Paediatric and neonatal solid organ donation & transplantation

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PAEDIATRIC DONORS

- PD
  - 5Y-18Y
  - 2Y-5Y
  - OD-2Y
PAEDIATRIC DONORS: 0D-2Y

PD (0D-2Y)

- Heart
- Liver
- Small bowel
- Kidney
PAEDIATRIC DONORS: 0D-2Y OLD

Current Limitations

- Donation after neurological determination of death (DNDD) from infants less 2m of age is precluded by guidelines on death certification
- Donation after circulatory determination of death (DCDD) has not been embraced widely from this age group
- Innovations in split/reduced/living donor segmental liver transplant has reduced demand for whole organ liver graft for paediatric recipients
- Advances in nutritional support and living donor SB transplant
- Currently Kidneys & Heart are the only potential solid organs to be transplanted from such small paediatric donors
- DNDD will allow liver SB & Heart to be transplanted from these donors
NEONATAL DONATION

Current Limitations

PD (0D-2Y)
- Heart
- Liver
- Small bowel
  - Kidney
PAEDIATRIC DONORS: EN BLOC KIDNEY TRANSPLANT (EKT)

Recipient is mostly an adult or an adolescent paediatric patient

The Leeds Teaching Hospital NHS Trust
Kidney transplant from small paediatric donors challenges and anxiety

- Nephron mass
- Dysplasia may be difficult to assess in neonates and infants
- Proteinuria after transplant
- Hyperfiltration injury (over-work fatigue) and glomerulosclerosis
- Increased risk of vascular thrombosis
- Increased risk of ureteric complications

In addition
- DCD donation poses additional risks
- Difficult procurement. Tedious bench work
- Implantation technically challenging
Kidney transplant from small paediatric donors: challenges and anxiety

- Nephron numbers finalized at 36 weeks gestation (0.3-1.4 million/kidney)
- Incidence of dysplasia is estimated 1 in 2000 live births
- Proteinuria is common but resolves within a year in most cases
- Hyperfiltration injury & glomerulosclerosis can be overcome
- Increased risk of vascular thrombosis
- Increased risk of ureteric complications

In addition

- DCD donation poses additional risks
- Difficult procurement. Tedious bench work
- Implantation technically challenging
Paediatric Donors: Procurement & Implantation
INFANT (<24M) & NEONATAL (<4W) DONATION (2010-2012)

- **PICU & NICU**: Audited deaths 1429
- **Referred**: 107
- **Proceeded**: 9

**CR 8%**

Leeds: 155 NICU deaths over 5 years (2008-12). None referred for donation

Source: NHSBT, 2012, NICU LGI 2013
Paediatric Kidney Donation: excellent outcome, yet an under-utilized resource: a 15 year review

GROUP A (5-18 YR)
- Identified 790
- Consented 769
- Proceeded 764
- CR 97%

GROUP B (2-5 YR)
- Identified 76
- Consented 67
- Proceeded 64
- CR 84%

GROUP C (0-2 YR)
- Identified 47
- Consented 31
- Proceeded 26
- CR 55%

n=914
10,718 Potential Donors

The Leeds Teaching Hospital NHS Trust
## RESULTS: UTILIZATION OF KIDNEYS

<table>
<thead>
<tr>
<th>Donor Groups (n=914)</th>
<th>Transplant A=Adult P=Paediatric</th>
<th>Transplant (EKT/SKT)</th>
<th>Utilization Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 – 18 years (n = 764)</td>
<td>A = 906</td>
<td>EKT = 9</td>
<td>88%</td>
</tr>
<tr>
<td></td>
<td>P = 437</td>
<td>SKT = 1334</td>
<td></td>
</tr>
<tr>
<td>2-5 years (n = 64)</td>
<td>A = 49</td>
<td>EKT = 40</td>
<td>88%</td>
</tr>
<tr>
<td></td>
<td>P = 5</td>
<td>SKT = 14</td>
<td></td>
</tr>
<tr>
<td>0-2 years (n = 26)</td>
<td>A = 15</td>
<td>EKT = 16</td>
<td>57%</td>
</tr>
<tr>
<td></td>
<td>P = 2</td>
<td>SKT = 1</td>
<td></td>
</tr>
</tbody>
</table>
## RESULTS: OUTCOME

