



Brigham and Women's Hospital
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Complications of Peritoneal Dialysis

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Disclosures

Vantive Canada: Speaker and
Consultant

Vantive Global: Speaker

Opterion: Consultant



Learning Objectives

Using real cases, we will discuss

- approach to problems with the PD catheter
- infectious complications
- hernias and leaks
- bloody effluent



Mrs. BaD Karma

- 33 year old woman with postpartum renal failure
- no appropriate kidney donor
- attends dialysis education class and chooses home peritoneal dialysis
- PD catheter inserted by laparoscopy: good flow in the OR



Mrs. BaD Karma

- comes to peritoneal dialysis unit to begin training
- dialysate infuses easily, but very slow outflow
- first 500 mls takes about 30 minutes, and then the flow stops



Catheter-Related Problems

These usually occur soon after implantation:

- 2-way obstruction
 - problem with inflow and outflow
- 1-way obstruction
 - good inflow, poor outflow
- painful inflow or outflow



What is *Not* Necessarily a Problem...

First ever exchange:

- 1 liter good inflow
- 500 ml good outflow

WHY?



Catheter-Related Problems

2-way obstruction

- kink or bend in catheter
- intraluminal obstruction (blood clot, fibrin)

Treatment

- vigorous flush with heparinized saline, insertion of brush into catheter lumen (should be done only by experienced personnel)



Fibrin Plug



Catheter Dye Study: Kink in Catheter



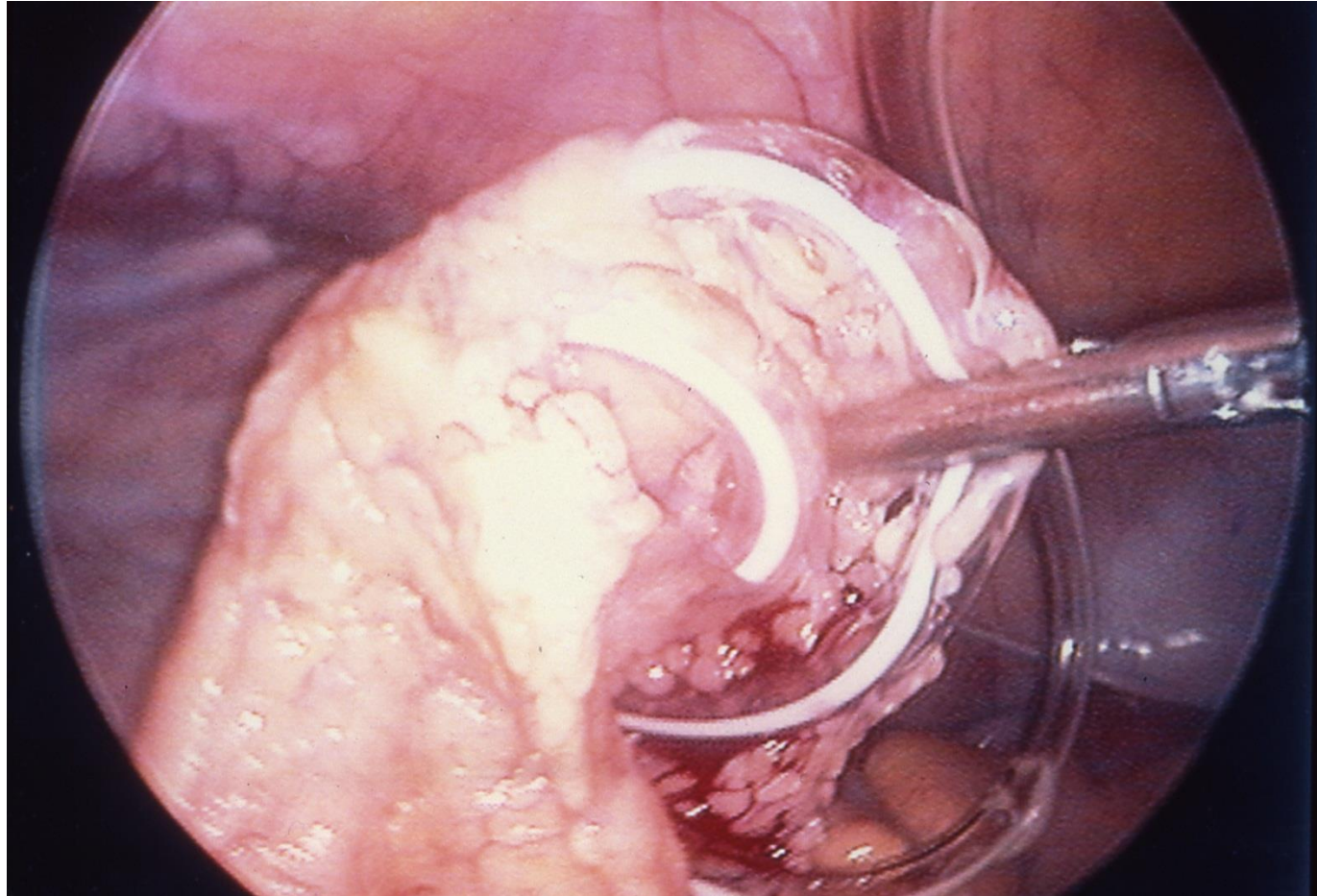
Catheter-Related Problems

1-way obstruction (good inflow, poor outflow)

- constipation ***
 - catheter migration into upper quadrants or into a loculated pocket
 - omental wrap
 - Fallopian tube wrap
- treatment
 - careful attention to bowel cleanout ***
 - radiologic or laparoscopic manipulation of catheter
 - surgical removal of omentum or laparoscopic omentopexy



Omental Wrap



Slide courtesy of Dr. J. Crabtree



Mrs. BaD Karma

Her abdominal flat plate shows:
lots of stool in the large bowel
catheter tip in the middle quadrant



Mrs. Karma

- she is given lactulose and a tap water enema, and you are told that there are “good results”

Are you happy?

- a. Yes
- b. No



Why Are We Not Happy?



