# PERITONEAL DIALYSIS (PD) – PERITONITIS MANAGEMENT AND TREATMENT

**Cross References**

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<td>Infection Control Policy; NSW Health PD2007_036</td>
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<td>Principles for the Management of Tuberculosis in New South Wales; NSW Health PD2014_050</td>
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<td>Aseptic Technique; SGSHHS CLIN027</td>
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<td>User applied Labelling of Injectable Medicines, Fluids and Lines; NSW Health PD2012_007</td>
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1. What it is
A guideline and procedure for the early diagnosis of peritonitis and timely management with antimicrobial therapy according to best practice guidelines

2. Risk Rating
Medium

3. Employees it Applies to
Registered Nurses (RN)
Medical Officers (MO)

4. Process
Peritonitis is one of the main complications of PD. Early diagnosis, rapid intervention and treatment with antimicrobial therapy are necessary measures to prevent further complications and peritoneal membrane failure

Definitions

Peritonitis
Inflammation of the peritoneum, typically caused by bacterial infection

Recurrent peritonitis
Peritonitis episode that occurs within 4 weeks of completion of therapy of a prior episode but with a different organism

Relapsing peritonitis
Peritonitis episode that occurs within 4 weeks of completion of therapy of a prior episode with the same organism

Refractory Peritonitis
Failure of the PD effluent to clear after 5 days of appropriate antibiotics

4.1 Diagnosing peritonitis
• The presence of 2 or more of the following clinical signs and symptoms:
  o Cloudy peritoneal fluid
  o Abdominal pain
  o Nausea and/or Vomiting
  o Constipation or diarrhoea
  o Fever (temperature > 37.5°C)
• Peritoneal dialysate microscopy should demonstrate white cell count (WCC) >100 with at least 50% polymorphonuclear (PMN) neutrophils
• For patients using automated peritoneal dialysis, >50% PMN is a strong indicator of peritonitis, even if total WCC is below 100/mm³
4.2 Management of peritonitis presentation (Flowchart 8)

Note: PD catheter connection and exit site swab and/or dressing can be performed by or under the supervision of an accredited staff only

1. Upon patient presentation, collect PD fluid specimen for microscopy, culture, sensitivities (MCS), cell count and cell differential as per Peritoneal Dialysis - Fluid Specimen Collection via CAPD or APD; Renal Department Protocol preferably before any antibiotic treatment is given

Note: If patient was given antibiotic/s prior to PD fluid specimen collection, note down all the antibiotics patient received on the pathology request form

2. Review PDC exit site and swab for MCS as per Peritoneal Dialysis Catheter – Exit Site Infection Management; Renal Department Protocol if necessary

3. Notify renal consultant and team to review patient during office hours or inform on-call renal consultant/registrar after-hours. Patients manifesting clinical signs and symptoms of peritonitis must commence empirical antibiotic treatment immediately

4. Symptomatic patient receiving empirical antibiotic treatment must be admitted (preferably in 4 South renal ward) for monitoring and ongoing treatment

5. Notify PD CNC (page 1091) and PD unit (ext 33770) of hospital admission

6. PD nurse to conduct a root cause analysis for any PD related infective episode, including a review of patient/carer’s dialysis technique and hand hygiene practices. PD nurse to provide PD retraining as required

4.3 Recommended empiric antibiotic therapy and management before organisms known (Flowchart 8)

1. Initiate antimicrobial treatment as soon as possible after obtaining PD fluid specimen.

2. Stat intraperitoneal (IP) administration of:
   a) Cephazolin 1g and Gentamicin 40mg combined in a PD fluid bag as per Peritoneal Dialysis – Intraperitoneal Cephazolin (1g) and Gentamicin Administration (40 milligram); Renal Department Protocols
   b) Patients with history of MRSA: Vancomycin 30mg/kg (maximum 2g) and Gentamicin 40mg combined in a PD fluid bag as per Peritoneal Dialysis – Intraperitoneal Vancomycin and Gentamicin Administration (40 milligram); Renal Department Protocols

