

# The Evaluation of Kidney Transplant Candidates and Potential Living Donors

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# Case #1

- 37 yo male, ESRD due to FSGS
- DD kidney transplant 5 years ago-  
primary nonfunction
- Second DD kidney transplant 3 years  
ago-massive proteinuria with recurrent  
FSGS 2 months post-transplant
- Back on dialysis 18 months later
- Wants another transplant
- Is he a candidate? Living donor or DD?

## Case #2

- 70 yo Asian male, neuropsychiatrist, works full time
- ESRD due to FSGS, BMI 20.4
- HTN, CABGx5 vessel 10 years ago, on PD for 3 months, blood transfusion+, PRA: 40%
- Prostate cancer: diagnosed 8 months ago, Gleason score 7, treated with cryoablation, most recent PSA < 0.1
- Two potential donors: 58 yo friend and 24 yo grandson
- Is he a candidate?, Can we transplant him now?

# Case #3

- 29 year old male, ESRD due to posterior urethral valves
- Kidney transplant from his mother at the age of 13- lasted 7 years
- DD kidney transplant at the age of 22- back on dialysis 14 months ago
- Multiple access surgeries- currently dialyzing via subclavian catheter
- Comes in for a 3<sup>rd</sup> transplant- 8 hospital admission in the last 12 months for cocaine overdose and misses his dialysis treatments 2-3 times per month

## Case #4

- 48 yo woman, ESRD due to IgA nephropathy, on dialysis
- Breast cancer treated with surgery and radiation 16 months ago
- Her sister wants to donate a kidney to her (6 antigen match), family wants surgery in 1 month
- Can we transplant her now?

# Case #5

- 31 year old woman, ESRD due to lupus
- Started dialysis 2 years ago
- Hospital admission 2 months ago for pericardial effusion and anemia, now has weight loss
- ANA: 1:320, anti-DNA: 1:1280, C3: 10, C4: 18
- She has 3 potential living donors
- Can we transplant her now?

# Recipient Evaluation

- The **best** treatment option for majority of patients with ESRD regardless of sex, race, age or cause of ESRD
  - Increase in life expectancy
  - Increase in quality of life
  - Decrease in healthcare costs
- No formal upper age limit
- The demand for kidney transplantation exceeds the supply of transplantable organs

# Recipient Evaluation

- Waiting times are quite long
- Patients and their families should be well informed concerning the procedure as well as immunosuppression-related side effects and complications
- Informed decision and active participant

# Recipient Evaluation

- Referral for transplant evaluation-from nephrologists (majority) or self-referral (rare)
- Basic information gathering: insurance coverage, **patient's medical history**, family history (including potential living donors) and laboratory results
- Initial interview and exam

# Recipient Evaluation

- Physical exam
- Chest x-ray, ECG-12 lead
- Dental evaluation\*
- Pap smear, mammogram
- Labs: CMP, CBC, serologies (HIV, hepatitis B and C, CMV, and RPR), HLA typing, PRA , PSA

# Recipient Evaluation

- Stress test (dobutamine echo or thallium)
- Colonoscopy
- Arterial Doppler of carotids or lower extremities
- CT abdomen/CT pelvis
- Toxicology screen
- Echocardiogram
- Pulmonary function test

# Physical Exam

- Dental health
- Carotid pulse/bruit
- Peripheral pulses, abdominal and femoral bruit
- Careful abdominal exam: previous surgeries/scars, organomegaly, large kidneys in patients with PKD
- Testicular exam, rectal exam
- Breast exam

# Medical History

- Recent diagnosis of cancer
- Active infection (catheter-related, endocarditis, osteomyelitis, etc.)
- Recent chest pain, MI, or arrhythmias
- Foot ulcers, GI bleeding
- Malnutrition, morbid obesity

# Medical History-Cancer

- Active or recent evidence of a malignancy, except for some skin cancer (basal cell): transplant is contraindicated
- Israel Penn International Transplant Tumor Registry (IPITTR)
- Waiting time: varies amongst different tumors
  - \*Breast Ca: at least 2 years-up to 5 years in certain tumors (regional lymph node involvement, bilateral disease, inflammatory histopathology)

## Recurrence Risk of Pre-existing Breast Cancer After Solid Organ Transplantation

Wait time	<2 yrs	2-5 yrs	>5 yrs
# Patients	10	30	51
% Recurrence	20	20	9.8
Died of disease	10	17	4

	Stage I (55)	Stage II (25)	Stage III (11)
Median wait (mo)	65.3	87.2	61.5
% Recurrence	5.4	8	63.6
% Died of disease	3.6	4	45
Survival (1,3,5 yrs)	95, 87, 73%	95, 88, 88%	100, 67, 14%

- High mortality with less than 5-year waiting period
- No transplantation in stage III breast cancer patients

*Buell JF et al, abstract #518, AST 2003*

# Risk of Post-Transplant Recurrence of Pre-Existing Malignancies

Risk group	Tumor type	Patients (n)	Patients treated >5 years prior to transplantation (%)	Overall Recurrence Risk (%)
Low	Incidental RCC <sup>1</sup>	72	0	1
	Uterine	26	50	4
	Testicular	43	58	5
	Cervical	93	54	6
	Thyroid	54	38	7
Moderate	Lymphoma	37	76	11
	Wilm's	78	33	13
	Prostate	33	34	18
	Colon	53	42	21
High	Breast	90	51	23
	Symptomatic RCC	222	22	27
	Bladder	55	22	29
	Sarcoma	17	24	29
	Skin	125	11	53

<sup>1</sup>Refers only to tumors incidentally discovered at time of bilateral nephrectomy pre- or concurrent with renal transplantation.

