Update in intra-abdominal Infections: 
Overview of new IDSA guidelines and case-based review

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Major reference: IDSA/SIS 2009 guidelines
Solomkin et al, CID 2010; 50:133-164

Diagnosis and Management of Complicated Intra-abdominal Infection in Adults and Children: Guidelines by the Surgical Infection Society and the Infectious Diseases Society of America

CID 2010; 50:133-164

IDSA guidelines 2009
A few definitions

• Complicated intra-abdominal infections: "extends beyond hollow viscus of origin into peritoneal space and is associated w/abscess formation or peritonitis"

• Divided into 3 groups:
  – Mild-moderate severity community acquired (CA) infection in adults
  – High risk CA infection
  – Health Care-Associated (HCA) infection
HCA-assoc abd infxn

• Associated w/ MDR GNRs, yeast, enterococcus, MRSA
• Community onset
  – invasive device
  – h/o MRSA infxn or colonization
  – h/o surgery, hospitalization, dialysis, or LTHCF in previous 12 mos
• Hospital-onset
  – hospitalized >48 hrs

Consistent principles

• Empiric rx according to predicted flora and likelihood of abx resistance
  – Narrower spectrum for mild-mod CA infxns
  – Broader coverage (MDR GNR, enterococcus, yeast) for severe HCA infxns

Consistent principles

• Prophylactic abx (< 24 hrs duration)
  – Traumatic injuries repaired within 12 hrs
  – Intra-op contamination
  – Acute perf of stomach, duodenum, proximal jejunum in absence of antacid therapy or malignancy
  – Uncomplicated acute appendicitis
• Treatment abx (>24 hrs): until resolution of clinical signs of infxn
• W/u if no response after 5-7 d of rx
• enterococcus, yeast only need to be treated in specific situations
Major changes in 2009 vs 2003 guidelines

- Amp/sulbactam (unasyn) no longer recommended
- Caution in using augmentin, ciprofloxicin
- Local abx resistance trends increasingly important

### Abdominal infection case #1

- 20 yo woman presented to the ER with RUQ pain, N/V after eating fried chicken. PE remarkable for T=38° and moderate RUQ tenderness. WBC=15. LFTs and amylase were nl. Pregnancy test neg.
• She was admitted and made NPO
• Should she get abx and if so, when and what?
• What is the bacteriology
• Is there a role for blood cultures?

Should she get abx?
• Cholangitis: decrease the incidence of post-operative infections
• Cholecystitis: no good studies, but usually done

When should abx be started?
• 2009 guidelines: As soon as intra-abd infection diagnosed or suspected
  – Within 1 hr if septic
  – Otherwise within 8 hrs
What are the bugs?

- Cover enteric aerobic and facultative GNR and enteric streptococci

Which abx?

- Cover enteric aerobic and facultative GNR and enteric streptococci
  - Unasyn, cefotetan, clindamycin, aminoglycosides no longer recommended
  - Quinolones of decreasing efficacy
  - Empiric coverage of MRSA, enterococci, or candida not necessary
  - If good response to rx, no need to revise abx based on culture results

IDSA guidelines... oops-you don't need metronidazole if using carbapenem or Zosyn

Does this patient need blood cultures?

- 2009 IDSA guidelines: "Blood cultures do not provide additional clinically relevant information for pts with community-acquired intra-abdominal infxns"
Are intra-op cultures useful?

- Optional in low risk CA infection, but "may be of value in detecting epidemiological changes in resistance patterns of pathogens associated with CA-IA infection and in guiding follow-up oral therapy"
- If >10-20% of common community isolates demonstrate abx resistance to commonly used regimens, routine (anaerobic) cultures should be obtained for perforated appendicitis and other CA-intra-abdominal infections. Anaerobic cultures not necessary if abx regimen covers anaerobes.

How long to treat?

