Peritoneal Dialysis Peritonitis and PD Catheter Exit Site Infection – Full Clinical Guideline

Reference no.: CG-REN/2021/003

This guideline is to be used by the renal team only, ALL individuals presenting outside the renal department who you suspect to have Peritoneal Dialysis Peritonitis should be discussed with the Renal or medical Registrar on call immediately. The decision to refer PD patients suspected of peritonitis to surgical team should ONLY be made by the renal team.

1. Introduction

Peritonitis related to peritoneal dialysis (PD) needs prompt treatment with appropriate antibiotics to prevent significant morbidity and mortality.

This guideline is to be used by the **renal team only**, ALL individuals presenting outside the renal department who you suspect have Peritoneal Dialysis Peritonitis should be discussed with the Renal Registrar on call immediately

2. Aim and Purpose

The aim of this document is to aid in the diagnosis of PD peritonitis and to ensure timely, appropriate antibiotic administration to patients by trained staff (PD nurses, ward 407 nurses, renal registrars and Renal Consultants).

3. Definitions, Keywords

Peritoneal dialysis peritonitis is defined as infection and inflammation of the peritoneum in patients undergoing PD.

Intraperitoneal (IP) antibiotics - Antibiotics mixed with dialysis fluid, administered into the peritoneum using the PD catheter. This should only be administered by PD nurses or trained ward 407 nurses out of hours.

Key Words - Peritoneal dialysis peritonitis, peritoneal dialysis, intraperitoneal antibiotics

Diagnosis(Need 2 out of 3 following criterion)

Criterion 1.Clinical features consistent with peritonitis, i.e. abdominal pain and/or cloudy dialysis effluent;

Criterion 2.Dialysis effluent white cell count > 100 (after a dwell time of at least 2 hours), with > 50% polymorphonuclear.

Criterion 3. Positive dialysis effluent culture.

Initial Treatment:	Record Observations, pulse, BP, temp, and inform medics. **If dwell present in the peritoneum & drainage is cloudy:** Send the fluid for urgent microscopy (WCC and Gram stain) and culture. (2 blood culture bottles and plain MSU pot).Carry out 2-3 rapid exchanges with 1 litre exchanges. • Take full set bloods incl. FBC, U&E, LFT, CRP, Blood cultures • Start IP antibiotics and consider analgesia • Document presence or absence of abdominal tenderness in vital data. • Document state of exit site and tunnel **If no dwell at presentation and minimal clinical evidence for Peritonitis or if dwell present in peritoneal cavity for >12 hours:** Put in a litre dwell(first drain out the existing dwell if present and send it for culture) , leave the dwell for 2 hrs before sending the fluid for urgent microscopy (WCC and Gram stain) and culture.(2 blood culture bottles and plain MSU pot).After this do 2-3 rapid exchanges with 1 litre dwells if clinically indicated
Initial Antibiotics	**Day 1 – start antibiotics without waiting for white cell count** **IP vancomycin 2g** and **IP gentamicin** 0.6mg/kg in a 6-hour intraperitoneal (IP) dwell. (Reduce vancomycin dose to 1.5g if patient weighs <45kg).
In-patient management Daily **IP gentamicin** (to continue once daily if gentamicin levels less than 2).If Urine output > 500 mls check vancomycin level on day 3 Daily PD WCC and cultures. **If no improvement in cell count by day 5**: Catheter should be removed.	**Outpatient management** Prescribe **Ciprofloxacin 500mg BD (Oral)** for 7 days pending culture results. (Reduce Ciprofloxacin dose to 250 mg BD if Renal Kt/v is less than 0.8, Check PD review section in Vital data for recent Kt/v values) **Day 3 -** visit the patient: Is there clinical improvement? **If no improvement:** • Arrange admission, consider vancomycin level check if Urine output >500ml & • Repeat PD WCC and culture. • Check growth and sensitivities**.** **If improving:**

For patients with antibiotic allergies, follow detailed guideline.	• Look at growth and sensitivities and tailor antibiotics accordingly (Follow detailed guideline) • Repeat PD fluid WCC and culture **Day 5 -** See the patient • Record full set of observations • Check abdomen for tenderness, exit site and tunnel • Check growths and sensitivities • Repeat WCC in PD fluid • Check vancomycin levels – aim for 15-20, repeat bloods FBC,CRP Adjust frequency of vancomycin administration dependent on levels. (see below section on vancomycin for detailed guidance) **If fluid not clearing inform registrar and PD consultant before the patient leaves the department – consider tube removal** **Days 5-21** **Manage as per the organism isolated, (Table 1)**

