCoV-19 and SARS-CoV-1 could be detected in aerosols for 4 hours on copper and reported that both viruses have less viability on copper [8,9].

One of the reports revealed that copper mediated inactivation of virus is oxidatively damage of biomolecules. Various mechanisms have been proposed based on the formation of ROS by free Cu ions as cupric and cuprous ions can participate in redox reactions. ROS (O^{2-}, ⍰OH, OH^-), Cu^+ and H_2O_2 play an important role in viral in activation [10].

It has been proposed that copper destroys the viral genomes and affect virus morphology which includes disintegration of envelope and dispersal of surface spikes. Massive structural damage, irreversible destruction of viral DNA has been observed when corona virus gets exposed to copper and copper alloys. Irreversible inactivation of corona virus on copper and copper alloy is due to in fragmentation of viral genome. Real-time quantitative PCR (RTqPCR) performed study revealed that virus which were exposed to copper surface demonstrated reduced copy number of fragments with increasing contact times. Protein misfolding is the key pathogenic events in various viral diseases. It has been reported that copper exposure could misfold the pathogenic proteins under physiological conditions. Thus, from the various studies possibly copper and its complexes could be potential drugs target as an antiviral agent against corona virus [9].

Conclusion

Corona virus also known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has rapidly spread all over the world and declared as pandemic. Number of drugs could help in the treatment of COVID-19 but the effectiveness of these drugs has not been fully evaluated yet. Copper and its compounds are known for their viricidal activity due to various mechanism viz. oxidative damage, cellular metabolism, protein defolding etc. So due to its virucidal activity copper and its complexes could be potential drugs target as an antiviral agent against corona virus.

Bibliography

1. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 (2020).

2. Lai CC., *et al*. "Asymptomatic carrier state, acute respiratory disease, and pneumonia due to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2): facts and myths". *Journal of Microbiology, Immunology and Infection* 20 (2020a): 30040-30042.

3. Lai CC., *et al*. "Drug treatment options for the 2019-new coronavirus (2019-nCoV)". *Biosciences Trends* 14 (2020b): 69-71.

4. Liu W., *et al*. "Learning from the past: possible urgent prevention and treatment options for severe acute respiratory infections caused by 2019-nCoV". *Chem Bio Chem* 21 (2020): 730-738.

5. Mario M. "Abnormal Copper Homeostasis: Mechanisms and Roles in Neurodegeneration". *Toxics* 2 (2014): 327-345.

6. Borkow G., *et al*. "Neutralizing viruses in suspensions by copper oxide-based filters". *Antimicrobial Agents and Chemotherapy* 51(2007): 2605-2607.

7. Gregor G., *et al*. "Metallic Copper as an Antimicrobial Surface". *Applied and Environmental Microbiology* 77 (2011): 1541-1547.

8. Warnes SL., *et al*. "Human coronavirus 229E remains infectious on common touch surface materials". *MBio* 6 (2015) :1697-1715.

9. Webber MA., *et al*. "Parallel evolutionary pathways to antibiotic resistance selected by biocide exposure". *Journal of Antimicrobial Chemotherapy* 70 (2015): 2241-2248.

10. Josko O and Natasa S. "Copper and Zinc, Biological Role and Significance of Copper/Zinc Imbalance". *The Journal of Clinical Toxicology* S3.001 (2011): 1-18.

Volume 9 Issue 10 October 2021