

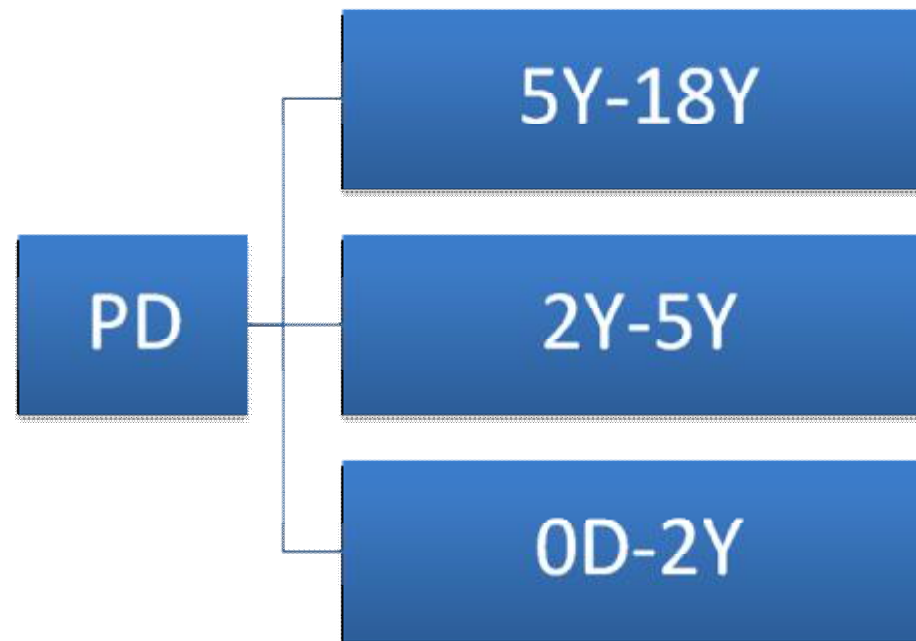
# Paediatric and neonatal solid organ donation & transplantation