- one bowel movement may just empty the rectum
- there may be 15 bowel movements lined up behind it



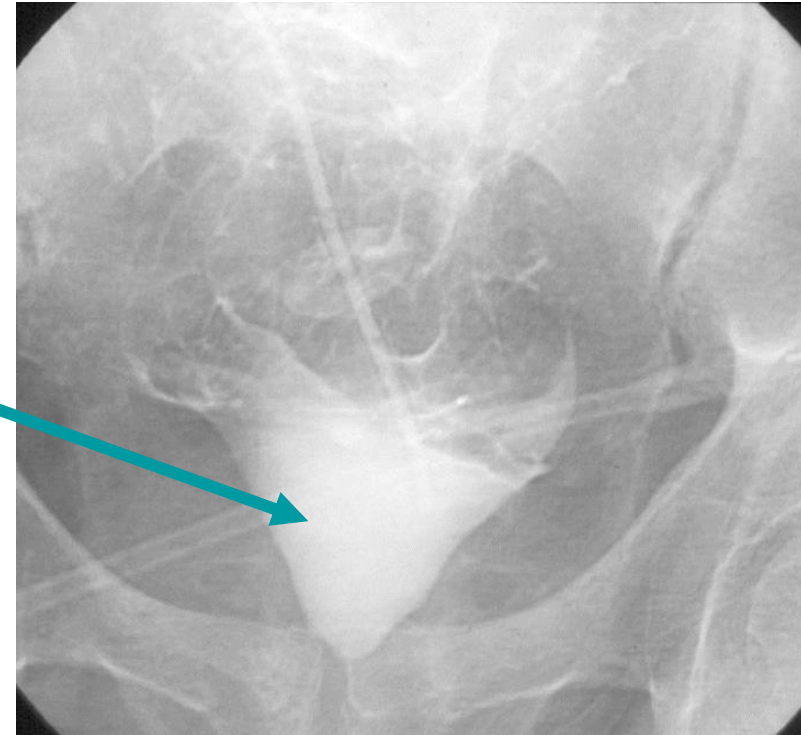
Mrs. Karma

- she is sent home for the weekend with lactulose and senna
- over the weekend she has 8 more bowel movements
- *still* no improvement in outflow



Catheter Dye Studies

- inject enough dye to fill catheter and spill into peritoneal cavity
- what you can diagnose:
 - kink in catheter
 - obstruction within lumen
 - peritoneal compartment problem



Mrs. B.D. Karma

Catheter dye study not diagnostic

- discussed with patient:
patient chose to continue with PD
- laparoscopic removal of fallopian tube from around catheter

Finally: catheter outflow improved dramatically!



Approach to Post-Insertion Catheter Dysfunction

- Figure out if it is one-way or two-way obstruction
- if two-way: flat plate +/- catheter dye study (kink, intraluminal clot)
 - can attempt catheter irrigation
- if one-way: abdo flat plate
 - you will likely see +++ stool and catheter may or may not be out of the pelvis



Approach to Post-Insertion Catheter Dysfunction *(cont'd)*

1. First of all: clean out the bowels (this may entail a lot of bowel movements!)
2. Recheck catheter outflow
3. If no improvement
 - another abdominal flat plate
4. If catheter tip is in the right place
 - ? omental wrap
 - ? tip not connecting with peritoneal cavity
 - make sure no more stool

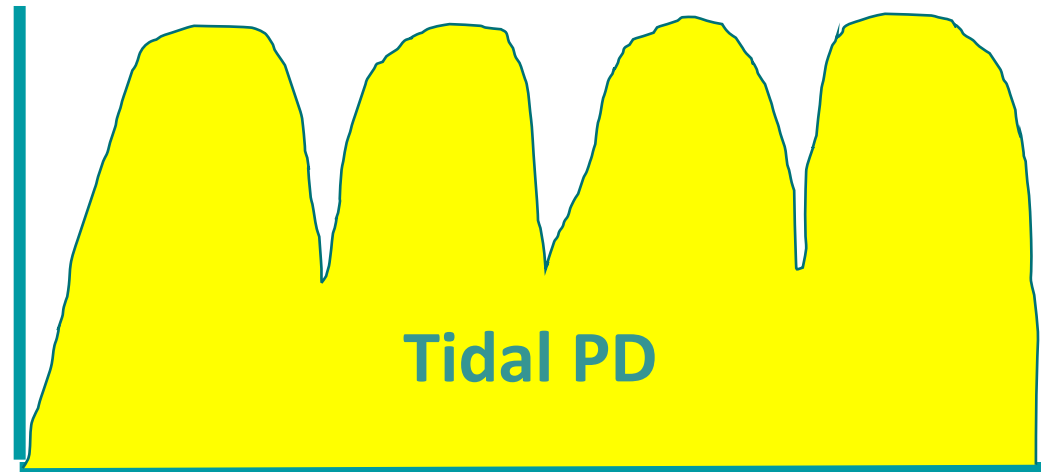
→ proceed to catheter dye study or diagnostic laparoscopy



Painful Inflow and Outflow

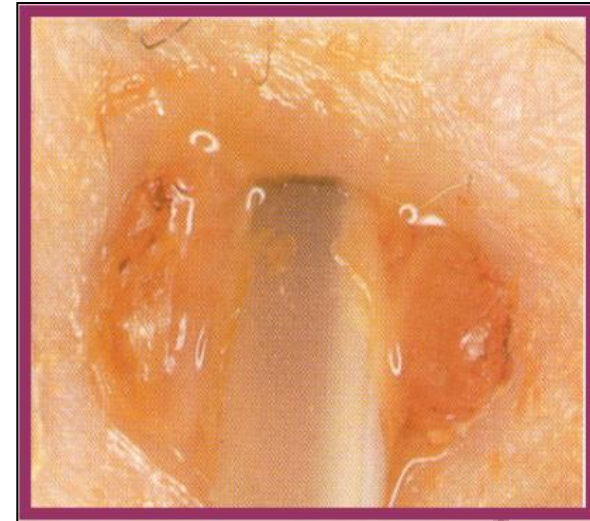
both can usually be treated by “tidal” PD:

- leave in a residual dialysate volume and cycle a smaller volume
 - eg 2L inflow, 1.7 L exchanges (I have occasionally used 50% tidal)
- (sometimes constipation will cause or exacerbate painful flow)



The Yucky Exit Site

- Mr. EZ is on PD X 2 years
- usual exit site care, including daily mupirocin
- presents with redness and pus around the exit site
- swab shows *Serratia Marcesens*



The Yucky Exit Site

What is The Best Course of Action?

- a) Remove the PD catheter and change to hemo for 4-6 weeks
- b) Remove the PD catheter and replace with a new catheter at the same OR
- c) Change the exit site ointment to gentamicin
- d) Change the exit site ointment to fluconazole



The Yucky Exit Site

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Prevention of Exit Site Infection

- regular application of antibiotic ointment to the catheter exit site is associated with a significant reduction in exit site infection and (in some studies) peritonitis
- the unknowns:
 - development of antibiotic resistance
 - effect of ointment/cream on catheter integrity
 - overgrowth of fungus



Gentamicin at the Exit Site: Yeast Overgrowth



2 of my patients who received gentamicin at the exit site
for gram negative cultures

Mr. G.W.

