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Summary of Kidney Disease: Improving Global Outcomes (KDIGO) Clinical Practice Guideline on the Evaluation and Care of Living Kidney Donors

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Abstract: Kidney Disease: Improving Global Outcomes (KDIGO) engaged an evidence review team and convened a work group to produce a guideline to evaluate and manage candidates for living kidney donation. The evidence for most guideline recommendations is sparse and many "ungraded" expert consensus recommendations were made to guide the donor candidate evaluation and care before, during, and after donation. The guideline advocates for replacing decisions based on assessments of single risk factors in isolation with a comprehensive approach to risk assessment using the best available evidence. The approach to simultaneous consideration of each candidate's profile of demographic and health characteristics advances a new framework for assessing donor candidate risk and for defensible shared decision making.

(*Transplantation* 2017;101: 1783–1792)

The need for this guideline originated from the Kidney Disease: Improving Global Outcomes (KDIGO) Executive Committee in consultation with The Transplantation Society and many others. A proposed scope of the guideline was developed by the work group cochairs with KDIGO staff and KDIGO cochairs. The draft scope of work was distributed for public commenting in October 2013 and was revised and finalized after a broad, international public review. The cochairs met with the evidence review team (ERT) to outline key questions amenable to formal evidence review and the literature search strategy. The search was conducted by the ERT and 2 face-to-face guideline work group meetings were subsequently held with the ERT. Given the paucity of

Received 29 March 2017.

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K.L.L, B.L.K., A.S.L., and A.X.G. prepared the first draft of the manuscript, led all subsequent revisions and integrated comments and suggestions from the entire authorship. All other authors participated in the writing of the KDIGO guideline that forms the basis of this review article.

The guideline upon which this manuscript is based was funded by KDIGO with contributions from Canadian Blood Services, Canadian Society of Nephrology, Minneapolis Medical Research Foundation, and The Transplantation Society.

A.X.G. acknowledges receiving research operating grant support on living kidney donation from the Canadian Institutes of Health Research which includes partnership funding from Astellas. A.X.G. is also supported by the Dr. Adam Linton Chair in Kidney Health Analytics. K.L.L. and D.L.S. receive support from the NIH/NIDDK for the study of "Long-Term Health Outcomes after Live Kidney Donation in African Americans" (R01DK096008).

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ISSN: 0041-1337/17/10108-1783

DOI: 10.1097/TP.0000000000001770

published evidence to support living donor evaluation, the work group decided at their second meeting to ask the Chronic Kidney Disease Prognosis Consortium[1] to estimate the long-term risk of end-stage renal disease (kidney failure requiring dialysis or transplantation), according to a donor candidate's profile of demographic and health characteristics. Results from this published work, along with the development of an online tool (http://www.transplantmodels.com/esrdrisk/)[2] to estimate the risk of kidney failure in the absence of donation (predonation risk), provide a quantitative framework for evaluating donor candidates. A draft of this guideline underwent public review November to December 2015 and was further revised by the work group after consideration of all comments.

As described in the guideline methodology chapter, the literature review performed by the independent ERT (Minnesota Evidence-based Practice Center, Minneapolis, MN) focused on the incidence of short-term (perinephrectomy) and long-term health outcomes for living kidney donors compared with healthy nondonors with respect to the presence of single clinical characteristics (eg, obesity, hypertension) before donation.[3] The ERT searched Ovid Medline, Ovid Embase, and the Cochrane Library to identify relevant systematic reviews, randomized-controlled trials, and observational studies published through September 2014. The ERT extracted data from systematic reviews and observational studies with sample sizes over 100 and mean follow-up of at least 5 years. Explicit recognition of perspectives of comparison is critical for drawing inferences about donor health outcomes (eg, estimation of predonation risk, absolute postdonation risk and donation-attributable risk) (Figure 1),[4] and types of comparison were a critical consideration throughout the development of this guideline, including the design and conduct of the evidence review. To be included, studies needed an adequate comparison group that excluded subjects with contraindications to kidney donation. The ERT examined both short- and long-term donor outcomes. For long-term outcomes, the ERT found only 5 systematic reviews and 40 observational studies that met the work group's inclusion criteria.[5] Guideline recommendations with supporting evidence identified by the ERT's systematic review are graded on the strength of recommendation (1 for strong or 2 for weak) and on the strength of evidence (A, B, C, or D for strong, moderate, weak, and very weak, respectively) in accordance with Grading of Recommendations Assessment, Development and Evaluation (GRADE) criteria.[6-8]

Many recommendations in this guideline were deemed important for the care of living donors and donor candidates even when not addressed by eligible studies in the evidence review. Combining guideline recommendations that have no supporting evidence with others that are evidence-based may appear to overrate the former and underrate the latter. Making recommendations that have little or no supporting evidence may discourage investigators from performing studies to produce the evidence that is needed. On the other hand, healthcare providers often express the need for guidelines to describe a