Complete peritonitis record on vital data. Every patient must have observations, examination findings (including abdomen / exit site and tunnel) documented on vital data. Blood results, culture results and further assessments during treatment must also be documented in Vital Data.
All antibiotics given to the patient should be entered on Lorenzo.
During OOH encounter with PD Peritonitis, alert PD Team via e-mail address: dhft.CAPD@nhs.net
Categorise Peritonitis as “simple” or “special” as detailed below.

Empirical antimicrobial treatment

Vancomycin (IP)

- Given as a single intraperitoneal (IP) loading dose, dependent on weight (see below)
  - **Patients ≥ 45kg** give a 2g dose of vancomycin made in 40ml WFI.
  - **Patients < 45kg** give a 1.5g dose of vancomycin made in 30ml WFI.

- Given in a volume of 2 litres dialysate for a minimum six-hour dwell. However, it may be given in 1.5 litres of dialysate if larger volumes are not tolerated

  IP vancomycin is prepared by the CAPD nurses and 407 nurses in a syringe to be added to the dialysate as above. (See Trust monograph on preparation).
  NB: Vancomycin vials are kept as stock in the CAPD office and on ward 407.

- Blood vancomycin levels must be checked **every 3 - 5 days** depending on residual renal function**.** Further doses (same as initial dose) should be given at 3 - 5 day intervals if indicated according to blood levels (see below) until the end of the course.

- Clearance of vancomycin after a single IP loading dose varies with differing residual function.

Vancomycin level

- **More than 20mg/L** - Do not give vancomycin and repeat level as per consultant advice.
- **Less than equal to 20mg/L** - Give vancomycin 2g IP (or 1.5g if less than 45 kg body weight) as before and repeat blood test in a further 3 - 5days.

Gentamicin (IP)

- **0.6mg/kg (body weight)** then subsequent doses adjusted by blood levels.
- Gentamicin may be used once daily in the long dwell only (day dwell for APD and overnight dwell for CAPD).

IP gentamicin is prepared by the CAPD nurses and 407 nurses in a syringe to be added to the CAPD fluids as above. (See Trust monograph on preparation).
NB: Gentamicin amps are kept as stock in the CAPD office and on ward 407.

- Levels of gentamicin should initially be measured a day after starting regular treatment, and thereafter as necessary (typically every 3 days).
- Aminoglycosides have a prolonged post-antibiotic antibacterial effect associated with high local concentrations in the infused dialysis fluid. This allows effective treatment with intermittent intraperitoneal dosing.
- **It is not necessary to achieve "therapeutic" systemic levels and the regular initial IP dose should not be increased above initial dose if blood levels are "sub-therapeutic".**
- Aminoglycoside toxicity often results from prolonged or repeated courses rather than short term high levels.
- Aminoglycosides (e.g. gentamicin) should be avoided if possible if the patient has received a course in the previous 3 months except where bacterial cultures suggest that this is essential.

Gentamicin levels

- Level less than or equal to 2mg/L – Continue with same dose, do not increase the dose.

- Level more than 2mg/L - subsequent doses should be reduced (but not omitted) to avoid toxicity (such as ototoxicity or loss of residual renal function).
    - Discuss with Renal consultant.

Ciprofloxacin (PO)

- **500mg 12-hourly (BD) orally.**

- Absorption of ciprofloxacin is reduced by sevelamer, calcium compounds, oral iron, zinc, magnesium and milk. It should therefore be given at least 2 hours before any of these medications.
- **Reduce Ciprofloxacin dose to 250 mg BD if Renal Kt/v is less than 0.8** (Check PD review section in Vital data for recent Kt/v values)

Drug allergies

Vancomycin allergy

- Substitute with IP teicoplanin (see below).

WARNING: There is an increased chance of cross-sensitivity and thrombocytopenia with teicoplanin in patients allergic to vancomycin. Monitor patient and FBC closely. Avoid use of teicoplanin in patients with a severe reaction to vancomycin e.g. anaphylaxis. Please seek advice on potential alternatives from microbiology for these patients.