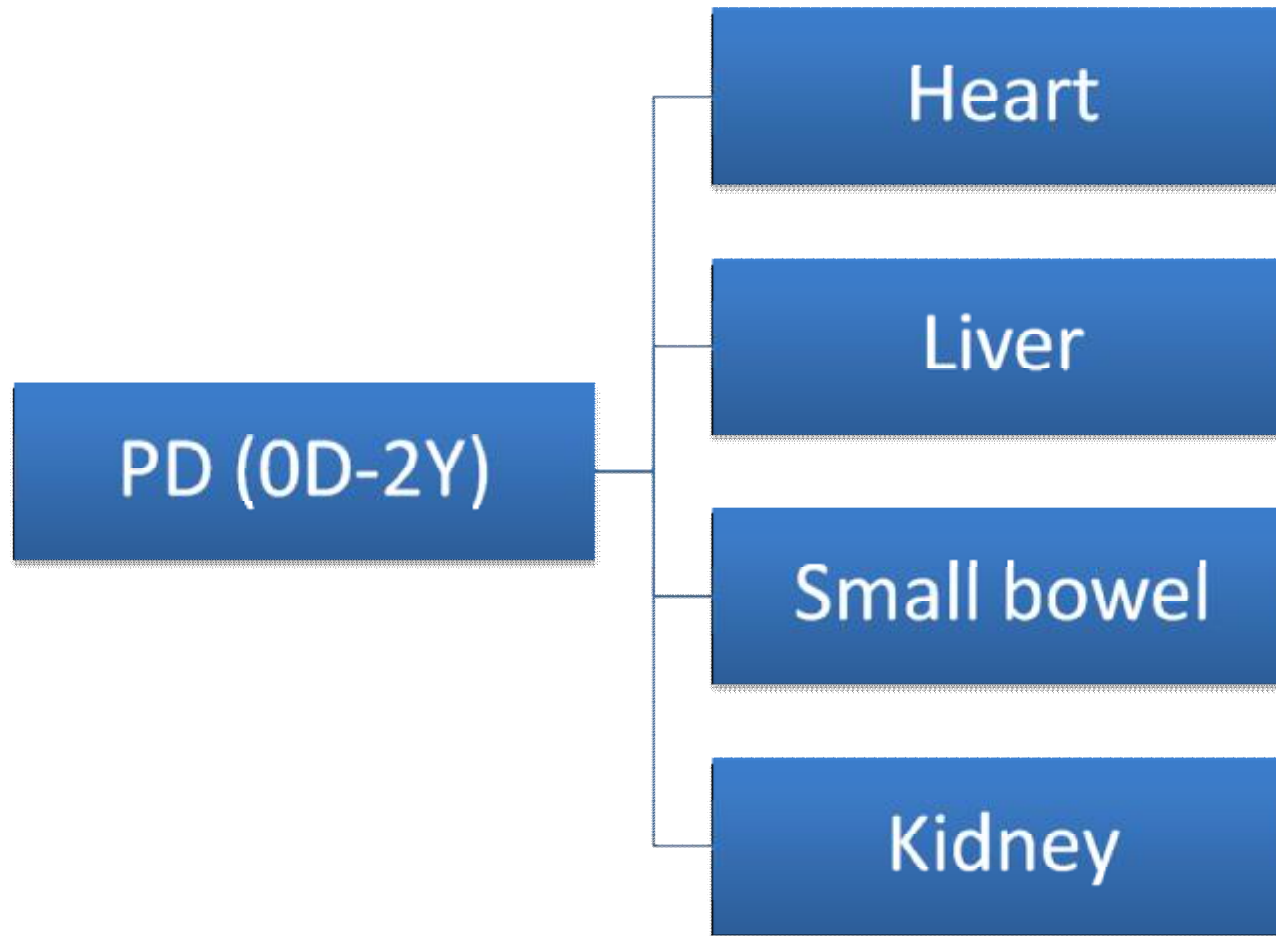
**Niaz Ahmad**

15 July 2015

# PAEDIATRIC DONORS



# PAEDIATRIC DONORS: 0D-2Y



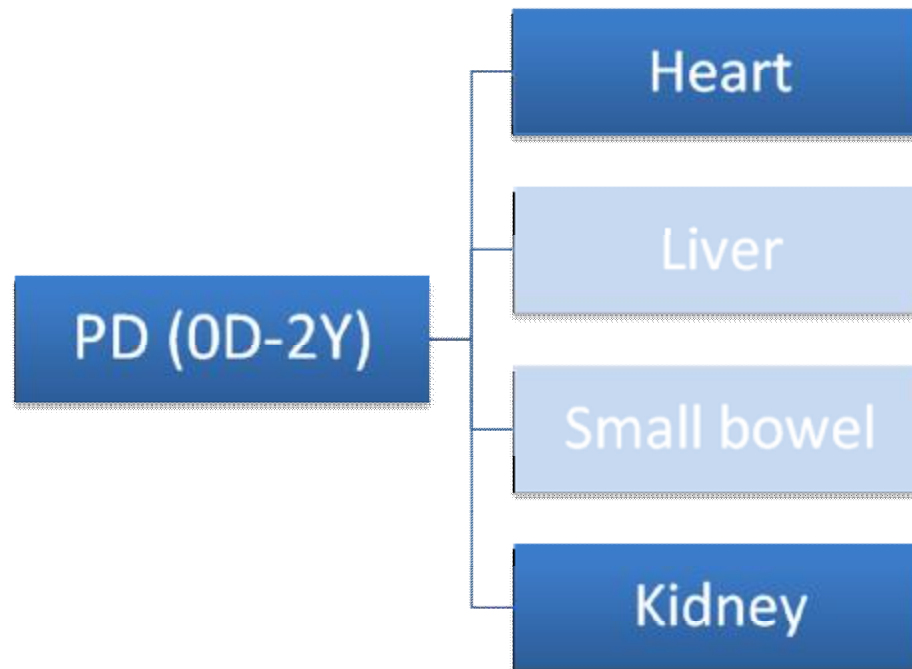
# PAEDIATRIC DONORS: 0D-2Y OLD

## Current Limitations

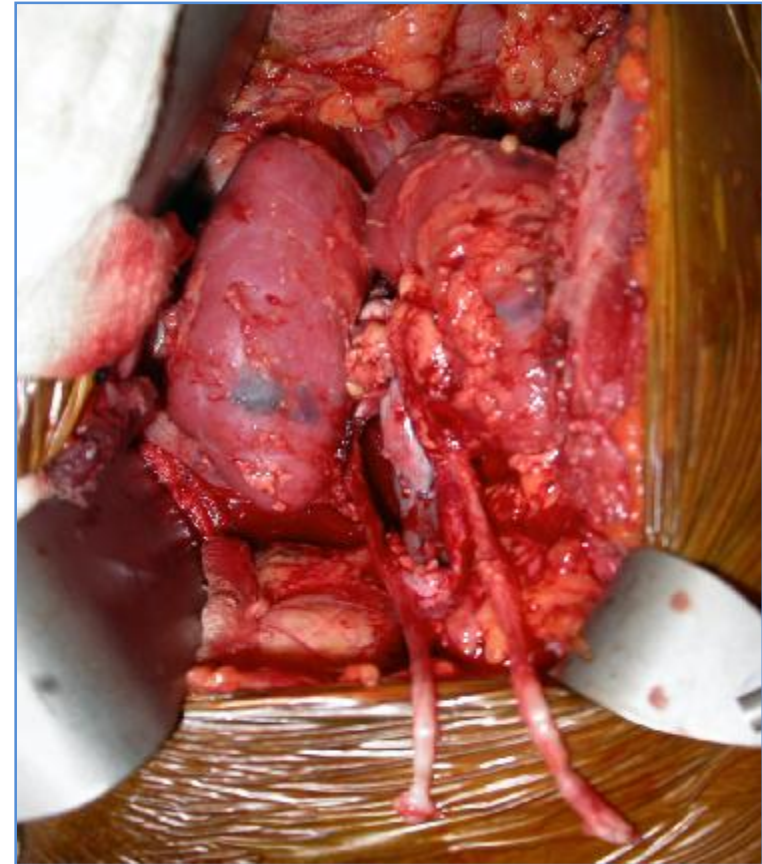
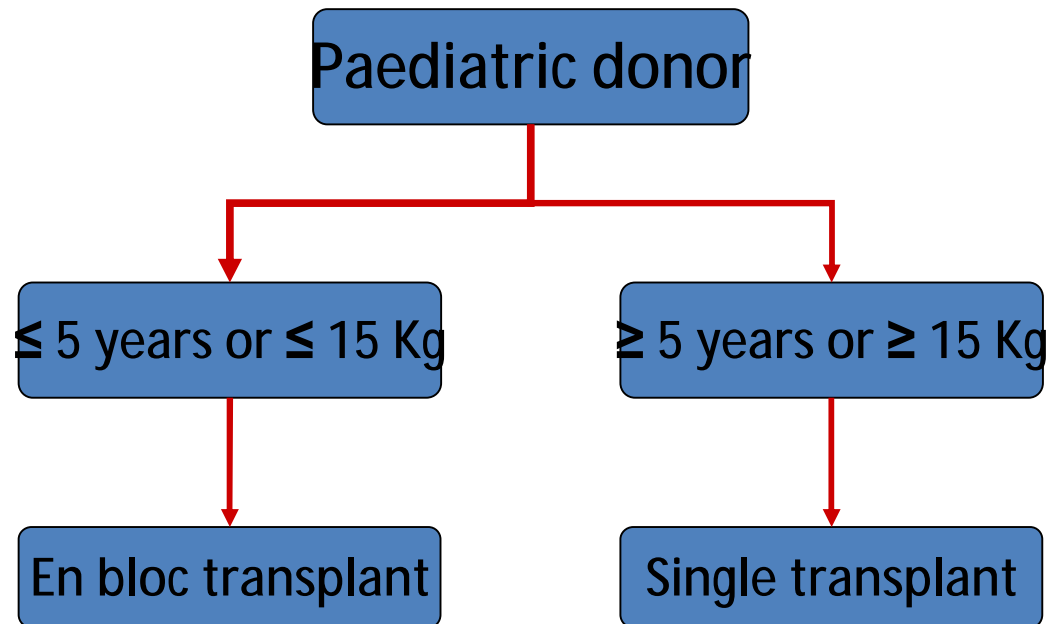
- § Donation after neurological determination of death (DNDD) from infants less 2m of age is precluded by guidelines on death certification
- § Donation after circulatory determination of death (DCDD) has not been embraced widely from this age group
- § Innovations in split/reduced/living donor segmental 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