- If no evidence of infxn outside the GB wall, 24 hrs after surgery
- If complicated infxn, 4-7 days "unless difficult to achieve adequate source control"

But the case doesn’t end yet

- She is scheduled for surgery in 24 hrs, but just as the antibiotics are being hung, she develops shaking chills and a fever to 104
  - Would you change her abx regimen?
But the case doesn’t end yet

• She is scheduled for surgery in 24 hrs, but just as the antibiotics are being hung, she develops shaking chills and a fever to 104
  – Would you change her abx regimen?
  – Should cover for E. coli, P. aeruginosa, B. fragilis, Klebsiella, Enterococcus
  – May want to broaden to Zosyn, Carbapenam, or cephalosporin or ciprof + flagyl

But the case doesn’t end yet

• She is scheduled for surgery in 24 hrs, but just as the antibiotics are being hung, she develops shaking chills and a fever to 104
  – Would you change her abx regimen?
  – Should cover for E. coli, P. aeruginosa, B. fragilis, Klebsiella, Enterococcus
  – May want to broaden to Zosyn, Imipenam

• Her blood cultures grew a sensitive E. coli

• She underwent an uneventful cholecystectomy. How long post-operatively should she get antibiotics?

• Until resolution of clinical signs of infection
Abdominal infection case #2

• 18 yo man with 1 d h/o worsening abd pain, now localizing to RLQ, low grade fevers, nausea, WBC 12 K

Abx in appendicitis

• Uncomplicated
  – <24 hrs 2nd generation cephalosporin

Abdominal infection case #3

• 18 yo man with 3 d h/o worsening abd pain, now localizing to RLQ, low grade fevers, nausea, WBC 12 K
• OR-ruptured appendix
Complicated Appendicitis:  
how long to treat?

- Old studies used 9 d IV abx
- Then 5 D IV abx using broad spectrum abx that covered anaerobic flora (see previous table)
- More recent studies suggest that using clinical criteria is sufficient for determining length of IV Rx
  - Afebrile
  - Resolution of abd pain
  - Return of bowel function
  - Ni WBC
- No clear indication for flu oral abx

Abdominal infection case #4

- 77 yo f in overall good health presented with several weeks of intermittent abd pain which progressed to 4d of constant diffuse abd pain. On admission, febrile, exam remarkable for hyperactive BS, rebound w/o guarding. WBC=12.8. LFTs nl.

CT scan
**Hospital course**

- Pt received 1 dose IV Zosyn, then IV Cipro x 1 d, and discharged on PO cipro to complete 1 week course.

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**Diverticulitis**

- Microbiology-colonic flora
  - Oral, outpatient regimen
    - Uncomplicated
    - Small abscess
    - Pt can tolerate orals
    - Otherwise relatively healthy
    - Quinolone/metronidazole; septra/metronidazole; augmentin; oral cephalosporin/metronidazole
  - IV Rx otherwise
  - If pt fails to improve within 2-3 days, re-image, consider abscess formation or other causes, surgical intervention

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**Abdominal infection case #5**

- 28 yo prev healthy asian m presented with sudden onset of severe abd pain, non-bloody emesis x 3. No F/C, prior episodes, no h/o GI disease.
- Soc Hx: Emigrated from China 4 yrs ago. Software developer
- ER: WBC 17
- Stool cultures neg
CT scan: markedly thickened descending colon with small foci of free air c/w diverticulitis c/b microperforation. Less likely dx included IBD, CA

Hospital course
- Treated w/Zosyn for presumed perforated diverticulitis
- Developed severe diarrhea, tx’d w/flagyl for possible C. diff (Ag test neg)
- Sx improved and pt Dc’d to home on Moxifloxacin and Flagyl for 10 d course
- Outpatient colonoscopy planned

Hospitalization #2
- 5 d later, pt returned with incr abd pain, intermittent sweats, fevers. Compliant w/abx, only taking tylenol for pain
- ER: Afebrile, VSS. PE remarkable for mod voluntary guarding but no rebound. WBC 17.8
• Abd CT: interval development of fat stranding and multiple ring-enhancing small fluid collections, dilated loops of small bowel in the LUQ c/w ileus and multiple Abd abscesses.

