PET and Membrane Characteristics

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Objectives

- Describe the procedural steps of the Peritoneal Equilibration Test.
- Review the four membrane characteristics determined by the PET and the clinical application.
Peritoneal Equilibration Test: What is it!

- 1987: Described and developed by Z. Twardowski
- Test to define individual patient solute transport characteristics.
- Simple to perform and interpret
- Guideline for prescription planning
Adequacy: Peritoneal Equilibration Test

- First PET should be done 4 to 8 weeks after initiation of CAPD
- Will identify membrane characteristics
- Will allow for prescription planning
  (well documented in the literature)
Current KDOQI Guidelines

Frequency of Measurement:

- Residual renal function every 2 months (if > 100mls)
- 24 hour dialysate every 4 months
- PET at baseline and then only when clinical changes may indicate need for repeat PET

Burkart 2005
Tests to determine transport status:

- PET
- Fast PET
- DATT (Dialysis Adequacy and Transport test)
- PDC (Peritoneal Dialysis Capacity Test)
Peritoneal Equilibration Test

- Defines solute transport and membrane characteristics
- Measures the dialysate to plasma ratios of creatinine and glucose
- Net ultrafiltration at 4 hours
- Re evaluation of membrane post peritonitis
- Evaluate inadequate dialysis or change in clinical presentation

Daugirdas, Ing 2007
Peritoneal Equilibration Test

PET calculations:

D/P Creatinine:
- Corrected creatinine DIALYSATE concentration at 0 Hr, 2 Hr, 4 Hr
- Corrected Creatinine PLASMA concentration at 2 Hr dwell

D/Do Glucose:
- Dialysate Glucose Concentration at 2 Hr and 4Hr dwell
- Dialysate Glucose Concentration at 0 Hr Dwell
Peritoneal Equilibration Test

Procedural Steps:
- Overnight dwell: 2 liter 2.5% dextrose (8 to 12 hr dwell)

Morning of Test:
- Drain overnight dwell with patient in sitting position over 20 minutes, record the amount drained
- Infuse 2 liters of 2.5% dextrose with patient supine, record time completed
- This is the 0 Hr Dwell time (zero hour)
Peritoneal Equilibration Test

Procedure continued:

- At 0 hour (Zero hour), drain back 200cc of dialysate and gently mix by inverting bag twice
- Collect dialysate samples. Send 10ml of dialysate for zero hour specimen
- Re-infuse the remaining 190ml

- Repeat above at the 2 hour dwell time.
- At the 2 hour dwell time, draw the serum sample for BUN, Creatinine, and glucose.
Peritoneal Equilibration Test

Procedure continued:

- At 4 hours, with the patient sitting up, drain completely at least for 20 minutes
- Obtain 10 ml dialysate sample, record volume of drained effluent.
# Peritoneal Equilibration Test

<table>
<thead>
<tr>
<th>Time</th>
<th>Dialysate Sample</th>
<th>Serum Sample</th>
</tr>
</thead>
</table>
| Overnight | Creatinine, BUN (urea)  
Glucose |                                |
| 0 Hour | Creatinine, BUN (urea) 
Glucose |                                |
| 2 Hour | Creatinine, BUN (urea)  
Glucose | Creatinine, Bun, Glucose       |
| 4 Hour | Creatinine, BUN (urea)  
Glucose |                                |
Peritoneal Equilibration Test

PET calculations:

D/P Creatinine:
- Corrected creatinine DIALYSATE concentration at 0 Hr, 2 Hr, 4 Hr
- Corrected Creatinine PLASMA concentration at 2 Hr dwell

D/Do Glucose:
- Dialysate Glucose Concentration at 2 Hr and 4 Hr dwell
- Dialysate Glucose Concentration at 0 Hr Dwell
## Peritoneal Equilibration Test

