Complications of Urinary Diversion

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Types of Diversion

- Conduit Diversions
  - Ileal conduit
  - Colon conduit

- Continent Diversions
  - Continent catheterizable reservoir
  - Continent rectal pouch
Overview of Complications

- Mechanical
  - Stoma problems
  - Bowel obstruction
  - Ureteral obstruction
  - Reservoir perforation

- Metabolic
  - Altered absorption
  - Altered bone metabolism
  - Growth delay
  - Stones
  - Cancer

Conduit Diversions

- Ileal Conduit:
  - Technically simplest
  - Segment of choice

- Colon Conduit:
  - Transverse or sigmoid
  - Used when ileum not appropriate (e.g., concomitant colon resection, abdominal radiation, short bowel syndrome, IBD)

- Early complications (<30 days): 20-56%
- Late complications: 28-81%

- Risks:
  - Abdominal radiation
  - Abdominal surgery
  - Poor nutrition
  - Chronic steroids

Farnham & Cookson, World J Urol, 2004
## Complications of Ileal Conduit

<table>
<thead>
<tr>
<th>Complication</th>
<th>Early (%)</th>
<th>Late (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine leak</td>
<td>2% (9/356)</td>
<td>—</td>
</tr>
<tr>
<td>Bowel leak</td>
<td>2%</td>
<td>—</td>
</tr>
<tr>
<td>Sepsis</td>
<td>3% (7/236)</td>
<td>—</td>
</tr>
<tr>
<td>Acute pyelonephritis</td>
<td>3% (11/700)</td>
<td>18% (133/726)</td>
</tr>
<tr>
<td>Wound infection</td>
<td>7% (17/233)</td>
<td>2% (4/178)</td>
</tr>
<tr>
<td>Wound dehiscence</td>
<td>3% (11/326)</td>
<td>—</td>
</tr>
<tr>
<td>Gastrinestinal bleed</td>
<td>2% (2/90)</td>
<td>—</td>
</tr>
<tr>
<td>Abscess</td>
<td>2% (3/168)</td>
<td>—</td>
</tr>
<tr>
<td>Paralytic ileus</td>
<td>0% (14/238)</td>
<td>—</td>
</tr>
<tr>
<td>Conduit bleed</td>
<td>2% (3/178)</td>
<td>10% (18/178)</td>
</tr>
<tr>
<td>Intestinal obstruction</td>
<td>5% (16/318)</td>
<td>5% (42/878)</td>
</tr>
<tr>
<td>Ureteral obstruction</td>
<td>2% (14/610)</td>
<td>6% (56/939)</td>
</tr>
<tr>
<td>Parastomal hernia</td>
<td>—</td>
<td>2% (9/454)</td>
</tr>
<tr>
<td>Stomal stenosis</td>
<td>—</td>
<td>30% (43/143)</td>
</tr>
<tr>
<td>Stone formation</td>
<td>—</td>
<td>7% (5/822)</td>
</tr>
<tr>
<td>Excessive conduit length</td>
<td>—</td>
<td>9% (26/276)</td>
</tr>
<tr>
<td>Metabolic acidosis</td>
<td>—</td>
<td>13% (27/206)</td>
</tr>
<tr>
<td>Conduit infection</td>
<td>—</td>
<td>2% (2/90)</td>
</tr>
<tr>
<td>Vesciulus</td>
<td>—</td>
<td>7% (2/268)</td>
</tr>
<tr>
<td>Conduit stenosis</td>
<td>—</td>
<td>5% (11/220)</td>
</tr>
<tr>
<td>Conduit-enteric fistula</td>
<td>—</td>
<td>≤1%</td>
</tr>
</tbody>
</table>

### Conduit: Bowel Complications

- **Paralytic ileus 18-20%**
  - Conservative management vs NGT
  - Consider TPN
- **Bowel obstruction 5-10%**
  - Causes: Adhesions, internal hernia
  - Evaluation: CT scan, Upper GI series
- **Anastomotic leak 1-5%**
  - Risk factors: bowel ischemia, radiation, steroids, IBD, technical error
- **Prevention:**
  - Pre-operative bowel prep
  - Attention to technical detail
    - Blood supply, tension-free anastomosis, realignment of mesentery
    - Farnham & Cookson, World J Urol, 2004
Conduit Complications

- Conduit necrosis:
  - Acute ischemia to bowel segment
  - Urgent re-exploration
- Conduit ischemia:
  - Stomal stenosis or stricture
- Conduit elongation:
  - Distal obstruction at fascia or stoma
- Prevention:
  - Attention to blood supply of segment
  - Periodic imaging post-operatively

Stoma Complications

- Most common long-term complication 25-60%
- Most common cause for re-operation
- Stomal Stenosis 10-25%
  - Cause: ischemia, fascial constriction, retraction, local skin changes, poorly fitting appliance
- Stomal Prolapse
- Parastomal Hernia 5-25%
  - Cause: gap between conduit and fascia

“Rosebud” Stoma (Campbell’s Urology, 8th Ed., 2004)
Parastomal Hernia (Farnham & Cookson, World J Urol, 2004)
Ureterointestinal Anastomosis

- Urinary leak 2%
  - Prevention: stents, drains, surgical technique
- Uretero-enteric stricture 4-7%
  - Potential renal damage
  - Cause: urinary leakage with fibrosis, anastomotic tension, ischemia of ureter, infection
  - Evaluation: IVP, CT scan, loopogram (if refluxing anastomosis)
  - Treatment: endoscopic balloon dilation or incision vs open reconstruction

Continent Diversion: Reservoir Complications

- Pouch stones 10%
  - Mostly struvite stones
  - Cause: chronic bacteriuria, urinary stasis, mucous, metabolic abnormalities, staples
  - Prevention: treatment of symptomatic infection, irrigation
  - Treatment: percutaneous vs open extraction
- Spontaneous perforation of reservoir: rare but potentially fatal
  - CT cystogram, clinical suspicion
  - Low threshold for exploration

CT scan of stone burden in Indiana Pouch
(Farnham & Cookson, World J Urol, 2004)
Incontinence

- Leakage: 1-8%
- Uninhibited pouch contractions
  - Tx: anticholinergics
- Poorly compliant reservoir
  - Tx: augmentation
- Incontinent mechanism
  - Tx: revision
- Urodynamic testing

Types of continence mechanisms:
- Nipple valves, tunneled Mitrofanoff
- Channels (Campbell’s Urology, 8th Ed, 2004)

Stomal Complications

- Difficulty catheterizing 3-18%
  - Cause: stomal stenosis or tortuosity of channel
  - Highest incidence in tunneled appendix
  - Prevention: in the OR, by stabilizing the channel, avoiding kinking, tension, or ischemia
  - Treatment: dilation vs stomal revision with V-flap

Appendiceal Continent Catheterizable Stoma
(Campbell’s Urology, 8th Ed, 2002)
Ureterointestinal Anastomosis

- Etiology and rates of leakage and stricture similar to conduit diversion
- Continent diversions usually use non-refluxing anastomosis
  - Decreased risk of upper tract deterioration,
  - May increase to risk of stenosis/stricture

Metabolic: Removed Bowel

- Resection of terminal ileum: 3.3-20%
  - B12 malabsorption/deficiency
  - Megaloblastic anemia, neurologic manifestations
- Resection of >60-100 cm ileum:
  - Bile Acid Malabsorption
  - Lipid malabsorption, hypertriglyceridemia
  - Steatorrheic diarrhea
  - Impaired absorption of fat-soluble vitamins: A, D, E, K
  - Increased risk of gallstone formation
  - Mills & Studer, J Urol, 1999; DeMarco & Koch, AUA Update Series, 2003
**Malabsorption**

- Resection of ileocecal valve:
  - Decreased transit time
  - Increased wet weight of stool
  - Diarrhea

- Resection of colon segment:
  - Right colon important for storage of stool

**Metabolic: Removed Bowel**

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  - Increased wet weight of stool
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- Resection of colon segment:
  - Right colon important for storage of stool
Metabolic Acidosis

- Hyperchloremic acidosis
- Ileal conduit: 10-15%
- Continent diversion: 50%
- Ureterosigmoidostomy: 80%
- Treatment:
  - oral sodium bicarbonate
  - sodium citrate
  - potassium citrate


Metabolic: Interposed Bowel

- Bone demineralization
- Acidosis
  - carbonate and phosphate released from bone to buffer hydrogen ions
  - Acidosis inhibits production of 1, 25-dihydroxycholecalciferol
  - Acidosis activates osteoclast activity
  - Increased excretion of calcium in urine
- Rickets
- Osteomalacia
Stone Disease

- Upper tract stones:
  - Metabolic etiology
  - Chronic dehydration, concentrated urine
  - If large ileal resection, risk of enteric hyperoxaluria with calcium oxalate stone formation
  - Hypocitraturia
  - Hypercalciuria due to metabolic acidosis

Cancer risk

- Ureterosigmoidostomy:
  - > 200 cases of secondary malignancy reported
  - Age 25-30 yo: 477-fold increased risk
  - Age 55-60 yo: 8-fold increased risk over general population
  - Histology: adenoma, adenocarcinoma
  - Follow-up starting between 3-5 years post-op with yearly endoscopy, ultrasound

Austen & Kalble, J Urol, 2004
Cancer risk

- Conduit and continent diversions:
  - Variable histology

<table>
<thead>
<tr>
<th></th>
<th>No. Ileum</th>
<th>No. Colon</th>
<th>Total No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduit</td>
<td>12</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>Continent:</td>
<td>35</td>
<td>28</td>
<td>63</td>
</tr>
<tr>
<td>Cystoplasty</td>
<td>30</td>
<td>15</td>
<td>45</td>
</tr>
<tr>
<td>Pouch/neobladder/rectal bladder</td>
<td>1</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>Ileal ureter</td>
<td>4</td>
<td>—</td>
<td>4</td>
</tr>
<tr>
<td>Totals</td>
<td>47</td>
<td>34</td>
<td>81</td>
</tr>
</tbody>
</table>

Austen & Kalble, J Urol, 2004

Compliance & Access to Care

- Conduit diversions:
  - Appliances
  - Stomal nurse support
  - Follow-up

- Continent diversions:
  - Rectal pouch:
    - Follow-up
  - Catheterizable reservoir:
    - Catheters
    - Lubrication
    - Irrigation and frequent catheterization
    - Follow-up
Potential Research Questions

- Which is better in this context:
  - Conduit,
  - rectal reservoir, or
  - catheterizable reservoir?

- Major issues:
  - Complications: short and long-term
  - Costs: Follow-up and consumables
  - Cultural acceptance of different diversions

References: