Home Dialysis University

Non-Infectious Non-Catheter Complications of PD

Rajnish Mehrotra, MD, MS

Harborview Medical Center

University of Washington, Seattle

Jointly provided by USF Health and the International Society for Peritoneal Dialysis.
Funded in part by unrestricted educational grants.

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HARBORVIEW MEDICAL CENTER

RMehrotra@Nephrology.washington.edu

Potential Conflict of Interest Disclosures at time of recording:

Consultant to Baxter Healthcare

Complications specific to PD

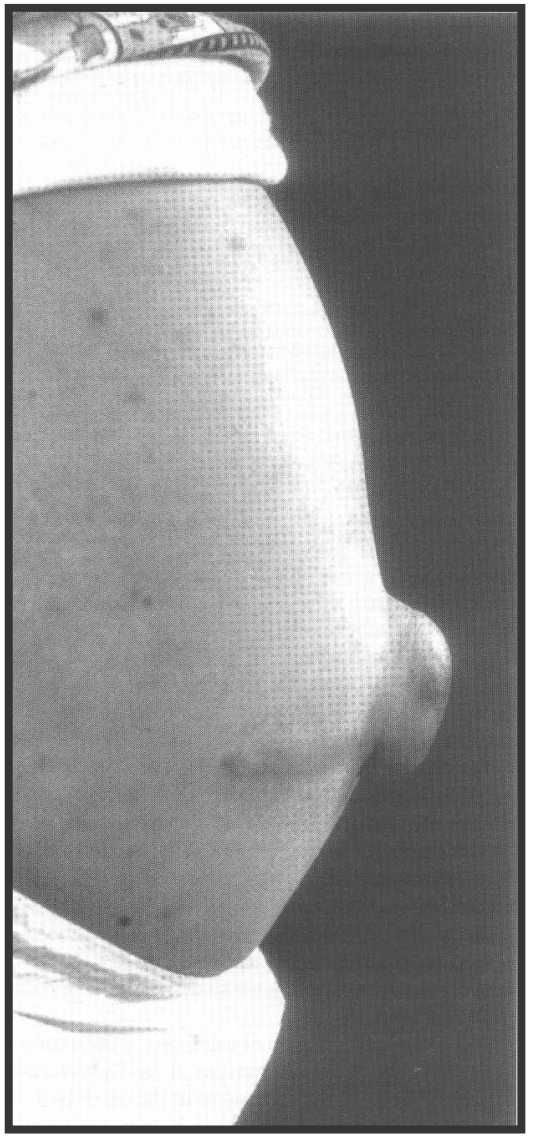
- Related to increased intra-abdominal pressure
  - Low back pain, Hernias, and Leaks including hydrothorax
- Short-term consequences:
  - Infusion/Drain Pain, Hypokalemia
- ……..peritoneum
  - Hemoperitoneum, Pneumoperitoneum, Chyloperitoneum
- Long-term consequences:
  - Encapsulating Peritoneal Sclerosis
  - ??Weight gain??

Secondary to increased intra-abdominal pressure

Low-back pain
Hernias
Leaks
Hydrothorax

A 67-year old woman with end-stage renal disease started treatment with PD 3 months ago. At the most recent clinic visit, she reported that she had noticed an abdominal lump. On physical examination, it looked like….

What should you do?



From: Bargman in Textbook of PD

Hernias: Clinical Considerations

- Most hernias are present prior to start of PD:
  - Intraperitoneal dialysate more likely to make it clinically apparent
  - Surgeon/operator should carefully inspect for presence of hernias prior to catheter placement
  - Hernia repair at the same surgical sitting as placement of PD catheter possible
- ***Unusual Presentations***:
  - Bowel obstruction and incarceration

Generally, hernias in people doing PD should be repaired

Hernia Repair: Surgical Approaches

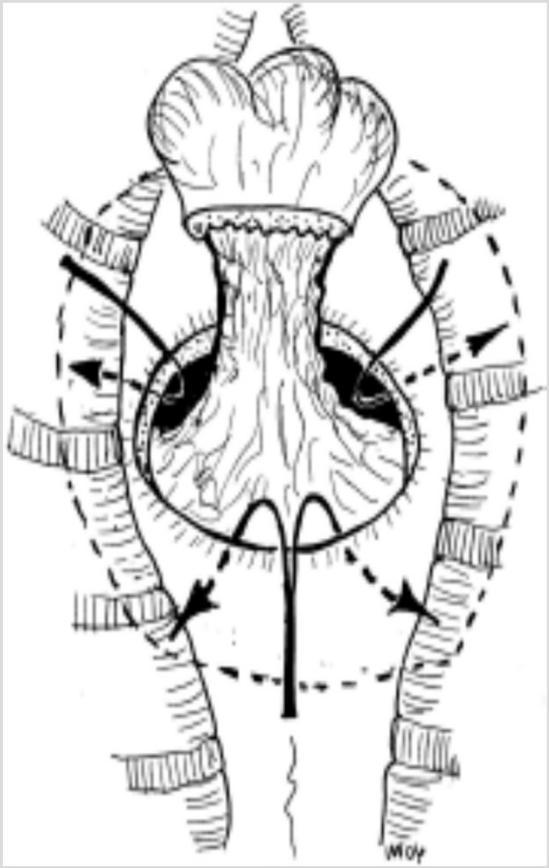
Crabtree, Perit Dial Int, 2006; 26: 178-182

- **Conventional Techniques**:
  - Suture closure of abdominal wall defects
  - Recurrence in people without kidney failure – 10-15%
  - Recurrence in PD patients – 22-29%

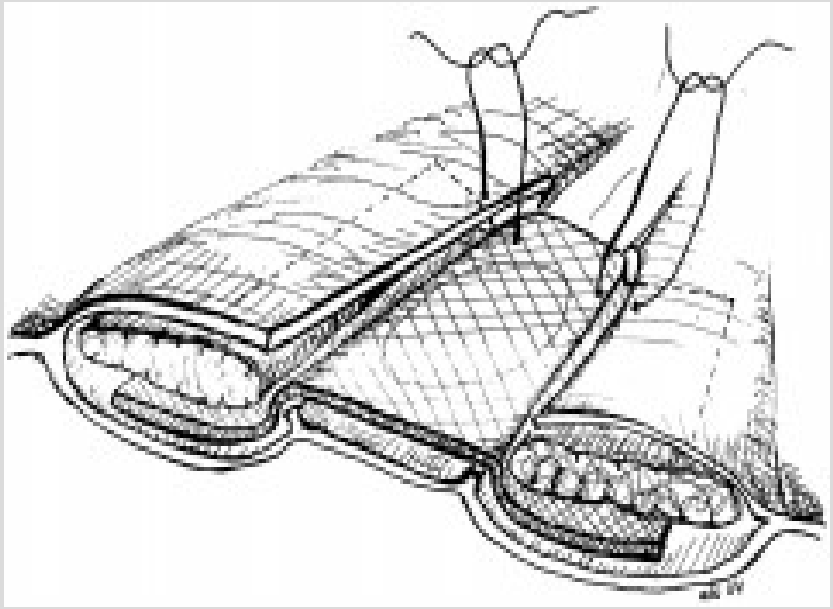
- **Tension-Free hernioplasty with polypropolene mesh:**
  - Achieves best results
  - Hernia sac dissected from surrounding structures and invert into peritoneal cavity without opening it
  - Mesh placed in pre-peritoneal space; avoids direct contact with the peritoneum

