An analysis of reasons for exclusion of potential live kidney donors from the paediatric renal transplant program at Johannesburg Hospital

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Medicine in the branch of Paediatrics

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DECLARATION

I, Cecil Steven Levy declare that this research report is my own work. It is being submitted for the degree of Master of Medicine in Paediatrics in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

Signed on this 2nd day of November, 2008.

DEDICATION

To my wife for her continual love, care and encouragement, especially during this project

To my parents for all the love, guidance and support given to me throughout the years

To the children and staff of Ward 296 Johannesburg Hospital for giving me the honour of being involved in their lives

PUBLICATIONS AND PRESENTATIONS

1. Presented in part as an oral presentation entitled “An analysis of reasons for exclusion of potential live kidney donors from the paediatric renal transplant program at Johannesburg Hospital” at the 3rd African Paediatric Nephrology Association Congress. Cape Town, 16th-17th March 2006.

ABSTRACT

INTRODUCTION: Deceased donor organ shortage has made live donor (LD) programs essential. Many live donors are excluded.

OBJECTIVES:

1. To analyze a group of excluded donors to the paediatric LD program looking at exclusion rate, age, population group, relationship to recipient and reason for exclusion.
2. To compare the group of excluded paediatric LD program donors to a group of excluded adult LD program donors.

METHODS: A retrospective case-file review.

RESULTS: In the paediatric group, mothers were referred more commonly. The main reasons for exclusion were hypertension, obesity, viral infections and immunological incompatibility. Donors to adult recipients were excluded more frequently and withdrew consent more often.

CONCLUSION: Public health issues such as hypertension and obesity as well as the high incidence of HIV impact negatively on the LD kidney pool. Donors to paediatric recipients withdraw consent infrequently reassuring us that our selection of potential donors for evaluation is appropriate.

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1.0 INTRODUCTION

The number of adults and children reaching end stage renal disease (ESRD) and requiring renal transplantation is growing at an exponential rate (1) (2) and it is well known that kidney transplantation improves longevity and quality of life compared with dialysis therapy in subjects with ESRD. However, a serious problem is that the numbers of deceased donor (DD) allografts available for transplantation has changed little in the past 20 years, which has made for longer times on DD waiting lists worldwide (1). In fact, in South Africa the number of DD allografts falls far below the requirements as compared with worldwide statistics (Prof AM Meyers, personal communication).

1.1 The extent of the problem

In South Africa at present, there are essentially only two paediatric renal units in the public service performing a significant number of transplants each year. They are Johannesburg Hospital and Red Cross Children's Hospital in Cape Town. As a result, Johannesburg Hospital provides a service to a very large area, with patients being managed in our unit from as far away as Kwa-Zulu Natal, Limpopo, Free State and Mpumalanga as well as all children in ESRD from Gauteng.

The incidence and prevalence of ESRD in children in South Africa is not known. According to the 2001 Census, the population of Gauteng was approximately 8.8 million with approximately 2.8 million of the population children under the age of 19 years. The total population of all the provinces we serve is probably closer to 29.4 million with around 12.6 million children under the age of 19 years (3).

A national survey performed in Sweden reported a median annual incidence and prevalence of childhood severe chronic kidney disease (CKD) (Creatinine clearance (C_{Cr}) < 30 ml/min per 1.73 m^2) of 7.7 and 21 per million of the age-related population (MARP) respectively (4). Due to a lack of national registries, incidence and prevalence data from developing countries primarily originates as reports from major tertiary care referral centers, and the nature of the data depends on local referral practices and accessibility to hospital care (5). A 15-year review of admissions from a university teaching hospital in Nigeria estimated the median annual incidence of severe CKD to be 3.0 per MARP, with a prevalence of 15 patients per million children (6).

Based on the above figures we should be seeing anywhere between 36 to 90 new cases per year, but currently we only see around 10 to 12 new patients with ESRD per year and presumably many children with ESRD are not making it to our referral centre. Those that do get to Johannesburg for assessment face a shortage of dialysis facilities, and once on the transplant program, a long wait for a kidney, unless they are fortunate enough to have a

suitable and willing potential live donor. We have approximately forty children with ESRD awaiting renal transplantation at Johannesburg Hospital at any one time, some of whom have been waiting more than 3 years for a transplant. Many more adult patients languish on the transplant list waiting for their chance to receive a donor kidney.

1.2 Allograft source

In South Africa, the refusal rates of family consent to allow recovery of potential DD allografts in the vast majority of the population have made the shortage of DD organs untenable. For example, it has been previously observed that the concept of living kidney donation has been accepted by black South Africans, with 80% of living donors approached saying they would be prepared to donate a kidney. This is however not the case for DD donation, with only 37.5% of potential donors approached saying they would be prepared to donate a kidney after death (7). Our experience is that, over the years, only a handful of black families gave consent to kidney retrieval from a DD when faced with the challenge (Prof AM Meyers, personal communication). Factors cited which may affect organ donation in black South Africans include ignorance, misconception and cultural beliefs (7). The growing need for kidney transplantation, and the better outcomes provided by living donation, are focusing transplant centre efforts on increasing living donation (8). In South Africa, proactive live donor (LD) programs have become essential to allow patients with ESRD to have a chance at a transplant.

Donor allograft source is remarkably different in paediatric transplantation compared with adult transplantation. In paediatrics, the use of LD allografts has increased steadily from 42% in 1987 to 60% in recent reports from units in the developed world (9). Most of the allografts (83%) come from a parent (1). In adult transplantation LD allograft source is also increasing, though remains significantly lower than paediatric use (10).

The paediatric renal unit at this hospital also follows this trend, with increasing numbers of LD kidneys being used over the past 10 years as fewer DD kidneys are made available to it. In the period 1995-1999, 24% (19/79) of all paediatric transplants at this hospital were LD transplants as compared to the period 2000-2004 where 54% (32/59) were from living donors (11). What is important to note is that, although in 1995-1999 only 7% (3/41) of transplants in black children were from LD grafts compared to 42% (16/38) for white, Asian and mixed race recipients, in the period 2000-2004 this improved to 52% (17/33) for the black recipients compared to 58% (15/26) for white, Asian and mixed race recipients (11). It is therefore reasonable to say that, with proper counselling and encouragement, in our unit all population groups have accepted the idea of LD transplantation as an ideal.

LD transplants are associated with better outcomes in comparison with DD transplants due to a number of reasons, an important one being reduction of the time spent waiting for a transplant on dialysis (12). This trend has been noted in our unit too with actuarial 1-, 5- and 10-year graft survival being 88, 62 and 40% for LD grafts, and 80, 41 and 20% for DD

grafts (13). Using live donors also provides an important source of organs in an environment where demand for organs far exceeds supply.

A major problem is that many live donors who are referred for evaluation of feasibility to donate a kidney are turned down for various reasons and the recipients end up having to wait for a DD graft (14)(15). This problem is markedly compounded in our DD pool where up to 60-70% of potential donors are found to be unsuitable (Prof AM Meyers, personal communication).

1.3 Benefit and risk to the donor

The benefit to the donor is mainly psychological with a sense of increased self esteem, and the potential donor needs to carefully weigh up the decision to donate a kidney (16) (17) (18). Of course, the work up is extensive and the potential donor is appraised with a very critical eye. This implies that very often asymptomatic but potentially serious pathology is detected during the work up. Although this would exclude the donor from donating, it does do the donor a service in that they can then be referred on for appropriate management.