- 68 year old Type II diabetic
- 3 recurrent episodes of coagulase negative staph peritonitis in 5 months
- re-trained
- 2 weeks later presents with peritonitis
 - culture grows *Candida parapsilosis*



Fungal Peritonitis – A Serious Complication

- accounts for 1 – 15% of peritonitis episodes
- technique failure in many (> 40%)
 - But 35% in our cohort successfully returned to PD
- mortality rate 5 – 53% (frail patients)

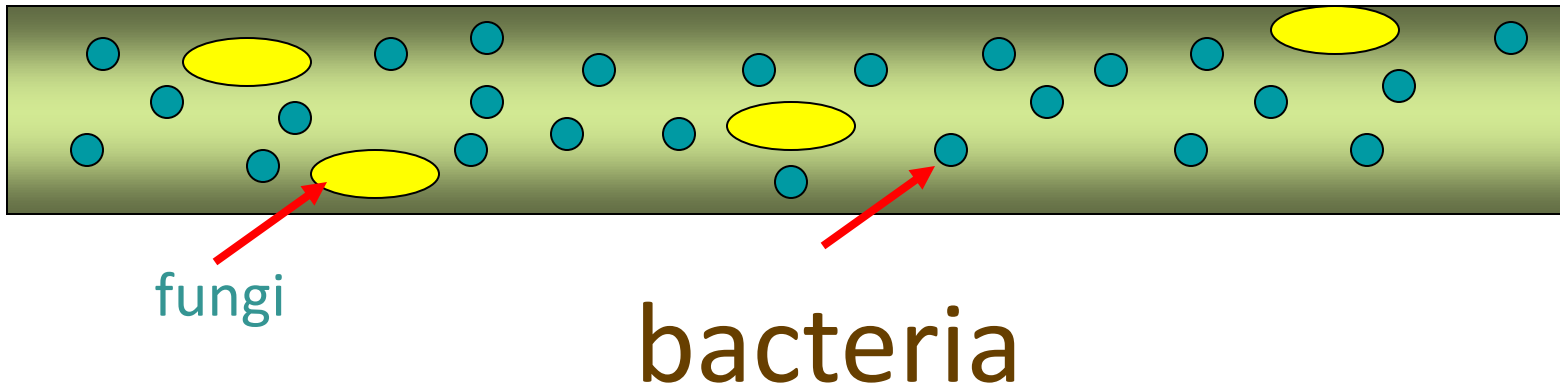


Risk Factors for Fungal Peritonitis

- frequent peritonitis **
- antibiotic therapy **
- immunosuppression
- peritoneo-vaginal communication

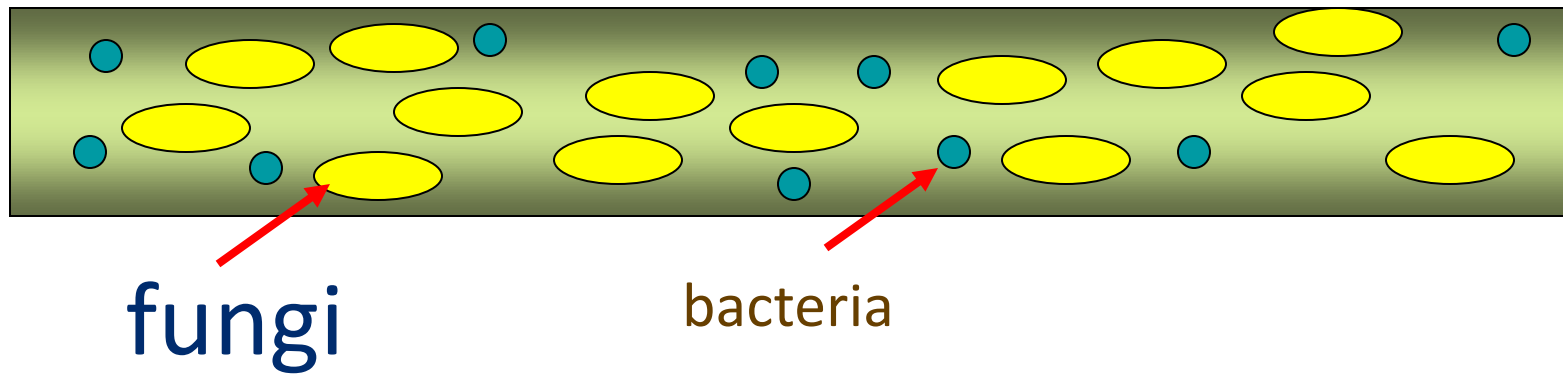


Antibiotic Therapy as a Risk Factor for Fungal Peritonitis



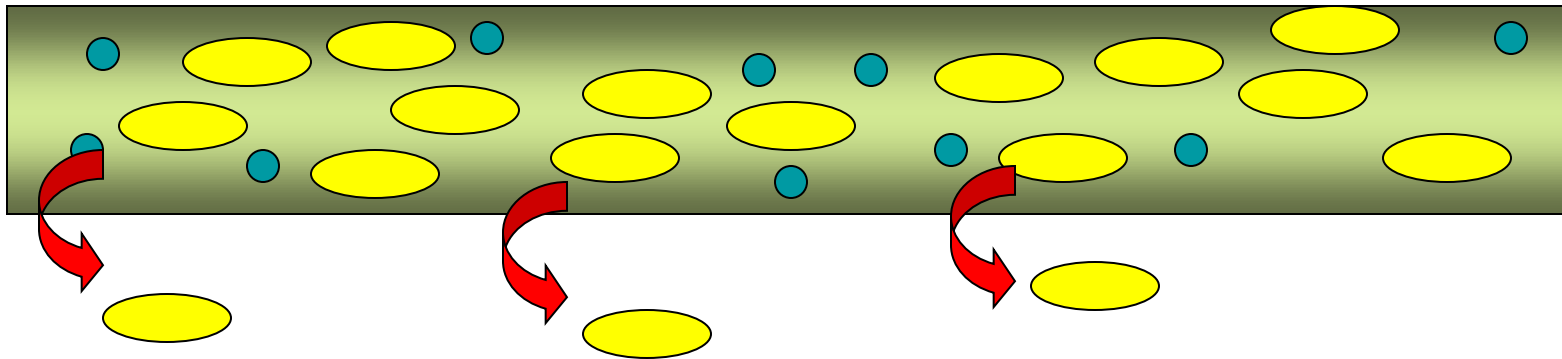
Then add antibiotics to the mixture...

Antibiotic Therapy as a Risk Factor for Fungal Peritonitis – with antibiotics



Fungal overgrowth of the intestine (and other sources?)

Antibiotic Therapy as a Risk Factor for Fungal Peritonitis – with antibiotics



Overgrowth of fungi leads to migration out of bowel and into peritoneal cavity?

Anti-Fungal Prophylaxis

- success rate of prophylaxis will depend on baseline rate of fungal peritonitis
- units with high rates have demonstrated reduction of fungal peritonitis rates with prophylactic anti-fungal therapy
- oral nystatin may be inconvenient, but safe
- can also use fluconazole



Fungal Peritonitis: After Catheter Removal, then What?



