Care of the Transplanted Kidney

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Why this topic is no longer esoteric…

Solid organ transplants have become more common.

The number organ recipient continues to grow.

As healthcare providers, we will care for a transplant patient at some point of our career.

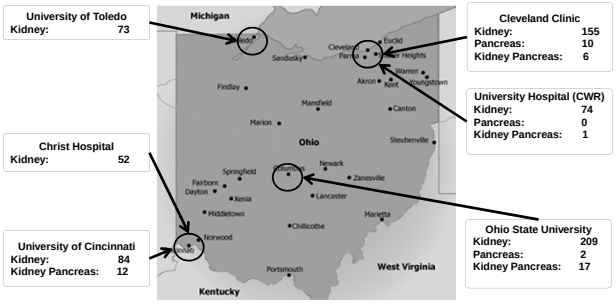
2016 Transplantation Statistics: United States

Kidney:	**19,061**
Pancreas:	**215**
Kidney/Pancreas:	**797**

2016 Transplantation Statistics: Ohio

Kidney:	**672**
Pancreas:	**9**
Kidney/Pancreas:	**38**

2016 Adult Transplantation Statistics: Ohio



Transplantation: The Ultimate Team Sport

Physician
- **Transplant Physicians**
- **Transplant Surgeons**

Nursing
- **Advanced Practice Providers**
- **Inpatient Acute Care Nurses**
- **Outpatient Transplant Nurse Coordinators**

Transplant Specialists
- **Psychology**
- **Infectious Disease**
- **Endocrinology**
- **Cardiology**
- **Pulmonology**
- **Dermatology**
- **Urology**

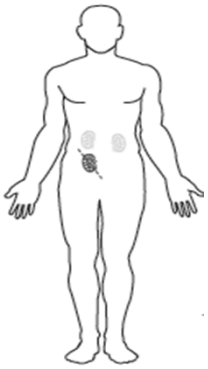
Ancillary Specialists
- **Social Worker**
- **Finance**
- **Pharmacists**
- **Nutritionists**
- **Case Management**

Transplantation: The Ultimate Team Sport

Our Most Valued Partners / Players (MVP):

Community Nephrologists and Internists

Transplanting a Kidney: The Nut and Bolts



- ***Incision is in the right or left lower quadrant.***
- ***Generally, the best lie will be left donor kidney to right and vice versa;***
- ***The native kidneys are generally left in place.***

Transplanting a Kidney: The Nut and Bolts

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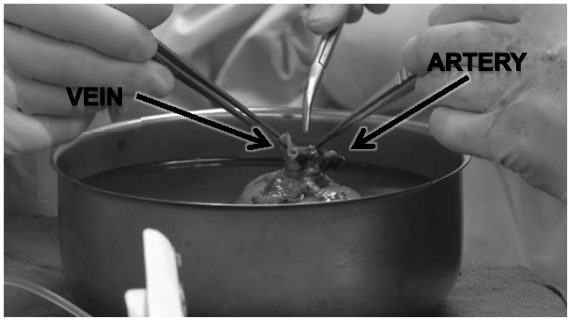
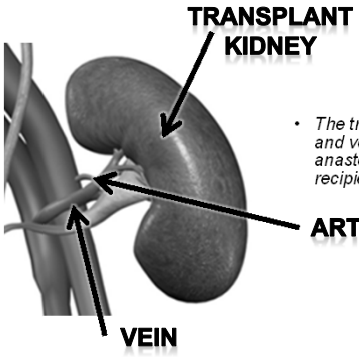


Transplanting a Kidney: The Nuts and Bolts



- *The transplanted artery and vein are anastomosed to the recipient's iliac vessels*

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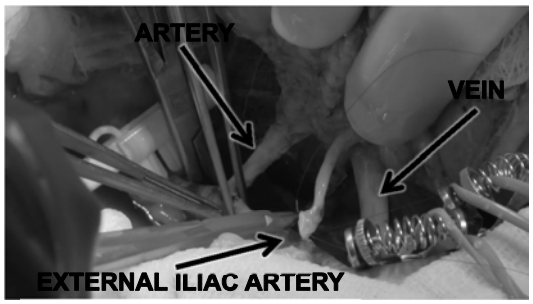
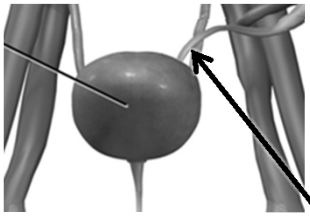
Transplanting a Kidney: The Nut and Bolts



