Recurrent CAPD Peritonitis

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Definition of Recurrent Peritonitis

Arbitrarily defined as another episode of peritonitis with the same genus and species that caused the preceding episode of peritonitis within 4 weeks of completion of the antibiotic course.

Causes of Recurrent Peritonitis

1) Noncompliance
2) Inadequate treatment :
   Intracellular sequestration of bacteria(S. aureus)
3) Tunnel infection
4) Exit-site infection
5) Intra-abdominal abscess
6) Biofilm on catheter

Pathogenesis of Recurrent Peritonitis

Resistant peritonitis is commonly associated with either 1) bacterial adherance along the catheter tunnel when Staphylococcus aureus or Pseudomonas species are involved or 2) formation of biofilm along the tunnel or intraperitoneal portion of catheter when Staphylococcus epidermidis or other slime forming microorganisms are involved. Theoretically, removal of the involved catheter should eliminate the nidus for infection(Table 1).

1. Biofilm

Bacterial adherence to various bioprosthetic materials used in the tratment of human disease can produce biofilm that are resistant to antibiotics and natural host defence mechanisms and can act as a source of disseminated infection.

The property of "biofilm" is the bacterial production of an extensive exopolysaccharide glycocalyx which acts as an ion-exchange resin allowing the adherent bacteria to draw nutrition from the host but protecting them from the damaging effects of various antibiotics, antibodies, and phagocytes.

Both the gram positive and gram negative bacteria can form biofilm adherent bacterial microcolonies(BABM) that can serve as reservoirs of infection.

1) Slime Production by Coagulase Negative Staphylococci- A Major Virulence Factor ?

Kristinssson KG, et al. Contr Nephrol 57:79, 1987

Coagulase negative staphylococci(CNS); a major part of the normal flora of human and generally low virulence but CNS emerged as important pathogens in infection associated with prothetic materials

Production of slime: enhance the adherence of CNS to plastic materials and may protect the organism aganist host defences and antibacterial agents

Table 1. Correlation of Peritonitis Episodes with Presence or Absence of Slime

Peritonitis	Slime producer	Non-slime producer	Total
Recurrent	11	7	18
Not recurrent	11	34($p<0.02$)	45

(Karl G Kristinsson et al. Contr. Nephrol 57:79, 1987)

Table 2. Groups of Different T Catheters Examined According to Clinical Peritonitis, Exit site Infection and Dration of Dialysis of CAPD Patients

Group	ESI	Peritonitis	CAPD (duration, mos)	T catheters (number)
A	+	−	−	4
B	+	+	15.20	5
C	−	+	20.67	6
D	−	−	2.6	5

Table 3. Prevalence of Bacterial Biofilm in Different Groups of Patients

Group	Extent of biofilm(%)(SEM)	
	Inside x±SD	Outside x±SD
A	44.8± 6.2	28.3±11.0
B	43.5±14.3	39.5±16.4
C	47.7±12.4	36.3± 8.1
D	43.9± 5.8	39.0±10.6

Table 4. Bacterial Morphology from the Culture of Scrapings of T catheters in Different Groups of the Study after 16 hours at 37℃ in Serial Dilution

Bacterial growth				
Bacterial species	Groups			
	A	B	C	D
Staph. epidermidis	1	2	3	1
Staph. aureus	3	2	−	−
Others :				
Enterobacteriacae	−	−	−	1
Pseudomonas	−	1	−	−
Mixed	−	−	1	1
No growth	−	−	2	3

But many different opinions have been reported about the significance of biofilm in the pathogenesis of recurrent peritonitis as shown in the following papers.

2) Biofilm on Tenckhoff Catheters: A Negligible Source of Contamination; Verger C et al. Perit Dial Bull 7: 174, 1987

17 CAPD patients to elucidate the role of biofilm as a source of peritonitis. 7 had 11 episodes of peritonitis and 10 with no history of peritonitis.

4 samples from each catheter; swabs from inside the titanium adaptor, a 5 cm proximal segment removed and sectioned longitudinally to obtain luminal scrapings, a nylon brush sample from the entire catheter, and flushed fluid after brushing.

100% of samples : no growth. Scanning EM of 10 catheters: inner surface of all covered with protein-like membranous deposit. On 2 catheters, biofilm looked like microcolonies but not confirmed by culture.

Suggestion : two types of biofilm.

