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OVERVIEW

The Team
The Kidney/Pancreas Transplant Surgical Service is comprised of an “on-call” surgery attending, General Surgery PGY-3 and -2 residents, three post-transplant NP’s (Deonna Moore, Chelsie Yellman, and April Demers), and one post-transplant RN (Tonya Clark). The Transplant Nephrology Service is comprised of a transplant nephrology attending, a transplant nephrology fellow or general nephrology fellow, and possibly medical residents (Rogers Service) or medical students. Transplant pharm.D’s Stephanie Bala and Nikita Wilson, and 7T3 case manager also provide inpatient and outpatient care. The nephrology fellows are good resources, and it’s important to discuss patients with them once a day. At night, the consult nephrology fellow is on call and will not necessarily know the transplant patients, but can help out with general questions regarding dialysis or medications in ESRD patients.

Surgical attendings rotate call weekly, usually changing Monday morning. All inpatient consults, access emergencies, admissions from ER or clinic, and cadaver transplants will come under attending on call. On call attending will be responsible to round once a day with residents and co-sign your notes (consults, daily progress, etc.) or write own daily immunosuppression note on post-transplant patients. Other surgical attendings may round with team or by themselves on their own in- house patients (e.g. living donors or recipients, elective access or general surgery) but to avoid confusion any changes in management should be implemented by housestaff and attending on call.

In general, transplant re-admissions, either from ER or clinic, go to surgery if less than a month post-transplant and to transplant nephrology if more than a month post-transplant. Exceptions would be an obvious medical issue within one month, e.g. acute MI, or an obvious surgical issue greater than one month post-transplant, e.g. urinary obstruction or leak. Transplant surgery generally consults transplant nephrology and vice versa on these readmissions. We think it is important for surgical residents to get exposed to and understand and contribute to the diagnosis and management of the typical medical or immunologic complications often seen > one month post-transplant, e.g. rejection, infection, drug toxicity, in these patients. Communication between the transplant nephrology and transplant surgery teams is essential and running the list of the patients in common between the services is an essential part of patient management. However, the nephrology team should not enter any orders on patients on surgical service and vice versa. All orders should be put in by the primary team.

IMPORTANT CONTACTS VU/VA

VUMC

<table>
<thead>
<tr>
<th>Name</th>
<th>Pager</th>
<th>Office</th>
<th>Home</th>
<th>Cell</th>
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<tbody>
<tr>
<td>Shaffer</td>
<td>835-0301</td>
<td>936-0404</td>
<td>385-1117</td>
<td>615-480-1027</td>
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Moore   831-6213  936-0404  615-429-0316  
Hale     835-1795  936-0404  891-7377  615-498-1735  
Forbes   835-5498  936-0404  615-473-2718  
Karp     835-9802 

(check with attending as to whether they prefer to be paged or called directly on cell-most will prefer direct call or text on cell)

Coordinators
Deonna Moore   615-579-1801 (cell)
Chelsie Yellman  816-304-6612 (cell)
April Demers   615-512-1476 (cell);  615-835-7772 (pager)
Tonya Clark    615-601-8201 (cell)

Nephrologists
Helderman      835-7350
Langone        835-0378
Heidi Schaefer  835-5036
Kelly Birdwell  835-9420
Bea Concepcion  835-7995

Surgery Clinic (TVC 3501)  322-2063
Nephrology Clinic (TVC 2501)  343-1064

Tissue Typing Lab (DCI) lab   321-0212

VA
VA Operator     327-4751
On Call Nurse Coordinator (615) 317 0690
Bea Edmundson (post tx)  66859 (o), 418-5133 (p), 693-7413 (c)
JoAnn Johnson (donors/post tx)  68668 (o), 317-3321 (p), 554-1290 (c)
Tommy Johnson (pre-tx)  68563 (o), 317-3383 (p), 714-3587 (c)
Claudia Loveland (pre-tx)
VA-dialysis  7103
Vincent Hill, RN (dialysis access coord)  873-7517 (o)
Calvin (OR)       5702
Barbara Slowey (OR Charge)  5698
Willa Rhodes (OR RN mgr)  5709
Anesthesia Call Pgr  252-5976

**CLINIC INFORMATION & SCHEDULE**

**Monday**  0830-0900.  Weekly Transplant Meeting, 901 Oxford House-PGY-3 to present all new transplants from previous week, any LDs scheduled for coming week, and any other transplant readmits that merit further discussion. PGY-2 to present any living donors for coming week. We do not review access cases at this meeting. [Nephrology will then present any pertinent patients on their service. OK to leave meeting and go to VA clinic any time after that].

0900-12n  VA CLINIC

**Tuesday**  0730  OR VUMC (2 rooms, usually Shaffer/Forbes and Moore
1300  Hale clinic
1330  Shaffer clinic
Wednesday 0630  VUMC M&M
0730  VA OR block time (PGY-2 usually does access cases)
0800  VUMC-often additional access cases scheduled

Thursday 0730  VUMC OR (2 rooms, usually Shaffer and Hale, both all day)
1300  Forbes Clinic

Friday 0700  Grand Rounds
8000  Surgical Education Conference
0900  Weekly Transplant Teaching conference, 901 Oxford House
1000  Shaffer Clinic
1000  Moore Clinic

Sat and Sun  Check with attending on call re: timing of Rounds.

**ROUNDS.** *Check with surgical attending on call each week how they want to organize rounds. One attending may want to make bedside rounds with you at 0700 before the OR. Residents should pre-round. Another may want to make bedside rounds between cases, between cases and clinic or at end of day. In any case, residents should round by themselves before 0730 and discuss any urgent issues/questions with attending early in the day, e.g. right before OR on Tues or Thurs or after M&Ms on Wed.

**RESIDENT CALL SCHEDULE.** The call schedule will be determined by the PGY-3 and/or the scheduling resident. This service is a “home call” service (unless, of course, a patient is critically ill).

**Friday morning Transplant Conference.** *3**<sup>rd</sup>** year residents are expected to lead one teaching conference on a topic of your choosing near the end of the rotation. Usually it will be a complication or clinical problem you’ve seen or read about during the rotation that you want to review in more depth. This should be thought of as similar to an expanded M&M presentation- a 20-30 min talk, ample time for discussion. Alternatively you could do a short journal club, i.e. review of a current transplant article. –If doing journal club, nice to email article out in advance.

**Operating**
OR cases are covered by residents as determined by the PGY3. In the past, the PGY-3 typically does the living donor transplants and the PGY-2 does the living donor nephrectomies. The PGY2 typically does most of the access at the VA (with the PGY-3 and/or attending).

H&P’s, consent forms, and pre-op orders are generally done in clinic (H&Ps done directly in StarNotes, consents and orders hand-written and scanned into StarPanel by clinic staff and should be available when patients show up to holding. It is common for the holding nurses to tell you there are no orders and/or consent. In this case, check starpanel yourself and if they are indeed missing you will need to do it again. It is helpful to keep copies of the consents and ordersets from clinic in the resident workroom for this situation.

**Useful CPT codes when booking cases:**
49421 insertion of intraperitoneal cannula or catheter for drainage or dialysis; permanent
49422 removal of permanent intraperitoneal cannula or catheter

36819 arteriovenous anastomosis, open; by upper arm basilic vein transposition
36821 arteriovenous anastomosis, direct, any site (i.e brachiocephalic, radiocephalic)
36830 creation of arteriovenous fistula by other than direct arteriovenous anastomosis (separate procedure); nonautogenous graft

35903 excision of infected graft; extremity

50360 kidney transplant
**DOCUMENTATION and ORDER SETS**

**Clinic notes and consults.** We have templates in StarNotes (you can use any) and/or use a template template from another service (e.g. post-op visit; some residents like EGS consult template—just change the heading so it’s filed correctly and put in beginning of consult that this is for kidney transplant) if you prefer using some other service’s template. Forward all clinic notes, consults to attending’s box in StarPanel for attestation.

**Inpatient orders-WizOrder.** There are specific order sets for transplants (Kidney, SPK, Pancreas alone, pre- and post-op), donor nephrectomy, and post-op dialysis access (AV fistula, AV graft, and PD catheter). We try to keep then updated and correct—if you find a problem accessing or using, or think they can be improved, please let Dr. Shaffer know.

