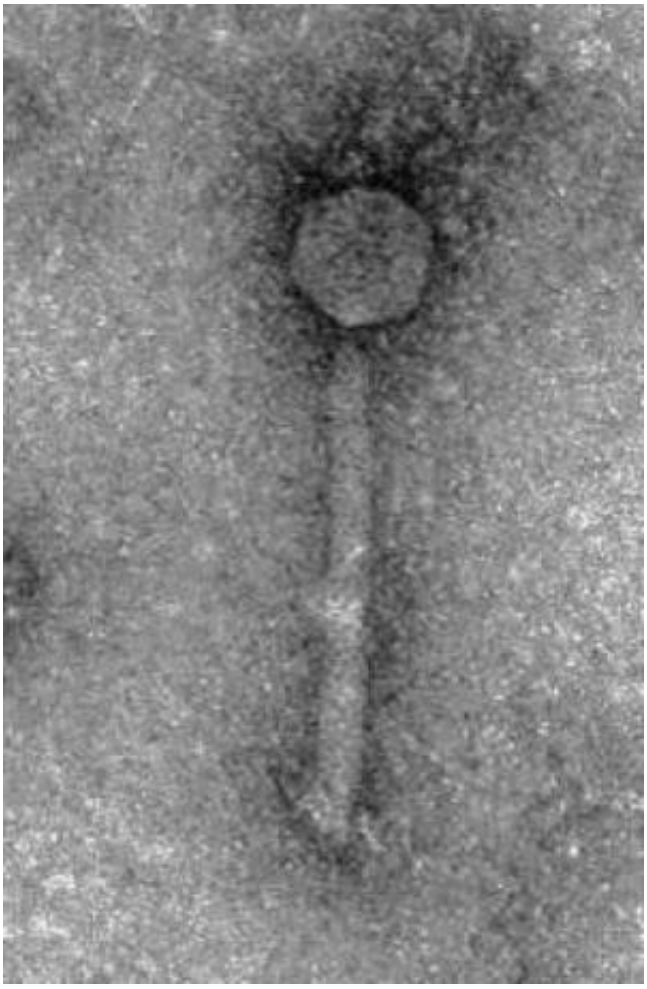
Medical Xpress

Bacteriophages battle superbugs

July 18 2013



This is *Clostridium difficile* bacteriophage ΦCD27. Credit: IFR

IFR microbiologists are reinvigorating a way of battling *C. difficile* infections that they hope will help overcome the growing problem of antibiotic resistant superbugs in hospitals.

Our digestive system is home to trillions of bacteria, which are crucial to our overall health, through helping us digest food and battling potentially harmful microbes. When we take antibiotics to combat bacterial infections these beneficial bacteria can also be killed off, leaving us at risk of infection by harmful bacteria. *Clostridium difficile* is one of these harmful bacteria and is the leading cause of hospital infections in England and Wales. Although the number of *C. difficile* infections is dropping, treating them is becoming harder as it becomes more resistant to antibiotics. New ways of controlling *C. difficile* infections are desperately needed to replace ineffective antibiotics, and bacteriophages are one such technology being investigated.

Bacteriophages are naturally occurring viruses that target bacteria. Bacteriophage therapy is not a new idea; it was being developed not long after their discovery at the start of the 20th century. However, after the discovery of penicillin and other antibiotics the research into the use of phages was abandoned in the West but its application continues in Eastern Europe, particularly in Georgia. Now that the bacterial resistance to antibiotics is becoming such a large problem, there is renewed interest in developing bacteriophage therapy.

For use as a therapy, the bacteriophage must not affect any of the hundreds of different bacterial species that make up a healthy human microbiota. Researchers at the IFR had previously discovered and isolated a bacteriophage that specifically targets *C. difficile*. The new study, published in the journal *Anaerobe*, looked to assess how effective using this phage might be in combatting *C. difficile* infections.

The researchers used a model of the human colon, set up to mimic that of an elderly person in hospital. Antibiotics were given in the same way as in hospital, disrupting the normal balance of bacteria and allowing *C. difficile* to establish itself, and then produce the toxins that make *C. difficile* infections so dangerous.

The study showed that the administration of a specific bacteriophage significantly reduced the number of *C. difficile* cells and also the amount of toxin produced, without significantly affecting the other members of the gut microbiota. This suggests that bacteriophages could have great potential for use to combat *C. difficile* infections in hospital settings.

The phage wasn't, however, able to kill off all of the *C. difficile* cells. This was because this bacteriophage, like many others, is able to insert its own DNA into the bacterial chromosome – a process known as lysogeny. This makes the bacteria resistant to further bacteriophage attack.

Interestingly, in some cases the lysogeny seemed to prevent the C difficile cells from producing the toxin. So although all of the cells aren't killed, those that survive are a lot less dangerous. This may give clinicians more time to get *C. difficile* infections under control.

This bacteriophage shows considerable promise as a new therapeutic agent to control *C. difficile* infections in hospitals, with potential to provide a new weapon that is desperately needed in the battle against superbugs.

More information: *Anaerobe* S1075-9964(13)00082-6. doi: 10.1016/j.anaerobe.2013.05.001

Provided by Norwich BioScience Institutes