# PAEDIATRIC DONORS: EN BLOC KIDNEY TRANSPLANT (EKT)



Recipient is mostly an adult or an adolescent paediatric patient

# 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

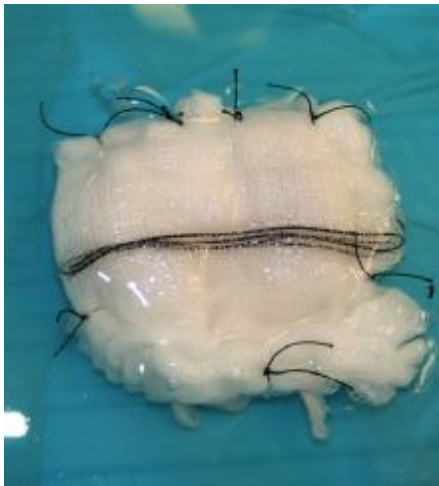
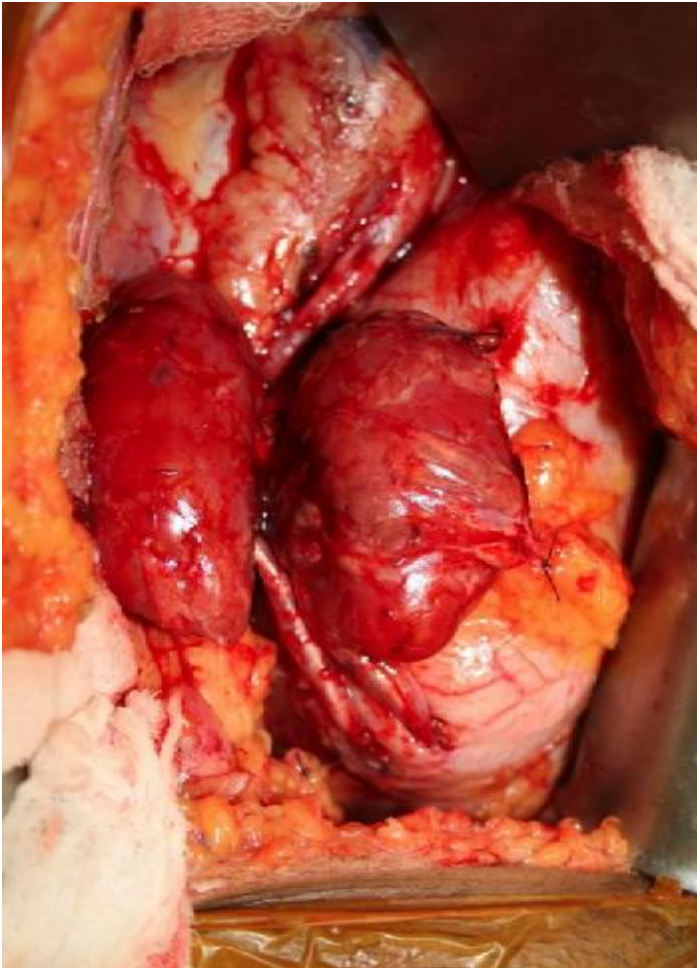
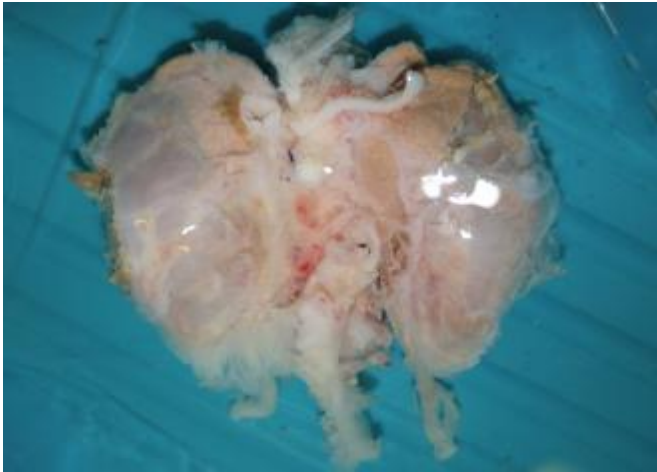
# Kidney transplant from small paediatric donors

## challenges and anxiety

- § Nephron numbers finalized @36w 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<sup>1</sup>
- § 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

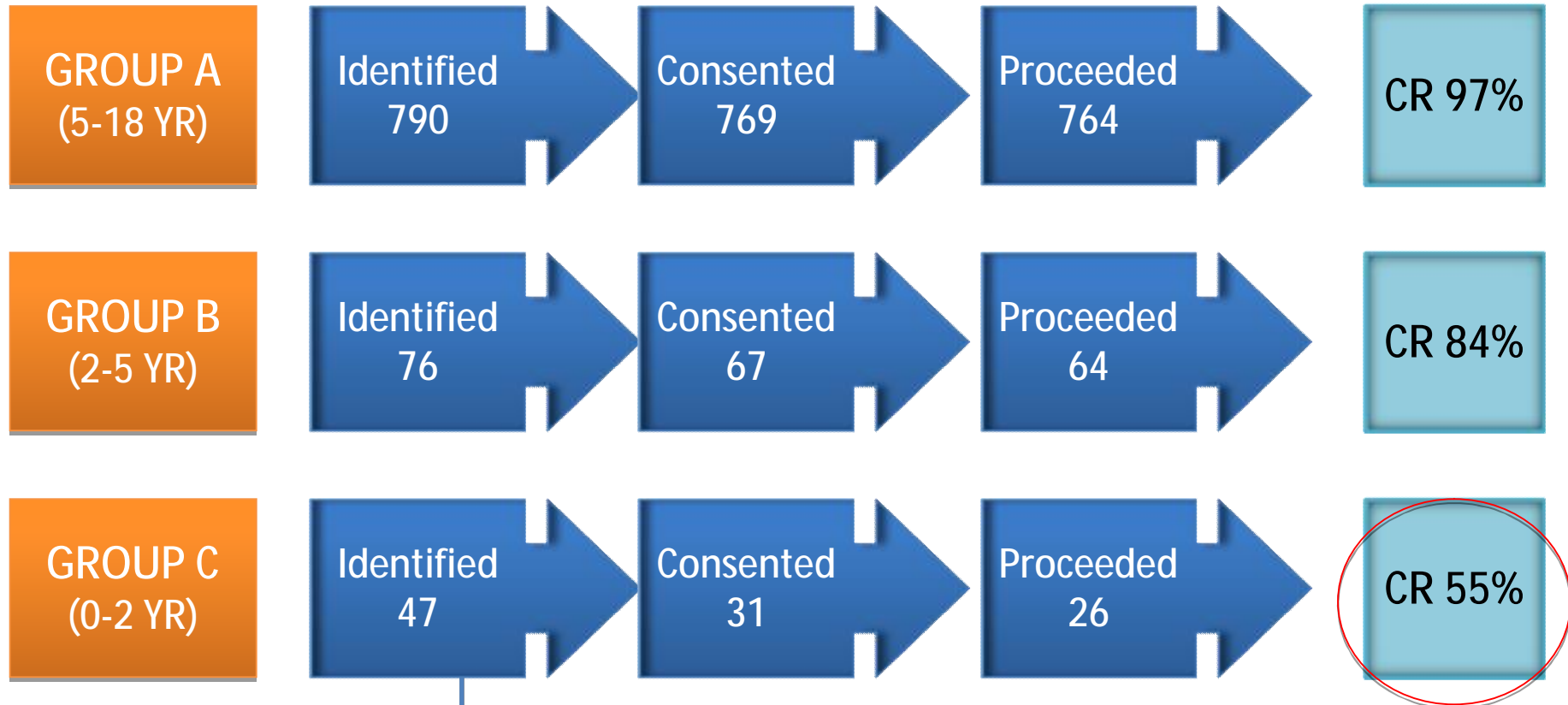


# INFANT (<24M) & NEONATAL (<4W) DONATION (2010-2012)



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

# Paediatric Kidney Donation: excellent outcome, yet an under-utilized resource: a 15 year review



n=914

10,718 Potential Donors

# RESULTS: UTILIZATION OF KIDNEYS

Donor Groups (n=914)	Transplant A=Adult P=Paediatric	Transplant (EKT/SKT)	Utilization Rate (%)
5 – 18 years (n = 764)	A = 906 P = 437	EKT = 9 SKT = 1334	88%
2-5 years (n = 64)	A = 49 P = 5	EKT = 40 SKT = 14	88%
0-2 years (n = 26)	A = 15 P = 2	EKT = 16 SKT = 1	57%

# RESULTS: OUTCOME

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

Outcome (n = 1414)	Group A (n=1343)	Group B (n=54)	Group C (n=17)	P value
DGF	7.2%	9.3%	0	0.109
PNF	0.7 %	0	5.9%	
Functioning grafts	76.5%	85.1%	82.4%	0.290
Duration of graft function in days	4303 (58.6)	4551 (287.8)	3306 (361.9)	0.565

