MR Urography (fMRU)

1. Patient Preparation:
   a. Sedation/anesthesia - usually < 7 years of age
   b. Non-sedate cases NPO 4 hours prior to scan
   c. Hydration - 20cc/kg bolus prior to imaging
   d. Bladder Catheterization- Foley catheter without balloon connected to a bag which is placed below the level of the table to facilitate bladder emptying
   e. Procedural meds- Lasix 1mg/kg (max 20 mg) given 15 min before IV gadolinium injection
   f. Positioning: Prone (unless precluded by surgery, sedation issues etc...)

2. Coverage- from diaphragm to below the bladder, A-P coverage through the kidneys

3. 3 pre-contrast sequences, one pre-contrast test scan prior to gad injection, then dynamic T1 3D GRE dynamic series comprised of repetitions for 8 min or until contrast seen in the ureters; delays obtained based on clinical question.

<table>
<thead>
<tr>
<th>Seq: T1/T2</th>
<th>2D/3D</th>
<th>Vendor Specific name</th>
<th>Plane</th>
<th>Fat sat</th>
<th>Motion correction</th>
<th>Other parameters</th>
<th>Additional info</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2 Single shot</td>
<td>2D</td>
<td>T2 HASTE, SSFSE, SSH-TSE</td>
<td>Sagittal and axial</td>
<td>No</td>
<td>FB or BH based on pt age</td>
<td>Essential for planning oblique coronals</td>
<td></td>
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<tr>
<td>T2</td>
<td>2D</td>
<td>T2 BLADE/Propeller/ MultiVane</td>
<td>Axial (abdomen)</td>
<td>Yes</td>
<td>FB</td>
<td>Depicts scarring, dysplasia well</td>
<td></td>
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<tr>
<td>T2</td>
<td>3D</td>
<td>T2 SPACE/CUBE/VISTA</td>
<td>Coronal (isotropic)</td>
<td>Yes</td>
<td>RT or Navigator</td>
<td>Can use to reconstruct in other planes</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>3D</td>
<td>VIBE/THRIVE/LAVA</td>
<td>Coronal</td>
<td>Yes</td>
<td>FB</td>
<td>Fast scan Pre-contrast Oblique to include kidneys, ureters and bladder</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>3D Post-contrast</td>
<td>VIBE/THRIVE/LAVA</td>
<td>Coronal</td>
<td>Yes</td>
<td>FB</td>
<td>Repeated till contrast in ureters or for 8 min Can be repeated, same oblique plane as pre-contrast</td>
<td></td>
</tr>
</tbody>
</table>
Legend: FB= free breathing, RT=respiratory triggered, BH=Breath-hold;

Optional sequences:

1. DWI axial b-value (2-3 b values)
2. Coronal T2 SSFSE

Special Situations:
1. Concern for *ectopic ureter* - acquire Axial T2 FS high resolution imaging through pelvis
2. Concern for *calyceal diverticulum* - Coronal and Sagittal 3D T1 VIBE/LAVA/THRIVE delays (at half hour, and one hour or more to identify contrast in the diverticulum)
3. Concern for *fibroepithelial polyp* - Coronal cinematic balanced SSFP (TruFISP/FIESTA/balanced FFE)