

# PERITONEAL DIALYSIS ASSOCIATED PERITONITIS: MANAGEMENT - SCH

## PRACTICE GUIDELINE<sup>®</sup>

### DOCUMENT SUMMARY/KEY POINTS

- Peritonitis is one of the major complications of peritoneal dialysis (PD). Episodes of peritonitis may result in increased morbidity and even mortality for the patient with acute renal failure or end stage renal disease maintained on peritoneal dialysis. (2)
- This protocol details the management of PD associated peritonitis for both the chronic PD patient and the acute renal failure patient treated with PD in the CICU setting.
- Clinical presentations have been broken down into categories:
  - A. Child presenting at the Emergency Department, with peritonitis of unknown aetiology.
  - B. Child presenting at the Emergency Department with peritonitis of unknown aetiology, with marked systemic features.
  - C. Peritonitis occurring while an Inpatient or within 7 days of discharge, (i.e.: Health Care Associated Infection).
  - D. CICU inpatient with peritonitis of unknown aetiology.
  - E. Geographically isolated child with peritonitis of unknown aetiology.
  - F. Child presenting with a peritonitis episode within 4 weeks of ceasing antibiotic treatment for peritonitis.
  - G. Line contamination
- Emergency department flow sheet included.
- Children on peritoneal dialysis should receive oral antifungal medication (e.g. nilstat) whenever they receive antibiotic therapy.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

<b>Approved by:</b>	SCHN Policy Procedure & Guideline Committee	
<b>Date Effective:</b>	1 <sup>st</sup> October 2015	<b>Review Period:</b> 3 years
<b>Team Leader:</b>	CNC Renal	<b>Area/Dept:</b> Nephrology SCH

## CHANGE SUMMARY

- Document due for mandatory review.
- Replaces SCH document C.13.08
- Changes made:
  - Drug dosages adjusted according to new guidelines.
  - References updated.
  - Definition of peritonitis included.
  - Emergency Department flow chart included (previously separate document).

## READ ACKNOWLEDGEMENT

- All staff caring for patients with peritoneal dialysis associated peritonitis, including ward, CICU and emergency department nursing and medical staff.

# TABLE OF CONTENTS

<b>Indications:</b> .....	<b>4</b>
<b>Aim:</b> .....	<b>4</b>
General (Home PD patient):.....	4
All patients presenting with suspected peritonitis:.....	5
Definition of peritonitis: .....	5
Initial management until culture and sensitivity results available: .....	6
A. <i>Child presenting at the Emergency Department, with peritonitis of unknown aetiology.</i> <sup>(1,2,3)</sup> .....	6
B. <i>Child presenting at the Emergency Department with peritonitis of unknown aetiology, with marked systemic features.</i> <sup>(1,2,3)</sup> .....	6
C. <i>Peritonitis occurring while an Inpatient or within 7 days of discharge, (i.e.: Health Care Associated Infection).</i> <sup>(1,2,3,4)</sup> .....	7
D. <i>CICU inpatient with peritonitis of unknown aetiology.</i> <sup>(1,2,3)</sup> .....	7
E. <i>Geographically isolated child with peritonitis of unknown aetiology.</i> .....	8
F. <i>Child presenting with recurrent peritonitis episode within 4 weeks of ceasing antibiotic treatment for peritonitis.</i> <sup>(1,2)</sup> .....	9
<i>MRSA (multi resistant Staphylococcus aureus) peritonitis(after consultation with Infectious Diseases consultant)</i> .....	10
<i>Decolonisation of Staphylococcus aureus</i> <sup>(6)</sup> .....	10
G. <i>Line Contamination</i> <sup>(1,2,3)</sup> .....	10
<b>References:</b> .....	<b>11</b>
Related Documents.....	11
<b>Appendix 1: Antibiotic Dosing Recommendations</b> .....	<b>12</b>
<b>Appendix 2: Treatment for peritoneal dialysis associated peritonitis.</b> .....	<b>13</b>

## Indications:

Peritonitis is one of the major complications of peritoneal dialysis (PD). Episodes of peritonitis may result in increased morbidity and even mortality for the patient with acute renal failure or end stage renal disease maintained on peritoneal dialysis<sup>(2)</sup>

