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Nanomedicine for Treating Bacterial Infections

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Description

Nanomaterials have been important in the quick, sensitive, and targeted detection of microbial diseases due to their distinctive physicochemical properties. It has also been shown that some organic and inorganic nanoparticles contain strong inherent antibacterial capabilities that are rarely manifested in their bulk forms. What's more, some of these nanomaterials have the potential to undermine current resistance mechanisms in order to prevent antibiotic resistance. In addition, nanoparticles for antimicrobial drug delivery have specific advantages over traditional antibiotics in terms of conquering resistance and producing fewer side effects. Antimicrobial nanoparticles can also stop microbial adherence and infection by being included into medical equipment. Not to mention, utilising nanomaterials as vaccine adjuvants and/or delivery systems can trigger immune responses that are more effective against microbial infection [1].

The most effective method for treating bacterial infections in a clinic is antibiotic therapy. However, due to the overuse and abuse of antibiotics, antibiotic resistance has emerged as one of the major risks to public health globally. What's worse is that compared to the rise in antibiotic resistance, the rate of new drug development is mostly hysteretic. The "post-antibiotic era" is about to start across the world. By using a variety of mechanisms, such as improving pharmacokinetics, enhancing antibiotic internalisation, disrupting bacterial metabolism, enhancing biofilm penetration, altering biofilm microenvironments, and so on, nanomaterials have demonstrated great promise in restoring the antibacterial activity of conventional antibiotics. The most effective way to combat bacteria that are resistant to antibiotics would be to combine nanotechnology with antibiotics [2].

Intestinal fever is the second most typical symptom of *Salmonella* infection worldwide, behind gastroenteritis. When bacteria enter the digestive tract by contaminated water or food, they frequently permeate the intestinal epithelium's epithelial cells. *Salmonella* type III secretory systems, which are multichannel proteins that enable *Salmonella* to inject its effects into the cytoplasm through the membrane of intestinal epithelial cells, are encoded by *Salmonella* pathogenicity islands (SPIs). In order to spread outward or rupture the epithelial cell membrane and ingest other bacteria, the bacteria first activate the signal transduction pathway and rebuild the actin cytoskeleton of the host cell. The membrane ruffle's morphology resembles that of phagocytosis [3].

This sector has undergone a revolution as a result of nanotechnological techniques, particularly smart polymeric nanoparticles, which offer an inventive therapeutic alternative capable of overcoming the drawbacks of currently accessible treatments and being effective on their own. The most recent and cutting-edge research using polymeric nanoparticles against the most prevalent bacterial infections of the human body is examined in this review along with the current status of the most dangerous human infections and an extensive discussion of the role of nanomedicine in overcoming the current drawbacks [4,5].

Conclusion

More and more therapeutic uses of nanotechnology using nanoscale materials are being used, particularly as a new paradigm for infectious disorders. Multidrug-resistant infections (MDROs) are increasingly being blamed for morbidity and mortality around the globe. There are frequently few antibiotic choices for infections brought on by MDROs. These clinical difficulties underscore the urgent need for more and efficient antibacterial methods. Pathogenic germs' cell membranes can be penetrated by nanoparticles (NPs), which then create special antimicrobial mechanisms by interfering with crucial molecular processes. NPs have shown synergy when used with the best antibiotics, which may help to contain the global epidemic of bacterial resistance.

Conflict of Interest

None.

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