Tension-Free Hernia Repair

Garcia-Urena, Perit Dial Int, 2006; 26: 198-202



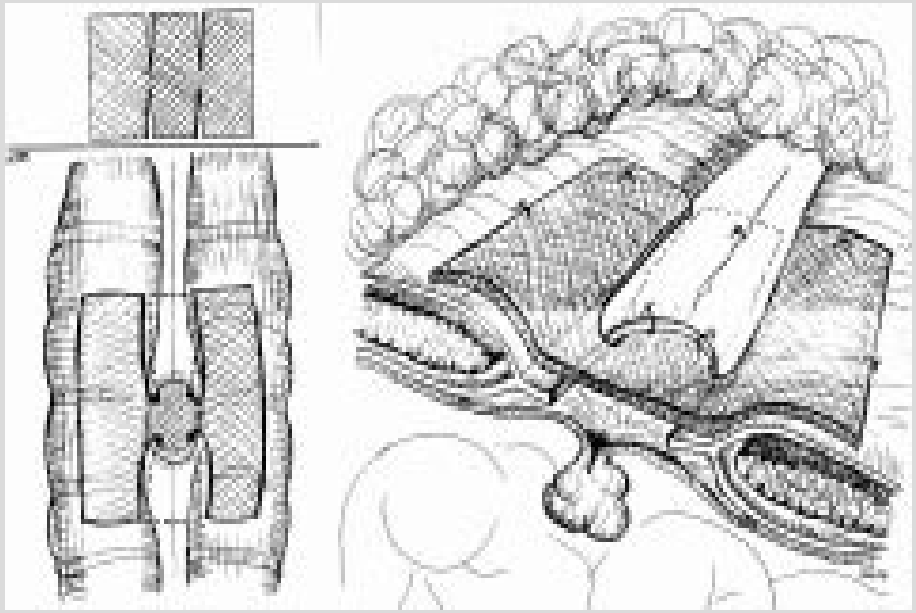
Dissection of Hernia Sac



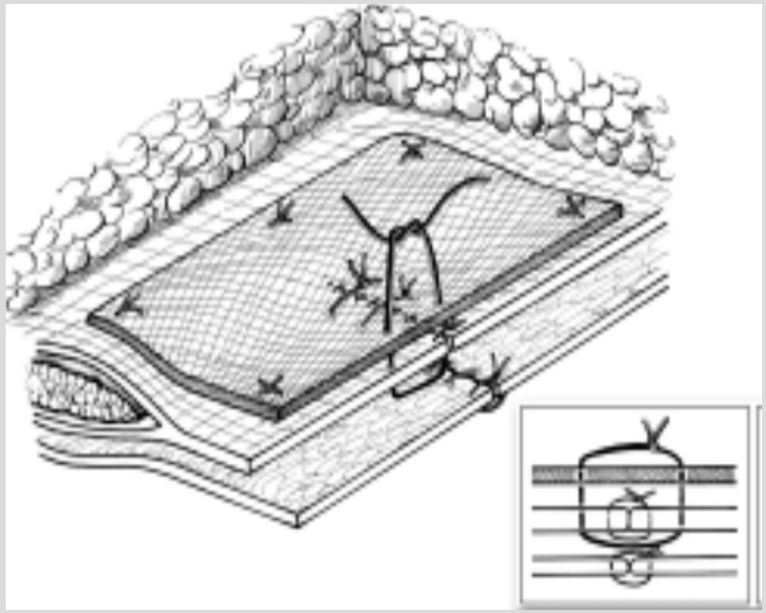
Retromuscular overlay technique for ventral hernia

Tension-Free Hernia Repair

Garcia-Urena, Perit Dial Int, 2006; 26: 198-202; Crabtree, Perit Dial Int, 2006; 26: 178-182



H-mesh hernioplasty for umbilical and epigastric hernias with ante-muscular overlay



Buttressed umbilical hernioplasty using polypropolene mesh hernioplasty

Does Hernia Repair Require Temporary Transfer to HD?

Shah et al, Perit Dial Int, 2006; 26: 684-687

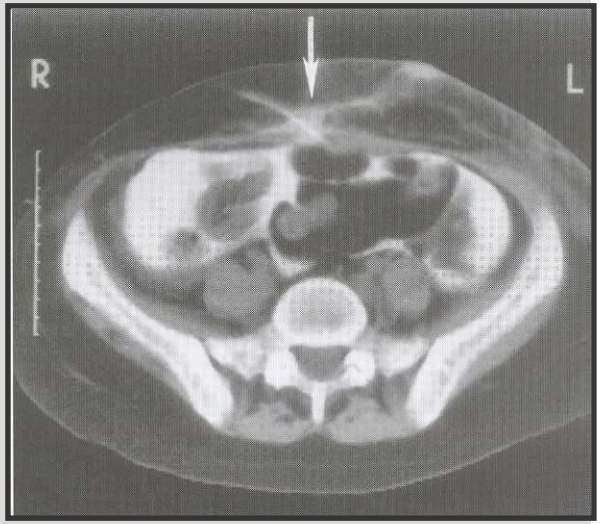
- NO
- If significant residual kidney function (> 4 ml/min):
  - No dialysis for 1-2 weeks; start low-volume PD thereafter
- If without residual kidney function:
  - No dialysis for 48 hours
  - IPD three times/week (1 L x 10 over 10 hours)
    - CAPD, 2 weeks
    - CCPD, 1 week
  - After IPD:
    - CAPD patients 1.0 – 1.5 L x 5 exchanges for 2 weeks
    - CCPD patients – NIPD x 4 weeks
  - Resume full-dose PD after 4-5 weeks

A 35-year old man has kidney failure for 10 years for which he received a pre-emptive living donor transplant. With failure of allograft, he has to start dialysis and he has chosen PD. The allograft function, however, has progressively declined and he was advised to start dialysis. He underwent placement of PD catheter two weeks ago. Today, he presents for training and a few minutes after instillation of dialysate, the patient reports wetness at the exit site. Two days ago, his serum creatinine was 7.8 mg/dl and his 24-hour urine volume was 1200 ml.

What is your diagnosis? How will you confirm it?
What should you do?

External Leaks

- ***Clinical presentation:*** Moist/wet dressing.
- ***Diagnosis:*** Usually clinical; ay use a glucometer test strip to check glucose conc. of the leaking fluid
- ***Management:***
  - Postpone PD initiation 1-2 wks
  - Low-volume supine PD
  - Infiltration of catheter cuff with fibrin glue
  - Surgical repair



Twardowski et al, ASAIO Trans 1990; 36: 95-103

A 53 year-old man with autosomal dominant polycystic kidney disease started treatment with continuous ambulatory peritoneal dialysis (CAPD) four weeks ago. He feels well but has noticed progressively increasing size of his scrotum. At the time of evaluation, he looks comfortable and his blood pressure is 132/78. He has no lower extremity edema. Upon examination of his genitalia, his left scrotum was found to be swollen with positive transilluminance.

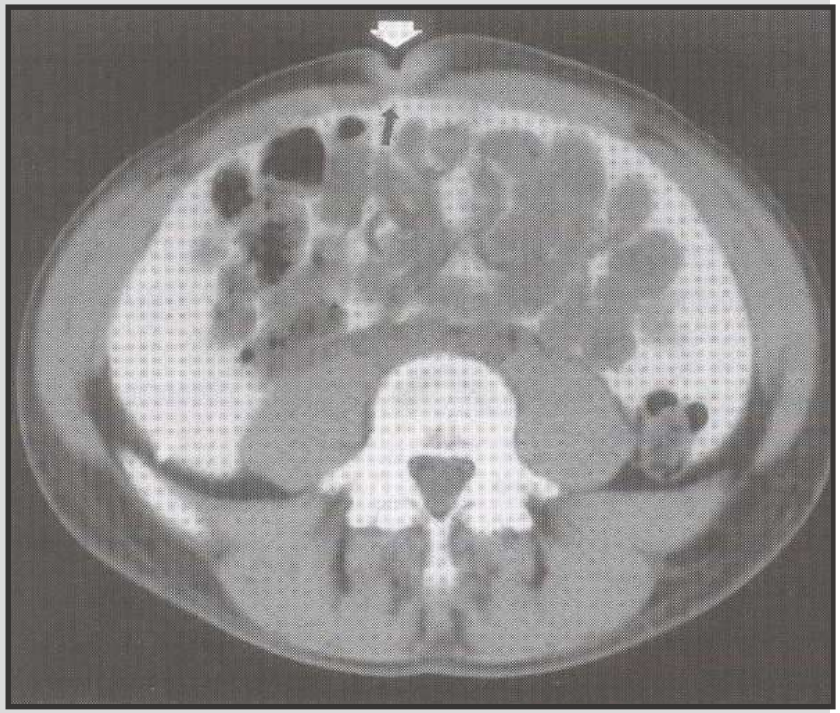
What should you do next?

