Troubleshooting the Dysfunctional PD Catheter

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Corporate Relationships in PD Area-Dr. Ash
• Developed Y-Tec™ System for placing PD catheters by peritoneoscope, now marketed by Merit Medical
• Consults with Merit Medical in PD and other areas.
• Chairman of HemoCleanse, Inc. and Ash Access Technology, Inc.

Dysfunction of PD Catheters
1. Improper initial position
2. Outflow Failure
3. Infection-Tunnel/Cuff, Exit site, Persistent Peritonitis
4. Peri-catheter Hernia
5. Inguinal/Periumbilical Hernias
6. Catheter breakage

1. Improper initial position of catheter elements
• Exit site erosion or irritation
• Subcutaneous kinks
• Pericatheter leaks, deep cuff outside muscle wall

Proper location of PD catheter components:
• Deep cuff in rectus muscle
• Superficial cuff 2 cm below exit site
• IP portion lying against parietal peritoneum

Primary incision locations for peritoneal catheter placement by surgical technique (open squares) and percutaneous techniques (solid squares). All entry points are through rectus muscle or midline and above anterior superior iliac spine.
In patients with panniculus proper exit is above anterior superior iliac spine, exit site can be moved later (Dr. John Crabtree)

2. Outflow Failure: definition = fluid out < fluid in

- Constipation
- Pericatheter fluid leak
- Omental attachment to catheter
- Migration of catheter
- Internal Occlusion (clotting/fibrin)
- Catheter kinking (subcutaneous tract)
- Diaphragmatic hernia
- Retroperitoneal leak

Diagnosis of pericatheter leak or hernia

- Outflow failure
- Physical exam-asymmetric edema, skin fold thickness different in one flank versus other
- Ultrasound showing fluid around deep cuff and stranding in SQ tissue
- CT scan with injection of 100cc iodinated dye (any type, diluted 1:3 with saline)
- MRI without dye

Ultrasound is very useful in evaluating normalcy of PD catheter components. The normal catheter in SQ tunnel has one reflective line for each surface.

The normal superficial cuff appears as a dense object, like a bone, casting a shadow below it.
The normal deep cuff appears as a dense object within the rectus muscle, casting a shadow below it.

Small amounts of fluid around the cuff create the “Signet Ring” sign. Fluid is due to inflammation, infection of the cuff or pericatheter fluid leak.

Larger amounts of fluid around a cuff obliterate the cuff and its shadow.

Diagnosis of Omental Attachment
- Catheters don’t migrate much on their own (tip moves 3-6 cm)
- Catheters migrate because of omental attachment
- If migration occurs in presence of outflow failure, assume there is omental attachment

Repair of pericatheter leak or hemia
- Dissect to intercuff tunnel, open, lift catheter
- Open hernial sac to level of abdominal wall
- Free cuff from hernial sac, place in at level of muscle wall, make sure there’s not too much tension from SQ cuff
- Close muscle wall around cuff with 2-0 suture
- Close hernial sac over the cuff
- Use dry abdomen at least 8 hours per day for one week
The genesis of outflow failure of PD catheters is omental attachment to the catheter, not the migration. Omental attachment causes the upward migration in general.

Injection of dye does not demonstrate omental attachment to the PD catheter very well. This is an injection of a totally normal catheter in a dry abdomen, just after placement. The linear dye collections around the catheter are due to apposition of bowels and omentum to the catheter.

Sometimes outflow failure is caused by omental trapping of the catheter into a limited space. In these cases a peritoneogram is very helpful because it indicates that reposition of the catheter will not work. In these cases in the same patient, PD may no longer be an option.

Options to correct outflow failure due to omental attachment:

• Stiff guidewire reposition with fluid in peritoneum (local anesthesia) or movement by stylet (local anesthesia)
• Laparoscopic removal of adhesions, reposition of catheter, and omentopexy (general anesthesia)
• Placement of a new PD catheter from other side of abdomen by peritoneoscopy (local anesthesia) and removal of prior catheter
• Manual manipulation of abdomen.
To increase success in guidewire reposition of PD catheters:

- Have patient leave at least 1 liter of dialysate in abdomen before procedure.
- Do peritoneogram first, to demonstrate movement of dye beyond a local pocket.
- Use a stiff guidewire with floppy end, 150 cm length.
- Make sure the guidewire exits the tip of a coiled catheter, not a side-hole.
- Continue pushing guidewire until loop forms to straighten and move entire catheter to anterior peritoneal space.

Catheter replacement can allow patients to remain on PD therapy:

- Try reposition by guidewire. If that fails, perform peritoneoscopy from opposite side of the obstructed catheter under local anesthesia and manual air insufflation.
- Visualize the PD catheter, first finding the entry site to the peritoneum and following the catheter to the point of omental attachment.
- Attempt to move the catheter with the scope and cannula.
- If the catheter does not move, place a new PD catheter and assure that cuff is in the rectus muscle.
- Remove the prior PD catheter, suturing the rectus muscle with two 2-0 Vicryl sutures.
- Start PD 36 hours later, with manual infusions at 5, 8, and 11 pm while the patient is inactive, drain in am and dry abdomen during days. Alternatively, use cycler therapy at night or in dialysis facility.
- After two weeks, start regular CA PD or cycler/daytime dwell therapy.
- Expect 80% of catheters will be functioning at 1 year (but monitor for repeated outflow failure).

Diagnosis of catheter occlusion by fibrin:

- Inflow and outflow are equally slow.
- Fibrin has been seen in fluid.
- Recent peritonitis.
- Can be demonstrated by xray with IV dye.
- Occurs both with Advantage catheter than with Tenckhoff.
- Can be treated by tPA (2 mg in 10 cc), leave overnight.

3. Infectious Complications:

- Tunnel/Cuff infection
- Peritonitis failing to clear or recurring
- Exit site infection

(Topics for another day)
4. Peri-catheter Hernia
- Golf-ball sized mass next to deep cuff
- More noticed on standing, filled with fluid
- Subcutaneous edema, asymmetric skin fold thickness
- Outflow failure
- Repair as for pericatheter leak

5. Inguinal and Umbilical Hernias
- More noticeable on standing
- Sometimes painful
- Risk of incarceration high when bowel-filled
- May be observed if small, pain-free and filled with fluid only
- Diastasis recti is NOT a hernia
- Repair large hernias with mesh

6. Catheter Breakage
- Silicone catheters are weakened by iodine solution (PVP-iodine is probably ok)
- Polyurethane catheters (Cruz cath) are weakened by alcohols (mupirocin ointment, any creme)
- Most leaks, breaks are on the external portion—Pinch, compress to pressurize whenever peritonitis occurs
- External portion of a silicone catheter is repairable/replacable with “shunt connector” and silicone glue

Fortunately, we're out of time…