For brief op note for kidney transplant, please use following template found in StarNotes, labeled as **Op note, brief, for KidneyTransplant.** We need all information recorded in StarPanel for UNOS.

The elements that are in the Kidney Tx specific note are below:

- **PRE-OP Dx:** End stage renal disease due to .
- **POST OP Dx:** same, .
- **PROCEDURE:** .
- **SURGEONS:** .
- **ANESTHESIOLOGISTS:** .

**RECIPIENT ABO:**
**DONOR ABO:** .
(see ABO confirmation sheet)
**UNOS DONOR ID#** .
**DONOR KIDNEY (Right or Left):**
**PRA:**
**ANTIGEN MISMATCH:**

**RECIPIENT CMV:** .
**DONOR CMV:**

**EBL:**

**FLUIDS:**
- Crystalloids for the case:
- Other fluids:

Note: UNOS ID # will be on the box with kidney or final XM paperwork from DCI that should be with ABO paperwork attending needs to sign before start of case. PRA and antigen mismatch will be on final XM sheet from DCI and paperwork inside. Donor CMV status will be in paperwork in kidney box or on donorNet—attending has access to donorNet.
Transplants

Pre-op

VUMC
Living Donor Transplants-
Living donor transplants are done on Tuesdays and Thursdays at VUMC. LD transplants at Children’s are usually done on Wed. Patients are seen pre-operatively in clinic (usually Tues or Friday clinic depending on who the donor surgeon will be (Hale sees donors on Tues, Moore and Forbes on Friday) where H&P’s, orders, and consents are done. Recipients will be seen by the transplant nephrologists as well as the surgical attendings. All scheduled living related transplants for the coming week will be discussed at the Monday morning conference. On the day of surgery, always reconfirm the immunosuppression protocol and post-operative plan with the surgery attending. At VUMC, immunosuppression orders should be available in holding area. However, no immunosuppression is to be given in the holding area! Although Campath or Simulect is on written order sheet scanned from clinic for LD recipients, pharmacy requires another order for these drugs to be placed in WIZ the morning of surgery while patient is in holding. All immunosuppression is to be given in OR after induction or anesthesia, Solumedrol first, then antibody-usually Campath-to begin ½ hr after SoluMedrol is in.

Deceased Donor Transplants
You will be notified-usually by text-by on call transplant coordinator when being called in for deceased donor transplant. Coordinator may also tell you if XM already done, if recipient serum already at DCI and XM pending, or whether XM can be done until new recipient serum sent from 7t3. At VUMC, patients go directly to observation room on 7t3. Coordinator will also notify 7t3 directly. There is a pre-op kidney transplant recipient order set in Wiz with all relevant orders that need to be placed (i.e. labs, CXR, EKG, induction immunosuppression orders). Enter as a “playback order” so nurses can access as soon as patient arrives and begin w/u before you physically get there. All potential DD recipients should be seen transplant nephrology fellow as well as the surgery resident. Also order set has “consult transplant nephrology” in it, you also need to enter another consult request.

In addition to typical labs (cbc, bmp, inr, ect) a red top and one yellow top tube should be drawn and sent to DCI (321-0226) for final cross-match. Note that if the recipient has stored monthly serum, DCI will begin the cross match prior to recipient arriving as long as they have donor blood/cells. Ideally, XM will be done or underway at DCI prior to patient’s arrival- this is ideal as it minimizes cold ischemia time but it’s best to also send a current sample to DCI. Coordinator or attending should let you know if XM already done-if XM not done, because patient does not have current serum in DCI, first order of business when patient hits 7t3 is to have labs drawn and sample sent as XM usually takes 4 hrs from time DCI receives blood.

Nephrology consultation.
A formal consult for medical management (e.g. hypertension, diabetes, infection prophylaxis, etc.) should be placed to transplant nephrology on each post-op transplant patient and/or readmission to the surgical service. Please note that the surgical service will monitor the immunosuppression. The surgical resident will write the immunosuppression orders. The surgical attending on call for the week will write a formal immunosuppression management note in the chart. Therefore, although we always discuss immunosuppression with our nephrology colleagues, the formal consult should not include immunosuppression management (this is for billing compliance issues).
Living donor transplants.

Block OR time on Wed at VA for LD transplants and access. Patients are seen pre-operatively in clinic the Monday before. Setting up Living Donor Transplants at the VA requires some leg work:

Boarding Living Donor Transplants at the VA

1) Every patient needs
   a) A signed complete H&P by the Transplant Surgery resident in CPRS
   b) An Amb Surg – Surgery Request form in CPRS, along with a trip to Ambulatory Surgery for pre-op anesthesia eval
   c) An Amb Surg – Scheduled Admission form in CPRS
   d) A signed consent sheet to go with patient to Ambulatory Surgery. This can now be done in CPRS with the iMedConsent tool and is more efficient.
   e) 
2) Board the case through VISTA no later than 11am the day prior to OR, easiest to do it at the end of clinic on Mondays
3) For transplant recipients, on Monday prior to Wednesday OR:
   a) Enter delayed orders for the morning of surgery for
      i) Induction agent (thymo or simulect)
      ii) Solumedrol
      iii) Peri-op antibiotic (ancef or clinda)
4) The day of the operation:
   a) The AOD needs to be notified the moment the patient steps into the hospital. The AOD can then “admit” the patient into the computer system. This should release the delayed orders to the pharmacy for the meds. The call should be made by the PACU around 6am, although it is probably wise to call yourself (5585).
   b) The pharmacy should then be able to prepare the induction agent and deliver it to the OR. Again, wisdom based on experience would suggest calling the pharmacy yourself (5335) 15 minutes after the AOD has been called.

Don’t forget to mark your patient, preferably prior to going to M&M, to ward off stat PACU pages.

Deceased donor transplants at VA

Coordinator will let you know when recipient coming to VA for CAD transplant. Coordinator usually makes transportation arrangements for patient. Patients go to ED Important to make sure labs drawn as soon as patient hits the door so serum can be sent to DCI for cross-match. You should go talk to the attending in the ED and show him/her the pre-transplant orderset to activate when the patient arrives.

At VA, you must be able to access paper chart on nights and weekend on all patients called in emergently for transplant. This paper chart should have H&P, cardiac work-up, serologies, etc. Please check with transplant coordinator on call as to how to obtain access to these records during “off hours.”

There are a few people you need to call to “load the boat” when you know a CAD transplant will be taking place at the VA.

1. call the NOD, she will be responsible for calling in an OR team and getting a bed if the patient needs to be admitted overnight prior to the case
2. call anesthesia let them know the time the case will be going
3. call the SICU and let them know you will need a bed
4. call the pharmacy after you put in orders and the NF consult for campath, they need a lot of help and encouragement to process the order. Tell them to have it ready 30minutes prior to the case. You have to physically pick it up at the impatient pharmacy and hand it to anesthesia prior to the start of the case.
5. call Tommy Johnson to confirm receipt of the ABO sheets from the DCI crossmatch (the case does not start without these and the scrub nurses are good at misplacing them)
6. one hour prior to the start of the case you need to pick up the kidney in the security office next to the central elevator on ground floor

At VA, all post-op transplant patients go to the SICU. OK to go to 3N once off any u.o replacement per IV.

Post-op management protocol, immunosuppression, IVs etc identical to VUMC as above. Post-op order sets are in computer at VA. There are 2 choices for steroids, a “steroid protocol (SoluMedrol 500 mg in OR, SM 250 mg POD#1, SM 125 mg POD#2, then pred 20 mg/d beginning POD#3)” and a “steroid avoidance protocol (3-dose rapid taper of Solumedrol as above, then discontinue/no prednisone).”

**VA Consults.**

At the VA, general surgical issues in ESRD patients are handled by the general surgery service. We are the appropriate consultants for hemodialysis and peritoneal dialysis access issues in the ESRD population.

At the VA, remember to dictate operative reports (some attendings, e.g. Shaffer, will dictate formal op note, you just need to put in Brief Op Note in computer), talk to family post op, arrange follow up, and alert the dialysis nurse (Vincent) so that he can see them in the PACU prior to discharge.