• Pt initially treated conservatively with Zosyn X 3 D, then PO Moxifloxacin/Flagyl.
• HD # 4 d, ↑ Abd pain.
• HD #8: ex lap which revealed perforated invasive signet cell adenocarcinoma of the colon & pericolonic abscess. Pt underwent lysis of adhesions, abscess drainage, left hemicolectomy w/diverting colostomy, 70 cm small bowel resection 2˚ to fistula between abscess cavity and prox jejunum with primary anastomosis. Intra-op cultures grew C. albicans.
• Pt treated with Moxifloxacin, Flagyl, Fluconazole. Post-op course complicated by superficial wound infection treated with vancomycin x 3 d. Pt d/c to home on 2 wk post-op course of augmentin and fluconazole.

Treatment of candida
• Not everyone needs to be treated, even if culture+
  – Cultured from 20% of pts w/acute perf
• “Anti-fungal therapy for pts w/severe CA- or HCA-infection recommended if Candida grown from intra-abd cultures”
  – Fluconazole if C. albicans
  – Echinocandin for Fluc-resistant Candida species
  – For critical ill pt, initial rx w/echinocandin until species and/or suscept available
  – Ampho B not recommended as initial rx 2˚ to toxicity
Abdominal infection case #5

• 58 yo woman with 3 d h/o low grade fevers, incr abd pain, h/o binge drinking, WBC 12 K, amylase 700, Bili 1.6
• Initial dx c/w pancreatitis
• 1 wk later, incr abd pain and new fevers
• CT abd

Infections complicating acute pancreatitis

• 80% of pts w/pancreatitis recover within 1 wk
• 15% pts develop acute necrotizing pancreatitis w/mortality 12%-35%
  – Release of pancreatic enzymes, vasoactive substances->vascular permeability, pancreatic swelling, necrosis->pseudocyst->release into peritoneum->necrosis, superinfection, abscess
  – Mortality of 10% w/sterile pancreatic necrosis->70-80% mortality if infected and not treated
  – Predominant bacteria: E. coli, Klebsiella, Staph, Pseudomonas, Enterococcus, anaerobes
  – Rx: abx, drainage, necrosectomy (removal of necrotic tissue)
    • Often involves multiple procedures
    • Length of Rx by clinical improvement

Abx with good pancreatic penetration

• Quinolones
• Imipenem
• Ceftazidime
• Cefepime
• Metronidazole
• Fluconazole
Prophylactic abx for severe pancreatitis

• Studies are small and open label
  – 3/5 randomized trials showed lower rates of sepsis
  – 2/5 lower rates of pancreatic infection
  – 0/5 reduced surgical intervention
  – 1/5 decreased mortality

Various meta-analyses also arrived at conflicting conclusions

  – Pro-abx:
    • Villatoro et al, Cochrane database syst rev 2006
    • Sharma et al, Pancreas 2001
    • Golub et al, J Gastrointest Surg, 1998
    • Heinrich et al, Ann Surg, 2006

  – Anti-abx
    • Mazaki et al, Br J Surg, 2006
    • Bai et al AGS 102:104, 2006

Dellinger et al 2007

• Multicenter, prospective, DB, Placebo-controlled randomized study in 32 centers in Europe and N. America
• 100 pts w/clinically severe (>30%), confirmed necrotizing pancreatitis
• 50 received meropenam, 50 placebo within 5d

Endpoints
  – 1°: development of pancreatic or peripancreatic infection within 42 d of randomization
  – 2°: time of onset of infection, all-cause mortality, requirement for surgical intervention, development of nonpancreatic infections within 42 d