What is your diagnosis? How will you confirm it?
What should you do?

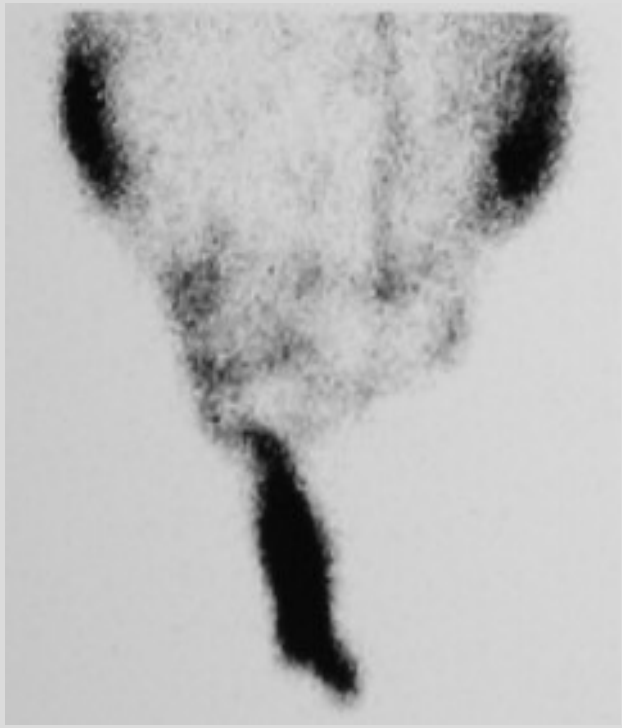
Internal Leaks
Twardowski et al, ASAIO Trans 1990; 36: 95-103

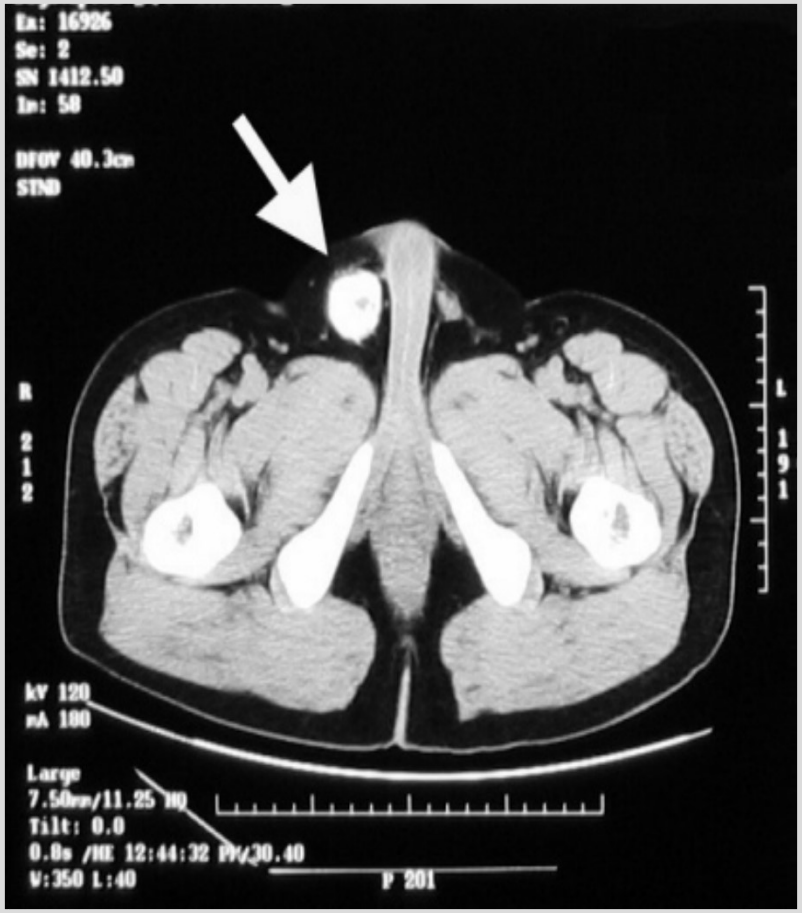
- ***Clinical presentation***:
  - Genital edema and/or abdominal wall edema
  - Apparent UF failure (unchanged PET)

- ***Diagnosis***:
  - Clinical diagnosis
  - CT peritoneography
  - Radionuclide studies
  - MRI



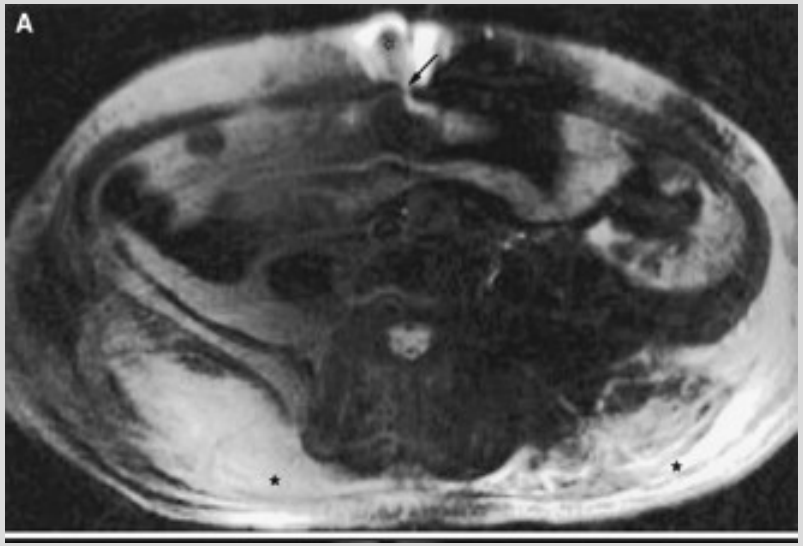
Patent Processus Vaginalis:
A form of internal leak
Crabtree, Perit Dial Int, 2006; 26: 178-182