This protocol details the management of PD associated peritonitis for both the chronic PD patient and the acute renal failure patient treated with PD in the CICU setting. The recommendations of The International Society of Peritoneal Dialysis Consensus Guidelines for the Prevention and Treatment of Catheter-related Infections and Peritonitis in Paediatric Patients Receiving Peritoneal Dialysis: 2012 Update<sup>(1)</sup>; The International Society of Peritoneal Dialysis Guidelines for Peritoneal Dialysis-Related Infections Recommendations: 2010 Update<sup>(2)</sup> and the Caring for Australasians with Renal Impairment (CARI) guidelines Management of peritoneal dialysis – associated peritonitis in adults and children<sup>(3)</sup> and Catheter removal, adjunct therapies and timing of reinsertion of peritoneal dialysis catheter after peritonitis<sup>(4)</sup> have been adapted and modified according to local experience<sup>(5)</sup>. Suitable alternative antibiotics are listed.

## Aim:

Ensure adequate and successful treatment of infection. Maintain the peritoneum for use as a dialysis membrane and where possible preserve the PD catheter.

## General (Home PD patient):

- During training for home Continuous Ambulatory Peritoneal Dialysis (CAPD) / Continuous Cycling Peritoneal Dialysis (CCPD), peritonitis is emphasised as the main complication of peritoneal dialysis. The patient and / or family are taught the diagnostic features of peritonitis.
- Manifestations of peritonitis include<sup>(1,2,3)</sup>:
  - Cloudy dialysate, with or without the following symptoms:
    - Abdominal pain
    - Fever
    - Nausea
    - Vomiting
    - Diarrhoea
- When the family identifies a possible episode of peritonitis, they will immediately contact the Sydney Children's Hospital (SCH) on-call nephrologist.
- If able, the family will be asked to collect a specimen of PD fluid and perform three<sup>(3)</sup> rapid exchanges, leaving a full dwell volume in situ. The patient is then to present to SCH emergency department, or local medical officer / hospital as previously arranged, with the PD fluid specimen.

**Note:** If the patient has not performed these quick exchanges, they may be performed when the patient arrives by accredited nursing staff.

## All patients presenting with suspected peritonitis:

On arrival in the Emergency department the following should be performed: ([See Emergency Department Flow Chart](#))

- Inoculate one set of blood culture bottles with PD fluid and send for culture and sensitivity.<sup>(1,2)</sup>
- Send the PD effluent bag for urgent microscopy and cell count as well as culture and sensitivity.<sup>(1,2)</sup>
- Swabs from both the PD catheter exit site and nose should be obtained from all patients with suspected peritonitis. These should be sent for bacterial culture.
- The patient should be transferred to the ward as soon as possible.

The antibiotics used, and route of administration will depend on the clinical presentation and the individual patient circumstances, for example: allergies and other conditions currently being treated.

### Clinical presentations have been broken down into:

- [Child presenting at the Emergency Department, with peritonitis of unknown aetiology.](#)
- [Child presenting at the Emergency Department with peritonitis of unknown aetiology, with marked systemic features.](#)
- [Peritonitis occurring while an Inpatient or within 7 days of discharge, \(i.e.: Health Care Associated Infection\).](#)
- [CICU inpatient with peritonitis of unknown aetiology.](#)
- [Geographically isolated child with peritonitis of unknown aetiology.](#)
- [Child presenting with a peritonitis episode within 4 weeks of ceasing antibiotic treatment for peritonitis](#)
- [Line contamination](#)

### Definition of peritonitis:

The diagnosis of peritonitis should be considered in the presence of cloudy peritoneal dialysis effluent<sup>(1,2)</sup>

Empiric diagnosis of peritonitis: effluent white blood cell count greater than 100/mm<sup>3</sup>, with at least 50% polymorphonuclear leukocytes.<sup>(1,2)</sup>

If the eosinophil count exceeds 10% and peritoneal dialysis effluent culture is negative, a diagnosis of eosinophilic peritonitis should be considered.<sup>(1)</sup>

Recurrent peritonitis is defined as an episode of peritonitis occurring within 4 weeks of completion of therapy for an earlier peritonitis episode, but the organism is different.<sup>(1,2)</sup>