(1) made up of adherent bacteria and glycocalyx

(2) non-contaminated protein-like deposits

3) Effect of Exit Site Infection and Peritonitis on the Distribution of Biofilm Encased Adherent Bacterial Microcolonies(BABM) on Tenckhoff Catheters in Patients Undergoing CAPD; Dasgupta MK et al.: in Khanna R et al eds. Advances in CAPD. Proc 6th Ann CAPD Conferences, Kansas City, 1986; 102

Evaluated the prevalence and distribution of BABM by SEM and TEM, inside and outside of serial segment of 20 T catheters with or without ESI or repeated peritonitis(>3 episodes). Prevalence of BABM in all groups were equal and cultures with predominantly Staph epidermidis within the BABM.

The expression of peritonitis is probably due to failure of undetermined local host factos to contain bacteria within the BABM and thus prevent disseminated infection(Table 2-4).

Therapeutic Modalities of Recurrent CAPD Peritonitis

1. Change of Antibiotics(Fig. 1)

Relapsing peritonitis with coagulase positive or negative staphyloccoci should be treated with

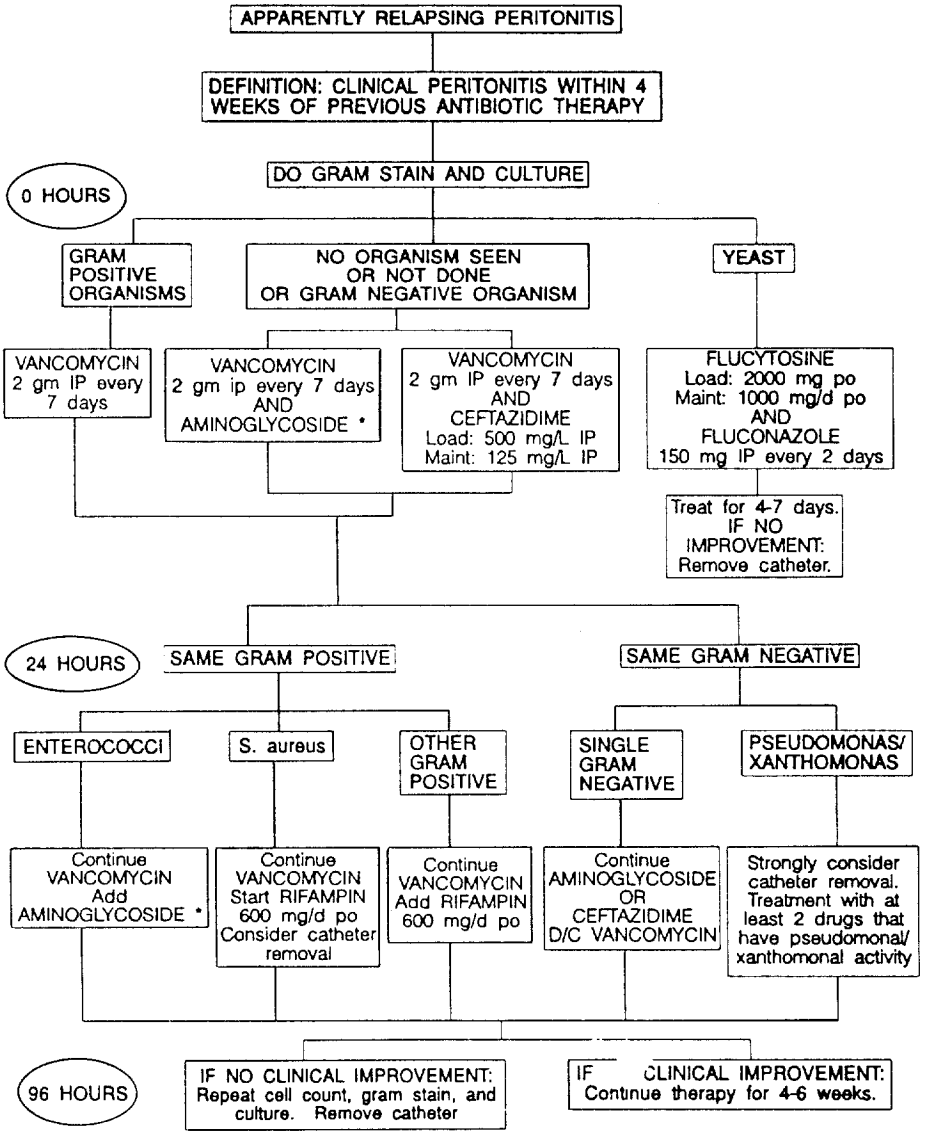


Fig. 1. Peritonitis management decision tree as recommended by the Ad Hoc advisory committee on peritonitis-management(1992).

vancomycin and rifampin for approximately 4 weeks.