(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

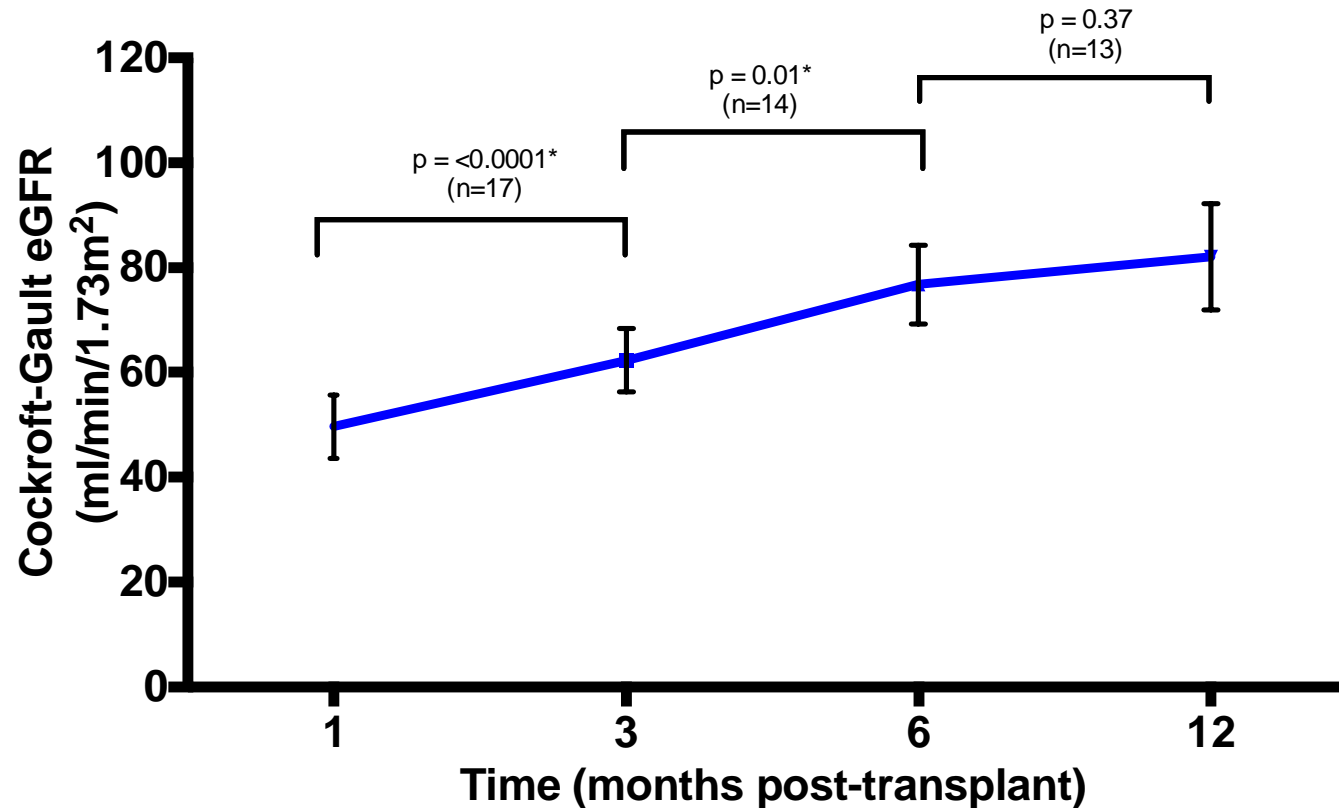
- Venous thrombosis (Day 0) – 1
- Late acute rejection (after 7 years) – 1
- Suboptimal graft function and early graft failure – 1 (<2years)
- Primary non-function – 1



# 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

- q Full term or near term pregnancy ( $\geq 36$ w)
- q Normal antenatal anomaly scan (weeks 16-20)
- q Evidence of urine output after birth
- q SCr  $< 50$  after 1 week of delivery
- q Absence of transmittable infection (HBV, HCV, HIV)