Ciprofloxacin allergy

- Substitute with IP gentamicin to provide gram-negative cover (in addition to vancomycin).

Teicoplanin (IP)

- **For APD Patients: Teicoplanin 15mg/kg every 5 days** as a minimum 6 hour dwell.
- **For CAPD patients**: **Loading dose 400 mg/bag**, as a 6 hour dwell and then a **maintenance dose of 20mg/bag (with each exchange).**

IP teicoplanin is prepared by the CAPD nurses and 407 nurses in a syringe to be added to the CAPD fluids as above. (See Trust monograph on preparation).
NB: Teicoplanin 400mg strength vials are kept as stock in the CAPD office and on 407.

- Teicoplanin levels do not need to be monitored if the patient is clinically responding.
- If the patient is deteriorating then please discuss with Microbiology about the need to send levels or whether a change to another antibiotic (e.g. linezolid) may be more appropriate.
- The Microbiologists must be told about patients who are receiving teicoplanin and in whom an organism has been isolated from the PD fluid. This is because extra susceptibility tests may need to be performed on any Gram-positive organisms grown.
- **There is an increased risk for ototoxicity when used with gentamicin.**

Adjunctive Treatments

- Patients with cloudy effluent may benefit from the addition of heparin 500 units/L IP to prevent occlusion of the catheter by fibrin. *(Heparin must not be added to the bag when vancomycin or gentamicin is given, as these are incompatible with Heparin).*
- Protein loss during peritonitis is also increased. Screening for malnutrition should be undertaken in patients with prolonged peritoneal inflammation.

Special cases – all must be discussed with consultant covering PD

Relapsing peritonitis

- Defined as return of peritonitis within 4 weeks at the end of treatment, with the same organism or a culture negative peritonitis within 4 weeks.
- Consider catheter removal if third episode – can do removal and insertion on same day

Refractory Peritonitis

- Failure to clear after 5 days appropriate antibiotics, necessitates catheter removal

Repeat Peritonitis

- Further episode with the same organism more than 4 weeks apart
- Consider catheter removal if third episode – can do removal and insertion on same day

Recurrent Peritonitis

- Further episode within 4 weeks with different organism.
- This carries the worst prognosis
- Consider catheter removal.

Catheter Related

- In conjunction with exit site or tunnel infection
- Consider catheter removal

Table 1

FINAL CULTURE RESULT	ANTIBIOTIC ADVICE	OTHER INFORMATION
Coagulase negative staphylococcus **Duration 21 days**	Stop ciprofloxacin Continue IP vancomycin for a total of 21 days. Monitor vancomycin levels.	If associated tunnel or exit site infection may have to consider catheter removal.
Staph Aureus **Duration: 21 days**	Stop ciprofloxacin Continue IP vancomycin to complete 21 days treatment	If failure to respond after 5 days on appropriate antibiotics or associated with exit site infection with the same organism consider catheter removal.
Enterococci **Duration: 21 Days**	Stop ciprofloxacin Continue IP vancomycin for 21 days	add IP gentamicin 0.6mg/kg daily for 21 days for severe enterococcal peritonitis
Other Streptococci **Duration: 14 Days**	Stop ciprofloxacin Continue IP vancomycin for 14 days	
Corynebacterium **Duration: 21 Days**	Stop ciprofloxacin Continue IP vancomycin for 21 days	Patients with concomitant exit-site or catheter tunnel infection caused by Corynebacterium, early catheter removal should be considered.