**Intra-op and Post-op-VUMC and VA**

Once you get patients to OR, intra-op and post-op surgical management essentially the same whether they are at VUMC or VA (except VUMC go to 7t3, VA go to SICU). At Children’s, recipients usually go to PICU and are on nephrology service (Dr. Jabs) and pediatricians will get all the calls from nurses, write orders, monitor tac levels and immunosuppression, etc. You need to keep a close eye on patient, e.g. pediatricians might not be as turned in to surgical issues such as bleeding, wound problems, but we will serve as consultants and mostly manage “tubes, lines, drains” and diet.

**Intra-op**

IV access-
1. Given prior AVFs and HD catheters, this population may be hard to obtain IV access.
2. Most transplants are done with peripheral access only
3. Reason for central access includes Thymoglobulin (now we predominantly use Campath induction which is given peripherally), inability to obtain reliable peripheral access, and bad heart (this should be rare as often they are not tx candidate to begin with)
4. If pt has HD cath, OK (preferred) to use tunneled HD catheter as central access for transplant (heparin must be aspirated first). Tunneled HD cath is removed in clinic post-discharge
5. If peripheral access tenuous for post-op management/blood draws, etc, particularly for pt with DGF who may be in hospital a few extra days, IJ PICC placed by PICC service is good option.
6. Avoid subclavian lines.
7. PD catheters get removed during living donor transplants and often during DD transplants if you think there will be immediate allograft function; remember to add this to the consent for appropriate patients.

Foley
1. 3-way-make sure irrigates well prior to draping
2. Dr. Forbes (others?) put methylene blue in irrigation to help identify bladder
3. Good to have some idea of how much urine patient makes pre-op
4. If patient has penile prosthesis, call urology for help
5. Similarly, if pt has had prostatectomy, XRT, previous urethral stricture, consider urology help early

Table positioning.
1. You want to raise kidney bar to elevate iliac vessels, make exposure easier. Kidney bar should be just caudad to ASIC.

Fluids
1. Usually aim for 3 liters crystalloid by unclamping vessels. You want SBP in 3 digits when you unclamp, ideally >110 systolic

Drugs
1. Solumedrol after induction
2. Campath (or other antibody) starts ½ hr after SM in.
3. Abx and SQ heparin/SCDs prior to induction
4. Usually no systemic heparin unless hypercoagulable
5. Consider holding Campath and giving Ca++ (usually low due to dilution) and dopa if adequate fluid and BP too low.

Post-op

Donors usually go to the floor at both VUMC (7T3) and the VA (3N). Recipients typically go to the SICU at the VA, and 7T3 at VUMC. Kids go to the PICU. There is a post-op WIZ order set for each type of transplant. Check with the staff before the end of the case to confirm plans for immunosuppression or any changes to standard algorithm, e.g. if small or difficult bladder, might want to get cystogram prior to removing Foley and/or remove Foley later, etc.

IV fluids:

Day 0 (transplant day):

PACU and 1st 12-24 hrs, focus on:

1. Is the kidney adequately perfused? Need BP in 3 digits, preferable >110 sys. If not:
   a. Is the patient bleeding?
   b. Has there been adequate crystalloid replacement?
   c. Is there a pump (cardiac) problem?
   d. Is pt hypocalcemic?

   If pt not bleeding, has received adequate crystalloid, no concern for new cardiac problem, and Ca++ nl, next step is dopamine to maintain SBP >100. Pts can go to 7t3 on dopa for 1st 24 hrs post op.

2. Urine output.
   a. LRDs should never be oliguric, i.e. essentially should always have immediate graft function with high u.o. and falling creat. If not, need to r/o correctable causes ASAP (bleeding, hypotension, obstruction, etc.)
   b. DGF may occur 20-30% of time in DDs, esp. DCD, ECD, or SCD with high KDPI or prolonged CIT, e.g. Imports. If volume status OK, no bleeding, BP OK, and no anatomic cause (ureteral obstruction, vascular thrombosis) can try high dose Lasix once or twice (e.g. 100 mg IV) to promote diuresis, reduce K+ and need for dialysis. If that doesn’t work, treatment for DGF is essentially the same as any AKI/ARF, i.e. optimize perfusion, avoid hypotension and additional nephrotoxic agents, dialyze prn, and wait it out—it will almost always resolve.

3. K+. Hyperkalemia. Problem in pts with DGF. Generally don’t need to treat unless K+ >6.0. Initial treatment is to make sure no K+ in IVF, low K+ diet, and insulin/glucose/bicarb. If the patient is making some urine give large dose of Lasix (e.g. 80mg IV) to remove total potassium along with the intra-cellular shifting maneuver listed above. If volume overloaded, anuric and not
responsive to Lasix, and measures above otherwised failed the patient will need dialysis. A phone call should be placed to nephrology when K+ is >6.0, every time. Typically this is first treated with the measures above, if these fail they will get HD. PO Kayexalate can be used if no ileus and tolerating PO’s, generally not 1st post-op night though. Never give Kayexalate enema in renal transplant patients, associated with rectal perforation, see S Med J 2009

4. **Na+.** Especially in LRDs, note Na+ as patients with large diuresis (500-1000 cc/hr) can become hyponatremic and need IV fluid replacement changed

**Avoid volume depletion and hypotension in post-op kidney transplant patient!**
Careful attention to volume status is critical in post-op renal transplant patients and this must be assessed individually for each patient, often several times a day. Make clinical assessment of volume status, i.e. I and O’s, weights (esp compared to “dry weight” on dialysis-virtually all patients on dialysis will know their “dry weight,” ask them. For pre-emptive LRDs, know their weight from pre-op clinic), blood pressure, signs or symptoms of orthostasis, lung exam, edema, etc.)

**If hypotensive in PACU or 7t3, make sure 1) they are not bleeding, 2) there was adequate crystalloid replacement, (note-patient called in for transplant who was just dialyzed will need more fluid than patients due for dialysis that day but transplanted instead) and 3) pump is OK, i.e. no new cardiac issues.**

**Note Ca++ in first BMP in PACU, often low. If BP low, additional IV Ca++ often helps.**

*In general,* start IV fluids for uncomplicated post-transplant pt as follows (this is in Wiz order set:

1. cc/cc U.O replacement with ½ NS
2. Maintenance of D5 ½ NS at 50 cc/hr

Note that if recipient has a large diuresis the first post-op night, particularly LRDs, they may become hyponatremic because the concentration of Na in ½ NS is usually a little less than the concentration in their urine. For patients with high U.O., check their serum Na and if low (certainly if <130), discontinue maintenance IV (i.e. D5 1/2 NS @ 50 cc/hr) and replace U.O.cc/cc with NS until Na normalizes. To normalize Na faster, give cc/cc-100 with NS. Occasionally they need K+ replacement as well.

**PAIN MEDS.** Use hydromorphone, not morphine, for parenteral pain medication in post-op renal tx patients. Although morphine principally metabolized in liver, active metabolite may accumulate in renal impairment and result in toxicity.

**POD#1:**

Unless nausea, vomiting, unable to take PO’s, or hypotensive or unsure about volume status (patients should be volume up, usually approx. 5kgs above dry weight, the morning of POD#1)

1. Discontinue maintenance IV (discontinue D5 ½ NS).
2. Straight rate IV, rate depending on u.o., e.g. ½ NS at 100-150/hr for u.o <4-500/hr and taking po’s, BP and pulse stable, or SL if DGF or u.o < 100-200/hr and taking PO’s. If u.o. > 4-500/hr, e.g. LRDs, reduce urine output replacement to ½ cc/cc with ½ NS and turn down to straight rate and SL when u.o. decreases.

**For LRDs making a liter/hr, reduce replacement more slowly to avoid volume depletion and/or hypotension, eg. cc/cc-100 or cc/cc-200 the morning of POD#1, then reassess in afternoon and may be able to go down to ½ cc/cc.**

For CADs in ATN/DGF, minimize IVFs as you would any pt in ARF, e.g. KVO or SL.

