Infectious complications of Peritoneal Dialysis
Prevention and management

From 30 years of our experience when confirmed by ISPD Guidelines 2005

Alain Slingeneyer : Montpellier
Main concern = PERITONITIS

1) Peritoneal infection may present
   • as a light complication, treated at home
   • as a deadly severe surgical peritonitis

2) Infection of peritoneal catheter may lead to peritoneal infection
Peritonitis

*Is a possible cause of...*

- Peritoneal membrane damage (*sclerosis*)
- Hospitalization and pain
- Temporary loss of UF
- Malnutrition (*via increased protein losses*)
- Extra cost
- Technique failure
- Catheter loss
- Possible death
Hospitalization in PD Patients

- Cardiac: 27%
- Peritonitis: 25%
- Surgery: 18%
- Other Infections: 19%
- PVD: 11%

Fried, at al., AJKD 1999;33:929
Time Course of UF after peritonitis

Ates, et al., PDI 20;2000:220-226

*p<0.05 vs baseline for all times

UF, ml/exchange

* p<0.05 vs baseline for all times

Ates, et al., PDI 20;2000:220-226
Peritoneal Infection

**DEFINITION:**

1. Cloudy effluent: >100 wbc/ml and > 50% N
2. Signs and symptoms
3. Identification of organism

Two of three required for diagnosis
Unused bag

Cloudy effluent

Normal effluent
Clinical course in PERITONEAL INFECTION

Introduction of bacteria into peritoneal cavity

Bacteria → Peritoneal wall → Multiplication

ASYMPTOMATIC FOR 24 - 48 HRS

Shed into PD fluid

Peritoneal immunological response

Abdominal pain, cloudy effluent = diagnosis of infection
Is peritonitis ineluctable?

What are the routes of infection?

How to prevent peritoneal infection?
Many patients don’t get peritonitis!

A minority of PD patients have the majority of peritonitis episodes

Overall rate 0.5 episodes/year

Finkelstein AJKD 2002;39:1278-1286

Rippe KI 2001; 59:348-357
Routes of Peritoneal Infection

- Exchange procedure “Touch contamination”
- Titanium/transfer set
- Peri-catheter
- Transcolonic
- Haematogenous
Sources of Peritonitis, %

- Contamination: 41%
- Catheter related: 23%
- Enteric injury: 11%
- Perioperative: 6%
- Diarrhea/UTI: 4%
- Sepsis: 1%
- Unknown: 14%

Harwell PDI 1997
ISOLATION OF RESPONSIBLE ORGANISM IS CRUCIAL
Micro-Organisms causing peritonitis

- CNS: 22%
- S. aureus: 13%
- Pseudo/Xanth: 7%
- other GPC: 8%
- enterococcus: 8%
- other GN: 2%
- bacteroides: 18%
- multiple: 22%
- fungus: 1%
- no growth: 4%

Harwell PDI 1997;17:586-594
Identification of bacteria is helpful to understand the route of contamination

- Coagulase - Staphylococci
- Staphylococcus aureus
- Pseudomonas-Xanthomonas
- Other Gram - bacteria
- Enterococcus
- Bacteroides
- Multiple
- Fungus
- No growth

Hands → Water → Colon → Microbiology Problem

No growth
Outcomes of Peritonitis

% of all episodes (without ESI/TI)

CNS  S. aureus  GN

Bunke, et al., KI 1997

Hospitalization  Catheter removed  Transfer
### Terminology for Peritonitis

<table>
<thead>
<tr>
<th>Episode</th>
<th>Therapy</th>
<th>Organism</th>
</tr>
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<tbody>
<tr>
<td><strong>Recurrent</strong></td>
<td>New</td>
<td>≤ 4 weeks of completion</td>
</tr>
<tr>
<td><strong>Relapsing</strong></td>
<td>New</td>
<td>≤ 4 weeks of completion</td>
</tr>
<tr>
<td><strong>Repeat</strong></td>
<td>New</td>
<td>&gt; 4 weeks of completion</td>
</tr>
<tr>
<td><strong>Refractory</strong></td>
<td>Same</td>
<td>&gt; 5 days of appropriate</td>
</tr>
<tr>
<td><strong>Catheter-related</strong></td>
<td>ESI or tunnel</td>
<td><strong>Within 2 months</strong></td>
</tr>
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</table>
What about Touch Contamination?
Peritonitis rates have improved over the years with new systems.

- But serious peritonitis is unchanged.