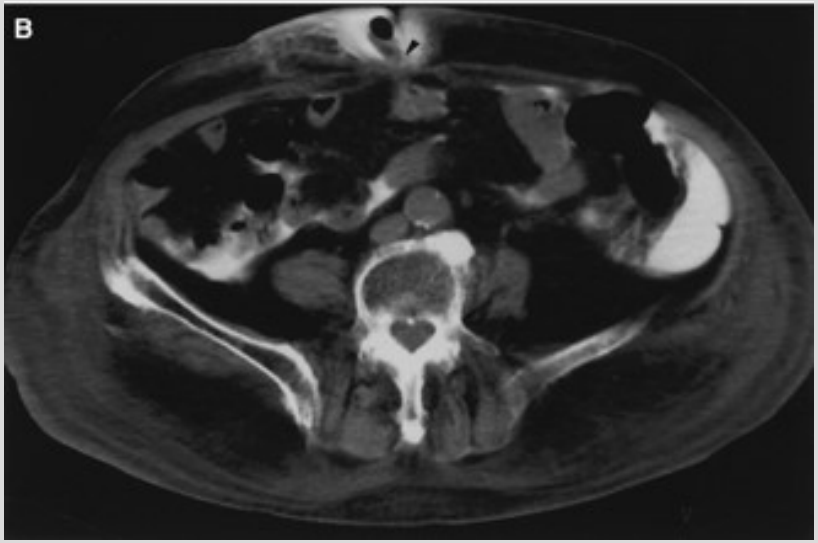


PD Leaks: MRI

Prischl, J Am Soc Nephrol, 2002; 13: 197-203



MRI



CT

Internal Leaks
Management

- Temporary interruption of PD
- Low volume, supine PD
- Surgical repair

A 48 year old woman with end-stage disease secondary to diabetic nephropathy started continuous ambulatory peritoneal dialysis (CAPD) about a month ago. Since then, she has noticed progressive shortness of breath. On physical examination, she has diminished breath sounds on the right lung-fields; there is no associated jugular venous distension, A plain X-ray of the chest showed a right sided pleural effusion. A thoracentesis was performed, the results of which were: protein, 1.2 g/dl, glucose, 220 mg/dl, LDH, 120 IU/L (serum protein, 6.4 g/dl, glucose, 174 mg/dl, LDH, 220 IU/L).

What is your diagnosis? How will you confirm it?
What should you do?

Hydrothorax

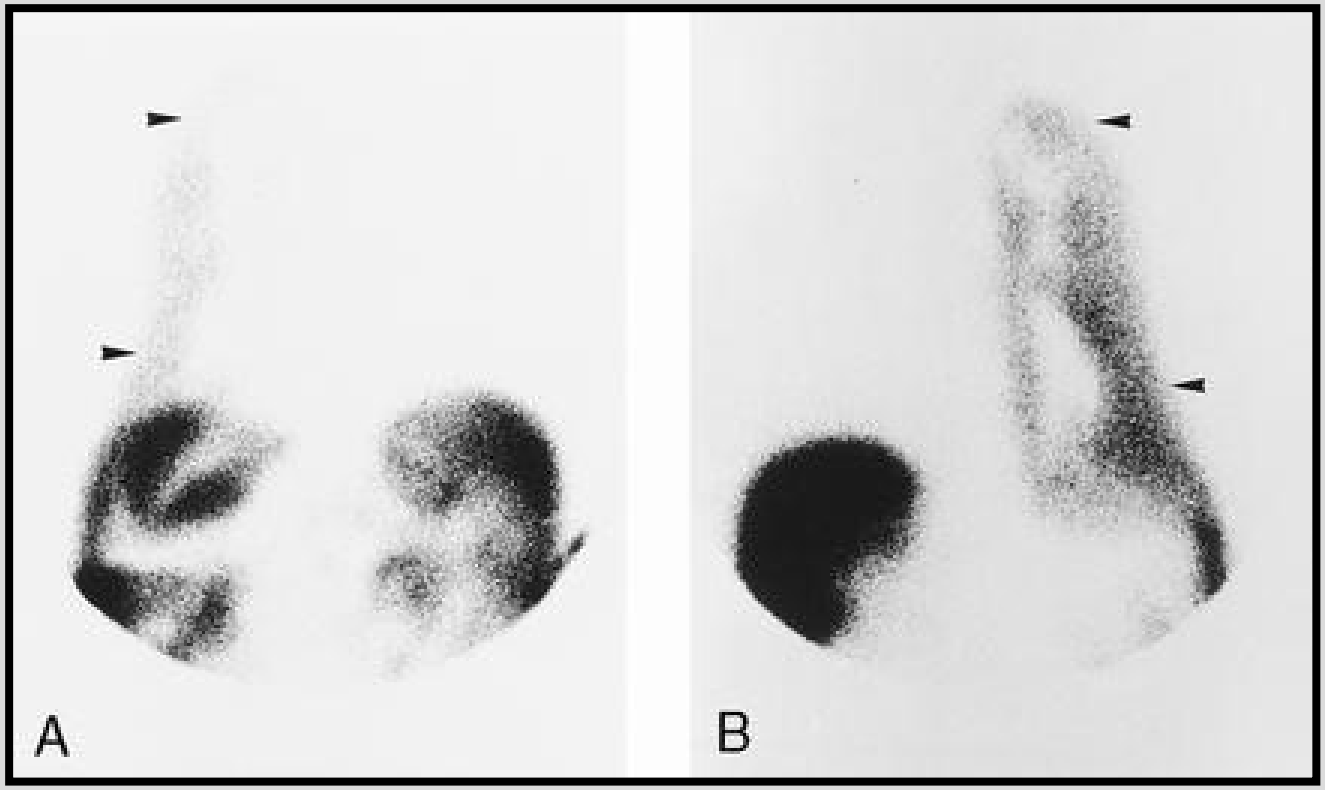
- Accumulation of peritoneal dialysate in the pleural space:
  - Invariably on right side
  - Movement of fluid through a pre-existent defect in the musculo-tendinous part of the diaphragm

- Key Findings on thoracentesis:
  - Transudative effusion
  - High glucose content – concentration depends upon duration of dwell
  - Remember the concentration of glucose in the dialysate:
    - 1.5% dextrose 1360 mg/dl
    - 2.5% dextrose 2250 mg/dl
    - 4.25% dextrose 3860 mg/dl
  - Don’t use methylene blue

Hydrothorax: Diagnosis

Radio-Isotope Scanning

Contreras-Puertas et al; Clin Nucl Med 2002; 27: 208-9



Pleuro-peritoneal communication

Study done using ^{99m}Tc-labelled albumin

Hydrothorax: Management

- Low-volume, supine PD
- Temporary transfer to HD
- Pleurodesis
- Surgical repair
  - Open surgical repair
  - Videoscopy assisted thoracoscopic surgery (VATS)

Secondary to Increased Intra-Abdominal Pressure

Condition	Usually Preferred Management
Hernia	Surgical Repair
External Leak	Interrupt PD or short-term low volume PD
Internal Leak, including patent processus vaginalis	Surgical repair
Hydrothorax	Interrupt PD or short-term low volume PD

Short-Term Consequences

Infusion/ Drain Pain
Overfill
Hypokalemia
Eosinophilic Peritonitis

Infusion Pain

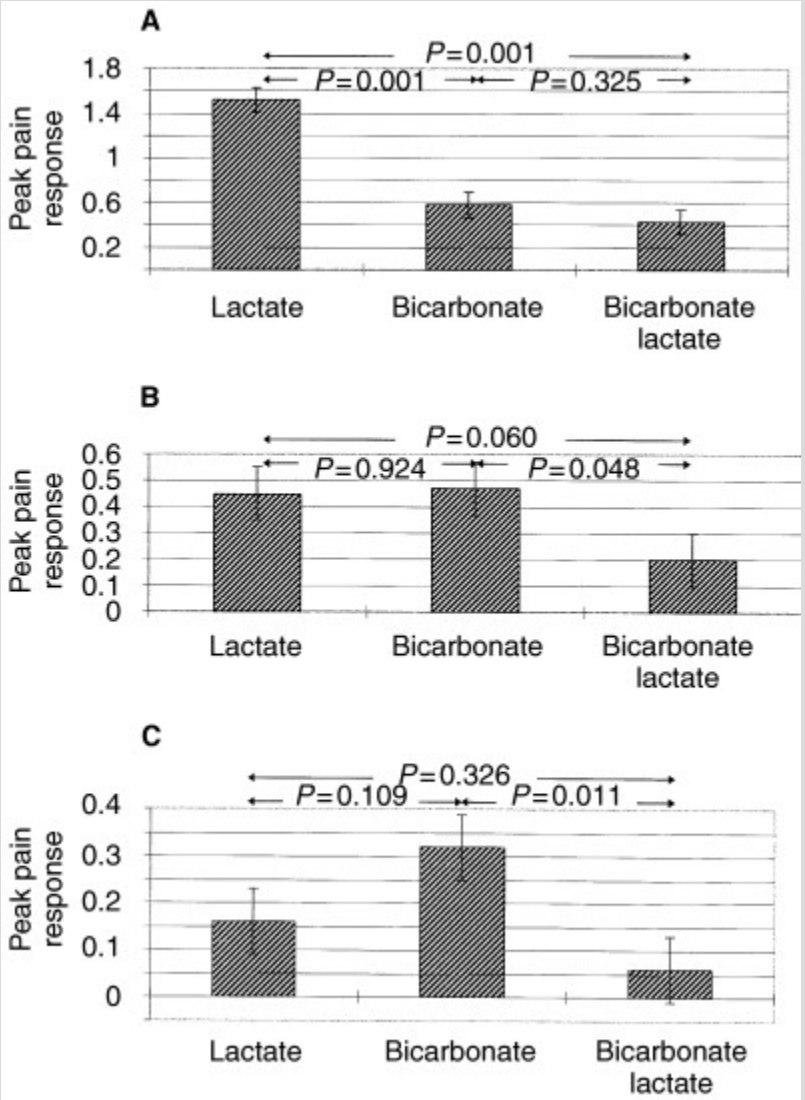
- Not uncommon when patients first start PD
  - Diminishes over time in most
- Can be severe in setting of peritonitis
- Related, in part, to low pH of the PD solution

