Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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COVID-19 Rapid Letter

Is low dose radiation therapy a potential treatment for COVID-19 pneumonia? ☆

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Fatal cases of COVID-19 are characterised by acute respiratory distress syndrome (ARDS), sepsis, pneumonia and respiratory failure [1]. The high transmission rate of the virus and the corresponding rapid escalation in the number of infections has resulted in unprecedented strains on healthcare systems worldwide, particularly as healthcare workers struggle to treat COVID-19 pneumonia.

We would like to draw the radiotherapy community's attention to the potential for low doses (<100 cGy) of low LET radiation to treat viral pneumonia as a possible therapy for COVID-19 patients. It was not uncommon in the early twentieth century to treat pneumonia with X-rays. A review showed low doses from kilovoltage X-rays reduced pneumonia mortality from roughly 30 percent to 10 percent on average [2]. Doses reported were generally in the 20 – few hundred Roentgen range, which given the attenuation through chest wall would likely have resulted in mean lung doses in the tens to <100 cGy range. Some reports noted rapid symptom relief on the order of hours [3,4] Animal models suggested LDRT could reduce the acute phase of pneumonia by half [5]. In light of the current mortality rates associated with COVID-19 pneumonia, it is therefore reasonable to re-examine this old treatment.

Pneumonia arises as an inflammatory immune response to infection when the alveoli become inflamed and secrete fluid compromising their gas exchange function. In a viral infection, viruses trigger immune cells to synthesize pro-inflammatory cytokines and chemokines [6], inciting the immune response. Historical evidence points to the induction of an anti-inflammatory phenotype induced by low doses of radiation as a potential explanation for the observed effects [2]. While doses ≥200 cGy tends to exert pro-inflammatory effects, triggering common toxicities observed in radiation therapy, more recent work shows low doses (<100 cGy) incite anti-inflammatory properties [7,8] such as decreasing levels of pro-inflammatory cytokines like IL-1β [9], or inhibiting leukocyte recruitment [10]. Therefore, it stands to reason that an LDRT treatment of 30–100 cGy to the lungs of a patient with COVID-19 pneumonia could reduce the inflammation and relieve the life-threatening symptoms.

A single fraction 30–100 cGy treatment could easily be delivered on a conventional megavoltage radiation therapy unit. Routinely, much higher, single fraction doses are delivered in a palliative context with fast-tracked patients going through the full workflow process of education, scanning, planning and treatment delivery in a matter of hours. Proof of principle simulations suggest that a POP treatment with a megavoltage beam could easily ensure 99% of the whole lung volume received between 90% and 120% of a 70 cGy prescribed dose. And because of the low doses, common radiotherapy toxicities would be avoided.

While a large scale up of such LDRT treatments would not be without obstacles (e.g. existing strain on radiotherapy resources, separating COVID-19 patients and cancer patients, etc.), we believe clinical trials to further investigate the efficacy of whole lung LDRT would present a very low risk to COVID-19 pneumonia patients, and have the potential to reduce mortality and alleviate COVID-19 related strains on healthcare systems.

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