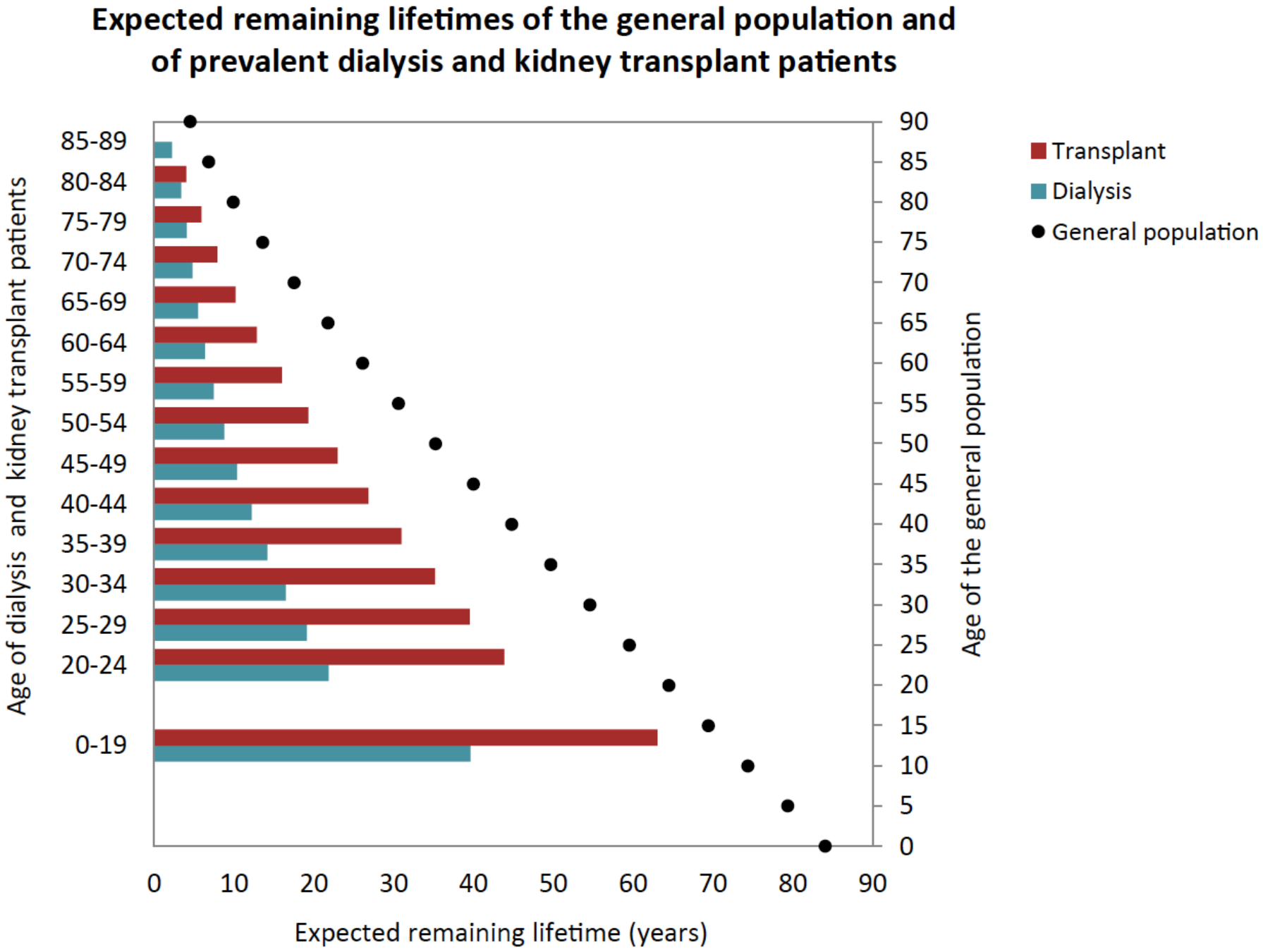
Qualification to kidney transplantation

Magdalena Durlik

General principles

- **Renal transplantation is the treatment of choice for many patients with ESRD. Despite an increased risk of death in the early post-transplant period, transplantation improves long term survival and quality of life compared with dialysis.**
- **All patients with end-stage renal disease should be considered for kidney transplantation provided no absolute contraindications exist.**
- **Eligibility for kidney transplantation should be determined on medical and surgical grounds. Criteria for eligibility should be transparent and made available to patients and the public. Eligibility should not be based on social status, gender, race or personal or public appeal.**
- **Preemptive kidney transplantation is the preferred form of renal replacement therapy and should be encouraged where feasible.**
- **Preemptive kidney transplantation should not proceed unless the measured or calculated glomerular filtration rate is < 15 (20) mL/minute and there is evidence of progressive and irreversible deterioration in renal function over the previous 6–12 months.**


Expected remaining lifetimes of the general population and of prevalent dialysis and kidney transplant patients
Age of dialysis and kidney transplant patients
85-89
80-84
75-79
70-74
65-69
60-64
55-59
50-54
45-49
40-44
35-39
30-34
25-29
20-24
0-19
0
10
20
30
40
50
60
70
80
90
Expected remaining lifetime (years)
Age of the general population
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
Transplant
Dialysis
General population

