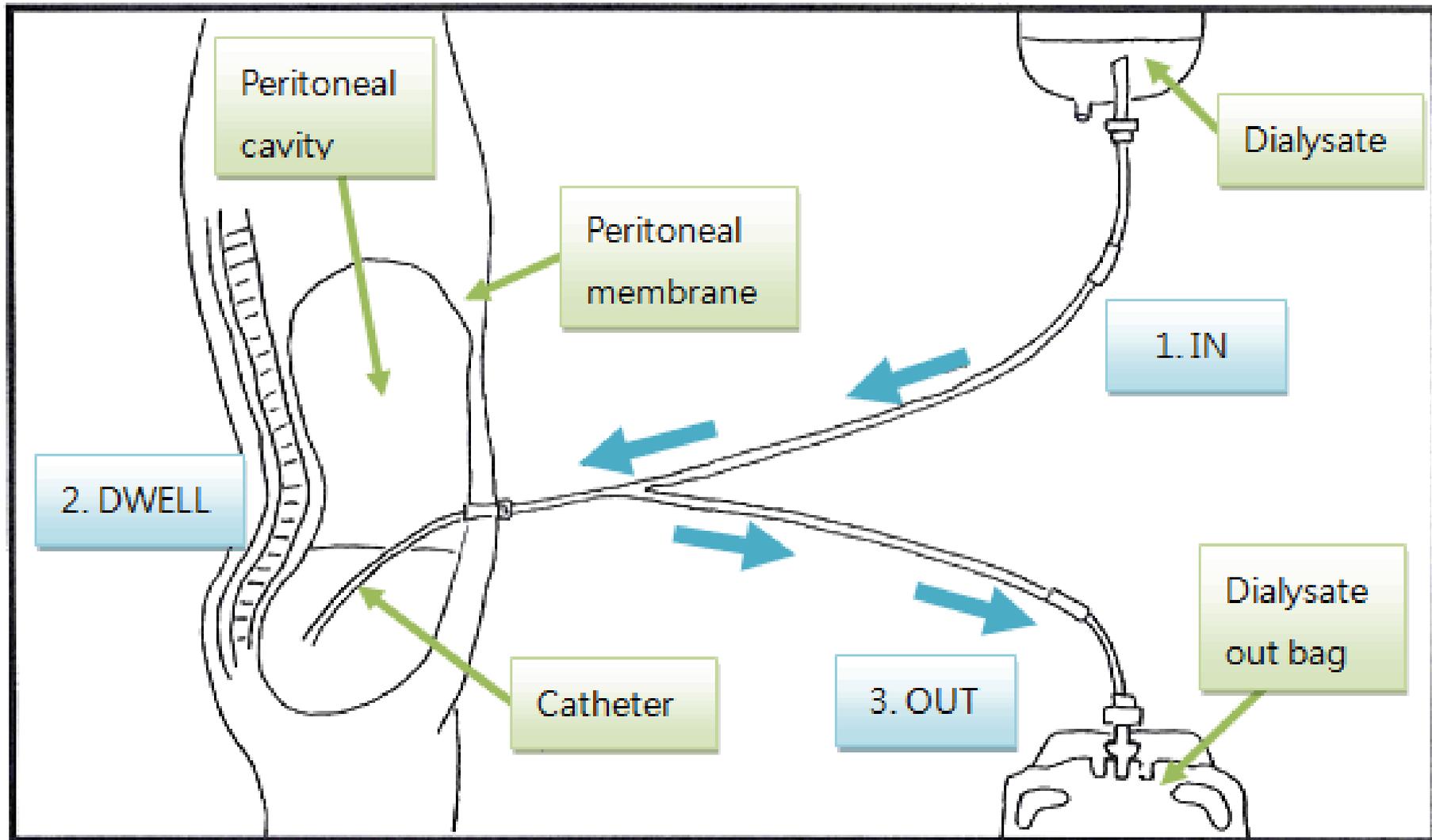
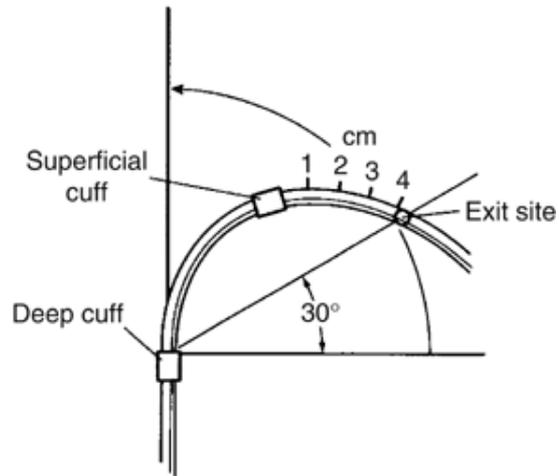