Mean donor age in Group C = 16m, no neonatal donor

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Group A (n=1343)</th>
<th>Group B (n=54)</th>
<th>Group C (n=17)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DGF</td>
<td>7.2%</td>
<td>9.3%</td>
<td>0</td>
<td>0.109</td>
</tr>
<tr>
<td>PNF</td>
<td>0.7%</td>
<td>0</td>
<td>5.9%</td>
<td></td>
</tr>
<tr>
<td>Functioning grafts</td>
<td>76.5%</td>
<td>85.1%</td>
<td>82.4%</td>
<td>0.290</td>
</tr>
<tr>
<td>Duration of graft function in days</td>
<td>4303 (58.6)</td>
<td>4551 (287.8)</td>
<td>3306 (361.9)</td>
<td>0.565</td>
</tr>
</tbody>
</table>

(Log rank between groups not significant)
Renal transplantation from infant & neonatal donors
The Leeds experience
OUTCOME OF EKT FROM PAEDIATRIC DONORS

20 EKT (2005-2015)
- 6 from donors aged >2 years (Range 2yrs 1m – 5yr 9m)
- 14 from donors aged ≤2 years (Range 0d – 24m)

Recipient age – Median 28yrs (Range 15 – 62yrs)

Graft survival at 1 year – 93% (n=14)

Overall graft survival – 80% (median f/u 640 days)
OUTCOME OF EKT FROM PAEDIATRIC DONORS

16/20 – Functioning grafts
4 graft losses
- Venous thrombosis (Day 0) – 1
- Late acute rejection (after 7 years) – 1
- Suboptimal graft function and early graft failure – 1 (<2 years)
- Primary non-function – 1
EKT FROM PAEDIATRIC DONORS

Evolution of graft function

<2yr Donor EKT Graft function vs Time

Wilcoxon signed-rank test, p < 0.05 considered significant (marked with * on graph)
KIDNEY DONORS UNDER 2 MONTHS
characteristics of suitable donor

- Full term or near term pregnancy (≥ 36w)
- Normal antenatal anomaly scan (weeks 16-20)
- Evidence of urine output after birth
- SCr < 50 after 1 week of delivery
- Absence of transmittable infection (HBV, HCV, HIV)
KIDNEY DONORS UNDER 2 MONTHS
Assessment of renal function in utero

- Normal progression of pregnancy
- Normal antenatal anomaly scan (weeks 16-20)
- Absence of oligohydramnios
- Presence of urine in the bladder (uss)
- NM scan: evidence of uptake and excretion
NEONATAL DONATION
characteristics of suitable recipient

q Age < 60, preferably young adult or adolescent paediatric
q BMI < 30
q Absence of hypertension or well controlled HTN
q No history of peripheral vascular disease, MI, Stroke
q Not long-term or complicated diabetic
q Non-smoker or committed to quit
Tx  #12 (donor 23d)
CONCLUSIONS

- Paediatric donors under 2 years are under-referred for solid organ donation (3 donors per year in the UK)
- Kidneys procured from these donors are often discarded
- Block appears to be at all key stages of the process, i.e. referral, donation and utilization
- Excellent results can be achieved through utilization of kidneys from donors under 2 years of age
- Graft function continues to improve throughout the first year achieving a GFR>90 in most cases
CONCLUSIONS

1. Largest single center experience in the UK for utilizing kidneys from donors under 2 years of age

2. Steady increase in our experience with EKT, including transplantation of kidneys from neonatal donors

3. Kidney transplant from donors under 2 months of age have not been previously reported in the UK
RECOMMENDATIONS

q Kidney transplant from donors under 2 years of age up to & including **neonatal** donors possible with good outcome

q Kidney transplant from these donors should initially be performed in designated centres

q A pooled list of suitable recipients will facilitate efficient utilization of these kidneys

q Once the protocol for such transplant is established, other centres should be invited to participate
ACKNOWLEDGMENT

- Imeshi Wijetunga
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- Donor families
- SNODs
- NHSBT