<table>
<thead>
<tr>
<th></th>
<th>st line</th>
<th>Y set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staph epi</td>
<td>0.34</td>
<td>0.17</td>
</tr>
<tr>
<td>Staph aur</td>
<td>0.15</td>
<td>0.13</td>
</tr>
<tr>
<td>Gram -ve</td>
<td>0.12</td>
<td>0.10</td>
</tr>
<tr>
<td>Fungal</td>
<td>0.02</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Holly AJKD 1994
Peritonitis rate is reduced with APD

Peritonitis in CAPD compared to APD

Episodes per year

Peritonitis rates—lower on APD than CAPD
0.31 versus 0.64 per year at risk

From Rodriguez-Carmona PDI 19; 1999
Prevention of contamination via the connections

- Perfect hands washing (alcohol !)
- Perfect hands drying
- Cap and mask
- Education on fingers position
- Every body do the same: training and retraining

Protocols
PRENDRE UNE DOUCHE AU DEUXIEME MOIS APRES LA POSE DU CATHETER

EQUIPEMENTS : La pose d'une baignoire est nécessaire. Le protocole ci-dessous est à suivre pour une pose correcte.

PRINCIPES :
- Pour une pose correcte, il est nécessaire de suivre le protocole ci-dessous.
- Le cathéter doit être posé en respectant les normes sanitaires.
- Le patient doit être mis en position adéquate pour la pose du cathéter.

PROTOCOLLE :
1. Nettoyer l'endroit du site de pose.
2. Appliquer un antiseptique sur la peau.
3. Placer le cathéter dans le périmètre approprié.

MATERIELS NÉCESSAIRES :
- Antiseptique
- Cathéter
- Gants stériles

PRENDRE UN RAIN

PRINCIPES :
- Prendre un bain est une pratique qui doit être suivie après la pose du cathéter.
- Le bain doit être pris dans un environnement propre.
- Le patient doit être couché pour le bain.

PROTOCOLLE :
1. Mettre le patient en position adéquate pour le bain.
2. Mettre le patient en position adéquate pour le bain.
3. Mettre le patient en position adéquate pour le bain.
4. Mettre le patient en position adéquate pour le bain.

PRENDRE UNE DOUCHE TOUS LES JOURS

PRINCIPES :
- Prendre une douche tous les jours est une routine quotidienne.
- Le bain doit être pris dans un environnement propre.
- Le patient doit être couché pour le bain.

PROTOCOLLE :
1. Mettre le patient en position adéquate pour le bain.
2. Mettre le patient en position adéquate pour le bain.
3. Mettre le patient en position adéquate pour le bain.
4. Mettre le patient en position adéquate pour le bain.

PRENDRE UNE DOUCHE DANS LES DEUX PREMIERS MOIS SUIVANT LA POSE DU CATHETER

PRINCIPES :
- Prendre une douche dans les deux premiers mois suivant la pose du cathéter est recommandée.
- Le bain doit être pris dans un environnement propre.
- Le patient doit être couché pour le bain.

PROTOCOLLE :
1. Mettre le patient en position adéquate pour le bain.
2. Mettre le patient en position adéquate pour le bain.
3. Mettre le patient en position adéquate pour le bain.
4. Mettre le patient en position adéquate pour le bain.
CATHETER RELATED INFECTIONS
Peritonitis related to catheter infection

- Bacteria more often encountered
  - Staphylococcus aureus
  - Pseudomonas species

- Biofilm related problems

- Changing a catheter is less dangerous than a severe peritonitis
BASIC RULES FOR A HEALTHY EXIT SITE

- Fibrosis maturation impeded by:
  - micro-organisms (even without infection)
  - air
  - antiseptics (Povidone-iodine)

- Two months are necessary for:
  - complete fibrosis around the cuffs
  - sinus epithelialisation

- Any trauma of exit site favours infection
  (proven in 10% of cases)
A PERFECT EPITHELIALISATION OF THE SINUS = A HEALTHY EXIT SITE
The TWO first months are critical ...

