SURGICAL CHALLENGES OF PEDIATRIC KIDNEY TRANSPLANT

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HISTORY OF KIDNEY TRANSPLANT

- First kidney transplant performed in 1954 by Joseph Murray on identical twins, the Herrick twins
- Initially pediatric kidney transplant recipients received size matched pediatric kidneys
  - High rates of thrombosis (10-20%)
  - Gradually with time adult sized kidneys were successfully transplanted into pediatric patients
- Immunosuppression and surgical technique has improved over time to very good outcomes today
- However many challenges still exist
WAITLIST CHALLENGES

- Growing waitlist for kidney transplant in the United States
- Both adult and pediatrics
- January 2019: 1069 kids < 18 on the kidney list
- Represents 1.1% of the total list
- 93,818 adults on the kidney waitlist

https://optn.transplant.hrsa.gov 1/15/2019
GROWING NUMBER OF TRANSPLANTS IS NOT ENOUGH

Optn.transplant.hrsa.gov
Numbers of pediatric kidney transplants are not increasing.

- 892 in 2005 (424 living donor)
- 755 in 2018 (274 living donor)

Although deceased donor numbers have increased slightly, living donors have decreased over time.
FEWER OVERALL PEDIATRIC KIDNEY TRANSPLANTS
(DECREASED LIVING DONATION)
Living kidney donation has decreased since 2005
- 2005 saw 424 living kidney donors for children
- 2018 only 274 living kidney donors
- Many theories as to why it has decreased
- Accounts for about 36% of peds kidney transplants
- Who donates to children?
LIVING DONORS FOR KIDS
BARRIERS TO FINDING A DONOR?

• Patient selection
  • Awareness of the potential risks
• Family history (diabetes, PCKD)
• Socio economic aspects
  • Less common to donate in lower income areas
  • Women more likely to donate than men
• Low Resources / Financial Barriers
  • Donors can’t afford to take time off
• Education
  • If people don’t know they can donate, they won’t
UROLOGIC CHALLENGES

• Congenital Urogenital Anomalies
  • Most common indication in children

• Common Issues Encountered:
  • Posterior Urethral Valves
  • Neurogenic Bladders
  • Defunctionalized Bladders

Severe reflux into left kidney post right nephrectomy
CAUSE OF KIDNEY FAILURE BY AGE GROUP
POSTERIOR URETHRAL VALVES

- Males only
- 1/8000 births
- Nearly 30% have long term kidney failure
- Surgery may re-implant the ureters or try endoscopic ablation
- Patients may need a vesicostomy to decompress the bladder and minimize damage
- Once it is realized transplant is imminent, interventions to save the kidneys should be minimized
- More surgery can impact the outcome of transplant and quality of the bladder, etc
NEUROGENIC BLADDERS

- Seen in many disorders
  - Spina bifida, meningomyelocele, SCI, MS
- Some may require Mitranoff
  - Use or ureter, bladder or tube to create stoma
  - Monti uses ileum
  - May require daily irrigation if a mucus secreting organ is used
- Intermittent catherization required
- Some require augmentation
- A good post transplant plan and compliance is essential
DEFUNCTIONALIZED BLADDPERS

- Small from disuse after nephrectomies
- Defunctional after injury from obstruction, etc
- May be fine for transplant as long as low pressure on filling
- In infants, some centers transplant safely without intervention
  - May use a suprapubic catheter post transplant for management
  - Interventions may increase the complications for transplant
- Important to include urologists on pre transplant discussions / evaluation
ALTERNATIVES

• Ileal conduit
  • Has been reported to have higher rates of complications
  • Reflux, infections
  • Good long term transplant results can be achieved with proper management

• Ureterostomy
  • In general has shown higher rates of infection
  • Stomal stenosis
  • However some studies have reported good long term results (70% 5 year graft survival)
PRE TRANSPLANT NEPHRECTOMIES

- Polyuria
- Proteinuria
- Size
- Infections
- Reflux
- Intractable Hypertension
  - Some evidence of reduced HTN post transplant with nephrectomies
SIZE CHALLENGES
SIZE CHALLENGES

- Adult sized kidneys are preferentially used
- Higher rates of thrombosis (10-20%) when using pediatric kidneys in pediatric recipients
- Postoperative management of adult sized kidneys into small pediatric patients can be complicated
- Better outcomes when using recipients > 10 kg
- PD can help expand the abdominal wall size for implantation
**INTRAOPERATIVE MANAGEMENT**