## Case #4

- 48 yo woman, ESRD due to IgA nephropathy, on dialysis
- H/o breast cancer treated with surgery and radiation 16 months ago
- Her sister is the donor (6 Ag match), family wants surgery in 1 month
- Waiting time: 5 years

# Medical History-Cancer

- Prostate Ca: At least 2 years disease-free period followed by negative blind random biopsies
- Renal cell Ca: 2-year waiting time for asymptomatic  $>2$  cm RCC, possibly shorter time  $<2$  cm, at least 5 years for symptomatic RCC (recurrence risk is still  $\sim 26\%$ )
- Colorectal Ca: waiting period of 5 years for all Duke's classifications

## Case #2

- 70 yo Asian male, neuropsychiatrist, works full time
- ESRD due to FSGS, BMI 20.4
- HTN, CABGx5 vessel 10 years ago, on PD for 3 months, blood transfusion+, PRA: 40%
- Prostate cancer: diagnosed 8 months ago, Gleason score 7, treated with cryoablation, most recent PSA < 0.1
- Two potential donors: 58 yo friend and 24 yo grandson
- Is he a candidate?, Can we transplant him now?

# Medical History-Infection-HIV

- Undetectable plasma HIV-1 RNA levels (viral load) for at least 3 months (kidney)
- CD4+ T-cell count of more than 200 cells/microL
- No history of opportunistic infections and neoplasms
- Maintained on highly active antiretroviral therapy (HAART)
- Increased incidence of acute rejection after transplantation
- Preliminary data are encouraging

# Medical History-Infection

## Hepatitis C

- The prevalence of the positive HCV antibody among HD patients in the US: average 9.3%, range: 6%-38% among dialysis centers
- Among the kidney transplant population, the prevalence of anti-HCV positivity range: 5%-46%, depending on the countries and/or centers
- Available data on kidney transplantation in this patient population suggest a survival advantage compared to remaining on hemodialysis

# Medical History-Infection

## Hepatitis C

- After transplantation, liver disease is more frequent in HCV-positive patients than in HCV-negative patients
- HCV-positive patients have a higher risk for developing proteinuria, diabetes and infections after transplantation
- Long-term patient and graft survival rates are lower in HCV-positive patients than in HCV-negative graft recipients

# Medical History-Infection

## Hepatitis C

- OPTN and SRTR database, Social Security Death Master File
- 75,629 HCV negative patients and 3,708 HCV positive patients, kidney transplant 1995-2004
- Increased mortality risk for HCV-positive recipients vs HCV-negative recipients, particularly among younger age groups
- The use of induction therapy was not associated with an increased mortality risk, for either lymphocyte depleting or nondepleting antibodies
- The use of MMF was associated with reduced mortality risk among HCV-positive recipients

*Luan FL, et al. Transplantation 2008*

# Medical History-Infection

## Hepatitis C

- All transplant candidates should be tested for HCV
- Serum transaminases may be normal even if the patient has advanced liver disease
- If HCV RNA is positive, proceed with liver biopsy
- Cirrhosis—consider combined liver/kidney transplant
- **HCV is not a contraindication for transplant**

# Medical History-Infection

## Tuberculosis (TB)

- The prevalence of TB in renal transplant recipients 0.4-1.7% in the US and up to 12% in developing countries
- Aggressive disease with dissemination
- Chest x-ray, PPD, h/o therapy (how long and which medication?)
- INH prophylaxis for at least 6 months in patients with +PPD, past history of TB, in patients from high-risk populations

# Medical History- Cardiovascular Risks

Mortality of transplant recipients from cardiovascular disease is 25 times higher than age/sex matched general population

Age, ESRD

Diabetes

Hypertension

Smoking

Hyperlipidemia

Obesity

# Cardiovascular Disease

- Pre-transplant CVD important risk factor for post-transplant CVD
- High risk patients (diabetics, older patients, patients with 2 or more risk factors) should have a cardiac stress test/cardiac cath before transplant
- Repeat screening 1-2 years during waiting, every year for diabetics

# Heart Disease-Evaluation

- 151 patients with IDDM, candidates for kidney transplantation without any chest pain, at University of Minnesota
- Routine arteriogram as part of the protocol
- 31 patients had significant stenosis
- 26/31 were randomized either to revascularization or medical treatment

*Manske CL et al, Lancet 340:998-1002, 1992*

# Heart Disease-Evaluation

- 10/13 medically managed and 2/13 revascularized patients had a cardiovascular end-point 8.4 months (median) after arteriogram
- Revascularization decreased the frequency of cardiac events in this patient population
- **Conclusion:** Diabetic renal transplant candidates should be screened for silent CAD before transplantation

*Manske CL et al, Lancet 340:998-1002, 1992*

# Screening Diabetic Transplant Candidates for CAD

- Coronary angiography is recommended:
  - All Caucasian type I diabetics over age 45
  - Type I diabetics younger than age 45 with EKG changes (ST-T segment), smoking history (>5 pack/year), diabetes for at least 25 years

Sensitivity: 97%, negative predictive value: 96%

*Manske CL et al, Kidney Int 44:617-621, 1993*

# Screening Asymptomatic Diabetic Patients for CAD

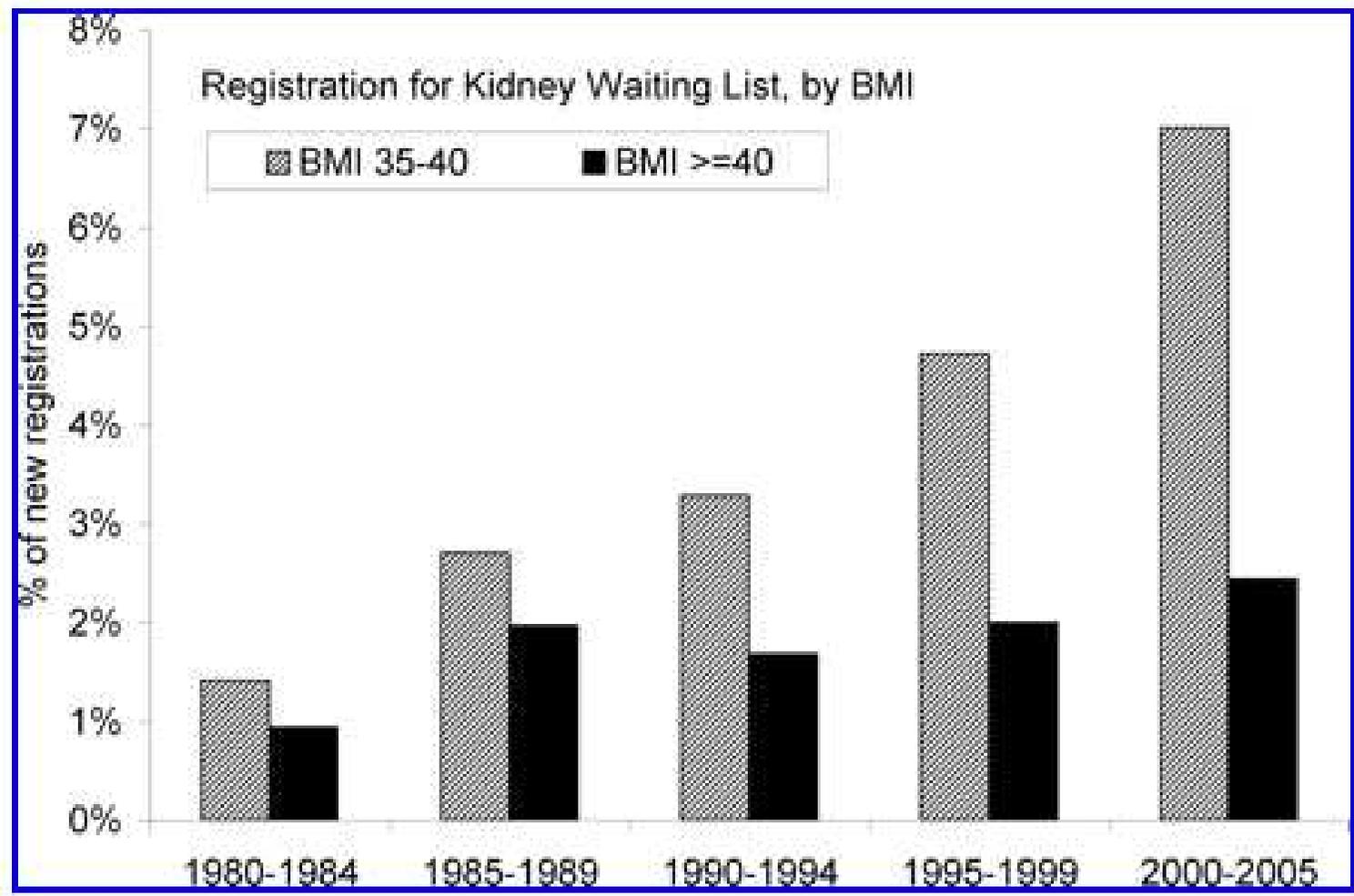
- 97 asymptomatic type 1 and 2 DM kidney and kidney-pancreas transplant candidates
- 33% of type 1 and 48% of type 2 DM patients had significant stenosis ( $\geq 70\%$ ) in 1 or more coronary arteries
- On multivariate logistic regression analysis, BMI  $>25$  was significantly associated with CAD (relative risk = 4.8,  $P = 0.002$ ), also age of the patient, and smoking history
- Young African American DM patients with no smoking history and a BMI  $\leq 25$  are at reduced risk, and invasive tests may not be necessary in this group

*Ramanathan V, Goral S, Transplantation 2005*

# Obesity and Transplantation

- The majority (60%) of subjects at time of transplantation currently are overweight or obese
- Between 1987 and 2001, the proportion of obese transplant recipients rose by 116% (grossly similar to that in the general population)
- The likelihood of being obese increased with age, female sex, NIDDM, black race, and the more recent the transplant year

*Friedman AN et al, Am J Kidney Dis 2003*



*Segev DL et al, JASN 2007*

# Obesity-Access to Kidney Transplantation

- 132,353 patients who were registered for kidney transplantation in the United States between 1995 and 2006
- Among all patients awaiting kidney transplantation, the likelihood of receiving a transplant decreased with increasing degree of obesity, categorized by ranges of BMI
- Similarly, the likelihood of being bypassed when an organ became available increased in a graded manner with category of obesity

*Segev DL et al, JASN 2007*

# Obesity and Transplantation

- 493 patients from Australia, 59 (12%) were obese (BMI 30 kg/m)
- More superficial wound breakdown (14% vs. 4%,  $P < 0.01$ ), complete wound dehiscence (3% vs. 0%,  $P < 0.01$ ), and wound infections (15% vs. 8%,  $P = 0.11$ )
- Similar graft survival and patient survival

*Johnson DW et al, Transplantation 2002*

# Obesity and Transplantation

- Analysis of paired kidneys: obesity (BMI>30) is not a risk factor for DGF, acute rejection, and 1-year graft survival, but decreased long-term graft survival

*Yamamoto S et al, Clin Transplant 2002*

- Obese transplant (BMI >35) recipients have similar outcomes to nonobese patients, more posttransplant diabetes, more delayed graft function and more acute rejection at 6 months

*Howard RJ et al, Transplantation 2002*

*Chang SH et al, Transplantation 2007*

# Obesity and Transplant Outcome

- UNOS database: 27,377 primary kidney-only transplants between 1997 and 1999
- Morbid obesity (BMI  $\geq 35$ ) was independently associated with increased risk of:
  - DGF ( $p < 0.001$ )
  - Prolonged hospitalization ( $p < 0.001$ )
  - Acute rejection ( $p = 0.006$ )
  - Decreased overall graft survival ( $p = 0.001$ )