In the absence of medical contraindications, most centres consider the risk to the donor to be low and far outweighed by the benefits to both the recipient and the donor (16) (17) (18). Death as a result of donor nephrectomy is very uncommon (17), as are long term postoperative complications.

Donating a kidney for transplantation could potentially cause hypertension and renal insufficiency (19). Experimental data has demonstrated that although compensatory hypertrophy in the remaining kidney does take place minimizing the reduction in GFR (20) (21), maladaptive consequences for glomerular function, with sustained hyperfiltration and striking changes in renal morphology, occur in rats after reduction of renal mass (22). However, studies examining the question of long term renal function in human kidney donors have found that although creatinine clearances are reduced after nephrectomy (23) (24) (25), the overall consensus is that in long term follow-up of living donors, no evidence of progressive renal deterioration has been found (26). Results of a meta-analysis suggest that organ donation does not cause a progressive decline in renal function or increase in proteinuria, despite the reduction in renal mass being associated with an increased serum creatinine (19).

A number of studies have reported on the natural history of hypertension in patients who underwent unilateral nephrectomy. The results vary with some papers reporting little or no increased risk for developing hypertension when compared with the general population or

matched controls (24) (26) (27), and others reporting an increase in the incidence of subsequent hypertension especially in patients with risk factors (such as a strong family history of hypertension) before donation or who had borderline hypertension (28) (29) (30). In the meta-analysis mentioned above, it was shown that although there was a small increase in blood pressure after donation, it did not appear to be of sufficient magnitude to result in a diagnosis of hypertension. It was unclear whether this increment in blood pressure should discourage donation in patients with borderline hypertension (19).

In summary, the risk of later complications such as hypertension and significant decreased renal function appears to be small (19) (23) (24) (25) (26) (27) (31). Careful donor selection will reduce this risk still further, but the small possibility of potential complications post donation necessitates life-long close follow-up of donors. Unfortunately, due to various factors and in spite of vigorous education and counselling, our donor follow-up is less than ideal. We achieve excellent donor follow-up rates in only 30% of our donors and adequate follow-up rates in a further 10% of donors. This leaves around 60% of our donors lost to follow-up. Also of concern is that it has been noted that a significant proportion of our donors who do come for follow-up are being found to have developed hypertension (Prof AM Meyers, personal communication).

1.4 Donor evaluation

In our hospital the evaluation of the potential donor is carried out by a separate donor evaluation clinic managed by an adult nephrologist with no connection to the recipient. This puts the donor's well being first, preventing any conflict of interest which may arise should the donor be worked up by the recipient's doctors, and is in keeping with guidelines from other respected centres (32). The aim of the donor evaluation process is to exclude individuals who may be put at risk by donating a kidney. It should also ensure that the recipient is not compromised by being given a suboptimal graft, by acquiring an infection such as Human Immunodeficiency Virus (HIV) or viral hepatitis from the donor, or by having a malignancy transferred from donor to recipient, all of which have been previously described (33) (34) (35) (36) (37).

Donor evaluation guidelines have been developed to ensure that the benefits to the recipient far out way the risk to both donor and recipient (16). Donors are carefully informed of the inconveniences and short term risks of diagnostic procedures, the pain and discomfort of nephrectomy, and the potential socio-economic and psychological risks associated with kidney donation (16).

Potential donors under the age of 18 years are not considered as it is felt that they cannot give informed consent. This is in keeping with international norms and practice (15).

Due to the shortage of DD kidneys, one possible way to increase the number of available kidneys has been reduction of the minimum criteria for acceptance of a prospective organ by including donors over the age of 60 years (38). It is difficult to define an upper age limit for donors, with one survey showing 27% of centres having no age cut-off while 60% of centres have some cut-off between the ages of 55 and 75 years (15).

The problem with using older donors is that there is a well described rate of decline in creatinine clearance with advancing age (39), and although compensatory renal hypertrophy has been found to take place in donors up to the age of 74, the greatest changes in renal size are observed in donors under the age of 40 (21). These two factors, among others, may place the older donor at risk.

Short and long term graft survival rates have been reported to be similar for kidneys from younger compared with older living donors (40)(41)(42)(43), but other studies still report poorer long term graft survival in kidneys from donors over the age of 60 years (38). Reluctance to use kidneys of older donors has been based on histological changes found in the kidneys of elderly donors such as small vessel wall thickening, progressive glomerular sclerosis and tubular atrophy (44). When these grafts suffer hemodynamic changes, acute tubular necrosis, graft rejection, sepsis or injury from nephrotoxic drugs, the recovery might be incomplete and there may be a higher risk of poor graft function and shortened

graft survival rate (43). For the above reasons our policy is not to use potential live donors who are above the age of 55 years.

Once the donor has been counselled and reassured that they can withdraw from the work-up at any time, ABO testing is done to ensure that there is no ABO incompatibility between donor and recipient. Although a few transplants have been successfully performed across the ABO barrier using a more aggressive immunosuppressive protocol preoperatively and postoperatively (45), current recommendations are that ABO – incompatible transplants should generally not be performed (16). At present our unit would not refer a donor for evaluation should there be ABO incompatibility, in keeping with this guideline.

Contraindications to donation discovered during the course of a preliminary medical evaluation may save time, money and potentially adverse (physical and psychological) effects of a more extensive evaluation (16). The medical evaluation includes a history and physical examination with careful attention being paid to a history of hypertension, nephrolithiasis, proteinuria, haematuria, oedema or renal parenchymal infection (16).

A history of established hypertension or renal disease may preclude the use of the donor and obviate further evaluation, and similarly, a history of multiple cardiovascular risk factors, diabetes mellitus, malignancy or systemic disease with potential renal involvement may make further evaluation unnecessary (16). A family history of hypertension, renal disease and diabetes is also sought, and if significant, would require careful assessment before accepting that donor. Physical examination is aimed at detecting obesity and other surgical or anaesthetic risks, as well as finding evidence of hypertension, chronic infections, malignancy, chronic pulmonary and cardiovascular disease and chronic renal disease (16).

Once the donor is been judged to be a good candidate, further testing is carried out to assess the donor's cardiopulmonary capacity, renal function and immunological compatibility with the recipient, and an angiogram is performed to assess the renal vasculature.

1.5 Potential reasons for exclusion of a live donor

Hypertension is defined as a systolic blood pressure of 140 mm Hg or greater and/or a diastolic blood pressure of 90 mm Hg or greater in subjects who are not taking antihypertensive medication (46), and is reported as being one of the most common reasons for excluding a candidate before angiography (14). In a study entitled "Selection criteria for the evaluation of living related donors", Riehle *et al* reported that of 159

candidates, 91 were accepted and underwent nephrectomy, 33 were accepted but did not undergo nephrectomy and 35 were rejected. Of the 68 potential donors who were not used, 26.5% (18/68) were not used because of hypertension (14). Bia *et a*l reported that up to 64% of centres will exclude a donor taking an antihypertensive agent and 54% exclude those with persistent borderline hypertension (15). The balance of data seems to indicate that donating a kidney can worsen existing hypertension and that it is therefore best to exclude potential donors who have hypertension (16). The possibility of an increased risk for hypertension in at least some living donors requires that the long term follow-up of donors include blood pressure monitoring and treatment (16).

In the donor evaluation the role of 24 hour blood pressure monitoring versus multiple office measurements is unclear (16), and our donors are evaluated using both office measurements and ambulatory blood pressure measurement where indicated.

