Evaluation of the Female urethra
Why Imaging?

• Non-specific urethral symptomatology
  – Mass, pain, bleeding, dyspareunia, obstruction
• Clinical evaluation difficult
• Frequently missed or misdiagnosed
• Appropriate management delayed
Female Urethra: Imaging Techniques

- VCUG, DBU (Double-Balloon Urethrography)
- US: Transvaginal, Transperineal, Transurethral, Transrectal sonography
- MR: Pelvic phased array, High-resolution endoluminal MRI
  - Transvaginal or Transrectal coil
Female Urethra: Imaging Techniques

- Transvaginal Sonography (TVS)
  - Broadband 9-5 MHz tightly curved array
  - TV probe placed approx. 1-2 cm in the vagina
  - Sagittal & coronal gray scale images
  - Color Doppler
Female Urethra: Imaging Techniques

• Endovaginal MRI
  – Endo-vaginal coil; im injection of 1 mg glucagon
  – Extended dynamic range, variable bandwidth, flow compensation and no-phase wrap.
  – Axial & sagittal FSE T2-W images
    • (TR/TE:3000/85, ETL: 8, 3 NEX, Bandwidth: 15.63kHz, Matrix: 256x192)
Female Urethra: Imaging Techniques

• Endovaginal MRI
  – Pre & post gadolinium, axial spin-echo T1-W images
    • (TR/TE:450/21, Matrix 256x192, 2 NEX).
  – Post-Gd images are most useful in evaluating the urethra and periurethral tissues
Normal Female Urethra
Imaging of the Female Urethra: Diverticulum

- Most common indication for urethral imaging
- Most common urethral abnormality (Up to 6% of ♀)
- Clinical symptoms: Varied and nonspecific
- Diagnosis and characterization by MR/US possible
- Surgery is curative
Imaging of the Female Urethra: Diverticulum

- Mechanism of formation
  - Chronic inflammation leads to gland dilatation
  - Rupture of periurethral gland forms a diverticula
- Commonly occur in posterolateral wall of midurethra
  - Distribution of glands and their ducts
- No., location, size, configuration, & content of Tics
- Neck of the diverticula: Most important information
Imaging of the Female Urethra: Diverticulum
Imaging of the Female Urethra: Diverticulum
Imaging of the Female Urethra: Diverticulum

- Neck of the diverticula: Most important information
  - Location, Number
- Resection of neck important to cure the disease
- Incomplete resection leads to recurrence
Imaging of the Female Urethra: Diverticulum
Imaging of the Female Urethra: Diverticulum
Complications of the Diverticulum: Calculus
Complications of the Diverticulum: Cancer

- Adenocarcinoma
- Transitional Cell Carcinoma
## Imaging of Urethral Diverticula: Relative Strengths

<table>
<thead>
<tr>
<th>Test</th>
<th>Connection to urethra</th>
<th>Neck</th>
<th>Configuration</th>
<th>Calculi</th>
<th>Tumor</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCUG</td>
<td>Sometimes</td>
<td>Sometimes</td>
<td>Partially</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>DBU</td>
<td>Yes</td>
<td>Yes</td>
<td>Partially</td>
<td>Yes</td>
<td>Sometimes</td>
</tr>
<tr>
<td>TVS</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>TV MRI</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Imaging of the Female Urethra: Cancers

- Urethral carcinomas are rare (<0.1% of ♀ cancers)
- Mostly postmenopausal women
- Predisposing factors
  - Diverticula, HPV infection
- Histology
  - Squamous, Adenocarcinoma, Transitional
- Diffuse Infiltrative or Exophytic, Fungating masses
- Poor prognosis
  - Location: Distal (50% survival); Proximal (6% survival)
Imaging of the Female Urethra: Cancers

- Squamous cell carcinomas: Most common subtype (70% of cancers)
- Involves the distal urethra and meatus
- Associated with chronic HPV infection
Imaging of the Female Urethra: Cancers

- Transitional cell carcinomas: Second most common subtype (20% of cancers)
- Involves the proximal urethra
- Associated with chronic HPV infection
Imaging of the Female Urethra: Cancers

- Adenocarcinomas: Least common subtype (10% of cancers)
- Most common cancer that develops in a tic
- Involves the distal urethra (Skene glands)
Imaging of the Female Urethra: Leiomyoma

- Rare benign mesenchymal neoplasm
- Well-circumscribed, homogenous, hypervascular neoplasm
- Increased Doppler flow
- Iso-hyperintense on T2-W images
- Uniform contrast enhancement
Imaging of the Female Urethra: Leiomyoma

Leiomyoma
Imaging of the Female Urethra: Leiomyoma
Imaging of the Female Urethra: Tumors

- Urethral metastases are rare
- Typically contiguous spread from adjacent cancer
  - Bladder, Cervix, Vagina, Anus
- Hematogenous spread extremely rare
Imaging of the Female Urethra: Tumors

Metastases
<table>
<thead>
<tr>
<th>Type</th>
<th>Origin/Etiology</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal inclusion cyst</td>
<td>Post-traumatic</td>
<td>Site of previous trauma/surgery</td>
</tr>
<tr>
<td></td>
<td>Epidermal inclusion</td>
<td></td>
</tr>
<tr>
<td>Gartner’s cyst</td>
<td>Embryonic,</td>
<td>Anterolateral vagina</td>
</tr>
<tr>
<td></td>
<td>Mesonephric</td>
<td></td>
</tr>
<tr>
<td>Mullerian cyst</td>
<td>Embryonic</td>
<td>Anterolateral vagina</td>
</tr>
<tr>
<td></td>
<td>Paramesonephric</td>
<td></td>
</tr>
<tr>
<td>Skene’s cyst</td>
<td>Paraurethral gland/duct</td>
<td>Distal urethra</td>
</tr>
</tbody>
</table>
# Imaging of the Periurethral Abnormality

<table>
<thead>
<tr>
<th>Type</th>
<th>Origin/Etiology</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartholin Cyst</td>
<td>Bartholin gland</td>
<td>Postero-lateral introitus medial to labia minora</td>
</tr>
<tr>
<td>Ectopic Ureterocele</td>
<td>Congenital</td>
<td>Periurethral</td>
</tr>
<tr>
<td>Endometriosis</td>
<td>Ectopic implantation</td>
<td>Site of previous of trauma/surgery</td>
</tr>
</tbody>
</table>
Imaging of the Periurethral Abnormality

Gartner Cyst

Skene Cyst
Ectopic Ureterocele

Imaging of the Periurethral Abnormality
Imaging of the Postoperative Urethra

- Surgery for stress incontinence, urethral mass/Tics
- Post-operative changes may simulate urethral pathology
- Knowledge of Surgical history: Important to make the correct diagnosis
Imaging of the Postoperative Urethra

Collagen Injection
Imaging of the Postoperative Urethra

Carbon-coated spheres