**POD#2:**
1. Saline lock or straight rate IV @ 50-100cc/hr in am depending on U.O, PO intake, BP and volume status,

2. **MAG & PHOS (checked on POD#2 in order set)**
Many patients (especially those with brisk diuresis and excellent allograft function eg LDTx) will require magnesium and phosphorus replacement (both inpatient and outpatient). Pt may require iv phosphorus if PO4 <2.0.
   Recommend: K-phos neutra (lowest amount of potassium) 500mg bid
   Magnesium oxide 400 mg bid

3. Laxatives. All patients should be on Colace post kidney transplant. You may give a suppository if the patient is having flatus and feels constipated. Patients do not need to stay in hospital waiting for a bowel movement if GI function otherwise normal and no other abdominal symptoms.

**POD#3,**

1. SL or D/C IV if anticipate discharge
2. If on thymo, d/c CVL after last (4th dose), usually POD#3

**In general, kidney tx recipient are 5 liters positive morning of POD#1.** Good rule of thumb for a “normal” post-op course with a good functioning kidney is to aim for the patient to be 1-2 liters negative/day (when you check I/O’s morning of POD2) so that they are back to their dry weight by discharge on day 3. If they are not negative and diuresing on own, 1) are you giving too much IVF? 2) is there something wrong with the kidney, or 3) do they need a little help, i.e. Lasix

Our goal for uncomplicated, immediately functioning allografts, especially LRDs, is discharge home POD#3.

**Drains, Foley, CVLs:**
For patients with JPs, D/C when <50cc/24 hrs. If ready to discharge and drain >50cc/24 hrs, leave in and drain will be removed in clinic.

For uncomplicated transplant recipients, Foley out on morning of POD #3. We take out Foleys early in the morning, never in evening (if there’s a problem post Foley removal, e.g. urinary retention, leak, you want it to happen at 10 or 11 am, not 2 am. If “hostile bladder,” e.g. very thin walled, scarred from previous surgery, very small and contracted, Foley may be left in longer and/or we may want to get cystogram as outpatient prior to removing-check with attending. Donors have Foleys removed in AM of POD#1.

**IMMUNOSUPPRESSION MANAGEMENT**
For living donor transplants, the immunosuppression plan is always discussed pre-operatively at Monday morning meeting. Nephrology and transplant surgery discuss immunosuppression peri-operatively for each cadaver transplant. Also, since we participate in multi-centered trials, always check with attending surgeon to see if patient to be enrolled in experimental study.

Access Wiz Order sets by typing in “renal transplant” in WizOrder and there should be 6 order sets, pre- and post for kidney alone, SPK and PAK.
Basic questions you need to answer re: immunosuppression are:
1. Is pt on or eligible for research study?
2. Does patient need maintainance steroids (prednisone), yes or no?
3. Which antibody induction (at Vanderbilt, we almost always use antibody induction—some centers elsewhere use less antibody):
   Alemtuzumab (Campath) vs Thymo vs basiliximab (Simulect)

To answer, you need to know:
1. Low or high immunologic risk?
2. Have they received antibody before, e.g. retransplant, and have anti-heterologous antibodies?
3. Are they chronically on steroids due to pre-existing disease, e.g. lupus
4. Do they have a native disease in which there is less recurrence if you give steroids, e.g. FSGS, IgAN (granted some of this data is soft).

Thus, immunosuppression may vary patient to patient. However, there are two general algorithms for immunosuppression that we use:

**Steroid avoidance/Campath**

Solumedrol and Campath intra-op,
Solumedrol taper, 250 mg POD#1, 125 mg POD#2, and
Maintenance with FK and MMF

Generally includes: Low immunologic risk patients, i.e. low PRA or unsensitized, first transplants.

**Steroids/Campath**

Same as above except prednisone 20 mg PO QD started POD#3

Generally includes:

High immunologic risk patients, i.e. high PRA (>20%)

Pancreas transplants, both SPK and PAK

Patients who are steroid dependent pre-transplant due to their native kidney disease, e.g. SLE

Patients with specific renal disease processes that have been shown to have improved outcomes/less recurrent disease with steroids (FSGS and IgAN)

Occasionally we may want to give Simulect instead of Campath, e.g. particularly well-matched LRDs or 0 Ag MM CADs or in patients with a relative contraindication to Campath such as thrombocytopenia, elderly, or long prior history of immunosuppression from prior transplant. Data comparing Thymo, Campath, and Simulect induction in steroid avoidance protocol showed significantly higher rejection rates with Simulect compared to Thymo or Campath. Thus simulect is usually not used in the situation of a steroid avoidance protocol.

**FK & Delayed graft function** (DGF-defined as requires dialysis post-transplant) or slow graft function (subjective, oliguric and/or creat rises a bit or doesn’t fall as much as you’d like but doesn’t need dialysis)

For all practical purposes here at Vanderbilt, only cadaver transplants experience DGF or SGF. For cadaver recipients, FK is generally not started until we know there is immediate allograft function (good urine output and fall in the creatinine). It will normally take 6-12 hrs to decide if there is
immediate allograft function (one reason we get a BMP q6hrs x 3 post-op) so FK should generally not be ordered in PACU for CAD patients. If there is slow graft function (no need for acute dialysis but urine output marginal or creat either doesn’t fall or rises slightly) or delayed graft function (oliguric, creat rises, and dialysis required), FK is held since it is nephrotoxic.

For LRDs, start FK nite of surgery when you get 2nd BMP back and if good u.o. and falling creat

If patient to be on maintenance FK and MMF (steroid avoidance protocol), FK should be started no later than POD#5 so the patient is not under-immunosuppressed following completion of campath/Solumedrol on POD#3. Remember, ATN/DGF is a risk factor for acute rejection.

Start FK at 4 BID. A few exceptions, e.g. HIV pts or known hyporesponders, CYP3A5 subtypes 1/1 or 1/3

MMF. Standard dose of MMF (Cellcept) is 1 gm BID. Discharge dose (i.e. scripts, discharge instructions) should be 1 gm BID. If patient is on Simulect or Campath, they should be started on MMF 1 gm BID initially and then adjust for toxicity, e.g. leukopenia/thrombocytopenia, GI symptoms.

Changes in immunosuppressive drug doses are generally made based on a combination of 1) renal function, 2) signs and symptoms of toxicity, 3) drug levels, and 4) time since transplant. The following are the common drugs we use, common toxicities, and target drug levels within the first month.

**Other Meds**

**CMV prophylaxis protocol:**
All patients at risk for CMV (i.e. D+ to R-, D+ to R+, D- to R+) should receive CMV prophylaxis. No prophylaxis for D- to R- patients. Currently we are using Valcyte (valganciclovir) due to QD dosing schedule and high plasma concentration of gancyclovir obtained. **Start Valcyte of POD#3.** Patients should be on a stable dose based on renal function at the time of discharge. Valcyte prophylaxis is typically continued for four months post-op.

Dose adjustment for Valcyte:

| CrCl ≥40 | 450 mg QD |
| CrCl 25-39 | 450 mg QOD |
| CrCL <25 | Hold |

Note: CBC&PLT are monitored each day; valganciclovir doses may need to be reduced and/or held in those patients who become leukopenic (check with surgical attending). Use of Campath or Thymo may result in long-term leukopenia. **In general, Hold Valcyte for WBC < 3.0**

**PCP prophylaxis protocol**
All patients are started on bactrim SS daily in house for PCP prophylaxis unless sulfa allergic, then they are started on dapsone 100mg daily. All patients receive prophylaxis for a total of 6 mos.

**BLOOD PRESSURE**
Most patients are on anti-hypertensives pre-op. They may or may not need anti-hypertensives post-op and if they do, they may differ from those they were on pre-op. Some guidelines:
1. Preferred post-op antihypertensive is the calcium channel blocker nifedipine XL (counteract the vasoconstriction in the kidney caused by CNI’s) or beta blocker (especially in those with known CAD).

**AVOID ACEI AND ARB’S** post-transplant as can cause hyperkalemia and higher creatinine levels.

Recommend: Nifedipine XL (do NOT give short acting secondary to increased risk of MI/death) starting at 30mg BID. Can titrate dose up to max 90mg bid.

Metoprolol 25-50mg bid and titrate up to max of 150mg bid. Do not give TID as difficult regimen when patient released from hospital.