PUBLISHED
NDT 2013, Vol 28 (Suppl.2)
www.european-renal-best-practice.org

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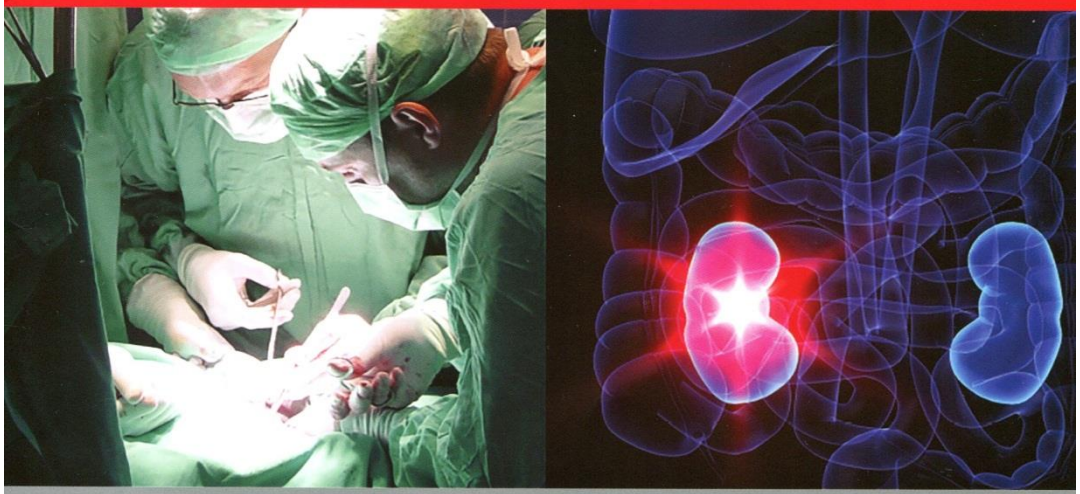
ERBP GUIDELINE ON THE MANAGEMENT AND EVALUATION OF THE KIDNEY DONOR AND RECIPIENT



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OXFORD OPEN
OXFORD UNIVERSITY PRESS
www.ndt.oxfordjournals.org
Official Publication of the European Renal Association -European Dialysis and Transplant Association

April 2020 ■ Volume 104 ■ Number 4S

Official Journal of
The Transplantation Society &
International Liver Transplantation Society

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KDIGO Clinical Practice Guideline on the Evaluation and Management of Candidates for Kidney Transplantation

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Absolute contraindications to renal transplantation

- **Active infections.**
- **Active malignancy.**
- **Active substance abuse.**
- **Reversible renal failure.**
- **Uncontrolled psychiatric disease.**
- **Documented active and ongoing treatment nonadherence.**
- **A significantly shortened life expectancy. There is no universally accepted life expectancy below which an individual is ineligible for renal transplantation, although a life expectancy of less than one year posttransplant precludes the possibility of transplantation at virtually all centers (depending upon the nature of the chronic illness).**
- **Selected patients with ESRD and other types of organ failure may be considered for combined organ transplantation, performed either simultaneously or sequentially (e.g., liver–kidney transplantation in a patient with cirrhosis who has developed kidney failure).**

A Guide to Calculating and Interpreting the Estimated Post-Transplant Survival (EPTS) Score Used in the Kidney Allocation System (KAS)

What is the EPTS score?

The Estimated Post Transplant Survival (EPTS) score is a numerical measure used in the new kidney allocation system to allocate some kidneys in the new kidney allocation system. Every adult patient on the kidney waitlist will receive an EPTS score for use in the new system.

EPTS scores range from 0% to 100%. Candidates with a lower EPTS score are expected to experience mo years of graft function from high-longevity kidneys compared to candidates with higher EPTS scores.

Per OPTN policy, the EPTS score is derived from the following formula:

