Muscle Invasive Bladder Cancer
&
The Use of Intestinal Segments For Urinary Diversion

Stephen J. Eyre, M.D.
Clinical Instructor in Surgery
Harvard Medical School
Beth Israel Deaconess Needham Hospital
September 24, 2014
Objectives

• Brief overview of bladder cancer
• Discuss the indications for urinary diversion
• Discuss various reconstructive options & selection criteria
• Discuss common complications after urinary diversion
Pre-Presentation Questions

• What is the most common type of urinary diversion?
  A. Continent catheterizable urinary diversion
  B. Ileal “neobladder”
  C. Ileal “loop” conduit
  D. Ureterosigmoidostomy
  E. None of the above
Pre-Presentation Questions

Under what circumstances is the bladder usually removed for bladder cancer?

A. For Stage T1 Urothelial Carcinoma
B. For Stage T2 Urothelial Carcinoma
C. For Stage T3 Urothelial Carcinoma and above
D. Only after a trial of endoscopic and intravesical treatment has failed
E. For all forms of bladder cancer
F. B and C
Indications for Urinary Diversion

- Muscle-Invasive Bladder Cancer
- Recurrent Pelvic Malignancies
- Refractory Interstitial Cystitis
- Bladder dysfunction requiring augmentation
Diagnosis/Workup of Bladder Cancer

• Hematuria workup
  – Flexible cystoscopy
  – Abdominal/Pelvic imaging
    • CT Urogram
    • MR Urogram
    • Abdominal/Retroperitoneal US with Retrograde pyelogram studies
  – Voided urine cytology (no longer “required”)

Diagnosis/Workup of Bladder Cancer

• Hematuria workup
  – Flexible cystoscopy
    • Evaluates for visible lesions
      – Papillary lesions
      – Flat erythematous lesions

www.sutherlandurology.com and www.urotoday.com
Diagnosis/Workup of Bladder Cancer

• Hematuria workup
  – Abdominal/Pelvic imaging
    • Evaluate for upper urinary tract abnormalities
      – Kidney stones, renal masses, ureteral masses
    • Evaluate for bladder wall abnormalities
      – Thickening, calcifications, inflammation
    • Evaluate for other pelvic abnormalities
      – Lymphadenopathy
      – Prostatic enlargement
Diagnosis/Workup of Bladder Cancer

- Hematuria workup
  - Voided urine cytology (no longer “required”)
    - AUA no longer recommends routine use of voided urine cytology
    - Helpful if there is suspicion of Carcinoma in situ (CIS), as the cells tend to slough off into urine
Diagnosis/Workup of Bladder Cancer

• Diagnosis of Bladder Cancer
  – Most commonly Urothelial Cell Carcinoma
  – Any suspicious findings based on workup require cystoscopy with intraoperative biopsies
  – Goal of biopsies
    • Identify Urothelial Cell Carcinoma
      – Obtain biopsies that are deep enough to contain muscle
      – Grade
      – Stage
Diagnosis/Workup of Bladder Cancer

• Bladder Cancer Staging

- Non-muscle invasive
- Muscle invasive
Treatment of Bladder Cancer

• Non-Muscle Invasive Bladder Cancer
  – Aggressive endoscopic resection
  – Intravesical Treatments
    • Immunotherapy
      – BCG
      – BCG + Interferon
    • Chemotherapy
      – Mitomycin
      – Doxorubicin
      – Valrubicin
      – Gemcitabine
Treatment of Bladder Cancer

• Non-Muscle Invasive Bladder Cancer
  – Aggressive Restaging/Surveillance for Recurrence
Treatment of Bladder Cancer

• Muscle Invasive Bladder Cancer
  – Standard of care is surgical removal of bladder (and other pelvic organs)
    • Radical Cystoprostatectomy (Men)
    • Anterior Exenteration (Women)

  – Neoadjuvant & Adjuvant Chemotherapy
    • Neoadjuvant Chemo becoming more common
      – Gemcitabine/Cisplatin
      – MVAC (Methotrexate, Vinblastine, Adriamycin, Cisplatin)
Treatment of Bladder Cancer

- Muscle Invasive Bladder Cancer
  - Radical Cystoprostatectomy
Treatment of Bladder Cancer

- Muscle Invasive Bladder Cancer
  - Anterior Exenteration (Female)
Reconstructive Options

**Intestinal Conduit**
- *Ileal Conduit*
  - Most commonly used portion
- *Jejunal Conduit*
  - Rarely, if ever used
- *Transverse Colon Conduit*
  - Used when ureteric length is short

** Continent Reservoirs**
- *Ureterosigmoidostomy*
  - No longer used
- *Catheterizable Reservoirs*
  - Large bowel
  - Composite large/small bowel
- *Neobladder*
  - Usually small bowel
Patient Selection Criteria

- Cancer Prognosis
- Bowel Considerations
- Renal Function
- Physical and Emotional Considerations
- Age
- Body Image Concerns
- Previous Abdominal Operations
- History of Radiation

Patient Selection Criteria

• Pelvic XRT
  – Transverse colon or stomach as farthest away from radiation field

• Myelomeningocele
  – Avoid using ileocecal valve to prevent intractable diarrhea

• Ulcerative Colitis
  – Avoid using colon

• Peptic Ulcer Disease
  – Avoid stomach
Patient Selection Criteria

- Short Bowel Syndrome
  - Consider using stomach to prevent further intestinal shortening
- Acidosis
  - Consider using stomach (least likely to worsen acidosis)
- Renal insufficiency
  - Consider using stomach when creatinine >2 to minimize acidosis
- Diverticulosis
  - Avoid colon
- Hepatic Dysfunction
  - Consider using stomach to minimize elevated ammonia levels
Intestinal Conduit (Ileal Loop)

- Safest procedure
- Reduced operative time
- Shortest length of bowel used
- Preserves ileocecal valve
- Refluxing
- Long term renal damage probable
Intestinal Conduit

- Bowel Re-anastomosis
- Ileal Loop
Intestinal Conduit

Bowel closure with TA stapler
Intestinal Conduit

Ureters are anastomosed to proximal end of loop

Stomal end of loop

Stomal site

Ureters are anastomosed to proximal end of loop
Intestinal Conduit

Completed stoma
Continent Catheterizable Reservoirs

- Higher patient satisfaction
- Avoids ostomy appliance
- Bowel detubularized to reduce peristaltic activity
- Continence mechanism using either appendix or intussuscepted nipple
- Several options for stomal placement

Image Source: SMITH'S GENERAL UROLOGY - 16th Ed. (2004) Fig 24-9
Continent Catheterizable Reservoirs

- Cecum
- Appendix
- Terminal Ileum
Continent Catheterizable Reservoirs

Appendix used as conduit to storage pouch – Anti-reflux mechanism is tunneled “flap-valve” mechanism
Continent Catheterizable Reservoirs

Bowel is de-tubularized
Continent Catheterizable Reservoirs

Intussuscepted bowel nipple as continence mechanism

Ileocecal Valve

Inside of future reservoir
**Continent Catheterizable Reservoirs**

- Catheter through nipple inside reservoir
- Catheter at stomal end
- Temporary Cecostomy Tube
- Catheter through stoma in umbilicus
Neobladder

- Highest patient satisfaction
- Avoids ostomy appliance
- Avoids stoma
- Continence mechanism using intact urinary sphincter muscle
- 50% rate of nocturnal incontinence

Image Source: SMITH'S GENERAL UROLOGY - 16th Ed. (2004) Fig 24-7
Detubularized loops of bowel being sewn together to form pouch of neobladder
Neobladder

Completed neobladder reservoir, prior to anastomosis with ureters

Sites of ureteric anastomoses
Neobladder

Hautmann “W-pouch” neobladder

Site of ureteric anastomosis

Site of urethral anastomosis
# Common Long Term Complications of Urinary Diversion

Incidence (%) of complications with urinary diversion

<table>
<thead>
<tr>
<th></th>
<th>Ileal Conduit</th>
<th>Colon Conduit</th>
<th>Continent Diversion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bowel Obstruction</strong></td>
<td>10%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Ureteral-Intestinal Stenosis</strong></td>
<td>10%</td>
<td>10%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Stomal Stenosis</strong></td>
<td>11%</td>
<td>7%</td>
<td>9%</td>
</tr>
<tr>
<td><strong>Renal Calculi</strong></td>
<td>4.5%</td>
<td>4%</td>
<td>No available data</td>
</tr>
<tr>
<td><strong>Acidosis requiring Treatment</strong></td>
<td>16%</td>
<td>5%</td>
<td>8% / 27%</td>
</tr>
<tr>
<td><strong>Pyelonephritis</strong></td>
<td>16%</td>
<td>11%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Table adapted from Campbell’s Urology, 8th ed. Data obtained from meta-analysis of complications of urinary diversion.
Complications - Electrolytes

• Severity depends
  – Segment of intestine used
  – Length of intestine used
  – Duration of urine contact with intestine
  – Pt’s overall renal function

• Colon and/or ileum
  – Hypokalemic, hyperchloremic metabolic acidosis
    • Active transport of ammonium chloride from urine into blood
    • Ammonium excretion is main mechanism for kidneys to eliminate acid –
      impaired with colon/ileum
    • Body compensates by titrating acid using bone buffers resulting in bone
      demineralization
    • Can be treated with potassium citrate
    • Severe cases treated with chloride transport blockers (Chlorpromazine or
      nicotinic acid)
Complications - Electrolytes

- **Stomach**
  - Hypokalemic, hypochloremic metabolic alkalosis
    - HCl secretion by stomach causes hypochloremic alkalosis
    - K lost in gastric secretions
    - Treatment with H2 blockers or hydrogen pump blockers

- **Jejunum**
  - Hyperkalemic, hypochloremic, hyponatremic acidosis
    - Na and Cl secreted, K and H+ absorbed
    - Na loss results in water loss
    - Dehydration increases aldosterone secretion resulting in urine with lower sodium and higher K
    - TPN can exacerbate electrolyte disturbances
    - Rx with NaCl solution, Bicarb, correct hyperkalemia
    - Long term prophylactic therapy with oral NaCl supplement
Complications - Electrolytes

