**Surgical Unit**

**Inclusion Criteria**
- Patient admitted for kidney transplant surgery

**Exclusion Criteria**
- Patient admitted for multiple organ transplant surgeries

**Drawing Labs**
- Transplant labs are high priority
  - Nurse to contact lab or VAS Team or dialysis to draw lab ASAP
  - If VAS Team unavailable, contact shift administrator to request assistance from PICU or ED
  - May exceed maximum allowable blood draw volumes
- Click [here](#) for details

**Admission**

### Admitting Procedure
- Schedule: patient and family will arrive at Seattle Children’s Hospital after being notified by the Transplant Coordinator of the available donor organ
- Transplant Coordinator notifies
  - Charge nurse on receiving unit as soon as possible before patient arrives
  - VAS Team to be prepared to draw stat labs and start peripheral IV (regardless of current access)
  - Shift administrator and lab
  - Security, as needed
- Patient
  - Goes to River C 6 surgical unit for height, weight, labs and admission +/- dialysis
  - Will be admitted to a single room on River 6 whenever possible

**Admitting Orders**
- Surgical Team (ARNP M-F, surgical resident / attending surgeon after hours, weekends and holidays) places lab and radiology orders in CIS
  - Completes required forms
    - Operative History and Physical Exam Form
    - Consent to Operate Form
    - Consent for Transfusion Form
  - Orders and initiates
    - Pre Op phase of Kidney Transplant Plan
    - Patient Navigator Request
  - Orders in pending state
    - Pre Op Antibiotics phase of Kidney Transplant Plan
    - Nephrology
      - Kidney Transplant Thymoglobulin Immunosuppression Plan
      - Dialysis orders, if applicable
      - Surgeon sets OR time

**Nursing Pre-Operative Checklist**
- Ensure orders were placed in CIS on inpatient encounter
  - Pre Op phase of Kidney Transplant Plan
  - Pre Op Antibiotics phase of Kidney Transplant Plan
  - Kidney Transplant Thymoglobulin Immunosuppression Plan
- Obtain height and weight; enter into CIS immediately
- Draw labs (see Drawing Labs box above)
- Ensure PIV has been placed regardless of current access
- After lab draw, send patient to radiology for chest x-ray
- Verify labs are being processed
  - Check CIS for results
  - Contact lab for clarification, if uncertain
- Confirm Anesthesia has seen patient
  - Ensure pre-operative boarding pass is in chart with anesthesia documentation
  - Complete nursing documentation on pre-operative boarding pass
- Confirm the following forms are in chart and completed by Surgical Team
  - Operative History and Physical Exam Form
  - Consent to Operate Form
  - Consent for Transfusion Form
- Ensure patient is NPO and has IVF infusing per Kidney Transplant Plan
- Confirm an active type and screen
  - In CIS under Blood Bank Summary tab
- Bathe patient with chlorhexidine
  - Pre-Operative Care P&P
- OR notifies floor when they are ready (Do not contact OR or Transplant Nurse Coordinator to request surgery time)
  - Orient family to surgical floor

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For questions or clarification, contact Transplant Nurse Coordinator On-Call via paging operator (Do not contact OR or Transplant Nurse Coordinator to request surgery time)
Kidney Transplant Pathway v1.0: Intraoperative

Operating Room

Arrive from Surgical Unit

Circulating Nurse
- Organ Chain of Custody Form
- Pre-Transplant ABO Verification by licensed healthcare professional, if recipient’s surgery starts before organ arrives
- Login of Organ Form

Anesthesiologist
- Initiate in CIS
  - Pre Op Antibiotics phase of Kidney Transplant Plan
  - Kidney Transplant Thymoglobulin Immunosuppression Plan
- Order vasoactive medications, if needed
- Order and start hydromorphone infusion/PCA on all patients prior to leaving OR (2 mcg/kg/hr)

Operative Team
- In addition to standard surgical checklist
  - Complete ABO Verification upon organ receipt by implanting surgeon
  - Record duration of backbench preparation
  - Maintain CVP of 10 mmHg
  - Give 50 cc/kg of crystalloids by the time of organ reperfusion
  - Discuss urine replacement with 1/2 NS after organ reperfusion

Close of Case

Circulating Nurse
- Document graft reperfusion on ABO Verification Form
- Send donor lab sample to lab for HLA crossmatch
- Call consult nephrologist and PICU charge nurse when surgeon is closing

Surgical Sign Out
- Complete ABO Verification
- Complete Implant Record
- Discuss extubation plan

Transfer to PICU

Direct family to PICU Waiting Area and PICU Front Desk. Obtain pager for updates from operating room staff.

Exclusive use of normal saline is not recommended because of the risk of non-anion gap metabolic acidosis.

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

Last Updated: October 2018
Next Expected Review: October 2023
Kidney Transplant Pathway v1.0: Postoperative Critical Care

Pediatric Intensive Care Unit

Arrive from Operating Room

OR to PICU Handoff
Surgeon, Anesthesiologist and Nephrologist Handoff to PICU
- Utilize Postoperative Handoff Template (OR/IR to ICU)
- Establish SBP range, CVP target and urine output goal with team
- Determine the medications to be given for hypertension
- Clarify pain management plan

Postoperative Management

Transplant Team orders
- Post Op phase of Kidney Transplant Plan

Labs
- Kidney Transplant GOC Appendix

Medications
- **Immunosuppression** Roadmap
  - In CIS under [Medication Management] tab
  - Antihypertensive
    - If on beta blocker pre-transplant → Labetalol
    - If not on beta blocker pre-transplant → Hydralazine
  - If tolerating oral medications → Isradipine PRN
  - Acetaminophen, hydromorphone
  - Transition to oxycodone when tolerating enteral diet
  - Pantoprazole, diphenehydramine
  - Cefazolin, clindamycin
  - Nystatin or clotrimazole
  - Trimethoprim-sulfamethoxazole or dapsone
  - Valganciclovir
  - Heparin or aspirin

Fluid Management
- IVF at 1/3 maintenance at a set rate
- Urine replacement 1:1 with a minimum rate
- Patient’s full maintenance fluid determines the minimum rate
- Minimum rate does not include medication volume
- Expectation – patients will be fluid positive given the medication volume
  - If done appropriately, patient would be positive 1/3 maintenance + medication volume
- When total fluid goal is established, medication volume would count at that time (IV + PO + Meds)
- Daily weights (standing scale, if possible)

Guideline of Care (GOC) and Clinical Policy and Procedure (P&P)
- Kidney Transplant GOC
- Comfort and Sedation in the ICU GOC
- Systemic Heparin P&P

Care Progression

Transplant Pharmacist
- Initiate medication teaching via iPad as soon as possible

Transplant NP or RN
- Arrange formal discharge education

Transfer Criteria
- Not requiring ICU-level care
- Total fluid goal or urine replacement every 2 hours
- PRN blood pressure meds no more than every 4 hours
- Labs no more than every 6 hours

Transfer to Surgical Unit

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Last Updated: October 2018
Next Expected Review: October 2023
Postoperative Management

**Labs**
- Daily labs as ordered
- May require two labs daily
  - One for AM labs, another for timed tacrolimus trough

**Medications**
- **Immunosuppression** Roadmap
  - In CIS under Mediation Management tab
- Antihypertensive, if applicable
- Acetaminophen, hydromorphone
- Transition to oxycodone when tolerating enteral diet
- Pantoprazole, diphenhydramine
- Cefazolin, clindamycin
- Nystatin or clotrimazole
- Trimethoprim-sulfamethoxazole or dapsone
- Valganciclovir
- Heparin or aspirin

**Fluid Management**
- Daily weights
- Strict I/O

**Consults**
- Child Life
- Social Work

**Guideline of Care (GOC) and Clinical Policy and Procedure (P&P)**
- Kidney Transplant GOC
- Renal Biopsy GOC, if biopsy performed
- Infection Prevention for Organ Transplant Patients P&P
- Gastric Suction P&P, if NG Tube
- Systemic Heparin P&P
- IV Line Maintenance P&P

**Discharge Criteria**
- Stable graft function
- Stable immunosuppression
- Stable urine output or have dialysis plan
- Meeting total daily fluid goal enterally
- Tolerating enteral diet
- Follow-up appointments scheduled
- Stent removal scheduled
- Caregivers completed education by pharmacy and transplant nurse
- Caregivers completed 24-hour room-in
- Social Work and Nutrition have discharge notes
- Completed Transplant Discharge Teaching Checklist Job Aid

**Discharge Instructions**
- Follow-up calendar
- Discharge medications and dosing schedule handed to family

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*Last Updated: October 2018
Next Expected Review: October 2023*
## Kidney Transplant Pathway v1.0: Admit Labs

### Standard Admit Labs

<table>
<thead>
<tr>
<th>Test</th>
<th>Container</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrolytes</td>
<td>Gold 1 mL</td>
</tr>
<tr>
<td>Glucose Level</td>
<td></td>
</tr>
<tr>
<td>BUN</td>
<td></td>
</tr>
<tr>
<td>Creatinine</td>
<td></td>
</tr>
<tr>
<td>Calcium Level, Total</td>
<td></td>
</tr>
<tr>
<td>Phosphorus Serum</td>
<td></td>
</tr>
<tr>
<td>Albumin Level</td>
<td></td>
</tr>
<tr>
<td>CBC+Diff</td>
<td>Lavender 1 mL</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>Lavender microtainer 0.5 mL</td>
</tr>
<tr>
<td>Prothrombin Time + INR</td>
<td>Lt. Blue Citrate 1.8 mL</td>
</tr>
<tr>
<td>APTT</td>
<td></td>
</tr>
<tr>
<td>HIV Antigen and Antibody</td>
<td>Lavender 3 mL (separate tube)</td>
</tr>
<tr>
<td>Hepatitis B surface antigen</td>
<td>Gold 3 mL</td>
</tr>
<tr>
<td>Hepatitis C Antibody</td>
<td></td>
</tr>
<tr>
<td>Blood Bank Hold Sample</td>
<td>Lavender 2 mL</td>
</tr>
</tbody>
</table>