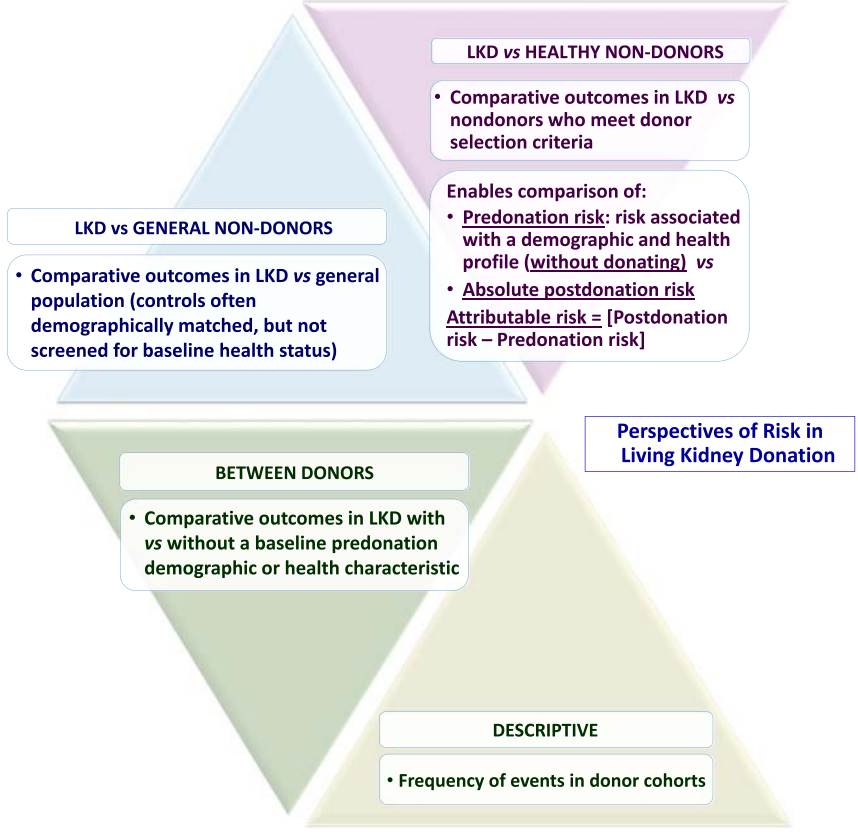

FIGURE 1. Perspectives of risk in living kidney donation. These perspectives provide a framework for assessment of donor outcomes, interpretation of observations, patient communication, and future research design. LKD, living kidney donors. Reprinted with permission from Reproduced with permission from Lentine KL, Segev DL. Understanding and communicating medical risks for living kidney donors: a matter of perspective. J Am Soc Nephrol. 2017;28:12–24.[4]

comprehensive approach to patient care and not ignore important decisions when there is no evidence. This sentiment was strongly expressed during the public review and the work group elected to provide comprehensive recommendations covering all major dimensions of living donor evaluation and care.

KDIGO provides comprehensive recommendations with transparency, and guideline work groups make all recommendations needed to inform cohesive patient care while also explicitly identifying which recommendations are supported by systematic evidence review and which are not. Recommendations for topics that are not addressed in the formal evidence review were based on other published evidence, newly generated evidence,[9,10] and work group consensus; these guideline statements are "not graded." When recommendations from other KDIGO work groups were adapted for this guideline, the guideline statements were also not graded, because they were not part of the current evidence review for this guideline.

This summary provides a brief overview of the guideline recommendations organized by chapters as they appear in the full guideline.[3] In addition, we provide a checklist of items that should be included in the evaluation, care and follow-up of living kidney donors (Table 1).

TABLE 1.

Checklist items for the evaluation, care and follow-up of living kidney donors

Chapter	Checklist item
1	Provide the donor candidate with individualized estimates of short- and long-term risks
	Evaluate risks with respect to predetermined transplant program acceptance thresholds
2	Obtain consent from the donor candidate for evaluation and donation
3	Determine ABO blood type and human leukocyte antigen compatibility
	Inform incompatible donors about exchange programs and incompatible living donor transplantation options
4	Conduct a preoperative assessment as per local guidelines to minimize risk
5	Estimate GFR using serum creatinine-based estimating equations and confirm with one or more of the following according to availability: measured GFR using an exogenous filtration marker, measured creatinine clearance, estimated GFR from the combination of serum creatinine and cystatin C, or repeat estimated GFR using serum creatinine
6	Assess albuminuria using albumin-to-creatinine ratio in an untimed urine specimen, and confirm albuminuria with AER in a timed urine specimen or by repeating albumin-to-creatinine ratio if AER cannot be obtained
7	Perform testing to identify cause of microscopic hematuria that is not reversible
8	Assess history and renal imaging for nephrolithiasis
9	Assess history of gout
10	Measure blood pressure before donation on at least 2 occasions
11	Assess metabolic and lifestyle risk factors for CKD and/or CVD before donation by obtaining: • BMI measurement • History of diabetes mellitus, gestational diabetes, and family history of diabetes • Fasting blood glucose and/or glycated hemoglobin (HbA_{1c}) • Fasting lipid profile including total cholesterol, low-density lipoprotein cholesterol and high-density lipoprotein cholesterol, and triglycerides • Present and past use of tobacco products
12	Screen for the following infections before donation: • Human immunodeficiency virus • Hepatitis B virus • Hepatitis C virus • Cytomegalovirus • Epstein-Barr virus • *Treponema pallidum* (syphilis) • Urinary tract infection • Other potential infections based on geography and environmental exposures
13	Perform cancer screening as per local guidelines
14	Assess family history of kidney disease
15	Confirm a negative quantitative β-hCG pregnancy test immediately before donation in women with childbearing potential
16	Perform face-to-face psychosocial evaluation, education and planning session with one or more trained, experienced health professionals
17	Select optimal surgical approach by an experienced surgeon
18	Respect donor autonomy during all phases of evaluation and donation
19	Perform annual postdonation follow-up care including: • Blood pressure measurement • BMI measurement • Serum creatinine measurement with GFR estimation • Albuminuria measurement • Review and promotion of healthy lifestyle practices including exercise, diet, and abstinence from tobacco • Review and support of psychosocial health and well-being