Obesity is steadily becoming the greatest health problem in the developed world and is defined as a body mass index (BMI) greater than 30 (47) (48). Obesity has numerous serious medical sequelae such as type 2 diabetes, the metabolic syndrome (insulin resistance and hyperinsulinaemia, dsylipidaemia, essential hypertension, type 2 diabetes and an increased risk of cardiovascular events), obstructive sleep apnoea and increased death rates from cancer (48) (49). Obese donors may provide the anaesthesiologist with a considerable challenge due to the effect of obesity on the upper airway, lung volumes,

cardiovascular system and drug handling (50). In addition, of importance to potential kidney donors is that obesity has been found to be a significant risk factor for the appearance of proteinuria and progressive renal failure after unilateral nephrectomy (51). Due to the above risk factors, 16% of transplant centres will exclude donors with moderate obesity (15) although in the study by Riehle *et al*, of the 68 potential donors who were not used, only 1/68 (1.5%) was not used because of obesity (14).

Smoking has been shown to predict the development of proteinuria in study subjects independent of hypertension and diabetes mellitus (52), and the association of smoking and kidney damage in the healthy population has also been documented (53). In the survey by Bia *et al* referred to above, 16% of transplant centres rejected donors with heavy cigarette smoking (15). Our centre does not specifically exclude donors who smoke but insists on smoking cessation if possible and lung function tests for all candidates. Poor lung function would exclude a donor from donating.

HIV has been transmitted from both infected deceased donors as well as from infected living related donors with the development of acquired immunodeficiency syndrome and ultimately death in the recipient (33) (34). For this reason, organ donor guidelines necessitate HIV infection in the donor to be a contraindication to organ donation (16) (54).

In addition to their effects on the liver such as hepatocellular carcinoma and cirrhosis, both hepatitis B and hepatitis C have been implicated in the pathogenesis of chronic glomerulonephritis (55) (56) (57). Given this risk to the donor, living kidney donation by an individual with chronic viral hepatitis is not justified (8). Also, not only is there a risk to the donor, but there is also a risk to the recipient. Transmission of hepatitis B and C from infected donors to recipients, with resultant development of post transplant liver disease, has been documented (35) (36) (58). In the study by Riehle *et al*, of the 68 potential donors who were not used, 3% (2/68) were not used due to chronic hepatitis (14). In our centre the policy was not to use a donor who is hepatitis B or hepatitis C positive. Recently however, as in some other units (58), we have begun to permit the use of kidneys from HBcAb (+), HBIgM (-), HBsAg (-) donors for immunized recipients.

Renal dysfunction in the donor is also an important reason for donor exclusion. Almost all centres (98%) working up potential kidney donors will perform a urinalysis, urine culture and renal angiogram on potential donors (15). A number of tests are used to assess glomerular filtration rate (GFR) such as serum creatinine, blood urea nitrogen and calculated creatinine clearance, but only 10% of centres use radio nucleotide scanning routinely (15). 58.8% of centres will exclude an otherwise healthy donor if the creatinine clearance is under 80 ml/min per 1.73 m^2, but other centres have a lower threshold for exclusion with 21% of centres accepting a GFR of more than 60 ml/min per 1.73 m^2 and 2.4% of centres accepting a GFR of more than 40 ml/min per 1.73 m^2 (15). Although some studies suggest that perhaps our current standards are too high (59), it is generally accepted that the donor's renal function should be normal after correction for age and gender (16).

In the study by Riehle *et al*, although some potential donors were turned down due to a variety of renal anatomy abnormalities detected on screening, none were turned down due to a low creatinine clearance (14).

Inadequate urine collection, diet and other factors may result in a low creatinine clearance rate in people with normal renal function, and so an alternative method for measuring GFR should be considered before excluding a potential donor because of a low GFR (8) (16). Our unit uses the Constable ^{51}Cr-EDTA isotopic plasma clearance technique which, like the other isotopic plasma clearance procedures, gives the best approximation to true GFR (8). We would exclude a potential donor if they have a GFR of less than 85 ml/min per 1.73 m^2 using the ^{51}CrDTPA scan.

The most frequently encountered anatomic variation in the kidney is that of multiple renal arteries, with 25% being unilateral and 6.5% bilateral in potential living kidney donors (60). The use of kidneys with multiple renal arteries from living related donors has been associated with increased risk to the allograft. Complications such as ureteric fistulae due to interference with the blood supply to the ureter during dissection of the inferior polar artery, and acute tubular necrosis and graft loss due to thrombosis or ligation of a polar artery have been reported (61).

However, Benedetti *et al*, analysing a combination of DD and LD transplants, found that kidney grafts with multiple arteries can be implanted with short and long term results equal to those with single arteries (62). They found no difference between short and long term graft outcomes based on the number of renal arteries and the technique used for reconstruction and anastomosis. Graft survival was excellent with multiple anastomoses and with multiple arteries converted to a single artery by bench reconstruction. Urologic complications did not increase, and no difference was found in the vascular complication rate between deceased donor and living related donor grafts (62).

Deceased donor kidney procurement using the *en bloc* technique has helped to decrease significantly accidental injury to polar arteries during donor nephrectomy (62), and kidneys from living donors with multiple renal arteries have been successfully engrafted by applying appropriate renovascular surgical techniques (60) (63). In the study by Riehle *et al*, there were no donors excluded due to multiple renal arteries (14). Our unit would discuss potential donors who have multiple renal arteries with both teams of surgeons and then decide on an individual basis which donors to accept.

Nephrolithiasis is at least a relative contraindication to living donor nephrectomy because of the future risk that recurrent stones, obstructions, and infections will injure the remaining kidney (16). Nephrolithiasis not only places the donor at risk, but cases of

inadvertent transplantation of a kidney with stones have been described with resultant hydronephrosis requiring surgical intervention (64) (65).

Lee *et al* followed up 50 patients with urolithiasis after unilateral nephrectomy, all of whom had a normal remaining kidney at the time of nephrectomy. Thirty percent had recurrent stones, two developed acute reversible anuria, and one had proteinuria and progressive renal failure 47 months after nephrectomy. Patients with metabolic stone disease had a greater recurrence rate (66).

Due to the continued formation of stones in a significant number of patients undergoing nephrectomy, and the associated risk of anuria, nephrectomy in patients with nephrolithiasis for the purpose of donation needs to be undertaken very carefully (8). A history of nephrolithiasis automatically eliminates a donor in 34% of centres, while 8% accept such donors if no stones are present and 48% accept them if no stones are present and metabolic studies are normal (15). In some guidelines, a history of stone formation is not considered to be an absolute contraindication if the donor has passed only one stone or has stone disease that has been inactive for 10 years, and if the nephrolithiasis is not currently present on radiographic studies (16).

To be certain that there is no risk for active stone disease in the future, it is recommended that the potential donor with inactive stone disease should be carefully screened for risk factors and metabolic abnormalities, and should such a donor be accepted, life long medical follow up should include periodic risk assessment and medical treatment to minimize risks that are subsequently discovered. A general recommendation to avoid dehydration should also be given (16). In the study by Riehle *et al*, of the 68 potential donors who were not used, only 1/68 (1.5%) was not used because of renal calculi (14). In our unit, previous nephrolithiasis is a total contraindication to donation.