Drain Pain

- Perhaps increasingly common
- To avoid overfill, cyclers are now designed to drain abdomen completely:
  - At the time of initial connection to cycler, this cannot be bypassed

Infusion Pain: Effect of alkalinization

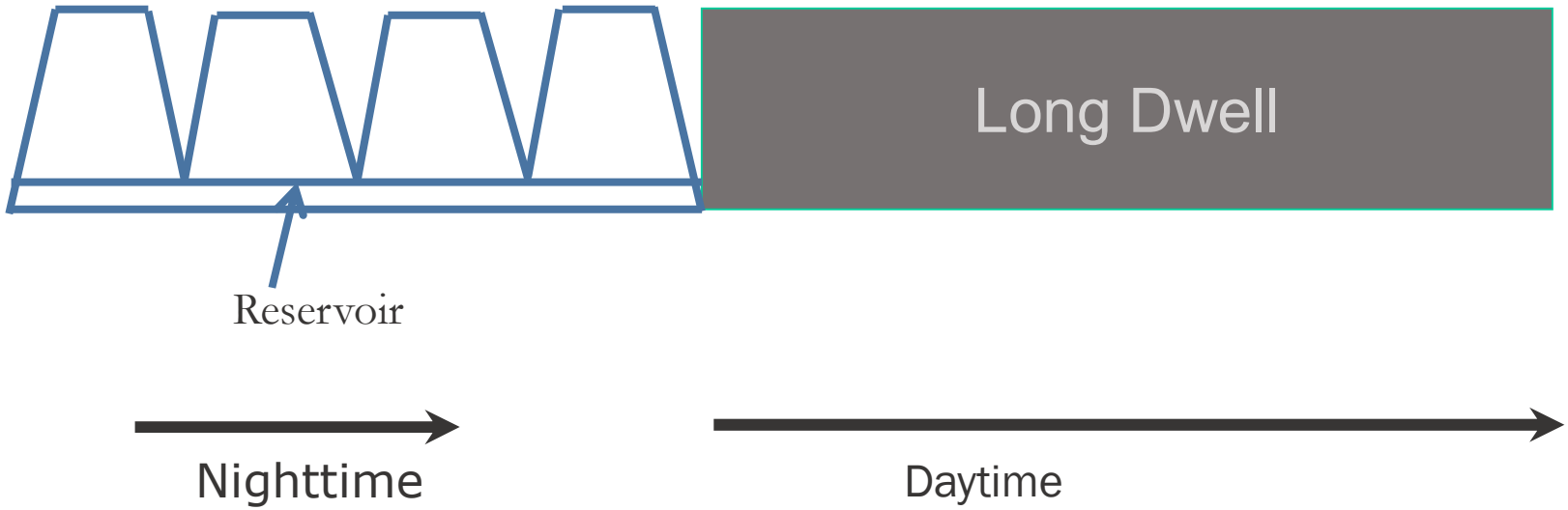
Mactier et al, Kidney Int 1998; 53: 1061-7



Add bicarbonate to dialysate if pain anticipated to be time-limited (as during peritonitis)

Infusion or Drain Pain
Tidal PD

For it to be safe:
Only with APD
Need to know anticipated UF

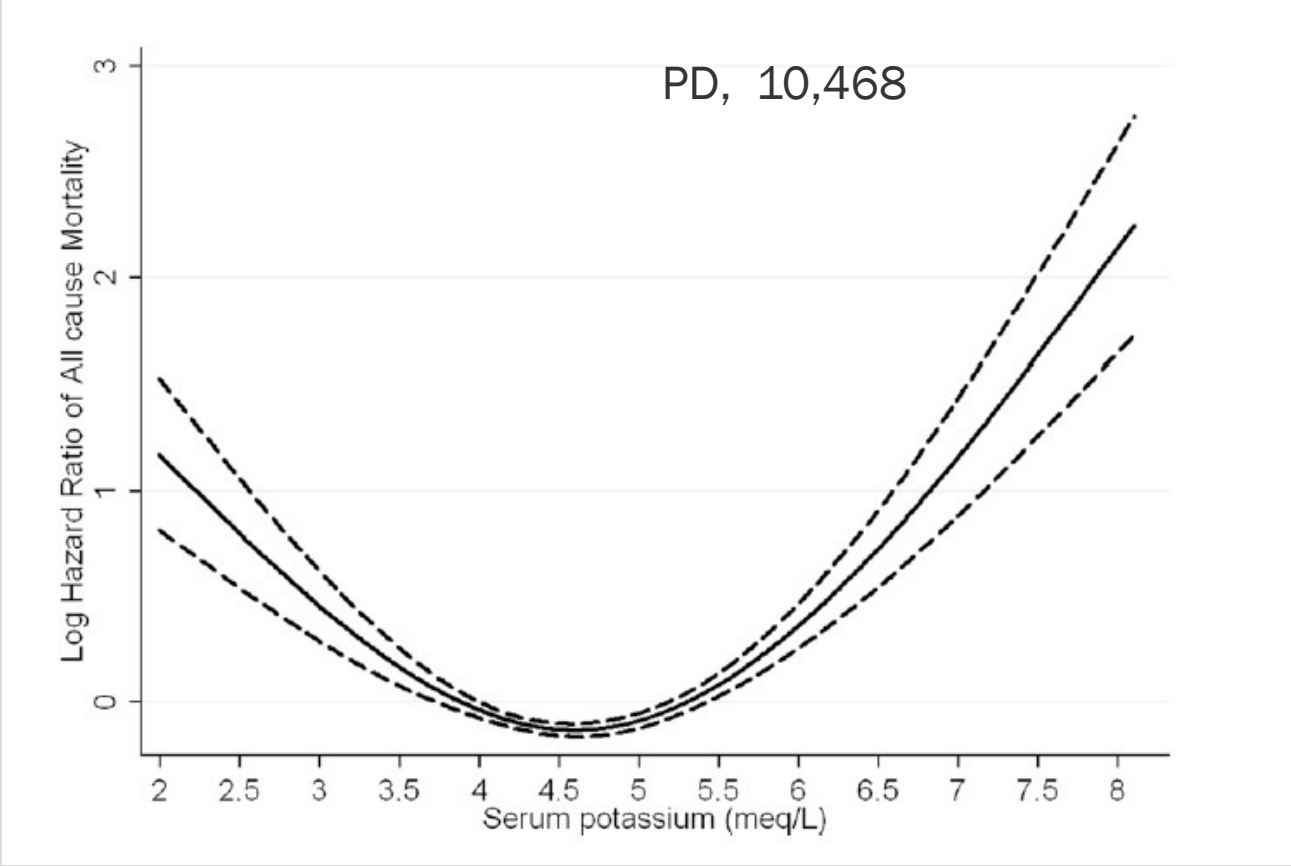


Hypokalemia in PD Patients

- Dialysate losses (dialysate K, 0)
  - Not sufficient
- Inadequate dietary intakes
- Transcellular shift induced by insulin released in response to glucose absorption from the dialysate
- Use of diuretics to maintain urine volume and laxatives to prevent constipation

Low Serum K is Not Good

Torlen et al, Clin J Am Soc Nephrol, 2012; 7: 1272-84



Also associated with higher risk for gram negative peritonitis

Treatment of Hypokalemia

- Increase dietary K intake
  - Usually insufficient
- Oral potassium supplements
  - Treatment of choice
- Spironolactone
- Add KCl to bags:
  - Not a scalable or sustainable treatment

Short Term Consequences of PD

Condition	Usually Preferred Management
Infusion/Drain Pain	Tidal PD
Hypokalemia	Potassium supplements
Eosinophilic peritonitis	Expectant observation

.....peritoneum

Hemoperitoneum
Pneumoperitoneum
Chyloperitoneum

RI, a 30 year male, followed in Nephrology Clinic, is known to have congenital lipodystrophy and type 2 diabetes since his teenage years. He now has diabetic nephropathy and has progressed to have end-stage renal disease. Upon learning his treatment options, he elects to do peritoneal dialysis.

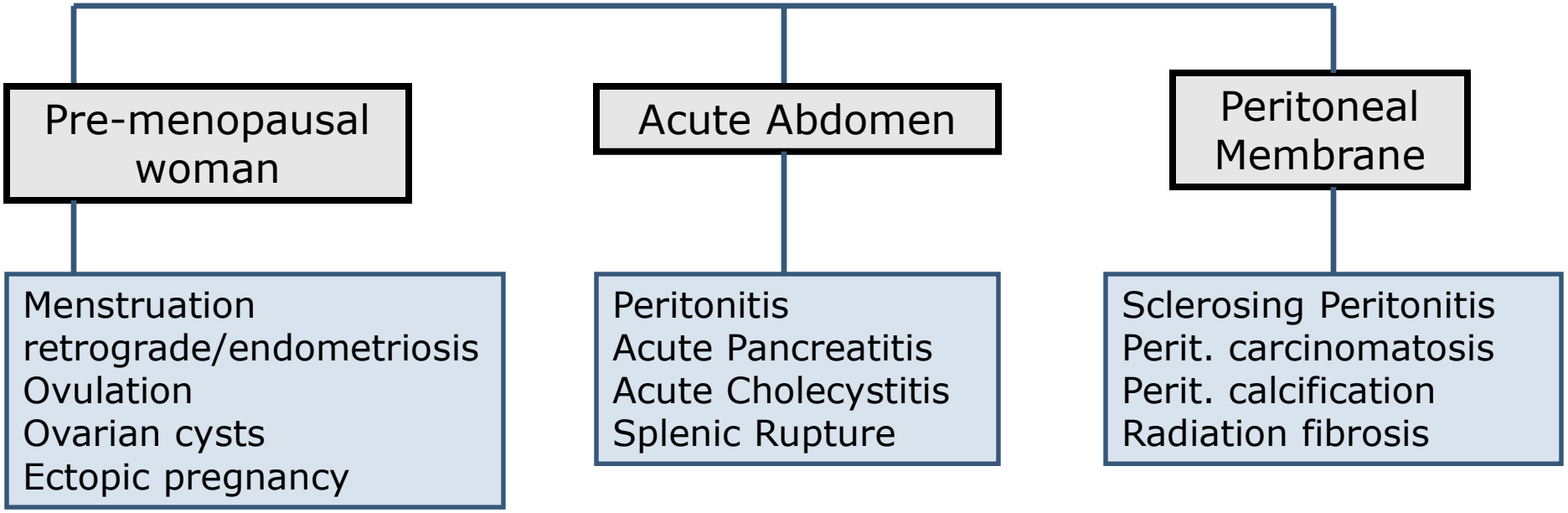
He has a PD catheter placed and he presents to the dialysis unit for the nurse to provide early post-implantation catheter care. The nurse puts in about 1 L of fresh dialysate – the fluid goes in easily and then drains. The fluid drains easily as well but the nurse notes that the patient has dark red effluent.

Hemoperitoneum: Management

- Risk with hemoperitoneum:
  - Catheter Blockage
  - Problems with both inflow and outflow

- ***General***:
  - Peritoneal lavage
  - i.p. heparin to prevent catheter obstruction (500-1000 u/L)
  - Rapid in/out exchange with dialysate at room temp.

Hemoperitoneum: Causes



Misc. causes: exercise*, trauma*, post-colonoscopy, hemat. problems

Pneumoperitoneum

- Free air on abdominal X-ray not infrequent in patients on PD:
  - Failure to clear line of air before infusing.
- Air entry may occasionally result in shoulder pain following an exchange.
- Clinical correlation necessary in individuals with acute abdomen.

Chyloperitoneum

- White, milky dialysate in the absence of peritonitis.
- ***Diagnosis:***
  - Dialysate triglycerides greater than plasma TGs
  - Let fluid stand; supernatant stains positive with Sudan
- Always rule out lymphoma; etiology may be obscure.

.....peritoneum

Condition	Usually Preferred Management
Hemoperitoneum	Lavage, expectant observation with intraperitoneal heparin
Pneumoperitoneum	Clinical correlation
Chyloperitoneum	May need to transfer off PD

Encapsulating Peritoneal Sclerosis

- Rare complication:
  - Increasing risk with longer length of treatment with PD
- Two components and both required for diagnosis:
  - Peritoneal sclerosis:
    - Increased D/P creatinine
  - Encapsulation
- May present many years after PD discontinued

EPS: Clinical Manifestations

- Four stages proposed:
  - Pre-Symptomatic
  - Inflammatory
  - Encapsulating
  - Ileus

