Management of Peritoneal Dialysis Catheter and
Treatment of Peritoneal Dialysis-related Infections

DEPARTMENT OF RENAL MEDICINE

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
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<td>Review Date</td>
<td>June 2021</td>
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1. INTRODUCTION

Peritoneal dialysis (PD)-related infections include catheter-related infections (exit site and tunnel infections) and PD peritonitis.

Peritonitis is a serious complication of peritoneal dialysis and requires prompt diagnosis and treatment.

**TERMINOLOGY FOR PD CATHETER-RELATED INFECTIONS:**

*Exit-site infection (ESI):* Presence of purulent discharge, with or without erythema of the skin at the catheter-epidermal interface.

*Tunnel infection:* Presence of clinical inflammation or ultrasonographic evidence of collection along the catheter tunnel.

**TERMINOLGY FOR PERITONITIS:**

*Recurrent:* An episode that occurs within 4 weeks of completion of therapy but with different organism.

*Relapsing:* An episode that occurs within 4 weeks of completion of therapy with the same organism or one sterile episode.

*Repeat:* An episode that occurs > 4 weeks after completion of therapy with the same organism.

*Refractory:* Failure of the effluent to clear after 5 days of appropriate antibiotics.

*Catheter-related peritonitis:* peritonitis in conjunction with an exit-site or tunnel infection with the same organism or one site sterile.

*NB: Relapsing episodes should not be counted as another episode during the calculation of peritonitis rates.*

2. PROPHYLAXIS FOR PD TUBE INSERTION

All patients should have teicoplanin 400mg IV in theatre immediately before PD tube placement.

If allergic to teicoplanin give cefuroxime 750mg IV.

3. PROPHYLAXIS FOR BOWEL INVESTIGATIONS/INVASIVE GYNAECOLOGICAL PROCEDURES

Drain out all peritoneal dialysis fluid prior to any investigation.

Give a stat dose of 1.2 g Co-amoxiclav IV immediately prior to the procedure.

In penicillin allergy (rash) give a combination of:
Cefuroxime 750mg IV and Metronidazole 500mg IV

In penicillin anaphylaxis give a combination of:
Gentamicin IV 1mg/kg (Max 80mg) and Metronidazole 500mg IV
4. **REPORTED ACCIDENTAL BREAK OF STERILE TECHNIQUE**

Give a single dose of vancomycin 1g in 6hrs dwell.

5. **MANAGEMENT OF THE EXIT SITE**

5.1 **EXIT SITE INFECTION PROPHYLAXIS**

All patients on peritoneal dialysis should be prescribed mupirocin nasal ointment 2% to apply to exit site daily or alternate day after cleaning. If the patient has a history of Pseudomonas exit site infection or allergy to mupirocin, then gentamicin cream 0.1% will be prescribed.

5.2 **MANAGEMENT OF CATHETER-RELATED INFECTIONS:**

Catheter-related infections are used as the collective term to describe both exit-site infection (ESI) and tunnel infection.

**Colonisation**

A positive culture in the absence of an abnormal appearance may represent colonisation rather than infection. Review by PD Nurse is required to check cleaning technique and ensure exit site prophylaxis usage.

**Infection**

Inform PD Nurses

Refer to flow chart below
Swab exit site for M, C&S
Blood samples for FBC, CRP and blood culture if patient is pyrexial or unwell
Consider ultrasound scan of catheter tunnel if tunnel infection is suspected but no obvious clinical signs or if collection is suspected

Commence oral Flucloxacillin 500mg QDS

*If Penicillin allergic*
Oral Clarithromycin 500mg bd (first-line)
OR Oral Clindamycin 450mg QDS (if unable to take clarithromycin)

*If known MRSA*
Commence oral Linezolid 600mg bd

*If recent Pseudomonas ESI or colonisation*
Add oral Ciprofloxacin 250mg bd

Give 7 day supply pending culture result

**Review Culture results**

<table>
<thead>
<tr>
<th>CULTURE RESULT</th>
<th>Treatment for ESI</th>
<th>Treatment for Tunnel infection</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulase–negative Staphylococcus</td>
<td>Continue above for <strong>14 days</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staphylococcus Aureus</td>
<td>Continue above for <strong>14 days</strong> (up to 21 days if incomplete resolution)</td>
<td>Continue treatment for <strong>21 days</strong></td>
<td></td>
</tr>
<tr>
<td>Pseudomonas species or other Gram negative bacteria</td>
<td>Oral ciprofloxacin 250mg bd for <strong>14 days</strong> (up to 21 days if incomplete resolution)</td>
<td></td>
<td>Change topical mupirocin to gentamicin Cream 0.1%</td>
</tr>
<tr>
<td>MRSA</td>
<td>Oral Linezolid 600mg bd for <strong>14-21 days</strong></td>
<td></td>
<td>Monitor weekly FBC</td>
</tr>
</tbody>
</table>