Transplanting a Kidney: The Nuts and Bolts



- *The transplanted ureter is anastomosed to the bladder*

TRANSPLANT URETER

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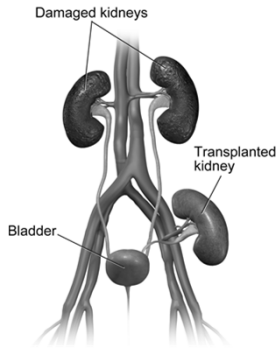
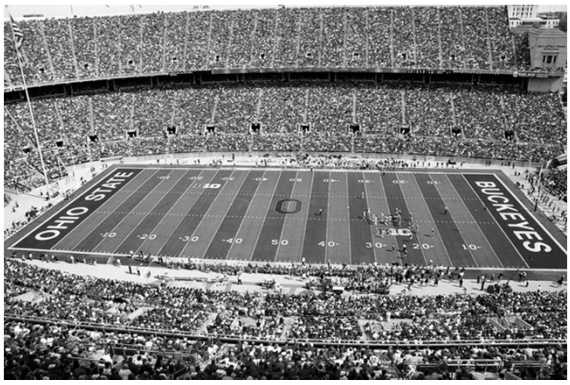
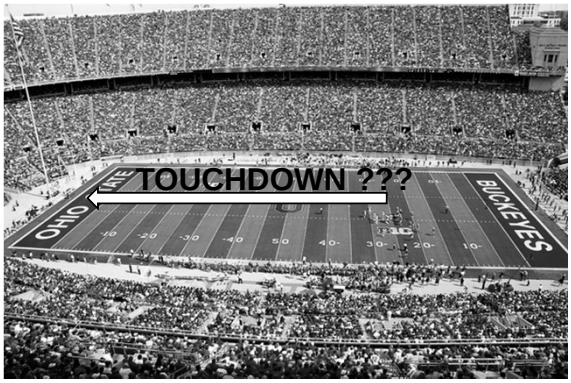
Transplanting a Kidney: The Nut and Bolts

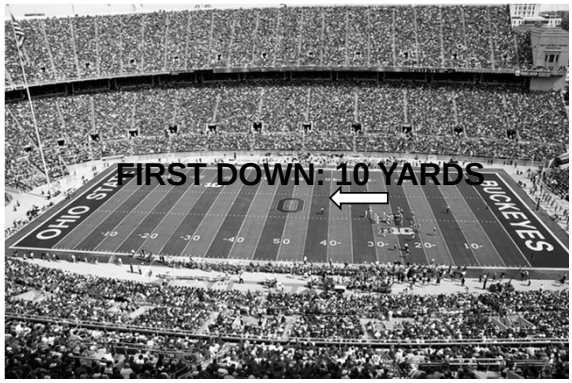


- **The Finished Product**

TRANSPLANT BEING A TEAM SPORT…



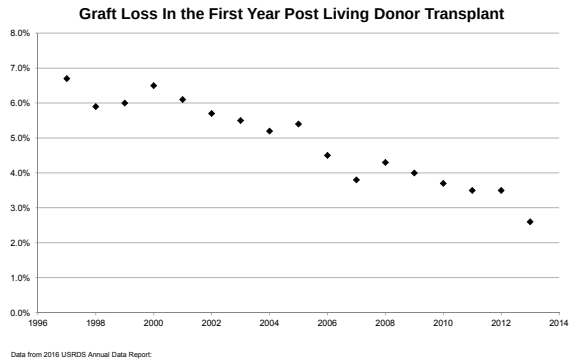




Implanting a Kidney is the First Step

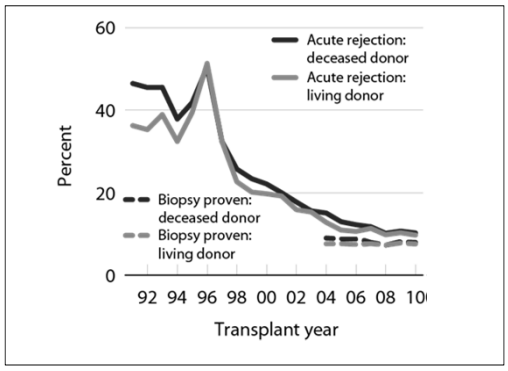
Immunosuppression Medications Keep Things Going…