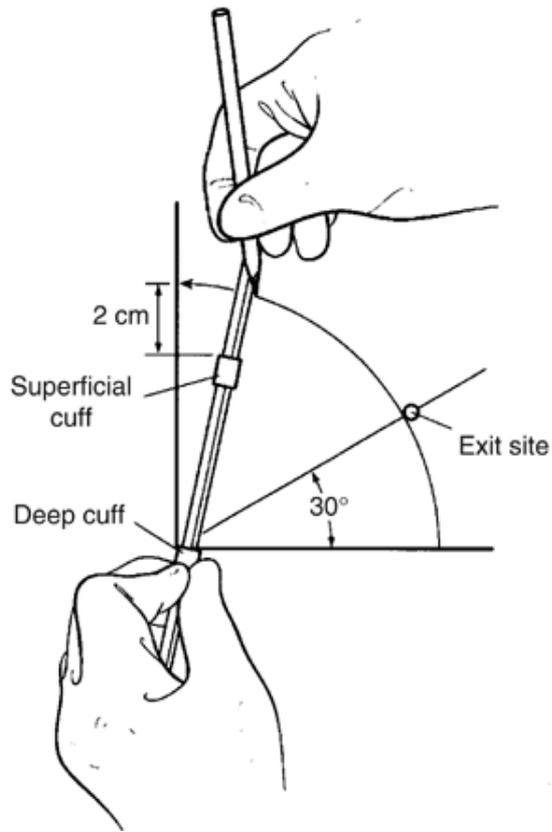