3. Whilst organisms and sensitivities are not available, continue antimicrobial treatment of:
   a) IP Cephazolin 250 mg in each CAPD bag for 4 x CAPD exchanges a day as per Peritoneal Dialysis – Intraperitoneal Cephazolin (250 mg); Renal Department Protocol (except for patients with history of MRSA who received IP Vancomycin)

And

b) Daily IP Gentamicin 40mg (combined with Cephazolin 250 mg) in the last CAPD bag for night dwell

Or

IP Gentamicin 10 mg (combined with Cephazolin 250 mg) in each CAPD bag for 4 x CAPD exchanges a day as per Peritoneal Dialysis – Intraperitoneal Gentamicin (10 mg); Renal Department Protocol

➤ Monitor gentamicin level after every 3rd dose

4. Leave antibiotics indwelling for 6 hours
5. Commence prophylactic antifungal treatment: oral Nystatin 500 000 units QID. Continue prophylactic antifungal treatment whilst patient is on antibiotics. For patient on Vancomycin, continue prophylactic antifungal treatment for another 7 days after last dose of Vancomycin.

4.3 Recommended antimicrobial therapy and management after organisms known

<table>
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<td>1. Patients on antibiotic treatment for peritonitis should be assessed for clinical improvement and have a repeat PD fluid MCS and cell count at days 3 and 5</td>
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<td>2. Re-evaluate treatment course after 5 days on appropriate IP antibiotics and repeat PD fluid MCS</td>
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<td>3. Immediate PD catheter removal is recommended for:</td>
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<td>• Patients with unresolved signs and symptoms of peritonitis (i.e. persisting cloudy effluent and elevated WCC &gt;100) after 5 days on appropriate antibiotic treatment</td>
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<td>• Peritonitis in conjunction with an exit site or tunnel infection of same organism</td>
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<td>• Patients with intra-abdominal pathology/abscess</td>
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<td>• Peritonitis with multiple enteric or anaerobic organisms</td>
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<td>• Fungal peritonitis</td>
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<td>• Refractory or relapse peritonitis</td>
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<td>• Refractory exit-site and tunnel infection</td>
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<td>4. Reinsertion of PD catheter is recommended after a rest period of 3-6 weeks from time of removal except for fungal peritonitis</td>
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<td>5. Continue antifungal prophylaxis with Nystatin (500 000 units orally QID) for the duration of the antibiotic treatment. For patients on Vancomycin, continue oral antifungal prophylaxis for another 7 days after last dose of Vancomycin</td>
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<td>6. Root cause analysis for every peritonitis episode should be conducted which may include reassessment and retraining of patient/carer’s PD technique by the PD nurses</td>
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1. Staphylococcus Aureus (SA) and Gram Positive Organisms
   a) Stop IP Gentamicin
   b) Continue with IP Cephazolin 250 mg in each CAPD bag for 4 x CAPD exchanges a day for at least 21 days
      Or
      Change to another IP antibiotic based on sensitivities and continue treatment for at least 21 days
   c) Review PDC exit site again and swab for MCS if necessary
   d) For Staphylococcus aureus peritonitis, collect body swabs (i.e. nasal, groin, axilla and umbilicus) to determine if the patient is a carrier of this organism.
      ➢ For nasal carrier, patient must commence on nasal mupirocin treatment immediately as per Peritoneal Dialysis Catheter – Nasal Swab And Mupirocin; Renal Department Protocol
   e) Refer to Table 1 and Flowchart 1 for subsequent management
   f) If clinical signs and symptoms of peritonitis are resolving, continue IP antibiotics for at least 21 days