AER, albumin excretion rate; β-hCG, human chorionic gonadotropin; BMI, body mass index; CKD, chronic kidney disease; CVD, cardiovascular disease; GFR, glomerular filtration rate.

CHAPTER 1: GOALS, PRINCIPLES, AND FRAMEWORK

- Provide the donor candidate with individualized estimates of short- and long-term risks.
- Evaluate medical risks with respect to predetermined program acceptance thresholds.

Determining the suitability of donor candidates requires balancing potential risks and anticipated benefits for the donor. Minimizing short- and long-term risks after donation should be the foundation of the donor evaluation.

Previous living kidney donor guidelines describe postdonation risk in relation to single predonation characteristics in isolation and do not consider risk in the context of multiple predonation characteristics assessed together.[11] The current guideline encourages transplant programs to consider the combined effects of a donor candidate's profile of predonation demographic and health characteristics, as well as the risks attributable to donation (Figure 2). Adverse postdonation outcomes can be medical or psychological and may occur during the perinephrectomy period or during the remaining lifespan of the donor.[4,12,13] The risk of adverse outcomes should be explained in a manner easily understood by the donor candidate, focusing on the absolute probability a candidate will experience a certain outcome if they decide to proceed with donation, and if known, how this risk will differ if they decide not to proceed with donation.

A transplant program can use various methods to establish thresholds for acceptable risk. For example, a program might decide that a 5% lifetime postdonation risk of kidney failure is their threshold for acceptable risk, and if a candidate's projected risk is estimated to be above this threshold, the program should not accept the candidate as a donor. If the donor candidate's estimated risk is below the threshold for acceptable risk, the donor candidate should be permitted to make an autonomous decision whether to proceed with donation after being informed of the risks. Donor candidate autonomy does not overrule medical judgment, and transplant professionals are ethically justified to decline a donor candidate when they believe the risk of poor postdonation outcomes is too high.[14]

Each transplant program should strive to develop and communicate quantitative thresholds of acceptable risk for each serious postdonation adverse outcome they wish to avoid. These thresholds can be both evidence-based and consensus-based. Once established, the threshold should be applied consistently and transparently for all donor candidates.

This guideline advances concepts and analyses to support this approach. We focus particularly on the postdonation development of kidney failure requiring dialysis or transplantation as a clinically important outcome with a biologically plausible link to donation. We describe methods to estimate risk for donor candidates in the absence of donation (predonation risk) using the best currently available evidence and how to use this information to estimate postdonation risk.[9] Finally, we acknowledge limitations[15] and describe the path for future work necessary to strengthen this framework, including the importance of efforts to develop individualized predictions of the attributable risk of donation.[16,17]

CHAPTER 2: INFORMED CONSENT

- Obtain consent from the donor candidate for evaluation.
- Obtain consent from the donor candidate for donation.

The transplant program has a responsibility to establish that the donor candidate has the capacity to give informed consent, is adequately informed of the likely risks and