- Catheter must be perfectly stabilised
  - First dressing changed after 15 days
  - Extension placed in the operating room

- No traumatic care
  - No anxiety to see what happens underneath the catheter

- No contact with tape water
  - Water proof dressing for shower and bath
  - During two first months after catheter insertion or catheter exteriorisation (Moncrief technique)
  - Dressing redone after shower
Exit site infection: diagnosis

- Redness > 3 mm at exit site
- Pus flow (spontaneously or on cuff pressure)
- Tumour, pain (above the tunnel)
- Fleshy granuloma
- Disruption of the epithelium, along the sinus
- Positive bacteriological cultures

Bacterio + alone is not an infection

Be vigilant about Staph. aureus and Pseud. aeruginosa
Site of infection

1) Sinus
2) Outer cuff
3) Tunnel
4) Inner cuff
4) Peritoneum

Diagnosis of INFECTION SITE

50% of peritonitis are related to unsolved exit site/tunnel infection

Scalamona, Am. J. Kidney Dis. 1991
HEMATOMA POST TRAUMA
GRADE 1 OF INFECTION
ACUUTE INFECTION
OF EXIT SITE
CHRONIC INFECTION OF EXIT SITE
Never accept it!

Peritoneal catheters and exit-site practice.
Toward optimum peritoneal access
P.D.I. vol 18 N° 1, 1998, Table 2

Insertion of a new catheter
\(=\) lower risk than a severe peritonitis
« Botryomycoma » or
"fleshy granuloma" or
« like-raspberry tumour »
too long neglected
TUNNEL INFECTION

- Redness, edema and/or tenderness over the subcutaneous tunnel
- Often ESI is associated but some cases are occult
- May need ultrasound to diagnose
  - clinical criteria: rate 0.13 ep/year
  - ultrasound criteria: rate 0.35 ep/year
  - negative US: 0% catheter loss
  - positive US: 50% catheter loss

(Plum AJKD 1994;23:94)
TREATMENTS OF EXIT SITE INFECTION

Prevention is **BETTER** than cure, but if curative action is needed use both medical and surgical.
CATHETER INFECTION: Prevention...

- Exit site orientated downward
- Double cuff catheter
- Prophylactic antibiotics at insertion
  (Vancomycin 1g IV superior to Cephalosporin 1g IV)
- Avoid haematoma and trauma
  First dressing redone after 15 days
CATHETER INFECTION: Prevention ...

- Permanent careful stabilisation (with or without dressing)
CATHETER INFECTION: Prevention...

- Diagnosis and treatment of S. aureus carriage
Diagnosis of Staphylococcus aureus carriage

- 10 days away from antibiotic treatment
- Wet and deep swab of the two nostrils
- Two swabs at 2 days interval

Two positive cultures = carrier
One + and one - third swab
Mupirocin prophylactic treatment

CARI Guidelines 2004
(Level II evidence)

Prophylactic therapy using mupirocin ointment, especially for *Staphylococcus aureus* carriage intranasally is recommended to decrease the risk of *S. aureus* catheter exit site/tunnel infections and peritonitis

Intranasal mupirocin twice daily x 5 days/month
Prophylactic antibiotic at exit site

Effective on:

- **Mupirocin** cream: Staphylo. aureus
- **Gentamicin** cream: Staphylo. aureus, Pseudo. aeruginosa
- **Ciprofloxacin** otologic solution: Staphylo. aureus, Pseudo. aeruginosa

Protocol to be adapted to local microbiological observations.
S. aureus exit site infections are reduced with mupirocin prophylaxis.
CATHETER INFECTION:

Prevention ...

- Monitoring of infection rates (ESI and peritonitis)
- Scoring system for ESI
- Education of nurses and patient
- At the slightest doubt
- The nephrologist is also concerned
MEDICAL TREATMENT

- Dressing every day
- Skin soaping (before antiseptic application)
  - antiseptic scrub
  - “Soap of Marseille”
- Cleaning the crusts
  - Hydrogen peroxide (20 volumes)
  - Diluted bleach
ANTIBIOTHERAPY

according Gram stain or history

LOCAL
(always)

• St. aureus:
  – Rifampicine (600 mg) + Protamine (1000 U)
  – Mupirocin cream
  – Fucidin cream

• Gram-:
  – Gentamicin cream
  – Ciprofloxacin solution

GENERAL
(according severity)
(PO or IP)

• St. aureus:
  – First generation cephalosporin
  – Vancomycin if MRSA
  – Rifampicin in association

• Gram-:
  – Quinolone (2 hours before others)
  – 3rd generation cephalosporin

Duration: 2 to 4 weeks
SURGICAL TREATMENT

- Fleshy granuloma:
  - Silver nitrate pen or electrocoagulation

- Sinus:
  - Reduce the length of the sinus:
OPENING THE SINUS TO TREAT LOCALISED INFECTION
SURGICAL TREATMENT

- **Fleshy granuloma**: 
- **Sinus**: 
- **Outer cuff**: 
  - Unroofing technique 
  - Peel away the cuff (shaving technique)
The unroofing shaving technique
SURGICAL TREATMENT

