Bug of the Month:  Clostridium

We recently began to explore the genus of bacteria known as Clostridium. Bacteria in this genus are rod shaped, gram positive, and form endospores. Clostridia are found in anaerobic habitats such as soil, aquatic sediments and the intestinal tracts of humans and animals. They usually do not grow under aerobic conditions. Because they release potent toxins and form spores which can persist in the environment for long periods of time, some Clostridia have serious consequences for humans. Over the next few months, we will look at the species of Clostridia that may have an impact in our work environments, *C. difficile*, *C. perfringens*, and *C. tetani*.

*Clostridium perfringens* is the second species of organisms within this genus we will explore.

The reservoirs for *C. perfringens* are soil, and the gastro-intestinal tract. Sources of infection with this organism can be endogenous or from environmental contact. *C. perfringens* can cause bacterial food poisoning, necrotizing soft tissue infections, and infections at the site of trauma and surgical sites. It is the most common organism involved with Clostridial gas gangrene a life-threatening condition.

Spontaneous metastatic infection with this organism can occur. Diagnosed or undiagnosed malignancy may be present in many of these instances. The blood or colo-rectal sites are the most frequent sites of malignancy in persons with metastatic *C. perfringens* infection. Spontaneous infections have a mortality rate of about 67-100%. After the infection is managed, conducting an evaluation for malignancy may be advisable.

Two conditions are necessary for *C. perfringens* infection, inoculation of the organism into the tissues and low oxygen in the tissues. After the organisms are inoculated into low oxygen tissues, they begin to grow and produce toxins. The incubation period can last from 1 hour to several weeks but usually is about 12-24 hours.

Infections with *C. perfringens* have devastating consequences. The organisms produce extracellular enzymes that break down protein, lipids, and collagen. These toxins and enzymes break down cell membrane and have a role in invasiveness and tissue destruction. The toxins cause lysis of red blood cells and leukocytes, platelets, and muscle cells. A collagenase toxin facilitates spread of necrosis through tissue planes by destroying connective tissue.
About 1,000 cases of Clostridial gas gangrene are reported each year. Symptoms include fever, pain, brownish discoloration of tissues, brownish serous drainage, gas bubbles in tissues, and mental status changes. The disease is managed by prompt debridement of all involved tissues, administration of supplemental oxygen, daily assessment of the wound and additional debridement if necessary. Hyperbaric oxygen may be considered. Wound closure may be done later or the area is healed by second intention. Penicillin G is the preferred antimicrobial medication. For penicillin allergic patients, clindamycin or chloramphenicol may be used. With appropriate treatment, mortality is 23-30%, but if untreated the mortality is 100%.

Although not a topic related to surgery, \textit{C. perfringens} is responsible for about one million cases of food-borne illness each year. The organism commonly found on raw meat and poultry. Meats, poultry, and gravies are often implicated with this type of food borne illness. The cause is usually related to undercooking or holding prepared food at unsafe temperatures above 41 degrees and less than 140 degrees; the organism proliferates in the food. About 6-24 hours after eating the food watery diarrhea and abdominal cramping occurs. The duration of illness is about 24 hours. Prevention includes cooking foods to an internal temperature of at least 145-165 degrees then keep the food at temperatures below 41 degrees or above 140 degrees. Refrigerate leftovers promptly and reheat leftovers to at least 165 degrees before serving.

Why is this of Interest in ambulatory surgery? Although surgical site infections with \textit{C. perfringens} are relatively rare the consequences can be devastating. Clostridial infections have occurred after intestinal surgery, ruptured appendix, bowel perforation, biliary surgery, laparoscopic cholecystectomy, colonoscopy, and liposuction. Post-operative endophthalmitis caused by this organism usually leads to loss of vision or actual loss of the affected eye. Skin and soft tissue infections can lead to massive tissue destruction.

Because this organism is found widely in soils, dust, and colonizing the GI tract, prevention is important. Suturing of wounds that are due to a crushing injury or open fractures with devitalized muscle tissue and soil contamination should be avoided.

In the ASC setting, thorough cleaning, disinfection, and dusting of the perioperative environment is essential. Awareness that infection with this organism is possible can promote early diagnosis. Patient education should be directed toward reporting pain, drainage, discoloration, fever and other signs of infection promptly.

Person to person transmission is rare. Use standard precautions when providing care to a person with \textit{C. perfringens}. And add contact precautions if there is extensive drainage.
Resources:

Todar’s on-line Textbook of Bacteriology:

Bacterial Protein Toxins
http://textbookofbacteriology.net/proteintoxins.html

Mechanisms of Bacterial pathogenicity
http://textbookofbacteriology.net/pathogenesis_4.html

Pathogenic Clostridia Including Botulism and Tetanus
http://textbookofbacteriology.net/clostridia.html

Medscape Clostridial Gas Gangrene
http://emedicine.medscape.com/article/214992-overview#a0199

Medscape Gas Gangrene follow-up
http://emedicine.medscape.com/article/217943-followup#a2648

CDC: Diseases and Conditions, Clostridium perfringens