2. Methicillin or Multiple Resistant SA (MRSA) Peritonitis
   a) Stop IP Gentamicin
b) Continue with or start IP Vancomycin 30mg/kg (up to a maximum of 2g) at least weekly for 3 weeks
   - Check trough Vancomycin level on day 5
   - Timing of repetitive dosing should be based on trough levels and is likely to be every 3-5 days
   - Patient should receive another dose once trough serum levels reach 15mg/mL

c) Add rifampicin 600mg/day orally (in single or split dose) for 7 days only as an adjunctive antibiotic

d) Collect body swabs (i.e. nasal, groin, axilla and umbilicus) to determine if patient is a MRSA carrier

e) Refer to Table 1 and Flowchart 1 for subsequent management

f) If clinical signs and symptoms of peritonitis are resolving, continue IP and oral antibiotics for at least 21 days

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

a) Stop IP Gentamicin

b) Continue with IP Cephazolin 250 mg in each CAPD bag for 4 x CAPD exchanges a day for 14-21 days

   Or

   Change to another IP antibiotic based on sensitivities and continue treatment for 14-21 days

c) For MRSE and clinically not responding, start IP Vancomycin 30mg/kg (up to a maximum of 2g) and continue weekly for 14-21 days.

d) Refer to Table 1 and Flowchart 2 for subsequent management

e) If clinical signs and symptoms of peritonitis are resolving, continue IP antibiotic for at least 14 days

f) Peritonitis with exit site or tunnel infection is for IP antibiotic treatment for at least 21 days

g) Antibiotic treatment following catheter removal and timing of resumption of PD may be modified depending on clinical course

4. Streptococcus and Enterococcus Peritonitis

a) Enterococcus or streptococcus peritonitis antimicrobial treatment should always be directed by sensitivity results

b) Stop IP Cephazolin

c) Commence preferred IP antibiotic treatment of Ampicillin 250 mg in each CAPD bag for 4 x CAPD exchanges a day for 14-21 days as per Peritoneal Dialysis – Intraperitoneal Ampicillin Administration (250 milligram); Renal Department Protocol

d) Continuing IP Gentamicin is potentially useful

e) If resistant to ampicillin, commence IP Vancomycin 30mg/kg (up to a maximum of 2g) and continue weekly for 14-21 days

f) If Vancomycin resistant Enterococcus (VRE) is susceptible to ampicillin, use IP ampicillin

g) If resistant to Vancomycin, consider quinupristin/dalfopristin, daptomycin, or linezolid

h) Refer to Table 1 and Flowchart 3 for subsequent management

i) If clinical signs and symptoms of peritonitis are resolving, continue IP antibiotic therapy for 14 days for streptococcus, 21 days for enterococcus and 21 days for peritonitis with concurrent exit site or tunnel infection
5. Single Gram Negative Organism (E.Coli, Proteus, Klebsiella, Enterobacter etc)  
   a) Adjust IP antibiotic treatment to sensitivity  
   b) IP Cephalozolin may be stopped  
   c) Commence preferred IP antibiotic treatment of Ceftazidime 1g loading dose as per Peritoneal Dialysis – Intraperitoneal Ceftazidime (1g); Renal Department Protocol  
   d) Continue with maintenance dose of IP Ceftazidime 250mg in each CAPD bag for 4 x CAPD exchanges a day for 14-21 days as per Peritoneal Dialysis – Intraperitoneal Ceftazidime Administration (250 milligram); Renal Department Protocol  
   e) If IP Cefepime is indicated, commence IP Cefepime 1g daily as per Peritoneal Dialysis – Intraperitoneal Cefepime (1g); Renal Department Protocol, continue treatment for 14-21 days  
   f) Adding a second agent based on sensitivity may be required to reduce the risk of relapse and recurrent peritonitis  
   g) Refer to Table 1 and Flowchart 4 for subsequent management  
   h) If clinical signs and symptoms of peritonitis are resolving, continue IP antibiotic for at 14-21 days  

6. Stenotrophomonas Peritonitis  
   a) Stop IP Cephalozolin  
   b) Stenotrophomonas is sensitive to very few antimicrobials. Treatment with two antibiotics with differing mechanism based on sensitivity pattern is recommended. Most effective agents are:  
      - Oral trimethoprim/sulfamethoxazole (preferred)  
      - IP ticarcillin/clavulanate  
      - Oral minocycline  
   c) Refer to Table 1 and Flowchart 4 for subsequent management  
   d) If clinical signs and symptoms of peritonitis are resolving, continue antibiotic therapy for 21-28 days  