**Indications for catheter removal in patients presenting with exit site and/or tunnel infection**

1. Simultaneous catheter-related infection and PD peritonitis*
2. Catheter-related infections that lead to subsequent peritonitis
3. Refractory catheter infections** (Defined as failure to respond after 3 weeks of effective antibiotic therapy)

* Re-insertion should be performed at least 2 weeks after catheter removal and complete resolution of peritonitis.

**Simultaneous removal and re-insertion of PD catheter under antibiotic coverage can be considered.
6. MANAGEMENT OF PD PERITONITIS

Advise patient to attend Department of Renal Outpatients/ Ward 32 immediately. Request to bring cloudy bag if available.

Bacterial peritonitis confirmed if at least two of the following are present:
(1) Clinical features of peritonitis;
(2) WCC >100/mm$^3$ of which at least 50% are polymorphonuclear cells;
(3) Positive dialysis effluent culture

### 1. Suspected PD peritonitis
Cloudy dialysate and/or abdominal pain

**Specimens for Microbiology/ Haematology/ Biochemistry**
(PD fluid suitable for WCC estimated after minimum 2 hour 500ml dwell)

- **2 x 20ml dialysate in white top universal containers to Microbiology** for white cell count (WCC) and differential count, gram stain, culture and sensitivity
- **2 x 8ml dialysate in blood culture bottles to Microbiology** for culture and sensitivity
- **Exit-site swab**
- **MRSA screening swabs**
- **Routine biochemistry** (incl. CRP and FBC)

If systemically unwell, then send **blood cultures** as well.

**START TREATMENT IMMEDIATELY IF PD EFFLUENT IS CLOUDY, DO NOT WAIT FOR RESULTS**

**Initial antibiotic treatment:**

**SINGLE DOSE**
- **Vancomycin 2g** in 6 hour intraperitoneal (IP) dwell (Dianeal 1.36% solution)
  (1.5g if patient weighs <50Kg and 2.5g if patient >90kg)

**OR**
- **Teicoplanin 15mg/kg** in 6 hour intraperitoneal (IP) dwell *(if allergic to vancomycin)*
  PLUS
- **Gentamicin 0.6mg/kg in 6 hour intraperitoneal (IP) dwell - daily** (Dianeal 1.36% solution)

May be modified in event of recent peritonitis, positive exit site cultures, or if initial Gram stain suggests fungal infection or primary intra-abdominal pathology *(vide infra)*.

Use 2nd line agents if the patient is allergic/intolerant to initial therapy or poor response to initial therapy after 48 hours.
2. Adjust treatment according to Gram stain result

<table>
<thead>
<tr>
<th>Gram positive organism</th>
<th>Gram negative organism</th>
<th>No organisms seen</th>
<th>Fungal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop Gentamicin if condition improving, otherwise continue Vancomycin &amp; Gentamicin until culture results are available or clinical improvement.</td>
<td>Stop Vancomycin and continue Gentamicin</td>
<td>Treat as Gram positive</td>
<td>IP Fluconazole 200mg daily</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Refer for catheter removal</td>
</tr>
</tbody>
</table>

