Phage therapy- A renaissance in combating multidrug-resistant infections

Authors:, Dr. Agnes George, Dr. Mahesh Kolli, Apollo Medicals Pvt., Ltd, India

Abstract:
Antimicrobial resistance poses a global health threat, contributing to an estimated 1.27 million deaths in 2019. Multidrug-resistant (MDR) bacteria, a significant cause of morbidity and mortality, require innovative treatments like phage therapy. Bacteriophages, discovered in the early 20th century, offer a vital adjuvant to antibiotics. This study systematically reviewed human studies reporting positive outcomes of phage therapy, with results indicating significant success in treatment using phage cocktails. These reduce resistance risks and improve clinical outcomes. Future research and regulatory approval are essential for broader clinical application and acceptance of phage therapy.

1. Background:

- Antimicrobial resistance (AMR), enforced through antibiotic misuse, constitutes a major threat to global health; it alone was responsible for an estimated 1.27 million deaths in 2019. Combating AMR calls for innovative studies [1].

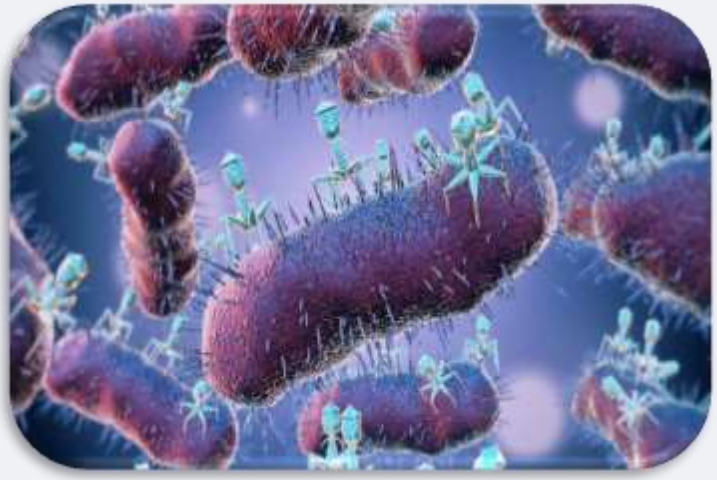


Figure 2: Phage attacking bacteria

- Bacteriophages, first discovered from the water of the Ganges river in 1800 to treat cholera, have been denied application because of largescale Penicillin production later in the 20th century. Multi-drug resistant (MDR) bacteria are a major source of morbidity and mortality; phage therapy is a potential solution, which is different from antibiotics and necessary for treatment [2].
- Lytic bacteriophages compiled into 'Phage Cocktails' are used in clinical treatment of multidrug-resistant bacteria[3].

2. Aim:

The aim of the research is to analyze reported positive treatment outcomes in human studies utilizing phage therapy to treat MDR bacteria.

3. Methodology:

- systematic approach using the search terms "phage therapy" AND "Antimicrobial resistance" in PubMed database
- relevant studies comparing clinical improvement on phage therapy.
- Positive or negative of treatment outcome in humans.
- Results given in Forest Plots

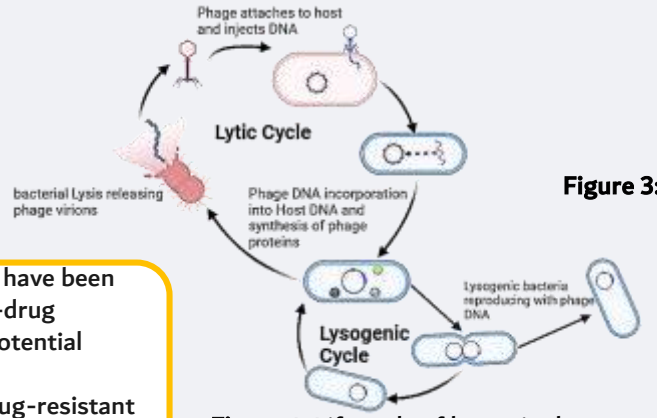


Figure 1: Life cycle of bacteriophage

4. Results:

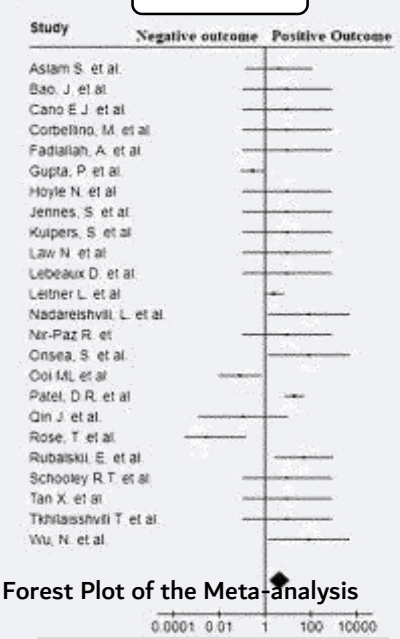
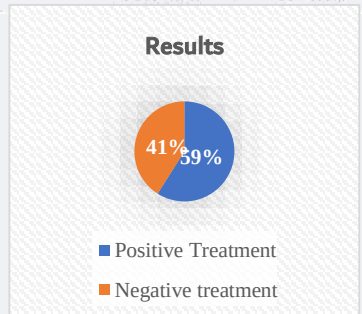


Figure 3: Forest Plot of the Meta-analysis



5. Limitations:

- Risk of bias not identified
- Not specific towards single resistant bacterial strain

6. Future Directions:

- Investigate potential combination therapies with antibiotics
- Explore and establish regulatory frameworks.

7. Conclusion

1. Phage therapy shows significant success in treating infections from multidrug-resistant bacteria, offering a precise, targeted alternative to antibiotics, especially where conventional treatments fail.
2. Phage cocktails and monotherapy reduce resistance risks, with positive clinical outcomes supporting further research and potential regulatory approval for broader healthcare use.

8. References:

1. Antimicrobial resistance [Internet]. [cited 2024 Oct 18]. Available from: https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance
2.Aranaga C, Pantoja LD, Martinez EA, Falco A. Phage Therapy in the Era of Multidrug Resistance in Bacteria: A Systematic Review. Int J Mol Sci. 2022;23(9).
3.Lin DM, Koskella B, Lin HC. Phage therapy: An alternative to antibiotics in the age of multi-drug resistance. World J Gastrointest Pharmacol Ther. 2017;8(3):162-73.