

Phage Therapy as a Potential Solution in the Fight against Antimicrobial Resistance

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Abstract : Excessive use of antibiotics is a main problem in the treatment of wounds and other chronic infections and antibiotic treatment is frequently non-curative, thus alternative treatment is necessary. Phage therapy is considered one of the most effective approaches to treat multi-drug resistant bacterial pathogens. Infections caused by *Staphylococcus aureus* are very efficiently controlled with phage cocktails, containing a different individual phages lysate infecting a majority of known pathogenic *S. aureus* strains. The aim of current study was to investigate the efficiency of a purified phage cocktail for prophylactic as well as therapeutic application in mouse model and in large animals with chronic septic infection of wounds. A total of 150 sewage samples were collected from various livestock farms. These samples were subjected for the isolation of bacteriophage by double agar layer method. A total of 27 sewage samples showed plaque formation by producing lytic activity against *S. aureus* in double agar overlay method out of 150 sewage samples. In TEM recovered isolates of bacteriophages showed hexagonal structure with tail fiber. In the bacteriophage (\emptyset VS) had an icosahedral symmetry with the head size 52.20 nm in diameter and long tail of 109 nm. Head and tail were held together by connector and can be classified as a member of the Myoviridae family under the order of Caudovirales. Recovered bacteriophage had shown the antibacterial activity against the *S. aureus* in vitro. Cocktail (\emptyset VS1, \emptyset VS5, \emptyset VS9 and \emptyset VS 27) of phage lysate were tested to know in vivo antibacterial activity as well as the safety profile. Result of mice experiment indicated that the bacteriophage lysate was very safe, did not show any appearance of abscess formation which indicates its safety in living system. The mice were also prophylactically protected against *S. aureus* when administered with cocktail of bacteriophage lysate just before the administration of *S. aureus* which indicates that they are good prophylactic agent. The *S. aureus* inoculated mice were completely recovered by bacteriophage administration with 100% recovery which was very good as compared to conventional therapy. In present study ten chronic cases of wound were treated with phage lysate and follow up of these cases was done regularly up to ten days (at 0, 5 and 10 d). Result indicated that the six cases out of ten showed complete recovery of wounds within 10 d. The efficacy of bacteriophage therapy was found to be 60% which was very good as compared to the conventional antibiotic therapy in chronic septic wounds infections. Thus, the application of lytic phage in single dose proved to be innovative and effective therapy for treatment of septic chronic wounds.

Keywords : phage therapy, phage lysate, antimicrobial resistance, *S. aureus*

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