Results

<table>
<thead>
<tr>
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<th>Meropenam</th>
<th>Control</th>
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<tbody>
<tr>
<td>Infections</td>
<td>9/50 (18%)</td>
<td>6/50 (12%)</td>
</tr>
<tr>
<td>Mortality</td>
<td>10/50 (20%)</td>
<td>9/50 (18%)</td>
</tr>
<tr>
<td>Surgical Intervention</td>
<td>13/50 (26%)</td>
<td>10/50 (20%)</td>
</tr>
<tr>
<td>Nonpancreatic infections</td>
<td>10/50 (20%)</td>
<td>24/50 (48%)</td>
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• On demand abx as effective as prophylactic abx
Bai et al  
*Am J Gast, 2008*

- 7 trials involving 467 pts  
- Statistically insignificant decrease in Infection rates (abx 18%, controls 23%)  
- Statistically insignificant decrease in mortality (abx 9%, controls 15%)  
- Type of abx (b-lactam vs quinolone) did not affect rates  
- Decreased mortality only seen in poor quality (single-center trials and single-blinded) trials

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**Prophylactic abx for severe pancreatitis**

- Consensus statement (Critical Care Med):  
  - recommended AGAINST use of prophylactic systemic antibacterial or antifungal agents in necrotizing pancreatitis  
- IDSA guidelines  
  - 2003: “A common but unproved practice”  
  - 2009: NOT RECOMMENDED

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**Abdominal infection case #6**

- 68 yo woman with 3 d h/o low grade fevers, abd pain, WBC 12 K  
- W/U compatible with diverticulitis  
- Sent home on Cipro/flagyl  
- 1 wk later, incr abd pain, low grade fevers
Intra-peritoneal abscess

- Drainage is key
- Antibiotic regimen should include anaerobic coverage
- No clear guidelines for length of rx
  - IDSA: until resolution of clinical signs of infection (Temp, WBC, return of GI function)

- 68 yo woman with 3 d h/o low grade fevers, abd pain, WBC 12 K
- W/U compatible with diverticulitis
- Sent home on Cipro/flagyl
- 1 wk later, incr abd pain, low grade fevers
- CT scan showed abscess
- IR drainage
- Cultures grow:
  - E. coli
  - Klebsiella
  - Enterococcus
  - Candida

Enterococcus

- Unclear role as pathogen
  - No good studies
  - Found in 20% of intra-abd infections
  - Regimens that don't cover enterococcus work for community acquired infections
  - Multicenter study showed that presence of enterococcus in initial culture independently predicted treatment failure in broad-spectrum abx regimens that lack enterococcal coverage
  - Unknown if initial enterococcal coverage would improve outcome
• Definite indication to treat
  – Positive blood culture
  – Only organism cultured in symptomatic pt?
  – Recovered from pts w/HCA abd infxn
  – Persistent sx in pt on broad-spectrum abx +/- appropriate drainage
  – Immunocompromised
• Empiric rx: HCA-associated infxn, espec if
  – Postoperative infxn
  – Previous receipt of abx ineffective against enteroccuc (ie, select for enterococcus: cephalosporins, quinolones, Ags)
  – IC pts
  – Valvular heart dz or prosthetic intravasc materials
  – Initial Rx: amp, zosyn, vanco
  – Do not need to empirically cover VRE unless very high index of suspicion

Candida

• Definite indications for treatment
  – Positive blood cultures
  – Cultured from HCA or severe CA-infxn
• Wait for speciation to start treatment unless pt is septic or unstable
  – Empiric echinocandin if unstable; otherwise fluconazole
  – ∆ to Fluconazole if C. albicans

Case #7

• 64 yo chinese-speaking male multiple medical problems including ESRD, DM, CAD, s/p recent ORIF hip 12/4/08, adm w/1 wk fevers, malaise, abd pain. On day of admission, rigors, CP-called 911. In ER, pt was hypotensive, T 40, became unresponsive, emergently intubated. Started on broad spectrum abx and required pressors.
• Bili 4.7, alkphos 521, AST 77, ALT 50, WBC 18.4, presumed to have cholangitis. Adm blood cultures grew E. coli and citrobacter.
CT scan