<table>
<thead>
<tr>
<th>Time</th>
<th>BUN (mg/dL)</th>
<th>Creatinine (mg/dL)</th>
<th>Glucose (mg/dL)</th>
<th>Corrected creatinine</th>
<th>Creatinine D/P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum 2 hours</td>
<td>70</td>
<td>18.04</td>
<td>111</td>
<td>18.04</td>
<td></td>
</tr>
<tr>
<td>Dialysate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O Hours</td>
<td>2</td>
<td>0.24</td>
<td>2210</td>
<td>0.24</td>
<td>0.01</td>
</tr>
<tr>
<td>2 hours</td>
<td>31</td>
<td>4.84</td>
<td>1620</td>
<td>4.84</td>
<td>0.27</td>
</tr>
<tr>
<td>4 hours</td>
<td>38</td>
<td>6.21</td>
<td>1480</td>
<td>6.21</td>
<td>0.34</td>
</tr>
</tbody>
</table>
### High Transport

4Hr D/P Creatinine: 0.82 to 1.03

<table>
<thead>
<tr>
<th>Solute Transport</th>
<th>Ultrafiltration</th>
<th>Clearance</th>
<th>Prescription</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Poor</td>
<td>Efficient solute transport</td>
<td>APD</td>
</tr>
<tr>
<td></td>
<td>Re absorbs quickly</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Risk: CHF, pulmonary edema</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
High Average Transport: 4 Hr D/P Creatinine: \(0.65\) to \(0.81\)

<table>
<thead>
<tr>
<th>Solute Transport</th>
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<th>Prescription</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Average</td>
<td>Adequate</td>
<td>Adequate</td>
<td>APD, CAPD</td>
</tr>
</tbody>
</table>
Low Average Transport: 4 Hr D/P creatinine: .50 -.64

<table>
<thead>
<tr>
<th>Solute Transport</th>
<th>Ultrafiltration</th>
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<th>Prescription</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Average</td>
<td>Good</td>
<td>Adequate</td>
<td>CAPD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inadequate</td>
<td>CAPD high dose (APD)</td>
</tr>
</tbody>
</table>
**Low Transport: 4 Hr D/P creatinine: .34 to .49**

<table>
<thead>
<tr>
<th>Solute Transport</th>
<th>Ultrafiltration</th>
<th>Clearance</th>
<th>Prescription</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Excellent</td>
<td>Poor Inadequate</td>
<td>High Dose PD</td>
</tr>
</tbody>
</table>
Corrected Creatinine

What is a correction factor?

- Lab measurement of creatinine maybe incorrect due to the high glucose concentration
- Creatinine level could be reported as falsely high
- Check with your respective lab about this correction factor
- The correction factor reported by Twardowski was 0.000531415mg/dl
Peritoneal Equilibration Test

What can go wrong?

- Possible errors: Sampling
  Data entry
  Calculations
  Lab
- Incorrect labeling of specimen tubes
- Incorrect patient instructions
- Patient collection errors
- High serum blood sugar (> 300mg/DL) may alter glucose interpretation
Peritoneal Equilibration Test

When should the PET be repeated?

- After repetitive infections that could alter membrane characteristics
- Unexplained clinical changes
- Increased need for hypertonic dialysate
- After invasive surgeries: loss of surface area of peritoneal membrane
- Possible lab error or sampling errors
- Per unit protocol
Inadequate Dialysis

- Uremic symptoms
- Malnourished
- Poor blood pressure control
- Neuropathy
- Increased hospitalizations
- Increased hospitalized days
- Increased cardiovascular events
- Sleep disturbance
- Inability to concentrate
Peritoneal Equilibration Test

Clinical Common Sense Point:

If you suspect the Pet does not correlate with the patient’s clinical presentation….

Repeat the PET
What counts?

The numbers count…..
..but so does your clinical assessment

- Become expert in collecting the data
- Use the data to support your expertise and experience
- Advocate for excellent patient management
- Network with colleagues to enrich your experience
Conclusions

PET accuracy depends on:

- Patient education
- Data collection
- Data interpretation
- Clinical assessment
- Your commitment
Best Practice: The Sum of Many Pieces

- ISPD
- APD
- Data Collection
- Infection
- Kt/V
- RRF
- Outcomes
- Access
- KDQOI
- Exit Sites
- Catheters
- Peritonitis
- CAPD
- Cr Cl.
References


Thank you
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