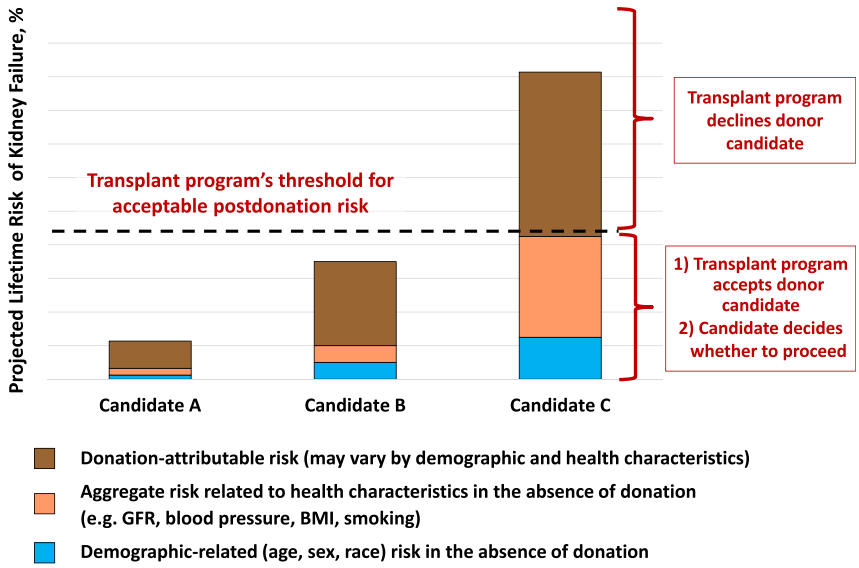

FIGURE 2. Framework to accept or decline donor candidates based on a transplant program's threshold of acceptable projected lifetime risk of kidney failure, quantified as the aggregate of risk related to demographic and health profile and donation-attributable risks. The decision by a transplant program to accept or decline a donor candidate is grounded on whether an individual's estimated projected postdonation lifetime risk is above or below the threshold set (dotted line) by the transplant program. Lifetime risk is comprised of estimated risk in the absence of donation (ie, related to donor demographic and health characteristics, as denoted in blue and beige, respectively) and estimated projected risk attributable to donation (brown). The threshold may vary across transplant programs, but the same threshold should apply to all donor candidates at each program. For example, candidate A would be acceptable because the estimated projected postdonation risk is far below the threshold. Candidate B could be accepted with caution because the estimated projected postdonation risk is close to the threshold, and candidate C would be unacceptable because the estimated postdonation projected risk is far above the threshold.

benefits of donation and the alternative treatment options available to the potential recipient, understands this information, and is acting voluntarily. The ethical principles of autonomy, beneficence, nonmaleficence, voluntarism, confidentiality, and justice form the basis of informed consent. Transplant programs need a process to ensure that the requirements of informed consent are met.[18-20] At least a portion of the informed consent process should be performed in the absence of the potential recipient, family members, and other persons who could influence the donation decision to minimize risks of a conflict of interest or external pressures.

Participating in donor evaluation includes risks of discovering a health condition that requires referral for further care, could affect the donor candidate's insurability or cost of insurance, or necessitates reporting to public health authorities (in the case of certain infections). Transplant programs should establish policies for managing such discoveries and share these policies with the donor candidate as part of the informed consent for evaluation.

The donor candidate should be informed of individualized risks, benefits, and expected outcomes of the donor evaluation, donation, and postdonation periods, including a discussion of the uncertainty in some outcomes. Anticipated medical, surgical, psychosocial, and economic outcomes of donation should be disclosed. The donor candidate should be informed of anticipated recipient outcomes, such as graft and patient survival, and treatment alternatives available to the intended recipient, including deceased kidney donor transplantation and different types of dialysis. Nondirected donors (donors without an identified recipient) should be informed of opportunities for kidney paired donation.

CHAPTER 3: IMMUNOLOGICAL COMPATIBILITY

- Determine ABO blood type and human leukocyte antigen compatibility.
- Inform incompatible donors about exchange programs and incompatible live donor transplantation options.

Unintended ABO-incompatible transplantation should be avoided with ABO typing of the donor and the recipient.[21] ABO-subtype testing should be performed when donation is planned to recipients with anti-A antibodies.[22] HLA typing for major histocompatibility class I (A, B, C) and class II (DP, DQ, DR) should be performed in donor candidates and their intended recipients, and donor-specific anti-HLA antibodies should be assessed in intended recipients. Donor candidates who are ABO- or HLA-incompatible with their intended recipient should be informed about their treatment options, including kidney paired donation[23] and incompatible living donor transplantation options.[24] Informing donor candidates about these treatment options includes describing their voluntary nature, associated processes and timelines, anticipated outcomes, and alternatives.

CHAPTER 4: PREOPERATIVE EVALUATION

- Conduct a preoperative assessment as per local guidelines to minimize risk.

The purpose of the general preoperative evaluation is to assess a donor candidate's risk of perinephrectomy complications, to determine if this risk is low enough to proceed with donation surgery, and to counsel the candidate how to minimize their risk of perinephrectomy complications (eg, stop smoking, lose weight if obese). There is no evidence that additional preoperative testing beyond guideline-based evaluation and management used for other noncardiac surgeries results in a reduced incidence of perioperative complications in kidney donors.[25]

Donor candidates should be informed that the risk of dying within 90 days after donation surgery is approximately 0.03%,[13,26] or 3 deaths in every 10 000 donors (although this estimate may vary based on donor characteristics).

CHAPTER 5: EVALUATION OF KIDNEY FUNCTION

- Estimate glomerular filtration rate (GFR) using serum creatinine-based estimating equations.
- Confirm GFR with one or more of the following according to availability: measured GFR using an exogenous filtration marker, measured creatinine clearance, estimated GFR from the combination of serum creatinine and cystatin C, or repeat estimated GFR from serum creatinine.