PD Catheter Placement and Management



PD catheter



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21-12-2018

A larger proportion of peritoneal dialysis patients **transfer to hemodialysis every year, than the converse. In the first year, 12%** of patients who start treatment with peritoneal dialysis transfer to hemodialysis. Many of the underlying causes of transfer to hemodialysis are preventable. Hence, while infectious complications still remain the most common reason for transfer of peritoneal dialysis patients to hemodialysis, catheter-related problems are the second most common cause. Care taken at the time of placement of the catheter for peritoneal dialysis can minimize transfers to hemodialysis. Thus, it is critical for the nephrology team to engage with the process to ensure appropriate placement of peritoneal dialysis catheter.

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 •
- 3 •

Why Is Design Or Surgical Technique Important? •

- Reduce risk for catheter-related complications •
- Reduce risk for transfer to HD •

Mechanical Complications •

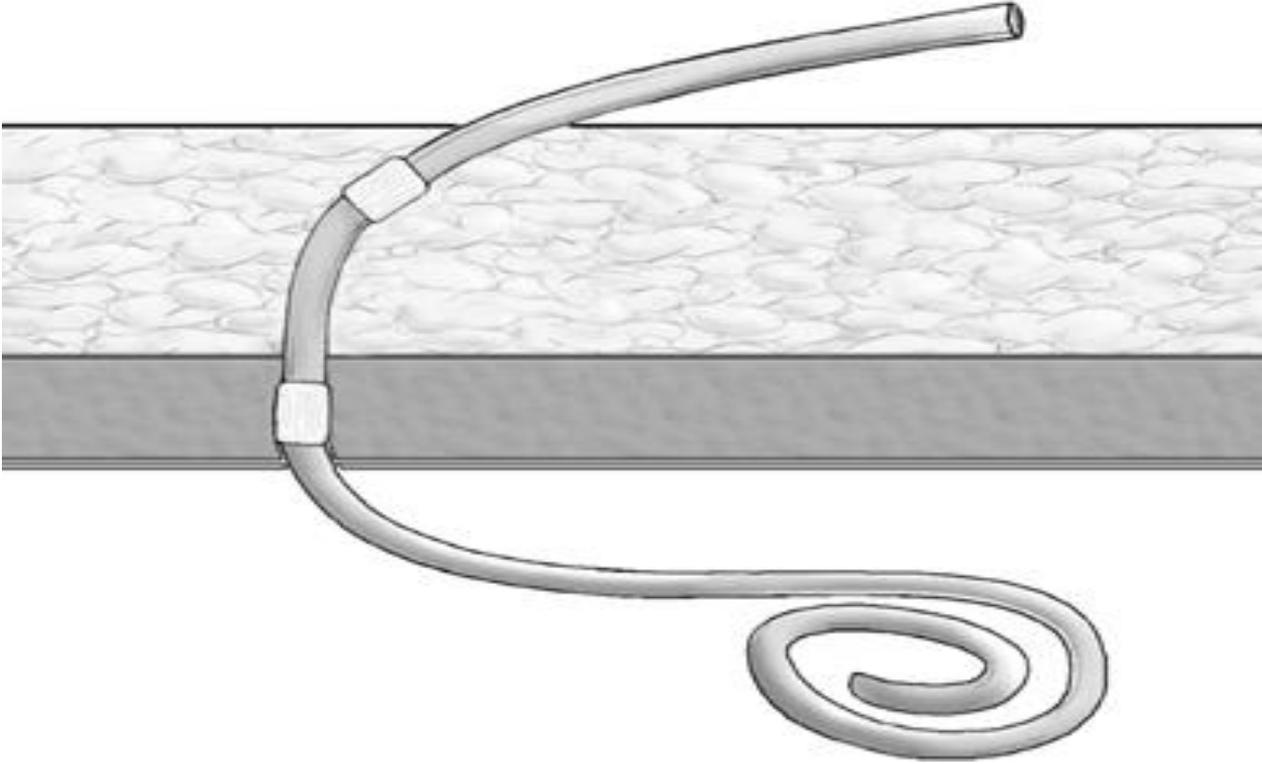
- Inadequate Hydraulic Function •
- Omental Entrapment •
- Leaks •

Infectious Complications •

- Exit-Site •
- Tunnel •
- Peritonitis •

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 •



A peritoneal dialysis catheter can be considered to have three segments:

- **The external segment** – the part that is outside the body and visible to us
- **The tunneled segment** – the part of the catheter that is tunneled through the subcutaneous tissue and the rectus muscle and
- **The intra-peritoneal segment** – the part of the catheter inside the peritoneal cavity

We will briefly review if design variations in each of the three segments have any effect on outcomes.

There are two variations to the design of the part of the catheter that is tunneled – the number of cuffs, and whether it has a bend or not (swan-neck or straight respectively). There are no controlled data to recommend one variation in the design of the tunneled catheter over other.

Two-cuff catheters

provide anchorage at two different points the tunnel and are generally preferable over single-cuff catheters.

Whether one uses a straight or swan-neck catheter depends upon

where you desire to have an exit site (see next slide for explanation)

