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Editorial

Role of Nanoparticles in Antimicrobial Resistance Modulation

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Drug resistance is the reduction in effectiveness of a medication such as an antimicrobial or an antineoplastic in treating a disease or condition. The pathogens are becoming multidrug resistant due to lavish and non-judicious use of antibiotic. Resistance in one bacterium is transferred to the neighboring bacteria, even while dying bacteria sends signals to other bacteria. The continued wide application or misuse of antibacterial medication has resulted in the emergence of multidrug bacteria which have risen to a remarkable level and are currently a grave matter of concern for medical practitioners dealing with contagious diseases [1]. The resistance to drugs requires the dispensing of raised doses of antibiotics, leading to raised drug toxicity [2]. The development of new antibiotics is long process with the involvement of estimated $1.2 billion USD for new commercial entry. In such situations, market analogues of existing therapeutics within economical and effective range are required. Nanoparticles of metallic nature have been found the flexible tools that may be used for highly responsible analytical assessments, drug and gene delivery, radiotherapy and thermal ablation methods [3]. Nanoparticles (NPs) are beneficial in terms of serving as vector for antibiotics to treat pathogens, enhancing drug solubility and stability; ease of synthesis; their modulated release, and compatibility with target agents. They may decrease detrimental consequences but increase healing effect of antibiotics by enhancing the pharmacokinetics and biodistribution. The high ratio of surface to volume of improves their distribution, and conveys chemical, optical, electrical, electro-optical, magneto-optical and magnetic features to the nanoparticles that differ from the features of their major characteristics [4]. The metal nanoparticles' antibacterial action is mainly due to relative volume and stability as well as intensity within the growth medium [5]. NPs demonstrate several abilities such as an enhanced collection of antimicrobial tools within cells [6] or prevention of the creation of biofilms [7] while have fewer negative impacts compared with regular antibiotics.

Nanoparticles (Ag, Au, Al, Cu, Ce, Cd, Mg, Ni, Se, Pd, Ti, Zn, and super-paramagnetic Fe) are made up of collections of atoms that range in size from 1 to 100nm. These compounds vary from colloids made up of nanoparticles thus some particles ranging in size from 100 to 2500 nm [8]. It has been established that in nano sizes, the biological features of metals are stronger, nanoparticles to be fascinating from a medical perspective [9]. The antibacterial function of all the nanoparticle varieties is not completely known. The surface area of dose of nanoparticles is raised as the size of the particle is reduced, thus permitting a greater material interaction with the immediate surroundings [10,11]. Small nanoparticles seem to be the most able to permeate bacterial cells. In additional to the particle size, their form, zeta potential and chemistry are some of the most pertinent elements influencing antibacterial activity. The zeta potential, in addition to particle size and chemistry are highly significant parameters accountable for antimicrobial impacts [10,11]. Among several NPs are zinc and silver that are renowned for their natural antibacterial activities. Silver nanoparticles have been studied extensively with their known effective antimicrobial efficacy. Silver nanoparticles attack gram negative bacteria by anchoring and penetrating the cell wall and consequence is the leading structural change in the membrane morphology. Therefore, there is significant increase in membrane permeability and alteration in transport through the plasma membrane resulting in cell death [12]. Silver nanoparticles of size 5 - 100 nm may damage the structure of bacterial cell membrane, that in turn affects the integrity of the surface of bacterial cell wall, cytoplasmic material is extruded from the cell which leads to collapse of the cells {Multidrug resistant *Pseudomonas aeruginosa* [13,14] and methicillin resistant *S. aureus* [15,16]. The combination of NPs' with existing antibiotics seems to be very enthralling option by combining the two treatment modalities. There remain several drawbacks of antibacterial agents that need to be given due attention in researches. The primary issue is related to the possible nanotoxicity of metallic NPs following treatment. Morphological alterations of nanomaterials may result in them being unrecognizable to phagocytic cells, resulting in additional toxicity [17]. Minor NPs demonstrate effective antibacterial action that may easily infiltrate the skin, brain and lungs, resulting in negative consequences. Furthermore, treatment with metallic NPs may result in their accumulation, mostly within the organs like kidney, spleen and liver causing various levels of injury [18]. It is thus concluded that the antimicrobial resistance may be modulated by nanoparticles, and the researches on antimicrobial efficacy and toxicity are need of the hour.

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