- Impaired growth
  - In children with long-standing diversions
- UTI
- Mucus production
  - Colon > ileum > stomach
  - Oral intake of dairy can increase mucus production
- Diarrhea
  - Decreased transit time of intestinal contents (after resection of ileocelecal valve)
  - Fat and bile acid malabsorbtion (after ileal resection)
  - Overgrowth of small bowel bacteria (after ileocelecal valve resection)
- Urolithiasis
  - Urease producing bacteria
  - Enteric hyperoxaluria after ileal resection
  - Mucus production
  - Acidosis and hypokalemia
  - Dehydration from diarrhea
Complications - Other

- Increased risk of cancer
- Vit B12 deficiency
  - Absorbed in distal ileum
  - Removal (>50 cm) can cause B12 def
  - Megaloblastic anemia (MCV>100 and hypersegmental neutrophils), neuro sx (demyelination), psych d/o, orthostatic hypotension, infertility, hyperpigmentation, GI Sx, inflammation of tongue/mouth
- Abnormal drug kinetics
  - Toxicity with drugs excreted in urine then reabsorbed
    - Phenytoin, methotrexate
    - If chemo given, drain conduit with catheter
Complications - Other

• Hematuria-dysuria syndrome
  • Only in gastrocystoplasty
  • Hematuria, dysuria, suprapubic pain
  • Rx with H2 blockers or PPI +/- irrigation of bladder with bicarbonate

• Hypergastrinemia
  • When gastric antrum used, exposure to alkaline urine can stimulate antral G cells to secrete gastrin
Complications - Cancer

• Increased risk of benign polyps in intestinal segment of certain diversions
• Tumors usually adenocarcinoma of intestinal origin, occur at urothelial/intestinal anastomosis
• Most data from ureterosigmoidostomy (rarely performed now) with 5-13% of patients developing malignancy
  • Latency period of approx 16 years
• Follow patients yearly with CT urogram, stool occult blood, c-scope, urine cytology
• Tumors in augmented bladders, conduits, ileal ureters found rarely
• No reports of malignancy when stomach used for urologic reconstruction
Key Points/Take Away Messages

• A number of options exist for reconstruction of the urinary tract when it is necessary

• All types of reconstruction utilizing intestinal segments require careful monitoring for possible early and late complications
Post-Presentation Questions

• What is the most common type of urinary diversion?
  A. Continent catheterizable urinary diversion
  B. Ileal “neobladder”
  C. Ileal “loop” conduit
  D. Ureterosigmoidostomy
  E. None of the above
What is the most common type of urinary diversion?

A. Continent catheterizable urinary diversion
B. Ileal “neobladder”
C. Ileal “loop” conduit
D. Ureterosigmoidostomy
E. None of the above
Post-Presentation Questions

- Under what circumstances is the bladder usually removed for bladder cancer?
  - A. For Stage T1 Urothelial Carcinoma
  - B. For Stage T2 Urothelial Carcinoma
  - C. For Stage T3 Urothelial Carcinoma and above
  - D. Only after a trial of endoscopic and intravesical treatment has failed
  - E. For all forms of bladder cancer
  - F. B and C
Post-Presentation Questions

• Under what circumstances is the bladder usually removed for bladder cancer?
  A. For Stage T1 Urothelial Carcinoma
  B. For Stage T2 Urothelial Carcinoma
  C. For Stage T3 Urothelial Carcinoma and above
  D. Only after a trial of endoscopic and intravesical treatment has failed
  E. For all forms of bladder cancer
  F. B and C
Summary of Intestinal Segments

1. Stomach
   a. Advantages—useful in patients with pelvic radiation, acidosis, renal failure, or hepatic failure. Acid secretion may inhibit bacterial growth and reduce infection. Least mucus production of intestinal segments.
   b. Disadvantages—hypokalemic hypochloremic metabolic alkalosis, hematuria dysuria syndrome, hypergastrinemia when the antrum is used.

2. Jejunum
   a. Disadvantages—hyperkalemic hypochloremic metabolic acidosis, hyponatremia, bone demineralization.

3. Ileum
   a. Advantages—familiar to urologists.
   b. Disadvantages—hypokalemic hyperchloremic acidosis, fat and bile malabsorption, diarrhea, vitamin B\textsubscript{12} deficiency, bone demineralization, not ideal after pelvic radiation.

4. Ileocecal region
   a. Disadvantages—hypokalemic hyperchloremic acidosis, fat and bile malabsorption, diarrhea (especially with myelomeningocele), vitamin B\textsubscript{12} deficiency, bone demineralization, not ideal after pelvic radiation.

5. Colon
   a. Advantages—transverse colon useful in those who had pelvic radiation.
   b. Disadvantages—hypokalemic hyperchloremic metabolic acidosis, most mucus production of intestinal segments, bone demineralization.