### Patient-specific Admit Labs (per provider order)

<table>
<thead>
<tr>
<th>Test</th>
<th>Container</th>
<th>As needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lymphocyte Crossmatch</td>
<td>Ask lab for ACD (A or B) tube</td>
<td></td>
</tr>
<tr>
<td>Patient’s Weight</td>
<td>(no serum separator)</td>
<td></td>
</tr>
<tr>
<td>9 - 13 kg</td>
<td>ACD 10 mL</td>
<td>Red 5 mL</td>
</tr>
<tr>
<td>14 - 21 kg</td>
<td>ACD 20 mL</td>
<td>Red 5 mL</td>
</tr>
<tr>
<td>22+ kg</td>
<td>ACD 30 mL</td>
<td>Red 7 mL</td>
</tr>
<tr>
<td>Post-transplant patients 9 - 21 kg</td>
<td>ACD 10 mL</td>
<td>Red 5 mL</td>
</tr>
<tr>
<td>Post-transplant patients 22+ kg</td>
<td>ACD 20 mL</td>
<td>Red 7 mL</td>
</tr>
<tr>
<td>Urinalysis</td>
<td>Sterile Screw-Capped Container</td>
<td>If urine available</td>
</tr>
<tr>
<td>Urine Culture</td>
<td>2 mL fresh random urine</td>
<td>If urine available</td>
</tr>
<tr>
<td>HCG, Serum Pregnancy Test</td>
<td>Gold 1 mL</td>
<td>As needed (if female &gt; 12 years old)</td>
</tr>
<tr>
<td>CMV Serology</td>
<td>Gold 2 mL</td>
<td>As needed (if historically CMV negative)</td>
</tr>
<tr>
<td>Epstein Barr Antibody Panel</td>
<td></td>
<td>As needed (if historically EBV negative)</td>
</tr>
</tbody>
</table>

### Summary

**Minimum volume for standard admit labs ONLY**
- 11.8 mL of blood

**Containers**
- 2 gold top
- 3 lavender top
- 1 light blue citrate

---

**Lymphocyte Crossmatch**
- Call Bloodworks Northwest Immunogenetics Lab (206) 689-6580 for HLA sample requirement questions and for patients less than 9 kg.
- Call main laboratory for ACD tubes.
- Attach Bloodworks Northwest form.
Kidney Transplant Pathway v1.0: Immunosuppression

Pre-Operative
- Deceased Donor
  - No Tacrolimus
- Living Donor
  - Tacrolimus

Induction Medications (Initiated in OR)
- Mycophenolate Mofetil (MMF)
- Methylprednisolone
- Thymoglobulin

Post-Operative

Induction Medications
- Pre-Medications
  - Acetaminophen
  - Diphenhydramine
  - Methylprednisolone
- Medication
  - Thymoglobulin

Maintenance Medications
- Mycophenolate Mofetil (MMF)
- Tacrolimus
- Steroids (if high risk)

Screen for drug interactions with tacrolimus
Approved by the CSW Kidney Transplant Pathway team for go-live on October 1, 2018

CSW Kidney Transplant Pathway Team:

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Surgeon-in-Chief: Robert Sawin, MD


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.):

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

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

Expert Opinion – Our expert opinion is based on available evidence that does not meet GRADE criteria (for example, case-control studies).

**Quality of Evidence:**
- 🌟🌟🌟🌟 High quality
- 🌟🌟🌟 Moderate quality
- 🌟🌟🌟 Low quality
- 🌟🌟 Very low quality

Guideline
Expert Opinion
Summary of Version Changes

- **Version 1.0 (10/1/2018):** Go-live.
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.
Search Methods, Kidney Transplant Pathway, Clinical Standard Work

Literature searches were executed by a medical librarian (PC) in two phases, in Jan 2018. The initial search targeted synthesized evidence on renal transplant in pediatric patients. It was executed in Ovid Medline, Cochrane Database of Systematic Reviews, Embase, National Guideline Clearinghouse and TRIP. The second search retrieved primary studies, focusing on intraoperative or immediate post-operative hemodynamics in renal transplant, with no age limits. This search was conducted in Medline and Embase. All searches were limited to items published in English, from Jan 2008-Jan 2018. Results were exported to RefWorks for de-duplication, then to Excel for the screening process.

Peggy Cruse, MLIS
March 15, 2018