# KIDNEY DONORS UNDER 2 MONTHS

## Assessment of renal function in utero

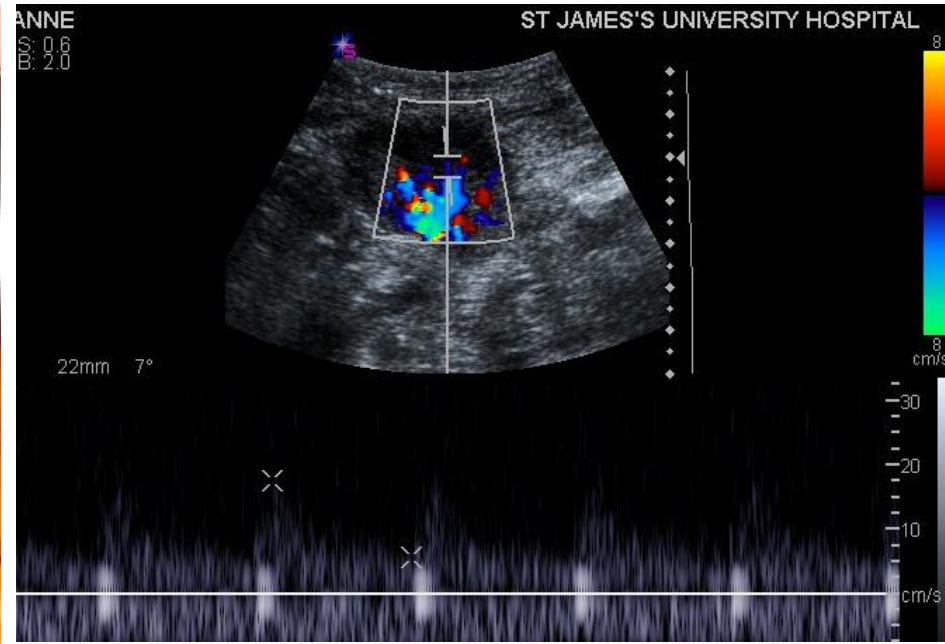
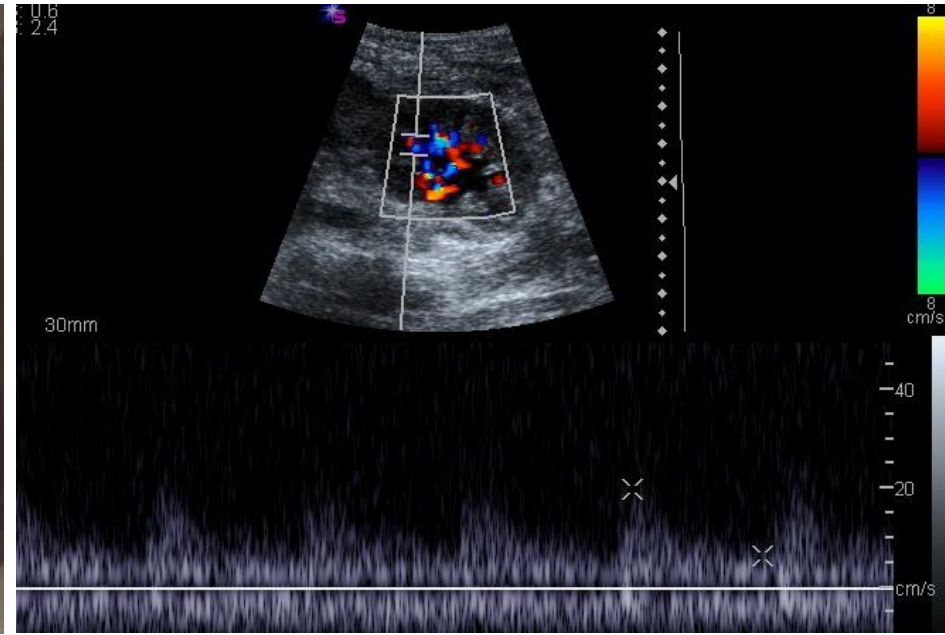
- q Normal progression of pregnancy
- q Normal antenatal anomaly scan (weeks 16-20)
- q Absence of oligohydramnios
- q Presence of urine in the bladder (uss)
- q NM scan: evidence of uptake and excretion

# 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)





Welcome to your preview of the Sunday Times

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NEWS

Baby's kidneys save woman's life

An acute shortage of organs is forcing surgeons to ask parents of dying babies to help save others, says Beezy Marsh

Beezy Marsh Published: 13 October 2013

Comment (6) Print



Samira Kauser plans to get married next year (Bob Collier Photos Ltd)

A FIVE-WEEK-OLD baby has become the youngest organ donor in Britain, after the infant's tiny kidneys were transplanted into a woman who was dying from kidney failure.

The organs from the baby, who suffered heart failure after a major infection, have saved the life of 22-year-old Samira Kauser from Halifax, West Yorkshire.

A chronic shortage of organ donors leads to three people every day dying while on waiting lists, which is forcing doctors to look for younger donors.

Transplant surgeons say they are now using babies less than two months old to counter the shortage, despite ethical dilemmas about the emotional distress of asking parents of dying infants if they will consider organ donation.

Kidneys are fully functioning at around 37 weeks in the womb and could technically be transplanted even then into an adult. Other organs including the liver, heart and lung are also fully developed at that stage.

LETTER

Neonatal kidney donation and transplantation: a realistic strategy for the treatment of end-stage renal disease

Charles and colleagues have highlighted an important although long ignored area of potential donation for transplantation and have explored this potential in the context of the neonatal population.<sup>1</sup> While the diagnosis of brain stem death (BSD) remains a problem in donors under 2 months of age, there has been progress in donation after circulatory death (DCD) in the UK in this age group. We report successful outcome following renal transplantation from a 7-week-old DCD donor, with 1-year follow-up.

The donor was a 7-week-old infant weighing 5 kg whose cause of death was hypoxic brain injury. The recipient was a 22-year-old female who had end-stage renal failure secondary to familial IgA nephropathy and been on peritoneal dialysis for over a year. The recipient was IA, 2B and 2DR mismatched to the donor.