Summary •

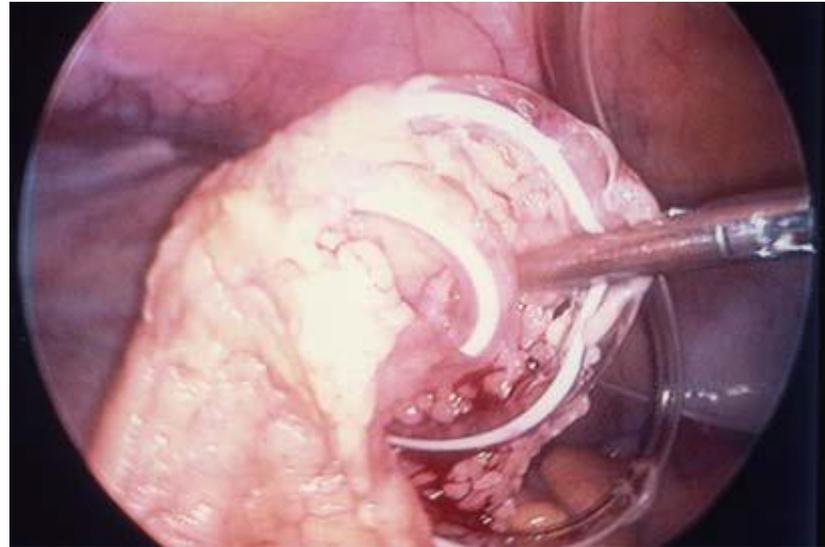
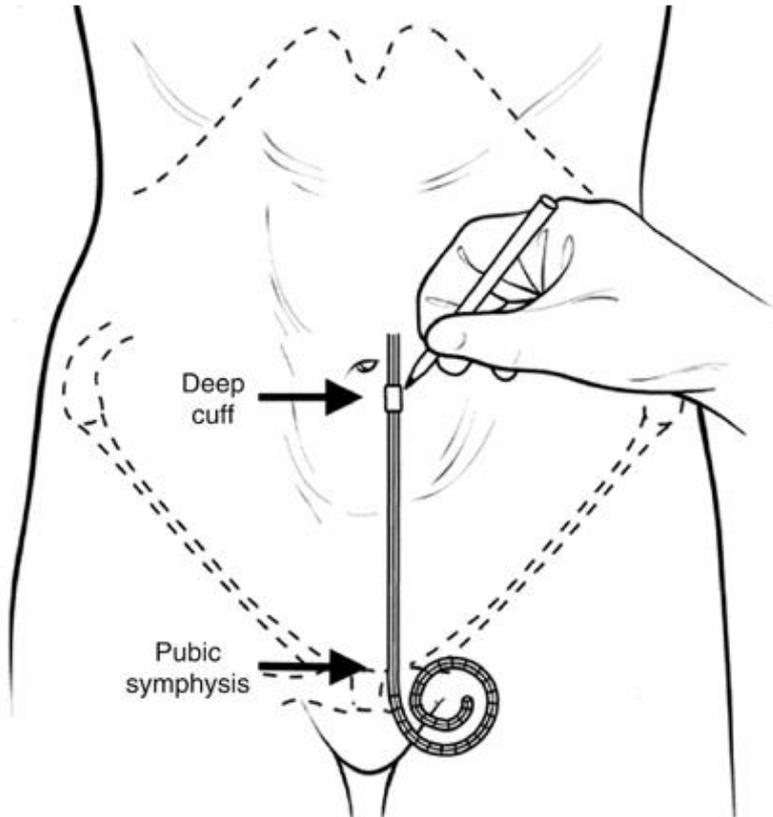
- Numerous design innovations; no conclusive proof that one is superior to other •
- Probably best to avoid polyurethane catheters entirely •
- Two-cuff catheters with coiled intra-peritoneal segment most commonly used: •
 - Two cuff catheters may lower risk of *Staph aureus* peritonitis •
 - Selection 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

It is important for the **nephrology team** to be involved •
in preoperative
management, including marking the abdomen prior to •
the placement of the PD catheter. •
It is best to mark the abdomen •
with the patient standing upright and taking into •
account the
patient's belt-line. The abdomen should be marked for: •
Location of deep cuff •
Location of superficial cuff •
Location of exit site •