If enterococci are recultured, vancomycin and aminoglycoside are recommended with consideration for intra-abdominal abscess. If no clinical response after 96 hours of this therapy, remove the catheter.

If the patient responds clinically, but subsequently relapses an additional time, catheter removal and replacement are recommended.

In relapsing peritonitis caused by gram negative organisms, one should clinically evaluate for an intra-abdominal abscess. Therapy with ceftazidime or aminoglycoside alone can be done once culture results are known. If pseudomonas are cultured again, the catheter should be removed.

2. Catheter Insertion after Removal

The optimal time period between catheter removal for infection and reinsertion of a new catheter is not known. Empirically a minimum of 3 weeks between catheter removal and reinsertion of a new catheter is recommended.

However, recent experience have suggested that a shorter interval may be acceptible.

A. Removal and Replacement of PD Catheter as an One-Step Procedure

1) Advantages of One-step Catheter Replacement Procedure

(1) No temporary hemodialysis needed

(2) Saving the patients from a second operation

(3) Prevention of the adhesion in the peritoneal cavity

2) Indication of One-step Procedure

(1) Non-infectious mechanical complication

(2) Infectious complicaion

- not associated with pseudomonas, fungus, or surgical complications

- temporary control of peritonitis with ip antibiotics for about 7 days

B. Two stage catheter removal and re-implantation

Adequate antibiotics with removal of CAPD catheter and re-insertion of catheter after infection control. Empirically minimum 3 weeks is recommended between catheter removal and re-insertion.

3. Externalization of External Cuff

Recurrent peritonitis with intractible exit site infection.

4. Shift to hemodialysis

In cases with resistant peritonitis not responded to catheter replacement with adequate antibiotics.

Recent papers about catheter replacement

(1) The Impact of Catheter Replacement and Change to Disconnect Systems on Recurrent Peritonitis: Hurt D and MacDonald J, Univ of Manchester; UK Seattle, Washington 16th Annual Conf on PD Feb. 1996

Between Oct. 1994 and May 1995; 12/139 patients had recurrent peritonitis.

Standard system 9/109, Disconnect system 3/30

Multiple episodes of recurrent peritonitis (>3 episodes) only in standard system.

Management protocol for recurrent peritonitis

After 3rd recurrence, treatment with ip Urokinase 5000 units at 0 and 48 hours.

If 4th recurrence, the catheter replaced immediately after 7 day course of IP antibiotics and converted to disconnect system.

All four cases remained on CAPD without peritonitis between 6-12 months.

※ Simultaneous Removal and Replacement of Infected Tenckhoff catheters; Majkiwski NL, Mendley SR : Children's Memorial Hospital/Northwestern Univ, Chicago USA; Seattle, Washington 16th Annual Conf on PD Feb. 1996

35 simultaneous Tenckhoff catheter removal and replacement procedure over 14 years.

17 switch for recurrent S. aureus peritonitis of whom 5 had tunnel infections --- 5 cases of peritonitis occurred in 60 days but no cases with S. aureus.

8 switch due to recurrent peritonitis with other organisms ---one case of recurrence due to E. coli.

15 cases for exit site of tunnel infections --- While 7 cases developed peritonitis within 60 days, only 3 due to cross contamination.

5. Other methods

1) Treatment of recurrent and resistant CAPD peritonitis by temporary withdrawal of peritoneal dialysis without removal of the catheter; Loatelli A et al. Adv Perit Dial 11:176-8, 1995

3 patients: 1 with resistant Klebsiella peritonitis and 2 with recurrent peritonitis(one due to Staph. and the other to Enterococcus) by stopping CAPD for a 2-4 week period leaving the catheter in situ and continuing antibiotic therapy.

All 3 patients had resolution of the infection and restarted CAPD.

2) Use of streptokinase or urokinase in recurrent CAPD peritonitis: Desgupta MK Adv Perit Dial 7:169, 1991

3) Long-term intraperitoneal vancomycin : D.G. Oreopoulos et al.

Three patients on CAPD for 48, 20, 56 months, infection rate 1.75, 3, and 2.14 episode/year. Organisms; Staph aureus, epidermidis, 1 gm vancomycin ip once a week prophylactically 2 patients had no peritonitis for 13 and 21 months; 3rd patients 1 doutful episode in 18 months.

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