Doncaster and Bassetlaw Teaching Hospitals
NHS Foundation Trust

Diagnosis & Management of Peritoneal Dialysis catheter-related Infections and peritonitis

DEPARTMENT OF RENAL MEDICINE

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Approved by	**Renal Clinical Governance Group** **Drug and Therapeutics Committee**
Date	**May 2025**
Implementation Date	**May 2025**
Review Date	**May 2028**

Date	Summary of changes	Authors
February 2025	Complete update of guideline based on ISPD 2022 and ISPD 2023 guidance	Dr M Elkossi, Debbie Starbuck, Joanne Cooke, Emma Cooper, Dr B Subramanian

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 & requires prompt diagnosis & 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 +/- ultrasound evidence of collection along the catheter tunnel.

TERMINOLOGY FOR PERITONITIS (Post PD Catheter insertion, and prior to commencement of treatment):
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, and white cell count of greater than a 100.

Catheter-related peritonitis: peritonitis within 3 months of an exit-site or tunnel infection with the same organism or one site sterile with recent antibiotic exposure

Enteric peritonitis: arising from a GI source e.g. gut inflammation, perforation or ischaemia

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 MSSA screening 14 days prior to surgery where possible. Positive results should be treated with nasal mupirocin 2% and topical Prontoderm for 5 days. In emergency cases, or those with less than 14 days' notice of theatre date, those patients should continue to use Prontoderm foam daily.

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 rash allergy**, 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 (Wet contamination)

Give a single dose of vancomycin 1g in 6hrs dwell, and perform PD set change

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% should 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. PD Nurse should check cleaning technique and ensure that exit site prophylaxis is being applied.

Infection
Inform PD Nurses
Refer to flow chart below

Flow chart for suspected PD Catheter-related infection (ESI +/- Catheter tunnel infection)

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 for 48 hours, then reduce dose to 600mg daily

If recent Pseudomonas ESI or colonisation
Add oral Ciprofloxacin 500mg daily

Give 7 day supply pending culture result

Review Culture results

CULTURE RESULT	Treatment for ESI	Treatment for Tunnel infection	Comments
Coagulase negative staphylococcus	Continue above for **10 days**	Continue treatment for minimum **21 days**	
Staphylococcus aureus	Continue above for **10 days**		
***Pseudomonas* species or other Gram negative bacteria**	Oral ciprofloxacin 500mg OD for **21 days**) or until 24 hours post PDC removal		Change topical mupirocin to gentamicin Cream 0.1%
MRSA	Oral Linezolid 600mg BD for 48 hours, then reduce 600mg once daily for **14-21 days**		Monitor weekly FBC Avoid SSRI interaction
FUNGAL	Oral fluconazole 100mg daily for 14 days		May need PDC removal

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 2 weeks of effective antibiotic therapy, or 3 weeks for Pseudomonas infection*)

* **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 (with a new exit site) under antibiotic coverage can be considered when exit site or tunnel infection do not resolve with effective antibiotic**

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 is confirmed if at least two of the following are present:
(1) Clinical features of peritonitis; (abdominal pain and/or cloudy effluent)
(2) WCC >100/mm^3 with >50% polymorphonuclear leukocytes;
(3) Positive dialysis effluent culture

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

Specimens for Microbiology/ Haematology/ Biochemistry
Ensure samples are sent to the laboratory immediately. During working hours, please fast track all samples. Out of Hours, call microbiology technician via switchboard. Chase sample results after 2 hours if not already conveyed.
(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 + CRP + FBC**
- **If clinically septic or immunosuppressed, 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)
PLUS Gentamicin 0.6mg/kg in 6 hour IP dwell - daily (Dianeal 1.36% solution)

OR

Cefazolin 20mg/kg in 6 hour IP dwell (if allergic to vancomycin).

PLUS
Gentamicin 0.6mg/kg in 6 hour 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 (see below).

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

Gram positive organism	Gram negative organism	No organisms seen	Fungal
Stop Gentamicin if condition improving, otherwise continue Vancomycin & Gentamicin until culture results are available or clinical improvement.	Stop Vancomycin, continue Gentamicin and add N-Acetylcysteine 600mg BD (in order to prevent aminoglycoside oto-toxicity).	Treat as Gram positive	IP Fluconazole 200mg daily Refer for catheter removal

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

4a. Treatment duration and adjustment according to culture result
(Refer to Appendix 4b for guidance on dosing of IP antibiotic)