- interim hemodialysis
- for how long?
 - no one knows
 - 1-3 months?
- in our experience, 1/3 of the patients successfully returned to PD

Nadeau-Fredette Perit Dial Int 2015

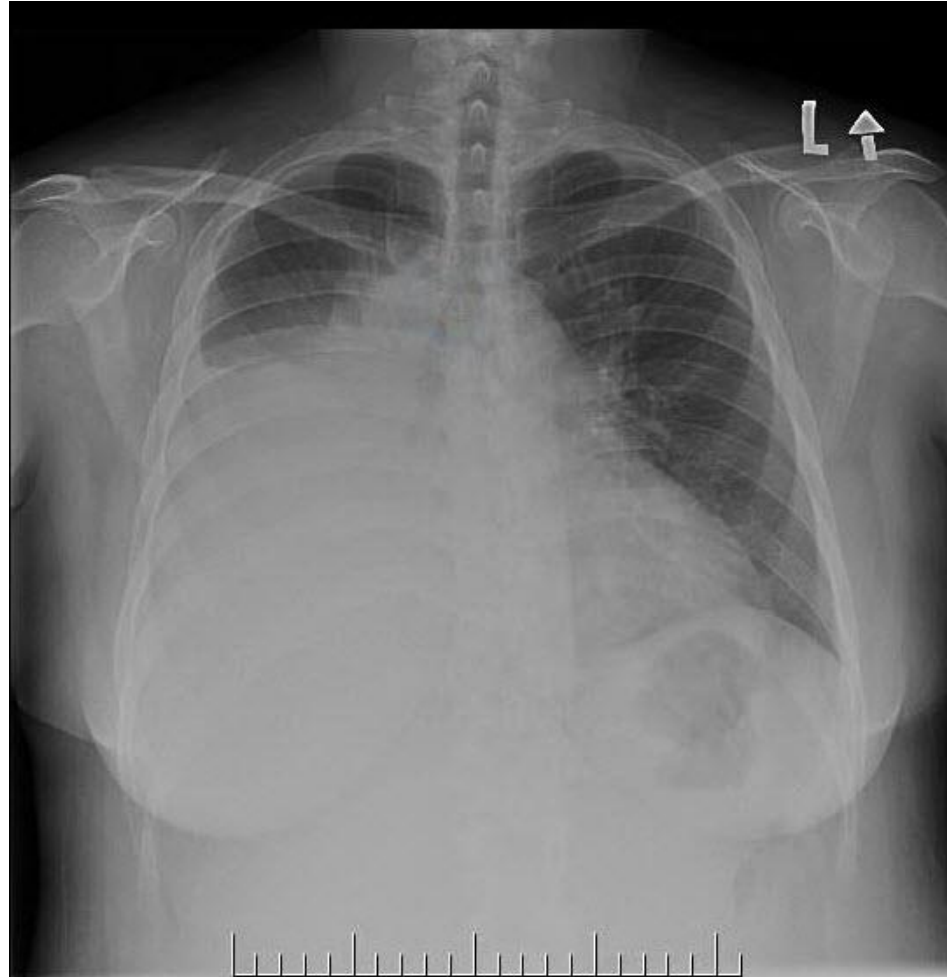


Mrs. Karma's Breathing Problems

- after her laparoscopic salpingolysis for Fallopian tube wrap, she is trained and discharged on APD, 2L X 3 exchanges over 8 h, 1.5L last fill
- 3 days later, she calls the unit, complaining of progressive shortness of breath
 - mild cough, but no fever or sputum
 - weight is increased 1 kg, but no edema nor change in blood pressure
 - a chest x-ray is ordered



Mrs. Karma's Chest X Ray



Hydrothorax

Definition: The presence of peritoneal dialysis fluid in the pleural cavity

Incidence: Probably < 5%

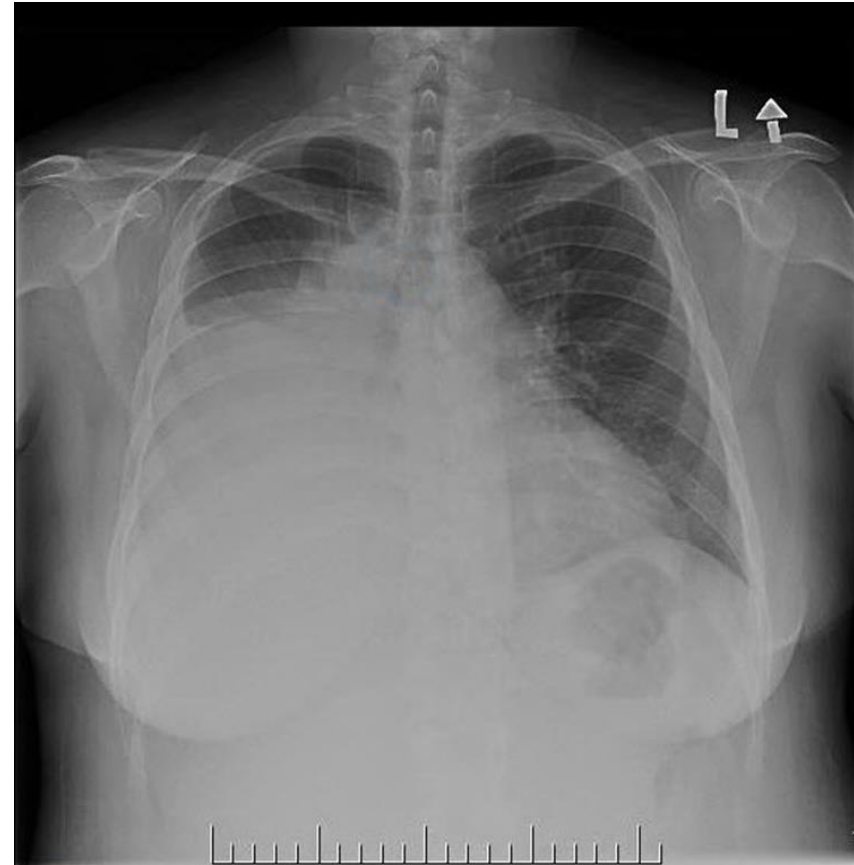
Pathogenesis: Movement of dialysate, under increased intra-abdominal pressure, from peritoneal to pleural cavity through congenital or acquired defects in the diaphragm



Hydrothorax

Presentation:

- may be asymptomatic
- shortness of breath
- diminished effluent return
- right-sided pleural effusion on CXR



Hydrothorax

- thoracentesis for relief of symptoms and/or diagnosis
- pleural fluid analysis:
 - transudate
 - very high glucose concentration (usually, *but not always*)
 - cell count variable
- don't use intraperitoneal methylene blue



Hydrothorax - Treatment

- thoracentesis may be helpful if very SOB
- stop PD
 - temporary hemodialysis, if dialysis needed
 - have a talk with the patient about returning to PD
- if patient wants to pursue PD:
 - pleurodesis (talc, tetracycline, bleomycin, autologous blood)
 - operative or pleuroscopic repair (diaphragmatic defects identified and patched or oversewn)



Mrs. Karma Gets Belly Pain



- after successful pleurodesis, Mrs. Karma returns to PD
- 4 years later she experiences crampy abdominal pain and cloudy PD fluid, afebrile



Which ONE of the Following is TRUE?

