Inclusion Criteria
- Pyeloplasty, ureteral reimplant, nephrectomy, ureteroureterostomy, urachals
- Open or robotic
- Primary or redo surgery

Exclusion Criteria
- None

Intraoperative Management

Circulating Nurse
- Put in line to use 8.5° scope and calibrate for 0° and 30° down with 0° scope to enter first
- Set insufflation pressures
  - < 12 years: 10 mmHg
  - ≥ 12 years: 12 mmHg
- Set cautery
  - Cut on “1”
  - Coag on “Blend 15”
  - Bipolar on “25”
- SCD or TED stockings for thrombosis prevention if over age 12 (OR Protocol)
- Sonosite Ultrasound (big probe) to confirm stent position
- Age-appropriate active warming
- Latex precautions

Anesthesia/Pain
- IV Fluids: After IV placement give NPO deficit over first hour then resume maintenance fluids through the remaining of the case
- Patient to be paralyzed to ease insufflation
- Place oral/gastric tube to be removed at end of case
- Local anesthetic
  - Ropivacaine 0.2% (2 mg/mL)
  - 1 mL/kg divided between incisional subcutaneous volume and intraabdominal aerosolization
  - Repeat as above with 0.5 mL/kg at end of case
- Age ≥ 3 years: Dexamethasone 0.15 mg/kg max 4mg and ondansetron 0.15 mg/kg max 4mg to prevent nausea and vomiting

Infection Prevention
- First-line: cefazolin 30 mg/kg IV q 3 h max 2,000 mg/dose
- If history of resistant infection: ceftriaxone 75 mg/kg IV max 2,000 mg/dose
- If allergic to penicillin or history of MRSA with known sensitivity: clindamycin 10 mg/kg IV q 3 h max 900 mg/dose
- If history of MRSA resistant to clindamycin: vancomycin 15 mg/kg IV max 1,000 mg/dose over 60 minutes

Safety Alerts
- Deviation from protocol expected (fluids, ketorolac, morphine)
  - Renal insufficiency, for example
    - Low GFR (< 90 mL/min/1.73m²)
    - Solitary kidney
    - Nephrostomy tube in place
    - Heart disease
  - Dexamethasone
    - Contraindicated if malignancy

Surgical Evidence
- Recommendations
- UPJ Obstruction
- Vesicoureteral Reflux
- Stents

Go to Postoperative Management

Patient fit for transport to PACU, then acute care unit
## Urology Minimally Invasive Surgery (MIS) v5.0

### Safety Alerts

**Deviation from protocol expected (fluids, ketorolac, morphine)**
- Renal insufficiency, for example
  - Low GFR (< 90 mL/min/1.73m²)
- Solitary kidney
- Nephrostomy tube in place
- Heart disease

### Inclusion Criteria
- Pyeloplasty, ureteral reimplant, nephrectomy, ureteroureterostomy, urachals
- Open or robotic
- Primary or redo surgery

### Exclusion Criteria
- None

### Postoperative Management

**Vital signs**
- Standard vital signs per acute care guidelines
- Strict I/O

**Activity**
- Out of bed ad lib
- May bathe

**Nursing**
- Follow Ureteropelvic Junction (UPJ) GOC (for SCH only)
- Foley catheter to gravity drainage
- Continue thrombosis prevention, if indicated
- Encourage ambulation
- Latex precautions

**Diet**
- Regular

**IV Fluids**
- D5½NS 1 x maintenance IV plus PO (no potassium)

**Medications**
- Acetaminophen PO/PR q 4h
- When urine output >1 mL/kg/hr, ketorolac IV q 6 h x 72 h; hold for urine output <1 mg/kg/hr
- Ondansetron q 6h prn nausea
- Diphenhydramine q 6h prn itching
- Morphine IV q 2h and oxycodone PO q 4h prn breakthrough pain
- Polyethylene glycol (Miralax)
- If pills tolerated, docusate
- Oxybutynin TID as needed for bladder spasms
- Home meds

### Discharge Criteria
- Temperature <38°C
- Ambulating
- Tolerating oral intake and oral pain medicine
- Family comfort with post-operative management plan established
- Voiding spontaneously

### Discharge Instructions
- No restrictions
- Plan for stent removal
- Postop constipation

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For questions concerning this pathway, contact: UrologyMISPPathway@seattlechildrens.org

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Last Updated: May 2020
Next Expected Review: May 2025
**Recommendations:**
1. Recommend robotic dismembered pyeloplasty for primary or secondary UPJ obstruction due to higher success rates, shorter operating time and LOS, fewer complications
2. Recommend open or robotic for management of vesicoureteral reflux due to equivocal benefits
3. Recommend against endopyelotomy because success rates are low
4. Use double J stent for postoperative pyeloplasty management, because it is associated with less urine leakage which leads to repair failure, acknowledging the trade-off that it is associated with more pain

**UPJ Obstruction: Robot-assisted vs laparoscopic pyeloplasty**
Robotic dismembered pyeloplasty is associated with shorter operating time [27 minutes (95% CI: 9 to 44), *LOE: +1 Very low certainty (Light 2018)*]; shorter LOS [1.5 days (95% CI 0.8 to 2.2 days) and 1.2 (95% CI 0.6 to 1.8 days), *LOE: +2 Low certainty (Tatak 2019, Light 2018)*], higher success rate [OR 2.41 (95% CI 1.08 to 5.83) and 2.76 (95% CI: 1.3 to 5.88) over around 12 months, NNTB around 41 given 96% success rate non-robotic surgery, *LOE: +2 Low certainty (Tatak 2018, Light 2018)*], and lower complication rate [OR 0.56 (95% CI 0.37 to 0.84), NNT 16 assuming a control event rate of 15.7%, *LOE: +2 Low certainty (Light 2018)*].

<table>
<thead>
<tr>
<th>Study</th>
<th>Outcome</th>
<th>Result</th>
<th>Certainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 cohort studies (n = 1219)</td>
<td>Operating time</td>
<td>Robotic shorter MD -26.71 minutes (95% CI: -44.42 to -9)</td>
<td>+1 Very low certainty (Light 2018)</td>
</tr>
<tr>
<td>6 Cohorts (n = 1791)</td>
<td>LOS</td>
<td>Robotic shorter LOS MD -1.49 days (95% CI: -2.22 to -0.77)</td>
<td>+2 Low certainty (Taktak 2019)</td>
</tr>
<tr>
<td>13 cohorts (n = 1170)</td>
<td>LOS</td>
<td>Robotic shorter MD -1.21 days (95% CI: -1.84 to -0.57)</td>
<td>+1 Very low certainty (Light 2018)</td>
</tr>
<tr>
<td>11 cohort and case-control (n = 1138)</td>
<td>Success rate (undefined follow-up)</td>
<td>Robotic higher success rate OR 2.41 (95% CI: 1.08 to 5.83 NNTB is 46 (95% CI: 32 to 369)</td>
<td>+1 Very low certainty (Tatak 2019)</td>
</tr>
<tr>
<td>14 Cohorts (n = 1301)</td>
<td>Success rate (12 months)</td>
<td>Robotic higher success rate OR 2.76 (95% CI: 1.3 to 5.88) NNTB 33 (95% CI: 25 to 92)</td>
<td>+2 Low certainty (Light 2018)</td>
</tr>
<tr>
<td>15 cohorts (n = 1162)</td>
<td>Complication rate (12+ months)</td>
<td>Robotic fewer complications OR 0.56 (95% CI: 0.37 to 0.84) NNTB 16 (95% CI: 11 to 46)</td>
<td>+2 Low certainty (Light 2018)</td>
</tr>
</tbody>
</table>
Urology MIS Pathway: Surgical Evidence

Vesicoureteral Reflux: Robot-assisted vs laparoscopic pyeloplasty
Robotic assisted pyeloplasty for vesicoureteral reflux may be associated with shorter operating time [67 minutes (95% CI: 42 to 92)] and shorter LOS [18 hours (95% CI 14 to 21 hours) LOE: +1 Very low certainty (Deng 2018)]. The impact of robotic pyeloplasty on success rate, reintervention [+1 Very low certainty (Deng 2019)], and complications [+1 Very low certainty (Tatak, 2019, Deng 2019)], are uncertain.

<table>
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<th>Outcome</th>
<th>Result</th>
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</tr>
</thead>
<tbody>
<tr>
<td>6 cohorts (n = 1828)</td>
<td>OR time</td>
<td>Open favored MD 66.69 minutes (95% CI: 41.71 to 91.67)</td>
<td>+1 Very low certainty (Deng 2018)</td>
</tr>
<tr>
<td>5 cohorts (n = 5520)</td>
<td>LOS</td>
<td>Robotic favored MD -17.8 hours (95% CI: -21.18 to -14.42)</td>
<td>+1 Very low certainty (Deng 2019)</td>
</tr>
<tr>
<td>5 cohorts (n = 223)</td>
<td>Success rate (range 3-22 months)</td>
<td>No difference OR 1.13 (95% CI: 0.43 to 2.99)</td>
<td>+1 Very low certainty (Deng 2019)</td>
</tr>
<tr>
<td>6 cohorts (n = 1828)</td>
<td>Complications (range 3-22 months)</td>
<td>No difference OR 0.77 (95% CI: 0.28 to 2.15)</td>
<td>+1 Very low certainty (Deng 2019)</td>
</tr>
<tr>
<td>12 Cohort studies (n = 1723)</td>
<td>Complications</td>
<td>No difference OR 0.61 (95% CI: 0.36 to 1.02)</td>
<td>+2 Low certainty (Tatak 2019)</td>
</tr>
<tr>
<td>6 cohorts (n = 421)</td>
<td>Re-intervention (unspecified follow-up)</td>
<td>No difference OR 0.43 (95% CI: 0.15 to 1.21)</td>
<td>+1 Very low certainty (Tatak 2019)</td>
</tr>
</tbody>
</table>

Endopyelotomy for UPJ obstruction
In a review of 15 cohorts or case series including 216 patients, authors recommended the following
- Crossing vessels should be considered a contraindication to endopyelotomy due to high prevalence of this finding in failed cases
- There may be a useful role for secondary endopyelotomy according to the summary data in this paper but a large case series, comparing techniques, found low success with secondary pyloromyotomy
- Endopyelotomy was associated with significant higher rates of complications and transfusions, longer LOS, and higher hospital charges when compared with minimally invasive pyeloplasty (18% compared with 9-11%). This case series also found a significant number of patients with respiratory complications (8.6%) which may have been underreported in other papers in this review.

[Level of Evidence (LOE): Expert opinion (Dirie 2018)]
Prognosis difference between primary and secondary pyeloplasty
A systematic review compared primary to secondary robot-assisted pyeloplasty found no difference in complications or length of stay, with a primary associated with low recurrence rate, operative time, and less blood loss over 1-3 years [LOE: +1 Very low certainty (Dirie 2019)].

Benefits and Risks of Stents
In a systematic review of 4 RCTs and 11 retrospective cohorts
- No obvious differences in operative time, operative success, hospital stay, improvement in renal functions, overall complications, or redo pyeloplasty between external stented, DJ stented, and stentless procedures for pediatric pyeloplasty. Additional high-quality studies are needed.
- In probability-ranking results:
  - More postoperative pain with stents
    - DJ stented vs stentless, OR 4.47 (95% CI 1.05 to 19.08)
    - External vs stentless, OR 5.83 (95% CI 0.09 to 1.43)
  - Lower rate of urine leakage
    - DJ stented vs external stented, OR 0.18 (95% CI 0.04 to 0.76)
    - DJ stented vs stent-less OR 0.07 (95% CI 0.01 to 0.34)
  - No differences in UTI, stent migration, recurrent UPJO, and fever
  - DJ stented was probably best treatment in LOS, operative success, improvement in renal function, urine leakage
  - Stent-less procedure probably has advantage in operative time, flank pain, UTI
  - External stented procedure had lowest rate of overall complications and redo pyeloplasty

The certainty was downgraded for presence of bias (selection bias and blinding, small patient numbers. [LOE: +1 very low certainty (Liu 2019)]
Approved by the CSW Urology MIS Pathway team for May 6, 2020, go-live

CSW Urology Minimally Invasive Surgery (MIS) Pathway Team:

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urology, Owner</td>
<td>Thomas Lendvay, MD, FACS</td>
</tr>
<tr>
<td>Post Anesthesia Care Unit,</td>
<td>Pam Christensen, MN, ARNP-CS,</td>
</tr>
<tr>
<td>Stakeholder</td>
<td>ACCNS-P, CPN</td>
</tr>
<tr>
<td>Pharmacy, Stakeholder</td>
<td>Jeremy Holt, RPh</td>
</tr>
<tr>
<td>Surgical Unit, Team Member</td>
<td>Kristine Lorenzo, MSN, ARNP-CS,</td>
</tr>
<tr>
<td>Urology, Stakeholder</td>
<td>ACCNS-P, CPN</td>
</tr>
<tr>
<td>Anesthesia, Stakeholder</td>
<td>Shilpa Verma, MD</td>
</tr>
</tbody>
</table>

Clinical Effectiveness Team:

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultant</td>
<td>Jennifer Hrachovec, PharmD, MPH</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Ivan Meyer, PMP</td>
</tr>
<tr>
<td>Data Analyst</td>
<td>Nathan Deam</td>
</tr>
<tr>
<td>Librarian</td>
<td>Sue Groshong, MLIS</td>
</tr>
<tr>
<td>Program Coordinator</td>
<td>Kristyn Simmons</td>
</tr>
</tbody>
</table>

Clinical Effectiveness Leadership:

<table>
<thead>
<tr>
<th>Role</th>
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</tr>
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<tbody>
<tr>
<td>Medical Director</td>
<td>Darren Migita, MD</td>
</tr>
<tr>
<td>Operations Director</td>
<td>Karen Rancich Demmert, BS, MA</td>
</tr>
</tbody>
</table>


Evidence Ratings

This pathway was developed through local consensus based on published evidence and expert opinion as part of Clinical Standard Work at Seattle Children’s. Pathway teams include representatives from Medical, Subspecialty, and/or Surgical Services, Nursing, Pharmacy, Clinical Effectiveness, and other services as appropriate.

When possible, we used the GRADE method of rating evidence quality. Evidence is first assessed as to whether it is from randomized trial or cohort studies. The rating is then adjusted in the following manner (from: Guyatt G et al. J Clin Epidemiol. 2011;4:383-94, Hultcrantz M et al. J Clin Epidemiol. 2017;87:4-13.):

Quality ratings are *downgraded* if studies:
- Have serious limitations
- Have inconsistent results
- If evidence does not directly address clinical questions
- If estimates are imprecise OR
- If it is felt that there is substantial publication bias

Quality ratings are *upgraded* if it is felt that:
- The effect size is large
- If studies are designed in a way that confounding would likely underreport the magnitude of the effect OR
- If a dose-response gradient is evident

**Certainty of Evidence:**
- 🌟🌟🌟 High: The authors have a lot of confidence that the true effect is similar to the estimated effect
- 🌟🌟🌟🌟 Moderate: The authors believe that the true effect is probably close to the estimated effect
- 🌟🌟🌟🌟 Low: The true effect might be markedly different from the estimated effect
- 🌟🌟🌟🌟🌟 Very low: The true effect is probably markedly different from the estimated effect

Guideline: Recommendation is from a published guideline that used methodology deemed acceptable by the team

Expert Opinion: Based on available evidence that does not meet GRADE criteria (for example, case-control studies).
Summary of Version Changes

- **Version 1.0 (6/26/2013):** Go live.
- **Version 2.0 (7/9/2014):** Updated maintenance fluids rate in OR care.
- **Version 3.0 (3/3/2016):** Removed tamsulosin from medications.
- **Version 3.1 (6/19/2017):** Updated cefazolin to new standard from 20mg/kg to 30mg/kg.
- **Version 4.0 (2/3/2020):** Updated maintenance fluids rate in OR care.
Medical Disclaimer

Medicine is an ever-changing science. As new research and clinical experience broaden our knowledge, changes in treatment and drug therapy are required.

The authors have checked with sources believed to be reliable in their efforts to provide information that is complete and generally in accord with the standards accepted at the time of publication.

However, in view of the possibility of human error or changes in medical sciences, neither the authors nor Seattle Children’s Healthcare System nor any other party who has been involved in the preparation or publication of this work warrants that the information contained herein is in every respect accurate or complete, and they are not responsible for any errors or omissions or for the results obtained from the use of such information.

Readers should confirm the information contained herein with other sources and are encouraged to consult with their health care provider before making any health care decision.
**Literature Search Methods:**
For this update, we revised the search strategies in line with current Library practices. Literature searches were conducted in October 2019 to target synthesized literature on pyeloplasty and ureteropelvic junction repair from 2014 to current and limited to English. The search was executed in Ovid Medline, Embase, Cochrane Database of Systematic Reviews (CDSR) and Turning Research into Practice (TRIP) databases.

Screening and data extraction were completed using DistillerSR (Evidence Partners, Ottawa, Canada). Two reviewers independently screened abstracts and included guidelines and systematic reviews that addressed treatment and prognosis of patients who meet pathway inclusion/exclusion criteria. One reviewer screened full text and extracted data, and a second reviewer quality checked the results. Differences were resolved by consensus.

**Literature Search Results:**
The search retrieved 249 records. Once duplicates had been removed, we had a total of 204 records. We excluded 177 records based on titles and abstracts. We obtained the full text of the remaining 27 records and excluded 19. We included 8 studies. The flow diagram summarizes the study selection process.

---

**Identification**
- Records identified through database searching (n=249)
- Additional records identified through other sources (n=0)

**Screening**
- Records after duplicates removed (n=204)

**Eligibility**
- Records assessed for eligibility (n=27)
  - Articles excluded (n=19)
    - Did not answer clinical question (n=8)
    - Did not meet quality threshold (n=4)
    - Outdated relative to other included study (n=6)
    - Not in English (n=1)

**Included**
- Studies included in pathway (n=8)

Flow diagram adapted from Moher D et al. BMJ 2009;339:bmj.b2535
Included Studies


