Non-Surgical Treatment of Diabetic Toe Infection with Bacteriophage

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Introduction

Diabetic foot infections are a major public-health problem, with high morbidity and long-term costs resulting from required wound healing and amputation, often leading to its complications. The most common infective organism is Methicillin-Sensitive Staphylococcus aureus (MSSA), but chronic infections are polymicrobial. In over 10% of the cases the infection is located in the toes, with healing times taking months or years. These infections occur in 10% of the diabetics and become very difficult to close and often fail antibiotic treatment even with good wound care, leading to amputations. With the growing problem of antibiotic resistance, interest is growing in using bacteriophages, which have been widely used mainly in Eastern Europe since the 1930s. However, these implementations have been largely hindered by a lack of modern double-blind studies, with many challenges for industry handling of such kits. A public-private academic thrust is badly needed, and chronically infected diabetic foot infections are an ideal target for such cooperation.

Therapeutic methodology

The following case studies involve single digit lesions on patients who did not respond to standard therapy including antibiotics. Each had exposed and infected foot, with circulation poor enough to believe the ulcers would not heal and amputation was considered a viable option. The patients had finished their course of antibiotics prior to the use of phage, so the installation of phage into the ulcer was the only treatment used besides of fasting during the study.

Case Study Series

Phage Therapy

The phage being used for this experiment is a commercial preparation of staphylo phage S-155, isolated to 10 6 plaque forming units (PFU) per milliliter on a semisolid glucose-agar base culture. Geographically it is a type specific isolate of the phages approved by the FDA for dealing with Staphylococcus aureus in ready-to-eat foods. S-155 has never been commercialized or marketed under a special US Department of Health and Human Services Biologics Evaluation Program (KE-155). The phage is stored in temperate levels to ensure microorganisms are in minimal virulence. The phage cultures were brought into this country as part of a research agreement between the Elavia Institute, Tbilisi, Production Center, and the Phagebiotics Research Foundation, Olympia, Washington, for the purpose of this type of case study.

Study Purpose

The purpose of the study was to evaluate the use of a single bacteriophage targeting staphy to facilitate healing of difficult-to-heal foot wounds in the presence of polymer antibiotic treatment with standard care. We evaluate both the ability of phage to control infection in previously non-responding ulcers and to resolve osteosynthetic non-surgically.

Study Purpose

Phage Cross the Blood Brain Barrier

Phage can be injected throughout the body and multiply wherever they find their target bacteria, even beyond the blood-brain barrier. As shown by NewellDoege in 1964, phage injected intraperitoneally into mice soon showed up in the blood and found the brain, but were cleared rapidly. However, phage-targeted bacteria had been injected into the brain at high levels, the phage rapidly multiplied there in the brain. Thus, 72% of the mice survived, as opposed to only 6% without phage therapy. Several studies were conducted.

Relevant prior work in Tbilisi, Georgia

Alfred Gelantine from Toronto - very badly smelly amputate - death still draining fries both sides after 4 years, including one full year on IV antibiotic - produced in Tbilisi with hipped phage for 24 hours, which burnt the place with the brain in the bone. Within a few days, no more bacteria was seen in the amputation.

Vascular Testing Results for Patient JB

Patient MM

Patient CC

References


Fig. 1: Model Phage Therapy Wound Healing Model. (A) Wound model on the back of NPCs. (B) Start of phage therapy with non-murine infected NPCs. (C) Start of phage therapy with murine infected NPCs. (D) Phage therapy and antibiotic therapy. (E) Increase in wound closure after antibiotic therapy. (F) Increase in wound closure after phage therapy. (G) Increase in wound closure after combination therapy. (H) Increase in wound closure after combination therapy 1 week later. (J) Time course of wound healing.


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