*Gore JL, et al. Am J Transplant 2006*

# Obesity and Cardiac Risk after Kidney Transplantation

- BMI at the time of transplant and posttransplant cardiac risk
- Single center, 1102 recipients, transplanted 1991-2004
- High BMI: risk factor for posttransplant congestive heart failure and atrial fibrillation

# Medical History-Other Risks

- Disease activity (lupus, vasculitis)
- Urologic disease, cystic disease
- Pre-transplant native kidney nephrectomy
- GI diseases (peptic ulcer, gallstones, pancreatitis)
- Medications (interactions)
- Psychosocial issues, alcohol and substance abuse
- Recurrent diseases (FSGS, MPGN, HUS, lupus)
- Ethical issues (noncompliance with meds, multiple transplants, transplant after recurrence)

# Live Donor Evaluation

# Living Donors

- The annual number of available deceased donors will not resolve the ongoing shortage of organs
- The survival of a kidney transplanted from a live donor exceeds the results achieved from a deceased donor
- Success of live donor transplantation no longer necessitates the consideration of an HLA match unless there is possibility of a transplant from HLA identical sibling
- The survival rate of a kidney transplant from a genetically unrelated donor is excellent

# Living Donors

- In 1954: Requiring an identical twin for success
- During the 1980's: Selection of an HLA-matched family member
- Current: any person (irrespective of the HLA match) can be a donor if they are medically and psychosocially suitable

# Potential Live Donor Should Be:

- Competent, willing to donate
- Free of coercion
- Medically and psychosocially suitable
- Fully informed of the risks and benefits as a donor
- Fully informed of risks, benefits, and alternative treatment available to the recipient

# Potential Advantages of Live Donation

- Better short-term and long-term results
- More consistent early function and ease of management
- Avoidance of long wait for cadaveric transplant
- Less delayed graft function
- Less aggressive immunosuppressive regimens
- Surgery can be planned ahead (medical and personal convenience)
- Emotional gain to donor
- Helps relieve stress on national cadaver donor supply

# Potential Disadvantages of Live Donation

- Psychological stress to donor and family
- Inconvenience and risk of evaluation process (i.e. IV contrast)
- Operative mortality (0.03% or 1 in 2000 patients)
- Major perioperative complications (4.4%, range: 0.0 to 13.0%)
- Minor postoperative complications (up to 50%)
- Long-term morbidity
- Risk of traumatic injury to remaining kidney
- Risk for unrecognized chronic kidney disease

# An International Survey

- Sent out by Donor Nephrectomy Outcome Research (DONOR) Network investigators
- 203 health practitioners from 119 cities in 35 different countries responded to the survey
- Sixty-three percent of respondents nephrologists, 27% surgeons, 4% nurse practitioners and 6% other individuals involved in discussing risks with potential donors

*Housawi AA, et al. Nephrol Dial Transplant 2007*

**Table 2.** Long-term medical risks discussed with potential living kidney donors

	Proportion of health care providers <sup>a</sup> who discuss risk (with 95% confidence interval)
Hypertension	92 (87–95)%
Proteinuria	83 (77–87)%
Chronic kidney disease <sup>b</sup>	81 (75–86)%
Kidney failure requiring dialysis	86 (81–90)%
Premature cardiovascular disease	33 (27–40)%
Premature death not related to the surgery	34 (28–41)%

<sup>a</sup>Survey of 203 transplant professionals (predominantly nephrologists and surgeons) who were responsible for informing potential donors of risks prior to donation.

<sup>b</sup>A glomerular filtration rate <60 ml/min.

Proportion of health care providers<sup>a</sup> who believe the following medical risks are increased, compared to if a donor had elected not to have the nephrectomy

	Not increased	Increased
<b>Blood pressure</b>		
Higher systolic blood pressure than expected for age	44%	56%
Higher diastolic blood pressure than expected for age	50%	50%
Hypertension <sup>b</sup>	55%	45%
<b>Proteinuria</b>		
Higher 24-h urine protein than expected for age	31%	69%
Higher 24 h urine albumin than expected for age	31%	69%
Microalbuminuria (30–300 mg/24 h)	27%	73%
Proteinuria (> 300 mg/24 h)	44%	56%
<b>Reduced kidney function</b>		
GFR 60–80 ml/min	21%	79%
GFR < 60 ml/min	45%	55%
<b>Other</b>		
Cardiovascular disease	84%	16%
Death, not related to surgery	92%	8%

*Housawi AA, et al. Nephrol Dial Transplant 2007*

# Long-Term Consequences of Live Kidney Donation

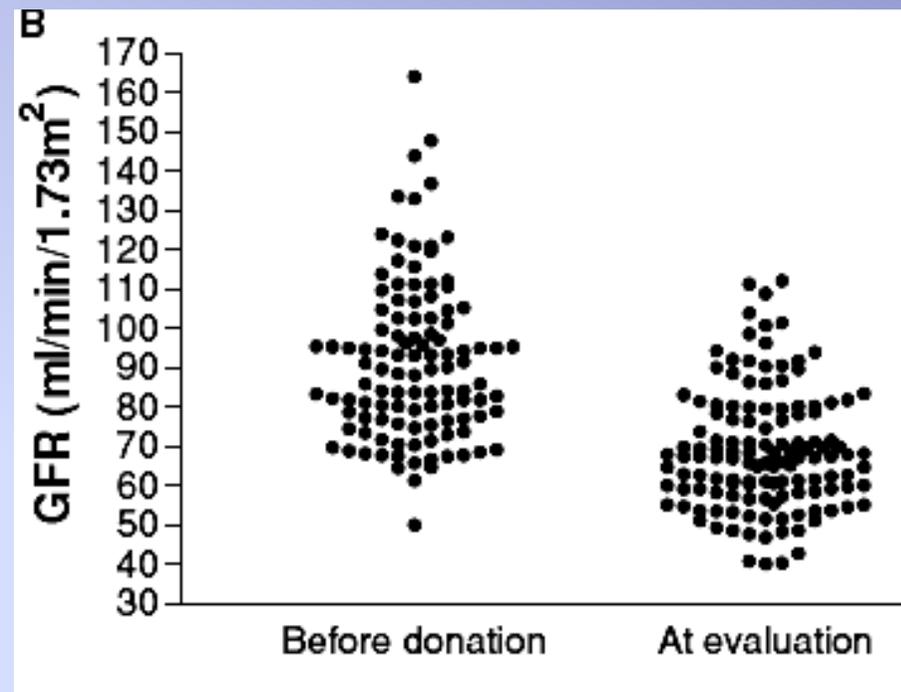
- Between 1973 and 2001, 152 living donor nephrectomies
- Seven of 152 donors had died from nonrenal diseases
- Of the remaining 145, data collection on 135 (93%) donors
- The mean time from nephrectomy to the current evaluation:  $11 \pm 7$  (range 1–28) years