Women should not be evaluated while they are pregnant (16). Cytomegalovirus (CMV) is also screened for because transplantation of a kidney from a donor who is CMV positive to a recipient who is CMV negative is associated with a higher risk for CMV disease in the recipient (16) (67). Although CMV positivity will not preclude the use of that donor, prophylactic measures in the recipient may be warranted (16) (67). Screening for tuberculosis (TB) with a chest X-Ray (CXR) is also performed as there is some risk that TB may be transmitted by the transplanted kidney (68) (69). Active TB is a contraindication to donation (16).

Even if the potential donor has no medical reasons for exclusion as a potential donor, there are other reasons that a donor may not be used. For example, there may be a positive cross

match between donor and recipient. In the study by Riehle *et al*, of the 68 potential donors who were not used, 10.3% (7/68) were not used because of a positive cross match (14).

The recipient may receive a DD organ while the LD work up is in progress. This could happen if the recipient was placed on the DD list by mistake, or if the recipient was deliberately put on the DD list because the potential LD work up was delayed for some reason such as financial issues or donor weight loss problems. True mistakes are regrettable because they take a DD kidney, which could have been used by someone else, out of the donor pool. In the study by Riehle *et al*, of the 68 potential donors who were not used, 5.9% (4/68) were not used because the recipient received a DD organ (14).

Death of the recipient may occur while waiting for the donor to complete their work up. In the study by Riehle *et al*, of the 68 potential donors who were not used, 10.3% (7/68) were not used due to recipient disease or death (14). Quicker referral of potential donors, quicker work-ups, and better medical care of the recipient could all prevent this outcome.

Transfer of the recipient and donor to another hospital for the transplant may occur. In the study by Riehle *et al*, of the 68 potential donors who were not used, this occurred in 5.9% (4/68) (14). Although the recipient received a graft in the end, perhaps in this era of

cost consciousness, the transplanting hospital should consider reimbursement of some of the costs incurred during the work-up.

Withdrawal of consent is a particularly vexing problem as it results in a waste of time, effort and cost on the part of the evaluation unit, not to mention disappointment to the recipient. More careful selection and counselling of potential donors may reduce the incidence of withdrawal of consent. In the study by Riehle *et al*, of the 68 potential donors who were not used, 14.7% (10/68) were reported as refusing to donate after passing the initial screening process (14). This came to 6.2% (10/159) of all the referred donors in that study.

2.0 THE AIMS OF THE STUDY

2.1 To analyze a group of excluded paediatric LD program donors at Johannesburg Hospital

We set out to determine the rate of exclusion of potential donors to our paediatric LD transplant program and then to analyze a group of excluded potential live donors. We aimed to document their age, their relationship to the recipient, and the reason for their exclusion as donors. We also set out to document and analyze any differences between the different population groups. This was done with a view to streamlining the referral of potential donors. We hoped to generate data which would give us direction on whether or not, in the light of the severe shortage of donor organs, some of our exclusion criteria are too strict and perhaps could be relaxed.

2.2 To compare the group of excluded paediatric LD program donors with a group of excluded adult LD program donors

We aimed to compare our data on excluded paediatric LD program donors to research done previously by Meyers *et al* on excluded donors to the adult LD program at our hospital (70). We aimed to see if there were any differences in their ages, rates of exclusion and reasons for exclusion. We theorised that there would be considerably fewer reasons to exclude potential paediatric LD program donors in comparison to the adult group. This notion was backed by the following postulates:

1. The donors would be younger and therefore generally fitter than their adult counterparts.

2. There would be less obesity in a younger age group of donors.

3. Most importantly there would be less hypertension, especially borderline hypertension. This is because in the black adult recipients, the prevalence of ESRF due to essential familial hypertension is about 60%. The potential donors to these adult recipients may have inherited the same genetic predisposition for hypertension.

4. We also postulated that, in the paediatric donor population, the prevalence of hepatitis B and C and HIV may be lower.

5. Finally, we thought that the withdrawal of permission, which was frequently found in the adult donors, would be lower in the paediatric donors.

If the above postulates were proven as true, we would be much more comfortable pushing for a proactive paediatric LD program than perhaps an adult program. This is particularly so remembering the phrase in the Hippocratic Oath “Non Nocere”. There are many pre-eminent nephrologists in the world who still feel that LD transplantation is, nearly always, difficult to justify (Prof B Brenner, personal communication with Prof AM Meyers).

3.0 MATERIALS AND METHODS

3.1 Donor evaluation at the Johannesburg Hospital

The recipients are managed by the paediatric renal unit at the Johannesburg Hospital. After a careful interview with the attending paediatrician, the paediatric unit senior professional nurse and the paediatric unit social-worker, a volunteer from the family is accepted for evaluation. ABO testing is performed by the paediatric unit on the potential donor, and the donor is then referred on to the donor evaluation clinic if they are compatible with the recipient. The donor must be between the ages of 18 and 55 years.

The history, physical examination and further explanation of the procedures, risks and potential outcomes of the work-up and donation are performed by a nephrologist who manages the transplant donor clinic. Ambulatory blood pressure monitoring is performed where indicated and an assessment for the metabolic syndrome is performed on obese patients. Standard blood tests are performed, namely a full blood count with differential and platelets, a urea, creatinine and electrolytes, liver function tests, fasting lipogram and blood sugar, thyroid function tests and HIV, CMV and Hepatitis B and C serology. Iron studies are done on all women and iron replacement therapy given when required. A 24 hour urine collection is collected for creatinine clearance calculation and protein and micro-albumin excretion measurement. Urine is also sent for microscopy, culture and sensitivity testing.

A chest X-Ray, renal ultrasound, pulmonary function test when required and cardiology assessment are done by the respective specialist clinics and if all of the above are normal, a Constable ^{51}CrDTPA scan is performed to assess GFR. Formal human leukocyte antigen (HLA) testing of the donor and recipient is performed, and a donor specific blood transfusion (DST) is given to each recipient after which a ^{51}Cr release assay test is done to detect potential recipient sensitisation. Recently DST has been abandoned except in specific cases. CT Subtraction Angiography is then done to look for multiple renal vessels, with delayed films to assess drainage of the renal systems. The surgeons on both the donor and recipient teams review the vessel anatomy.

3.2 Reasons for exclusion of a potential donor

1. A history of donor hypertension, renal insufficiency or renal surgery, nephrolithiasis, cancer, co-existing diabetes, significant heart disease, chronic lung disease or drug abuse would be regarded as contraindications for donating.
2. A family history of renal disease and diabetes may, after extensive testing, preclude the use of that donor.
3. The presence of hypertension. Hypertension is defined as a systolic blood pressure of 140 mm Hg or greater and/or a diastolic blood pressure of 90 mm Hg or greater in subjects who are not taking antihypertensive medication (46), and is screened for by manual office measured blood pressure using a correct sized cuff and a sphygmomanometer on three separate occasions. More recently ambulatory blood pressure monitoring has been done using a Dynamap device when required.
4. The presence of obesity. Obesity is defined as a BMI greater than 30 (47) assessed using a calibrated scale and stadiometer.
5. The presence of HIV, Hepatitis B and/or Hepatitis C.
6. The presence of diabetes mellitus, ischemic heart disease, pulmonary dysfunction, malignancy or any other chronic disease.
7. The history or presence of renal calculi.
8. The presence of immunological cross reactivity between donor and recipient using a ^{51}Cr release assay.
9. A GFR of less than 85 ml/min per 1.73 m^2 using a Constable $^{51}CrDTPA$ scan.
10. The presence of more than two renal arteries bilaterally.
11. The presence of psychological problems.
12. Donor ages less than 18 years or above 55 years.

