Intra-Peritoneal Abscess in Adults, Lower Gastrointestinal Tract Origin – Microbiology Full Clinical Guideline

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Introduction

- The lower gastrointestinal tract consists of the small intestine (distal duodenum, jejunum, and ileum) and large intestine (caecum, colon [ascending, transverse, descending, and sigmoid], rectum, and anal canal).
- Intra-peritoneal abscesses of lower gastrointestinal tract origin can be caused by multiple pathogens, i.e. polymicrobial infectious disease.
- Gram negatives (e.g. *Escherichia coli*, *Klebsiella* spp, and *Proteus* spp), Gram positives (e.g. *Streptococcus* spp, *Staphylococcus aureus*, and *Enterococcus* spp), and anaerobes (e.g. *Bacteroides fragilis* and *Clostridium* spp) are commonly identified bacterial causes.
- Mechanisms of transmission include mucosal breach, enabling inoculation of gastrointestinal tract flora. Breaches in the mucosa can be secondary to:
    - Perforated viscera.
    - Surgical anastomotic breakdowns.
- Other mechanisms of transmission include:
    - Contiguous: another focus of intra-abdominal viscera infection (e.g. appendicitis or diverticulitis) disseminates locally and invades the abdominal cavity.
    - Haematogenous: another focus of infection (e.g. infective endocarditis) culminates in bacteraemia; the microorganism disseminates via the blood and inoculates the abdominal cavity.
    - Iatrogenic: direct inoculation via surgery.
- One of the outcomes of:
    - Microbial invasion from the lower gastrointestinal tract into the abdominal cavity; and
    - The subsequent inflammatory response

  Is the formation of an encapsulated lesion containing necrotic immune cells and invading pathogens, i.e. an intra-peritoneal abscess.
- Manifestations include abdominal pain, tenderness, and ± mass.
- Temperatures > 38°C or < 36°C, a respiratory rate > 20 breaths/minute, a heart rate > 90 beats/minute, and hypotension can denote progression of localised infectious disease into sepsis or septic shock.

Investigation

Radiology

- First line: in general, computed tomography (CT) abdomen pelvis.
- Second line: discuss with the surgical senior and collaborate with the consultant radiologist.

Microbiology

- With the range of bacterial pathogens, variations in resistance and susceptibility profiles, contraindications, and side-effects, microbiological investigation enables best antibiotic practice:
    - Before starting antibiotics:

        - Blood cultures × 2, drawn approximately 1-15 minutes apart, from 2 locations/venepunctures.
    - If surgery or radiology intervenes:
        - Fluid, pus, or tissue for microscopy, culture, and susceptibility (MC&S).

Blood sciences

- Full blood count (FBC), C reactive protein (CRP), lactate, urea and electrolytes (U&Es), and liver function tests (LFTs).

Treatment

Surgical opinion ± intervention

- Intra-peritoneal abscesses can progress from localised infectious disease into sepsis and septic shock.
- Intra-peritoneal abscesses can be secondary to perforated viscera, anastomotic breakdown, or another focus of intra-abdominal infection (e.g. appendicitis or diverticulitis). Therefore, early discussion with the lower gastrointestinal tract registrar/consultant on call is recommended.
- Surgical intervention could enable: (i) elimination of the origin(s) of the infectious episode; (ii) reduction of the microbial inoculum; (iii) identification of the causative agent(s); and, (iv) restoration of host physiological function.
- Equally, source control via radiological intervention can be considered.
- If the surgical team consider radiological intervention, consultant to consultant discussion is recommended.