Relapsing peritonitis is defined as an episode of peritonitis occurring within 4 weeks of completion of therapy for an earlier peritonitis episode, with the same organism or a sterile peritonitis. Repeat peritonitis is defined as an episode of peritonitis occurring more than 4 weeks after completion of therapy for an earlier peritonitis episode, with the same organism.<sup>(1,2)</sup>

Refractory peritonitis is defined as failure to clear after 5 days of appropriate antibiotics.<sup>(1,2)</sup>

## Initial management until culture and sensitivity results available:

- After consultation with Nephrologist on-call, commence antibiotics as per categories [A](#), [B](#), [C](#), [D](#), [E](#), [F](#) or [G](#).
- Prophylactic oral nystatin drops 1 ml (100,000 units) QID should be commenced with antibiotic therapy and continued for several days after completion of antibiotic treatment. <sup>(1,2,3)</sup>
- Antibiotic therapy is the same for patients maintained on CAPD and CCPD.
- Other antibiotics may be required depending on the clinical circumstances, see [Appendix 1](#).

### **A. Child presenting at the Emergency Department, with peritonitis of unknown aetiology.** <sup>(1,2,3)</sup>

#### 1. Loading Dose:

Single dose of:

<b>cefalotin</b> at a dose of 500 mg/L dialysis fluid  <b>AND</b>  <b>ceftazidime</b> 500 mg/L dialysis fluid.
--

These should be added to the peritoneal dialysis fluid (using the patients usual exchange volume) and left to dwell for six (6) hours.

#### 2. Maintenance dose:

Thereafter, peritoneal dialysis is continued with maintenance antibiotics.

These are:

<b>cefalotin</b> at a dose of 125 mg/L dialysis fluid  <b>AND</b>  <b>ceftazidime</b> 125 mg/L dialysis fluid.
--

Using the patients usual exchange volume.

### **B. Child presenting at the Emergency Department with peritonitis of unknown aetiology, with marked systemic features.** <sup>(1,2,3)</sup>

On presentation at the Emergency Department, the child is to be assessed by the medical officer and the nephrologist on-call contacted immediately. Parenteral antibiotic therapy may then be prescribed at the discretion of the nephrologist.

#### 1. Loading dose:

##### IP antibiotic administration:

Single dose of: <b>vancomycin</b> 1000 mg/L dialysis fluid  <b>AND</b>  <b>ceftazidime</b> 500 mg/L dialysis fluid.
---

These should be added to the peritoneal dialysis fluid (using the patients usual exchange volume) and left to dwell for six (6) hours. **OR**

**IV antibiotic administration:**

IV dose of:           **vancomycin** at a dose of 15mg/kg body weight to a maximum of 500 mg  
**AND**  
                                  **ceftazidime** 25-50 mg/kg body weight to a maximum of 2 gram.

**2. Maintenance dose:**

Thereafter, peritoneal dialysis is continued with maintenance antibiotics of:

**vancomycin** at a dose of 25 mg/L dialysis fluid  
**AND**  
                                  **ceftazidime** 125 mg/L dialysis fluid,

Using the patients usual exchange volume.

**C.     *Peritonitis occurring while an Inpatient or within 7 days of discharge, (i.e.: Health Care Associated Infection).*** <sup>(1,2,3,4)</sup>

**1. Loading dose:**

Single dose of:           **vancomycin** 1000 mg/L dialysis fluid  
**AND**  
                                  **gentamicin** 8 mg/L dialysis fluid.

Added to the peritoneal dialysis fluid (using the patients usual exchange volume) and left to dwell for six (6) hours.

**2. Maintenance dose:**

Thereafter, peritoneal dialysis is continued with maintenance antibiotics of:

**vancomycin** at a dose of 25 mg/L dialysis fluid  
**AND**  
                                  **gentamicin** 4 mg/L dialysis fluid.

Using the patients usual exchange volume.

**D.     *CICU inpatient with peritonitis of unknown aetiology.*** <sup>(1,2,3)</sup>

If peritonitis is suspected (cloudy effluent or febrile / symptomatic child), obtain a specimen of PD fluid. This specimen should be collected from the dialysis catheter, by disconnecting the PD set, after thoroughly cleaning with Povidone Iodine or Aqueous 0.5% chlorhexidine acetate. Inoculate a set of blood culture bottles with PD fluid. These should be sent with the PD fluid specimen for cell count, microscopy culture and sensitivity.