- **Fleshy granuloma**:

- **Sinus**:

- **Outer cuff**:

- **Tunnel**:
  - Shorten the tunnel length
  - Peel away the outer cuff

- **Peritonitis**:
  
  *If same organism at the exit site, remove the catheter*
GOOD RESULTS ARE POSSIBLE!!
Comparison of frequency
1 event / 1 patient-year

<table>
<thead>
<tr>
<th></th>
<th>Literature*</th>
<th>Our experience**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leakage</td>
<td>0 to 0.017</td>
<td>0.007</td>
</tr>
<tr>
<td>Drainage prob.</td>
<td>0 to 0.21</td>
<td>0.02</td>
</tr>
<tr>
<td>Exit site infect.</td>
<td>0.05 to 0.65</td>
<td><strong>0.05</strong></td>
</tr>
</tbody>
</table>

* Meta-analyse by Ash

** 1119 Tenckhoff (straight and curl)
HAEMATOGENOUS and TRANS COLONIC CONTAMINATION
Antibiotic prophylaxis for extensive dental procedures

Single oral dose of amoxicillin 2 g two hours before.
Abdominal Catastrophe with Associated Peritonitis

- Ischemic bowel disease
- Ruptured sigmoid diverticula
- Appendicitis
- Gangrenous cholecystitis
- Perforation in association with ulcer, endoscopy, polypectomy

Harwell PDI 1997
MULTI-ORGANISM PERITONITIS

More than one organism in 9% of episodes

**Gram positive** - staph epi and aureus;
- contamination and/or catheter infection
- low mortality

**Gram negative** - bowel should be suspected
- anaerobes, 2 bacilli or fungus
- or Enterococcus + G- bacillus
- bowel perforation or across wall?
- laparotomy should be considered

**Intra abdominal abscesses**
Outcome of Enteric Peritonitis

- peritonitis with intra-abdominal disease
- all other episodes

Harwell PDI 1997
Prevention against enteric peritonitis

- Fight against constipation (*hypokaliemia*)
- No enema
- Treat rapidly diarrhoea and gastro-enteritis
  - Nifuroxazide,
  - diosmectite,
  - ioperamide
- Prophylactic antibiotic treatment when enteroscopy prescribed (*prior*, 3 days after)
Antibiotic prophylaxis before endo-luminal procedures

Colonoscopy, polypectomy, endometrial biopsy, renal transplantation ...

- Empty abdomen and
- Ampicillin 1 g +
- Aminoglycoside +
- Metronidazole

1 single dose IV
Prophylactic Antibiotic Use

- **Extended use:**
  - does not prevent peritonitis
  - been shown for penicillins and septrin

- **Short term use:**
  - *in case of invasive procedures with transient bacteraemia (colonoscopy, dental)*

- **After technique break?**
  - no evidence to support prophylactic use
Trimethoprim/sulfamethoxazole prophylaxis to prevent peritonitis

Proven to have taken cotrimoxazole
Placebo

% patients free of peritonitis at one year

Churchill PDI 1988; 8: 125-128
Use of Oral Nystatin to reduce fungal peritonitis

*Observational studies suggest that previous exposure to antibiotics within last month were more common in patient developing fungal peritonitis.*

- Use of oral nystatin (or fluconazole, 100 mg) should be considered at time of administration of antibiotics to reduce fungal peritonitis
- Seems to be beneficial in programs with high baseline rate of fungal peritonitis
### Fungal Peritonitis without/with prophylaxis

<table>
<thead>
<tr>
<th>Reference</th>
<th>Prophylaxis</th>
<th>Incidence*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zaruba 1991</td>
<td>Nystatin tid</td>
<td>0.29 vs 0.03</td>
</tr>
<tr>
<td>Robitaille 1994</td>
<td>Nystatin or Keto</td>
<td>0.14 vs 0</td>
</tr>
<tr>
<td>Wadhwa 1996</td>
<td>Fluconazole qid</td>
<td>0.08 vs 0.01</td>
</tr>
<tr>
<td>Lo 1996</td>
<td>Nystatin qid</td>
<td>0.02 vs 0.01</td>
</tr>
<tr>
<td>Thodis 1998</td>
<td>Nystatin qid</td>
<td>0.02 vs 0.02</td>
</tr>
<tr>
<td>Williams 2000</td>
<td>Nystatin qid</td>
<td>0.01 vs 0.01</td>
</tr>
</tbody>
</table>