Recommended methods for evaluating GFR are based on the KDIGO 2012 Chronic Kidney Disease (CKD) guideline.[27,28] GFR of 90 mL/min per 1.73 m^2 or greater should be considered an acceptable level of kidney function for kidney donation, while donor candidates with GFR less than 60 mL/min per 1.73 m^2 should not donate. The decision to approve donor candidates with GFR 60 to 89 mL/min per 1.73 m^2 should be individualized based on demographic and health profile in relation to the transplant program's acceptable risk threshold.

When there is asymmetry in GFR or when parenchymal abnormalities, vascular abnormalities, or urological abnormalities are present but do not preclude donation, the more severely affected kidney be used for donation. All donor candidates should be informed that the risk of someday developing kidney failure necessitating treatment with dialysis or transplantation is slightly higher as a result of donation; however, average absolute postdonation risk in the first few decades remains low.[29-32]

CHAPTER 6: EVALUATION OF ALBUMINURIA

- Assess albuminuria using albumin-to-creatinine ratio in an untimed urine specimen.
- Confirm albuminuria with albumin excretion rate (AER) in a timed urine specimen or by repeating albumin-to-creatinine ratio if AER cannot be obtained.

Recommended methods for evaluating albuminuria are based on the KDIGO 2012 CKD guideline.[27,28] Urine AER less than 30 mg/d should be considered an acceptable level for kidney donation. Donor candidates with urine AER greater than 100 mg/d should not donate. The decision to approve donor candidates with AER 30 to 100 mg/d should be individualized based on demographic and health profile in relation to the transplant program's acceptable risk threshold.

CHAPTER 7: EVALUATION OF HEMATURIA

- Perform testing to identify cause of microscopic hematuria that is not reversible.

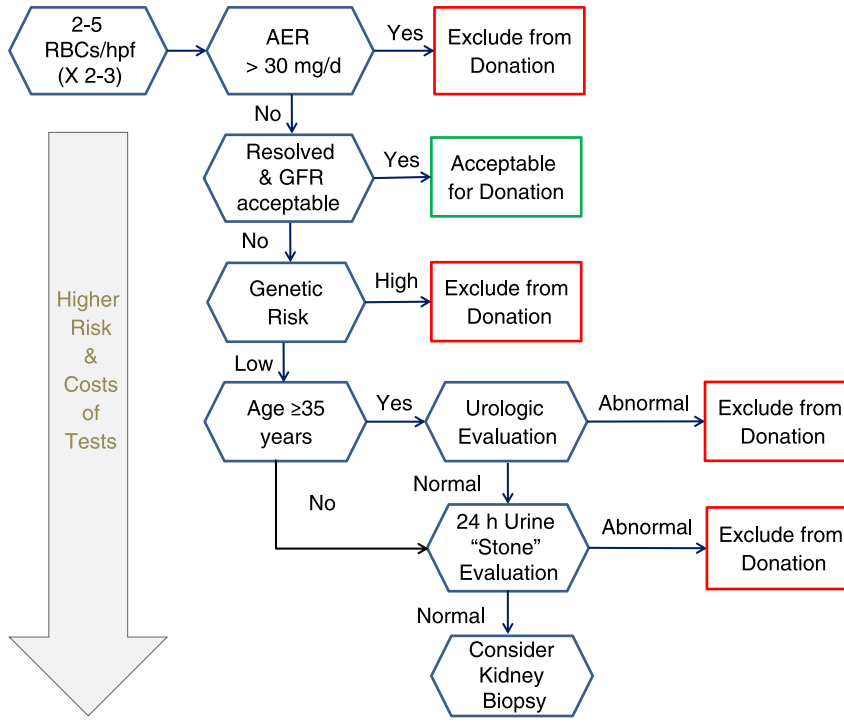

FIGURE 3. Sequential evaluation of microscopic hematuria in living kidney donor candidates. AER, albumin excretion rate; GFR, glomerular filtration rate; hpf, high-power field; RBC, red blood cell.

A common definition of persistent microscopic hematuria is greater than 2 to 5 red blood cells per high-power field of urinary sediment on 2 to 3 separate occasions, unrelated to exercise, trauma, sexual activity, or menstruation.[33-35] A positive dipstick alone does not define microhematuria, and evaluation should be based solely on findings from microscopic examination of urinary sediment.[34]

The presence of hematuria is not normal and should always be evaluated when found in a donor candidate.[25] This evaluation can help determine if hematuria is due to a correctable cause (eg, urinary tract infection, nephrolithiasis), a malignancy threatening donor health and/or disease transmission, or glomerular disease that may be associated with increased lifetime chance of kidney failure. Appropriate testing may include urinalysis and urine culture to assess for infection, cystoscopy and imaging to screen for urinary tract malignancy, 24-hour urine stone panel, and/or kidney biopsy to assess for glomerular disease (Figure 3). Candidates with hematuria from a reversible cause that resolves (eg, a treated infection) may be acceptable for donation. Donor candidates with IgA nephropathy should not donate.