7. Pseudomonas Peritonitis without PD catheter exit site or tunnel infection  
   a) Stop IP Cephalozolin  
   b) Commence preferred IP antibiotic treatment of Ceftazidime 1g loading dose in a CAPD bag x 1 CAPD exchange  
   c) Continue with maintenance dose of IP Ceftazidime 250mg in each CAPD bag for 4 x CAPD exchanges a day  
   d) Add a second agent based on sensitivity i.e. continue IP Gentamicin or change to oral quinolone, cefepime, tobramycin or piperacillin  
   e) Refer to Table 1 and Flowchart 5 for subsequent management  
   f) If PD catheter is removed, continue with oral or systemic antibiotics for 14 days from time of PD catheter removal  
      Or  
      If clinical signs and symptoms of peritonitis are resolving, continue antibiotic therapy for 21 days  

8. Pseudomonas Peritonitis with or following a PD catheter exit site or tunnel infection  
   a) Arrange for immediate PD catheter removal. Refer to Flowchart 5.  
   b) Treat with antibiotics whilst PD catheter is insitu:
i. Commence preferred IP antibiotic treatment of Ceftazidime 1g loading dose in a CAPD bag x 1 CAPD exchange
ii. Continue with maintenance dose of IP Ceftazidime 250mg in each CAPD bag for 4 x CAPD exchanges a day
iii. Add a second agent based on sensitivity i.e. continue IP Gentamicin or change to oral quinolone, cefepime, tobramycin or piperacillin
c) Continue with oral or systemic antibiotics for 14 days from time of PD catheter removal

9. Multiple Gram-Negative Organisms
   a) Stop IP Cephazolin
   b) As a first agent, continue IP Gentamicin or commence other agents based on sensitivities i.e.
      - IP Ampicillin (250 milligram) in each CAPD bag for 4 x CAPD exchanges a day for 14-21 days
      - IP Ceftazidime (250 milligram) in each CAPD bag for 4 x CAPD exchanges a day for 14-21 days
   c) Commence a second agent, Metronidazole (500mg q8h IV or oral if appropriate)
   d) Refer to Table 1 and Flowchart 6 for subsequent management
   e) If clinical signs and symptoms of peritonitis are resolving, continue both treatment for 21 days or longer if clinically indicated
   f) If intra-abdominal abscess/pathology is suspected:
      i. Admit patient
      ii. Investigate
      iii. Arrange for urgent surgical review and abdominal CT scan ± urgent PD catheter removal

