PERITONITIS TREATMENT PROTOCOL

CARI - Caring for Australasians with Renal Impairment - CARI Guidelines complete list


Objective

Early diagnosis of peritonitis and rapid intervention with antimicrobial therapy.
1. Patients will be treated in a timely manner.
2. Patients will not experience any adverse events as a result of treatment.
3. All qualified staff will be able to follow the protocol and provide the treatment required safely and efficiently.
4. An accurate record will be kept of all peritonitis treatment received by the patient.

Diagnosis: Presenting signs and Symptoms include:

1. Cloudy peritoneal fluid
2. Peritoneal Dialysate White Cell Count >100
3. Abdominal pain and rebound tenderness.
4. Nausea/vomiting, constipation/diarrhoea.
5. Fever (temperature > 37.5 °C)
6. Demonstration of bacteria on gram stain culture.

Management

1. Obtain PD fluid for cell count, microscopy culture and sensitivity prior to any treatment:
   For CAPD patients or APD patients with a day dwell: Drain abdomen and send entire effluent bag to microbiology for cell count, microscopy, culture and sensitivity, before any antibiotic therapy is commenced. Make a note if the patient is already on some form of antibiotic therapy.
   For APD patients without a day dwell: Infuse 1 L of dialysate and permit dwell time of minimum of 30 minutes, then drain, observe turbidity, send the entire effluent bag for differential cell count, microscopy culture and sensitivity.

   The differential may be more useful than WCC where there is a dwell <2 hours. Polymorphonuclear cells >50% is strong evidence of peritonitis, even if WCC is <100/uL (ISPD 2010)
2. Consult Renal Consultant and document in patient notes.

3. Commence empirical antibiotics (see below).

4. Antibiotics are administered intra-peritoneally after PD fluid culture is taken (add blood cultures if patient appears septic). IP administration is superior to IV dosing (ISPD 2010).

5. Start oral nystatin (500 000 units QID po) if patient has had a prolonged course of antibiotics as prophylaxis against fungal peritonitis [1]. This is to be used in PD patients who are on antibiotics regardless of the indication. For patients on vancomycin, nystatin should be continued for 7 days after the last vancomycin dose.³

**Patient Flow**

1. Patient to attend Emergency Department and be assessed by an Emergency Department triage nurse and doctor.
2. Contact Renal Consultant and document in patient notes.
3. All patients with peritonitis must be admitted to the Renal Ward 4S to be treated with antibiotics via CAPD mode of dialysis.
4. Discharge planning: Prompt referral to PD unit for training of IP antibiotic loading and administration, preferably at the start of the week and when the patient is well enough for training.
5. The patient should only be discharged when capable of performing CAPD, have CAPD stock at home and can mix antibiotics and administer in a safe manner.
CARI Guidelines:

In peritoneal dialysis patients with a provisional diagnosis of peritonitis, treatment should commence with a combination of intraperitoneal antibiotics that will adequately cover Gram-positive and Gram-negative organisms. (Level II evidence) [2]

Empiric Therapy: Before Organisms Known

1. Initiate treatment as soon as possible after obtaining microbiological specimens
2. Intraperitoneal cephazolin 1g/2L bag and gentamicin 40mg/2L bag. Patients with history of MRSA, give IP vancomycin 2g/2L bag and gentamicin 40 mg/2L bag
3. Leave indwelling for 6 hours (ISPD 2010).
4. Then, until sensitivities available:
   a. Intraperitoneal cephazolin 125mg/1L in each CAPD bag for 4 CAPD exchanges a day, and
   b. Daily Intraperitoneal gentamicin 40mg in the 1st morning bag
5. Continue this treatment for 14-21 days (unless sensitivities require change).
6. Monitor gentamicin level after every 3rd dose due to risk of toxicity or consider alternative antibiotics i.e. Ceftazidime or cefepime is an appropriate alternative for gram negative coverage. Continuous use of gentamicin is not advisable due to toxicity.
7. Commence prophylactic antifungal treatment. Use nystatin 500 000 units po QID.
8. Admit if necessary. (all unwell patients must be admitted)
9. Notify CNC and PD unit (ext 33770) of admission.
10. Consider fungal peritonitis for refractory peritonitis (failure to clear after 5 days of appropriate antibiotics).
Definitive Therapy: After identification of organisms

A. Gram Positive Organisms

Flow chart for treatment of Gram-positive peritonitis (ISPD2010)

- **Staphylococcus aureus on Culture**
  - Continue gram-positive coverage based on sensitivities*
  - Stop gram-negative coverage, assess exit site again

- If methicillin resistant, adjust coverage to vancomycin or teicoplanin†
  - Add rifampin 600 mg/day orally (in single or split dose) for 5–7 days (450 mg/day if BW <50 kg)

- Assess clinical improvement, repeat dialysis effluent cell count and culture at days 3–5

- **Clinical improvement** (symptoms resolve; bags clear):
  - Continue antibiotics;
  - Reevaluate for exit-site or occult tunnel infection, intra-abdominal abscess, catheter colonization, etc.

