Silver Nanoparticles with Bronchodilators through Nebulisation to Treat Covid 19 Patients

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*DOI: https://doi.org/10.15520/jcmro.v3i04.276

Accepted 21-04-2020; Received 01-04-2020; Publish Online 22-04-2020

1 INTRODUCTION:
There are no effective antiviral drugs available against the pandemic causing COVID 19 virus. The complex protein-protein interaction between the virus and host is yet to be determined for designing of precise antiviral drugs against corona virus. The pandemic had claimed several thousand lives and had resulted most devastating effects on our mankind. In this scenario a potent drug is needed which will kill the viruses with minimal side effects on human body. Here I propose a novel antiviral therapy for effective killing of COVID19 with minimal side effects.

2 HYPOTHESIS:
Application of water dispersed silver nanoparticles (AgNP) size 10 nm with bronchodilators in lungs through nebulization with simple nebulizer machine or bi-level ventilation in Corona patients may result in better outcome. Silver has potent antiviral activity. There will be the following effects

1. The silver nanoparticles will directly kill the viruses over respiratory epithelium. Antiviral activity with immunomodulatory effects of silver nanoparticles (AgNP) has already been established in treating RSV [1].

2. Inhalation route for administering silver nanoparticles (AgNP) have never been tried before. Ag+ ions will leach out from the nanoparticles and will exert its antiviral effects through binding with phosphorus or sulfur containing bio-molecules of the virus [2].

3. The Ag+ ions released from the AgNP will result in alteration of pH of the respiratory epithelium to alkaline. This environment will be hostile for the viruses to survive. Experimental evidence suggests there is direct low pH dependent fusion activation of Corona Viruses during entry into host cells [3].

4. As the viral load is reduced in the respiratory epithelium there will be less chance of spread from the infected person to healthy ones. The main source of spread is via coughing or sneezing with expulsion of virus loaded droplets [4].

5. Overall silver has no significant side effects in low concentrations. Preclinical data of avian corona viruses [3] already exists which further strengthen our proof-of-concept. We have to try in different concentrations to determine the maximum antiviral effects and also safety. Till now there is no experimental animal model of COVID 19 is present. So we have to administer silver nanoparticles directly initially in low doses and titer up.

3 LITERATURE REVIEW:
The antiviral effects of AgNP may be due to binding of AgNP to surface glycoproteins of RNA viruses preventing the fusion of the virus to host cells [5]. AgNP administration in mice has resulted in significant reduction of pro-inflammatory cytokines such as IL-6, TNF-α, CCL5 and IFNs [1]. All these features suggest that AgNP will be an effective drug against the COVID 19.

In a preclinical study BALB/c mice was inoculated with AgNP and respiratory syncytial virus (RSV) and significant antiviral and immunomodulatory effect was seen. AgNP up to dose of 4 mg/kg body weight was used without any significant toxicity [1]. On A549 epithelial cell line AgNP (10 – 12 nm size distribution at dose 50 microgram/ml has shown maximum anti viral property without toxicity [1]. AgNP has a very long half life and up to 35-36% of inhaled AgNP can be recovered from rat lungs 56 days after single 6 hours exposure [6].
4 DOSE CALCULATION:
Systemic use – from the first study we can calculate systemic dose of AgNP for human model [7].

Human equivalent dose (HED)

\[
\text{HED (mg/kg) = Animal NOAEL mg/kg} \times \left(\frac{\text{Weight}_{\text{animal}} [\text{kg}]}{\text{Weight}_{\text{human}} [\text{kg}]}\right)^{1.067}
\]

Considering reference body weight of mouse = 0.02 kg,

Human – 60 kg, NOAEL – 4 mg/kg

We get HED = 0.3 mg/kg

We have to apply this dose of AgNP in divided doses.

REFERENCES

4. AFRICA A. Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations.