NON-INFECTIONOUS COMPLICATIONS OF PERITONEAL DIALYSIS CATHETER-RELATED PROCEDURES

PERITONEAL DIALYSIS TRAINING PROGRAM
### Non-Infectious Complications of Peritoneal Dialysis (PD)¹,²

<table>
<thead>
<tr>
<th>Non-Infectious PD Complications</th>
<th>Catheter-Related</th>
<th>Intra-Abdominal Pressure-Related</th>
<th>Metabolic</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter-Related</td>
<td>Perioperative perforation</td>
<td>Hernia</td>
<td>Hyperglycemia</td>
<td>Hemoperitoneum</td>
</tr>
<tr>
<td></td>
<td>i.e. bladder or bowel</td>
<td>Pleural leak (hydrothorax)</td>
<td>Hyper-triglyceridemia</td>
<td>Encapsulating peritoneal sclerosis</td>
</tr>
<tr>
<td></td>
<td>Catheter dysfunction</td>
<td>Abdominal leaks</td>
<td>Hyperinsulinemia</td>
<td>Electrolyte abnormalities</td>
</tr>
<tr>
<td></td>
<td>Leakage</td>
<td>Genital edema</td>
<td>Hyperleptinemia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Abdominal wall or pericatheter</td>
<td>Back pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cuff extrusion</td>
<td>Shoulder pain (pneumo-peritoneum)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pain on infusion or drainage</td>
<td>GERD/Delayed gastric emptying</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹McCormick and Bargman. 2007.
²Bender. 2012.
# PERIOPERATIVE BOWEL PERFORATION AND VISCERAL INJURY

<table>
<thead>
<tr>
<th>Description</th>
<th>Well-recognized and most serious complication of insertion procedure. Occurs when entering into the abdominal cavity and advancing the catheter into lower abdomen.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence</td>
<td>Rates range from 0–2%, depending on insertion technique (^2,^3)</td>
</tr>
<tr>
<td>Cause</td>
<td>Perioperative complication</td>
</tr>
<tr>
<td>Prevention</td>
<td>Technique dependent, use of imaging thought to improve safety (i.e., fluoroscopic guidance) (^4)</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Pain, nausea, bleeding, rigid abdomen (^5)</td>
</tr>
<tr>
<td>Management</td>
<td>Terminate procedure to avoid infection and peritonitis. NPO and treat with triple antibiotics. Repeat attempt at insertion after 2-week course of antibiotics. (^4)</td>
</tr>
</tbody>
</table>

\(^2\)Bender. 2012.  
\(^3\)Haggerty, et al. 2014.  
## CATHETER DYSFUNCTION

<table>
<thead>
<tr>
<th>Description</th>
<th>Early poor flow is frustrating for patients and negatively impacts their experience with PD. May be due to blockage, catheter migration or entrapment, or bladder compression due to urine retention. Constipation is a common cause.¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence</td>
<td>Up to 38%³</td>
</tr>
</tbody>
</table>
| Causes      | ▪ Constipation may cause catheter migration and external compression of the lumen¹  
▪ Clot, omental wrap, adhesions, catheter tip migration⁵ |
| Prevention  | Patient education is important to avoid the issue and provide adequate bowel care² |
| Symptoms    | Inadequate dialysate inflow or outflow                                                                                                       |
| Management  | Evaluate cause of dysfunction. Management of constipation with high doses of laxative, flushing or infusion of thrombolytics for clot, guidewire manipulation under imaging, laparoscopic salvage¹ |

¹ McCormick and Bargman. 2007.  
² Bender. 2012.  
EVALUATION OF CATHETER DYSFUNCTION\textsuperscript{1,3,6-8}

- **Check external causes**
  - Mechanical obstruction
    - Clamps, tubing kinks, external tubing/connector blockage, connectors
  - Patient position

- **Rule out**
  - Constipation, peritonitis, catheter malposition, catheter obstruction, ultrafiltration issues

- **Diagnostics**
  - Abdominal x-ray, fluoroscopy with contrast, MRI, CT peritoneography, peritoneal scintigraphy
  - Examination of PD drainage

- **Consider**
  - Catheter flushing or irrigation
  - Non-invasive maneuvers & guidewire guided repositioning for suspected malposition
  - Thrombolytic instillation

- **Advanced interventions**
  - May involve laparoscopic management of omental wrapping, adhesiolysis, hernia repair, repositioning, or replacement of catheter

\textsuperscript{1}McCormick and Bargman. 2007.
\textsuperscript{2}Haggerty, et al. 2014.
\textsuperscript{3}Gokal, et al. 1998.
\textsuperscript{4}Kellman and Watson. 2006.
\textsuperscript{5}Bammens, et al. 2014.
TYPES AND LOCATIONS OF LEAKAGE\textsuperscript{9}

- Pericatheter
- Prior surgical incision site
- Patent processus vaginalis
- Non-specific areas of peritoneum

\textsuperscript{9}Leblanc, et al. 2001.
## ABDOMINAL WALL OR PERICATHETER LEAK

| Description | Leakage of dialysate either at the exit-site or loss into the peritoneal cavity due to poor implantation, anatomical issues, or use of the catheter prior to healing. Highest risk patients include those with healing issues (diabetic, elderly, malnourished, corticosteroid use) and increased intra-abdominal pressure.  
Bender, et al. 2012. | ![Image](https://via.placeholder.com/150) | ![Image](https://via.placeholder.com/150) |
| --- | --- | ![Image](https://via.placeholder.com/150) | ![Image](https://via.placeholder.com/150) |
| Incidence | Approximately 5%, insertion technique dependent | ![Image](https://via.placeholder.com/150) | ![Image](https://via.placeholder.com/150) |
| Causes | Early leaks: (<30 days): Typically related to placement issues; more commonly pericatheter, exit site or incision site leaks  
Late leaks: Mechanical or surgical tear; hernias; present as internal leakage | ![Image](https://via.placeholder.com/150) | ![Image](https://via.placeholder.com/150) |
| Prevention | Allow catheter to heal for 2 weeks before use.  
Low volume PD in supine position until tunnel is well healed | ![Image](https://via.placeholder.com/150) | ![Image](https://via.placeholder.com/150) |
| Symptoms | Pericatheter leak: Wetness or swelling at exit site  
Abdominal swelling or bogginess, Diminished effluent return, Weight gain and abdominal wall edema without peripheral edema; genital edema, dyspnea for pleural leak | ![Image](https://via.placeholder.com/150) | ![Image](https://via.placeholder.com/150) |
| Management | Evaluation of cause. Early recognition, dressing changes at exit site, and antibiotics to prevent infection. Low pressure PD or temporary HD during healing | ![Image](https://via.placeholder.com/150) | ![Image](https://via.placeholder.com/150) |

ABDOMINAL WALL OR PERICATHETER LEAK

- **Diagnosis**
  - Physical exam
  - Unchanged PET results yet suggested volume overload
  - Contrast CT scan (100 mL per 2 liter bag)
  - MRI (no contrast – use plain dialysate)
  - Pericatheter leak: Ultrasound around exit site
  - Verify fluid content using glucose test strips

CT SCAN WITH IP CONTRAST
DEMONSTRATING LEAK THROUGH CATHETER INSERTION SITE

Photo courtesy of Cheol Whee Park, MD
TREATMENT OF PERITONEAL FLUID LEAKS

- Temporarily stop PD with short-term transfer to hemodialysis
  - Defect may spontaneously repair after 1-2 weeks of rest, or may take up to a month

- Consider low volume/pressure supine dialysis (NIPD)

- Surgical repair for some leaks
  - Patent processus vaginalis
  - Pericatheter leak
  - Fibrin glue infiltration
  - Genital swelling

# HERNIAS

<table>
<thead>
<tr>
<th>Description</th>
<th>While known hernias should be fixed prior to initiation of PD, installation of dialysate into the peritoneal cavity increases pressure in the abdomen and rising pressure may cause hernia to occur in weak areas.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence</td>
<td>Wide range of reported incidence depending upon screening and repair before catheter placement: as low as &lt;5%(^2,10) to 30% in adults and 40% children for abdominal wall hernias(^3)</td>
</tr>
<tr>
<td>Cause</td>
<td>Weak area of abdomen wall and high pressure of dialysate(^2,10)</td>
</tr>
<tr>
<td>Prevention</td>
<td>Pre-insertion physical exam and knowledge of any pre-existing abdominal weakness. Repair as needed prior to PD.</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Painless swelling or painful lump in abdomen; severe cases may present as bowel obstruction or strangulation(^10)</td>
</tr>
<tr>
<td>Management</td>
<td>Diagnosed via CT peritoneography. Small hernias can be watched carefully.(^2) For larger hernias, treatment requires surgical repair and post-op recovery on low volume intermittent dialysis or hemodialysis.(^10)</td>
</tr>
</tbody>
</table>

\(^2\)Bender, et al. 2012.  
\(^3\)Haggerty, et al. 2014.  
\(^10\)Saha and Singh. 2007.
TYPES OF HERNIAS\textsuperscript{10}

- Incisional
- Inguinal
- Umbilical
- Epigastric
- Ventral
- Obturator
- Foramen of Morgagni

\textsuperscript{10}Saha and Singh. 2007.
HERNIAS RISK FACTORS\textsuperscript{9,10}

- Multiple pregnancies
- Elderly males
- Previous hernia repair
- Previous abdominal surgery
- Abdominal obesity
- Midline incision for PD catheter placement

\textsuperscript{9}Leblanc, et al. 2001.
\textsuperscript{10}Saha and Singh. 2007.
HERNIAS

COMPLICATIONS OF HERNIAS

Hernia
↓
Bowel Incarceration and Strangulation
↓
Transmural Leakage of Bacteria
↓
Peritonitis

Saha and Singh. 2007.
A CLINICAL APPROACH TO A PD PATIENT WITH HERNIA

- Determine likelihood for incarceration/strangulation (size/location) - warn patient of the risk and symptoms

- Always rule out incarcerated bowel within a hernia if patient presents with peritonitis
  - Repair surgically if patient is at low risk
  - Temporary transfer to HD post-op best option
  - Hyperdialyze for days pre-op, then low volume APD post-op
  - Use RRF, operate sooner rather than later

- Some large hernias do not need repair

- Location rather than size is the incarceration risk

- Consider low volume supine dialysis

Bender. 2012.
EXAMPLE
EVALUATION OF SCROTAL EDEMA

Examination

- Palpable hernia
  - Surgery

- No palpable hernia
  - Weight gain

4.25% PET

- Low returning volume
  - Imaging/Surgery

- Normal returning volume
  - Fluid intake compliance
  - Prescription compliance
  - Inappropriate prescription

Imaging
# PAIN DURING INFUSION OR DRAINAGE

<table>
<thead>
<tr>
<th>Description</th>
<th>Inflow or outflow pain that occurs during exchange of dialysate, especially common during the early use of the catheter.(^2)</th>
</tr>
</thead>
</table>
| Causes      | ▪ pH of dialysate: 5.0-5.5 infusion into the abdomen may cause discomfort.  
               ▪ Solution too warm or too cold may increase discomfort.  
               ▪ May be due to placement of the catheter too deep in the abdomen or position of the catheter tip against pelvic wall, bladder or rectum.\(^4\) |
| Prevention  | Placement is critical as catheters that are placed too deep in the pelvis might produce infusion or drain pain.\(^4\) |
| Symptoms    | Discomfort during inflow or outflow of dialysate |
| Management  | ▪ Rule out peritonitis.  
               ▪ Use of Tidal PD (75% to 90% tidal volume, cycler best) or allow time and encourage patient to keep trying as pain may resolve on its own.\(^2\)  
               ▪ Consider addition of few mL of NaHCO\(_3\) to dialysate if persistent (can increase peritonitis rate) and ensure dialysate is body temperature.  
               ▪ Extreme cases may require replacement of the catheter.\(^4\) |