Pseudomonas **Two antibiotics** **Duration: 21 days**	• Stop vancomycin • Continue two antibiotics for a minimum of 21 days. Ciprofloxacin 500 mg BD (oral) and Gentamicin 0.6mg/kg IP daily. Monitor gentamicin regularly to avoid toxicity. If gentamicin toxicity occurs, contact microbiology for alternative agents based on sensitivities.	❖ Pseudomonas peritonitis is generally severe and often associated with catheter infection; in such cases catheter removal is required. ❖ Continue antibiotics for a minimum of 21 days. Longer may sometimes be required.
Single other gram negative eg. E.coli **Single antibiotics** **Duration: 21 days**	**Stop vancomycin** **Single antibiotic** – either ciprofloxacin 500 mg BD (oral) or Daily gentamicin 0.6mg/kg IP. If gentamicin used monitor levels to avoid toxicity.	❖ Complete 21 days of treatment. If failure to respond after 5 days on appropriate antibiotics consider catheter removal. ❖ Consider CT Abdomen to look for underlying cause.
Stenotrophomomas maltophilia	**Two antibiotics** PO ciprofloxacin + IP gentamicin Discuss with Microbiology	❖ Prolonged therapy for 3 - 4 weeks may be indicated.
Yeast or other fungus	This is an **emergency** and removal of catheter should have occurred. **Continue anti-fungal treatment for at least 14 days after catheter removal**. Discuss treatment options with microbiology.	❖ Fungal peritonitis is serious leading to death in approximately 25 % or more of episodes. ❖ If part of a polymicrobial culture may be associated with underlying bowel perforation.
Multiple Gram positive organisms **Duration: 21 days**	Stop ciprofloxacin Continue vancomycin and other additional antibiotics as per sensitivities for a total of 21 days.	The source is most likely contamination or catheter infection; the patient's technique should be reviewed and the exit site carefully examined. Generally, resolves without catheter removal unless the catheter is the source of infection.
Multiple enteric organisms	Duration and choice of antibiotics should be discussed with microbiology.	Consider CT scan of abdomen. The catheter may need to be removed, particularly if laparotomy/CT Scan indicates an intra-abdominal focus.
Culture negative **Duration: 14 days**	Stop ciprofloxacin If improving continue IP vancomycin for 14 days.	❖ If no clinical improvement after 4 days consider adding **Ceftazidime 3g IP STAT then 1g IP daily for 14 days.** ❖ *(To order from Pharmacy).*

		❖ Resend PD WBC differential count, culture for TB and Fungal. ❖ Discuss with Microbiology ❖ May warrant catheter removal.

Exit-site and tunnel infections

An exit-site infection is defined by the presence of purulent drainage, with or without erythema of the skin at the catheter–epidermal interface. Peri-catheter erythema without purulent drainage is sometimes an early indication of infection but can also be a simple skin reaction, particularly in a recently placed catheter or after trauma to the catheter. Clinical judgment is required to decide whether to initiate therapy or to follow carefully.
A positive culture in the absence of an abnormal appearance is indicative of colonisation rather than infection. Intensification of exit-site cleaning with antiseptics is advised.
A tunnel infection may present as erythema, oedema, or tenderness over the subcutaneous pathway but is often clinically occult.

A tunnel infection usually occurs in the presence of an exit-site infection but rarely occurs alone. Staphylococcus aureus and Pseudomonas aeruginosa exit-site infections are very often associated with concomitant tunnel infections and are the organisms that most often result in catheter infection-related peritonitis; aggressive management is always indicated for these organisms.

Treatment of exit site and tunnel infections

The most serious and common exit-site pathogens are Staphylococcus aureus and Pseudomonas aeruginosa. As these organisms frequently lead to peritonitis such infections must be treated aggressively. Oral antibiotic therapy is generally recommended, with the exception of methicillin-resistant Staph aureus (MRSA).

- **Flucloxacillin 500mg QDS** for a minimum of **2 weeks** (continue until resolution)
- **OR** in pseudomonas aeruginosa infections **ciprofloxacin 500mg BD** for minimum of **2 weeks** (continue until resolution)
- (**Reduce Ciprofloxacin dose to 250 mg BD if Renal Kt/v is less than 0.8** (Check PD review in Vital data for recent Kt/v values))

Consider adding **topical gentamicin 0.3%** in recurrent Pseudomonas exit-site infection. If resolution of the exit site or tunnel infection is slow, IP gentamicin should be added.

If exit site infection still persists after 4 weeks of antibiotic treatment , the catheter should be changed with a new exit site.

Disconnection or contamination of PD catheter/ extension line

- Give a single dose of **vancomycin 2g IP** and **gentamicin 0.6mg/kg IP** in a 6-hour intraperitoneal (IP) dwell. (Reduce vancomycin dose to 1.5g if patient weighs <45kg).

- A set change should also be performed by a trained member of staff/ home dialysis team.

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5. Documentation Controls

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