Advances in Immunosuppression
Have Increased Early Graft Survival



Data from 2016 USRDS Annual Data Report:

Advances in Immunosuppression Have Increased Early Graft Survival

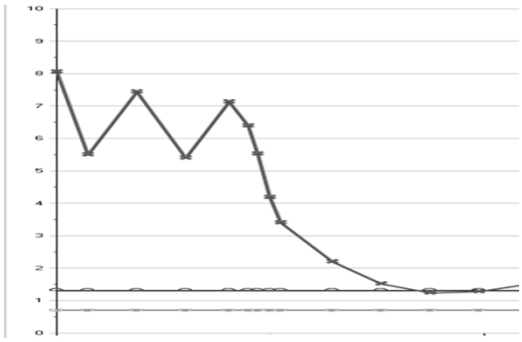


Source: USRDS 2013 ADR

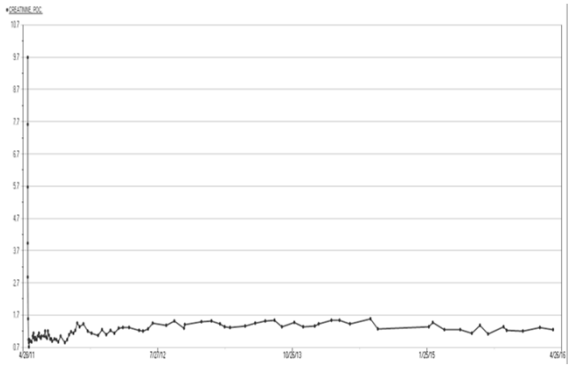
Maintenance Therapy

- **Calcineurin Inhibitors**
  - **Cyclosporin (Sandimmune* / Neoral*)**
  - **Tacrolimus (Prograf / FK 506)**
- **Antimetabolites**
  - **Azathioprine (Imuran)**
  - **Mycophenolate Mofetil (Cellcept)**
  - **Enteric-Coated Mycophenolic Acid (Myfortic)**
- **mTOR Inhibitors**
  - **Rapamycin (Sirolimus)**
  - **Zortress (Everolimus)**
- **Co-Receptor Blockers**
  - **Belatacept (Nujolix)**
- **Steroids**

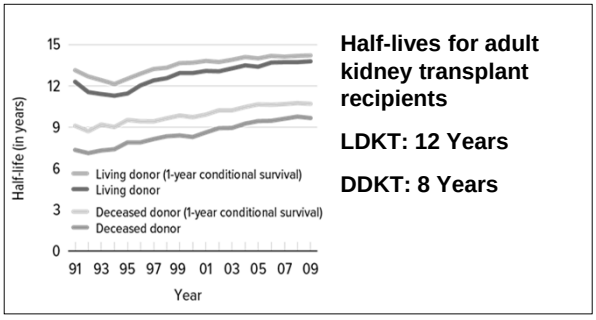
What we like to see…



What we really like to see…



Long-Term Kidney Transplant Outcomes



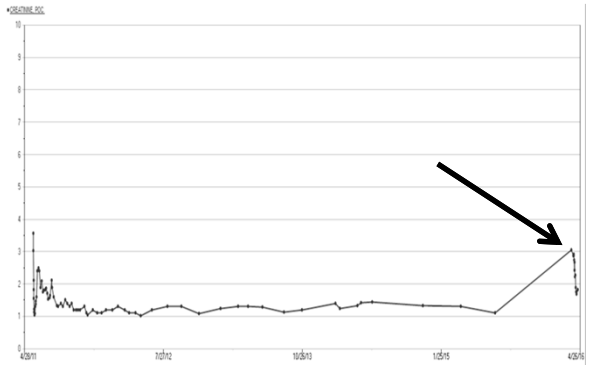
Half-lives for adult kidney transplant recipients