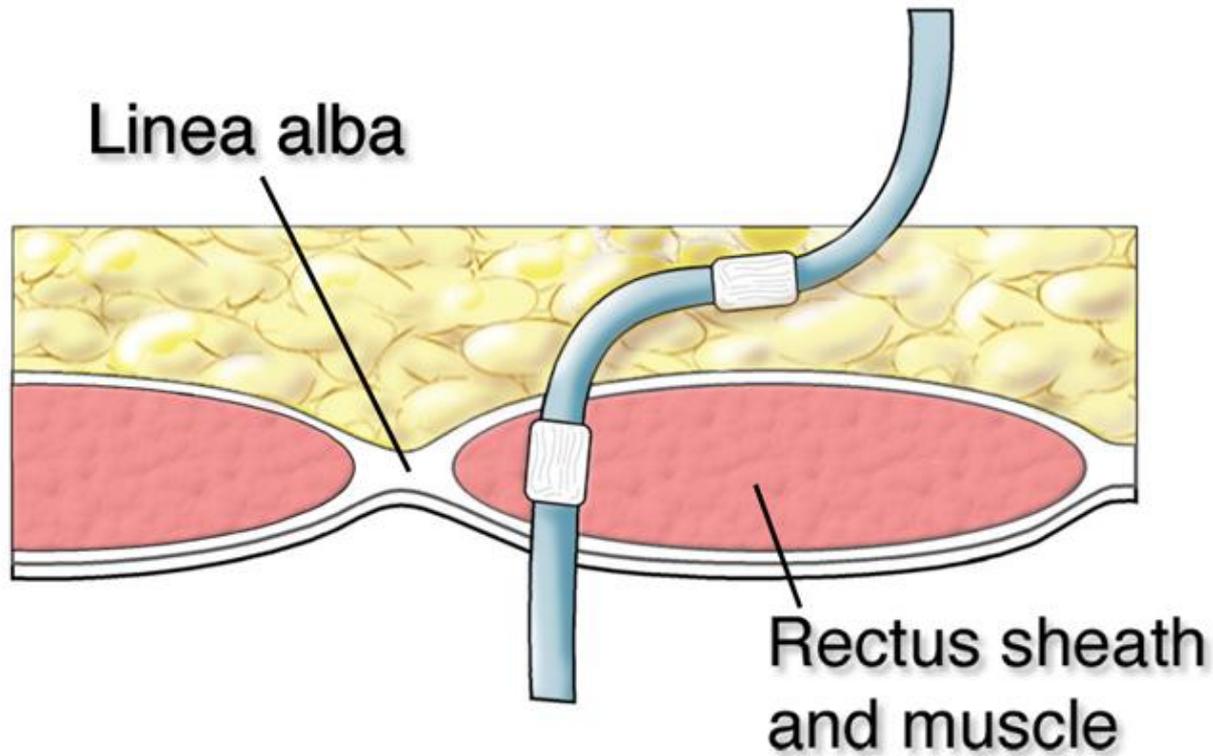
Location of Catheter Tip



It is important that the tip of the catheter be in the deep pelvis – this ensures optimal hydraulic function of the catheter and minimizes the risk for omental entrapment (lower right figure – omental entrapment as seen on laparoscopy).

The landmark that corresponds to a deep pelvic location for the tip of the peritoneal dialysis catheter is the pubic symphysis. Hence, when marking the abdomen pre-operatively, one can hang the catheter against the abdominal wall such that the tip of the catheter is at the level of pubic symphysis. This would then allow you to mark the area on the skin where to make the surgical incision for entry into the peritoneal cavity in order to intercept the muscle layer at the proper level to insert the catheter and position the deep cuff.