Radiological opinion ± intervention

- Interventional radiology with:
    - Ultrasound (US)- or CT-guided percutaneous aspiration or drainage

  Can be considered for intra-peritoneal abscesses.
- Drainage could enable: (i) reduction of the microbial inoculum; (ii) identification of the causative agent(s); and, (iii) restoration of host physiological function.
- However, intra-peritoneal abscesses can be complex; varying from single to multifocal, from superficial to deep, and relative proximity to abdominal viscera and non-abdominal (e.g. pleura) anatomy that could be cross-contaminated.
- Consultant to consultant discussions - regarding the specific patient, contraindications, and complications – are recommended.
- Interventional radiology requires:
    - An electronic request; and
    - Informed consent for the procedure (https://derby.koha-ptfs.co.uk/cgi-bin/koha/opac-detail.pl?biblionumber=774); and
    - An up-to-date platelet count and clotting (https://derby.koha-ptfs.co.uk/cgi-bin/koha/opac-detail.pl?biblionumber=1577)

  To be completed by the referring team.
- Please note, in general, local Trust policy requires omission of antiplatelets (e.g. clopidogrel for 5-7 days) and anticoagulants (e.g. warfarin for 5 days, apixaban or rivaroxaban for 48 hours) before radiological intervention.
- Possible exceptions – wherein the clinical condition dictates drainage or antiplatelet/anticoagulant omission is contraindicated – require surgical consultant to interventional radiologist consultant discussion, regarding potential benefits and risks of intervention.

Empiric, intravenous antibiotics

- Community acquired (symptoms, signs, and/or radiological findings of intra-peritoneal abscess within 48 hours of hospital admission):

	If clinically stable	If clinically unstable (haemodynamic instability, sepsis, or septic shock)
First line	Co-amoxiclav 1.2 g 8 hourly	Piperacillin tazobactam 4.5 g 8 hourly
Second line, if non-immediate without systemic involvement penicillin allergy	Ceftriaxone 2 g 24 hourly **and** Metronidazole 500 mg 8 hourly	Ceftazidime 1 g 8 hourly **and** Vancomycin or teicoplanin, dose as per hospital guidelines, vancomycin target pre dose level 15-20 mg/l, teicoplanin target pre dose level 15-30 mg/l **and** Metronidazole 500 mg 8 hourly
Third line, if immediate rapidly evolving or non-immediate with systemic involvement penicillin allergy	Ciprofloxacin 400 mg 12 hourly **and** Metronidazole 500 mg 8 hourly	Ciprofloxacin 400 mg 12 hourly **and** Vancomycin or teicoplanin, dose as per hospital guidelines, vancomycin target pre dose level 15-20 mg/l, teicoplanin target pre dose level 15-30 mg/l **and** Metronidazole 500 mg 8 hourly

- Hospital acquired (symptoms, signs, and/or radiological findings of intra-peritoneal abscess > 48 hours after hospital admission):

First line	Piperacillin tazobactam 4.5 g 6 hourly
Second line, if non-immediate without systemic involvement penicillin allergy	Ceftazidime 2 g 8 hourly **and** Vancomycin or teicoplanin, dose as per hospital guidelines, vancomycin target pre dose level 15-20 mg/l, teicoplanin target pre dose level 15-30 mg/l **and** Metronidazole 500 mg 8 hourly
Third line, if immediate rapidly evolving or non-immediate with systemic involvement penicillin allergy	Ciprofloxacin 400 mg 8 hourly **and** Vancomycin or teicoplanin, dose as per hospital guidelines, vancomycin target pre dose level 15-20 mg/l, teicoplanin target pre dose level 15-30 mg/l **and** Metronidazole 500 mg 8 hourly

- NB Empiric anti-fungals can be considered in specific patients, including a distal duodenal focus of intra-abdominal abscess, recurrent intra-abdominal abscess (for example, post-operative/radiological recurrence or after completion of anti-bacterials) or history of immunocompromise. However, in general, anti-fungals are reserved for patients with cultures of *Candida* species from blood or intra-operative/procedural fluid, pus, or tissue.

Directed, intravenous antibiotics (with susceptibilities)

- Reflecting the polymicrobial nature of intra-peritoneal abscesses, microbiologists commonly recommend antibiotics (both for empiric and directed antimicrobial chemotherapy) with Gram negative, Gram positive, and anaerobic spectrums:

If the pre-operative blood and/or intra-operative fluid, pus, or tissue cultures:	First line	Second line, if non-immediate without systemic involvement penicillin allergy	Third line, if immediate rapidly evolving or non-immediate with systemic involvement penicillin allergy
Gram negatives (e.g. *Escherichia coli*,	Narrowest spectrum of co-	Ceftriaxone 2 g 24 hourly **and**	Ciprofloxacin 400 mg 12 hourly **and**