LDKT: 12 Years

DDKT: 8 Years

Source:
2011 OPTN/SRTR Annual Report
Solez K, Colvin RB, Racusen LC, et al. Banff '05 Meeting Report: differential diagnosis of chronic allograft injury and elimination of chronic allograft nephropathy ('CAN'). Am J Transplant. 2007;7:518-526

What we would rather not see…



What's Next?

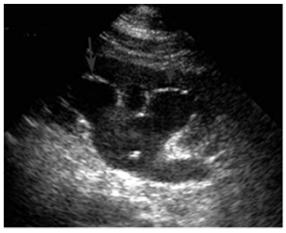
Initial Work-up for Increased Creatinine in a Renal Transplant Patient

- **Structural Abnormalities**
- **Calcineurin Toxicity**
- **Allograft Glomerulopathy**
- **Renal Issues**
- **Rejection**
- **Infection**

Structural Abnormalities

We Order:

Renal Ultrasound With Dopplers



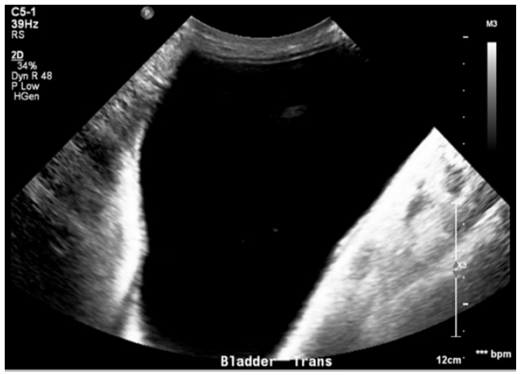
Reason:

Vascular Anastomosis Strictures

Collections (Urinomas / Seromas / Hematomas)

Blockages (Hydronephrosis)

Structural Abnormalities

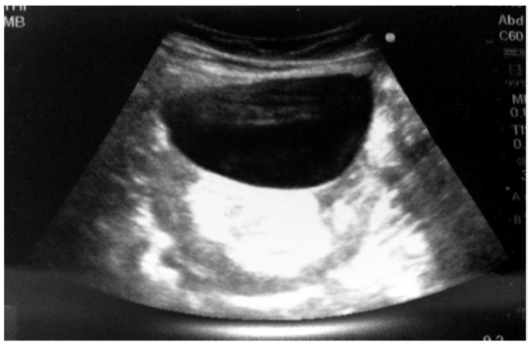


Structural Abnormalities

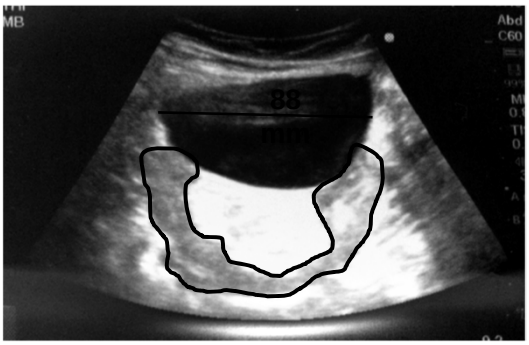
Structural Abnormalities

Transplant Ureter Stenosis

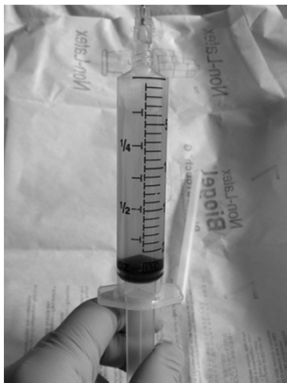
Structural Abnormalities



Structural Abnormalities



Structural Abnormalities



We Order:

CBC / Cell Count
Creatinine (Fluid / Serum)
Urea (Fluid / Serum)

Reason:

Hematoma
Seroma
Urinoma

Calcineurin Toxicity

We Order:

Drug Levels (Random)

- **Calcineurin Levels**
- **Cyclosporin**
- **Tacrolimus**

Reason:

If too high: Toxicity ?
If too low: Rejection ?

