Encapsulating Peritoneal Sclerosis (EPS)

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EPS: Outline

• Definition and epidemiology
• Clinical presentation
• Imaging
• Pathology
• Treatment
• Outcomes
• Summary
Encapsulating Peritoneal Sclerosis (EPS)

• Rare complication but serious complication of peritoneal dialysis (PD):
  – First described in 1980 (1)
  – Incidence varies between 0.5 to 4.4% (2-8)
  – Associated with significant morbidity and mortality
  – Many present after PD has been discontinued
  – The diagnosis requires both the:
    • **Clinical features** of intestinal obstruction or disturbed gastrointestinal function
    • **Evidence** of bowel encapsulation either radiologically or pathologically
Incidence of EPS

SCOTLAND
1238 pts (1/1/2000-12/31/2007)
46 cases
8-year cumulative incidence, 8.1%

Australia and New Zealand
7618 pts (1/1/1995-12/31/2007)
33 cases
8-year cumulative incidence, 3.9%

Johnson et al, Kidney Int 2010; 77: 904-12
EPS: Risk Factors

• The only consistent risk factor is duration on peritoneal dialysis

• Other potential factors
  – Glucose exposure
  – Inflammation – peritonitis
  – Chemical exposure
    • chlorhexidine
  – Genetic factors
  – Various other factors unrelated to peritoneal dialysis
EPS: Clinical Manifestations

- Symptoms of bowel obstruction
  - Persistent/intermittent
  - Partial/complete
  - Abdominal pain/distention/nausea/vomiting

- Abdominal mass

- Hemoperitoneum

- Malnutrition and failure to thrive

- Ultrafiltration problems
EPS: Radiologic Manifestations

• Ultrasound Evaluation:
  – Classical trilaminar appearance of the bowel wall with PD fluid in abdomen
  – Abnormal small bowel peristalsis (small bowel dilation)
  – Matted bowel loops with tethering to posterior abdominal wall
  – Membrane formation anterior to bowel loops
  – Loculated Ascites

• CT abdomen:
  – Isolated peritoneal thickening or calcification is not enough
  – Need to look for constellation of findings
  – Diagnostic imaging modality of choice
# CT Scan Findings in EPS

<table>
<thead>
<tr>
<th>Tarzi et al</th>
<th>Vlijm et al</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peritoneal thickening</td>
<td>Peritoneal thickening</td>
</tr>
<tr>
<td>Peritoneal calcification</td>
<td>Peritoneal calcification</td>
</tr>
<tr>
<td>Bowel wall thickening</td>
<td>Peritoneal enhancement</td>
</tr>
<tr>
<td>Bowel tethering</td>
<td>Adhesions of bowel loops</td>
</tr>
<tr>
<td>Bowel dilatation</td>
<td>Signs of bowel obstruction</td>
</tr>
<tr>
<td>Loculation (ascites)</td>
<td>Fluid loculation/septation</td>
</tr>
</tbody>
</table>

CT score 0-4 for each except bowel tethering and loculation (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%

*Vlijm et al, Perit Dial Int 2009; 29: 517-22*
CT Findings of EPS

- Thickened Enhancing Peritoneum (arrows)
- Loculated Fluid Collection (arrows)
- Tethered small bowel Loops (arrows)

Cameron et al: American Roentgen Ray Society Annual Meeting, 2010
CT Findings of EPS

Dilated and thick-walled loops of small bowel filled with fluid and oral contrast (arrows).

Peritoneal thickening (arrow).

Loculated fluid collections (arrows).

Cameron et al: American Roentgen Ray Society Annual Meeting, 2010
CT Findings of EPS

Bowel Tethering (arrow)
Peritoneal calcification (arrow)

Cameron et al: American Roentgen Ray Society Annual Meeting, 2010
CT Findings of EPS

Tethered bowel Loops (arrows)

Peritoneal Enhancement (arrow)

Vlijm et al, Perit Dial Int 2009; 29: 517-22
Gross Pathologic Findings of EPS

Peritoneal thickening (arrow)
Peritoneal inflammatory changes (arrow)
Peritoneal calcifications (arrow)
Omental fat (arrow)

Cameron et al: American Roentgen Ray Society Annual Meeting, 2010
Histology of EPS

Peritoneal thickening and fibrosis (arrows)
Peritoneal calcification (arrow)
Inflammatory cells - neutrophils/lymphocytes (arrow)

Cameron et al: American Roentgen Ray Society Annual Meeting, 2010
Proposed Pathogenesis of EPS

Long-term exposure to PD (pH, glucose, GDPs)

↓Fibrolysis  ↑Procoagulation

↓Mesothelial cell denudation  ↓Capacity of peritoneal regeneration

Progenitor cells?  Fibroblasts  Macrophages

EMT

Cytokines (TGFβ, VEGF, FGF), Chemokines

Fibrosis, angiogenesis and vasculopathy

↑Permeability

↑HSP47

Remodeling failure (MMPs)

Progressive peritoneal thickening and adhesion

Inflammatory stimuli
- Peritonitis
- Antiseptics
- etc.

EPS: Management

• Supportive therapy (*ileus*):
  – Aggressive nutritional support

• Medical Therapy:
  – Tamoxifen (*anti-fibrotic*)
  – Immunosuppressive (*anti-inflammatory*)

• Surgical Intervention (*encapsulating*):
  – Partial or complete enterolysis,
  – Avoid enterotomy
## EPS: Outcomes

<table>
<thead>
<tr>
<th>Study</th>
<th>Cases</th>
<th>Mortality (over study period)</th>
<th>Median Survival, months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nomoto et al, '96</td>
<td>62</td>
<td>44%</td>
<td>-</td>
</tr>
<tr>
<td>Rigby et al, '98</td>
<td>54</td>
<td>56%</td>
<td>-</td>
</tr>
<tr>
<td>Lee et al, ‘03</td>
<td>31</td>
<td>26%</td>
<td>-</td>
</tr>
<tr>
<td>Kawanishi et al, ‘01</td>
<td>17</td>
<td>35%</td>
<td>11 (to death)</td>
</tr>
<tr>
<td>Kawanishi et al, ‘04</td>
<td>48</td>
<td>38%</td>
<td>-</td>
</tr>
<tr>
<td>Summers, ‘05</td>
<td>27</td>
<td>30%</td>
<td>-</td>
</tr>
<tr>
<td>Balasubramaniam, ‘09</td>
<td>111</td>
<td>53%</td>
<td>14</td>
</tr>
<tr>
<td>Brown, ’09</td>
<td>46</td>
<td>57%</td>
<td>6</td>
</tr>
<tr>
<td>Johnson, ‘10</td>
<td>33</td>
<td>55%</td>
<td>48</td>
</tr>
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Many deaths may not be related to EPS
EPS: Prevention

• No prospective data supporting a benefit of preemptively transferring long-term PD patients to HD

• Preserve residual renal function

• Try to minimize the use of high-glucose PD solutions

• Minimize episodes of peritonitis

• Await experience with “biocompatible” PD solutions
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

• Diagnosis requires:
  – high index of clinical suspicion from clinical manifestations
  – constellation of CT or pathologic findings consistent with EPS

• Aggressive nutritional support, trial of medical therapy, and surgery in selected cases

• Outcomes better in contemporary cohorts?
EPS: References


Question #1

Which of the following is most consistent with the diagnosis of EPS?

- A. 32 year old man on PD for 2 years presents with abdominal pain and cloudy fluid
- B. 50 year old woman on PD for 5 years is found to have peritoneal thickening on a CT done for the evaluation of her lower back pain
- C. 38 year old man on PD for 6 years who has lost weight in the setting of intermittent nausea and abdominal pain. A CT revealed peritoneal thickening/calcification and dilated small bowel.
- D. 40 year old woman on PD for 3 years who has had persistent abdominal pain, nausea, vomiting and weight loss. A CT of her abdomen and pelvis was normal.
Question #1: Answer

• The correct answer is C. The diagnosis of EPS requires both the clinical features of the disorder and evidence of bowel encapsulation either radiographically or pathologically.
Question #2

- Which is the most consistent risk factor for the development of EPS?
  - A. Rapid transport status
  - B. Recurrent peritonitis
  - C. Ultrafiltration problems
  - D. Length of time on PD
Question #2: Answer

• The correct answer is D. The only consistent risk factor for EPS is duration on PD.