Intra-abdominal Infections

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Intra-abdominal Infections

- Peritonitis
- Intra-abdominal Abscess
- Diverticulitis
- Appendicitis
- Antibiotic-Associated Diarrhea
  - (Clostridium difficile)
- Food Poisoning/ Traveler’s Diarrhea
- Helicobacter pylori
- Pelvic Inflammatory Disease
- Viral
- Parasitic
I.D. 101

Site of Infection?

Organisms at the Site??

ChemoTX with activity against Organisms???

Patient and Disease Specific Factors????
Intra-abdominal Infections

Infections contained within the peritoneum or retroperitoneal space.

- Peritoneal cavity contains:
  - Stomach
  - Jejunum, Ileum
  - Appendix
  - Large intestine (colon)
  - Liver, gallbladder and spleen

- Retroperitoneal space:
  - Duodenum
  - Pancreas
  - Kidneys
Anatomy of the GI Tract

- **GI microflora** depends on the anatomic site!

**Upper Intestine:**
- Streptococci
- Enterococci
- Staphylococci
- E. coli
- Klebsiella
- Bacteroides

**Stomach:**
- H. Pylori
- Lactobacilli

**Ileum:**
- Streptococci
- Staphylococci
- Escherichia coli
- Klebsiella
- Enterobacter
- Bacteroides
- Clostridium

**Colon:**
- Bacteroides
- Peptostreptococci
- Clostridium
- Bifidobacteria
- Escherichia coli
- Klebsiella
- Enterobacter
- Streptococci
- Enterococci
- Staphylococci
Normal GI Microflora

**Stomach:**
- Total bacterial count $0-10^8$ log organisms/g
  - *Helicobacter pylori*
  - *Streptococci*
  - *Lactobacilli*

**Upper Small Intestine:**
- Total bacterial count $0-10^5$ log organisms/g
  - **Aerobes**
    - *Streptococci (Enterococci)*
    - *Staphylococci*
    - *Lactobacilli*
    - *E. coli, Klebsiella*
  - **Anaerobes**
    - *Bacteroides*
Normal GI Microflora

**Ileum**
- Total bacterial count $10^3$-$10^9$ log organisms/g
- **Aerobes:**
  - Streptococci
  - Staphylococci
  - *Escherichia coli*, Klebsiella
  - Enterobacter
- **Anaerobes:**
  - Bacteroides
  - Clostridium

**Large Intestine (Colon)**
- Total bacterial count $10^{10}$-$10^{12}$ log organisms/g
- **Anaerobes:**
  - Bacteroides
  - Peptostreptococci
  - Clostridium
  - Bifidobacteria
- **Aerobes:**
  - *Escherichia coli*, Klebsiella
  - Enterobacter
  - Streptococci (Enterococci)
  - Staphylococci
Peritonitis

Inflammation of the serous lining of the peritoneal cavity due to:

- Microorganisms
- Chemicals
- Irradiation
- Foreign body injury
Clinical Symptoms

- Abdominal pain
- Anorexia (N/V)
- Fever (100 to 102 F)
- Abdominal distention and tenderness
- Hypoactive or faint bowel sounds
- Leukocytosis
Peritonitis

- **Normally**: 20 to 50 mL transudate
  - Peritoneal membrane measures approx. 1.7 m²
  - WBC < 300 cells/ mm³
  - Protein: <3 g/ dL

- **Bacterial peritonitis**: 300 to 500 mL inflow/ hr resulting in hypovolemia.
  - WBC > 300 cells/ mm³
  - Gram stain + for bacteria
Peritonitis

**Primary**
- No focus of disease is evident
- Bacteria transported from blood stream to peritoneal cavity (Cirrhosis, CAPD)

**Secondary**
- Acute perforation of the GI tract (Gastric, Diverticular, Appendix, Gallbladder, Tumor perforations) [66%]
- Post-operative peritonitis [24%]
- Post-traumatic peritonitis [10%]

Primary Peritonitis

- Relatively infrequent
- 25% of patients with alcoholic cirrhosis
- 60% of all patients on chronic ambulatory peritoneal dialysis (CAPD) will have at least one episode in 1st year.
- Average incidence in CAPD patients is 1.3 to 1.4 episodes/yr.
- Catheter connecting abdominal cavity to exterior body is a major risk factor.
Common Bacteria:

- Escherichia coli
- Streptococci
- Enterococci
- Klebsiella
- Staphylococci (CAPD patients)
- Pseudomonas aeruginosa
- Bacteroides sp.
Figure 49. Diverticulitis. Multiple sigmoid diverticula (arrows), one of which has perforated to produce (large arrow) a pericolonic abscess.
Intra-abdominal Abscess

- Result from chronic inflammation and often occur without generalized peritonitis.
- Located within peritoneal cavity or visceral organs.
- May range from a few milliliters to a liter in volume.
- Often have a fibrinous capsule and take days to years to form.
- Appendicitis is the most common cause.
- Ultrasound or CT scan may be used for evaluation.
Intra-abdominal Abscess

- **Clinical Manifestations:**
  - Symptoms less dramatic than peritonitis
  - +/- pain
  - +/- fever
  - +/- abdominal distention

- **Common Bacteria:**
  - E. coli
  - Klebsiella
  - Enterococci
  - B. fragilis
  - Clostridium
Management of Intra-Abdominal Infections

**Combination of modalities:**

- **Surgical**
  - Prompt drainage of abscess (secondary peritonitis) and/or debridement
  - Resection of perforated colon, small intestine, ulcers
  - Repair of trauma