**Table 3:** Renal function before and after kidney donation, determined by different methods

	Before donation	At evaluation	p-value*
Plasma creatinine ( $\mu\text{mol/L}$ )	$72.5 \pm 15.0^\dagger$	$85.7 \pm 16.8$	$<0.001$
Cystatin C (nmol/L)		$67.4 \pm 13.5$	
Cystatin C above normal (%)		23	
Measured creatinine clearance (mL/min/1.73 m <sup>2</sup> )	$119 \pm 30$	$99 \pm 30$	$<0.001$
Calculated GFR (MDRD 4) (mL/min/1.73 m <sup>2</sup> )	$92 \pm 20$	$71 \pm 15$	$<0.001$

\*Wilcoxon test.

†Mean  $\pm$  SD.



*Gossman J, et al. Am J Transplant 2005*

**Table 4:** Blood pressure before and after kidney donation

	Before donation	At evaluation	p-value*
Systolic blood pressure (mmHg)	125 ± 15 <sup>†</sup>	134 ± 19	<0.001
Diastolic blood pressure (mmHg)	79 ± 11	81 ± 9	n.s.
Hypertensive, %	7	30	<0.001 <sup>‡</sup>

**Table 6:** Proteinuria in kidney donors

Percentage with protein-excretion > 150 mg/day	56
Percentage with urinary albumin > 50 mg/L	10
Percentage with urinary $\alpha_1$ -microglobulin > 12 mg/L	7
Percentage with urinary IgG > 10 mg/L	2

*Gossman J, et al. Am J Transplant 2005*

# Long-Term Consequences of Live Kidney Donation

- A decrease in creatinine-clearance or GFR by 20–25%, but no correlation between residual renal function and blood pressure or the amount of proteinuria in this cohort
- Blood pressure in these donors were slightly higher but it remained lower than in the normal population
- An increase in urinary protein excretion, but pathological albuminuria was rare

# Long-term Morbidity

- Information on 464 live donors (60%)
- 20-37 years of follow-up
- 84 had died and 380 were alive; 3 in 84 had kidney failure; Of the 380 still alive, three had abnormal kidney function and two had undergone transplantation
- The rate of proteinuria and hypertension was similar to the age-matched general population

*Ramcharan T et al, Am J Transplant 2002*

# Long-Term Morbidity

- 73 patients who had unilateral nephrectomy
- Normal kidney function, no proteinuria at the time of surgery
- Reasons for nephrectomy: stones in 29, renal mass in 14, hydronephrosis in 11, and renal tuberculosis in 5 patients
- Mean follow-up:  $13.6 \pm 8.6$  years (18 months-35 years)
- 20 in 73 patients (27%) developed proteinuria/renal insufficiency

*Praga M, et al. Kidney International 2000*

**Table 1.** Clinical characteristics of patients at the time of unilateral nephrectomy

	Total (N = 73)	Patients who maintained normal renal function (Group I) (N = 53)	P value	Patients who later developed proteinuria/ renal insufficiency (Group II) (N = 20)
Age years	39.7 ± 14.7 (11–66)	39 ± 14 (11–65)	NS	41 ± 14 (11–66)
Gender	35 M; 38 F	24 M; 29 F	NS	11 M; 9 F
Mean arterial pressure mm Hg	94 ± 12 (70–140)	93 ± 12 (70–140)	NS	98 ± 12 (80–130)
Serum creatinine mg/dL	1 ± 0.1 (0.7–1.4)	0.9 ± 0.1 (0.7–1.3)	NS	1 ± 0.1 (0.9–1.4)
Proteinuria g/24 hours	0	0	NS	0
Body weight kg	68 ± 12 (40–99)	63.5 ± 8.9 (40–85)	<0.001	80.1 ± 12.1 (53–99)
Body mass index kg/m <sup>2</sup>	26.2 ± 5.3 (18–41.4)	24.3 ± 3.7 (18–34)	<0.001	31.6 ± 5.6 (22–41.4)

In 14 obese patients (BMI>30 at the time of nephrectomy), 13 (92%) developed proteinuria/renal insufficiency.