- A. Given the absence of fever, this pain is not likely due to PD peritonitis
- B. Typical PD peritonitis rates average about 1 episode a year in most centers
- C. There is an approximate 20% risk of bacteremia resulting from PD peritonitis
- D. Empiric coverage should be given for both gram positive and gram negative organisms



Peritonitis - Diagnosis

The diagnosis of peritonitis requires at least 2 of the following 3 features:

- peritoneal fluid leukocytosis ($>100/\text{mm}^3$, and at least 50% polymorphonuclear cells)
 - the fluid should dwell 2 to 4 hours
- abdominal pain
- positive culture of the dialysis effluent



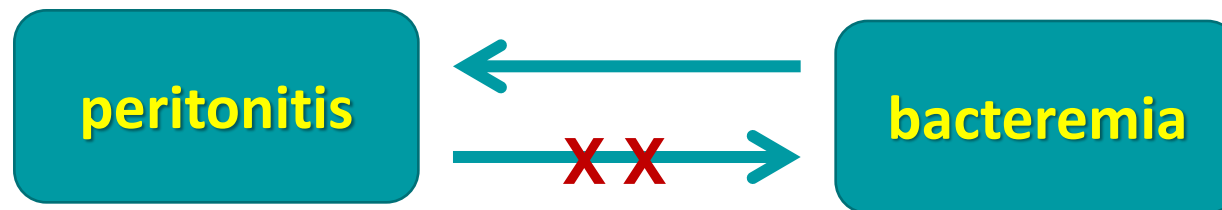
Hematogenous seeding

- bacteremia can cause peritoneal seeding and secondary peritonitis

but

peritonitis hardly ever causes bacteremia

(keep this in mind if you have a patient with a mechanical heart valve, LVAD or prosthetic hip)



Hematogenous seeding

Use antibiotic prophylaxis at times of anticipated bacteremia

eg dental work, endoscopy (upper and lower), colposcopy or GU instrumentation (and drain effluent before the procedure)



Peritonitis - Principles of Treatment

- start antibiotic treatment quickly
- cover for both gram positive and gram negative organisms until cultures available
- adjust antibiotics according to culture results
- re-evaluate the treatment if no improvement* in 36-48 hours
 - * less abdominal pain, falling peritoneal fluid WBC count



Peritonitis - Principles of Treatment

- consider removal of the PD catheter if little or no improvement in 4-5 days (especially if staph. aureus or pseudomonas)
- fungal peritonitis: catheter removal as soon as possible

don't let peritonitis drag on for days !



Most Recent Guidelines: Find them at www.ispd.org

Special Series/Guidelines

PERITONEAL
DIALYSIS
INTERNATIONAL



ISPD peritonitis guideline recommendations: 2022 update on prevention and treatment

**Philip Kam-Tao Li^{1,2} , Kai Ming Chow^{1,2} , Yeoungjee Cho^{3,4} ,
Stanley Fan⁵, Ana E Figueiredo⁶, Tess Harris⁷, Talerngsak Kanjanabuch^{8,9} ,
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Xueqing Yu^{20,21}  and David W Johnson^{3,4} **

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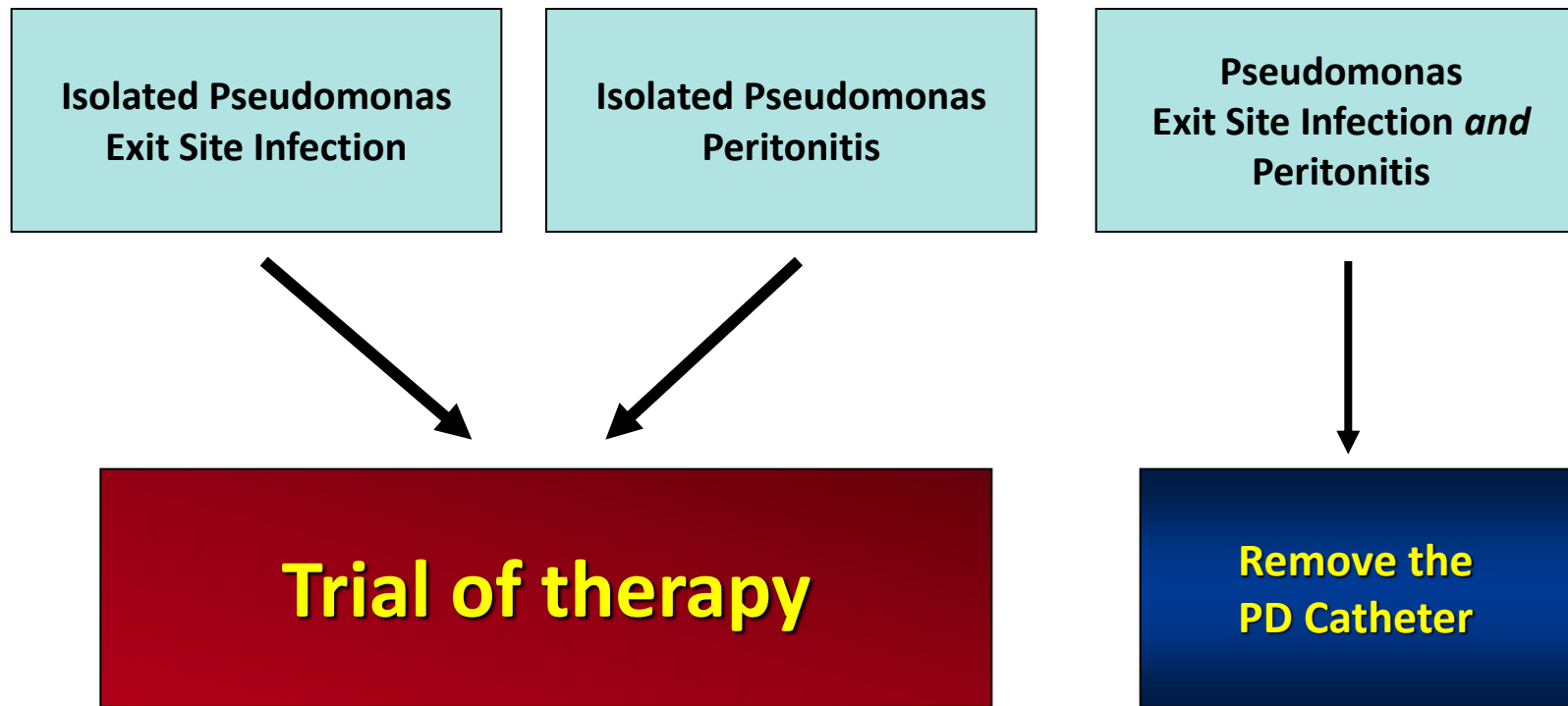


Special Cases: Pseudomonas Peritonitis

- combine 2 anti-pseudomonal antibiotics for 21 days
- if pseudomonas peritonitis is in association with pseudomonas exit site or tunnel infection, remove catheter