Location of Deep Cuff



Rectus Muscle •

Paramedian position - •

away from the linea •

alba •

**The catheter enters the peritoneal cavity just distal to the deep •
cuff. As**

**said earlier, deep cuff should be located at a place that allows the •
tip of**

**the catheter to be in the deep pelvis. Furthermore, the entry point •
into the**

**peritoneal cavity (and hence, the location of the deep cuff)) should •
be**

**paramedian – this ensures that the catheter is not going through •
but linea**

**alba (collagenous tissue in the midline that does not adequately •
close**

around the PD catheter and increases risk for leaks). •

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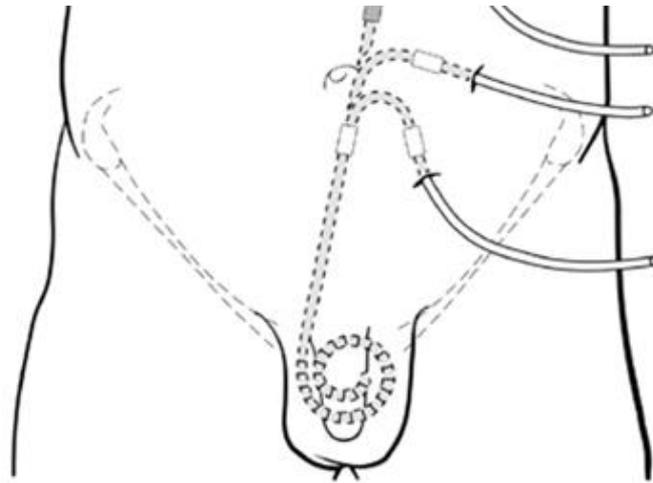
Principles in Fashioning Exit Site •

- 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 •

Once the location of the catheter tip and deep •
cuff is identified, the next •
steps would be to mark the abdomen for the •
location of the superficial cuff •
and the exit site. •

The principles outlined in the slide above allow •
one to •
identify the correct placement of the exit site, •
which in turn would allow •
identification of the appropriate site for the •
superficial cuff. •

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**

It is imperative to consider the belt-line when marking the abdomen for the location of the exit-site. In patients whose ***belt-line is above the umbilicus,*** the exit site should be located below the umbilicus. It is best achieved by using a swan-neck catheter with the exit site pointed downwards. In contrast, in patients whose ***belt-line is below the umbilicus,*** the exit site is best located in the upper abdomen. This is best achieved with a straight catheter with the exit-site pointed laterally.

Is the Exit Site Visible? Particularly Important for the Obese



Should be visible for a patient to perform daily



Proper placement of the exit site is particularly important for obese individuals •

– it should be visible to the patient to perform daily exit site care and should not be buried under the pannus to prevent recurrent exit site infections. The best way to identify the correct site for the placement of the exit site is preoperatively, •

with the patient upright. When the patient is lying supine in the operating room, the pannus falls onto the side, making it difficult to identify the correct location for the exit site. •

The two images on the left demonstrate an inappropriately placed exit site since it is buried under the pannus and not visible to the patient to perform daily exit-site care. •

There are two alternative approaches that can be considered for obese patients •

– upper-abdominal exit site (demonstrated in the middle panel; may require the use of extended catheters) or pre-sternal catheters (right panel). •

Where Is It Relative To Superficial Cuff?