CHAPTER 8: EVALUATION OF KIDNEY STONES

✔ Assess history and renal imaging for nephrolithiasis.

Donor candidates should be asked about prior kidney stones, and and related medical records should be reviewed if available. Renal imaging should be reviewed for the presence of stones. Donor candidates with prior or current kidney stones should be assessed for an underlying cause. The acceptance of a donor candidate with prior or current kidney stones should be based on an assessment of stone recurrence risk and knowledge of the possible consequences of kidney stones after donation. Donor candidates and donors with current or prior kidney stones should follow general population, evidence-based guidelines for the prevention of recurrent stones.

CHAPTER 9: EVALUATION OF HYPERURICEMIA, GOUT AND METABOLIC BONE DISEASE

✔ Assess history of gout.

Donor candidates may be informed that the decline in kidney function with donation raises the serum concentration of uric acid, which may increase the risk of gout.[36,37] Postdonation gout risk varies with baseline donor traits.[38] Donor candidates and donors with prior episodes of gout should be informed of recommended methods to reduce their risk of future episodes of gout. The effect of donation on the development of metabolic bone disease is unclear. Several recent studies describe changes in bone and mineral metabolism in donors including a decline in the serum concentration of 1,25-dihydroxyvitamin D and phosphate, a decline in tubular phosphate reabsorption, and a rise in the concentration of serum parathyroid hormone; the prognostic significance of these changes is uncertain.[39]

CHAPTER 10: EVALUATION OF BLOOD PRESSURE

✔ Measure blood pressure before donation on at least 2 occasions.

Hypertension is a risk factor for kidney and cardiovascular disease. When the presence or absence of hypertension in a donor candidate is unclear based on history and clinic measurements, blood pressure should be further evaluated using ambulatory blood pressure monitoring or repeat standardized blood pressure measurements. Normal blood pressure, as defined by guidelines for the general population in the

country or region where donation is planned, is acceptable for donation. Donor candidates with hypertension that can be controlled to less than 140/90 mm Hg using 1 or 2 antihypertensive agents, and who do not have evidence of target organ damage, may be acceptable for donation. The decision to approve donation in persons with hypertension should be individualized based demographic and health profile in relation to the transplant program's acceptance risk threshold.

Donor candidates should be counseled on lifestyle interventions to address modifiable risk factors for hypertension and cardiovascular disease, including healthy diet, smoking abstinence, achievement of healthy body weight, and regular exercise according to guidelines for the general population. These measures should be initiated before donation and maintained lifelong. We suggest that donor candidates should be informed that blood pressure may rise with aging, and that donation may accelerate the rise in blood pressure and the need for antihypertensive treatment over that expected with normal aging.[40,41] Postdonation hypertension risk varies with baseline donor traits.[42]

CHAPTER 11: EVALUATION OF METABOLIC AND LIFESTYLE RISK FACTORS

✔ Assess risk factors for kidney and cardiovascular disease including:

- Body mass index (BMI)
- History of diabetes mellitus, gestational diabetes, and family history of diabetes
- Fasting blood glucose and/or glycated hemoglobin (HbA_{1c})
- Fasting lipid profile including total cholesterol, low-density lipoprotein cholesterol and high-density lipoprotein cholesterol, and triglycerides
- Present and past use of tobacco products

Metabolic and lifestyle risk factors for kidney and cardiovascular disease should be identified prior to donation and addressed by counseling to promote long-term health.

The decision to approve donor candidates with obesity and BMI greater than 30 kg/m^2 should be individualized based on demographic and health profile in relation to the transplant program's acceptance threshold.

Two-hour glucose tolerance testing or HbA_{1c} should be performed in donor candidates with elevated fasting blood glucose, history of gestational diabetes, or family history of diabetes in a first-degree relative, and results should be used to classify diabetes or prediabetes status using established criteria for the general population. Donor candidates with type 1 diabetes mellitus should not donate. The decision to approve donor candidates with prediabetes or type 2 diabetes should be individualized based on demographic and health profile in relation to the transplant program's acceptance threshold. Donor candidates with prediabetes and type 2 diabetes should be counseled that their condition may progress over time and may lead to end-organ complications. The decision to approve donor candidates with dyslipidemia should be individualized based on demographic and health profile.

Donor candidates who use tobacco products should be counseled on the risks of perioperative complications, cancer, cardiopulmonary disease, and kidney disease. They should be advised to abstain from use of tobacco products and should be referred to a tobacco cessation support program if possible. Active smokers should be encouraged to quit smoking for at least 4 weeks before donation surgery to decrease the risk of perioperative complications, and commit to lifelong abstinence to prevent long-term complications. The decision to approve donor candidates who are active tobacco users should be individualized.