The kidneys were procured en bloc with segments of aorta and inferior vena cava and prepared meticulously on backbench for implantation. The implantation was extraperitoneal in the right iliac fossa to the external iliac vessels (see figure 1). First warm, cold and second warm ischaemia times were 13 min, 11.8 h and 45 min. Primary function was observed, and there were no immediate postoperative complications. Immunosuppression consisted of

alemtuzumab induction followed by tacrolimus, mycophenolate mofetil and prednisolone maintenance. Creatinine level ( $\mu\text{mol/L}$ ) and GFR (Cockcroft-Gault estimation in  $\text{mL/min/1.73 m}^2$ ) at 1, 6 and 12 months were 90(69), 64(120) and 55 (112), respectively. On an ultrasound scan performed at 3 months, these kidneys measured 7 cm in length compared with 4 cm at time of transplant.

Anxieties associated with use of these young donor kidneys include presumed insufficient nephron mass, risk of dysplasia, risk of hyperfiltration injury and an increased risk of vascular thrombosis.<sup>2</sup> Our single-centre experience of en bloc kidney transplants from donors less than 2 years, which is currently the largest in the UK, has shown that with meticulous care and in appropriate recipients within the right milieu, these kidneys work well after transplant. The absolute GFR and graft size adapts to recipient's body mass with maximal growth occurring in the first year post-transplantation, often achieving a GFR superior to a living donor renal transplant. Successful transplant from the 7-week-old donor in this cohort supports using neonatal donor kidneys for transplant. Kidney transplant from donors under 2 years of age in the UK has remained at disappointingly low (17 in 15 years, median donor age=12 months).<sup>2</sup> In their recent article, Charles *et al* identified 45 potential donors under 2 months in a single centre that if extrapolated at an estimated 50% consent and utilisation rate would have yielded 22 en bloc kidney pairs for transplant.

Published literature on renal transplant from donors under two years of age are

scanty but report successful outcomes.<sup>3-5</sup> Currently, only DCD donation is possible in the UK under 2 months of age, a deterrent for use of organs from these donors. We support a change in criteria for diagnosing BSD in this population of infants to allow more organs available for transplantation.

Imeshi Wijetunga,<sup>1</sup> Sanjay Pandanaboyana,<sup>1</sup> Shahid G Farid,<sup>1</sup> Clare Ecuver,<sup>1</sup> Andrew Lewington,<sup>2</sup> Lutz Hostert,<sup>1</sup> Magdy Attia,<sup>1</sup> Niaz Ahmad<sup>1</sup>

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Contributors IW and NA conceived, initiated and drafted the manuscript. SP and SG undertook the literature review. CE assisted with data collection. MA, LH and AL participated in critical revision of the manuscript. All authors approved of the final manuscript.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; internally peer reviewed.

Data sharing statement All unpublished data on this case are stored securely and is available to the first and senior authors on this paper.

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REFERENCES

- Charles I, Scallan A, Brierley J. The potential for neonatal organ donation in a children's hospital. *J Arch Dis Child Fetal Neonatal Ed* 2014;99:F215-9.
- Raza I, Hakeem A, Saeed R, *et al*. The referral and utilization of paediatric solid organ donors less than two years old in the United Kingdom (abstract). *Paediatr Transplant* 2013;17:48.
- Farid SG, Goldsmith P, Fisher L, *et al*. Successful outcome of paediatric en bloc kidney transplantation from the youngest donation-after cardiac-death donor in the United Kingdom. *Transpl Int* 2009;22:761-2.
- Mellet FK. Transplantation of small en bloc kidneys including a horseshoe kidney from donors aged 2 to 60 months to adult recipients: a 13-year experience. *Transplant Proc* 2001;33:1783-4.

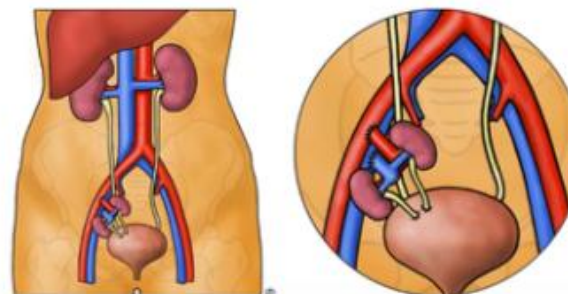


Figure 1 Implantation technique for en bloc kidneys. (Image courtesy Paul Brown).

Wijetunga I, Pandanaboyana S, Farid SG, Ecuver C, Lewington A, Hostert L, Attia M, Ahmad N. Neonatal kidney donation and transplantation: a realistic strategy for the treatment of end-stage renal disease. Arch Dis Child Fetal Neonatal Ed. 2014 Jun 27.

# CONCLUSIONS

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

# CONCLUSIONS

- q Largest single center experience in the UK for utilizing kidneys from donors under 2 years of age
- q Steady increase in our experience with EKT, including transplantation of kidneys from **neonatal** donors
- q 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

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