*Praga M, et al. Kidney International 2000*

# Long-term Morbidity

- Organ Procurement and Transplantation Network (OPTN) database
- A total of 56 previous living donors in 47,996 subsequently listed for cadaveric kidney transplantation (0.04%); 43 have received transplants; 36 currently have functioning grafts; One died after transplantation; Two candidates died while waiting
- 1999 adjusted incident rate for ESRD in the general U.S. population: 315 per million population, or 0.03%

*Ellison MD et al, Transplantation 2002*

# Proteinuria and Reduced Kidney Function in Living Kidney Donors- A Meta-Analysis

- Forty-eight studies from 27 countries followed a total of 5048 donors
- Follow-up: average of 7 years (median 6, range 1–25 years)
- Published from 1973 to 2005
- 21% prospectively followed donors in time
- Four studies described the characteristics of donors lost to follow-up

*Garg AX, et al. Kidney Int 2006*

24 h urine protein

Source*	Donors, post-donation		Controls		24 h urine protein Mean difference (mg/day) 95% CI
	Years after donation,	24 h urine Protein (mg/day)	24 h urine Protein (mg/day)	24 h urine Protein (mg/day)	
	Mean (range)	N mean (s.d.)	N mean (s.d.)		
D'Almeida <i>et al.</i> <sup>45</sup>	7 (1–14)	59 151 (125)	28 96 (116)		54 (1, 108)
Williams <i>et al.</i> <sup>58</sup>	13 (10–18)	37 115 (135)	17 31 (125)		84 (10, 157)
Mathillas <i>et al.</i> <sup>60</sup>	15 (10–20)	33 306 (320)	14 212 (255)		94 (–79, 267)
Pooled estimate		129 147 (22)	59 83 (30)		66 (24, 108)

- The average 24 h urine protein was 154mg/day and the average GFR was 86 ml/min
- Kidney donation resulted in small increases in urinary albumin, which increased with the time after donation

# Proteinuria and Reduced Kidney Function in Living Kidney Donors- A Meta-Analysis

- Ten years after nephrectomy, donors had a GFR that was 10 ml/min lower compared to controls
- 12% of donors developed a GFR less than 60 ml/min during follow-up
- However, after the initial decrement in GFR from the nephrectomy, there was no evidence of an accelerated loss in GFR over that anticipated with normal aging
- The pooled incidence of proteinuria: 12%

# Cardiovascular Disease and Hypertension Risk in Living Kidney Donors

- A retrospective cohort from Ontario, Canada between the years 1993 and 2005
- 1278 living donors and 6359 healthy adults as controls
- Follow-up: a mean of 6.2 years (range, 1-13 years) after donation
- There was no significant difference in death or cardiovascular events between donors and controls (1.3% vs. 1.7)
- Donors were more frequently diagnosed with hypertension than controls (16.3% vs. 11.9) but were also seen more often by their primary care physicians

*Yasuda, et al for the DONOR Network, Transplantation 2008*

# Donor Evaluation

- Live kidney donor **must** receive a complete medical and psychosocial evaluation
- Blood typing: often the first test, relatively inexpensive
- Initial cross-match
- Preliminary medical evaluation

# Donor Evaluation

- Complete history (\*hereditary dz) and physical exam
- Labs (routine, serologies, OGTT for diabetic families)
- UA, urine culture, pregnancy test
- 24 hour urine for protein and creatinine
- GFR measurement (glofil-ideal)
- Chest x-ray, ECG, exercise stress test for patients older than 50 years of age
- CT angio or MRA of renal arteries
- Psychosocial evaluation
- Repeat crossmatch before transplantation

# Hereditary Diseases

- Alport's syndrome
- Diabetes
- Polycystic kidney disease
- FSGS
- IgA nephropathy
- Hypertension
- HUS, SLE, and cystinosis

# Amsterdam Forum Guidelines

- A **GFR**<80 ml/min or 2 SD below normal (based on age, gender, and BSA corrected to 1.73 per m<sup>2</sup>) generally preclude donation
- Patients with a **BP**>140/90 mmHg by ABPM are generally not acceptable as donors
- Patients with a **BMI**>35 kg/m<sup>2</sup> should be discouraged from donating
- **Dyslipidemia** alone does not exclude kidney donation (Keep an eye on “Metabolic Syndrome”)

# Amsterdam Forum Guidelines

- A 24 h urine **protein** of >300 mg is a contraindication to donation
- Individuals with a history of **diabetes** or fasting blood glucose  $\geq 126$  mg/dl (7.0 mmol/l) on at least two occasions (or 2 h glucose with OGTT  $\geq 200$  mg/dl (11.1 mmol/l)) should not donate

# Hematuria-Prospective Kidney Donors

- 512 consecutive prospective donors, 14 (2.7%) continued to have asymptomatic, microscopic hematuria over 1 month
- If the medical history, physical examination, and computerized tomographic angiography were unremarkable, and if they still wished to donate, a kidney biopsy was performed
- In two prospective donors, hematuria resolved after treatment for urinary tract infection
- Two others declined donation and were referred to their primary care provider

*Koushik R, et al. Transplantation 2005*

# Hematuria-Pro prospective Kidney Donors

- Kidney biopsy in the remaining 10 showed: two normal; 4 thin basement membrane nephropathy (TBMN); one nonhomogeneous basement membrane abnormalities; one IgA nephropathy, one patient with 7 of 30 glomeruli globally sclerotic; and one TBMN and early hypertensive changes without systemic HTN
- Only 4 of the 10 who underwent kidney biopsy donated (two normal, two TBMN).  
*Koushik R, et al. Transplantation 2005*

**Persistent Microscopic Hematuria**  
Two or more positive dipstick urine tests on separate occasions over at least one-month period



<b>Detailed family history</b>	<b>Need to undergo</b> for TBMN, Alport's syndrome etc
<b>Urine culture</b>	to rule out infection
<b>24 hour urine collection</b>	to estimate protein, calcium, urate etc
<b>Cytology</b>	to look for malignancy
<b>Cystoscopy</b>	
<b>Renal imaging:</b>	
<b>CT-Renal angiogram</b>	to look for Nephrolithiasis, urothelial cancer
<b>(or)</b>	and also to assess anatomy of renal vasculature
<b>Intravenous Pyelography</b>	



If no urological cause found, then **Counseling** and **option for deferring donation**

