Doncaster and Bassetlaw Teaching Hospitals
NHS Foundation Trust

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

DEPARTMENT OF RENAL MEDICINE

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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

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

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

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 **14 days**	Continue treatment for **21 days**	
Staphylococcus Aureus	Continue above for **14 days** (up to 21 days if incomplete resolution)		
Pseudomonas species or other Gram negative bacteria	Oral ciprofloxacin 250mg bd for **14 days** (up to 21 days if incomplete resolution)		Change topical mupirocin to gentamicin Cream 0.1%
MRSA	Oral Linezolid 600mg bd for **14-21 days**		Monitor weekly FBC

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

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 and continue Gentamicin	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

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

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

1. ISPD Peritonitis Recommendations: 2016 Update on Prevention and Treatment. *Peritoneal Dialysis Internatiol;* Vol 36, pp. 481-508
2. ISPD Catheter-related Infection Recommendation: 2017 Update. *Peritoneal Dialysis International;* Vol 37, PP.141-154