\(^2\)Bender, et al. 2006.  
# HYDROTHORAX

<table>
<thead>
<tr>
<th>Description</th>
<th>The presence of peritoneal dialysis fluid in the pleural cavity, typically early in treatment as it is most frequently due to congenital defects of muscle fibers in the diaphragm(^1,10)</th>
</tr>
</thead>
</table>
| **Incidence** | ▪ Range varies from 1.6 to 10%\(^2,10\)  
▪ More common in females\(^10\) |
| **Cause** | Movement of dialysate, under increased intra-abdominal pressure, from peritoneal to pleural cavity through congenital or acquired defects in the diaphragm\(^2\) |
| **Symptoms** | ▪ Shortness of breath, decrease in effluent return, pain; most common on the right side\(^11\)  
▪ Pleural fluid: transudate, high sugar concentration, D-lactate present, LDH level low |
| **Management** | Thoracentesis for dyspnea or minimally invasive techniques such as pleurodesis or more invasive approaches using video-assisted thoracoscopic surgery (VATS). The treatment goal is to seal the porous diaphragmatic vent and allow full separation of the peritoneal cavity from the pleural cavity. Low pressure PD or stop PD and transition to temporary hemodialysis. Resumption of PD after repair is possible.\(^11\) |

\(^1\)McCormick and Bargman. 2007.  
\(^2\)Bender. 2012.  
\(^10\)Saha and Singh. 2007.  
\(^11\)Guest. 2015.
HYDROTHORAX

- 33 year old female with sudden dyspnea & right chest pain approximately 5 weeks post-PD catheter\(^\text{12}\)

- Etiology
  
- Congenital diaphragmatic defect

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12 Cho. 2010: https://creativecommons.org/licenses/by/4.0/
## HEMOPERITONEUM

<table>
<thead>
<tr>
<th>Description</th>
<th>The presence of blood in peritoneal effluent, this is generally a benign complication of chronic PD. A small amount (2-3 ml) of blood in dialysate will make it appear bloody.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence</td>
<td>More common in females and most common cause is menstruation in 41% and ovulation in 57% (Warn female patients ahead of time to avoid panic).</td>
</tr>
</tbody>
</table>
| Causes      | ▪ Benign intraperitoneal bleeding (GYN, idiopathic, warfarin, etc.)  
▪ Serious causes: ischemic bowel, colon or urologic cancer, pancreatitis, encapsulating peritoneal sclerosis  
▪ Minor intraperitoneal bleeding with pathology (sclerosing peritonitis, peritonitis, pancreatitis, colonoscopy followed by anaerobic peritonitis)  
▪ Significant intraperitoneal bleed requiring intervention [ovarian cyst rupture, sclerosing peritonitis, polycystic kidney cyst rupture, tumor (liver, GI tract), amyloid spleen rupture, bleeding post PD catheter, etc.] |
| Symptoms    | Dialysate appears bloody. Typically without other symptoms.                                                                                                                                               |
| Management  | ▪ Diagnosis by fluid cell counts and hematocrit for pathology. Ultrasound and CT for negative ultrasound.  
▪ Un-warmed 1.5% dextrose-containing dialysate for 1 to 3 rapid exchanges at home to vasoconstrict and establish hemostasis.  
▪ Hormonal therapy for women with excessive bleeding with menstruation.  
▪ IP heparin (500 or 1000 U/L) due to increased risk of PD catheter clotting in patients with hemoperitoneum. |

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*Saha and Singh. 2007.*
REFERENCES