3.3 Study method

A retrospective case file review was conducted looking at all data of potential donors excluded from our paediatric LD program from January 1989 to December 2004.

Data was collected from the files on the following parameters:

1. Donor hospital number
2. Donor age
3. Donor sex
4. Donor race
5. Donor relationship to the recipient viz. father, mother, other (sibling, other relative, non related live donor)
6. The main exclusion criterion e.g. obesity, hypertension, concomitant renal dysfunction, congenital anatomical abnormalities of the renal system or renal vessels, systemic disease, psychosocial issues such as withdrawal of consent by the donor, HIV, other viruses

Data was entered directly into a Microsoft Excel spreadsheet for storage and analysis. See the attached data capture sheet (APPENDIX A).

All files of excluded potential donors are held by the unit which assesses these patients and were easily accessible. These files are kept in a locked room in the adult renal department with access restricted to the senior professional nurse in charge and the head of the assessment clinic.

We also compared our data to similar research done previously on excluded adult LD program donors (70).

3.4 Ethics

Access to files and data collection was limited to the investigator and strict levels of confidentiality were adhered to at all times. At no point was it necessary to identify a subject in any way in the final paper, and in the data collection, a unique study number was assigned to each participant in order to maintain patient confidentiality.

Ethics approval was obtained from the ethics committee of the University of the Witwatersrand (Reference number: M050940).

3.5 Statistical analysis

Statistical analysis was done using the statistical package Stata Release 8.0 statistical software and advice was obtained from a statistician.

The Student's *t* test was used to compare the ages of the different groups.

Comparisons of rates of exclusion, rates of referral of different relatives and reasons for exclusion for the different groups were performed using the chi-square test where appropriate.

4.0 RESULTS

4.1 The excluded paediatric LD program donors

4.1.1 Division of the cohort of excluded potential donors into two groups for analysis

Between January 1989 and December 2004 111 potential living donors to the paediatric LD program were evaluated. 51 were excluded and 60 were accepted. All 60 accepted donors donated their kidney to their recipient. All files of the 51 excluded donors were complete and available for analysis

The group of 51 excluded donors was made up of 22 black African subjects who, for the purposes of the study, were labelled the black donor group and 29 other race subjects who, for the purposes of the study, were labelled the other donor group. The group of 29 other race subjects was made up of 24 Caucasian, 3 Asian and 2 mixed race excluded donors.

Because the Asian and mixed race groups were felt to be similar to the Caucasian group in terms of their socio-economic standing and cultural beliefs, and because of the small numbers of Asian and mixed race excluded potential donors, these two groups were added to the group of Caucasian donors to create the group labelled other donors.

4.1.2 The rate of exclusion of the paediatric LD program donors

During the study period 111 potential living donors (PLD) to the paediatric LD program were evaluated. 51 were excluded from donating and 60 were accepted for donation giving an overall exclusion rate of 45.9% (51/111).

The group of 111 potential donors to paediatric recipients was made up of 41 black donors of which 22 were excluded and 70 other donors of which 29 were excluded, giving exclusion rates of 53.7% (22/41) and 41.4% (29/70) respectively for the two groups (see Table 4.1). There was no statistical difference found in the rate of exclusion between the black donor group and the other donor group using the chi-square test (p=0.21).

Table 4.1 Rate of exclusion of paediatric LD program donors

	Black donors	Other donors	Total
PLD	41	70	111
ALD	19	41	60
XLD	22	29	51
% excluded	53.7%	41.4%	45.9%

PLD = potential living donor

ALD = accepted living donor

XLD = excluded living donor

4.1.3 The age of the excluded paediatric LD program donors

The average age of the excluded potential donors to the paediatric LD program was 37.1 years (SD +/- 8.08) with the average age for the group of black donors being 36 years (SD +/- 7.4), and the average age of the group of other donors being 38 years (SD +/- 8.6). There was no statistical difference found between the ages of the two groups using the Student's *t* test.

4.1.4 The relationship of the potential donors to the paediatric recipients

When looking at the overall rates of referral for evaluation of the different relatives to the recipient, the recipients' mothers made up 51.4% (57/111) of the potential referrals compared to the recipients' fathers who made up 29.7% (33/111) and the other relatives who made up 18.9% (21/111) (see Table 4.2). There was no statistical difference found between the rates of referral of the different relatives for the two groups on chi-square testing (p=0.92).

Table 4.2 Rates of referral of the different relatives as potential paediatric LD program donors

	Black donors	Other donors	Total
Mothers	23 (56%)	34 (48.6%)	57 (51.4%)
Fathers	10 (24.4%)	23 (32.9%)	33 (29.7%)
Other relative	8 (19.6%)	13 (18.7%)	21 (18.9%)
Total	41 (100%)	70 (100%)	111 (100%)

4.1.5 The reasons for exclusion of paediatric LD program donors

The prevalence of hypertension in the group of potential donors to the paediatric LD program was 17% (7/41) in the group of black donors and 1.4% (1/70) in the group of other donors. The prevalence of HIV in our black potential donors was 12% (5/41) and all the HIV positive donors were female. There were no HIV positive donors in the other donor group. The prevalence of obesity in the black donors was 7.3% (3/41) and in the other donor group 5.7% (4/70). The three black donors who were obese were female. Three of the four other donors who were obese were male.

As can be seen in Table 4.3, the most common reason for exclusion of a potential paediatric LD program donor was hypertension (8/51) followed in equal numbers by viral infections (7/51), obesity (7/51) and immunological incompatibility (7/51). Then came renal dysfunction (4/51), multiple renal arteries (3/51), “mistake” (patient received a DD graft before the LD kidney could be used) (2/51), “withdrew” (the donor changed their mind and declined to donate a kidney) (1/51) and a host of miscellaneous reasons (see Table 4.4). The viral infections in the black donor group were made up of HIV in five cases and hepatitis B in one case, whereas the other donor group had one case of hepatitis B.

When comparing the excluded black donors to the excluded other donors, statistical analysis showed that the two groups differed significantly from each other especially with regards to hypertension (p=0.015), viral infections (p=0.034) and immunological incompatibility (p=0.015) using the chi-square test. (See Table 4.3)

Table 4.3 Reasons for exclusion of donors to black paediatric recipients (Black) VS donors to other paediatric recipients (Other)

Reason	**Black – n (%)**	**Other – n (%)**	**Total – n (%)**	**p**
Hypertension	**7 (31.8)**	**1 (3.5)**	**8 (15.7)**	**0.015**
Viral infections	**6 (27.3)**	**1 (3.5)**	**7 (13.7)**	**0.034**
Immunological	**0**	**7 (24.1)**	**7 (13.7)**	**0.015**
Obesity	3 (13.6)	4 (13.8)	7 (13.7)	NS
Renal dysfunction	1 (4.6)	3 (10.3)	4 (7.8)	NS
Multiple vessels	2 (9.1)	1 (3.4)	3 (5.9)	NS
Mistake	0	2 (6.9)	2 (3.9)	NS
Withdrew	0	1 (3.5)	1 (2.0)	NS
Miscellaneous	3 (13.6)	9 (31.0)	12 (23.6)	ND
Total	22 (100)	29 (100)	51 (100)	

NS = not significant

ND = not done

Immunological = positive cross match indicating immunological incompatibility

Mistake = the recipient received a DD graft before the LD kidney could be used

Withdrew = the donor changed their mind and declined to donate a kidney

Table 4.4 Reasons for exclusion of paediatric LD program donors - The miscellaneous group

