Assessment of the Peritoneal Membrane: 
Practice Workshop

Marina Villano, MSN, RN, CNN 
maring.villano@fmc-na.com

Objectives

• Briefly review normal peritoneal physiology including the three pore model.
• Compare and contrast the basic concepts of the Standard Peritoneal Equilibration Test (PET) vs. other tests for accurate peritoneal membrane assessment.
• Discuss the process the clinician uses to ensure PET validity.
• Using the standard PET, participate in a workshop and develop best practice to maximize patient prescriptions.

Review of Physiology

(Fresenius Kidney Care, 2013)
Three Pore Model

Tests to Determine Peritoneal Membrane Transport Status

FAST Peritoneal Equilibration Test

- A variation of the PET
- 4 hour creatinine and glucose tested *only*
- Less labor intensive for the staff and patient
- Determinations of membrane transport similar to standard PET

(Invivo Kidney Care, 2013)

(Guest, 2010)
<table>
<thead>
<tr>
<th>Modified PET</th>
</tr>
</thead>
<tbody>
<tr>
<td>• This is a variation of the PET</td>
</tr>
<tr>
<td>• Uses a 4.25% solution to test for ultrafiltration failure (UFF) (Type 1</td>
</tr>
<tr>
<td>aquaporin)</td>
</tr>
<tr>
<td>• Exposes the membrane to a maximum osmotic pull during the test</td>
</tr>
<tr>
<td>• The same samples are drawn as per the standard PET with a sodium sample</td>
</tr>
<tr>
<td>added and a test is done at the 0, 1, 2 and 4 hr. marks</td>
</tr>
<tr>
<td>• Total UF&lt;400 validates UFF</td>
</tr>
<tr>
<td>[Guest, 2010]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dialysis Adequacy and Transport Test (DATT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A variation of the PET</td>
</tr>
<tr>
<td>• A single blood draw and one aliquot of a pooled CAPD 24 hour sample</td>
</tr>
<tr>
<td>• Daily ultrafiltration information recorded</td>
</tr>
<tr>
<td>• Less labor intensive for the staff and patient</td>
</tr>
<tr>
<td>• Determinations of membrane transport similar to standard PET</td>
</tr>
<tr>
<td>[Guest, 2010]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Peritoneal Dialysis Capacity (PDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A variation of the PET</td>
</tr>
<tr>
<td>• Used internationally, not in the US</td>
</tr>
<tr>
<td>• Estimates characteristics using specific computer modeling</td>
</tr>
<tr>
<td>• Determinations of membrane transport</td>
</tr>
<tr>
<td>• Discussed in Van Biesen’s publication</td>
</tr>
<tr>
<td>[Van Biesen et al, 2006]</td>
</tr>
</tbody>
</table>
Peritoneal Equilibration Test (Standard PET)

Mechanics of the PET

- Smooth catheter performance is a must
- Blood sugar < 235 mg/dl
- Night dwell of at least 8 hrs.
- Drain completely at clinic
- 2L 2.5% fill over 10-15 min rolling recumbent
- Draw 0, 2, 4 hour dialysate samples
- Blood sample at 2 hours
- Weigh dialysate and record

Timely and Precise
Prepare for a Valid PET

- Prepare the patient prior to the test
  - Accurate prescription, 8 hr. overnight dwell
  - Prevent constipation, high blood sugar, dehydration, missed treatments
- Ensure complete drain prior to the test
- Recline the patient and dance in the chair!
- Validate the blood sugar is < 235 mg/dl
- Keep the test on time
- Draw and label specimens accurately

Transport of Different Solutes

Idealized Ultrafiltration Curves
High Average and Low Average Transporters

High Average (37%)
- Good solute transport
- OK ultrafiltration

Low Average (33%)
- OK solute transport
- Good ultrafiltration

Prescriptions to Match the Membrane

**High Transporter Prescriptions**
- CCPD/APD highly recommended
- Require shorter dwell times, but never less than 90 minutes
- Prescription 9-10 hours, 4-5 cycles, with a last fill
- May need to be dry for a portion of the day related to reabsorbing fluid

**Low Transporter Prescriptions**
- CCPD/APD or CAPD
- Dwell greater than 2 to 5 hours CCPD/APD
- Longer dwells allow for more toxin and fluid clearance
- Prescription 9-10 hours, 2-3 cycles with last fill dextrose
- Require day fill, recommended high dose (day exchange) to achieve solute clearance

---

(Fresenius Kidney Care, 2014)

(Fresenius Kidney Care, 2014)
Standard PET Curves

7 Step PET Validation Process

1. Is the blood sugar < 235 mg/dl?
2. Locate PET Interpretation: Creatinine and glucose transport. Do the membrane types agree?
3. Is the solute transport class inconclusive? Why?
4. D/P Ratio PET 4 hour and D/DO PET 4 Hour
   Do the numbers agree as to type?

