Intra-abdominal Infections

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Definitions and Classifications

Intra-abdominal Infections
Intra-abdominal Infections

- Intra-abdominal infections are generally the result of invasion and multiplication of enteric bacteria in the wall of a hollow viscus or beyond.
- When the infection extends into the peritoneal cavity or another normally sterile region of the abdominal cavity, the infection is described as a "complicated" intra-abdominal infection.

Infections of the walls of viscera:
- Cholecystitis, cholangitis
- Appendicitis, typhlitis, colitis
- Diverticulitis

Infections of serous membranes and spaces:
- Peritonitis, abscess

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<table>
<thead>
<tr>
<th>Type</th>
<th>Definition</th>
<th>Microbiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>A peritoneal infection developing in the absence of a break in the integrity of the gastrointestinal tract, as a result of hematogenous or lymphatic seeding, or traumatic perforation.</td>
<td>Mucormycotic infection due to <em>Mucor</em> or <em>Rhizopus</em></td>
</tr>
<tr>
<td>Secondary</td>
<td>A peritoneal infection develops in conjunction with an inflammatory process of the gastrointestinal tract or its extramural structures, usually associated with mucosal or submucosal perforation.</td>
<td>Gram-negative bacilli, <em>Enterococcus</em>, and enteroic aerobes.</td>
</tr>
</tbody>
</table>
| Intestinal | An ascendant or recurrent peritoneal infection developing after initial treatment of secondary peritonitis. | Mucocutaneous organisms, including *Escherichia coli*, *Enterococcus*, *Staphylococcus*, and *Clostridium*.

Intra-abdominal Infections

- Classificacíon
  - Community Acquired
  - Mild to moderate
  - High Risk
  - Health Care Associated
  - Community onset
  - Hospital onset

Pathophysiology and Microbiology
Intra-abdominal Infections
Intra-abdominal Infections

Pathophysiology

• Experimental studies suggest that the aerobic Gram-negative organisms are largely responsible for the lethality of peritonitis, whereas the anaerobes play an important role in the induction of abscess formation

• The clinical features of peritonitis, however, are dependent more on the response of the host than on the intrinsic virulence of the infecting flora
Microbial Synergy in Experimental Intra-Abdominal Abscess

Intra-abdominal abscess was studied in a rabbit model for enteric bacterial strains. 

An experiment was conducted to evaluate the synergistic effects of various bacterial combinations. 

**Table:**

<table>
<thead>
<tr>
<th>Bacterial Strain</th>
<th>Survival Rate (%)</th>
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<tbody>
<tr>
<td>E. coli</td>
<td>50</td>
</tr>
<tr>
<td>E. coli + E. hirae</td>
<td>20</td>
</tr>
<tr>
<td>E. coli + E. cloacae</td>
<td>10</td>
</tr>
</tbody>
</table>

**Diagram:**

- E. coli
- E. hirae
- E. cloacae

**Legend:**

- Single strain
- Mixed strain combinations

**Note:**

The synergistic effect observed in the study indicates that the combination of certain bacterial strains can lead to a more severe infection in the experimental model.
Clinical Presentation

- Patients with intra-abdominal infection typically present with rapid-onset abdominal pain and symptoms of gastrointestinal dysfunction (loss of appetite, nausea, vomiting, bloating, and/or constipation)
- With or without signs of inflammation (fever, tachycardia, and/or tachypnea)
- With or without hypotension
Diagnostics Modalities

- Radiology
  - CT scan
  - Ultrasound
  - X-Ray
- Laboratory
- Cultures

Management

Intra-abdominal Infections

- Hemodynamic resuscitation and support of vital organ function
- Rapid anatomic diagnosis and the institution of adequate source control measures
- Early administration of antimicrobial agents appropriate for the infectious problem
Fluid Resuscitation

- Patients should undergo rapid restoration of intravascular volume and additional measures as needed to promote physiological stability
- There is compelling historically controlled data that patients with perforated or abscessed appendicitis benefit from administration of fluids even absent septic shock
- For patients with septic shock, such resuscitation should begin immediately when hypotension is identified

Source Control

- The term “source control” is used to encompass all physical measures undertaken to eradicate a focus of infection, to prevent ongoing microbial contamination, and to restore functional anatomy
- Involves
  - drainage of abscesses or infected fluid collections;
  - debridement of necrotic infected tissue;
  - definitive measures to control a source of ongoing microbial contamination and to restore anatomy and function