*antibiotic associated fungal peritonitis*

*Williams, et al., PDI 2000;20:352-353*
TREATMENT

The patient presents with

- Cloudy effluent
- With or without (Co Neg Staphylo.) other signs and symptoms of infection

What to do?
Treatment of PD Peritonitis:

- Patient questioning on last 48 h PD history
- Two to four rapid exchanges to relieve pain
- Analgesic medications (opioid if necessary)
- Heparin (2500 U/l) in PD solutions
- Careful exam of exit site
- Careful abdominal exam (localised pain?)
- Effluent and blood samplings
- Prescription of empirical antibiotic treatment
Differential diagnosis of Cloudy Effluent

- Specimen taken from “dry” abdomen
- Culture positive infectious peritonitis
- Infectious peritonitis with sterile cultures
- Chemical peritonitis
- Eosinophilia of the effluent
- Haemoperitoneum
- Malignancy (rare)
- Chylous effluent (rare)
Treatment of PD Peritonitis: 2

Empiric antibiotics

• In peritoneal dialysis patients with the provisional diagnosis of peritonitis, treatment should commence with a combination of intraperitoneal antibiotics that provide **adequate cover of both gram positive and negative organisms**.

• Renal units should monitor isolates, base empiric antibiotic choices on **isolate resistance patterns** and undertake regular reviews of empiric antibiotic choices based on the **local epidemiology**.

```
Gram +
Vancomycin
or 1st gener. cephalosporin

Gram -
3d gener. cephalosporin
or aminoglycoside
or quinolone
```
Factors influencing empiric therapy

- Signs and symptoms at presentation
- Probable organisms according to the probable cause
- Organisms sensitivities in your team (MRSA?)
- Cephalosporin-allergic patients
- Ototoxicity, especially with long term aminoglycosides
- Emergence of vancomycin resistance: Staphy. / Strepto.
- Convenience, cost
ISPD Guidelines 2005

Cloudy effluent

Clinical evaluation
Effluent evaluation
Gram stain and culture

Initiate empiric therapy

Possible treatment at home

- No fever
- Mild/no abdominal pain
- No risk factor for severe infection

1st generation cephalosporin and quinolone or ceftazidime

Hospitalisation required

- History of MRSA infection / carriage
- Recent-recurrent catheter infection
- Severe clinical presentation

Glycopeptide and ceftazidime or aminoglycoside
Adjusted antibiotic therapy once culture and sensitivities are known

- VRE/MRSA problem: largest use of vancomycin
  - re-dosing once serum level reaches 15 µg/ml

- Aminoglycosides should be discontinued as soon as possible (*to prevent vestibular and ototoxicity*)
  - not advisable if an alternative approach is possible

- Quinolone, PO
  - at least 2 hours before oral CaCO3, iron, sucralfate

- Rifampin should never be given as monotherapy
  - keep it in reserve if tuberculosis is endemic
VRE bacteria and Vancomycin

- Screening for VRE in stool cultures
  2 out of 37 were carriers (5.5 %)

- Over 6 month period 58 isolates of staphylococci
  17 staph aureus - all sensitive to V, M, R
  39 coagulase negative staph -
    all sensitive to Vancomycin
    9 (23%) sensitive to Methicillin
    17(49%) sensitive to Gentamicin
    24(62%) sensitive to Ciprofloxcin
    28(72%) sensitive to Rifampicin

- Findings suggested that 50% CNS would not respond to cephalosporin as empiric treatment

Sandoe, Gokal, Struthers, PDI 1997;17:617
Dosing of antibiotics

Antibiotic administration is preferable

- By IP route
- After a loading dose (with dwell time > 6 h)
- Continuous administration for cephalosporin
- Intermittent (long dwell) for vancomycin/aminoglycoside
- Transitory transfer of APD patient to CAPD (if possible)
- Treatment duration:
  - 2 weeks (general)
  - 3 weeks (Pseudomonas)
  - 4 weeks (fungal)
Coag - Staphylococcus on culture

• Adjust prescription to sensitivity

• Clear effluent after 48 hours:
  1 - No change in antibiotics
  2 - Change extension and connector
  3 - Consider urokinase prescription in the catheter
  4 - Review patient’s technique

• Still turbid effluent:
  – 2 and 3 as above
  – Consider vancomycin \textit{(if not yet prescribed)}
  – Consider rifampin prescription \textit{(600 mg/day, PO)}

• Relapsing episode:
  – Consider catheter replacement
Staphylococcus aureus on culture