**1. Loading dose:**

IV dose of: **vancomycin** at a dose of 15 mg/kg body weight to a maximum of 500 mg  
**AND**  
**ceftazidime** 25-50 mg/kg body weight to a maximum of 2 gram.

**2. Maintenance dose:**

Peritoneal dialysis is then continued with maintenance antibiotics of:

**vancomycin** at a dose of 25 mg/L peritoneal dialysis fluid  
**AND**  
**ceftazidime** 125 mg/L peritoneal dialysis fluid.

Using the patients usual exchange volume, until culture results available.

**Notes:**

- Dependent of patient circumstances Intraperitoneal antibiotics may be more appropriate than intravenous, this should be discussed with the CICU director.
- Patients maintained on manual PD are to have antibiotics loaded into every exchange.
- Once cultures are available, treatment should be discussed with the CICU director and/or treating nephrologist so that it can be individualised according to the specific patient circumstances as well as the culture results.

**E. Geographically isolated child with peritonitis of unknown aetiology.**

The geographically disadvantaged child with peritonitis will present to his / her local medical officer or local hospital as arranged. Assessment will be made and the nephrologist on-call at SCH contacted by the local treating medical officer. Generally first line management will depend on the clinical situation.

**1. Loading dose:**

Administration route for initial loading doses of antibiotic therapy will be at the discretion of the nephrologist on-call, generally IMI or IVI. The choice of drug will be dependent on the individual patient situation and drug availability. The usual drugs used will be:

**A first generation cephalosporin:**

Drug	Dose	Maximum dose
<b>cephazolin</b>	50 mg / kg body weight	2 gram (IV, IM)
<b>OR</b>		
<b>cefalotin</b>	12.5-25 mg / kg body weight	2 gram (IV, IM)

**AND one of the following**

Drug	Dose	Maximum dose
<b>ceftazidime</b>	25-50 mg / kg body weight	2 gram for IV, OR 2 gram for IM
<b>OR</b>		
<b>gentamicin</b>	2 mg / kg body weight	80 mg (IV, IM)



- The child will generally be transferred to Sydney Children's Hospital for further management.

**F. Child presenting with recurrent peritonitis episode within 4 weeks of ceasing antibiotic treatment for peritonitis.** <sup>(1,2)</sup>

A child who presents with peritonitis within 4 weeks of ceasing antibiotic treatment for a previous peritonitis episode is generally considered to have recurrent or relapsing peritonitis. Initial treatment should be as previously noted. Once the organism has been identified treatment should be tailored and patient treated for at least 3 weeks. A second agent may be indicated, check with Infectious Diseases consultant.

Any second relapse of any organism should be treated with removal of the PD catheter. Antibiotics should be continued for 2 weeks. In general catheter should not be replaced for 2 to 3 weeks. <sup>(1,3)</sup>

**Continuing management once culture and sensitivities are available:**

Once cultures are available, length of treatment is to be individualised according to the results. In general these are: <sup>(1,2,3)</sup>

- Treatment for peritonitis caused by gram positive organisms should be continued for 14 days, except staphylococcus species, which should be a 21 day treatment course. <sup>(1)</sup>
- If culture is positive for gram negative organisms, antibiotic choice and length of treatment dependent on organism usually 14 days; except pseudomonas / Stenotrophomonas species which should be treated for 21 days. Two antibiotics should always be used to treat pseudomonas peritonitis. <sup>(1,2,3)</sup>
- If culture positive for anaerobes, length of treatment should be 21 days.
- If culture positive for multiple organisms, length of treatment should be 21 days.
- If culture is positive for fungal organisms the catheter is generally removed <sup>(1,2)</sup>, and haemodialysis commenced. Treatment for the fungal infection is continued for 2 weeks after complete resolution of symptoms <sup>(1)</sup>. If the catheter is not removed, treatment is usually for at least 6 weeks. Prolonged treatment with antifungal agents to determine response and to attempt clearance is discouraged <sup>(2)</sup>. Obtain Infectious Diseases consultation for appropriate management.
- If no organism is identified by culture antibiotic therapy covering both gram negative and gram positive organisms should be continued for 2 weeks. Continue treatment with initial drug regimen <sup>(1,2)</sup>, however aminoglycoside should be discontinued at 72 hours. <sup>(1)</sup>
- CAPD patients have antibiotics loaded into every exchange.
- CCPD patients have antibiotics loaded into all PD fluid. The **day-time dwell volume should be the same as the night time dwell volume for the duration of the treatment.**
- Consider removal of peritoneal dialysis catheter for refractory peritonitis. <sup>(1,2,4)</sup> It may also be appropriate to consider removal of peritoneal dialysis catheter for repeat and relapsing peritonitis. <sup>(1,2)</sup>