Source Control

- Patients with diffuse peritonitis should undergo an emergency surgical procedure ASAP, even if ongoing measures to restore physiologic stability need to be continued during the procedure
- Where feasible, percutaneous drainage of abscesses and other well-localized fluid collections is preferable to surgical Drainage
Source Control

- Three general strategies should be considered for critically ill patients who are either physiologically unstable or at high risk of experiencing failed source control.
- These include:
  1. laparostomy or the “open abdomen,”
  2. planned re-laparotomy,
  3. on-demand re-laparotomy
Antimicrobial Therapy

- Antimicrobial therapy should be initiated once a patient receives a diagnosis of an intra-abdominal infection or once such an infection is considered.
- For patients with septic shock, antibiotics should be administered as soon as possible.
- In patients undergoing a source control procedure, antimicrobial therapy provides for surgical wound prophylaxis and treatment of pathogens that are potentially disseminated during the procedure.
When to use Antifungal therapy?

- *C. albicans* or other fungi are cultured from ~20% of patients with acute perforations of the gastrointestinal tract.
- Even when fungi are recovered, antifungal agents are unnecessary in adults unless
  1. recently received immunosuppression
  2. has a perforation of a gastric ulcer on acid suppression or malignancy
  3. transplantation
  4. inflammatory disease
  5. postoperative
  6. recurrent intra-abdominal infection

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**Recommendations for Impaired Antioxidant Therapy for Health-Related Compromised Immunity**: Table and text on antioxidant therapy for health-related compromised immunity.
When to use Antifungal therapy?

- Antifungal therapy for patients with severe community acquired or health care–associated infection is recommended
  - if *Candida* is grown from intra-abdominal cultures
  - Fluconazole is an appropriate choice for treatment of *C. albicans*
  - For fluconazole-resistant *Candida* species, therapy with an echinocandin (caspofungin, micafungin, or anidulafungin)
  - For the critically ill patient, initial therapy with an echinocandin instead of a triazole is recommended
  - Because of toxicity, Amphotericin B is not recommended as initial therapy

When to cover for *Enterococcus*?

- Certain patient groups at particularly high risk of a poor outcome due to enterococcal infection include
  1. Immunocompromised patients
  2. Health care–associated postoperative peritonitis
  3. Severe sepsis of abdominal origin who have previously received cephalosporins and other broad-spectrum antibiotics selecting for *Enterococcus* species
  4. Peritonitis and valvular heart disease or prosthetic intravascular material, which place patients at high risk for endocarditis

When to cover for *Enterococcus*?

- Isolation of *Enterococcus* is more common among patients with HCA-intra-abdominal infection, and its isolation is a risk factor for treatment failure and death
- Ampicillin and vancomycin are agents that have activity against this organism and could be added to a regimen lacking antenterococcal activity.
- Empiric therapy directed against vancomycin-resistant *Enterococcus faecium* is not recommended unless the patient is at very high risk for an infection due to this organism
  - liver transplant recipient with an intra-abdominal infection
  - patient known to be colonized with vancomycin-resistant *E. faecium*
When to cover for MRSA?

- MRSA isolates are recovered from patients with postoperative infection, pancreatic infection, and tertiary peritonitis
- MRSA is not commonly isolated from patients with community-acquired intra-abdominal infection
- There are no specific data with regard to antibiotic preferences in treatment of intra-abdominal infections due to MRSA. In general, vancomycin has been used to treat infections due to this organism

<table>
<thead>
<tr>
<th>Product</th>
<th>MIC Value (µg/mL)</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vancomycin</td>
<td>5</td>
<td>High</td>
</tr>
<tr>
<td>Teicoplanin</td>
<td>8</td>
<td>High</td>
</tr>
<tr>
<td>Linezolid</td>
<td>2</td>
<td>High</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>2</td>
<td>Moderate</td>
</tr>
<tr>
<td>Piperacillin-Tazobactam</td>
<td>2</td>
<td>Moderate</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>4</td>
<td>Moderate</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>0.25</td>
<td>Low</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>0.5</td>
<td>Low</td>
</tr>
</tbody>
</table>

Duration of Antimicrobial therapy

- A duration of therapy no greater than 1 week was appropriate for most patients with intra-abdominal infections, with the exception of those who had inadequate source control
- Resolution of clinical signs of infection can be used to stop therapy. This usually implies that the patients are
  - afebrile,
  - have normal white blood cell counts
  - tolerating an oral diet
Oral Therapy?