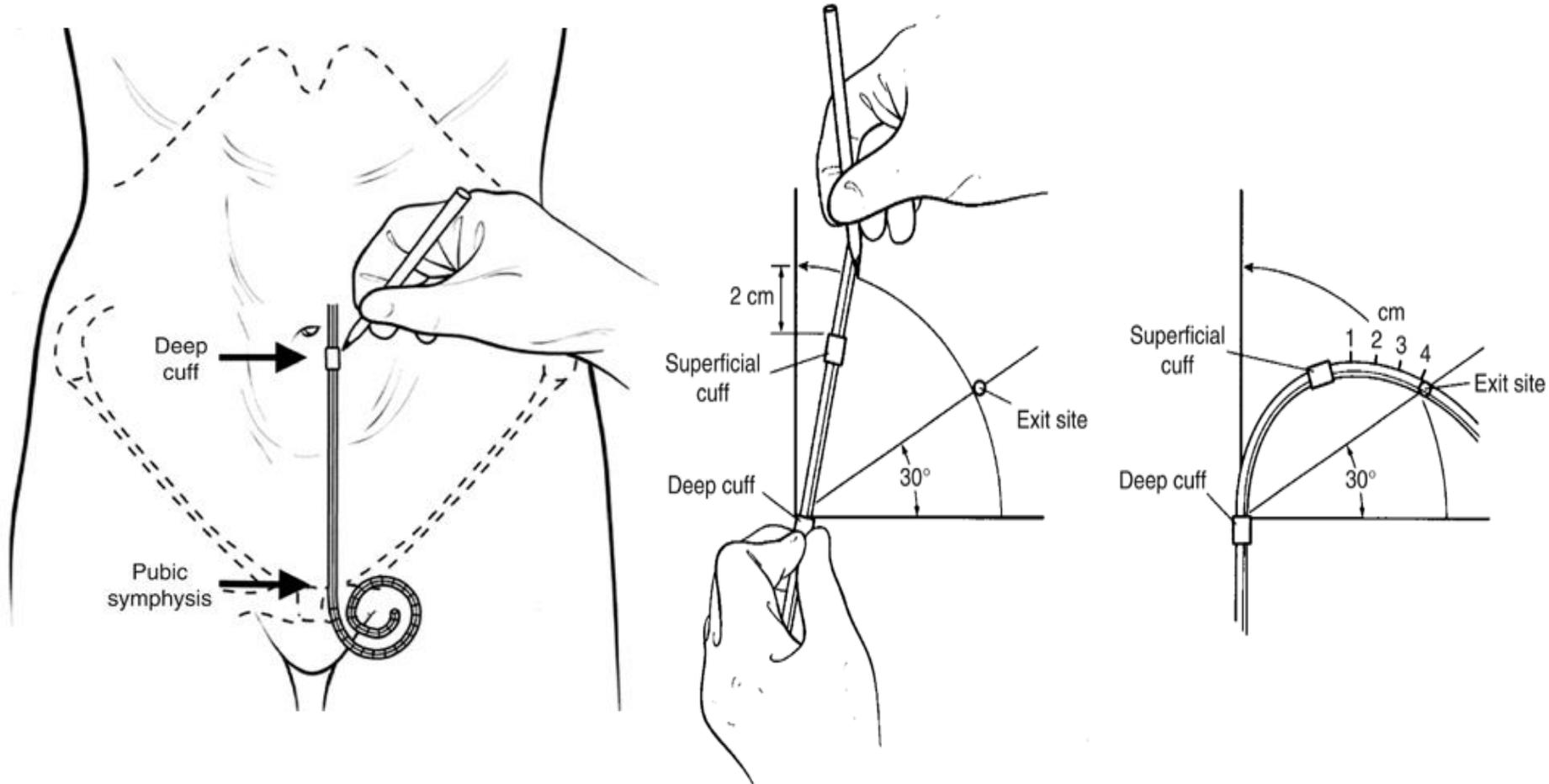


Should be about 1 inch from the
superficial cuff
WHY?

The exit-site should be located about 1 inch •
distal to the superficial cuff.

Placement of the exit site too close to the •
superficial cuff can result in
extrusion of the superficial cuff as is illustrated •
by these two patients.

Use Of Pre-Operative Marking May Obviate Exit Site Problems



To summarize

, the abdomen should be marked pre-operatively with the patient upright to minimize long-term problems. Several manufacturers include a stencil with each PD catheter placement kit and they can be used. Alternatively, stencils can be created by dialysis programs using the catheters that are being used by the surgeons to whom the patients are referred.

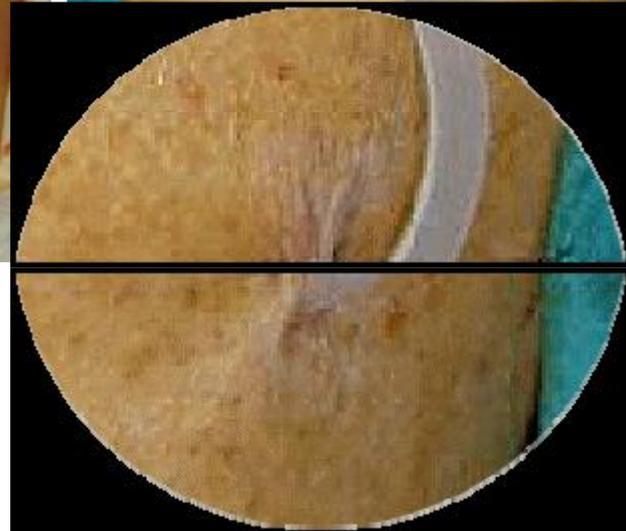
To recap, the following principles should be used when marking the abdomen:

- The abdomen should be marked with the patient recumbent but the marking should be checked with the patient upright.
- The location of the skin incision for entry into the peritoneal cavity should be first identified and marked – this should be a paramedian location, at a point that allows the tip of the catheter to be at the pubic symphysis
- The exit site should be marked such that:
 - It would be visible to the patient for appropriate exit site care
 - It is away from the belt-line and
 - It is 1 inch from the superficial cuff

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No

No Sutures or Staples At Exit Site!



The exit-site should be fashioned such that it is not patulous. This is best achieved by creating it by pushing the trocar, with the catheter threaded over at the distal end, through the skin, rather than using a blade to make an incision. This would also obviate the need for stitches/sutures at the exit site. Indeed, stitches/sutures at the exit-site should be assiduously avoided as they prevent complete healing of the exit-site and increase risk for infections.

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 standalone access centers
 - • Interventional radiologists
 - Many

Many different specialists have published their successful experience in placing PD catheters. It is best to place the PD catheter under direct vision and there are many advantages of advanced laparoscopy (discussed subsequently).

There are no controlled clinical trials that have compared advanced laparoscopy with open surgical placement of PD catheters. The few clinical trials that have compared basic laparoscopy to laprotomy have shown similar results with the two techniques. Furthermore, excellent results have been reported for catheters placed by nephrologists or interventional radiologists. Hence, if local expertise for advanced laparoscopy is not available locally, alternative approaches may be considered and are acceptable.

What Is Advanced Laparoscopy

There are three components of advanced laparoscopy: •

Rectus Sheath tunneling implies that the catheter traverses the thickness of the rectus muscle obliquely, rather than perpendicularly. This ensures a longer track through the muscle and a better anchorage of the catheter; •

Selective omentopexy is performed in patients with redundant omentum. The omentum is tagged with a stitch to the parietal peritoneum and this keeps the omentum away from the tip of the PD catheter and minimizes chances for omental entrapment; •

Selective adhesiolysis in patients with intra-peritoneal adhesions. •

As is evident from the table, use of advanced laparoscopy can be performed as an outpatient and is associated with a very low rate of complications and a very high long-term success rate. •

One additional point to be noted is that hernias, if identified pre-operatively, can be fixed at the same time as the placement of the PD catheter. •

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” •

How Long Can Catheters Be Embedded Before Exteriorization?

Catheters can be successfully used after having been embedded for over two years •

- One should expect a finite futility rate – catheters that are placed but never used (causes listed in slide) •
- Ten percent of more catheters have initial problems with drainage. •

However, they are generally easily resolved with flushing the catheters and primary failure of the catheter is rare. •

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How Long Should Catheters Be Embedded?

Based upon this one study, the optimal length for embedding the catheter is between 6 weeks to 6 months. Hence, if you anticipate that the patient will need PD within six weeks, the catheter should be placed using the conventional approach without embedding the external limb of the catheter.

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 •

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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 •

Generally, we wait for about two weeks from the time of placement of the PD catheter before first using it for peritoneal dialysis. This is done to allow the catheter tunnel to heal and minimize the risk of leak. However, if necessary, PD can be commenced on the same day as the catheter is placed and in appropriate cases, will minimize the need for temporary HD. •

There are some important considerations for “early break-in”. During this period, it is important to perform put only small volumes of the fluid at a time with the patient supine (“low-volume, supine PD”). This will minimize the increase in intra-peritoneal pressure and reduce the risk for leaks. This is best done with the use of a cyclor. •

It should be recognized that a patient in whom an “early break-in” still needs to be trained – training can happen while the patient is connected to the cyclor in an outpatient dialysis unit. Alternatively, the patient can come in to a dialysis unit two to three times a week for intermittent PD while training is scheduled for a later time. While inadequate, this would be enough to patient to maintain biochemical and volume control till full-dose PD can be started. •

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