• **Severe symptoms**
  - More often “catheter related” than touch contamination

• **Antibiotic treatment according to sensitivity**
  - Third generation cephalosporin
  - + Vancomycin (*1 g IP every 5 days*) or Teicoplanin
  - Rifampin if MRSA (*600 mg every day*)
  - Linezolid, quinupristin/dalfopristin if VRSA

• **Consider catheter removal** (*2 weeks on HD*)
  - If catheter related infection
  - or refractory peritonitis

• **Consider urokinase if touch contamination**
Streptococcus - Enterococcus

• Adjust prescription to sensitivity

• Consider:
  – ampicillin prescription \((125 \text{ mg/l IP})\)
  – vancomycin if “ampicillin resistant”

• Possible intra-abdominal pathology: add
  • Third generation cephalosporins
  • or Quinolone
  • or Aminoglycoside (synergy)
  • and Antifungal prophylaxis

• Touch contamination is also possible
  – review patient’s technique
Pseudomonas - Xanthomonas

- Pseudomonas aeruginosa peritonitis is
  - severe
  - often related to neglected catheter infection
  - permanent membrane damage may occur
- Other species are often tape water contaminant
  - review patient’s hand washing/drying
- Antibiotics to be chosen
  - Ceftazidime, cefipime (*IP continuous*)
  - + Oral quinolone
  - or piperacillin (*4g IV every 12 hours*)
  - or tobramycin
- Remove rapidly responsible infected catheter
- Consider urokinase in other cases
- Three weeks treatment
Multiple enteric organisms (+/- anaerobic bacteria)

- Search for intra-abdominal pathology
  - CT scan
  - Ultrasound

- Antibiotics
  - ampicillin
  - + ceftazidime or aminoglycoside
  - + metronidazole 500 mg every 8 h, IV or PO
  - + antifungal treatment
  - treat for 3 weeks

- Consider surgery (and catheter removal)
Fungal Peritonitis

- 2.5% of 1375 episodes
- *Candida* caused 97% (yeasts)
- 70.6% of patients had received multiple antibiotics in the preceding month
- 94% required catheter removal
- Mortality was 26.5%

Yeast (on Gram stain or culture)

**Flucytosine**
- PO: load 2 g then 1 g daily
- IP: 300 mg/l

Associated with **fluconazole**, 200 mg PO/IP daily

If organism is resistant consider **itraconazole, voriconazole**

If no clinical improvement, remove catheter and treat for 10 additional days after catheter removal

If clinical improvement

Duration of therapy
4-6 weeks

Filamentous fungi
Catheter colonised by Dreschlera specifera
Catheter Removal for infection

Membrane preservation overhangs catheter saving

• Catheter infection
  - associated peritonitis (related the same bacteria)
  - proven inner cuff infection
  - chronic infection (refractory to medical and surgical treatment)

• Peritonitis
  - catheter related
  - refractory (no response after 4-5 days of appropriate therapy)
  - severe (more than 10 days of turbid effluent)
  - relapsing (same organism within 4 weeks after compl. treatment)
  - fungal :
    - yeast : if no response after 7 days of appropriate therapy
    - filamentous fungi : immediate, at laboratory results
CATHETER REMOVAL FOR REFRACTORY PERITONITIS

- 9/191 patients with peritonitis died (5%)
- 18% episodes of peritonitis resulted in transfer to HD.
- If the fluid was still cloudy after 5 days, failure rate was 46%.

These results support ISPD guidelines to remove catheter if effluent fails to clear by 5 days.

Catheters removed for infection can be replaced within 2 weeks

RESULTS:
Survival of replaced catheter was not related to the timing of replacement.

Gupta, Bernardini, Piraino unpublished data
Relapsing-recurrent peritonitis

Another episode of peritonitis caused by the same genus/species within 4 weeks of completing antibiotic course

• S aureus, CNS are likely repeat offenders
• Often due to biofilm and/or catheter infections.
• Catheter change decreases likelihood of recurrence.

For recurrent peritonitis, catheter replacement can be done as same day procedure

Finkelstein AJKD 2002;39:278-1286
Acceptable Peritonitis incidence? 1 epis. / patient month

- I.S.P.D. < 1/24

- In Montpellier:
  - Since 1973: 1/35.72
  - 01/01/2004 to 31/12/2004: 1/81.18

153 patients on PD treatment

“Obsession” against bacteria may be fruitful
CONCLUSION

PREVENTION = 10 g

has to be compared with

TREATMENT = 10 Kg