Pseudomonas Infection



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- D. Empiric coverage should be given for both gram positive and gram negative organisms



Explanation



- Fever is present in about 50% of patients with PD peritonitis
- Most units will have peritonitis rates of 1 episode every 36 months or better (our rate is 1 episode every 60-70 months)
- PD peritonitis rarely rarely leads to bacteremia

Risk for Technique Failure After Peritonitis

- 9100 episodes across 51 centers
- cure rate varied from 38% to 69%
- predictors of higher cure rate
 - higher % of patients on PD
 - empiric antibiotics covering Gm+ and Gm –
- units with greater % of patients on PD also had lower odds of catheter removal and lower transfer to HD

center-specific characteristics were more important than patient-specific characteristics





Mr. C the Building Superintendent

48 year old man with polycystic kidney disease is trained on cyclor dialysis. Current prescription is 2.0 L X 3 exchanges over 8 hours at night, with 2.0 L day dwell

- one year later: he is doing well
- residual kidney GFR is 8 ml/min
- his wife is almost finished being worked up as a kidney donor

The Building Superintendent

- at clinic, he reports a new “lump” in his left groin.
- he had been bent over looking under a sink and felt a “pop” and some tenderness in the groin
- on physical exam, there is a left inguinal hernia

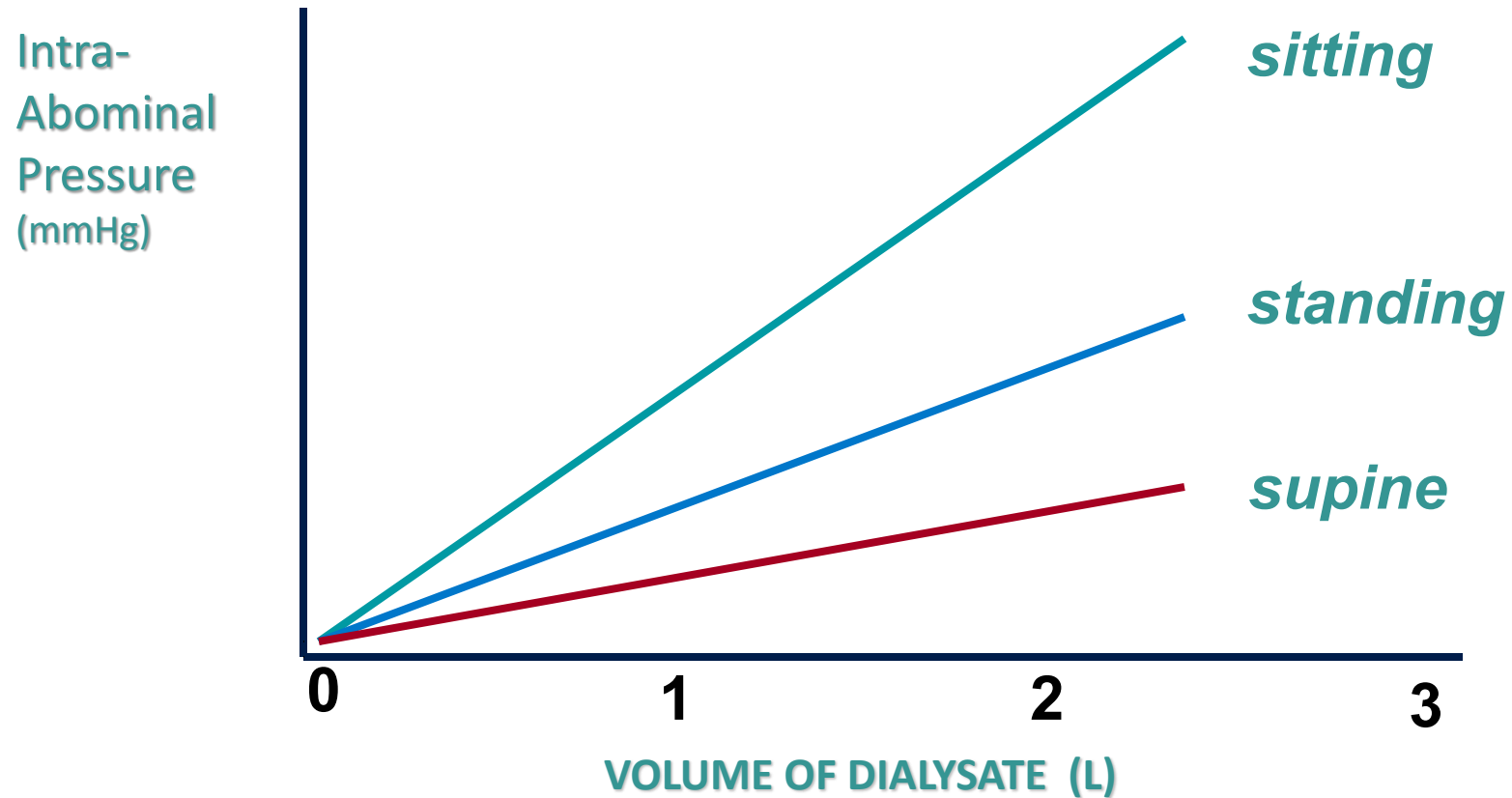


PD and Increased Intra-Abdominal Pressure (IAP)

- instillation of dialysate into the peritoneal cavity leads to increased IAP
- the magnitude of the increase depends upon:
 - volume of dialysate instilled
 - position of the patient (sitting>standing>supine)
 - age, body mass index
 - coughing, lifting, straining at stool, aerobics class, chopping wood



Relationship among Intra-Abdominal Pressure (IAP), Position & Dialysate Volume



Ventral Hernias



Umbilical Hernia



Inguinal Hernia



Treatment of Hernias

- warn patient about signs of incarceration
- surgical repair:
 - dialysis around repair depends on renal function and condition of the patient
 - don't usually have to put them on HD !
 - reintroduce PD with low volumes, supine posture, increase volume over 2 weeks
- The exception to keeping them on PD over the hernia repair: bowel compromise (incarceration and/or strangulation)



So What Happened to Our Superintendent?