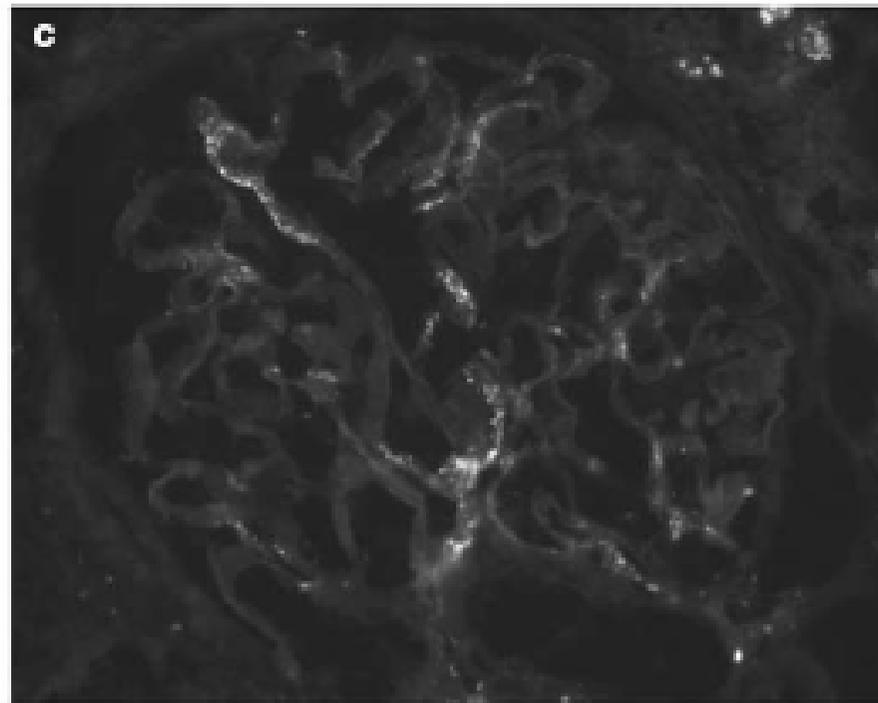
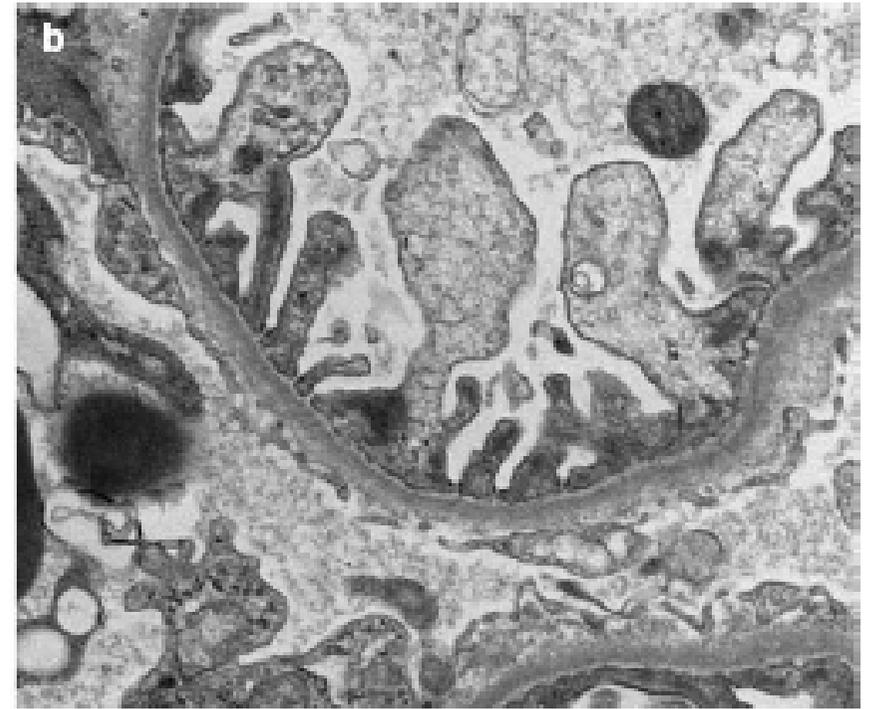
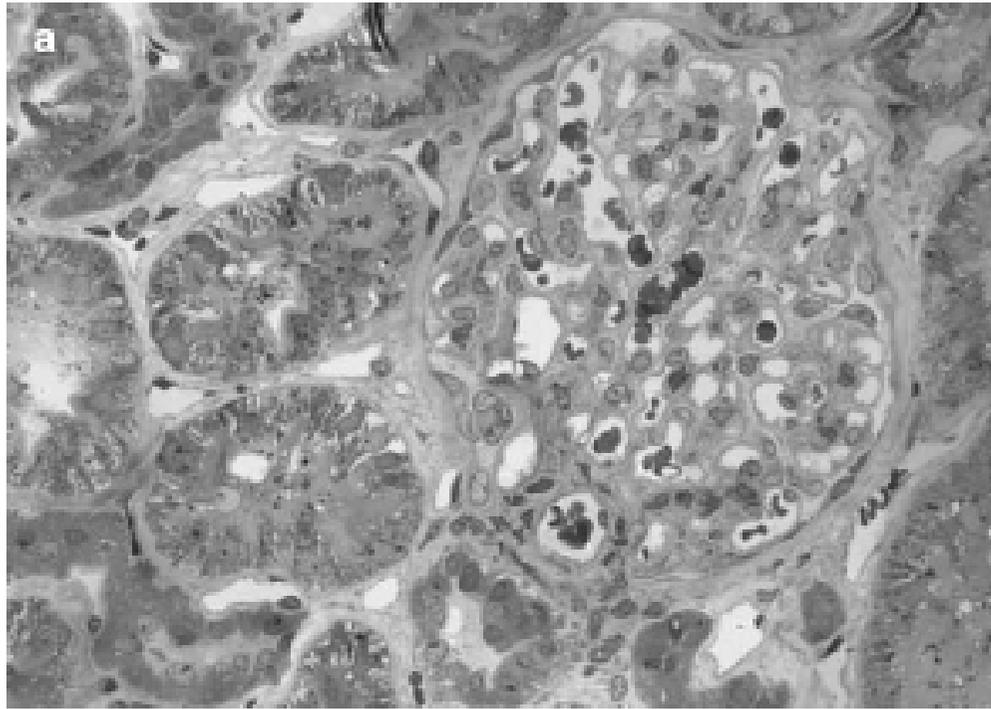