2. If on clonidine pre-op, continue post-op (start at 0.1mg bid and titrate up as needed) and wean slowly if possible. Cannot stop abruptly.

3. If patient on 2, 3, 4 anti-hypertensives pre-op, don’t restart all immediately post-op. Better to start one or two, e.g. clonidine or beta-blocker, and see what BP does post-op. Remember, avoid hypotension early post-transplant.

4. No need to try to get perfect BP control/long-term regimen in first 2-3 days post-op. Too many changing factors (IV fluids, pain, steroids) early post-op to know where patient will settle out. Again better to have SBP 140-160 early post tx than 90-100. BP meds can be fine-tuned in clinic over the next week or two.

5. Transplant nephrology with assist with management.

**STATINS**
Do not restart statins/lipid lowering medications while in house. Will be restarted in outpatient clinic by nephrology.

**DIABETICS.** Most diabetic patients (even those on oral agents preop) will require insulin therapy postop due to the iv solumedrol and prograf. Would recommend SSI based on accuchecks while NPO and once tolerating po, initiate lantus 10units qhs and titrate up as needed. OK to consult Endo if needed for labile patients. It is usually not necessary to treat hyperglycemia in non-diabetic patients with BG in the 200s while on solumedrol induction. If pt is diabetic and not responding to SSI sometimes it is necessary to move to SICU for an insulin gtt if BG>400.

**HEPARIN.** Unless otherwise contraindicated, renal transplant recipients should generally get SQ Heparin 5000 units BID, not TID, due to increased bleeding risk (uremia and platelet dysfunction) and increased risk of thrombocytopenia (Campath, Thymo, MMF). Lovenox is contraindicated in renal failure.

**DISCHARGE**
Uncomplicated, stable transplant patients may either be discharged to home or to a hotel by POD#3. Uncomplicated, stable patients will then need to come to Clinic (Medical and Surgical) 1-2x/wk for the first month post-transplant. If a patient prefers and they have transportation back and forth to clinic, they certainly may be discharged directly home. Patients who 1) live a long distance away such that transportation to clinic is problematic, 2) need continued IV therapy (e.g. thymoglobulin or antibiotics) or 3) with unstable creatinine or drug levels that require more frequent monitoring than 1-2x/wk may initially be discharged to the hotel.

**TRANSPLANT DISCHARGE PLANNING**
The unit clerk on 7T3 and the post-transplant coordinator, Tonya Clark, RN can help you organize the discharges and follow-up appts at VUMC. All new recipients get 3 appts, General Surgery Clinic (322-2063, note, this is the clinic #, not office in Oxford House), Transplant Nephrology Clinic (343-1064) and Urology Clinic (322-2880). The post-transplant NP’s can assist with prescriptions. For anticipated weekend discharges, try to get it all organized on Friday. Remember that Prednisone scripts (if pt on prednisone) should be in 5 mg tabs to facilitate tapering and usual discharge dose of Cellcept is 1 gm BID.
**VUMC Discharge planning team:**
Deonna Moore and Chelsie Yellman are the post-transplant coordinators (NPs), writing prescriptions for new transplant recipients and donors, doing discharge summaries. They can also assist with pulling JP drains and central lines, orders, etc if you’re in OR or otherwise busy. Tonya Clark is the post-transplant RN. She can assist with scheduling post-transplant clinic appointments and patient education.

<table>
<thead>
<tr>
<th>Name</th>
<th>Phone (cell)</th>
<th>Phone (pager)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deonna Moore</td>
<td>615-579-1801</td>
<td>835-4100</td>
</tr>
<tr>
<td>Chelsie Yellman</td>
<td>816-304-6612</td>
<td>835-7042</td>
</tr>
<tr>
<td>Tonya Clark</td>
<td>615-601-8201</td>
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</tbody>
</table>

Betty Palmer is the 7t3 social worker. Her pager number is 831-8033. The outpatient social worker is Mary Schaefer. Her pager number is 835-5939.

It is extremely important that all scripts and discharge medications are in order. Generally, we give patients a month’s supply of each medication with 3-6 refills. This should be completed the night prior to anticipated discharge or in the morning, prior to going to the OR, clinic, or conference. Also note that certain meds should be dispensed in their smallest units, to facilitate changes doses as an outpatient (e.g. prednisone in 5mg tabs, Prograf in 1mg, cyclosporine in 100’s and 25’s). Again, this is usually done by Deonna or Chelsie.

Per departmental policy:
1. Write discharge order by 9 am if possible to meet routine discharge time of 10 am. (For Mon discharges, this should be done prior to 8:30 meeting. Check with attending on call prior to 8:30 meeting about Mon discharge if there is any question regarding plan.)
2. Discuss anticipated discharge with NPs the day before or on Friday for a weekend discharge. Make sure that patient have all available prescriptions before a weekend discharge so that they can pick them up from the pharmacy.

All new transplant patients upon discharge should have three clinic appts (These will usually be scheduled by RN):

1. **Surgical Clinic** with Post-transplant NP’s within 2 weeks. The secretary on 7t3 should schedule this directly with the clinic (322-2063). If pt has staples, they will be removed in clinic. Patient may shower or take bath with staples in.

2. **Transplant Nephrology Clinic** (343-7592) within one week. Exception to this are those patients referred by Drs Johnson or Ynares, transplant nephrologists in Nashville, who will see their patients in their own clinic shortly after discharge.

Note, in patient discharged with JP drain, we often reverse order and see in surgical clinic within one week and nephrology clinic the following week.

3. **Urology Clinic** (22880) for stent removal approximately- 3-4 weeks after transplant. Make a note of this arrangement in the discharge summary.

**Vanderbilt discharge summaries.**
Discharge summaries should be brief but include information you will need if patient readmitted with a problem in a month or two, i.e. DGF or immediate allograft function, CMV status of donor and recipient, induction therapy or not and which agent, maintenance immunosuppression, nadir creatinine, any blood transfusions, surgical complications, and any scans, ultrasounds, biopsies. Also include in the discharge summary a complete list of discharge medications, latest weight and blood pressure. Also include
discharge weight. We need to include all these things to comply with UNOS reporting requirements. You do not need to give a day by day description of urine output, labs, diet, GI function, etc. unless there is something clinically significant.

We now have a template in StarNotes for discharge summaries. Go to StarNotes, then "Discharge notes," then "Discharge summary for kidney/pancreas." Much of the data will auto-import. Use Tab on keyboard to advance through note. It will stop at different fields. For most fields, there will be a "Pic list" on right-hand side to use to fill in narrative. For an uncomplicated post-transplant course, you can generally use just the Pic list. If there is a complication, you will have to type a sentence or two regarding that. I believe any imaging tests (e.g. ultrasound), allergies, discharge meds will autopopulate from Wiz. Follow-up appts will not autopopulate and will need to be typed in. Please give me feedback on using this. It is relatively easy for StarPanel people to adjust things.

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**Immunosuppression Medications**

(a short guide, not to replace looking up in textbook or Up to Date)

**Campath** Anti-CD52 monoclonal antibody, reacts against T and B cells, and some monocytes, macrophages, and dendritic cells. Published protocols in transplant use either one or two doses of 30mg peri-op. At Vandy, we give one 30mg dose iv in OR at time of transplant (30 minutes after solumedrol given) and is given over six hours. The most common complication with campath is hypotension. Once ruled out bleeding, you may hold the campath for one or two hours to allow hypotension to resolve. May also use to treat acute rejection, e.g. if patient has antibodies to Thymo. Minimal early side effects with one dose 30mg regimen.