Reason	Black Donors (n)	Other Donors (n)
Recipient death	3	1
Transfer to another unit	0	2
Recipient stabilised	0	1
Prior renal surgery	0	1
Renal calculi	0	1
Hypoplastic kidney	0	1
Connective tissue disease	0	1
Other source	0	1
Total	3	9

Transfer = transferring of the recipient to another unit before the transplant took place

Recipient stabilised = the recipient's renal function stabilised and he did not need a transplant by the end of the study period

Other source = the recipient received a kidney from a different live donor

4.2 Comparison of the excluded paediatric LD program donors with a cohort of excluded adult LD program donors

4.2.1 The age of the excluded paediatric LD program donors versus the age of the excluded adult LD program donors

The average age of the excluded paediatric LD program donors was 37.1 years (SD +/- 8.08) with the average age for the group of black donors being 36 years (SD +/- 7.4) and the average age of the group of other donors being 38 years (SD +/- 8.6). The average age of the excluded adult LD program donors was 36.5 years (SD +/- 9.14) with the average age for the black donors being 36.2 years (SD +/- 8.29) and the average age of the other donors being 36.7 years (SD +/- 9.91) (see Table 4.5). There was no statistical difference between the ages of the two groups using the Student's *t* test.

Table 4.5 The ages of the donors

	Paediatric donors	Adult donors
Age of all donors (yrs)	37.1 (SD +/- 8.08)	36.5 (SD +/- 9.14)
Age of black donors (yrs)	36.0 (SD +/- 7.39)	36.2 (SD +/- 8.29)
Age of other donors (yrs)	38.0 (SD +/- 8.6)	36.7 (SD +/- 9.91)

4.2.2 The rate of exclusion of the paediatric LD program donors versus the rate of exclusion of the adult LD program donors

111 potential living donors (PLD) to the paediatric LD program were evaluated of which 51 were excluded from donating and 60 were accepted for donation giving an overall exclusion rate of 45.9% (51/111). 381 potential living donors to the adult LD program were evaluated of which 226 were excluded from donating and 155 were accepted for donation giving an overall exclusion rate of 59.3% (226/381).

When comparing the rate of exclusion of the paediatric LD program donors versus the rate of exclusion of the adult LD program donors, we see that the paediatric LD program donors were excluded less often than the adult LD program donors. This was statistically significant using the chi-square test (p=0.012). (See Table 4.6)

Table 4.6 Rates of exclusion of the paediatric LD program donors (Paed) VS the adult LD program donors (Adult)

	Paed	Adult	Total
PLD	111	381	492
ALD	60	155	215
XLD	51	226	277
% excluded	45.9%	59.3%	56.3%

PLD = potential living donor

ALD = accepted living donor

XLD = excluded living donor

4.2.3 The reasons for exclusion of the paediatric LD program donors versus the reasons for exclusion of the adult LD program donors

As can be seen in Table 4.7, when comparing the paediatric LD program donors to the adult LD program donors, the two groups were the same for all the reasons of exclusion except for withdrawal of consent. The most common reasons for exclusion of a potential donor for both groups were hypertension, viral infections, obesity and immunological incompatibility.

The adult group withdrew consent to donation far more often than the paediatric group. This was statistically significant on Chi-square testing (p=0.009) (see Table 4.7). When looking at the prevalence of withdrawal of consent in the two groups of potential donors, we see that 9% (35/381) of all potential donors to the adult LD program withdrew consent to donation compared to 0.9% (1/111) of all potential donors to the paediatric LD program.

Table 4.7 Reasons for exclusion of paediatric LD program donors (Paed) VS reasons for exclusion of adult LD program donors (Adult)

Reason	**Paed – n (%)**	**Adult – n (%)**	**Total – n (%)**	**p**
Hypertension	8 (15.7)	26 (11.4)	34 (12.3)	NS
Viral infections	7 (13.7)	25 (11.1)	32 (11.6)	NS
Immunological	7 (13.7)	37 (16.4)	44 (15.9)	NS
Obesity	7 (13.7)	28 (12.4)	35 (12.6)	NS
Renal dysfunction	4 (7.8)	19 (8.4)	23 (8.4)	NS
Multiple vessels	3 (5.9)	18 (8.0)	21 (7.6)	NS
Mistake	2 (3.9)	16 (7.1)	18 (6.4)	NS
Withdrew	**1 (2.0)**	**35 (15.5)**	**36 (12.9)**	**0.009**
Miscellaneous	12 (23.6)	22 (9.7)	34 (12.3)	ND
Total	51 (100)	226	277	

NS = not significant

ND = not done

Immunological = positive cross match indicating immunological incompatibility

Mistake = the recipient received a DD graft before the LD kidney could be used

Withdrew = the donor changed their mind and declined to donate a kidney

5.0 DISCUSSION

Recognizing the challenges facing a LD program, we set out to determine the rate of exclusion of potential donors to our paediatric LD transplant program and then to analyze a group of excluded potential live donors. We aimed to document their age, their relationship to the recipient and the reason for their exclusion as donors. We also set out to document and analyze any differences between the different population groups. We also postulated that the group of donors to paediatric recipients would differ from a previously studied group of donors to adult recipients (70), and that these differences might help us to refine our criteria for donor acceptance and exclusion.

When examining the data with respect to the paediatric LD program donors, we found that even though there were different reasons for exclusion of potential donors from the different groups, there was no statistical difference found in the rate of exclusion between the black donor group and the other donor group (see Table 4.1). The overall exclusion rate for the potential donors in our study was 45.9% (51/111). This was similar to that reported by Riehle *et al* where, of 159 potential donor candidates, 68 were not used giving an overall exclusion rate of 42% (68/159) (14).

We found that the recipients' mothers were referred much more commonly for evaluation than the recipients' fathers or other relatives. As can be seen in Table 4.2, mothers made up

51.4% (57/111) of the potential referrals compared to fathers who made up 29.7% (33/111) and the other relatives who made up 18.9% (21/111). There was no statistical difference in the referral rates of the different relatives between the two groups. We are not sure why there appears to be reduced referral rates for fathers compared to mothers. We could speculate that either the fathers were not around, or if they were, that they felt that as the main bread winners for the family they could not afford to take the risk presented by donation, albeit small. More research needs to be done on this matter.

As can be seen in Table 4.3, the main reasons for exclusion of the paediatric LD program donors were firstly hypertension followed in equal numbers by viral infections, obesity and immunological incompatibility. When comparing the black paediatric donor group to the other paediatric donor group for the reasons for exclusion of a potential donor (see Table 4.3), statistical analysis showed that the two groups differed significantly from each other especially with regards to hypertension ($p=0.015$) and viral infections ($p=0.034$) which were more common in the black donors, and immunological incompatibility ($p=0.015$) which was more common amongst the group of other donors. The viral infections in the black donor group were made up of HIV in five cases and hepatitis B in one case, whereas the other donor group had one case of hepatitis B and no cases of HIV. The rates of obesity were the same for the two groups.

As mentioned, our study found that the commonest reason for exclusion of a potential donor was hypertension with 15.7% (8/51) of all paediatric LD program donors excluded for this reason. In a similar study, Riehle *et al* reported that of 68 potential donors who were not used, 26.5% (18/68) were turned down because of hypertension (14).

The fact that our results indicated that hypertension was significantly more common in black donors was not surprising. We found a prevalence of 17% (7/41) amongst our group of black potential donors which was much more than the 1.4% (1/70) prevalence for the other group of potential donors. In South Africa in general, studies of the prevalence of hypertension have shown differing rates due the effects of different population groups and regions. Rates have been reported to be as varied as 12,7% in the rural Eastern Cape (71), 25% for rural Limpopo (72), and 55% in urban general practices where up to 50% of white patients and 59% of black patients were reported as being hypertensive (73). In a random sample of 13 802 subjects aged 15 years or older, of whom 76% were black, 13% of mixed ancestry, 8% white, and 3% Indian/Asiatic, the age-adjusted incidence of hypertension for this predominantly black South African population was 21% (females and males had equal rates). For those more than 65 years of age, 50% to 60% were hypertensive (74).

It must be remembered that our two groups of donors had mean ages of 36 years (SD +/- 7.4) and 38 years (SD +/- 8.6) for the black group and the other group respectively. The differences in the prevalence of hypertension between the two groups of excluded donors

probably reflects the fact that hypertension is more common in younger black people than in other race groups of the same age in South Africa.

With nearly half of our population still rural, and much of the African urban population now rapidly adopting Western lifestyle habits, it is likely that the prevalence rates will increase with time (74) Keeping the above in mind, and knowing that our follow-up rates are less than ideal, we feel that it would not be in the donor's best interests to lower our exclusion criteria for hypertension.

Obesity was found to be a common reason to exclude a potential donor in both groups of donors to paediatric recipients, accounting for 13.7% (7/51) of all excluded donors. In the study by Riehle's *et al*, of the 68 potential donors who were not used, only 1/68 (1.5%) was turned down because of obesity (14). The prevalence of obesity in our potential black donors was around 7.3% (3/41) and in the potential other donors it was 5.7% (4/70). Obesity is steadily becoming the greatest health problem in the developed world and has numerous serious medical sequelae (47) (48) (49). Obese donors may be at considerable surgical risk when undergoing nephrectomy and are also at risk for long term renal dysfunction post nephrectomy (50) (51).

The prevalence of obesity in South Africa varies between the different population groups and areas, with Puoane *et al* reporting rates of 6% and 18% for African and white males respectively and 31% and 22% for African and white females respectively (75). In that study there was a trend towards higher levels of obesity in the urban setting as compared with the non-urban setting, particularly for Africans (75).

The study also found that in South Africa, obesity in women seems to start at a young age, with 10% of women obese at the ages 15 to 24 years, and they therefore recommended that primary prevention of obesity must start at a young age, particularly for girls (75). In African women the highest rate of obesity was in urban women, and women with no education had lower BMIs than those with schooling, perhaps because they do more manual labour than their better educated counterparts (75).

In our study, the three black donors excluded due to obesity were female, and in the other group three out of the four donors excluded because of obesity were male. The numbers we are dealing with are small, and it is difficult to know if this picture was due to the female black donors and male other donors having difficulty losing weight for the transplant, or whether this was just a reflection of the prevalence of obesity in the different communities. More research needs to be done on this matter.

We try to get our potential donors to lose weight if they are a good match with the recipient, but often this goal is not achieved. Also, weight gain post nephrectomy is of concern and potential donors need to be made aware of this possibility and given the means to prevent it.

Viral infections, in particular HIV, were found to be an important cause of exclusion in the group of black donors to the paediatric LD program. In the study by Riehle *et al*, of the 68 potential donors who were not used, 3% (2/68) were not used due to chronic hepatitis and there were no HIV positive potential donors in their cohort (14).

HIV has been transmitted from both infected deceased donors as well as from infected living related donors with the development of the acquired immunodeficiency syndrome and ultimately death in the recipient (33) (34). For this reason organ donor guidelines necessitate HIV infection in the donor to be a contraindication to organ donation (16) (54).

The prevalence of HIV among our group of black potential donors was 12% (5/41) and all the HIV positive donors were female. This was in keeping with a comprehensive South African national community-based study which showed the estimated national prevalence of people living with HIV/AIDS to be at least 11.4%, although there was wide variation with regards to age, sex, race and location (76). Antenatal clinic prevalence was reported

as 24%. Both age, in particular being between 25 and 49 years, and being female, increased the likelihood of a person being HIV positive, with prevalence rates of 38.6%, 29.7% and 17.5% reported for African women between the ages of 25-29, 30-34 and 35-39 respectively (76). The report found that Africans had a higher prevalence of HIV (12.9%) than whites (6.2%) and that HIV prevalence was lower in rural areas and highest in urban informal areas (76).

As mentioned above, in the study by Riehle *et al* no potential donors were found to have HIV (14), but in our situation it is a sad fact that, for the foreseeable future, we will be encountering more and more potential donors who will be HIV positive. The impact of diagnosing HIV infection in a potential donor is more than just the potential recipient not having access to a kidney. It will also affect long term care issues which may arise in the event of illness or death of an HIV infected caregiver, not to mention the social stigma still carried by this disease. As with all severe chronic illnesses, great understanding and care needs to be given to the potential donor and the family who will now have to deal with this new burden. Luckily, access to antiretroviral drugs is becoming a reality for the average South African, and so the outlook for a diagnosis of HIV is not as bleak as it once was.

Immunological incompatibility occurred much more commonly as a reason for exclusion in the group of other donors compared to the group of black donors ($p=0.015$). In the study by Riehle *et al*, of the 68 potential donors who were not used, 10.3% (7/68) were not used

because of a positive cross match (14). In our study, 24.1% (7/29) of other donor group were excluded due to a positive cross match between the donor and the recipient as compared to none of the black donor group. This finding may have been due to increased referral rates of unrelated living donors in the other donor group but more research needs to done on this matter. If this is the case, this number can be expected to increase in the black donor group as our education of families on the need for LD transplantation improves.

When comparing the group of excluded paediatric LD program donors with the group of excluded adult LD program donors, we had postulated that the donors to the paediatric program would be younger and therefore fitter than the donors to the adult program. We felt that this would have resulted in the paediatric LD program donors having lower rates of exclusion due to hypertension, obesity and viral infections such as HIV. This was not found to be the case. There was no difference found between the two groups in terms of their ages (see Table 4.5) and hence it was not surprising that, when looking at the medical reasons for exclusion of the adult donors compared to the paediatric donors, we found the two groups were essentially the same (see Table 4.7).

However, we found a definite difference in the rate of exclusion of the paediatric donors compared to the adult donors. As can be seen in Table 4.6 the adult LD program donors were excluded significantly more frequently than the paediatric LD program donors

(p=0.012). When looking at the reason for this, we see in Table 4.7 that the only significant difference between the adult LD program group and the paediatric LD program group was in withdrawal of consent to donation. 15% (35/226) of excluded donors to the adult program were excluded due to withdrawal of consent compared with only 2% (1/51) of excluded donors to the paediatric program (p=0.009). In the study by Riehle *et al*, of the 68 potential donors who were not used, 14.7% (10/68) were not used because of withdrawal of consent (14).

In the group of donors to adult recipients, 9% (35/381) of all referred potential living donors were ultimately not used because they withdrew consent whereas in the group of donors to paediatric recipients less than 1% (1/111) of potential donors refused to donate a kidney. In the study by Riehle *et al*, 6.2% (10/159) of all potential donors were reported as refusing to donate after passing the initial screening process (14).