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

4a. Treatment duration and adjustment according to Culture result

<table>
<thead>
<tr>
<th>CULTURE RESULT</th>
<th>1st line</th>
<th>2nd line (D/W on-call renal consultant)</th>
<th>Course length</th>
<th>Comments/Additional actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulase negative Staph.</td>
<td>IP Vancomycin</td>
<td>IP Teicoplanin</td>
<td>14 days</td>
<td>Consider interactions with other medications. PD fluid and urine can become orange-coloured.</td>
</tr>
<tr>
<td>Staph aureus/MRSA</td>
<td>IP Vancomycin PLUS</td>
<td>IP Teicoplanin</td>
<td>IP - 21 days</td>
<td>PO - 7 days</td>
</tr>
<tr>
<td></td>
<td>Oral Rifampicin 300mg bd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterococci</td>
<td>IP Vancomycin</td>
<td>D/W Microbiologist</td>
<td>21 days</td>
<td>Consider adding IP Gentamicin if severe peritonitis. If VRE – remove catheter</td>
</tr>
<tr>
<td>Streptococci</td>
<td>IP Vancomycin</td>
<td>IP Amoxicillin</td>
<td>14 days</td>
<td></td>
</tr>
<tr>
<td>Corynebacterium</td>
<td>IP Vancomycin</td>
<td>IP Teicoplanin</td>
<td>21 days</td>
<td></td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>IP Gentamicin AND IP Ceftazidine</td>
<td>Oral Ciprofloxacin AND IP Meropenem</td>
<td>21 days (IP until catheter removal. IV after removal)</td>
<td>Refer for urgent catheter removal</td>
</tr>
<tr>
<td>Other Gram negative</td>
<td>IP Gentamicin</td>
<td>IP Ceftazidine</td>
<td>21 days</td>
<td></td>
</tr>
<tr>
<td>Polymicrobial</td>
<td>IP Vancomycin + IP Gentamicin + IV Metronidazole OR IV Tazocin + IV Teicoplanin</td>
<td>D/W Microbiologist</td>
<td>21 days (IP until catheter removal. IV after removal)</td>
<td>Consider intra-abdominal pathology. Consider IV route for all antibiotics if patient is septic. Refer for urgent catheter removal</td>
</tr>
<tr>
<td>Fungal</td>
<td>IP Fluconazole 200mg daily</td>
<td>D/W Microbiologist</td>
<td></td>
<td>Continue for 14 days after catheter removal (IP until catheter removal. IV/oral after removal) Refer for urgent catheter removal</td>
</tr>
</tbody>
</table>

6
**Culture negative**
Repeat PD effluent cell count and culture on day 3.
Discontinue IP Gentamicin at day 3 if peritonitis is resolving and continue IP Vancomycin for 2 weeks
If not resolving at day 3, consider culture for fungi/ TB/ atypical mycobacteria.
Discuss with Microbiologist.

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### 4b. Further antibiotic dosing and monitoring

**IP Vancomycin:**
Doses are given every 3 days. Initial dose (as per section 1) on **day 1**. Check random vancomycin level on **days 4, 7, 10, 13, 16 and 19** prior to each subsequent dose.

Await level before administering further doses and adjust as follows:
- ≤15 mg/L: 2g in 6hr IP dwell (1.5g if patient weighs <50Kg and 2.5g if patient >90kg)
- >15-20 mg/L: 1g in 6hr dwell
- >20 mg/L: No dose required

**IP Gentamicin:**
Gentamicin is given daily starting at 0.6mg/kg in 6hr IP dwell. Check random gentamicin level every 3 days according to above schedule.

Await level before administering further doses and adjust as follows:
- Level <2mg/L: Continue daily IP Gentamicin 0.6mg/kg in 6hr dwell
- Level ≥2mg/L: Reduce dose to 0.4mg/kg
- Level ≥3mg/L: Omit dose and check Gentamicin level daily. Restart Treatment and monitoring every 3 days once level is <3.

**IP Teicoplanin:**
15mg/kg in 6hr IP dwell every 5 days. No monitoring is required.

**IP Ceftazidime:**
1.5g (1g if patient weighs <60kg) daily in 6hr IP dwell

**IP Amoxicillin:**
There is no data regarding its use in once daily exchange and therefore APD patients have to do CAPD. 150mg/L in every CAPD exchange.

**IP Meropenem:** 1g daily in a 6 hr dwell or 100mg/L in each dwell.
### Indications for catheter removal in patients presenting with peritonitis

1. Refractory/ Relapsing/ Repeat peritonitis* (See definitions above)
2. Pseudomonas peritonitis
3. Fungal/ Mycobacterial/ polymicrobial peritonitis*
4. Simultaneous catheter-related infection and PD peritonitis*

* Re-insertion should be performed at least 2 weeks after catheter removal and complete resolution of peritonitis

### 7. REFERENCES