CHAPTER 12: SCREENING FOR TRANSMITTABLE INFECTIONS

✔ Obtain screening tests for the following infections before donation:

- Human immunodeficiency virus
- Hepatitis B virus
- Hepatitis C virus
- Cytomegalovirus
- Epstein-Barr virus
- *Treponema pallidum* (syphilis)
- Urinary tract infection
- Other potential infections based on geography and environmental exposures

Screening for infections identifies illnesses that may require management and helps prevent transmission to the recipient. Evaluation of donor candidates should include assessment of the individual's history of past infections and infectious disease risk factors (eg, risk of local endemic infections or travel to endemic areas), awareness of current patterns of geographically endemic infections, and focused microbiological screening. Donor candidates should be assessed for factors associated with increased likelihood of endemic or unexpected infections, including geographic, seasonal, occupational, animal and environmental exposures. Microbiological screening should be performed if regional epidemiology or individual clinical or social history suggests increased risks for *Mycobacterium tuberculosis*, *Strongyloides, Trypanosoma cruzi*, West Nile virus, histoplasmosis, or coccidiomycosis.[43] In addition, transplant programs should develop and maintain protocols to screen donor candidates for emerging infections in consultation with local public health specialists. Donor infection risk factor and microbiological assessments should be performed or updated as close to donation as possible. If a donor candidate is found to have a potentially transmissible infection, then the donor candidate, the intended recipient and transplant team should weigh the risks and benefits of proceeding with donation, and develop a management plan if the decision is to proceed with donation.

CHAPTER 13: CANCER SCREENING

✔Perform cancer screening as per local guidelines.

Malignancy screening is necessary to identify cancers that require management to protect the health of the donor candidate. Decreased kidney function may compromise long-term health outcomes in individuals requiring cancer treatments with nephrotoxic or cardiovascular side effects. In addition, the evaluation reduces risks of transmitting malignancy from the donor to recipient.[43] Donor candidates should undergo cancer screening consistent with clinical practice guidelines of the country or region where the donor candidate resides. Cancer screening should be current at the time of donation. In general, donor candidates with active malignancy should be excluded from donation. In some cases of active

malignancy with low transmission risk, a clear management plan, and minimal donor health implications, donation may be considered. Donor candidates with high-grade Bosniak renal cysts (III or higher) or small (T1a) renal cell carcinoma curable by nephrectomy may be acceptable for donation on a case-by-case basis. Donor candidates with a history of treated cancer that has a low risk of transmission or recurrence may be acceptable for donation on a case-by-case basis.

CHAPTER 14: EVALUATION FOR GENETIC KIDNEY DISEASES

✔ Assess family history of kidney disease.

Genetic kidney diseases are an important consideration when evaluating kidney donor candidates, as many donor candidates are genetically related to an intended recipient. Examples include autosomal dominant polycystic kidney disease (ADPKD), apolipoprotein-L1 (*APOL1*)-related kidney disease, atypical hemolytic uremic syndrome, Alport syndrome, Fabry disease, familial focal segmental glomerulosclerosis, and hereditary interstitial kidney diseases.[44] A family history of a genetic kidney disease with an autosomal recessive mode of inheritance (such as cystinosis or some forms of familial focal segmental glomerulosclerosis) is usually not a contraindication to living kidney donation.

When the intended recipient is genetically related to the donor candidate, the cause of the intended recipient's kidney failure should be determined whenever possible. The intended recipient should consent to share this medical information with the donor evaluation team, and with the donor candidate if it could affect the decision to donate. Donor candidates found to have a genetic kidney disease that can cause kidney failure should not donate. However, after the evaluation, it may be uncertain whether a donor candidate has a genetic predisposition to kidney disease or whether the disease can cause kidney failure; in such cases, donation should proceed only after informing the donor candidate of the risks of donation if the disease manifests later in life.

Donor candidates must provide informed consent for genetic testing if indicated as part of their evaluation. Informed consent includes understanding the potential impact of receiving a diagnosis of a genetic renal disease on their insurability.

A diagnosis of ADPKD precludes donation. Donor candidates with a family history of ADKPD in a first degree relative may be acceptable for donation if they meet age-specific imaging or genetic testing criteria that reliably excludes ADPKD. When imaging fails to rule out ADPKD, genetic testing can sometimes help diagnose or exclude the condition.

If a donor candidate is of sub-Saharan African ancestry, testing for APOL1 risk allels may be offered.[45,46] The presence of 2 APOL1 risk allele increases the lifetime chance of developing kidney failure even in the absence of donation. The effects of kidney donation on this risk are unknown.

CHAPTER 15: PREGNANCY

✔ Confirm a negative quantitative human chorionic gonadotropin (β-hCG)pregnancy test immediately before donation in women with childbearing potential.

Female donor candidates should be asked about prior hypertensive disorders of pregnancy (eg, gestational hypertension, preeclampsia, or eclampsia). Female donor candidates should be asked about future childbearing plans. Women should not be excluded from donation solely on the basis of a desire to have children after donation. Women with a history of a prior hypertensive disorder of pregnancy (which includes preeclampsia) may be acceptable for donation if the long-term postdonation risks are acceptable. A decision to proceed with donation in the year after childbirth should consider the psychological and health needs of mother and child.