- **No clinical improvement** (symptoms persist; effluent remains cloudy):
  - Reculture & evaluate‡

- **No clinical improvement by 5 days on appropriate antibiotics**: remove catheter

- Duration of therapy: at least 21 days

- Peritonitis with exit-site or tunnel infection may prove to be refractory§
  - and catheter removal should be seriously considered.
  - Allow a minimum rest period of 3 weeks before reinitiating PD¶
Staphylococcus Aureus

- May be due to touch contamination, or catheter related infection. Check the exit site and tunnel for evidence of infection.
- Patient may require review and/or retraining on PD connection and disconnection techniques

| ISPD: If the episode occurs in conjunction with an exit site infection with the same organism, then often the infection will prove to be refractory and the catheter must be removed. (Evidence) After a rest period of a minimum of 2 weeks, PD can be tried again. ISPD 2010 |

If patient has a Staphylococcus aureus peritonitis then, continue cephazolin for 21 days. Do body swabs (i.e. nasal, groin, axilla and umbilicus) to determine if the patient is a carrier of this organism. If a carrier, the patient should receive nasal Mupirocin.

**MRSA**

1. Intraperitoneal (IP) vancomycin 15-30mg/kg up to a maximum of 2g.
2. Check trough vancomycin level on day 5.
3. Timing of repetitive dosing should be based on trough levels and is likely to be every 3-5 days.
4. Patient should receive another dose once trough serum levels reach 15mg/mL. (ISPD 2010)
5. Add Rifampicin 600mg/day orally (in single or split dose) for 7 days only (ISPD 2010) as an adjunctive antibiotic.
6. If patient has MRSA peritonitis, do body swabs to determine if patient is a carrier of this organism.

| ISPD: The dosing interval is dependent on residual renal function. ISPD 2010 |


Coagulase-Negative Staphylococcus peritonitis including S. epidermidis or Methicillin Resistant Staphylococcus (MRSE)

(Methicillin resistance of staphylococci is defined as resistance to all beta-lactam-related antibiotics, including penicillins, cephalosporins, and carbapenems.

Adapted from ISPD 2010

1. Stop aminoglycoside (i.e. gentamicin)
2. Continue Cephalosporin (i.e. cephazolin)
3. If MRSE and clinically not responding, Start Vancomycin. (If there is a unit rate of MRSE >50% then the unit may wish to use Vancomycin as empiric therapy) ISPD 2011
4. Duration of therapy, 14 days minimum. But treat for 21 days if there is peritonitis with ESI or tunnel infection.
5. Consider removal of catheter if no clinical improvement by 5 days. Antibiotic treatment following catheter removal and timing of resumption of PD may be modified depending on clinical course.
Streptococcus and Enterococcus

**Enterococcus/Streptococcus on Culture**

- Discontinue starting antibiotics*
  - Start continuous ampicillin 125 mg/L each bag; consider adding aminoglycoside for Enterococcus†

- If ampicillin resistant, start vancomycin;
  - If vancomycin–resistant enterococcus, consider quinupristin/dalfopristin, daptomycin, or linezolid

Assess clinical improvement, repeat dialysis effluent cell count and culture at days 3–5

- Clinical improvement (symptoms resolve; bags clear):
  - Continue antibiotics;
  - Reevaluate for exit-site or occult tunnel infection, intra-abdominal abscess, catheter colonization, etc.

- No clinical improvement (symptoms persist; effluent remains cloudy):
  - Reculture & evaluate*

  - No clinical improvement by 5 days on appropriate antibiotics: remove catheter

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ISPD (2010) Enterococcus or streptococcus peritonitis—Choice of therapy should always be directed by sensitivity results.

1. Ampicillin 125mg/L/bag is the preferred antibiotic (ISPD 2010).
2. Continuing gentamicin is potentially useful.
3. If ampicillin resistant start vancomycin
4. If vancomycin resistant consider quinupristin/dalfopristin, daptomycin, or linezolid (ISPD 2010)
5. If VRE is ampicillin susceptible, use ampicillin
6. Duration of therapy 14 days for streptococcus, 21 days for enterococcus (21 days with concurrent exit site or tunnel infection).
B. Gram Negative Organisms

Single Gram Negative Organism  (*E.Coli, Proteus, Klebsiella, Enterobacter etc*)

1. Adjust antibiotics to sensitivity

2. Ceftazidime 1g loading dose, then 250mg/2L in each bag for 14-21 days (or 1g/bag once daily.)

3. If stenotrophomonas or pseudomonas is isolated, use the antibiotic recommendations below. Two antibiotics should always be used for pseudomonas infection.

Stenotrophomonas

Stenotrophomonas is only sensitive to a few antimicrobials. Therapy recommended for 21-28 days if patient is clinically improving. Treatment with two drugs chosen based on sensitivities recommended. (ISPD 2010). Treat with 2 antibiotics with differing mechanism based on sensitivity pattern.

Most effective agents are:

- Oral trimethoprim/sulfamethoxazole
- IP ticarcillin/clavulanate
- Oral minocycline

*If not responding to treatment, then peritoneal dialysis catheter must be removed.*
Flow chart for the treatment of Single Gram Negative organism (ISPD 2010)

Pseudomonas

- **ISPD 2010**: If Pseudomonas aeruginosa catheter infection is present or has preceded peritonitis, catheter removal is necessary. (Evidence)
- **Two antibiotics** should always be used (ISPD 2010). Antibiotics must be continued for 2 weeks while the patient is on haemodialysis (ISPD 2010).

1. Discontinue cephaezolin
2. Ceftazidime 250mg/2L IP in each bag, for 21 days *(or 1g/bag once daily).*
3. Add a second agent based on sensitivity, i.e. continue gentamicin.
4. Repeat PDF culture in 3-5 days
5. If not responding to treatment after 5 days, then peritoneal dialysis catheter must be removed and oral or systemic antibiotics continued for 2 weeks.
Multiple Gram-Negative Organisms

1. There is a possibility of intraabdominal pathology
2. If intestines are felt to be the source,
   a. Admit patient
   b. Investigate
   c. Obtain surgical review and abdominal CT scan
   d. Catheter removal may be necessary
   e. Use ampicillin, gentamicin (or ceftazidime) and metronidazole (500mg q8h IV or oral if appropriate)

Treat at least 21 days or longer if clinically indicated.

C. Fungal Peritonitis

- ISPD 2010 guidelines recommend the catheter be removed immediately even without signs of systemic sepsis to reduce the risk of death.
- Prolonged treatment with antifungal to determine response is not encouraged

After fungi are identified on microscopy or culture:
1. Prompt removal of PD catheter and peritoneal lavage.

Initial treatment until culture results with susceptibilities:
- Fluconazole 200mg po daily.

*Antifungal treatment should be continued for an additional 10 days after catheter removal (ISPD 2010)*

- Intraperitoneal use of amphotericin causes chemical peritonitis and pain. IV use leads to poor peritoneal bioavailability. (ISPD 2010)
- Prolonged treatment with antifungal to determine response is not encouraged
- If flucytosine is used, regular monitoring of serum concentrations is necessary to avoid bone marrow toxicity. Trough serum concentrations should be 25-50 ug/mL and transiently not greater than 100ug/mL. (ISPD 2010)
D. No Growth (Culture Negative)

2. Continue Initial therapy as needed (until asymptomatic of peritonitis)
3. Repeat PDF culture and clinical assessment in 3 days
4. Fungal cultures may be obtained
5. The patient may already be on antibiotics causing the negative culture.
6. If peritonitis is previously associated with no growth, the microbiologist should be informed of the details of the patient and further cultures can be obtained.

E. Relapsing/Recurrent/Refractory Infections

The ISPD committee recommends stronger consideration to be given to timely catheter removal. The focus should be on preservation of peritoneum rather than saving the PD catheter. Recurrent peritonitis episodes have worse prognosis than relapsing episodes. [1]

Relapsing/Recurrent Gram-Positive Peritonitis

ISPD 2010 guidelines recommend. S. epidermidis & Coag neg staph-relapsing infections; catheter replacement is advised. Staph aureus is often due to catheter infection, which is unlikely to respond to antibiotics without catheter removal.

- Treat using standard treatment protocol
- Consider removal of PD catheter if there is no improvement by day 5.

Relapsing/Recurrent Gram-Negative Peritonitis

ISPD 2010: Recurrent pseudomonas aeruginosa, the catheter must be removed and the patient taken off PD for a period of time.

- Treat using standard treatment protocol
- Consider removal of PD catheter if there is no improvement by day 5
- Re-assess patient technique, and investigate for possible bowel leakage.
References


4. UpToDate v 19.2. *Fungal peritonitis in continuous peritoneal dialysis.*


Terms and Abbreviations Used in this document

APD | Automated Peritoneal Dialysis
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CAPD | Continuous Ambulatory Peritoneal Dialysis
Recurrent peritonitis | An episode that occurs within 4 weeks of completion of therapy of a prior episode but with a different organism
Relapsing peritonitis | An episode that occurs within 4 weeks of completion of therapy of a prior episode with the same organism
Refractory Peritonitis | Failure of the effluent to clear after 5 days of appropriate antibiotics
PD | Peritoneal Dialysis
WCC | White Cell Count