Nanomedicine: A modern advent for combating COVID-19

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Madam, our current understanding of the COVID-19 virus and its vulnerabilities has not been translated into the approval of its standard line of treatment. COVID-19, although primarily a respiratory ailment, may culminate in acute respiratory distress syndrome, hyperinflammatory response, sepsis, and multiorgan failure, which often carry a grave prognosis. Drugs addressing such severities of COVID-19 are often limited by their therapeutic indices, bioavailability, and side effects, necessitating the exploration of new avenues to counter them. The ever-evolving field of nanotechnology presents one such example. Nanomaterials, by definition, are particles ranging from 1-100nm and owing to their size, porosity, adaptability, and easy tenability of physicochemical properties, are revolutionizing diagnosis, prophylaxis, and management of various diseases.[1]

Nanomedicine may even be a better choice in managing COVID-19 infection. A Graphene conjugated anti-spike antibody kit has been developed to detect SARS-CoV-2 at minuscule concentrations.[2] Experimental studies have also demonstrated that metal-derived nanoparticles, AgNPs and CuNPs, have antiviral effects owing to their toxic ions and reactive oxygen stress.[3] Nanostructured lipid carriers adhere to mucosa and may increase the antiviral potency of intra-pulmonary delivered drugs like salinomycin in COVID-19 patients.[4] COVID-19 vaccine combined with double-layered hydroxide nanoparticles stops the infection early by silencing viral expression.[2]

Nanotechnology may also help in early diagnosis and prompt management of the complications of COVID-19. Nanotechnology-based biosensors can detect markers such as IL-6, C-reactive protein, and pro-calcitonin extremely early in the disease course hence, contributing to a better prognosis.[5] The emerging antimicrobial resistance in septic, hospitalised patients can also be tackled by nanoparticle-coated antibiotics which have decreased risk of drug resistance and overall favourable pharmacokinetics.[5] A similar benefit can also be appreciated in Nano-formulated dexamethasone liposomes delivered intra-pulmonary which may much better than free dexamethasone when targeting alveolar macrophages to suppress hyperinflammation.[3] Furthermore, magnetic nanoparticles-based extracorporeal blood-cleansing has proved to capture infectious toxins on the basis of particle sizes and this can be applied in combating COVID-19 sepsis.[5] Recently, macrophage-biomimetic nanoparticle (Mϕ-NPs) was developed which can neutralize endotoxins and downregulate 'cytokine storm', therefore preventing immune hyper-activation and ultimately sepsis.[5]

Despite the apparent appeal of these techniques, one cannot underestimate the drawbacks their use might entail. Many hypotheses regarding nanotechnology in COVID-19 need to be proved clinically. We highly recommend that more intensive research is directed towards this field to gain a deeper insight into their practicality and rationale for use and to adjudicate their short and long-term side effects and cost-effectiveness.

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