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

<table>
<thead>
<tr>
<th>Organ</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney</td>
<td>19,061</td>
</tr>
<tr>
<td>Pancreas</td>
<td>215</td>
</tr>
<tr>
<td>Kidney/Pancreas</td>
<td>797</td>
</tr>
</tbody>
</table>

2016 Transplantation Statistics: Ohio

<table>
<thead>
<tr>
<th>Organ</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney</td>
<td>672</td>
</tr>
<tr>
<td>Pancreas</td>
<td>9</td>
</tr>
<tr>
<td>Kidney/Pancreas</td>
<td>38</td>
</tr>
</tbody>
</table>
2016 Adult Transplantation Statistics: Ohio

- University of Toledo
  - Kidney: 73

- University of Cincinnati
  - Kidney: 84
  - Kidney Pancreas: 12

- Cleveland Clinic
  - Kidney: 155
  - Pancreas: 10
  - Kidney Pancreas: 6

- University Hospital (CWR)
  - Kidney: 74
  - Pancreas: 0
  - Kidney Pancreas: 1

- Ohio State University
  - Kidney: 209
  - Pancreas: 2
  - Kidney Pancreas: 17

- Christ Hospital
  - Kidney: 52

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

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.

Our Most Valued Partners / Players (MVP):

Community Nephrologists and Internists
The transplanted artery and vein are anastomosed to the recipient’s iliac vessels.
Transplanting a Kidney: The Nut and Bolts

- The transplanted ureter is anastomosed to the bladder

The Finished Product

Transplant being a team sport...
Implanting a Kidney is the First Step

Immunosuppression Medications Keep Things Going...

Advises in Immunosuppression Have Increased Early Graft Survival

Data from 2016 USRDS Annual Data Report
Advances in Immunosuppression Have Increased Early Graft Survival

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

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
We Order:
Renal Ultrasound With Dopplers

Reason:
Vascular Anastomosis
Strictures
Collections (Urinomas / Seromas / Hematomas)
Blockages (Hydronephrosis)

Transplant Ureter Stenosis
We Order:
- CBC / Cell Count
- Creatinine (Fluid / Serum)
- Urea (Fluid / Serum)

Reason:
- Hematoma
- Seroma
- Urinoma

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

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**Allograft (Transplant) Glomerulopathy**

- Chronic “Burning Out” of the transplanted kidney

- Biopsy
  - Imaging
  - Clinical
  - Half Lives:
    - DDKT: 8
    - LDKT: 12

Image: Nadasdy / Díaz (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

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**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:

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

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

Answer:
2 Antigen Mismatch

Rejection: What the HLA Lab Sees

Antibodies Against HLA

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

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

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

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

What the HLA Lab Tells Us:

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

Rejection: What We Interpret

- Cellular
  - BANFF Criteria
  - BANFF Ia & Iib
  - Interstitial & Tubular Injury
  - Vascular Injury

- Humoral
  - Donor Specific Antibody Production
  - C4d Deposition
  - Direct Tissue Injury

Rejection: How We Treat

- Cellular
  - Steroids
  - Thymoglobulin

- Humoral
  - 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.