Deferred donation  
Further follow-up with PCP

For those willing to undergo further evaluation  
**Renal Biopsy should be performed**

# Causes of Persistent Microscopic Hematuria

- **Glomerular** bleeding (common causes, not associated with proteinuria or casts)
  - Thin basement membrane nephropathy (TBMN)
  - Alport Syndrome (early stage) or carrier state
  - IgA nephropathy



# Causes of Persistent Microscopic Hematuria

- **Extraglomerular** bleeding
  - Stone disease
  - Hemoglobinopathy (SS/SA hemoglobin)
  - Polycystic kidney disease
  - Benign prostatic hyperplasia (elderly donors)
  - Malignancy (bladder, kidney, prostate)
  - Arteriovenous malformations and fistulas
  - Schistosomiasis (in endemic areas)
  - Hypercalciuria, hyperuricosuria, etc.

# Amsterdam Forum Guidelines

- Asymptomatic potential donor+history of a **single stone** may be suitable if:
  - No hypercalcuria, hyperuricemia, or metabolic acidosis
  - No cystinuria or hyperoxaluria
  - No urinary tract infection
  - No evidence of multiple stones or nephrocalcinosis on CT scan

# Amsterdam Forum Guidelines

- **Stone** formers who should not donate are:
  - Nephrocalcinosis on X ray or bilateral stone disease
  - Stone types with high recurrence rates, and are difficult to prevent

# Amsterdam Forum Guidelines

- A prior history of the following **malignancies** usually excludes live kidney donation:
  - Melanoma
  - Testicular cancer
  - Renal cell carcinoma
  - Choriocarcinoma
  - Hematological malignancy
  - Bronchial cancer
  - Breast cancer
  - Monoclonal gammopathy

# Amsterdam Forum Guidelines

## Cardiovascular Risk Assessment

- The clinical predictors of an **increased perioperative risk** (for non-cardiac surgery) by the American College of Cardiology /American Hospital Association standards fall into three categories: major, intermediate, and minor
- **Major predictors:** unstable coronary syndromes, decompensated heart failure, significant arrhythmias and severe valvular disease-contraindications to live kidney donation

# Amsterdam Forum Guidelines

## Cardiovascular Risk Assessment

- Most of the **intermediate predictors**: mild angina, previous myocardial infarction, compensated or prior heart failure, and diabetes mellitus-contraindications to donation
- **Minor predictors**: older age, abnormal ECG, rhythm other than sinus, low cardiac functional capacity, history of stroke, or uncontrolled hypertension-warrant individual consideration

# Psychosocial Evaluation of Living Kidney donors

- Sociodemographic history and current status
- Capacity to comprehend information
- Psychological status
- Relationship with transplant candidate
- Rationale and reasons for volunteering to donate
- Knowledge, understanding, and preparing for donation
- Social supports
- Financial status and suitability

# Donor Evaluation-Actual Cases

- Microscopic hematuria and renal mass (renal cell carcinoma)
- Unknown pregnancy
- Significant bilateral hydronephrosis
- Horseshoe kidney
- Unrecognized hypertension
- Slightly elevated liver enzymes, + HCV (previously unknown)
- Fibromuscular dysplasia
- EF < 20% on ECHO
- Proteinuria: kidney biopsy IgA nephropathy



# The Impact of BMI on Renal Transplant Outcomes

*Meier-Kriesche HU et al, Transplantation 2003*

**TABLE 1. Cox proportional hazard model for graft loss by categorized body mass index**

BMI (kg/m <sup>2</sup> )	RR	95% CI	P
<18	1.213	1.110–1.326	<0.001
18–20	1.114	1.044–1.189	0.001
20–22	1.034	0.976–1.094	0.257
22–24	0.963	0.912–1.017	0.117
24–26	1.000	-Reference-	
26–28	1.071	1.008–1.136	0.026
28–30	1.073	1.004–1.140	0.047
30–32	1.181	1.098–1.271	<0.001
32–34	1.151	1.055–1.257	0.002
34–36	1.205	1.084–1.339	0.001
>36	1.385	1.300–1.551	<0.001

# Polycystic Kidney Disease

- Potential donor >30 years of age, negative ultrasound, CT or MRI: safe to donate
- Suspected PKD with ultrasound: two or more cysts in individuals 30 years or younger, or two or more cysts in each kidney in those aged 30–59 years, or four cysts in each kidney in those older than 60 years
- Suspected PKD with MRI: If all cysts are to be counted, five cysts or more for 18–29-year-olds, six cysts or more for 30–44-year-olds, six cysts or more for women 45–59 years old, and nine cysts or more for men 45–59 years old

*Alessandra B et al, Radiology 2001*

# Long-term Morbidity

**TABLE 1. Diagnosis of previous living donors at time of listing**

Diagnosis	Number	Percent
Hypertensive nephrosclerosis	20	35.71
Focal glomerular sclerosis	9	16.07
Chronic glomerulonephritis unspecified	7	12.50
Unknown/not reported	5	8.93
Malignant hypertension	4	7.14
Familial nephropathy	2	3.57
Diabetes—insulin dependent	2	3.57
Blunt trauma	1	1.79
Chronic pyelonephritis/reflux nephropathy	1	1.79
Membranous glomerulonephritis	1	1.79
Nephritis	1	1.79
Renal cell carcinoma	1	1.79
Systemic lupus erythematosus	1	1.79
Vasculitis	1	1.79
Total	56	100.00