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Editorial

The Advantages of Bacteriophages in the Diagnosis of Bacterial Infections

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DESCRIPTION

Bacteriophages (BPs) are viruses that can infect and kill bacteria without harming human or animal cells. As a result, it is thought that they can be used to treat bacterial infections, either alone or in combination with antibiotics. The rapid spread of multidrug-resistant bacteria around the world, combined with a decline in the development and production of novel antibacterial agents, has prompted scientists to consider BPs for the treatment of bacterial infection.

The use of BPs to combat the problem of increasing bacterial resistance to antibiotics is appealing, and some research data suggest that it may be a reasonable measure. However, current knowledge appears to be insufficient to permit the use of BPs for this purpose.

To date, the problems of preparing formulations for clinical use and avoiding or limiting the risk of bacterial resistance emergence through the transmission of genetic material are not completely solved. Before BPs can be used in humans, more research specifically devoted to resolving these issues is required. The most common biological entity is a bacteriophage. They can be found in soil and seawater, as well as on oceanic and terrestrial surfaces and in extreme environments such as those with extremely high or extremely low temperatures.

Furthermore, they have been found in hospitals, wastewater, and other places where bacteria can live, including animal and human tissues. Thousands of BPs have been described. They are classified based on their morphological characteristics, nucleic acid content, the location where they are most commonly found, and the bacterial species that they can kill.

Theoretically, there are no bacteria that cannot be lysed by at least one BP. In this regard, BPs are significantly more effective than antibiotics, as, although some antimicrobial drugs have a very large spectrum of activity, an antibiotic able to kill all the bacterial species does not exist.

The most appealing feature of BPs, however, is their specificity of action, or their ability to kill only the pathogen that they recognise.

They have a very narrow spectrum of activity, which avoids the most serious issue directly related to antibiotic administration, namely the impact on the entire microbiome with the elimination of potentially beneficial bacteria, secondary pathogen overgrowth, and the emergence of resistant bacteria. Several studies in both animals and humans have reported the use of BPs without altering the microbiota.

In addition to antibiotics, BPs are said to have a number of other advantages. Because BPs replicate only in the target bacterium and cannot infect mammalian cells, they are thought to be significantly safer and more tolerable.

Furthermore, administration is simplified because BPs do not require repeated administrations over several days, as is commonly required for antibiotics, because they can remain in the human body for relatively long periods of time, i.e., up to several days. Because of the increase in BP concentration at the site of infection after the initial administration, very few doses are required in general.

In contrast to antibiotics, their effect is limited to the site of infection that can be reached, even if bacteria are located in a body organ or system that antimicrobials cannot penetrate. BPs can be engineered to overcome some of the limitations of antibiotic treatment using new cost-effective, large-scale DNA sequencing and DNA synthesis technologies.

The evidence that BPs can disperse biofilm, a structure that makes infections difficult to eradicate even when bacteria are sensitive to the administered drug, is a good example of this. It was possible to attack both the bacterial cells and the biofilm matrix at the same time.

Finally, the use of BPs may be less costly than the use of antibiotics that target multidrug-resistant pathogens. The use of BPs significantly reduced healthcare costs in a small group of patients with methicillin-resistant Staphylococcus aureus infection.

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