It is of concern that the rate of withdrawal of consent in the group of donors to the adult LD program was so high. Late withdrawal of consent implies the waste of a lot of time, resources and effort spent on working up the potential donor not to mention the delay in listing the recipient on the DD list and the disappointment to the recipient. The fact that potential donors to our paediatric LD program withdrew consent so infrequently reassures us that our selection and referral of potential donors for evaluation is appropriate.

We could speculate as to the reasons for the lower rates of withdrawal of the donors to the paediatric program. The most likely reason is that the parents and family of the recipient are more altruistically motivated to relieve the burden of ESRD placed on their child than a donor to an adult recipient would be. Perhaps it is due to feelings of guilt and pressure placed on the parents by their communities who may repeatedly enquire as to why the child has not yet been transplanted. It is also possible that there is an element of expected self-benefit on behalf of the parents. They may feel that it would be easier to care for their child once they have had a successful transplant compared to the effort involved in the rigours of ambulatory peritoneal dialysis or transporting the child to hospital for regular haemodialysis.

A study on motives for becoming a living donor looked at donors to adult recipients and found that a wish to help was the strongest motive, but almost as highly ranked were self-benefit due to the recipient's anticipated improved health, and identification with the recipient (77). A gain in self-benefit by the donation was a strong motive particularly for spouses and parents (77). More research needs to be done on this matter.

6.0 CONCLUSION

In conclusion, as noted in other studies, there are many reasons that a potential live kidney donor could be excluded (8) (14) (15) (16), and many of these reasons are lifestyle induced diseases such as hypertension and obesity. The opportunity to convert the potential donor to a healthier lifestyle (smoking cessation and weight reduction) should not be missed (12), but it is difficult for a paediatric nephrology unit to have an impact on these diseases which are perhaps more the domain of the public health specialists. We would add our voice to the strident calls for government involvement in the long term prevention of these conditions.

It is important to address the question of excluding potential donors with hypertension, borderline renal dysfunction and even obesity. As the need for organ transplantation grows, we must ensure that the risk to the donor is not overlooked during the tally of financial benefit to society and the quality of life to the recipient (8). Increasing donation should not mean increasing risk to the donor; instead it should mean minimal long-term risk to the donor while maintaining the huge benefit to the recipient and society (8). Our donor follow-up is not optimal for a number of reasons and the principle of ‘first do no harm’ should be foremost in our decision making process.

Another relevant issue is that of the HIV positive child in ESRF who has an HIV positive live potential donor. Transplanting HIV positive recipients from HIV negative donors is accepted practice in many units worldwide (78) (79) although in South Africa at present, mainly due to financial constraints, there is great reluctance to offer transplantation and even chronic dialysis to HIV positive individuals. Does the era of highly active antiretroviral therapy (HAART) imply that, if both the HIV infected parent and child respond well to HAART, perhaps we could use the parent's organ for the child? Would the attitude of the transplant community to HIV infection become similar to the cases of hepatitis and CMV where, as long as the recipient is immune or covered with antiviral agents (as in CMV), the transplant would take place (16) (58)? At present HIV-positive donors are not considered for HIV-infected recipients since there are concerns that this group of stable HIV-infected patients may be adversely affected by a different quasispecies of HIV (79). With the prevalence of HIV at epidemic proportions in South Africa, and more infections taking place each day, it is expected that this topic will be hotly debated in the future.

Newer and better immunosuppressive therapy has resulted in better outcomes for DD and LD transplants with relaxation of the criteria for suitability of renal failure candidates for transplantation. However, the strict criteria outlined for the selection of living renal donors must remain relatively inflexible if we are to ensure the safety and long-term health of the donor (14). Ongoing donor monitoring is necessary to enable us to document long-term outcome in our donors. This will give us the tools to allow us to continually re-evaluate our

exclusion criteria based on solid evidence from our own population of donors with their own unique demographic picture.

It was gratifying to see that although the rate of withdrawal of consent was high in the group of potential donors to the adult LD program at our hospital, it was almost non-existent in the group of donors to paediatric recipients. This bodes well for our transplant program as we can feel confident that our donor selection criteria are good.

Finally, it is important to note that in our unit the percentage of LD transplants performed have become similar for black and other recipients over the past few years (11). Our LD rates for black recipients (52%) are much higher than those reported for black recipients in a study from the USA which showed that family education could increase the LD transplant rate from 9.4% at 3 years post transplant evaluation to 16.6% (80). As mentioned before, it is reasonable to say that all our population groups have accepted the idea of LD transplantation as an ideal. In light of the decreasing availability and increasing demand for DD kidneys in South Africa this gives hope for the future of paediatric renal transplantation at Johannesburg Hospital.

APPENDIX A: The Data Capture Sheet

Subject number	Year	Age	Sex	Race	Relation	Reason
1	1989	37	female	black	Other	HIV Positive
2	1991	45	male	white	Female	Mistake
3	1992	45	male	white	Female	Recipient not ready
4	1993	43	female	black	Mother	HIV Positive
5	1993	44	male	black	Father	Hypertension
6	1993	36	female	black	Mother	Obesity
7	1993	32	male	white	Other	Renal surgery
8	1994	47	male	black	Father	Hepatitis B
9	1994	46	male	white	Other	Obesity
10	1994	34	female	white	Mother	Multiple vessels
11	1995	45	female	black	Mother	Hypertension
12	1995	26	female	black	Mother	Hypertension
13	1995	29	female	black	Mother	Recipient died
14	1996	36	male	white	Father	Obesity
15	1996	22	female	white	Mother	Recipient died
16	1997	41	female	white	Mother	Immunological
17	1997	31	female	white	Other	Other source
18	1997	46	female	white	Mother	Renal dysfunction
19	1998	41	male	Asian	Father	Immunological
20	1998	38	male	white	Other	Immunological
21	1998	49	male	white	Father	Renal Calculi
22	1999	31	male	Asian	Other	Withdrew consent
23	1999	39	male	black	Father	Recipient died
24	1999	52	female	white	Mother	Renal dysfunction
25	1999	37	female	white	Mother	Renal dysfunction

Subject number	Year	Age	Sex	Race	Relation	Reason
26	2000	32	male	white	Father	Mistake
27	2000	51	male	white	Other	Immunological
28	2000	28	male	white	Father	Immunological
29	2000	29	female	white	Mother	Obesity
30	2001	39	female	black	Mother	HIV Positive
31	2001	38	female	black	Mother	Hypertension
32	2001	30	male	black	Other	Hypertension
33	2001	35	female	black	Mother	Multiple vessels
34	2001	22	male	black	Other	Multiple vessels
35	2002	42	male	Asian	Father	Transfer
36	2002	37	female	black	Mother	Obesity
37	2002	52	female	white	Other	Hypertension
38	2002	37	female	white	Other	Immunological
39	2003	28	female	black	Mother	HIV Positive
40	2003	40	female	black	Mother	Obesity
41	2003	45	female	black	Mother	Recipient died
42	2003	23	female	white	Other	Immunological
43	2004	37	female	black	Mother	HIV Positive
44	2004	37	female	black	Mother	Hypertension
45	2004	20	male	black	Other	Hypertension
46	2004	39	female	black	Mother	Renal dysfunction
47	2004	42	female	coloured	Mother	Connective tissue disease
48	2004	33	female	coloured	Mother	Hepatitis B
49	2004	27	female	white	Mother	Hypoplastic Kidney
50	2004	32	male	white	Father	Obesity
51	2004	47	male	white	Father	Transfer

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