**Thymoglobulin** – used for induction or treatment of rejection. At VUMC, Campath has supplanted Thymo for routine antibody induction. Polyclonal antibody against T-lymphocytes. **Dose is usually 1.5 mg/kg/d x 4 doses ( Day 0,1,2, and 3).** Total target dose is 6 mg/kg over the 4 days. Thymoglobulin is very expensive and comes in vials of 25 mg so round off dose to nearest 25 mg. Dose must be given slowly (4-6 hrs) via CVL. First dose reaction includes fever, chills, CP, SOB, brochospasm – this is more common when treating acute rejection than when giving for induction. When given for induction in OR, patient should get usual intra-op SoluMedrol dose of 500 mg IV first (after patient asleep and CVL is in) and then thymo should be started about ½ hr later. Aim is to have SoluMedrol in and thymo started prior to completion of vascular anastomoses. When given to treat acute rejection post-op, premedicate first dose with SoluMedrol 500mg IV, Tylenol and Benadryl. Premedicate second dose with SoluMedrol 125 mg IV, Tylenol and Benedryl. For third and subsequent doses just give Tylenol and Benadryl if needed. There should be a thymo order set in WizOrder. **Watch out for leukopenia and/or thrombocytopenia – dose shouldn’t be scheduled to be given until morning labs back (give half dose for wbc 2000-3000 or plts 50-75K; hold dose for wbc <2000 or plts <50K).** Also, write to give dose at 10am so labs can be checked (this is true for all drugs that can cause leukopenia (thymo, atgam, cellcept, ganciclovir, etc…). **If given for induction, i.e. beginning intra-op, (as opposed to treatment for rejection), NO need to routinely order T-cell subsets-dosing of the drug is based on a target total mg/kg dose (usually 6 mg/kg total) and adjusted for toxicity, i.e. low wbc or plts**

**Simulect**-monoclonal antibody directed against T lymphocytes. Pts given 20mg during transplant and on POD#3. Near placebo side effect profile. Can be given through peripheral IV. Dosage scheduled is modeled after initial drug study, but can given on POD3 if patient otherwise ready to be discharged.

**Cyclosporine** (Neoral or Gengraf-specify which) – Target level 250-350 ng/mL. Major side effects include renal and hepatotoxicity, neurotoxicity (H/A, parathesias, tremors), hyperkalemia, glucose intolerance, hypertension, hyperlipidemia, gingival hyperplasia, hirsuitism. Rarely used for de novo kidney
transplants here anymore. You may see some liver/kidneys or heart/kidneys on cyclo so we may continue cyclo post kidney tx in these pts.

**Tacrolimus (Prograf, FK-506)** – Target level 8-12 ng/mL. This is the main CNI we use for our patients. Major side effects are renal toxicity, hyperkalemia, glucose intolerance/diabetes, neurotoxicity (H/A, parathesias, tremors), N/V (especially when supratherapeutic), alopecia.

**Sirolimus (Rapamycin, Rapamune)** – Target level 8-12 if on CNI avoidance protocol. Major side effects are bone marrow toxicity (leukopenia, thrombocytopenia, anemia), hyperlipidemia, oral ulcers, poor wound healing or lymphoceles. Rarely, pts can get an interstitial pneumonitis.

**Mycophenolate mofetil (Cellcept)** – Usual dose is 1 gm BID. No blood levels used clinically. Start pts on half dose which on Thymo to avoid over-suppression of bone marrow and then increase to full dose when Thymo stopped, i.e. POD#3 or discharge dose. Major side effects are nausea, dyspepsia, diarrhea, leucopenia. Patients on tacrolimus may not tolerate more than 500 mg BID due to toxicity (tacrolimus increases blood levels of Cellcept). Most common adverse effect of MMF is nausea/abd discomfort/diarrhea. You may decrease dose or hold if symptoms are severe and consider alternative agent (myfortic).

**Myfortic (Mycophenolic acid)** may be tried if patient experience severe GI side effects to Cellcept. Myfortic comes in 180mg and 360mg tablets and 720mg BID Myfortic is equivalent to 1 gm BID of Cellcept.

**Prednisone** – Pts given SoluMedrol 500 mg IV in OR after induction of anesthesia and prior to receiving antibody induction agent (thymo or Simulect), then rapid taper (250 mg POD#1, 125 mg POD#2), then either no further steroids or 20 mg pred QD beginning POD#3. Tapered as outpatient after 1 month if stable, usually in 5 mg decrements. Given scripts for 5mg tablets to make taper easy. Major early side effects are mental status changes/steroid psychosis, glucose intolerance, insomnia, hypertension.

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**SPK/PAK**

**Note separate order sets in Wiz, pre- and post-op, for SPK and PAK**

**SPK/PAK patients get started on warfarin POD 1 or 2 when you feel the risk of peri-op surgical bleeding is low.**

**INR goal is 1.5-2.0**

Start at 1 mg/day. These patients seem exquisitely sensitive to warfarin, perhaps from chronically poor nutrition.

Also, SPK/PAK patients are on fluconazole prophylaxis for 5 days which decreases FK metabolism, raises levels, so usual dose is 2 mg BID, not 4 mg BID.

SPK and PAKs can now go directly to 7T3/monitored bed x 24 hrs, same as kidney alone, bypassing SICU, unless patient is vented or hemodynamically unstable. Low dose dopamine (up to 5 ug) and IV antihypertensives can also be given to post-op kidney and/or pancreas patients who otherwise would not need SICU.
Place Foley catheter and irrigate as with kidney transplants. Midline incision. I place all primary pancreas transplants with SPK into the IVC with arterial inflow from the right common iliac artery. In PAK transplants the pancreas will be placed above the kidney on the right unless the previous kidney was placed into the right common iliac artery and vein. In the latter instance the pancreas is placed into the left common iliac vessels. I proceed to portal venous drainage in re-do pancreas transplants if the iliac vessels have already been used previously.

For SPK the dissection the right colon and the distal small bowel are mobilized as from the retroperitoneum to the upper abdomen. The dissection continues up to the level of the duodenum. The duodenum does not need to be mobilized. Bookwalter retractors are placed exposing the retroperitoneum. The proximal IVC above the bifurcation and the right common iliac artery are dissected freely. The ureter is mobilized laterally on the right. For the kidney in SPK, The sigmoid colon is mobilized medially and the left common or external iliac vessels are dissected freely. The left ureter is mobilized medially.

The pancreas is brought to the field. The portal vein of the pancreas is sutured the IVC with running 6-0 Prolene. Mannitol (12.5 g) is given IV at the time of caval clamping. The arterial conduit of the graft is sutured to the right common iliac artery with a running 5-0 Prolene. After clamps removed and hemostasis attained a loop of proximal jejunum approx. 20 cm from LOT is identified and the donor duodenoejunostomy is performed in 2 layers with interrupted 3-0 silk seromuscular sutures and a running 3-0 chromic on the inside.

**Postoperative Care:** It is very important for pancreas transplant recipients to stay well hydrated and maintain a good BP. Hypotension for whatever reason in the postoperative period can easily precipitate pancreas graft thrombosis because it is a low-flow organ. Blood sugars usually normalize within 8-24 hours without the need for exogenous insulin. Acute rises of BS > 200 usually necessitate a CTA of the pancreas to assess flow. However, when patients begin to eat in combination with daily steroids, it is not uncommon for blood sugars to rise toward 200 mg/dl without suggesting graft thrombosis. When in doubt, contact staff. JP placed lateral to pancreas to look for pancreatic leak (check drain amylase prior to pulling). Foley d/c'd on POD #3. NGT remains for 2-4 days depending on the presence of the degree of gastroparesis preoperatively. Liquids started with flatus and diet advanced. Immunosuppression as described above.
LIVING DONORS
Living donors are seen in surgical clinic 1-2 weeks prior to transplant. VPEC evaluation is completed at that time and DCI Final Crossmatch is drawn.

If medications are prescribed as a result of pre-op labs (i.e. antibiotics for UTI), these can be provided at no cost to the patient from VOPP by indicating “Bill to Kidney Acquisition” in the comments section of Rx Star.

Living donors are presented at Monday morning selection committee meeting the week of scheduled transplant by PGY-2. Presentation should include:
- PMH (h/o DM, UTI, stones, kidney disease, hematuria)
- PSH
- Family history of DM, Kidney disease
- Brief physical exam
- BMI
- Labs (24 hour urine, NAT testing)
- CT Imaging
- Planned L/R lap/open procedure
- Final crossmatch results

Enter preorders for living kidney donor

Surgical procedure:

Post-op management:
- Order set (IVF, Foley, diet, IV/PO analgesia-no PCA, etc.)
- Discharge on POD #2
  Post-transplant RN schedules follow up in surgeon’s clinic 1-2 weeks post-op. Urology (Dr. Duke Herrell) schedules their post-op follow up.
  Discharge meds will be ordered by post-transplant NP. Percocet 5-325 1 tab PO q 4 hours PRN pain x 7 days #42 and Docusate 100 mg 1 capsule PO TID #90 are provided at no cost to the patient and VOPP knows to bill these to Kidney Acquisition. Any additional medications (i.e. Zofran) will need indication to bill to kidney acquisition fund.
TRANSPLANT READMISSIONS.

General Info
Any kidney transplant patients readmitted within the first month of surgery should be admitted to the surgical service under a transplant surgery attending unless there is an obvious medical problem such as chest pain/MI, uncontrolled diabetes, etc. In general, during the first month, fever or elevated creatinine should be admitted to surgery. When in doubt, check with the attending. All these patients should have a formal consult to transplant nephrology as described above to help manage their multiple medical problems.

After one month post-op, unless there is an obvious surgical problem, e.g. wound infection, urine leak, abdominal pain, all transplant patients should be admitted to medicine (transplant nephrology). A formal consult to transplant surgery if appropriate should be made to assist in diagnosis and management. The residents should leave a formal consult note in StarPanel on these patients. Please use template in StarChart for these. Most residents feel it works well. In StarNotes, go to “Surgical Clinics,” then in middle column “Kidney Pancreas Transplant Inpatient Consult” If you prefer to use template from another service (some residents like EGS consult template) that’s fine, just be clear in first sentence of consult that this is for renal transplant surgery. After saving note, please send to the attending’s StarPanel box for review.

Specific complications.

KIDNEY
Acute rejection:
Nephrology will arrange/do biopsy-path AND Donor specific antibodies (DSA) generally available within 24 hrs. Make sure we have standard transplant ultrasound first to r/o hydro/collection/vascular issues, etc.

Historically:
1st line therapy: SoluMedrol 500 mg IV QD x 3-5 doses
2nd line therapy: Antibody (Thymo 7-14 doses/OKT3 7-14 doses/?Campath) for “steroid unresponsive” rejection.

With more sophisticated immunopathology and understanding of mechanisms, best to try to understand and characterize underlying pathophysiology and treat accordingly:

   1. SoluMedrol 500 mg IV x 3-5 days
      (for patients with rejection on steroid free regimen, “pulse” solumedrol and initiation of chronic prednisone, e.g. start at 20 mg/day after SoluMedrol may be adequate)
   2. Thymo for steroid unresponsive rejection
      (note-if patient received induction with Thymo, send 2 red top tubes to DCI-call them first so they are expecting and can pick up-for anti-heterologous antibodies. Thymo is made in a rabbit and you’re looking for high titers of ant-rabbit antibodies in recipient. If high titer anti-rabbit Abs, this may diminish effectiveness of re-treatment with Thymo and increase risk of serum sickness.) In this situation, may choose Campath.

2. Antibody-mediated rejection (AMR)
   Suspect in re-transplant or high PRA
   1. Start with SoluMedrol and Thymo
   2. Plasmapheresis/IVIG/Rituximab
      To make diagnosis of AMR, look for 1) fibrin thrombi or fibrinoid necrosis on histology, 2) positive C4d staining on immunopath, and 3) serologic evidence of anti-donor antibodies (DSA). So in working up patient with acute rejection, especially if retransplant/high PRA. send 2 red top tubes to DCI for “donor specific antibodies.”
Urinary complications:

Wound problems:
DIALYSIS ACCESS

AV access and PD caths

We frequently get consults (NEVER SEE A PATIENT WITHOUT FORMAL CONSULT REQUEST) from nephrology/medicine/ED for inpatients or outpatients.

They generally fall into 3 categories:

1) Clotted or dysfunctional access. These are usually in the ED. In general, a straightforward clotted AVF or graft does not warrant a surgical consult. The ED/primary team should be instructed to set the patient up for a fistulagram +/- percutaneous stenting/angioplasty. If the access cannot be salvaged in interventional radiology, then a permcath will be placed. It is then appropriate for surgical consultation as an outpatient in clinic.

2) AV graft infection, either called to ER to see or inpatient on nephrology service with fever. These need to be removed. Most bacteremic patients even w/o local signs of infection will need graft removed.

3) New ESRD patient who needs permanent access. They may have just started HD with tunneled cath placed by IR. Attending on call should make plans for access, either during that admission if they have time and it’s appropriate from medical standpoint or as an outpatient in the near future. Goal from nephrology standpoint is to minimize prevalence of tunneled catheter so they want these patients to have a plan for permanent access, that they are “plugged in” to our system, and they won’t fall thru the cracks.

Points to remember when evaluating patients (i.e. in clinic) for vascular access. Check BP in both arms as a simple check for proximal arterial (inflow) stenosis. Use a tourniquet to assess the caliber (by inspection and palpation) of the cephalic vein in the forearm, and cephalic/basilic veins in the upper arm. Assess patency by occluding (and palpating) the proximal vein while tapping it distally. Always check and document radial and brachial pulses. The books say (correctly) that a radiocephalic (“cimino”) fistula in the nondominant arm is the best choice for an initial access when possible-the problem is that only a small minority of patients have suitable anatomy for this.

Dialysis Catheters

All tunneled-dialysis catheters are now placed in IR at nephrologist’s discretion. We do not manage problems associated with tunneled dialysis catheters.

Peritoneal dialysis (PD) catheters are placed and removed by our service.

Catheter-associated peritonitis. This is most common consult we receive for patients on PD. Diagnosis usually easily made on clinical grounds, i.e. abdominal pain, peritoneal signs, and cloudy PD fluid. W/U includes PD fluid cell count (>200 wbc's abnl), gram stain, and culture. In general, try treating with antibiotic without catheter removal for GPC (staph). Patient should improve quickly. Peritonitis usually doesn’t clear with antibiotics alone and catheter needs to be removed for GNR and fungal infections. Also, tunnel infections and recurrent GPC infections with same bug requires cath removal. Consider “secondary” catheter-associated peritonitis for GNR and fungal infections, i.e. secondary to diverticulitis, appendicitis, etc. Further w/u, e.g. CT scan, appropriate in these patients.

VANDERBILT DIALYSIS ACCESS:

PREOP:
Update h+p, confirm orders and consent in hand, mark pt

POSTOP:
-Usually outpatient procedures.
-There are order sets for: “AV fistula”, “AV graft”, or “peritoneal dialysis” discharges
-You need to schedule f/u appointments for all access patients: generally 2 weeks for a new AV graft and 4 weeks for a native vein fistula. Uncomplicated PD cath insertions should follow-up with “Home training” (PD nurse) at their dialysis unit within one week of surgery and don’t need a clinic appt. PD nurse will handle any dressing changes.

**VA DIALYSIS ACCESS**

Note that we have only one day to operate at the VA-Wed. VA Cases must be boarded (using the computer) by 1100 on Tuesday.

**PREOP:**

Inpatients: will need standard scheduling per VA, H&P/consult note, appropriate pre-op labs

Outpatients: scheduled by residents from VA access clinic or after seeing as inpatient consult

5) Every patient needs
   a) A signed complete H&P by the Transplant Surgery resident in CPRS
   b) An Amb Surg – Surgery Request form in CPRS, along with a trip to Ambulatory Surgery for pre-op anesthesia eval
   c) An Amb Surg – Scheduled Admission form in CPRS
   d) A signed consent sheet to go with patient to Ambulatory Surgery. This can now be done in CPRS with the iMedConsent tool and is more efficient.

6) Board the case through VISTA no later than 11am the day prior to OR, easiest to do it at the end of clinic on Mondays

**POSTOP:**

At the VA, remember to dictate operative reports (some attendings, e.g. Shaffer, will dictate formal op note, you just need to put in Brief Op Note in computer), talk to family post op, arrange follow up, and contact (Email) or call Vincent Hill RN (the dialysis nurse coordinator) at 873-7517 to let them know what was done (i.e. “brachiocephalic fistula in Mr. Jones on 4 August 2001, no complications, f/u appt in clinic in 2 wks”).

