



Clostridial Diseases and Fecal Transplants

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What is *Clostridium*?

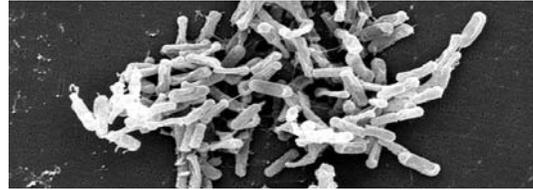
- + *Clostridium* is a genus of Gram-positive bacteria. They are obligate anaerobes, preferring environments with low oxygen concentration such as soil, deep inside wounds, or the gut
- + *Clostridium* spp. are capable of forming endospores—can resist harsh environmental conditions and many common sterilization methods. Foodborne transmission may be possible
- + Some common species include *C. botulinum*, *C. difficile*, *C. perfringens*, and *C. tetani*. Many species can infect both humans and animals.
- + Depending on species, infection by clostridial bacteria can cause wide range of symptoms: ex. paralysis, gastrointestinal problems, fasciitis, and death. Notorious diseases such as tetanus, botulism, and blackleg are caused by *Clostridium* spp.



Figure 1. Infection by *C. perfringens*. (A) A horse being treated for clostridial myonecrosis caused by *C. perfringens*. When *Clostridium* spores enter the anaerobic environment surrounding muscle tissue, they grow and release large amounts of gas and toxins, leading to necrosis of the fascia. This condition is often known as 'gas gangrene' and becomes fatal very quickly.¹ (B) Radiograph of human thigh infected with *C. perfringens*. Note the huge gas bubbles within the tissue.² (C) Gas bubbles in the intestinal mucosa of a patient suffering from gas gangrene.³

References:

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- + 5: Kuuffman, Karla. "The Drenchmate - rumen fluid extractor" Online video clip. YouTube. YouTube, 22 Jan. 2004. Web. 15 March. 2014.
- + Keel, M.K., Songer, J.G. 2006. The comparative pathology of *Clostridium difficile* - associated disease. *Vet. Pathol.* 43:225-240.
- + Brandt, L.J. 2012. Fecal transplantation for the treatment of *Clostridium difficile* infection. *Gastroenterol. Hepatol.* N.Y. 8:191-194



Clostridium difficile

- + Commensal organism in the gut of domestic and food animals, as well as some people, but can be pathogenic under certain conditions. Rising problem in the U.S.
- + Can cause severe diarrhea and colitis in both humans and animals. Primarily affects the caecum and colon but depends on species. Virulence factors include Toxin A and Toxin B.
- + Might be the cause of Colitis-X in horses. In humans, *C. difficile* infection is associated with exposure during a stay in healthcare settings. Particularly prevalent in individuals taking antibiotics.
- + Loss of normal gut flora due to antibiotic use is thought to contribute to *C. difficile* pathogenicity-- "Antibody-associated diarrhea." Some spores are also highly resistant to antibiotics.
- + **How do you fight bacteria when antibiotics are part of the problem? New treatment: fecal transplant!**



Figure 2. Micrograph of Pseudomembranous colitis caused by *C. difficile*. Note the necrotic debris erupting from the infected colon.⁴

Fecal Transplants

- + Fecal bacteriotherapy or fecal transplant: the process of transplantation of fecal bacteria from a healthy individual into a recipient.
- + Based on popular recent theory that having a balanced microbiome is an important part of reducing effects of potentially pathogenic organisms
 - "normal" gut flora displace pathogenic species
- + Similar process has been performed in animals for centuries (transfaunation) but has only recently been applied to humans



Figure 3. Rumen fluid being extracted from a healthy, cannulated cow.⁵

Methods:

- + procedure involves single to multiple infusions of bacterial fecal flora by enema or colonoscope, originating from a healthy donor

- + Similar to process in cows where bacteria taken from rumen of a healthy donor are transplanted into the rumen of a sick animal

Results:

- + study published in the New England Medical Journal in 2013 reported a 94% cure rate of colitis caused by *C. difficile* by fecal transplant, compared to 31% with vancomycin

- + increasingly being studied and used by human clinicians to treat *C. difficile*, other causes of colitis, and some neurological conditions

Conclusion:

Good example of the importance of a dialogue between human and veterinary medicine!