10. Fungal Peritonitis
    a) Peritoneal lavage may be necessary for grossly turbid PD effluent until clear
    b) Stop IP Cephazolin and IP Gentamicin
    c) Commence IP Fluconazole as per Peritoneal Dialysis – Intraperitoneal Fluconazole Administration; Renal Department Protocol whilst the PD catheter remains
       - Consider alternative antifungals for patients who had significant exposure to azole antifungal treatment. Consult the Infectious Diseases team immediately
       - 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
       - IP amphotericin causes chemical peritonitis and pain. IV amphotericin leads to poor peritoneal bioavailability
       - Prolonged treatment with antifungals to determine response is not encouraged
    d) Organise for urgent removal of PD catheter (within 3 days from the time fungi is identified by microscopy or culture) even without signs of systemic sepsis
    e) Patient is to be placed on haemodialysis and to continue antifungal treatment (i.e. oral Fluconazole 200mg daily) for an additional 10 days after PD catheter removal
    f) For prevention of fungal peritonitis: PD patients on prolonged antibiotic treatment should be given antifungal prophylaxis (oral nystatin 500 000 units QID) for the entire duration of the antibiotic treatment. Patients on Vancomycin treatment should continue oral antifungal prophylaxis for another 7 days after last dose of Vancomycin
11. No Growth (Culture Negative) Peritonitis (refer to flowchart 7)
   a) Confirm if patient is on any antibiotic treatment at time of PD fluid collection for MCS. If previous peritonitis episodes are with no growth, the microbiologist should be informed of the details of the patient and further cultures can be obtained
   b) Continue with initial treatment of IP Cephazolin 250 mg in each CAPD bag for 4 x CAPD exchanges a day and daily IP Gentamicin 40 mg in the last CAPD bag (in combination with IP Cephazolin)
   c) At day 3, repeat clinical assessment and send PD effluent again for MCS, WCC with differential and fungal cultures
   d) If clinical signs and symptoms of peritonitis are resolving, continue initial treatment for at least 14 days or until asymptomatic of peritonitis
   e) If clinical signs and symptoms of peritonitis are not improving or resolving, repeat clinical assessment and send PD effluent again for special culture for unusual causes i.e. viral, mycoplasma, mycobacteria and legionella
      ➢ If PD effluent continues to be culture negative with clinical improvement, continue initial treatment for at least 14 days or until asymptomatic of peritonitis
      ➢ If PD effluent continues to be culture negative with no clinical improvement after 5 days, organise for urgent PD catheter removal and continue oral or systemic antibiotics for at least 14 days after catheter removal
      ➢ If PD effluent becomes culture positive, adjust type and duration of antibiotic therapy based on identified organism/s and sensitivity

12. Polymicrobial Peritonitis (refer to Flowchart 6)
   a) Management and treatment of multiple enteric organisms or mixed gram-negative/gram-positive peritonitis:
      i. Stop IP Cephazolin
      ii. As a first agent, continue IP Gentamicin or commence other agents based on sensitivities i.e.
         ➢ IP Ampicillin (250 milligram) in each CAPD bag for 4 x CAPD exchanges a day for 14-21 days
         Or
         ➢ IP Ceftazidime (250 milligram) in each CAPD bag for 4 x CAPD exchanges a day for 14-21 days
      iii. Commence a second agent, Metronidazole (500mg q8h IV or oral if appropriate)
      iv. Likely source is intra-abdominal pathology i.e. bowel or intestinal, arrange for an abdominal CT scan, a surgical assessment, and immediate PD catheter removal
      v. Antibiotic treatment should be continued intravenously for 14 days after PD catheter removal

Note: Death risk is increased for peritonitis with multiple enteric or anaerobic organisms

13. Management and treatment of multiple gram-positive peritonitis:
   i. Stop IP Gentamicin
   ii. Continue IP Cephazolin or change IP antibiotic therapy based on sensitivity. Continue treatment for a minimum of 21 days
   iii. Refer to Table 1 and Flowchart 6 for subsequent management
   iv. Likely source is touch contamination or PD catheter infection. PD nurses to reassess patient/carer’s PD technique and offer PD retraining as necessary
   v. Review PD catheter exit site and treat if required as per Peritoneal Dialysis Catheter – Exit Site Infection Management; Renal Department Protocol
vi. Arrange PD catheter removal immediately for multiple gram-positive peritonitis associated with PD catheter exit site or tunnel infections

14. Mycobacterial (M) Peritonitis
   i. Treatment for M. Tuberculosis (TB) Peritonitis is to be based on general protocols for TB treatment and as per Principles for the Management of Tuberculosis in New South Wales; NSW Health PD2014_050
      ➢ Start treatment with four anti-TB agents: Rifampicin, Isoniazid, Pyrazinamide and Ofloxacin.
      ➢ Stop pyrazinamide and ofloxacin after 3 months
      ➢ Continue anti-TB treatment of rifampicin and isoniazid for 6-12 months
      ➢ Pyridoxine (50 – 100 mg/day) should be given to avoid isoniazid-induced neurotoxicity
      ➢ PD catheter removal may be considered. PD catheter may be reinserted after 6 weeks of anti-TB treatment
   ii. Treatment for non-TB mycobacteria peritonitis is to be based on sensitivities, refer to Table 1 for subsequent management