Schedule for follow-up in VA Transplant/Access Clinic (Monday AM). Usually 2 weeks for a new AV graft and 4 weeks for a native vein fistula. Uncomplicated PD cath insertions should follow-up with “Home training” (PD nurse) at their dialysis unit within one week of surgery and don’t need a clinic appt. PD nurse will handle any dressing changes.

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**Attending Preferences**

**Shaffer** - For AV access... uses two arm boards, half sheet, split sheet and towels to drape. Uses isolation bag on the hand. Prep one “level” proximal to site where working. Uses chloroprep. Wear loupes. All get pre-op abx (clinda if pcn/ceph allergic). Uses needle-tip for bovie- put it back in the holder when done, or far out of the way. Uses small vessel-loops in “Potts” fashion or baby Debakeys clamp artery. Doesn’t like springs. Occasionally uses Weitlaner (note spelling and correct pronunciation), but often don’t need a retractor at all. Uses stay sutures (double-armed 6-0 prolene cut in half) to set up arteriovenous anastomosis. Anchors toe and heel of anastomosis with double-armed prolene suture, then runs it to middle - always inside out on the artery. Uses longitudinal incision (between radial a. and cephalic v.) for RC AVF, usually transverse antecubital incision for BC AVF.. Uses Castro for all vascular work. Likes Gore-
Tex suture for Gore-Tex grafts. Never uses tapered (i.e. 4-7mm) grafts. Often uses 3-0 chromic for deep dermis (don’t need to bury) followed by running 5-0 monocryl or pds (i.e. absorbable undyed monofilament) to close. No steri strips. Tegaderm and small 2x2 gauze for dressing. Clinic f/u 4 wks for AVF, 2 wks for graft.

For transplants...doesn’t prep perineum or prep-in Foley. No need for a headlight (even though it looks cool). Wear loupes. Places 3 way Foley before prepping patient, check that irrigation works. Uses staples to secure towels when draping. Uses curved transplant incision (Gibson)- two fingerbreadths above symphysis (midline), two fingerbreadths medial to ASIS, and then cephalad. Divides rectus fascia and then retracts rectus medially to enter retroperitoneum. Inferior epigastrics doubly ligated and divided. Cord isolated with vessel-loop in male, Round ligament ligated and divided in female. Uses large round ring for Bookwalter with pediatric and adult blades. Uses Fogarty hydrogrip clamps for artery and Kay-Lembert clamp for vein. May use topical papaverine on external iliac if appears in spasm while preparing kidney for transplantation. Clips a folded cold, wet lap sponge along the edge of the wound under the retractor on your side to hold kidney prior to anastomosis. Wet laps to cover clamps. Does arterial anastomosis first, using stay sutures and parachuting the entire back wall, running the entire anastomosis. Uses a 4 or 5 mm aortic punch for living donor transplants. In general uses 6-0 prolene on C-1 for LDs, 5-0 prolene for CADs. Parachutes vein in a similar fashion. Doesn’t “test” anastomosis by placing distal bulldog. Uses simple interrupted 5-0 PDS for ureteroneocystostomy followed by chromic to imbricate anastomosis (to protect it and prevent ureteral reflux). Remember ureter gets passed under cord in male. Always uses a 6 Fr x 12cm ureteral stent and always leaves a JP drain. Uses ultrasound probe to check flow in kidney. Closes musculofascial layers in two layers using #0 PDS. Skin approximated with staples. Primapore for dressing.

Moore-

Hale

Forbes

Karp

REFERENCES-TRANSPLANT

Read!
You are expected to supplement the clinical teaching during the rotation (didactic conferences, rounds, OR, etc.) with outside reading. Although there are innumerable sources, the best source at the resident level remains a standard surgery textbook. A minimum goal should be the following in the newest edition of Sabiston’s Textbook (Dr. Beauchamp’s book):

- Immunosuppression, pp 665-697
- Kidney transplantation, pp 699-722
- Pancreas transplantation, pp 732-742
- Dialysis access, pp 2081-2093
If you read these sections during your 2nd year rotation, read them again as a 3rd year because you probably forget most of the information!

**Handbook of Kidney Transplantation**, Danovitch ed. is also excellent. There’s a copy kept at 10S nursing station.


“**Up-to-date**” in the Eskind Digital Library is also excellent for looking up specific clinical issues.

**ASTS ACADEMIC UNIVERSE**

It is from American Society of Transplant Surgeons and has about 25-30 modules with “what you need to know” as a baseline for transplant rotations.

[http://www.astsuniverse.org/resLogin.asp](http://www.astsuniverse.org/resLogin.asp)

The code is “TNVU”

**REFERENCES—VASCULAR ACCESS**

In addition to standard surgical textbook, e.g. Sabistons above, 2 best references for vascular access are the KDOQI guidelines and the SVS guidelines referenced below:

National Kidney Foundation.


The Society for Vascular Surgery: Clinical practice guidelines for the surgical placement and maintenance of arteriovenous hemodialysis access

Anton N. Sidawy, MD, MPH,a Lawrence M. Spergel, MD,b Anatole Besarab, MD,c Michael Allon, MD,d William C. Jennings, MD,e Frank T. Padberg Jr, MD,f M. Hassan Murad, MD, MPH,g Victor M. Montori, MD, MSc,g Ann M. O’Hare, MD, h Keith D. Calligaro, MD,i Robyn A. Macsata, MD,a Alan B. Lumsden, MD,j and Enrico Ascher, MD,k Washington, DC; San Francisco, Calif; Detroit, Mich; Birmingham, Ala; Tulsa, Okla; Newark, NJ; Rochester, Minn; Philadelphia, Pa; Houston, Tex; and Brooklyn, NY

Recognizing the impact of the decision making by the dialysis access surgeon on the successful placement of autogenous arteriovenous hemodialysis access, the Society for Vascular Surgery assembled a multispecialty panel to develop practice guidelines in arteriovenous access placement and maintenance with the aim of maximizing the percentage and functionality of autogenous arteriovenous accesses that are placed. The Society commissioned the Knowledge and Encounter Research Unit of the Mayo Clinic College of Medicine, Rochester, Minnesota, to systematically review the available evidence in three main areas provided by the panel: timing of referral to access surgeons, type of access placed, and effectiveness of surveillance. The panel then formulated practice guidelines in seven areas: timing of referral to the access surgeon, operative strategies to maximize the placement of autogenous arteriovenous accesses, first choice for the autogenous access, choice of arteriovenous access when a patient is not a suitable candidate for a forearm autogenous
access, the role of monitoring and surveillance in arteriovenous access management, conversion of a prosthetic arteriovenous access to a secondary autogenous arteriovenous access, and management of the nonfunctional or failed arteriovenous access. For each of the guidelines, the panel stated the recommendation or suggestion, discussed the evidence or opinion upon which the recommendation or suggestion was made, detailed the values and preferences that influenced the group’s decision in formulating the relevant guideline, and discussed technical remarks related to the particular guideline. In addition, detailed information is provided on various configurations of autogenous and prosthetic accesses and technical tips related to their placement. (J Vasc Surg 2008;48:2S-25S.)

Complications of arteriovenous hemodialysis access: Recognition and management

Frank T. Padberg Jr, MD,a Keith D. Calligaro, MD,b and Anton N. Sidawy, MD, MPH,c Newark and East Orange, NJ; Philadelphia, Pa; and Washington, DC

English language citations reporting complications of arteriovenous access for hemodialysis are critically reviewed and discussed. Venous hypertension, arterial steal syndrome, and high-output cardiac failure occur as a result of hemodynamic alterations potentiated by access flow. Uremic and diabetic neuropathies are common but may obfuscate recognition of potentially correctable problems such as compression or ischemic neuropathy. Mechanical complications include pseudoaneurysm, which may develop from a puncture hematoma, degeneration of the wall, or infection. Dysfunctional hemostasis, hemorrhage, noninfectious fluid collections, and access-related infections are, in part, manifestations of the adverse effects of uremia on the function of circulating hematologic elements. Impaired erythropoiesis is successfully managed with hormonal stimulation; perhaps, similar therapies can be devised to reverse platelet and leukocyte dysfunction and reduce bleeding and infectious complications. (J Vasc Surg 2008;48:55S-80S.)


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