- Patients who are convalescing from complicated intra-abdominal infection may be treated with oral antibiotic therapy
- Therapy should be included as part of the brief treatment intervals recommended, which in total should rarely exceed 4–7 days
- Providing antimicrobial therapy for patients who are afebrile, with normal WBC and with return of bowel function, is rarely indicated
- Oral therapy is selected on the basis of susceptibilities of the identified primary isolates or, in the absence of cultures, commonly isolated pathogens that include \( E. \) \( coh \), streptococci, and \( B. fragilis \)

Treatment Failure?

- CT or ultrasound imaging
- Further source control may needed
- Extra-abdominal sources of infection and noninfectious inflammatory conditions should also be considered
- Antimicrobial regimens should be adjusted according to the results of the diagnostic investigations
- Broadening the regimen to include agents with activity against health care–associated organisms

Surgical Site Infections
Surgical Site Infection (SSI)

- Surgical wound infections (SWI) are the second most common healthcare-associated infection
- Although usually localized to the incision site, SWI can also extend into adjacent deeper structures
- The term SWI has now been replaced with the more suitable name, Surgical Site Infection (SSI)

Surgical Site Infection (SSI)

- CDC define SSIs as infections related to the operative procedure that occur at or near the surgical incision (incisional or organ/space) within 30 days of an operative procedure or within one year if an implant is left in place.

Surgical Site Infection (SSI) Prevention

- The most important factors in the prevention of SSIs are
  - Meticulous operative technique and
  - Timely administration of effective preoperative antibiotics
- A number of interventions have been used over the years to reduce the risk of SSIs, including:
  - Preoperative showering with antimicrobial soaps
  - Preoperative application of antiseptics to the skin of the patient
  - Washing and gloving of the surgeon’s hands
  - Use of sterile gowns and masks by operating room personnel

Surgical Site Infection (SSI) Antimicrobial Prophylaxis

- The goal of antimicrobial prophylaxis is to prevent SSI by reducing the burden of microorganisms at the surgical site during the operative procedure
- Patients who receive prophylactic antibiotics within 1 to 2 hours before the initial incision have lower rates of SSI than patients who receive antibiotics sooner or later than this window
Table 1. Temporal Relation between the Administration of Prophylactic Antibiotics and Rates of Surgical-Wound Infection.

<table>
<thead>
<tr>
<th>Time of Administration</th>
<th>No. of Patients</th>
<th>No. (%) of Infections</th>
<th>Relative Risk (95% CI)</th>
<th>Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
<td>369</td>
<td>14 (3.8%)</td>
<td>2.4 (2.0–3.0)</td>
<td>4.3 (3.8–10.4)</td>
</tr>
<tr>
<td>Preoperative</td>
<td>513</td>
<td>10 (3.0%)</td>
<td>1.0</td>
<td>1.0 (0.6–1.9)</td>
</tr>
<tr>
<td>Postoperative</td>
<td>488</td>
<td>16 (3.3%)</td>
<td>2.4 (1.9–3.0)</td>
<td>5.6 (3.3–10.0)</td>
</tr>
<tr>
<td>All</td>
<td>2377</td>
<td>44 (1.8%)</td>
<td>1.8 (1.5–2.1)</td>
<td>5.8 (4.6–7.2)</td>
</tr>
</tbody>
</table>

*For the administration of antibiotics, “early” denotes 2 to 24 hours before the incision, “preoperative” 6 to 12 hours before the incision, “postoperative” within 2 hours after the surgery, and “all” represents more than 2 hours after the incision.

P value determined by logistic regression analysis.

**P = 0.013; **P = 0.01 compared with the prophylactic group.

***P = 0.22; ***P = 0.01 compared with the prophylactic group.
Conclusions

- Differentiation among community acquired and hospital related intra-abdominal infections
- Fluid resuscitation prompt antibiotic therapy initiation and source control are key in the management of intra-abdominal infections
- If source is controlled short term antibiotic therapy recommended
- Antifungal, enterococcal and MRSA therapy in selected cases
- If failure suspected need to consider additional source control measures and also consider extrabdominal infections and non-infectious processes.
- Antibiotic prophylaxis one hour before surgery decreased risk of SSI.

Recommended references

- Solomkin. Complicated intra-abdominal infection Guidelines. CID 2010:50 (15 January)

Thank you