Reducing PD Loss from Infection

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Objectives

► To review the relevance of PD-related infection as a cause of TF, and the organisms most likely to lead to catheter loss
► To discuss trends in peritonitis rates over time
► To discuss strategies to minimize infection-related TF
PD-related infection is an important cause of technique failure

Mujais et al, KI 2006
PD-related infection is an important cause of technique failure worldwide.

![Bar chart showing the percentage of events by country.]

PDOPPS data courtesy of Dr. Jeff Perl.
Possible outcomes of PD-related infection

- Resolution (~80%)
- Death (<5%)
- Transfer to HD (~15-20%)
  - Temporary
  - Permanent
Most common organisms causing infection

<table>
<thead>
<tr>
<th>PERITONITIS</th>
<th>EXIT SITE INFECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNS</td>
<td>32%</td>
</tr>
<tr>
<td>S. aureus</td>
<td>9%</td>
</tr>
<tr>
<td>Strep species</td>
<td>11%</td>
</tr>
<tr>
<td>E.Coli</td>
<td>6%</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>3%</td>
</tr>
<tr>
<td>Fungal</td>
<td>4%</td>
</tr>
<tr>
<td>Culture negative</td>
<td>19%</td>
</tr>
<tr>
<td>S. aureus</td>
<td>42%</td>
</tr>
<tr>
<td>CNS</td>
<td>16%</td>
</tr>
<tr>
<td>Corynebacteria</td>
<td>10%</td>
</tr>
<tr>
<td>Strep species</td>
<td>4%</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>13%</td>
</tr>
<tr>
<td>E. Coli</td>
<td>2%</td>
</tr>
<tr>
<td>Klebsiella</td>
<td>1%</td>
</tr>
</tbody>
</table>

Mujais, KI 2006
But which organisms are associated with the highest risk of catheter loss?

<table>
<thead>
<tr>
<th>Organism</th>
<th>% resolved</th>
<th>% catheter removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNS</td>
<td>92%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Culture negative</td>
<td>90%</td>
<td>9%</td>
</tr>
<tr>
<td>S. Aureus</td>
<td>72%</td>
<td>25%</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>51%</td>
<td>46%</td>
</tr>
<tr>
<td>Enterococcus</td>
<td>65%</td>
<td>29%</td>
</tr>
<tr>
<td>E. Coli</td>
<td>55%</td>
<td>34%</td>
</tr>
<tr>
<td>Enterobacter</td>
<td>60%</td>
<td>32%</td>
</tr>
<tr>
<td>Fungal</td>
<td>6%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Mujais, KI 2006
Which organisms are associated with the highest risk of catheter loss?

van Esch et al, PDI 2013
Problem Bugs

- *S. aureus*
- Pseudomonas
- Enteric organisms
- Fungi
- CNS (based on its frequency)
How can we reduce PD loss due to infection?

**STEP 1:** Decrease frequency of peritonitis, particularly for organisms most likely to lead to catheter loss

**STEP 2:** If peritonitis occurs, maximize chance of successful treatment

**STEP 3:** If catheter removal required, maximize chance of successful return to PD
What has happened to peritonitis rates over time?

CANADA

POET database, unpublished data
What has happened to peritonitis rates over time?

Han et al, PDI 2007
What has happened to peritonitis rates over time?

BRAZIL

Moraes et al, PDI 2009
What has happened to peritonitis rates over time?

van Esch et al, PDI 2013

NETHERLANDS
What has happened to peritonitis rates over time?

Figure 5.23 - PD Peritonitis Rate - Australia 2004-2017

ANZDATA registry 2018 report
Peritonitis rates are decreasing over time

BUT WHICH ORGANISMS ARE DRIVING THE DECREASING PERITONITIS RATE?
Gram positive vs. Gram negative trends

1656 patients from Korea
1981-2005
438 patients from Portugal
1985-2010

Fig. 2. Peritonitis rates from 1985 to 2010 expressed as episodes per patient-year.
• 680 patients from Brazil
• 1980-2005
Trend over time in *S. aureus* infections
Summary re. organism-specific peritonitis trends

- Decreasing Gram positive peritonitis rate, driven by a reduction in the frequency of CNS peritonitis and S. aureus peritonitis
- No change in Gram negative peritonitis rate in most studies

What changes in PD practice have led to these improvements over time?
PDEP = multidisciplinary PD education program
- Individual teaching
- Retraining
- Group sessions

The impact of patient training on CNS peritonitis

Gadola et al, PDI 2013
The impact of exit site prophylaxis with mupirocin on *S. aureus* peritonitis

Barretti et al, PloS 2012
The impact of exit site prophylaxis with gentamicin on Pseudomonas catheter infections

Piraino et al, NDT 2010
We have successfully decreased intraluminal entry of bugs.