- In larger kids the transplant can be performed as in adults
  - Renal artery sewn to the common or external iliac artery
  - Renal vein to the external or common iliac vein
- In smaller kids, the size of vessels is limiting
  - The donor artery will be sewn directly to the aorta
  - Donor renal vein to the IVC
INTRAOPERATIVE MANAGEMENT

- The new kidney will need extra blood volume
- It also needs an adult kidney blood pressure
- CVP is increased to at least 12
- Pressors are used to keep the SBP > 120
  - Dopamine to start
- Hgb kept < 10 to avoid risk of graft thrombosis
POSTOPERATIVE MANAGEMENT

• Cardiac output of an infant recipient will go up with an adult sized kidney
• Continued use of pressors (dopamine) to keep SBP > 120
• Fluids are used aggressively to provide more cardiac output for the kidney
  • Proven improved perfusion and outcomes for the kidney transplant
  • Cardiac output will go up with transplant, but will still not be what the kidney had
• Once extubated patients have a high fluid intake goal
  • May be met with g-tube / NGT
  • 2.5 – 3 liters a day for an infant
• Most commonly, IVC thrombosis
• Congenital
• Acquired
  • After prior nephrectomy or other abdominal operation
• Wilms Tumor
• Teratoma with IVC resection
Some children have incidental or expected findings of a missing IVC or thrombosed IVC

Several approaches to kidney transplant

Some centers advocate using small kidneys (young pediatric donors)

Others have placed adult sized kidneys in the left renal fossa

Principal includes finding adequate venous drainage for the graft
A new allocation system was put into place on Dec 4, 2014.

Prior to this, pediatric recipients had priority for kidneys from donors aged < 35 (Share 35).

The goal of the new allocation system was:
- To increase transplant of highly sensitized patients (adult).
- Decrease geographic variability in access.
- Increase organ longevity.
  - By matching better kidneys with healthier recipients (KAS system).
- Allocation is based on KDPI.
KDPI

- Kidney Donor Pool Index
- A system to decide the long term survival of a kidney
- 1-100%
  - 90% indicates 90% of kidneys transplanted the year before were better
- Recipients < 18 get prioritized for KDPI < 35%
- Young pediatric donors often end up with KDPI > 35%
  - Somewhat inaccurate for pediatric donors
OTHER PRIORITIES

- Highly sensitized patients now get priority over pediatrics
  - Studies have shown better outcomes with pediatric transplants than with highly sensitized transplants
- Multiorgan transplants for adults also get priority
  - Liver / kidney
  - Kidney / pancreas
- The number of multiorgan transplants is rising
PEDIATRIC KIDNEY WAITLIST TIMES

- Study completed with data up to 2010
- Evaluated the wait times for pediatric kidney transplant
  - Short. < 180 days
  - Medium 181-270 days
  - Long > 270 days
- Significant variability based on OPO / location
- 29% of pediatric quality kidneys were diverted to adults

POST KDPI / KAS

- Pediatric patients may be waiting longer
  - Longer dialysis times for kids
- DGF rates increased post KAS
  - DGF associated with higher risk of graft loss
- Pediatric patients received fewer kidneys from pediatric donors
  - 32% pre-KAS versus 21% post-KAS
- 19.4% of KDPI < 35 kidneys were used for multiorgan from 2010-2016


Graft survival with DGF
New changes will be instituted in the next 1-2 years
Looking at sharing of kidneys based on distance from donor hospital
No longer will be OPO based
Similar systems have been changed for other organs after a lawsuit was filed
Unclear at this point how this will affect pediatric allocation of kidneys
SUCCESS OVER TIME – IMPROVED OUTCOMES

- Improved patient and graft survival
- Improved surgical techniques
- Improved immunosuppression
- Improved donor selections
- Work on transition to adult care
SIGNIFICANTLY IMPROVED SURVIVAL

In one study examining over a 25 year time period
Lower incidence of DGF and PNF
Biggest improvement in graft and patient survival in first year post transplant
Graft survival above
Patient survival below

GRAFT SURVIVAL AFTER TRANSPLANT

OPTN/SRTR 2016 Annual Data Report: Kidney
American Journal of Transplantation, Volume: 18, Issue: S1, Pages: 18-113, First published: 02 January 2018, DOI: (10.1111/ajt.14557)
PATIENT SURVIVAL AFTER TRANSPLANT

OPTN/SRTR 2016 Annual Data Report: Kidney

American Journal of Transplantation, Volume: 18, Issue: S1, Pages: 18-113, First published: 02 January 2018, DOI: (10.1111/ajt.14557)
FURTHER CHALLENGES

- Post transplant issues
- BK Virus
- Chronic Rejection
- Transition to adulthood
- Finding more Living Kidney Donors
THANK YOU

Questions?

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