### ***MRSA (multi resistant Staphylococcus aureas) peritonitis(after consultation with Infectious Diseases consultant)***

- **Rifampicin** and sodium fusidate (orally) may be added for the treatment of *Staphylococcus aureus* if the peritoneal cultures remain positive for MRSA despite 5 to 7 days of treatment with IP. **vancomycin**. Treat for a period of 3 weeks.
  - Rifampicin. Oral: 10 to 20 mg / kg / day (Max 600mg) in one or two divided doses.
  - Sodium fusidate. Oral: Tablets: 10 – 15mg/Kg/dose (adult 500mg) three times a day. Round dose to part or whole tablet. (\*\* Fusidic Acid Mixture is no longer available\*\*).
  - Warn patient and parents of the likely change in colour of the PD fluid.

### ***Decolonisation of Staphylococcus aureus*** <sup>(6)</sup>

- If *Staphylococcus aureus* is cultured from either the PD catheter exit site or nasal swabs, and the organism isolated is the same as the organism isolated in the PD fluid, eradication of nasal carriage should be attempted using the “5 day decolonisation plan”.
- Nasal mupirocin
  - 2% nasal mupirocin (Bactroban) apply to each nostril, three times a day for 5 days
  - If on an antibiotic for MSSA or MRSA therapy, the “5 day decolonisation” should coincide with the last 5 days of antibiotic treatment
- Body wash
  - Suitable body washes are either 1% triclosan (PhisoHex) or a chlorhexidine-based wash like Microshield (2) TM which is a 2% chlorhexidine gluconate wash. If however the child has eczema, then Oilatum Plus should be used instead.
  - Apply the antiseptic body wash in the bath or shower daily for the same 5 days as nasal mupirocin.
  - Take care to wash hair, under the arms, inguinal region and in any skin folds.
  - Allow the antiseptic to remain on the skin for at least 5 minutes before washing off.

### **G. Line Contamination** <sup>(1,2,3)</sup>

If a patient has contaminated his/her dialysis lines, luer lock, or catheter, the patient is to have an emergency line change and antibiotic cover.

The antibiotic cover is to be a once only dose of:

<b>cefalotin 500 mg/L</b> <b>AND</b> <b>ceftazidime 500 mg/4 mg/L.</b>
--

added to the usual dwell volume of peritoneal dialysis fluid. This exchange should dwell for six hours.

**All antibiotics are to be given intra-peritoneally, not intravenously.**

Patients to have their temperature checked 4 hourly.

Observe for cloudy bags.

## References:

1. Warady, B.A. et al (2012) Consensus guidelines for the Prevention and Treatment of Catheter-Related Infections and Peritonitis in Pediatric Patients Receiving Peritoneal Dialysis:2012 Update Peritoneal Dialysis International, Vol 32, pp S32-S86.
2. Li, P. K. et al (2010) Peritoneal Dialysis-Related Infections Recommendations: 2010update. Peritoneal Dialysis International, Vol 30, pp 393-423.
3. CARI guideline: Management of Peritoneal dialysis-associated peritonitis in adults and children. 2013. [http://www.cari.org.au/Dialysis/dialysis%20peritonitis/management\\_of\\_PD\\_associated\\_peritonitis\\_final\\_26Feb2014.pdf](http://www.cari.org.au/Dialysis/dialysis%20peritonitis/management_of_PD_associated_peritonitis_final_26Feb2014.pdf)
4. CARI guideline: Catheter removal, adjunct therapies and timing of reinsertion of peritoneal dialysis catheter after peritonitis. 2013. [http://www.cari.org.au/Dialysis/dialysis%20peritonitis/Catheter\\_removal\\_adjunct\\_therapies\\_final\\_15April2014.pdf](http://www.cari.org.au/Dialysis/dialysis%20peritonitis/Catheter_removal_adjunct_therapies_final_15April2014.pdf)
5. SCH patient peritonitis statistics from September 1999 to January 2015.
6. Multi Resistant Staphylococcus Aureus (MRSA): Management – SCH <http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2012-7003.pdf>
7. Warady, B.A. et al (2000) Consensus guidelines for the Treatment of Peritonitis in Pediatric Patients Receiving Peritoneal Dialysis. Peritoneal Dialysis International, Vol 20, pp 610-624.
8. Piraino, B. et al (2005) Peritoneal Dialysis-Related Infections Recommendations: 2005 update Peritoneal Dialysis International, Vol 25, pp 107-131.
9. Keane, W.F. et al (2000) Adult peritoneal dialysis-related peritonitis treatment recommendations: 2000 update. Peritoneal Dialysis International, Vol 20, pp

