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# Low Dose Radiation Therapy for COVID-19 Pneumonia – An Imminent Panacea for Sickest of the Sick Patients

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**Abstract:- Coronavirus disease is an infectious disease caused by a newly discovered novel coronavirus first reported in 2019. COVID-19 virus has resulted in an ongoing pandemic. The virus is primarily transmitted amongst individuals via airborne droplets produced by coughing, sneezing, and talking. The infected individual may remain asymptomatic, most of them may have mild symptoms but some may progress to develop acute respiratory distress syndrome (ARDS). Because of the high rate of transmission of the virus, the number of COVID-19 pneumonia patients are increasing day by day. As of now, there is no vaccine to prevent and no antiviral drug to treat human coronavirus infection.**

**Low dose of radiation therapy (<100 cGy), unlike high dose of radiation, has anti-inflammatory effects which occur due to decrease in pro-inflammatory cytokines such as IL-6. It is observed that low doses of kilovoltage X-rays reduce fatality due to pneumonia by almost 20%. But some studies have also reported increased uptake, activation, transcription and spread of some viruses after radiation therapy.**

**To conclude, low dose radiation therapy (<100 cGy) help to alleviate life-threatening symptoms of COVID-19 pneumonia. But more research is required in larger cohort of patients to validate the use of radiation therapy for COVID-19 pneumonia. Until then, the use of radiation therapy for COVID-19 pneumonia shall be done very carefully. Radiation therapy shall only be used as a part of clinical trial or as a last resort in sickest of the sick patients.**

## I. INTRODUCTION

Coronavirus disease is an infectious disease caused by a newly discovered novel coronavirus. According to WHO, large number of cases of pneumonia of unknown etiology were reported in Wuhan, China in December 2019.[1] Novel coronavirus was identified as the cause of this pneumonia of unknown etiology by the Chinese authorities and was temporarily named 2019-nCoV. A novel coronavirus (nCoV) is a new strain of coronavirus which was not previously identified in humans. The new virus was subsequently named COVID-19 virus.[1] COVID-19 virus has resulted in an ongoing pandemic.[2]

Coronaviruses are spherical or pleomorphic, single-stranded RNA viruses[3] which belong to coronaviridae family.[4] They cause diseases in mammals and birds. In humans, these viruses cause respiratory tract infections ranging from mild to more severe lethal diseases. Coronavirus disease 2019 (COVID-19) is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[5]

The virus is primarily transmitted amongst individuals via airborne droplets produced by coughing, sneezing, and talking.[6] After transmission, the virus replicates in cells of the ciliated epithelium, and thus causes cell damage and inflammation. The time from exposure to onset of symptoms may range from two to fourteen days.[6]

Common symptoms of COVID-19 are fever, cough, fatigue, shortness of breath, and loss of smell and taste.[7] The infected individual may remain asymptomatic, most of them may have mild symptoms but some may progress to develop acute respiratory distress syndrome (ARDS). The severity of the symptoms results due to possibility of cytokine storm,[8] septic shock, and multiple organ failure.[9]

COVID-19 infected patients who have progressed to develop acute respiratory distress syndrome (ARDS), sepsis, pneumonia and respiratory failure have high fatality rate.[10] Because of the high rate of transmission of the virus, the number of COVID-19 pneumonia patients are increasing day by day. Pneumonia is an inflammatory condition of the lung which occurs in response to infection. The alveoli become inflamed and secrete fluid which compromises their function of gas exchange. As of now, there is no vaccine to prevent and no antiviral drug to treat human coronavirus infection.[11]

Radiation therapy is a cancer treatment modality that uses high doses of radiation to kill cancer cells and shrink tumors. High doses of radiation therapy (>200 cGy) lead to inflammatory effects and cause various toxicities observed in radiation therapy. Low dose of radiation, unlike high dose of radiation, has anti-inflammatory effects which occur due to decrease in pro-inflammatory cytokines such as IL-6. The thought to use radiation for pneumonia is not new. There are alluring reports from the early twentieth century which showed high efficacy in treatment of pneumonia by X-rays.[12,13]

Low doses of low LET radiation (<100 cGy) can be likely used to treat COVID-19 pneumonia. It is observed that low doses of kilovoltage X-rays reduce fatality due to pneumonia by almost 20%.[14] Doses of less than 100 cGy lead to rapid symptomatic relief within a few hours.[15]

Various trials carried out on experimental animals suggested that low doses of radiation therapy could reduce the acute phase of pneumonia by 50%.[16] In view of the current fatality rates associated with COVID-19 pneumonia, it is reasonable to use radiation therapy. But there is limited knowledge about the interaction of low dose radiation with viruses. Some studies have also reported increased uptake, activation, transcription and spread of some viruses after radiation therapy.[17,18] Also the anti-inflammatory effects of low radiation doses are not just limited to the irradiated site but it exhibits systemic effects. Therefore, instead of irradiating the lungs (having high virus concentration) as the target organ, low radiation dose can be given to total body which may exhibit more efficacy.[19]

To conclude, low dose radiation therapy (<100 cGy) may reduce the inflammation in COVID-19 pneumonia and alleviate life-threatening symptoms. But more research is required in larger cohort of patients to validate the use of radiation therapy for COVID-19 pneumonia. Until then, the use of radiation therapy for COVID-19 pneumonia shall be done very carefully. Radiation therapy shall only be used as a part of clinical trial or as a last resort in sickest of the sick patients.

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