4.4 Relapsing/Recurrent/Refractory Infections
Note: Stronger consideration to be given to timely PD catheter removal
   • Preservation of peritoneum should be the main focus rather than saving the PD catheter
   • Recurrent peritonitis episodes have worse prognosis than relapsing episodes
1. Relapsing/Recurrent/Repeat Gram-Positive Peritonitis
   a) For management and treatment, refer to section 4.3
   b) Relapsing Staphylococcus peritonitis is often due to catheter infection which is unlikely to respond to antibiotics without catheter removal.
   c) PD catheter replacement is recommended for relapsing Coagulase-Negative Staphylococcus or Staphylococcus epidermidis infections

2. Relapsing/Recurrent Gram-Negative Peritonitis
   a) For management and treatment, refer to section 4.3 for “Single, Mixed or Multiple Gram Negative Organisms”
   b) Investigate for possible bowel leakage

3. For recurrent pseudomonas aeruginosa peritonitis, refer to Flowchart 5 and section 4.3 “Pseudomonas Peritonitis with or following a PD catheter exit site or tunnel infection.” Patient must be rested from PD for a period of time as permanent peritoneal membrane damage may have occurred
4.5 Treatment Flowcharts

Flowchart 1

**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¶
Flowchart 2

Other Gram-Positive Organisms, Including Coagulase-Negative Staphylococcus, on Culture

- Continue gram-positive coverage based on sensitivities
- Stop gram-negative coverage

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.

Duration of therapy: 14 days

Peritonitis with exit-site or tunnel infection:
- Consider catheter removal†
- Duration of therapy: 14–21 days

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

No clinical improvement by 5 days on appropriate antibiotics: remove catheter
Flowchart 3

**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
  - Re-evaluate for exit-site or occult tunnel infection, intra-abdominal abscess, catheter colonization, etc.

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

- **Duration of therapy**: 14 days (Streptococcus)
  - 21 days (Enterococcus)

- **Peritonitis with exit-site or tunnel infection**:
  - Consider catheter removal
  - **Duration of therapy**: 21 days
Flowchart 4

Single Gram-Negative Organism on Culture

Other
E. coli, Proteus, Klebsiella, etc.

Adjust antibiotics to sensitivity pattern. Cephalosporin (ceftazidime or cefepime) may be indicated

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

Clinical improvement (symptoms resolve; bags clear):
– Continue antibiotics;
– Duration of therapy: 14–21 days

Stenotrophomonas

Treat with 2 drugs with differing mechanisms based on sensitivity pattern (oral trimethoprim/sulfamethoxazole is preferred)

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

No clinical improvement by 5 days on appropriate antibiotics (symptoms persist; effluent remains cloudy): remove catheter

Clinical improvement (symptoms resolve; bags clear):
– Continue antibiotics;
– Duration of therapy: 21–28 days
Flowchart 5

**Pseudomonas Species on Culture**

- **Without catheter infection (exit-site/tunnel)**
  - Give 2 different antibiotics acting in different ways that organism is sensitive to, e.g., oral quinolone, ceftazidime, cefepime, tobramycin, piperacillin
  - Assess clinical improvement, repeat dialysis effluent cell count and culture at days 3–5

  **Clinical improvement (symptoms resolve; bags clear):**
  - Continue antibiotics;
  - Duration of therapy: at least 21 days

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

- **With catheter infection (exit-site/tunnel) current or prior to peritonitis**
  - Catheter removal*

  **Continue oral and/or systemic antibiotics for at least 2 weeks**

- **No clinical improvement by 5 days on appropriate antibiotics: remove catheter**
Flowchart 6

**Polymicrobial Peritonitis: Days 1–3**

- **Multiple gram-negative organisms or mixed gram-negative/gram-positive:**
  - Consider GI problem
  - Change therapy to metronidazole in conjunction with ampicillin, ceftazidime, or aminoglycoside
  - Obtain urgent surgical assessment
  - In case of laparotomy indicating intra-abdominal pathology/abscess: remove catheter*
  - Continue antibiotics: 14 days