Klebsiella spp, *Proteus* spp)	amoxiclav or piperacillin tazobactam standard dosage	Metronidazole 500 mg 8 hourly	Metronidazole 500 mg 8 hourly
Streptococcus species	Co-amoxiclav 1.2 g 8 hourly	Ceftriaxone 2 g 24 hourly **and** Metronidazole 500 mg 8 hourly	Vancomycin or teicoplanin, dose as per hospital guidelines, vancomycin target pre dose level 15-20 mg/l, teicoplanin target pre dose level 15-30 mg/l **and** Ciprofloxacin 400 mg 12 hourly **and** Metronidazole 500 mg 8 hourly
Enterococcus species	Co-amoxiclav 1.2 g 8 hourly	Vancomycin or teicoplanin, dose as per hospital guidelines, vancomycin target pre dose level 15-20 mg/l, teicoplanin target pre dose level 15-30 mg/l **and** Ceftriaxone 2 g 24 hourly **and** Metronidazole 500 mg 8 hourly	Vancomycin or teicoplanin, dose as per hospital guidelines, vancomycin target pre dose level 15-20 mg/l, teicoplanin target pre dose level 15-30 mg/l **and** Ciprofloxacin 400 mg 12 hourly **and** Metronidazole 500 mg 8 hourly
Anaerobes (e.g. *Bacteroides fragilis*, *Clostridium* spp)	Co-amoxiclav 1.2 g 8 hourly	Ceftriaxone 2 g 24 hourly **and** Metronidazole 500 mg 8 hourly	Ciprofloxacin 400 mg 12 hourly **and** Metronidazole 500 mg 8 hourly

- NB Please note, directed antimicrobial chemotherapy relates to pre-operative blood cultures and/or intra-operative/procedural fluid, pus, or tissue sterile site MC&S. Post-operative wounds and chronic drains can become colonised with single or multiple microorganisms. With the administration of pre- and post-operative broad spectrum anti-bacterials, non-sterile site investigations may isolate multi-drug resistant, colonising flora only.

Intravenous to per oral step down; outpatient parenteral antimicrobial therapy

- After ≤ 7 days of intravenous antimicrobial chemotherapy, if the patient is afebrile, observations stable, and inflammatory markers downward trending, collaborate with the surgical consultant first - ± microbiologist second - regarding (1) per oral step down or (2) outpatient parenteral antimicrobial therapy (OPAT).
- After ≤ 7 days of intravenous antimicrobial chemotherapy, if the patient is febrile, observations unstable, and/or inflammatory markers upward trending, collaborate with the surgical consultant first ± radiology second regarding intervention/re-intervention, update the microbiologist, and continue intravenous therapy.

Directed, per oral antibiotics (with susceptibilities)

- Reflecting the polymicrobial nature of intra-peritoneal abscesses, microbiologists commonly recommend antibiotics (both for empiric and directed antimicrobial chemotherapy) with Gram negative, Gram positive, and anaerobic spectrums:

If the pre-operative blood and/or intra-operative fluid, pus, or tissue cultures:	First line	Second line	Third line
Gram negatives (e.g. *Escherichia coli*, *Klebsiella* spp, *Proteus* spp)	Co-amoxiclav 625 mg 8 hourly plus amoxicillin 500 mg 8 hourly	Ciprofloxacin 500 mg 12 hourly **and** Metronidazole 400 mg 8 hourly	Co-trimoxazole 960 mg 12 hourly **and** Metronidazole 400 mg 8 hourly
Streptococcus species	Co-amoxiclav 625 mg 8 hourly plus amoxicillin 500 mg 8 hourly	Clindamycin 300 mg 6 hourly **and** Ciprofloxacin 500 mg 12 hourly	Linezolid 600 mg 12 hourly **and** Ciprofloxacin 500 mg 12 hourly **and** Metronidazole 400 mg 8 hourly
Enterococcus species	Co-amoxiclav 625 mg 8 hourly plus amoxicillin 500 mg 8 hourly	Linezolid 600 mg per oral 12 hourly **and** Ciprofloxacin 500 mg 12 hourly **and** Metronidazole 400 mg 8 hourly	Linezolid 600 mg per oral 12 hourly **and** Co-trimoxazole 960 mg 12 hourly **and** Metronidazole 400 mg 8 hourly
Anaerobes (e.g. *Bacteroides fragilis*, *Clostridium* spp)	Co-amoxiclav 625 mg 8 hourly plus amoxicillin 500 mg 8 hourly	Ciprofloxacin 500 mg 12 hourly **and** Metronidazole 400 mg 8 hourly	Co-trimoxazole 960 mg 12 hourly **and** Metronidazole 400 mg 8 hourly