5. PET Glucose PDF, 0 Hr: Is it > 2000-2200 ml for a 2 L 2.5% bag? (If it is less, the patient did not drain well and it is not accurate.)
6. Is the PET glucose PDF 0 Hour value the highest and progressively decreases to the 2 and 4 hour values?
7. Is the PET PDF 0 hour Corrected Creatinine 0 to < 0.2 and progressively increases to the 2 and 4 hour values?
Why is this PET Inconclusive?

| Initial Prescription |

(Baxter, 2006)
Individualizing Therapy

- Patients with higher D/P require an increased number of exchanges during the night
- Patients with higher BSA require higher fill volume per exchange
- Anuric patients are advised to have an extra day exchange
- Icodextrin may be considered in patients during a long day dwell as it can improve the UF and clearance of patients

(Baxter, 2006)

Let’s Practice!

Case Study #1

25 yo male, single (twin)
F/T hotel clerk
Transfer from HD (2 mos)
Lupus nephritis, HTN
64.6 kg (142 lb)
178 cm (5’10”)
50cc 0UO
Transport Status?
Case Study #1

25 yo male, single (twin)
F/T hotel clerk-
Rotates days to middles
Transfer from HD (2 mos)
Lupus nephritis, HTN

64.6 kg (142 lb)
178 cm (5’10”)
300-50cc UO
(almost anuric)

Lifestyle?
Body size?
CAPD or CCPD?
Continuous or intermittent?
Number of exchanges?
Dry day or not?
Pause/walk away?
Volume of fills?
Dwell time?

How can we preserve RRF?
Should we add a diuretic?
Does being underweight matter?

Underweight or Overweight <95% or >115% Standard BW
Adj BW=Edema free BW+
(Standard BW-Edema free BW) x 0.25
68 kg [81 - 68] x .25 = 71.4 kg = 157 lbs

Case Study #1: Prescription

[Prescription details]

(NKF KDOQI, 2000)
Case Study #2

65 yo married female
Type II diabetes
“Retired” schoolteacher
Math Tutor afternoons
Husband FT works 2-10 P

48.7 kg (107.4 lb)
144.8 cm (4’9”)
24 hr UO=1200 cc

Blood sugar=160 mg/dl
4 Hour D/P= 0.70
4 Hour D/DO= 0.29

**Can use 1100 mL/m² of 2.5% PET (Kaku & Honda, 2008)

Transport status?

Case Study #2

Lifestyle?
Body size?
CAPD or CCPD?
Continuous or intermittent?
Number of exchanges?
Dry day or not?
Pause/walk away?
Volume of fills?
Dwell time?

Case Study #2

65 yo married female
Type II diabetes
“Retired” schoolteacher
Tutors 5:30-8 PM M-Th
Husband FT works 12-8 P
Likes to eat dinner with her husband

48.7 kg (107.4 lb)
144.8 cm (4’9”)
24 hr UO=1200 cc

How can we preserve RRF?
Should we add a diuretic?
What about her height?
What about her weight?
How do we minimize glucose exposure?
What about her diet?
Case Study #2: Prescription

- CAPD 7xweek, EDW 45(kg), # Exchanges 4, fill volume 1400cc, dwell time 90 minutes, last fill 0, pause 800cc
- CAPD, 7 x week, EDW 45(kg), # Exchanges 5, fill volume 1400cc, dwell time 90 minutes, last fill 0, pause 800 cc
- CAPD, 7xweek, EDW 45(kg), # Exchanges 5, fill vol 1500 cc, Dwell time 2 hours, last fill 800cc , day exchange 0, daytime fill volume 800cc

To Summarize

- The peritoneal capillary, namely the capillary vascular surface area is the critical barrier to peritoneal transport
- There are three pores in the capillary. When the aquaporin pores fail, the capillary membrane loses the ability to ultrafiltrate.
- The PET provides a map of the peritoneum to point the clinician in the right direction when developing a prescription for adequate dialysis.
- The PET is mathematical. It is crucial to prepare your patient and stick to the procedure for accuracy

To Summarize

- Following a troubleshooting algorithm will help the clinician validate PET results and ensure accuracy.
- It is important to consider lifestyle when choosing a prescription. The patient’s PET data should be entered into prescription modeling software and the patient should be allowed to choose what they can do.
- Knowing how to optimize the peritoneal prescription by considering preserving RRF, dwell time, dry or wet day, the pause and other factors will allow your patient to achieve Kt/V standards without having dialysis be their life, only a treatment so they can live their life.
<table>
<thead>
<tr>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fresenius Kidney Care (2014). National Adequacy Series.</td>
</tr>
</tbody>
</table>