- **Multiple gram-positive organisms**
  - Touch contamination
  - Consider catheter infection
  - Continue therapy based on sensitivities
  - Without exit-site or tunnel infection: continue antibiotics
  - With exit-site or tunnel infection: remove catheter*
  - Duration of therapy: minimum 21 days based on clinical response
Flowchart 7

Culture Negative on Days 1 & 2

- Continue initial therapy

Day 3: culture still negative
  - Clinical assessment
  - Repeat PD fluid white cell count and differential

Infection resolving
  - Patient improvement clinically
  - Continue initial therapy for 14 days

Infection not resolving:
  - Special culture technique for unusual causes (e.g., viral, mycoplasma, mycobacteria, Legionella). Consider fungi

Now culture positive
  - Adjust therapy according to sensitivity patterns
  - Duration of therapy based on organism identified

Still culture negative
  - Clinical improvement:
    - Continue antibiotic
    - Duration of therapy: 14 days
  - No clinical improvement after 5 days:
    - Remove catheter

Continue antibiotics for at least 14 days after catheter removal
Flowchart 8

**Signs and Symptoms**
Cloudy Peritoneal Fluid, Abdominal Pain & Rebound Tenderness, Nausea & Vomiting, Constipation/Diarrhoea, Fever

**Diagnostic Tests**
Collect PD fluid specimen for MCS, cell count and cell differential as per PD Fluid Specimen Collection via CAPD or APD Protocol before any antibiotic treatment is given (preferred) or note down all the antibiotics patient received prior to PD fluid specimen collection on the pathology request form.

*Note: PD catheter connection and exit site swab and/or dressing can be performed by or under the supervision of an accredited staff only.*

Review PDC exit site and swab for MCS as per PDC Exit Site Infection Management Protocol if necessary.

**Notify:**
Renal consultant and team to review patient during office hours or On-call renal consultant/registrar after hours
PD CNC and team X33770 or page 1091

**Empiric Therapy**
Cephazolin 1g & Gentamicin 40 mg IP. Leave indwelling for 6 hours. Continue with IP Cephazolin 250mg in each bag QID and daily IP Gentamicin 40mg until sensitivities available.

*Patients with History of MRSA-Empiric Therapy*
Vancomycin 2g & Gentamicin 40 mg IP. Leave indwelling for 6 hours. Continue with daily IP Gentamicin 40mg IP until sensitivities available.

Commence prophylactic antifungal treatment: oral Nystatin 500,000 units QID.

Admit patient in 4 South (preferred) for ongoing peritonitis treatment.

IP antibiotic treatment to continue based on sensitivities once organism is known.
Continue oral antifungal prophylaxis for the duration of antibiotic treatment.

Repeat PD fluid MCS and cell count at days 3 and 5.

**No Improvement**
Re-evaluate treatment and re-culture after 5 days on appropriate IP antibiotics.

If not responding to treatment (Refractory Peritonitis) REMOVE PD CATHETER.

As per 4.3 Recommended antimicrobial therapy and management after organisms known: 3-6 weeks rest from PD and Continue appropriate antibiotic treatment (po or IV).

Reinsertion of PD catheter except for Fungal Peritonitis.

**Clinical Improvement**
Continue antibiotic treatment for 14-21days as per 4.3 Recommended antimicrobial therapy and management after organisms known.

Continue oral antifungal prophylaxis for the duration of antibiotic treatment.

For patients on Vancomycin, continue oral antifungal prophylaxis for another 7 days after last dose of Vancomycin.

Repeat Culture 7 days post antibiotic therapy.