- changed to night cycler dialysis
- dry during day (RKF 8 ml/min)
- elective hernia repair
- no PD for 2 days
- back to night cycler 1.5L volume X 2 weeks, then 2L volume overnight
- elected not to resume day dwell for now, given his good RKF



Abdominal Wall and Genital Edema

- abdominal swelling or bogginess, scrotal or labial edema
- diminished effluent return
- weight gain without peripheral edema
- pericatheter leak: wetness or swelling at exit site



“Peau d’orange” of Abdominal Wall Edema



Abdominal Wall Leak Due to Umbilical Hernia



Subcutaneous Edema Secondary to Dialysate Leak



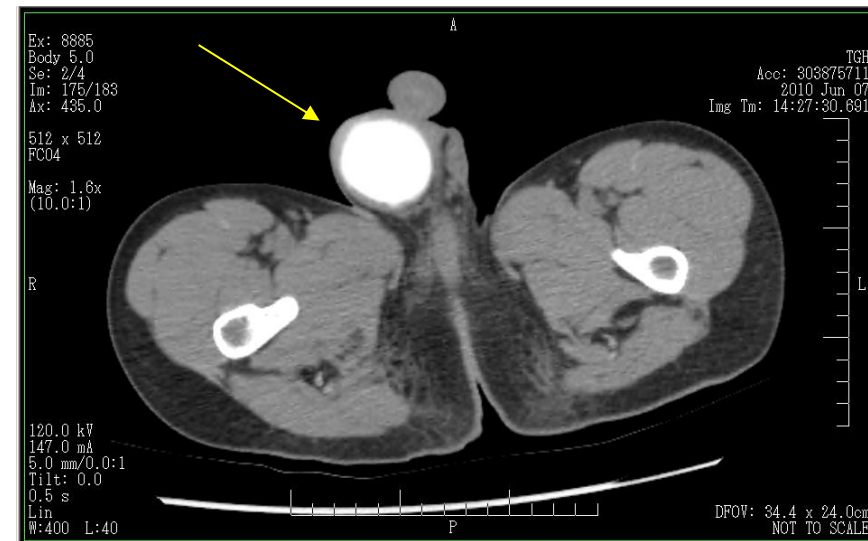
Abdominal Wall and Genital Edema

Diagnosis by CT Scanning:

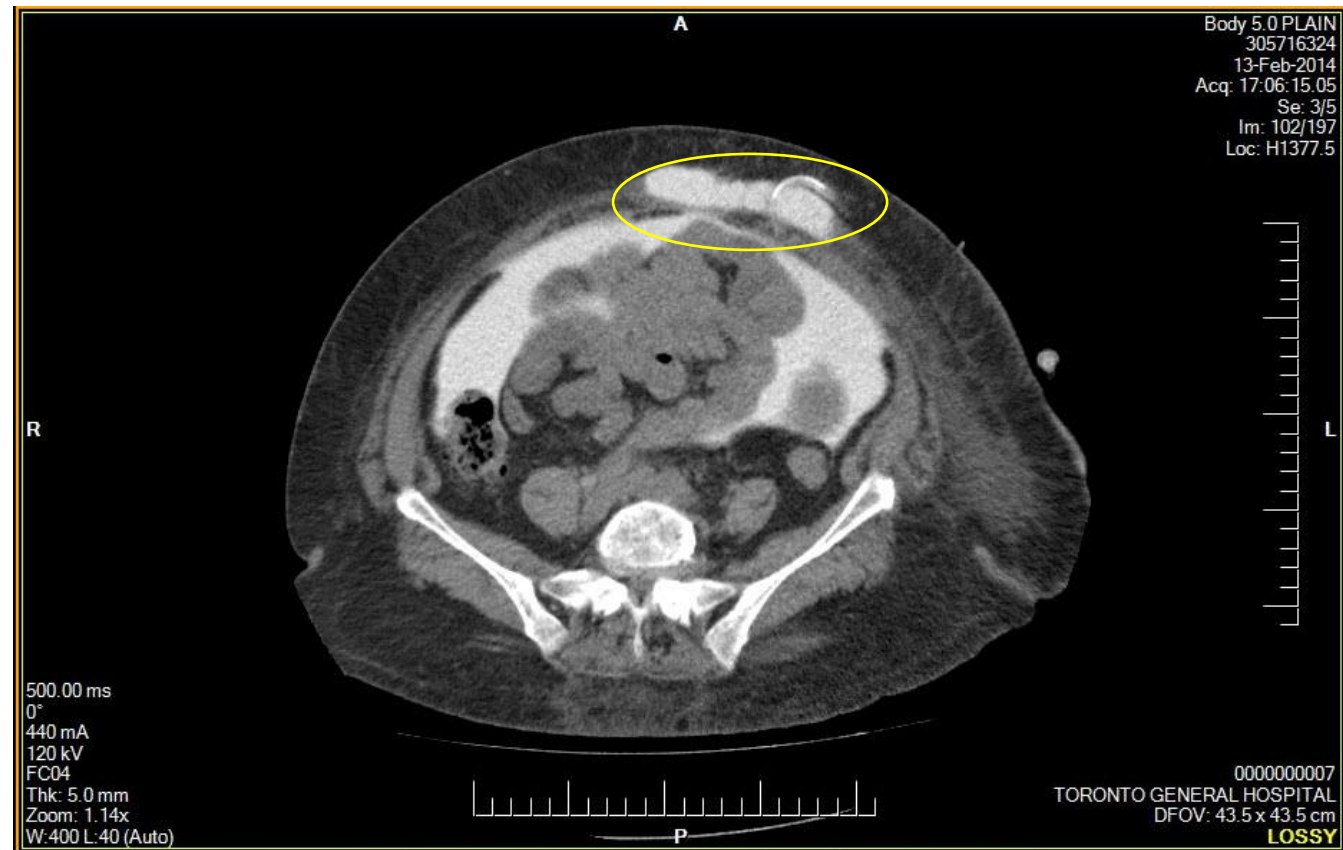
- add 100-150 ml iohexol to dialysis bag
- infuse dialysate into patient
- have patient ambulatory for 30 to 60 minutes to increase intra-abdominal pressure
- send for CT scan - discuss with the radiologist



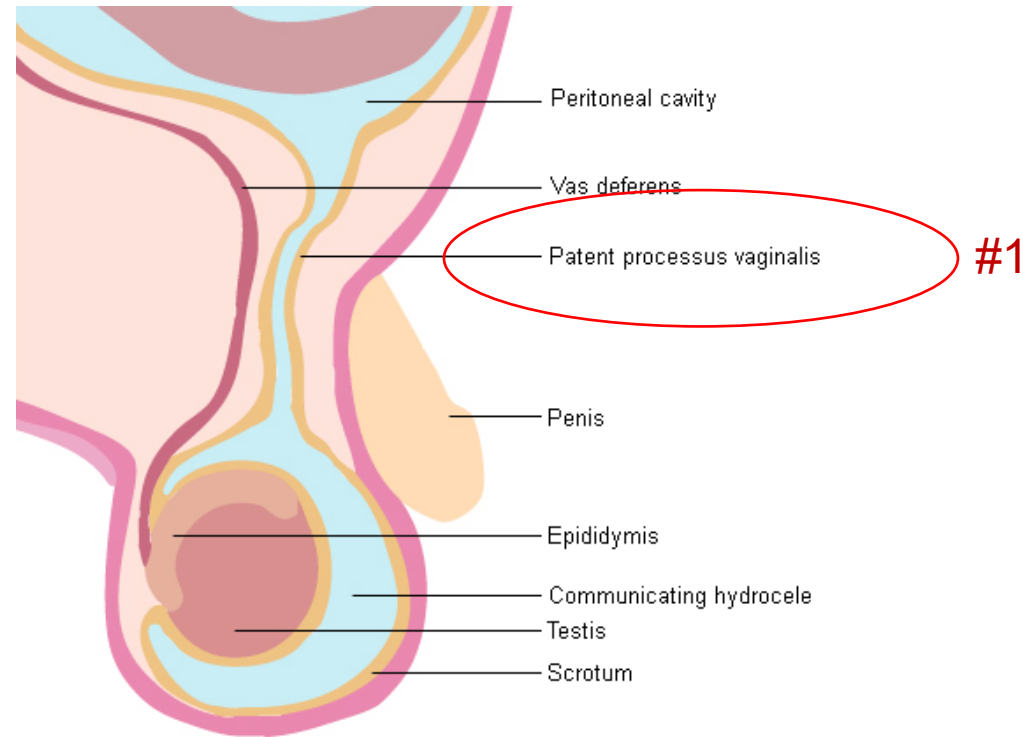
CT Scan with IP Contrast in a Young Man With Scrotal Edema



