PD Catheter Placement and Management

Rajnish Mehrotra¹ and John Crabtree²

¹Harbor-UCLA Medical Center, Torrance, CA and 
²Kaiser Permanente, Bellflower, CA
Importance of PD Access
Status of PD Patients At One Year

All 55,587 incident PD patients in US, 1996-2003

Outline of Presentation

• Selection of PD catheter:
  – Design Issues

• Key Placement Issues:
  – Who should place it?
  – Key technical issues

• Management issues – avoid temporary HD:
  – Planned start of PD
  – Emergent start of PD
Why Is Design Or Surgical Technique Important?

- Reduce risk for catheter-related complications
  - Mechanical Complications
    - Inadequate Hydraulic Function
    - Omental Entrapment
    - Leaks
  - Infectious Complications
    - Exit-Site
    - Tunnel
    - Peritonitis
- Reduce risk for transfer to HD
Catheter Material

- Catheters are made either of polyurethane or silicone rubber

- Exit-site, antibiotic prophylaxis – either mupirocin or gentamicin - may damage polyurethane catheters

- Manifestations of Damage:
  - Opacification of catheter
  - Leaks – leading to peritonitis
  - Rarely – rupture of catheter

- Know what the catheter that is used at your center is made of; make sure to completely avoid polyurethane catheters *

  * Cruz polyurethane catheters were withdrawn from the market August 2010
Catheter Design Issues

External Segment

Tunneled Segment

Intra-Peritoneal Segment

Crabtree J. Kidney Int Suppl 2006; 70: S27-37
Catheter Design And Outcomes
Tunneled Segment

Cuffs (Dacron)
- Superficial and/or deep
- Mechanical anchors not microbiologic barriers

Inter-Cuff Segment
- Straight
- Swan-Neck
Catheter Design And Outcomes
Extra-Peritoneal Segment – Extended Catheters

Pre-Sternal Catheters

Upper Abdominal Extended Catheters

Crabtree J. Kidney Int Suppl 2006; 70: S27-37
Catheter Design And Outcomes
Intra-Peritoneal Segment

- Straight Tenckhoff
- Coiled Tenckhoff
- TWH with Silicone Discs
- Ash (T-Fluted)
Selection of PD Catheter

Summary

• Numerous design innovations; no conclusive proof that one is superior to other

• Probably best to avoid polyurethane catheters entirely

• Two-cuff catheters with coiled intra-peritoneal segment most commonly used:
  - Two cuff catheters may lower risk of *Staph aureus* peritonitis

• Selection of swan-neck or straight catheters may be determined by:
  • Belt line and
  • Placement of exit site

• Use of extended catheters or pre-sternal catheters is often dictated by body habitus
Key Technical Issues

• Pre-operative antibiotic prophylaxis

• Location of the catheter tip

• Placement of the deep cuff

• Placement of the exit site:
  - Location on the abdominal wall
  - Direction – downward, lateral, or upward pointing?
  - Location of superficial cuff relative to exit site
Location of Catheter Tip

Catheter Tip Location – Deep Pelvic = pubic symphysis
Why?
Hydraulic function of catheter AND
Minimize omental entrapment
Location of Deep Cuff

- Rectus Muscle
- Paramedian position - away from the linea alba
Principles in Fashioning Exit Site

- Should be away from belt-lines, skin creases, and folds
- Should be clearly visible to the patient to perform daily exit site care
- Inserted through the abdominal wall with least amount of tubing stress
- About one inch from the superficial cuff
- Generally achieved when planned with patient upright, rather than supine
Where Is It Relative to the Belt-Line?  
Need to Determine Before Patient Sedated

Above the Umblicus:  
Exit site below the umbilicus

Below the Umblicus:  
Exit site above the umbilicus
Is the Exit Site Visible? Particularly Important for the Obese

Should be visible for a patient to perform daily exit site care.

Pictures Courtesy Dr. John Crabtree – Kaiser Bellflower
Where Is It Relative To Superficial Cuff?

Should be about 1 inch from the superficial cuff

WHY?

Pictures Courtesy Dr. John Crabtree – Kaiser Bellflower
Use Of Pre-Operative Marking May Obviate Exit Site Problems

Crabtree J. Kidney Int Suppl 2006; 70: S27-37
No Sutures or Staples At Exit Site!

Pictures Courtesy Dr. John Crabtree – Kaiser Bellflower
How Should PD Catheters Be Placed?

- Methods of placement of PD catheters:
  - Percutaneous, blind (with/without fluroscopy)
  - Direct visualization:
    - Peritoneoscopic (Y-Tec®)
    - Open, surgical dissection
    - Laparoscopic (local anesthesia, using nitrous oxide or helium insuffulation)

- Who should place PD catheters?
  - Whoever places them well in your area; depends on local expertise:
    - Surgeons
    - Nephrologists, including interventional nephrologists in stand-alone access centers
    - Interventional radiologists
## What Is Advanced Laparoscopy

Advanced laparoscopy – Rectus sheath tunneling, selective prophylactic omentopexy, and/or adhesiolysis

<table>
<thead>
<tr>
<th></th>
<th>Open Dissection (n=63)</th>
<th>Basic Laparoscopy (n=78)</th>
<th>Advanced Laparoscopy (n=200)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-op FU (mo)</td>
<td>49.5 ± 13.7</td>
<td>55.8 ± 13.1</td>
<td>54.4 ± 104.3</td>
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<tr>
<td>Previous laparotomy</td>
<td>30%</td>
<td>55.1%</td>
<td>53%</td>
</tr>
<tr>
<td>Implanted as outpt</td>
<td>78%</td>
<td>68%</td>
<td>93%</td>
</tr>
<tr>
<td>Simultaneous hernia repair</td>
<td>5%</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>Procedural Comp:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cath flow obst</td>
<td>11</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Postop peri-cannular leak</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Peri-cannular hernia</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sup cuff extrusion</td>
<td>-</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Visceral Perf</td>
<td>1</td>
<td>0</td>
<td>0</td>
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</table>

