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LETTER

Nanodrugs: optimism for emerging trend of multidrug resistance

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Dear Editor

This is with reference to an article published recently in your journal regarding the antibiotic activity of chitosan-coated silver nanoparticles.[1] This is an inspiring move towards control of infection caused by multidrug-resistant bacteria which has become a serious problem for clinicians and physicians worldwide.[2] At the moment, carbapenems are being used as the drugs of choice to combat infections. However, the emergence of carbapenem resistance has changed current remedial approaches in the management of serious infections. One of the latest enzymes, NDM-1 (New Delhi metallo-β-lactamase-1), first identified in a Swedish patient of Indian origin in 2008,[3] has been key in the development of resistance to almost all antibiotics. Infection caused by NDM-1 producers is widespread on the Indian subcontinent,[4] and is now emerging in the US and other countries throughout the world.[5]

In the current scenario, it is of the utmost importance to develop an efficient and nontoxic strategy to control microbial infections in humans. Nanomaterials are very attractive in terms of their potential for targeted infection control. Recently, Chiao et al[6] developed an effective and safe nanoscale silicate platelet, and its nanohybrid, silver nanoparticle-nanoscale silicate platelet, which can replace antibiotics, is expected to solve the problem of multidrug-resistant bacteria. The efficacy of these nanomaterials has been found to be excellent for protecting Salmonella-infected chicks from septicemia and death.[6]

Meningitis and ventriculitis are major infections and life-threatening complications of external ventricular drainage, and rifampin-impregnated and clindamycin-impregnated silicone catheters and external ventricular drainage devices impregnated with silver nanoparticles and insoluble silver salts have been developed to overcome this problem.[7] These external ventricular drainage devices have been found to minimize infection rates. Moreover, complications associated with cardiovascular implants may be reduced by modification of the surfaces of these devices using, for example, antimicrobial and antithrombotic agents. In one study, silver nanoparticles were reported to be efficient broad-spectrum antimicrobial agents, and another recent report has proposed that these nanoparticles also have antiplatelet activity. Therefore, Ragaseema et al[8] have advocated that silver nanoparticles protected by polyethylene glycol may be incorporated with biomaterials to achieve both antimicrobial and antithrombotic activity. Moreover, their cytotoxicity may be minimized to limit adverse affects on tissues and cells.[8]

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Due to their noteworthy antimicrobial activity, nanoparticles are recognized as hopeful candidates in the fight against pathogens that have developed resistance. With the advent of nanoscale technology comes new hope that engineered silver nanoparticles will solve the worldwide problem of antibiotic resistance. The efficacy of silver nanoparticles with different modifications has been well accepted for the treatment of various systemic and intracellular infections without toxic effects in mammalian cells. hence, they can be proposed as potential therapeutic agents in the current scenario. Furthermore, a novel formulation of nanomaterial that can inhibit bacterial and fungal colonization of surfaces as well as in human and animal systems needs to be developed. Hence the field of nanotechnology and its implications in biology and medicine have opened up new opportunities in the diagnosis and treatment of infectious diseases.

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