• U/S and abd CT showed biliary sludge, multiple hepatic abscesses new since Aug 2005. No evidence of appendicitis, diverticulitis, biliary infection. ERCP deferred because of angina.
• Pt was ultimately treated w/levofloxicin and flagyl as abscesses were not thought to be amenable to IR drainage

Pyogenic liver abscess

• Etiology
  – cryptogenic
  – Abd source
    • Biliary, diverticulitis, appendicitis, IBD
  – Hematogenous
  – Penetrating trauma
• Diagnosis
  – Mild Abi LFTs common
  – Often eludes diagnosis for weeks to months
• Microbiology
  – Aerobic (enterics, Strep viridans, enterococcus, other GNs)
  – Anaerobes (Bacteroides, Fusobacterium, peptostreptococcus, lactobacillus)
  – 50% + blood cultures
  – Anaerobic abscess usually polymicrobial
  – Klebsiella (in conjunction with DM) common in Taiwan

• Rx
  – Long course abx
    • PO (4-6 wks) or
    • IV (2-3 wks)/PO (2-3 wks))
  – Drainage

Drainage options

• < 3 cm: abx 100% successful
• > 3 cm, uniloculated
  – Abx + percutaneous drainage 83% successful
• > 3 cm, multiloculated
  – Abx + percutaneous drainage 33% successful
  – Abx + surgery: 100% successful

• Lecture will stop here but I’ve included a few more slides on amebic liver abscess
Abdominal infection case #8

- 58 yo woman with 2 mos h/o wt loss, low grade fevers, mild abd pain
- Recent travel to India
- CT scan

Amebic liver abscess

*E. histolytica*

- Epidemiology: found worldwide, particular tropics
- Transmission: ingestion of cysts.
  - No animal reservoir
- Mostly in travelers and immigrants
  - Most have traveled to endemic areas within past 5 mos
  - Remote travel hx occasionally

- Life cycle: two stages
  - Trophozoites (ameba): motile, found in intestine (liver)
  - Cysts: non-motile, found in stool
Diseases

• Amebic dysentery
  – Colonization of cecum and colon
  – Localized necrosis->invasion into portal submucosa
  – Several week h/o abd pain, bloody mucous-containing diarrhea, wt loss

Diseases (cont)

• Liver abscess
  – subacute sx: RUQ pain, fever, wt loss, hepatomegaly
  – Not always preceded by dysenteric sx
  • Penetration across diaphragm can lead to lung disease

Diagnosis

• Liver abscess
  – Stool examination
    • Cysts: <30-40% of pts have intestinal amebiasis, and 10% are colonized with E. dispar; not useful
    • Trophozoites: hard to see
  – Stool ag detection-sensitive and specific, but doesn’t distinguish liver abscess from intestinal amebiasis
  – Serologic dx (EIA)
    • + in 95% pts with extraintestinal amebiasis, 70% of patients with active intestinal infection, and 10% of asymptomatic cyst passers
    • Become negative 6-12 mos following eradication of infection
Radiologic w/u

- U/S
- CT scan
- Technicium scan: distinguish amebic abscess (cold) from pyogenic abscess (hot)
- Aspiration not recommended

Treatment

- Drugs: 2 goals
  - Eradicate the liver trophozoites
    - Metronidazole 750 mg PO ID x 7-10 D
  - Eradicate lumenal cysts
    - Diloxanide (10 d)
    - Iodoquinol (20 d)
    - Paromomycin (7d)

Surgical care

- Therapeutic aspiration if
  - High risk of abscess rupture (cavity > 5 cm)
  - Left lobe liver abscess
  - No response to medical Rx after 5-7 days
  - Cannot differentiate from pyogenic abscess
  - Image guided needle aspiration or catheter drainage