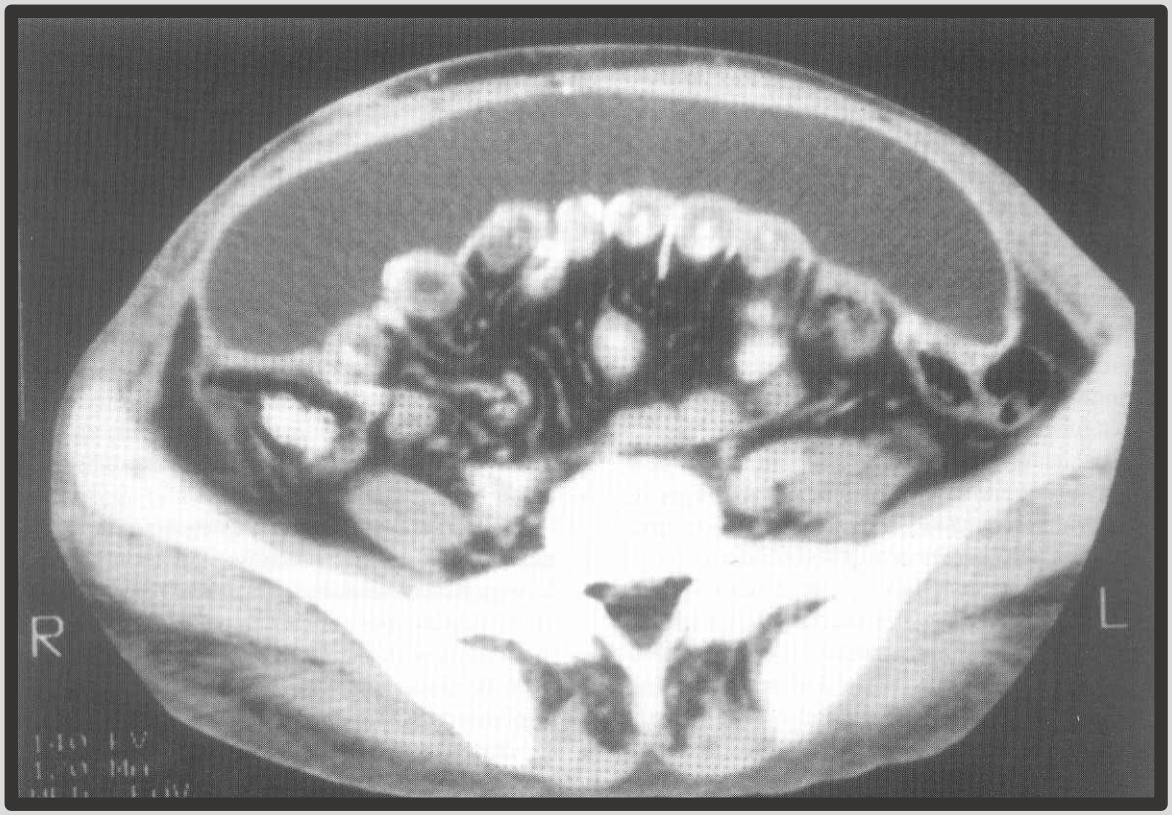
- Clinical Presentation:
  - Persistent/intermittent, partial/complete small bowel obstruction
  - Abdominal Mass
  - Hemoperitoneum
  - Failure to thrive
  - Ultrafiltration Problems

CT Scan Findings in EPS

Tarzi et al, Clin J Am Soc Nephrol 2008, 3: 1702-10
Vlijm et al, Perit Dial Int 2009; 29: 517-22

Tarzi et al	Vlim et al
Peritoneal thickening Peritoneal calcification Bowel wall thickening Bowel tethering Bowel dilatation Loculation (ascites)	Peritoneal thickening Peritoneal calcification Peritoneal enhancement Adhesions of bowel loops Signs of bowel obstruction Fluid loculation/septation
CT score 0-4 for each except bowel tethering (scored 0-3); range 0-22	Presence of three of above six items
Median score: pts, 9; PD controls, 1; HD, 0	Sensitivity, 79-100%; Specificity, 88-94%