Women with childbearing potential should be informed of the need to avoid becoming pregnant from the time of approval for donation to the time of recovery after donation. We suggest that women with childbearing potential be counseled about the effects donation may have on future pregnancies, including the possibility of a greater likelihood of being diagnosed with gestational hypertension or preeclampsia.[47-51]

CHAPTER 16: PSYCHOSOCIAL EVALUATION

✔ Perform face-to-face psychosocial evaluation, education and planning session with 1 or more trained, experienced health professionals.

The psychosocial evaluation helps determine if a donor candidate is psychologically fit for donation, addresses donor candidate concerns, and ensures potential psychosocial risks and benefits of kidney donation are disclosed and understood. The psychosocial evaluation can also be used to develop a plan to support the donor candidate in having a positive psychosocial experience throughout the evaluation and donation processes, and long-term after donation. Transplant programs should follow protocols for assessing psychosocial factors that either preclude donation or prevent further evaluation until resolution. We suggest that donor candidates be informed that donors usually have good quality of life after donation. However, donor candidates should also be informed that some people experience psychosocial difficulties after donation.[52,53]

CHAPTER 17: SURGICAL APPROACHES

✔ Select optimal surgical approach by an experienced surgeon.

Renal imaging (such as a computed tomographic angiography) should be performed in all donor candidates to assess renal anatomy before nephrectomy. In general, the left kidney should be procured because of the relative technical ease associated with a longer venous pedicle, but procurement of the right kidney may be preferred in some cases because of vascular, urological, or other abnormalities. We suggest that "mini-open," laparoscopy, or hand-assisted laparoscopy by trained surgeons should be offered as optimal approaches to donor nephrectomy. In some circumstances, such as donors with extensive previous surgery and/or adhesions, and programs where laparoscopy is not routinely performed, open nephrectomy (flank or laparotomy) may be acceptable. Laparoscopic procurement of the right kidney can be an appropriate alternative to laparoscopic left donor nephrectomy when undertaken by surgeons with adequate training and experience. The surgeon must have adequate training and experience for the surgical approach used for the donor nephrectomy.

Robotic, single-port and natural orifice transluminal nephrectomies are not current standard of care for donor

nephrectomy, and should only be performed by surgeons with adequate training and experience after informed consent. Nontransfixing clips (eg, Weck Hem-o-lok clip) should not be used to ligate the renal artery. Tissue transfixation (by suture ligature or anchor staple within the vessel wall) is necessary to ligate the renal artery during living donor nephrectomy.

CHAPTER 18: ETHICAL, LEGAL AND POLICY CONSIDERATIONS

- Follow local laws and regulations on living donation, and explain these rules to donor candidates.
- Respect donor autonomy during all phases of evaluation and donation.

Living kidney donation must be practiced within a framework of the laws and regulations of each country and its governing or regulatory bodies.[54,55] The legal framework gives legitimacy to living donation and provides some protection to the donor. All practitioners in transplant programs should be aware of relevant laws and regulations that pertain to the living donor transplant program. Ethical tenets and specific transplant program processes should be applied to minimize donor risk.

Donor candidates should be informed of the availability of legitimate financial assistance for expenses from evaluation and donation[56-58] If a living kidney donor develops kidney failure, there should be a process in place to assure access to kidney replacement therapy (dialysis and/or transplantation) for that donor.

CHAPTER 19: POSTDONATION FOLLOW-UP CARE

- Perform annual postdonation follow-up care including:

- Blood pressure measurement
- BMI measurement
- Serum creatinine measurement with GFR estimation
- Albuminuria measurement
- Review and promotion of healthy lifestyle practices including exercise, diet, and smoking abstinence
- Review and support of psychosocial health and well-being

A personalized postdonation care plan should be provided prior to donation to clearly describe follow-up care recommendations, who will provide the care, and how often, considering resources and donor convenience. Donors should be monitored for CKD and those meeting criteria for CKD should be managed according to the 2012 KDIGO CKD Guideline.[27] Donors should receive age-appropriate healthcare maintenance, and management of clinical conditions and health risk factors according to clinical practice guidelines for the regional population.

ACKNOWLEDGMENTS

The authors and KDIGO gratefully acknowledge the support from Minnesota ERT members: Yelena Slinin, MD, Michelle Brasure PhD, Keith Eidman, DO, Jason Bydash, DO, Saugar Maripuri, MD, MPH, Maureen Carlyle, MPH, Areef Ishani, MD, and Timothy J. Wilt, MD, MPH.

The authors also acknowledge the valuable contributions from CKD Prognosis Consortium and its members for their meta-analysis and risk model which serve as the basis for the donor selection framework used in the guideline: Josef Coresh MD, PhD, Morgan E. Grams MD, PhD, Yingying Sang MS, Kunihiro Matsushita MD, PhD, Shoshana Ballew PhD, Alex R. Chang MD, Eric K. H. Chow MSc, Csaba P. Kovesdy MD, Girish N. Nadkarni MD, MPH, and Varda Shalev MD, MPA.

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