

Peripheral Vascular Disease

Limits Antibiotic Treatment for Diabetics with Infections

The greatest threat to patient's health is when the infection spreads uncontrolled and deep into the surrounding foot tissue and bone. Once the bacterial infection establishes itself on the surface on the bone, the bone is dead and further treatment becomes very difficult. Amputation of the infected of the foot and lower limb are required. Long term antimicrobial therapy can continue for many years to control any resurgent infections.

The Key Question: How did the infection spread from a minor foot ulcer to a fully infected foot? The principle reason is that many diabetics suffer from **Peripheral Vascular Disease (PVD)**. Though antibiotics can theoretically attack the bacterial infection, the **PVD** restricts blood flow and thus the treatment potential of the antibiotics.

2026: A New Development: There is a supplementary treatment opportunity, a result of the significant innovation and research by **Dr. Deepa Ghosh** of the *Institute of NanoScience and Technology* in Mohali, India.*

Innovation: It is common knowledge that bacteria absorb iron for its own biological needs. This fact represents an opportunity that innovation can exploit. The bacteria *biosynthesizes* this iron to form it into *iron nanoparticles*. Iron nanoparticles are *paramagnetic*. *Paramagnetic nanoparticles* will easily self-heat inside the bacteria cell membrane when exposed to **Magnetic Hyperthermia (AMF)**.* Bacteria death follows. FDA recognizes this **technology**.

Magnetic Hyperthermia to Treat Diabetic Foot Infections:

- 1) Regardless of diabetic patient's **peripheral vascular disease (PVD)** that restricts blood flow and antibiotics from reaching the infected tissue, the magnetic energy heats and kills the bacteria directly.
- 2) Magnetic Heating is a *Quasi Drug* treatment that uses the bacteria's own iron to over-heat the cell membrane from the inside, resulting in cell death.

- 3) The Magnetic Field **penetrates** both dense tissue and bone mass.
- 4) The Magnetic Heating easily **penetrates** past the biofilm layering on the bone's surface. The heating continues and penetrates inside the bone to kill the bacterial infection residing there. Once the bacteria are subjected to this type of internal heating, the bacteria cell membrane denatures and no longer functions. The bacteria cannot continue to grow and spread the infection into the surrounding tissue and bone.
- 5) Magnetic Heating is not a drug. It does not inadvertently cause the bacteria to develop a new resistance or mutation.
- 6) The dead bacteria are consumed by the body's **macrophages**. The body's immune system helps with recovery. Surrounding healthy tissue is without iron nanoparticles and is unaffected by the **AMF**.

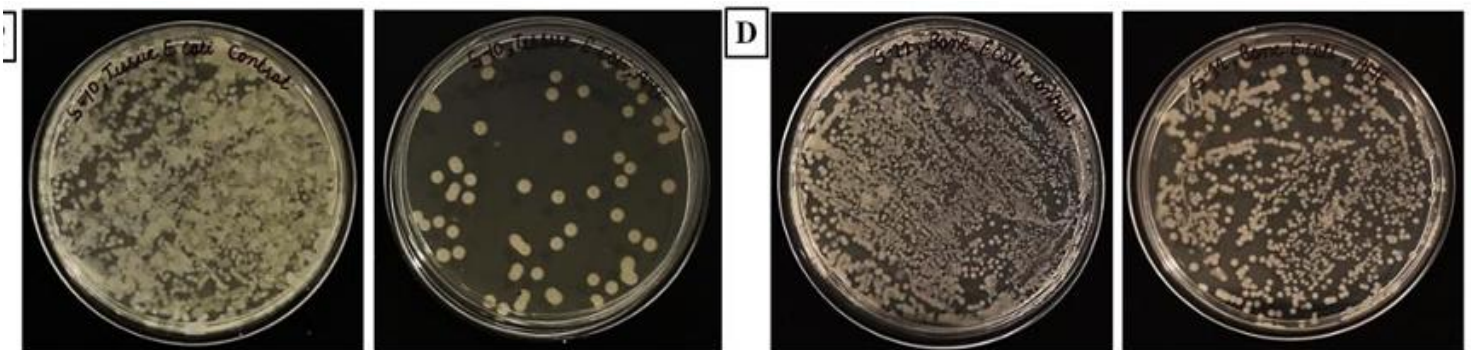
Laboratory Results of live Human Tissue that were received from a hospital whose patients suffered from drug-resistant foot and leg infections.

LIVE HUMAN TISSUE

E-Coli Infection

LIVE HUMAN BONE

E-Coli Infection



BEFORE

AMF

BEFORE

AMF

Tissue samples taken from live patients whose infections spread despite antibiotic treatment. (C) E. Coli infected muscle sample. (D) E.Coli infected bone sample. Both treatments were exposed to magnetic hyperthermia heating (**AMF**) for 5-15 minutes. Longer exposure results in higher death rate for the bacteria. Scanning electron microscope images revealed the destruction of the bacterial cell wall. **AMF** treatment also resulted in excess reactive oxygen species formation, which might contribute to bacteria cell death. As required by the **FDA**: A lengthy safety study of 25 female rats showed an overall lack of significant edematous response to **AMF**. (*Journal of the Royal Society of Chemistry 2022: NanoScale,14. 1713...*)

Upon exposure of the bacteria for 5-15 minutes with AMF (360 kHz / 400 Oe), we observed a hyperthermia response with 3-5 log reduction in live bacterial load. The hyperthermia anti-bacterial treatment was confirmed using multiple patient specimens with different pathogens.

“This validates the clear potential of the drug-free strategy to address the infection.” (Dr. Deepa Ghosh)

*Dr. Deepa Ghosh of The *Institute of Nano Science and Technology* / (Mohali, India). Aug 7, 2022-2024 Nanoscale DOI: 10.1039/d1nr07435k (pp 1713-1722)

Worldwide Announcement: 2025-2026

In 2024 Dr. Deepa Ghosh of the Institute of NanoScience and Technology (Mohali, India) used the MSI Automation Magnetic Hyperthermia Instrument to conduct research to kill bacteria.

The findings were that Magnetic Heating bypasses the fundamental failures of antibiotic treatments. Magnetic Heating can penetrate easily into deep tissue to kill the bacteria. It is the only treatment that can enter through deep tissue and reach the infection inside the bone, eliminating the single biggest cause of amputations: ***osteomyelitis***.

The dead bacteria are consumed by the body's own macrophages. Recovery starts with the help of the body's own immune system and without the toxicity of antibiotics.



Magnetic Heating can now provide a needed synergy to assist antibiotics in the treatment of most infections.

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