We have successfully decreased periluminal entry of bugs from the exit site along the catheter tunnel.

We have not significantly decreased the risk of translocation of organisms across the bowel wall.
Have decreasing peritonitis rates over time translated into an improvement in PD technique failure due to peritonitis?

**Changes in Patient and Technique Survival over Time among Incident Peritoneal Dialysis Patients in Canada**

Jeffrey Perl,‡ Ron Wald,§ Joanne M. Bargman,‡ Yingbo Na,§ S. Vanita Jassal,‡ Ash K. Jain,¶ Louise Moisi,¶ and Sharon J. Nessim**

Table 3. Results of the piecewise proportional hazards model for cause-specific PD technique failure

<table>
<thead>
<tr>
<th></th>
<th>Inadequate PD</th>
<th>Peritonitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (n=13,120)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995–2000</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2001–2005</td>
<td>1.21 (1.00, 1.46)</td>
<td>1.21 (0.99, 1.48)</td>
</tr>
<tr>
<td>2006–2009</td>
<td>0.69 (0.54, 0.90)</td>
<td>1.19 (0.94, 1.51)</td>
</tr>
</tbody>
</table>

Perl et al, CJASN 2012
In other words…

- We are getting better at reducing the frequency of peritonitis caused by more indolent organisms!
- Little reduction in peritonitis due to virulent organisms (e.g. enteric Gram negatives, fungi)
Strategies to decrease catheter loss due to Gram negative and fungal peritonitis

- Antibiotics at time of colonoscopy
- Treatment of constipation, hypokalemia?
- Antifungal prophylaxis


- Exit site prophylaxis in 91% (gentamicin >> mupirocin)
- Antibiotics at time of colonoscopy in 66%
- Antifungal prophylaxis in 54%

Boudville et al, NDT 2019
How can we reduce PD loss due to infection?

STEP 1: Decrease frequency of peritonitis, particularly for organisms most likely to lead to catheter loss

STEP 2: If peritonitis occurs, maximize chance of successful treatment

STEP 3: If catheter removal required, maximize chance of successful return to PD
If peritonitis occurs, maximize chance of successful treatment

- Initiate broad spectrum antibiotics **early**
- Ensure appropriate dosing (consider RKF, patient weight, pharmacokinetics of antibiotic)
- Adjust antibiotics according to sensitivities
- Beware of SPICE organisms (inducible beta-lactamase)
How can we reduce PD loss due to infection?

STEP 1: Decrease frequency of peritonitis, particularly for organisms most likely to lead to catheter loss

STEP 2: If peritonitis occurs, maximize chance of successful treatment

STEP 3: If catheter removal required, maximize chance of successful return to PD
Return to PD after transfer to HD for peritonitis

- Szeto *et al*, JASN 2002
  - Retrospective review of 100 PD patients who required PD catheter removal for peritonitis between 1995-2000
  - Attempted reinsertion in all patients after at least 4 weeks
    - Failed reinsertion in 49 ("because of peritoneal adhesion or UF failure due to peritoneal sclerosis")
    - Successful reinsertion in 51 - technique survival was 31% at 24 months
Return to PD after transfer to HD for peritonitis

- Caveats of Szeto study:
  - only took out catheter if fluid didn’t clear after **10 days** (more prolonged inflammation – more adhesions and potential for peritoneal membrane injury)
  - Catheters re-inserted by surgical open approach – may have had higher success rate with laparoscopic insertion
Return to PD after transfer to HD for peritonitis

- Cho et al, NDT 2014
  - Observational study of 3305 patients who developed peritonitis in ANZDATA registry from 2003-2011
  - 553 (17%) required transfer to HD, and 101 of those 553 returned to PD
  - After matching patients, temporary HD transfer was not associated with inferior patient survival or technique survival when compared with others who either never required HD transfer or remained on HD permanently
PD-related infection is the most common cause of PD technique failure

- Not all organisms are created equal – certain organisms are more likely to lead to catheter loss
- Peritonitis rates have decreased over time mainly due to a reduction in CNS and S. aureus peritonitis
- Reducing PD loss due to infection involves (1) decreasing peritonitis caused by ‘problem organisms’, (2) optimizing peritonitis Rx, and (3) early catheter removal if refractory infection to maximize chance of returning to PD