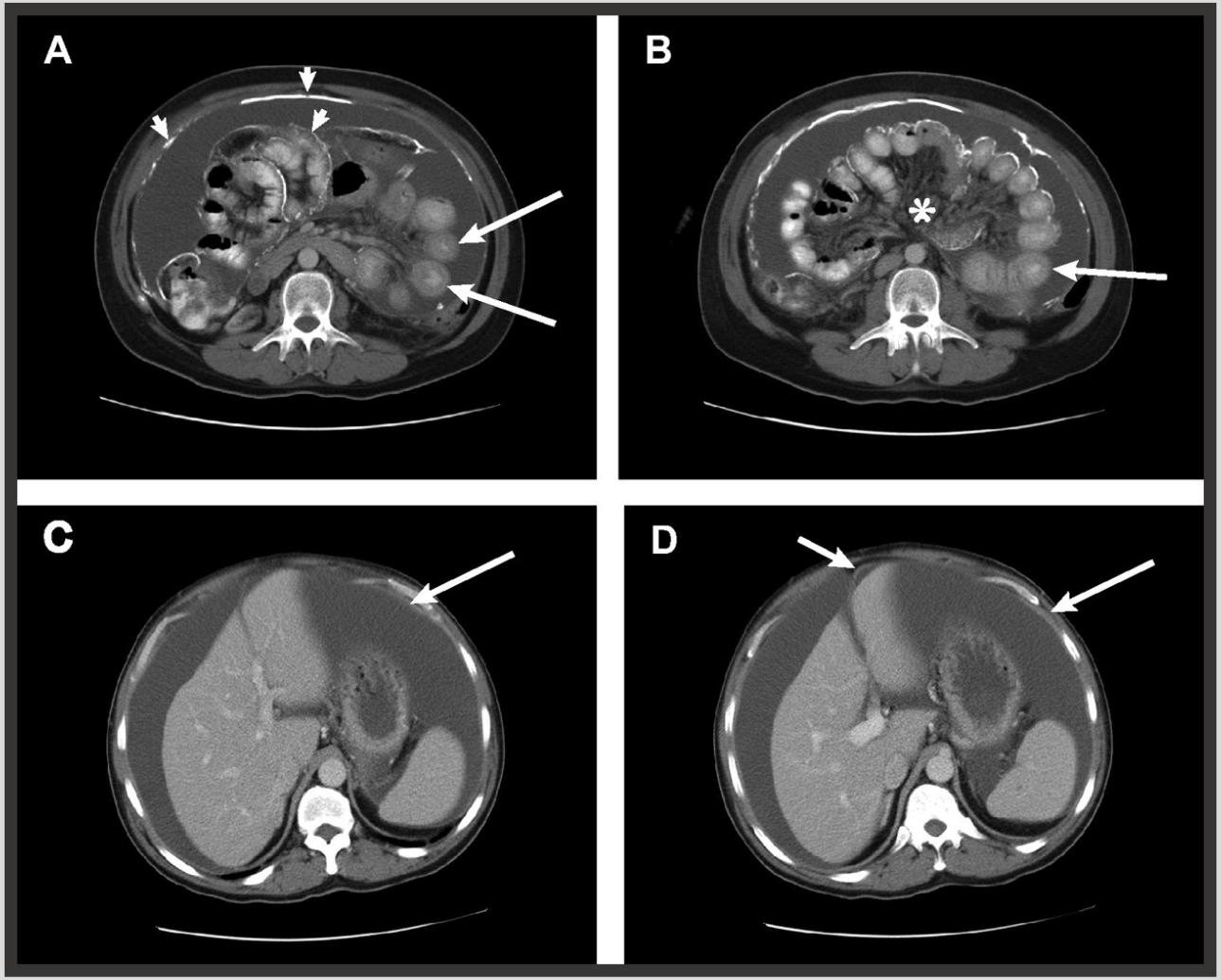
Encapsulating Peritoneal Sclerosis



Bargman in Textbook of PD

CT Findings of EPS

Tarzi et al, Clin J Am Soc Nephrol 2008, 3: 1702-10

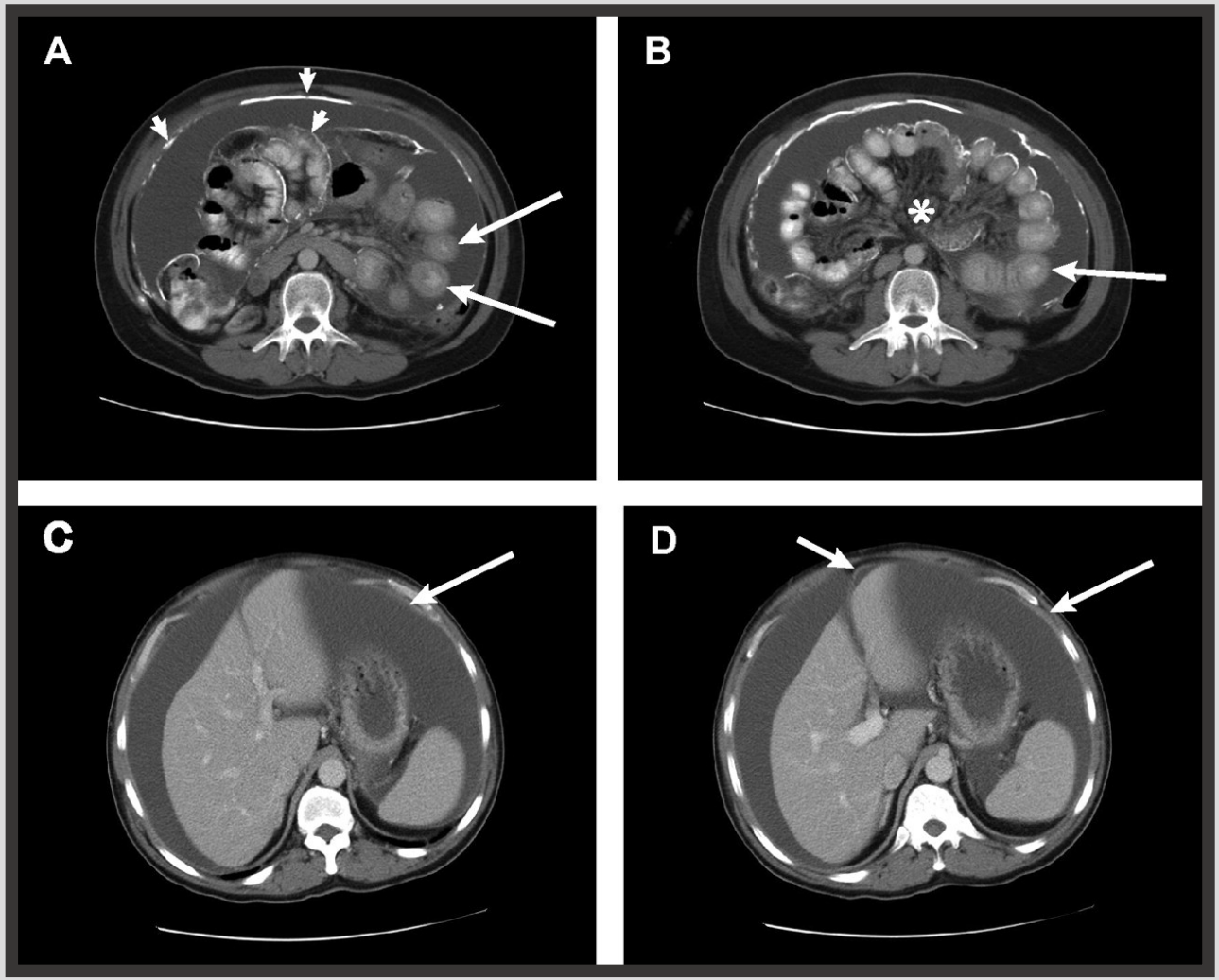


Peritoneal calcification and bowel wall thickening

Bowel wall thickening and tethering of mesentery

CT Findings of EPS

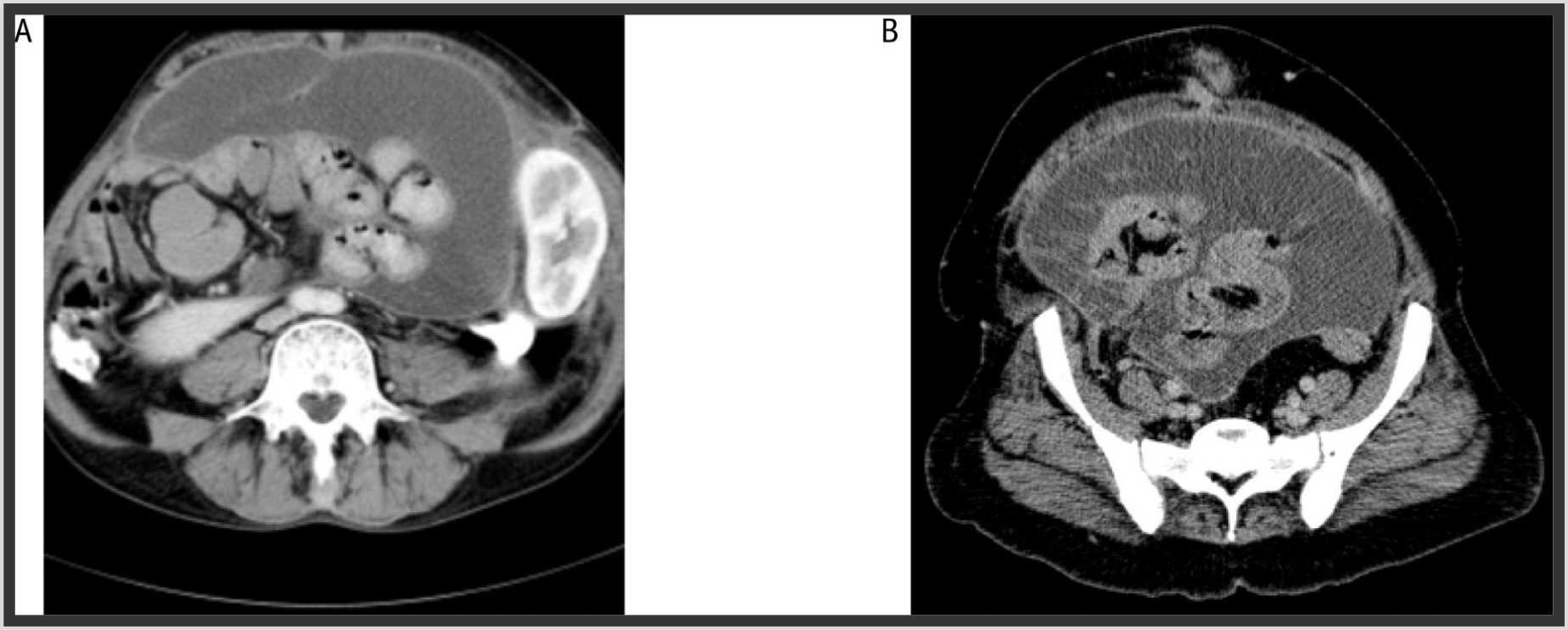
Tarzi et al, Clin J Am Soc Nephrol 2008, 3: 1702-10



Peritoneal calcification and ascites in a patient not currently treated with PD

CT Findings of EPS

Vlijm et al, Perit Dial Int 2009; 29: 517-22



Peritoneal Enhancement

EPS: Management

- Medical Therapy:
  - Tamoxifen *(pre-symptomatic)*
  - Immunosuppressive *(inflammatory)*
- Surgical Intervention *(encapsulating)*:
  - Partial or complete enterolysis,
  - Avoid enterotomy
- Supportive therapy *(ileus)*:
  - Aggressive nutritional support

EPS: Outcomes

	EPS Cases	Mortality (over study period)	Median Survival, months
Nomoto et al, ’96	62	44%	-
Rigby et al, ’98	54	56%	-
Lee et al, ‘03	31	26%	-
Kawanishi et al, ‘01	17	35%	11 (to death)
Kawanishi et al, ’04	48	38%	-
Summers, ‘05	27	30%	-
Balasubramaniam, ’09	111	53%	14
Brown, ’09	46	57%	0.4
Johnson, ‘10	33	55%	48

Many deaths may not be related to EPS

EPS - Summary

- Rare:
  - Most long-term patients will not develop the complication
  - Mandatory transition off PD after a pre-determined interval does not seem justified
- High index of clinical suspicion and need to have constellation of findings on CT
- Aggressive nutritional support, trial of medical therapy, and surgery in selected cases
- Outcomes better in contemporary cohorts?

Summary and Conclusions

- Non-infectious complications are relatively infrequent
- Complications from high intraperitoneal pressure:
  - Decrease such pressure, usually by low-volume supine PD or temporary interruption of PD
- EPS is a devastating complication of PD, risk increases with increasing time on PD:
  - Shared decision making in long-term patients
- Most of the other complications can be managed while continuing PD