CULTURE RESULT	1st line	2nd line (D/W on-call renal consultant)	Course length	Additional actions
Coagulase Negative Staphylococcus	IP Vancomycin	To be guided by sensitivities	14 days	Consider retraining the patient
MRSA	IP Vancomycin **PLUS** Oral Rifampicin 300mg BD	IP Daptomycin 300mg daily + PO Rifampicin 300mg BD	IP - 21 days PO - 7 days	Consider interactions with other medications. PD fluid and urine can become orange-coloured with rifampicin. For concurrent S.aureus exit site or tunnel infection, refer for catheter removal. If removed, add oral flucloxacillin 1g QDS for 14 days
MSSA	IP Cefazolin 20mg/kg PLUS Oral Rifampicin 300mg BD	IP Vancomycin PLUS Oral Rifampicin 300mg BD		
Enterococcus faecalis	PO Amoxicillin 500mg TDS	IP Vancomycin (if amoxicillin R but vancomycin S)	21 days	Consider adding IP Gentamicin if severe peritonitis (to cover for polymicrobial enterococcal peritonitis)
Enterococcus faecium	IP Vancomycin	IP Daptomycin 300mg daily		
VRE	Oral Linezolid 600mg BD for 48h, then 600mg daily	To be guided by sensitivities		If no improvement after 5d, remove catheter and treat with 14d systemic antibiotic after catheter removal Avoid SSRI interaction Weekly FBC

CULTURE RESULT	1st line	2nd line (D/W on-call renal consultant)	Course length	Comments/ Additional actions
Streptococci	IP Cefazolin 20mg/kg	IP Vancomycin	14 days	If no improvement after 5d, remove catheter and treat with PO/IV antibiotic for 14 days
Corynebacterium	IP Vancomycin	To be guided by sensitivities	14 days	Consider early catheter removal if concurrent exit site or catheter tunnel infection
Pseudomonas	IP Gentamicin AND IP Ceftazidime 1.5g daily for 7 days and discuss with microbiology	To be guided by sensitivities	21 days (IP until catheter removal. IV after removal)	**Refer for urgent catheter removal,** and post operatively give oral Ciprofloxacin 500mg BD for 14 days (Please consult with Renal Pharmacist at earliest opportunity for renal dose adjustment)
Enteric Gram negative	IP Ceftazidime 1.5g daily	To be guided by sensitivities	21 days	If no improvement after 5d, remove catheter and treat with antibiotic for 14d after catheter removal
Polymicrobial	IV Tazocin 4.5g BD + IP Gentamicin	D/W Consultant in Infection	21 days (IP until catheter removal. IV after removal) Do not administer IP Gentamicin for >7d	Consider intra-abdominal pathology Consider IV route for all antibiotics if patient is septic. **Refer for urgent catheter removal**
Fungal (Candida sp)	PO Fluconazole 200mg loading, then 100mg daily	D/W Consultant in Infection	Continue for 14 days after catheter removal	**Take blood cultures (x 2 sets). Refer for urgent catheter removal**
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/ legionella If still culture negative and no clinical improvement by Day 5, remove the catheter. Post operatively, treat with oral doxycycline 200mg stat dose, and then 100mg daily.	

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**

4b. APPENDIX: 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**.** Give oral N-acetylcysteine 600mg bd from Day 4 in order to minimise risk of aminoglycoside ototoxicity.

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 & check level daily. Restart treatment & monitoring every 3 days once level is <3.

IP Cefazolin:
20mg/kg to be given daily in 6 hour IP dwell.

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

IP Ceftazidime:
1.5g daily in 6hr IP dwell

IP Meropenem: 1g daily in a 6 hr dwell.

IP Daptomycin: 300mg in a 6 hr dwell. Limited data on use and stability. Monitor closely. Stop statins and monitor creatinine kinase.

GUIDANCE FOR FLUOROQUINOLONE PRESCRIBING
a) ‡ Fluoroquinolone warning: · Fluoroquinolones should not be used for mild-moderate infections, unless other antibiotics cannot be used. · The European Medicines Agency's Pharmacovigilance Risk Assessment Committee has recommended restricting the use of fluoroquinolone antibiotics following a review of side effects mainly involving muscles, tendons, bones, nervous system and in those at high risk of aortic aneurysm. · Patients should be warned about these side effects, which are rare but can be disabling and potentially long-lasting. A Patient Information Leaflet is available here. Click here for further information (FQ-patient-sheet-final.pdf)

4c. Antibiotic Stability in Peritoneal Dialysate
a= Limited data. Administer immediately

Antibiotic	Peritoneal Dialysate (2L)	Compatibility in 6hr dwell	Compatibility with other drugs
Vancomycin	Dianeal 1.36%	✓	Vancomycin + Gentamicin Vancomycin + Ceftazadime
Gentamicin	Dianeal 1.36%	✓	Gentamicin + Vancomycin Gentamicin + Cefazolin
Cefazolin	Dianeal 1.36%	✓	Cefazolin + Gentamicin Cefazolin + Ceftazidime
Ceftazidime	Dianeal 1.36%	✓	Ceftazidime + Cefazolin Ceftazidime + Vancomycin
Teicoplanin	Dianeal 1.36%	✓a	
Meropenem	Dianeal 1.36%	✓a	
Cefotaxime	Dianeal 1.36%	✓a	
Daptomycin	Dianeal 1.36%	✓a	
Fluconazole	Dianeal 1.36%	Unknown – administer immediately	

7. REFERENCES

1. ISPD Peritonitis guideline Recommendations: 2022 Update on Prevention and Treatment. *Peritoneal Dialysis International;* Vol 42(2) , pp. 110 - 153
2. ISPD Catheter-related Infection Recommendation:. 2023 Update *Peritoneal Dialysis International;* Vol 43(3), PP. 201 – 219