Leak of Dialysate Out of the Peritoneal Cavity

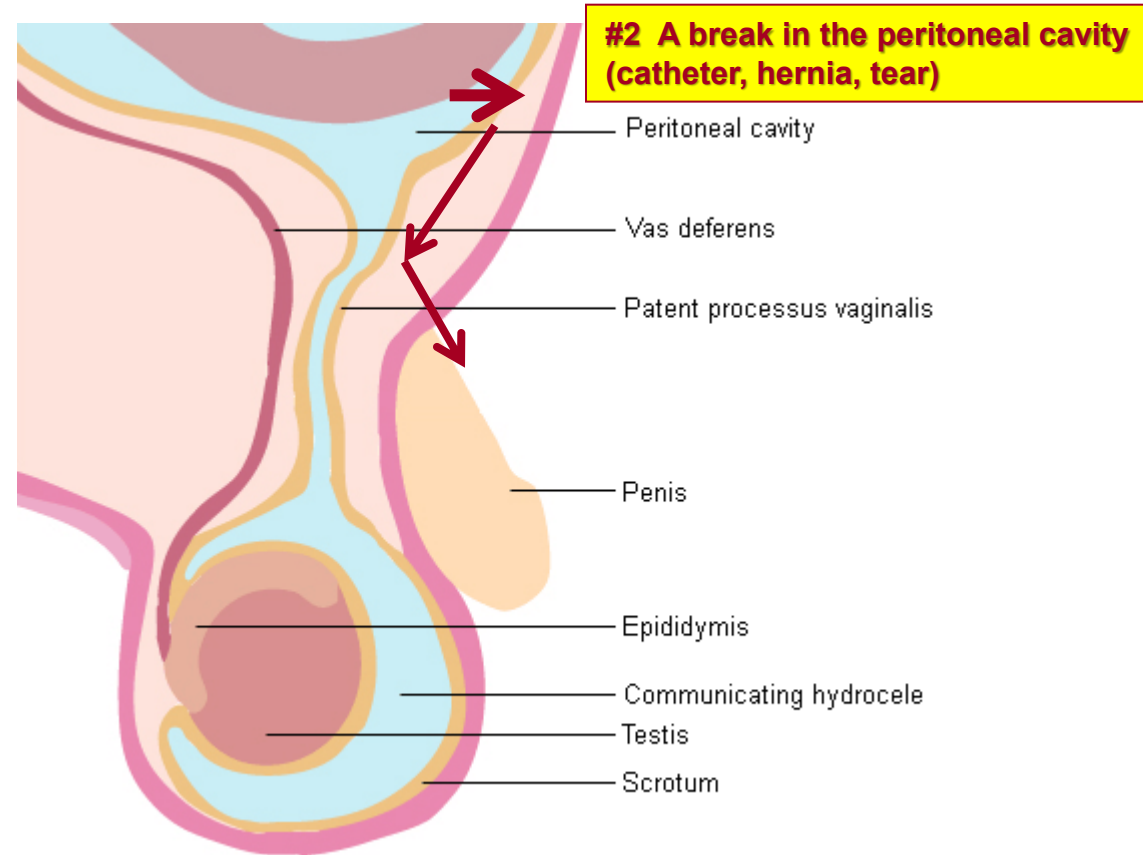


Two Pathways to Genital Edema



Leads to dialysate hydrocele +/- scrotal wall edema
Can lead to associated indirect inguinal hernia
Can uncommonly cause labial swelling in women

Two Pathways to Genital Edema



Leads to abdominal wall edema

If tracks by gravity, edema of the penis or mons pubis

Abdominal Wall & Genital Edema

Management:

- reintroduce low pressure PD (eg APD with low volumes)
- temporary HD to allow healing
- abdominal wall: CT scan for occult hernia
- genital: CT scan for patent processus vaginalis, which is easily repaired



SV and Her Scary Episode



- 28 year old woman, CKD of unknown etiology (presented with amenorrhea)
- predialysis education: chooses and starts on PD

SV and Her Scary Episode

- doing well on PD
- menses resume
- with 2nd menses: painless bloody dialysate effluent
- to ER: hemodynamically stable, but urgent CBC, PTT, cross and type



Hemoperitoneum

“Benign” Causes

- menstruation (retrograde menses or endometriosis)
- ovulation
- ruptured renal or ovarian cysts
- trauma
- coagulopathy



How Does Menstruation Lead to Bloody Effluent?

- retrograde uterine bleeding
- endometriosis of peritoneal cavity



speakendo.com



centerforendo.com

Hemoperitoneum

Serious Causes

- ischemic bowel
- hepatic or colon cancer
- pancreatitis
- encapsulating peritoneal sclerosis
- kidney cancer



Hemoperitoneum

Treatment

- IP heparin to avoid clotting of catheter
- flushes
- dialysate at room temperature if active bleeding
- investigations depend on whether benign or serious type of presentation



And What Do You Think About
This?



So What Have We Learned? (1)



- constipation is the #1 cause of outflow obstruction in new catheters
- having a bowel movement doesn't necessarily mean it's cured
- think of hydrothorax if a patient gets short of breath early in the course of PD





So What Have We Learned? (2)

- long-term antibiotics are a risk for fungal peritonitis
 - fungal prophylaxis may or may not work, but it's low-risk therapy
- staph aureus or pseudomonas infection of BOTH exit site and PD fluid won't get better with antibiotics – remove the catheter



So What Have We Learned? (3)

- commonest cause of hemoperitoneum is menstruation and needs no further investigation in that setting



So What Have We Learned? (4)

Hernias are common in PD patients

- try to prescribe day dry or small day volumes in at-risk patients
- they can usually be repaired operatively without switching to hemodialysis
- they may lead to secondary bowel incarceration and even strangulation
- they can be a source of leak of PD fluid into surrounding tissues

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