Calcineurin Toxicity

Concern for the Internist:

Drug Interactions: P450-3A5

Enzyme Inducers:
Decrease levels

Enzyme Blockers:
Increase levels

Allograft (Transplant) Glomerulopathy

- **Chronic "Burning Out" of the transplanted kidney**
- **Biopsy**
  - **Imaging**
  - **Clinical**
  - **Half Lives:**
    - **DDKT: 8 LDKT: 12***

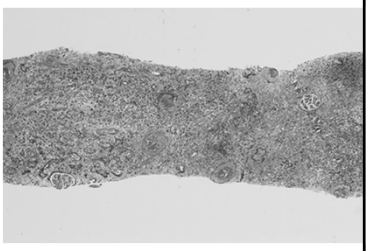


Image: Nadasdy / Diez (OSUWMC)

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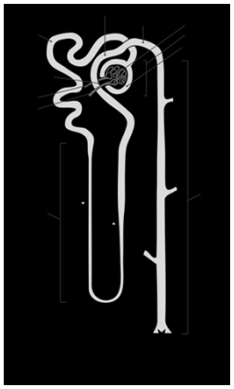
Renal Causes

Pre-Renal
Volume Depletion
Medications

Renal
Tubular Necrosis
Interstitial Nephritis
Recurrent Disease

Post Renal
Obstruction
BPH
Neurogenic Bladder

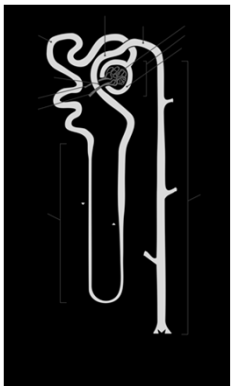


Renal Causes

Pre-Renal
Urinalysis
FENa*
Orthostatics

Renal
Urinalysis
Urine Protein*
Urine Eosinophils

Post Renal
Renal Ultrasound / PVR

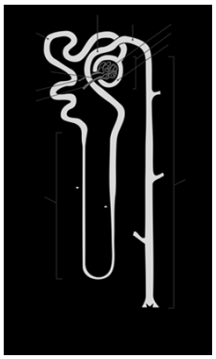


Fractional Excretion Sodium (FENa)

We Order:
- **Urine Na / Creat**
- **Serum Na / Creat**

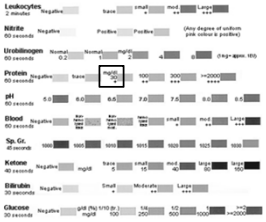
Interpretation:
- **If < 1%, then Pre-Renal*****

Caution:
- **Diuretics (Furosemide)**
- **Cardiac / Liver Failure**
- **Bladder Drained Pancreas**



Urine Protein (Random)

We Order:
- **Urine Protein**
- **Urine Creatinine**
- **Not a Urinalysis!**



Rejection

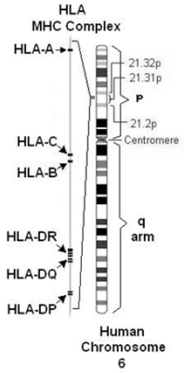
We Order:

Biopsy
Alloscreen* (Anti-HLA Antibody Assay)

Reason:
Biopsy:
- **Gold Standard**
- **Rejection Yes / No / Other**
- **Severity Of Rejection**
- **Guides Treatment**

"Alloscreen" / "Luminex":
- **Are there anti-HLA Antibodies?**

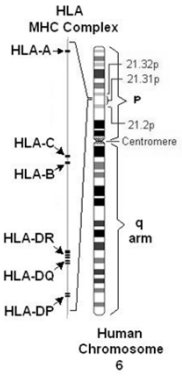
Rejection: What the HLA Lab Sees
HLA Type: The "ID Tag"



Donor:
A 2,8 **B** 5,16 **DR** 2,52

Recipient:
A 2,10 **B** 5,5 **DR** 2,52

Find The Mismatch:



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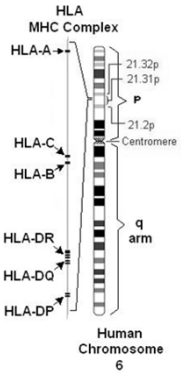

Donor:
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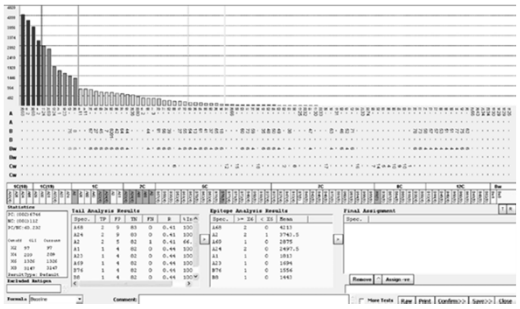
Answer:
2 Antigen Mismatch

Rejection: What the HLA Lab Sees Antibodies Against HLA



What the HLA Lab Tells Us:

The patient has two HLA Antibodies:
A8 at 7000 MFI
DR51 at 10,000 MFI

Why this matters:
A8 is specific against the donated kidney (DSA)
DR1 is not specific to the donated kidney (non-DSA)

Donor:
A 2,8 **B** 5,16 **DR** 2,52

Recipient:
A 2,10 **B** 5,5 **DR** 2,52

Rejection
Biopsy: What The Pathologist Sees

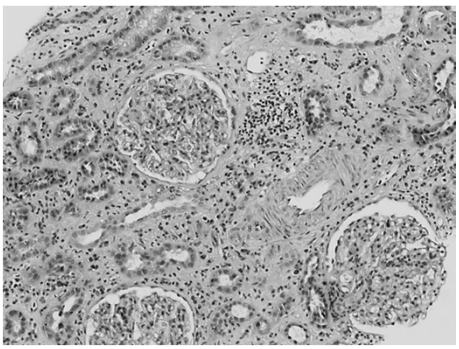


Image: Nadasdy / Diez (OSUWMC)

Rejection
Biopsy: What The Pathologist Sees

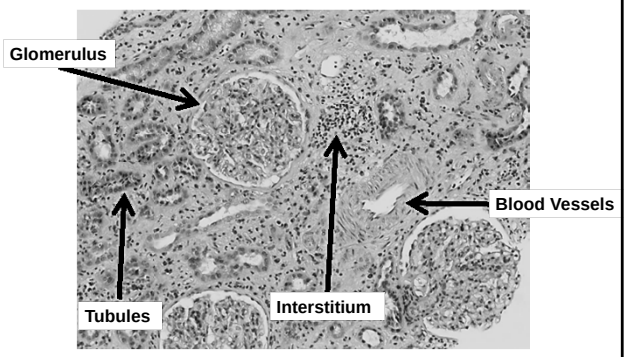


Image: Nadasdy / Diez (OSUWMC)

Rejection:
What We Interpret

Rejection

Cellular	Humoral
BANFF Criteria	-Donor Specific Antibody Production -C4d Deposition -Direct Tissue Injury
BANFF Ia & IIb Interstitium & Tubular Injury BANFF IIa & IIb Vascular Injury	

Rejection:
How We Treat

Rejection

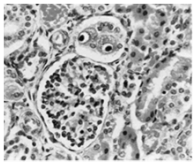
Cellular	Humoral
Steroids + / - Thymoglobulin	Steroids +/- Plasma Pheresis +/- IVIG

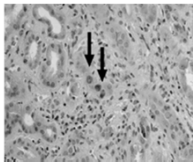
Infection

We Look For:

The usual suspects
- Sepsis
- Bacteremia et al

Opportunistic Infections
- CMV
- BK





We Order:
- Urinalysis
- Urine Cultures
- Blood Cultures
- BK PCR
- CMV PCR

Infection

Concerns for the Internist:

Urinary Tract Infections:
- Treat as a Complicated Infection
- Be aware of recurrent infections

Fever

Flu Vaccines

Low Threshold to Transfer Patient

Pearls

Common things may be common; but this population is quite eclectic.

There is no substitute for a good clinical history.

We are here to help.