If peritonitis recurs within 4 weeks, refer to 4.4 Relapsing and Recurrent Infection Treatment.
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<th><strong>5. Keywords</strong></th>
<th>Peritonitis, Infection, Peritoneal dialysis, Peritonitis management</th>
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<td><strong>6. Functional Group</strong></td>
<td>Renal, Peritoneal Dialysis</td>
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<tr>
<td><strong>7. External References</strong></td>
<td>Ballinger, A. P., Suetonia; Wiggins, Kathryn; Craig, Jonathan; Johnson, David; Cross, Nicholas; Strippoli, Giovanni (2014). Treatment for peritoneal dialysis-associated peritonitis. <em>Cochrane Database of Systematic Reviews</em>, 4. doi: 10.1002/14651858.CD005284.pub3</td>
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|                          | Piraino, B., Bernardini, J., Brown, E., Figueiredo, A., Johnson, D. W.,
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<th>8. Consumer Advisory Group (CAG) approval of patient information brochure (or related material)</th>
<th>N/A</th>
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| 9. Implementation and Evaluation Plan  
Including education, training, clinical notes audit, knowledge evaluation audit etc | - Included in the education tools developed to assist nurses in increasing their knowledge to the care of patients on peritoneal dialysis i.e. Renal care flip chart, advance and basic PD learning package and PD orientation package  
- Monthly in-service education by PD CNC/nurses to all renal nurses  
- PD tutorial to Junior Medical Officers by the PD CNC at the beginning of renal rotation |
| 10. Knowledge Evaluation | **Q1:** What are the signs and symptoms of peritonitis?  
**A:** Peritonitis can manifest as a combination of any 2 of these symptoms: cloudy peritoneal fluid, abdominal pain, nausea, vomiting, diarrhoea and fever (temperature > 37.5°C)  
**Q2:** What is the management for a patient presenting with suspected peritonitis?  
**A:** PD patients presenting with signs and symptoms of peritonitis should have PD fluid specimen collected for MCS, a review of their PDC exit site ± swab for MCS, commence on empirical IP antibiotic and prophylactic anti-fungal treatment and be admitted to 4S renal ward for ongoing management.  
**Q3:** When would empiric antibiotic therapy commence?  
**A:** After the PD fluid specimen is collected for MCS for symptomatic patients. |
Q4: What are the indications for PD catheter removal?
A: There are several conditions a PD catheter removal is recommended:

- Patients with unresolved signs and symptoms of peritonitis (i.e. persisting cloudy effluent and elevated WCC >100) after 5 days on appropriate antibiotic treatment
- Peritonitis in conjunction with an exit site or tunnel infection of same organism
- Patients with intra-abdominal pathology/abscess
- Peritonitis with multiple enteric or anaerobic organisms
- Fungal peritonitis
- Refractory or relapse peritonitis
- Refractory exit-site and tunnel infection

| 11. Who is Responsible | Director of St George and Sutherland Renal Service. Nursing Unit Manager, Dialysis Unit |

Approval for (Insert Clinical Business Rule Title)

| *Specialty/Department Committee | Committee title: Peritoneal Dialysis Committee  
| | Chairperson name/position: Sunil Badve, Staff Specialist  
| | Signature Date |
| *Nursing/Midwifery Co-Director | Name/position Christine Day, Nurse Manager Medicine  
| | Signature Date |
| *Medical Co-Director | Name/position Mark Brown, Department Head Renal Services  
| | Signature Date |
| *Drug and Therapeutics Committee (SGH) | Chairperson’s Name: Winston Liauw  
| | Signature Date |
| Executive Sponsor | Name/Position: Clinical Group Manager Medicine & Critical Care  
| | Signature Date |

Contributors to CIBR development
e.g. CNC, Medical Officers (names and position title/specialty)

Revision and Approval History

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<tr>
<th>Date</th>
<th>Revision number</th>
<th>Author (Position)</th>
<th>Revision due</th>
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<tr>
<td>March 2016</td>
<td>0</td>
<td>Anna Claire Cuesta (PD CNC)</td>
<td>March 2019</td>
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General Manager’s Ratification

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<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Leisa Rathborne</td>
<td>Signature</td>
<td>Date</td>
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