- **Support of Vital functions:**
  - Blood pressure/ fluid replacement
  - Monitor Heart rate
  - Monitor urine output (0.5 ml/ kg/ hr)

- **Appropriate antimicrobial therapy**
I.D. 101

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  - Enterococci
  - Staphylococci
Antibiotic Therapy

Empiric Therapy must include aerobic/anaerobic coverage

- Aerobic and Anaerobic activity
  - Ampicillin/sulbactam (Unasyn) *(enterococci)*
  - Piperacillin/tazobactam (Zosyn) *(enterococci)*
  - Cefotetan (Cefotetan)
  - Cefoxitin (Mefoxin)
  - Imipenem/cilastin (Primaxin)
  - Meropenem (Merrem)
  - Moxifloxacin (Avelox)
Antibiotic Therapy

Empiric Therapy must include aerobic/anaerobic coverage

- **Anaerobic activity:**
  - Chloramphenicol (also includes aerobic Gram +/−)
  - Clindamycin (also includes aerobic Gram +)
  - Metronidazole (anaerobic coverage only)

- **Aerobic activity:**
  - **Aminoglycosides:**
    - gentamicin, tobramycin (Gram negatives only)
  - **Beta-lactams:**
    - Cefotaxime (Claforan)
    - Ceftriaxone (Rocephin)
    - Aztreonam (Azactam) (Gram negative only)
  - **Quinolones:**
    - Ciprofloxacin (Cipro) (Mostly Gram negative)
    - Levofloxacin (Levaquin) (Gram +/− and some anaerobic coverage)
  - **Vancomycin/Linezolid** (Enterococci, MRSA)
Antibiotic Therapy

Factors involved in selection:
- Severity of infection, suspected infecting organism(s) and resistance patterns, efficacy, toxicity (renal dysfunction), allergies.

Evaluating response:
- Improvement in 2 to 3 days
- Switch for oral antibiotic therapy

Failure to improve:
- Resistant organisms
- Recurrent surgical infections
- Other infections: (urinary tract infections, pneumonia)
Appendicitis

- One of the most common causes of intra-abdominal infections.
- Treatment: Both Surgical and Antibiotics
  - Depends on presentation of appendix:
    - Normal, inflamed, gangrenous or perforated
    - Begin antibiotics before appendectomy is performed
      - Anti-anaerobic cephalosporin (e.g. Cefotetan, Cefoxitin, Piperacillin/ tazobactam, Ampicillin/ sulbactam, Imipenem
      - Combination therapy: Aminoglycoside +/- Clindamycin or Metronidazole.
  - Continue antibiotics for 7 to 10 days if appendix is perforated or gangrenous (Switch to oral equivalents)
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Antibiotics and GI flora

- Broad spectrum antibiotics can change the normal GI flora.
  - Increases in Candida or Gram-negative bacteria
  - Proliferation of antibiotic-resistant organisms
  - Pseudomembranous colitis from over proliferation of toxin-producing anaerobe, Clostridium difficile
Pseudomembranous Colitis

- *Clostridium difficile* toxin mediated disease
  - Toxin A (major) and B (minor): cause inflammation, necrosis, loss of fluid electrolytes
- Associated with broad spectrum antibiotics
- Patients may develop diarrhea after 3 or more days of hospitalization or within 2 months of antibiotic therapy.
- 3 to 5% of adults are carriers of *C. difficile*
- Metronidazole (oral) treatment of choice with vancomycin (oral only) +/- rifampin for recurrences.
- Recurrence in 7 to 20% of patients.
Clinical Questions

“Recommend dosing for intraperitoneal administration of an antibiotic for a CAPD patient with a Staphylococcus peritonitis?”
Peritonitis in CAPD

- Antibiotics may be given intraperitoneal via the dialysate: (exchanges every 4 to 6 hrs)
  - Gentamicin and tobramycin: 8mg/L
  - Clindamycin: 1 to 3 mg/L
  - Penicillin G: 50,000 units/L
  - Cephalosporins: 125 mg/L
  - Ampicillin: 50 mg/L
  - Vancomycin: 30 mg/L
  - Amphotericin B: 3 mg/L

- Duration: 2 to 3 weeks
Clinical Questions

“Recommend an empiric antibiotic treatment for a ruptured appendix?”
Ruptured Appendix

- Immediately begin empiric antibiotic with aerobic and anaerobic coverage and continue following appendectomy.
  - Ampicillin/sulbactam (Unasyn) +/- Aminoglycoside
  - Piperacillin/ tazobactam (Zosyn) +/- Aminoglycoside
  - Clindamycin + Ampicillin + Aminoglycoside
  - Ampicillin + Metronidazole
  - Levofloxacin + Metronidazole
  - And many other combinations............
What are the antibiotic treatment options for Pseudomembranous colitis?
Pseudomembranous colitis

FIRST LINE:

- **Oral Metronidazole** Treatment of Choice:
  - 250 to 500mg PO 4 times per day X 10 days

ALTERNATIVE: (when not responding to Metronidazole or recurrences)

- **Vancomycin oral** (not absorbed) 125 to 500mg PO 4 times per day X 10 days +/- rifampin 600mg PO BID.
  - Not recommended as 1st line due to concern of vancomycin-resistant enterococci (VRE) spread.
Conclusions

- Intra-abdominal infections demand immediate evaluation based on patient history and presentation.

- Management includes three components:
  - Surgical evaluation
  - Vital Support
  - Appropriate antimicrobial selection

- Antibiotic selection is based on likely source of infection and should always include aerobic and anaerobic bacterial coverage.