Directed, outpatient parenteral antimicrobial therapy

- Collaborate with the OPAT consultant.

Empiric, per oral; empiric outpatient parenteral antimicrobial therapy

- If symptoms/signs/radiology features of an intra-peritoneal abscess, and the microbiology is negative, collaborate with a microbiologist regarding empiric options.

Duration of antibiotics

- Before discharge to the community, the medical or surgical team to collaborate with radiology with regard to the optimal re-imaging modality and timeframe for follow up imaging.
- If for per oral step down or OPAT, monitor bloods (FBC, CRP, U&Es, and LFTs) weekly-fortnightly.

- If surgical washout and if the patient is afebrile, observations stable, and inflammatory markers have resolved:
    - 7 days, from the date of the operation.

- If radiological drainage and if the patient is afebrile, observations stable, and inflammatory markers have resolved:
    - 10-14 days, from the date of the procedure.
- If neither surgery nor radiology have intervened:
    - Collaborate with the microbiology consultant responsible for sterile site investigations. Extended courses of 4-6 weeks could be recommended.
    - Follow up with the medical or surgical team on intravenous or per oral antibiotic therapy.

NB Pathophysiology and antibiotics

- In microbial infection with abscess formation, an antibiotic must first traverse the membranes of the endothelium, then diffuse through the interstitium, and then traverse a second membrane, that of the abscess:
    - Infection initiates an inflammatory response; the inflammation renders the interstitial fluid more viscous. The increase in viscosity decreases the amount of antibiotic transferred by diffusion.
    - The abscess is traversed through passive diffusion across the membrane - rather than pores - impairing the delivery of antibiotics. As the abscess forms and matures, the permeation of the membrane decreases, further impeding the delivery of antibiotics.
    - In microbial infection with abscess formation, as the abscess matures, bacteria transition from the planktonic to the sessile state. The planktonic state of bacteria is preferable for antibiotics; active bacterial metabolism is integral to the mechanism of action for anti-bacterials and bactericide (e.g. turnover of peptidoglycan enables beta-lactam inhibition of transpeptidases to cause bacterial death). The slow growing bacteria of mature abscesses are less susceptible to antibiotics.

Management

Clinical concerns re intra-peritoneal abscess (symptoms and signs include abdominal pain, tenderness, and ± mass)

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Investigation

- Radiology:
  - First line: in general, CT abdomen pelvis
  - Second line: discuss with the surgical senior and collaborate with the consultant radiologist
- Microbiology:
  - Before starting antibiotics: blood cultures × 2, drawn approximately 1-15 minutes apart, from 2 locations/venepunctures
- Blood sciences:
  - FBC, CRP, lactate, U&Es, and LFTs

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Treatment

- Surgical opinion ± intervention:
  - Consult with the lower gastrointestinal tract registrar/consultant on call
- Empiric, intravenous antibiotics (please note, page 3)
  - Empiric anti-fungals can be considered in specific patients, including a distal duodenal focus of intra-abdominal abscess, recurrent intra-abdominal abscess (for example, post-operative/radiological recurrence or after completion of anti-bacterials) or history of immunocompromise. However, in general, anti-fungals are reserved for patients with cultures of *Candida* species from blood or intra-operative/procedural fluid, pus, or tissue

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Investigation (if surgery or radiology intervenes):

- Microbiology:
  - Fluid, pus, or tissue for MC&S

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Treatment

- Directed, intravenous antibiotics (please note, pages 3-5)

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Document control

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