## Related Documents

- Antimicrobial Stewardship – SCH <http://chw.schn.health.nsw.gov.au/o/documents/policies/policies/2012-7002.pdf>
- Vancomycin – SCH <http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2012-7003.pdf>
- Multi Resistant Staphylococcus Aureus (MRSA): Management – SCH <http://chw.schn.health.nsw.gov.au/o/documents/policies/procedures/2015-7017.pdf>
- Peritoneal Dialysis: Care of the Paediatric PD Patient – SCH: <http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2015-7020.pdf>

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## Appendix 1: Antibiotic Dosing Recommendations

Administration should be via intra-peritoneal route unless otherwise specified.

	Continuous Therapy Loading dose	Continuous therapy Maintenance dose	Intermittent therapy
<b>Glycopeptides</b>			
Vancomycin	1000 mg/L	25 mg/L	30 mg/kg every 5-7 days
Teicoplanin	400 mg/L	20 mg/L	15 mg/kg every 5-7 days
<b>Cephalosporins</b>			
Cefazolin/Cefalotin	500 mg/L	125 mg/L	20 mg/kg daily
Cefotaxime	500 mg/L	250 mg/L	30 mg/kg daily
Ceftazidime	500 mg/L	125 mg/L	20 mg/kg daily
<b>Antifungals</b>			
Fluconazole	-	-	1 mg/kg/day <b>IV</b> 6-12 mg/kg <b>IP, IV</b> or <b>PO</b> daily hours (max dose 400 mg)
Caspofungin	70 mg/m <sup>2</sup> IV daily (max dose 70 mg)	50 mg/m <sup>2</sup> IV daily (max dose 50mg)	
<b>Aminoglycosides</b>			
Amikacin	25 mg/L	12 mg/L	-
Gentamicin	8 mg/L	4 mg/L	-
Tobramycin	8 mg/L	4 mg/L	-
<b>Penicillins</b>			
Ampicillin	-	125 mg/L	-
<b>Quinolones</b>			
Ciprofloxacin	50 mg/L	25 mg/L	-
<b>Combinations</b>			
Trimethoprim/ Sulfamethoxazole (Co-trimoxazole)	320/1600 mg/L	80/400 mg/L	-
<b>Others</b>			
Clindamycin	300 mg/L	150 mg/L	-
Metronidazole	-	-	May be given <b>IV, PO</b> or <b>rectally</b> in 3 doses See Paediatric Pharmacopoeia for dosing.
Rifampicin	-	-	10 to 20 mg/kg/day <b>PO</b> (max dose 600 mg/day)
Aztreonam	1000 mg/L	250 mg/L	-

Table adapted from Warady, B.A. et al (2000/2012) Consensus guidelines for the Prevention and Treatment of Catheter-Related Infections and Peritonitis in Pediatric Patients Receiving Peritoneal Dialysis. :2012 Update Peritoneal Dialysis International, Vol 2032, pp 610-624S32-S86; and Warady, B.A. et al (2000) Consensus guidelines for the Treatment of Peritonitis in Pediatric Patients Receiving Peritoneal Dialysis. Peritoneal Dialysis International, Vol 20, pp 610-624.

All patients treated with vancomycin, gentamicin and tobramycin should have levels attended after 48 hours of treatment, then weekly or as required by the levels.

## Appendix 2: Treatment for peritoneal dialysis associated peritonitis.

### Emergency Department Flow Chart