Timing of Placement of PD Access

• General principle:
  – Wait for two weeks from the time of placement of PD catheter before starting PD (“break-in” period)
  – Initial, and periodic flushing during break-in
  – Break-in period may be longer if wound healing impaired:
    • Post-transplant failure OR
    • Patient on immunosuppressives

• Implant catheter too early:
  – prolonged need for catheter care before dialysis started

• Implant catheter too late:
  – Need early “break-in”
Embedded Catheters
Fashion the Exit-Site At A Different Time

First described with Moncrief-Popovich catheter
But can be used with virtually any catheter
Burying the External Limb of PD Catheter

• Initial rationale:
  – All catheters rapidly form biofilm
  – Exteriorizing the external limb only after tunnel is completely healed would prevent the formation of biofilm
  – Reduce risk for exit-site infection and/or peritonitis

• Rationale for which it is being increasingly used:
  – PD catheter placed shortly after patient decides on the modality
  – Obviates guessing about timing of catheter placement relative to need to start RRT and
  – Catheter can be used on the day of the exteriorization of the external limb
# How Long Can Catheters Be Embedded Before Exteriorization?

<table>
<thead>
<tr>
<th>Author, year</th>
<th>No</th>
<th>Mean/median</th>
<th>Range</th>
<th>Placement Futile, %</th>
<th>Initial Drainage Problem, %</th>
<th>Catheter Never Worked, %</th>
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</thead>
<tbody>
<tr>
<td>Prischl, ’97</td>
<td>26</td>
<td>11.4 wks</td>
<td>4- 96 wks</td>
<td>19%</td>
<td>29%</td>
<td>0%</td>
</tr>
<tr>
<td>Danielsson, ‘02</td>
<td>30</td>
<td>7.1 wks</td>
<td>1-170 wks</td>
<td>0</td>
<td>3%</td>
<td>0%</td>
</tr>
<tr>
<td>McCormick, ’06</td>
<td>266</td>
<td>13.1 wks</td>
<td>5-42 wks</td>
<td>11%</td>
<td>15%</td>
<td>7%</td>
</tr>
<tr>
<td>Junejo, ’08</td>
<td>20</td>
<td>15.7 wks</td>
<td>5-127 wks</td>
<td>10%</td>
<td>5%</td>
<td>-</td>
</tr>
</tbody>
</table>

Causes of Futility:
- Pre-emptive transplantation
- Patient Death
- Started HD instead of PD

Prischl et al, Nephrol Dial Transplant 1997; 12: 1661-7
McCormick et al, Kidney Int suppl 2006; 70: S38-S43
Junejo et al, Perit Dial Int 2008; 28: 305-8
How Long **Should** Catheters Be Embedded?

<table>
<thead>
<tr>
<th></th>
<th>Tertile One</th>
<th>Tertile Two</th>
<th>Tertile Three</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days</td>
<td>11-47</td>
<td>48-133</td>
<td>134-2041</td>
<td></td>
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<tr>
<td>Primary Failure Rate</td>
<td>6.9%</td>
<td>1.7%</td>
<td>9.4%</td>
<td>0.04</td>
</tr>
<tr>
<td>Required Intervention for mechanical complications</td>
<td>7.8%</td>
<td>6.0%</td>
<td>15.4%</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Brown et al, Nephrol Dial Transplant 2008; 23: 2299-2303
Embedded Catheters: Final Word

Allows elective start of PD (“fistula-concept” applied to PD)
No conclusive evidence that embedding itself reduces peritonitis risk

- Should be attempted only if there is at least 4-6 weeks from the time of surgery to anticipated need of catheter

- Anticipate a finite futility rate

- Initial non-function often related to fibrin thrombi:
  - Amenable to interventions that often don’t require placement of a new catheter
Early Break-In

Start PD ("break-in") within 24 hours of placement of PD catheter

- Risks: Peri-catheter leak
- Solution: Low-volume, supine dialysis (1 L dwell volume x 6-10 exchanges)
- Challenges: Inadequate dialysis
  Place where dialysis is performed – home, hospital, or dialysis clinic
Conclusions

• Placement technique and skill of operator most important determinant of catheter outcomes

• Advanced laparoscopy has advantages and desirable, if available

• Careful planning of exit site placement very important

• If enough time available, embedding external limb is a good option

• Early break-in possible, if needed

• All above would minimize/eliminate need for temporary HD
Question #1

• Which ONE of the following describes the BEST DEMONSTRATED PRACTICES for fashioning the exit site?
  – A. Pre-operative marking with the patient recumbent; confirm with the patient upright
  – B. Intra-operatively after the deep cuff has been placed; confirm post-operatively
  – C. Pre-operative marking with the patient upright; confirm with the patient recumbent
  – D. Intra-operatively using the stencil provided by the manufacturer; confirm after placement of deep cuff
Question #1: Correct answer is A
Question #2

- Which ONE of the following BEST describes the desirable interval between placement of PD catheter and start of peritoneal dialysis therapy?
  - A. PD therapy is contra-indicated during the first two weeks after placement of PD catheter
  - B. It is imperative that the external limb of the PD catheter be buried subcutaneously for four weeks for adequate wound healing
  - C. PD catheters can be used within 24 hours of placement
  - D. PD therapy is contra-indicated during the first seven days after placement of PD catheter.
Question #2: Correct answer is C