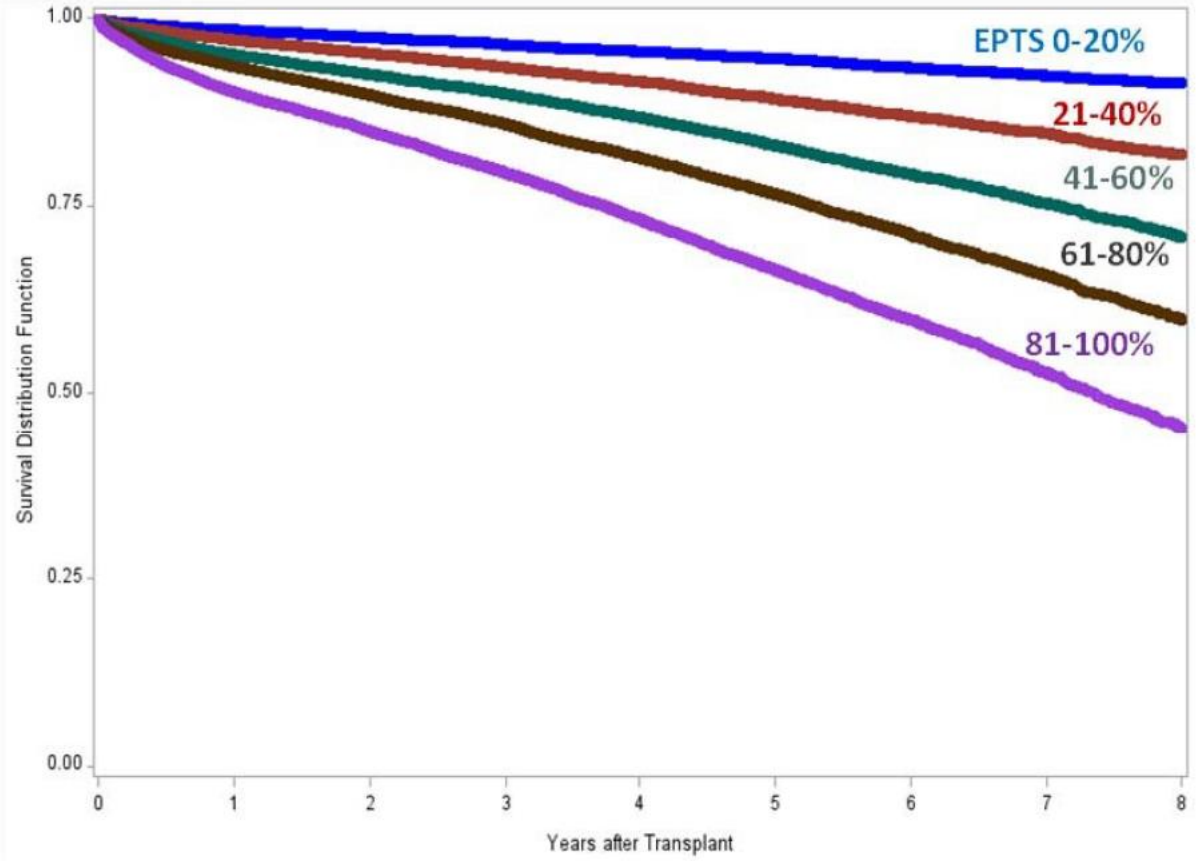
"Raw EPTS" =

```
 0.047 * max(Age - 25, 0) +
-0.015 * Diabetes * max(Age - 25, 0) +
 0.398 * Prior Solid Organ Transplant +
-0.237 * Diabetes * Prior Organ Transplant +
 0.315 * log(Years on Dialysis + 1) +
-0.099 * Diabetes * log(Years on Dialysis + 1) +
 0.130 * (Years on Dialysis = 0) +
-0.348 * Diabetes * (Years on Dialysis = 0) +
 1.262 * Diabetes
```

Age
Diabetes
Time on dialysis
Previous KTx

Figure 1 shows that the EPTS score is able to distinguish between expected outcomes among broad of kidney transplant recipients.

Figure 1: Kaplan-Meier Patient Survival Curves by EPTS Score
Deceased Donor, Adult, Solitary Kidney Transplants from 2003-2010
Based on OPTN data as of Feb 7, 2014



SECTION 2: AGE

2.1: Consider age in the context of other comorbidities, including frailty, that may impact outcome when deciding about suitability for kidney transplantation *(Not Graded)*.

2.1.1: We recommend not excluding patients from kidney transplantation because of age alone *(1A)*.

Transplantation in erderly

Recipient age alone is not a contraindication to transplantation. Many patients >60 years of age and selected patients >70 years have been transplanted safely and with an acceptable rate of long-term graft function.

Life expectancy is less, older recipients experience death-censored graft survival rates that are as good as those of younger patients. Survival of the older patient is superior with transplantation compared with remaining on the waiting list.

The older recipient is at greater risk of perioperative complications, including death, largely due to infection and cardiovascular disease. Older patients with significant comorbidities, should be encouraged to consider their current quality of life on RRT in the context of what they could reasonably expect following kidney transplantation. Because physiologic age and the burden of comorbid conditions is more likely to influence outcome, a detailed evaluation with emphasis on screening for cardiovascular disease, occult gastrointestinal disease, infection and malignancy is warranted.

Timing of referral

- **Potential transplant recipients should be referred for evaluation by a transplant program once renal replacement therapy is expected to be required within the next 12 months.**
- **Patients already requiring dialysis support should be referred for transplant evaluation as soon as their medical condition stabilizes**
- **The process of evaluation for transplantation may be complex and involve health professionals from multiple disciplines, many of whom may be external to the transplant program. In a patient with significant comorbid conditions, completion of the evaluation may take as long as 6–12 months.**
- **Sufficient time must also be allowed for patients to receive adequate information concerning the risks and benefits of transplantation and the options with respect to type of transplantation (living donor vs. deceased donor, usual vs. extended-criteria deceased-donor kidneys, kidney transplantation alone vs. a combined procedure, such as simultaneous kidney–pancreas transplantation).**

Risk of recurence of kidney disease

Table 1 Estimated rates of recurrence and consequent graft loss risk of glomerular disease

	Recurrence rate	Graft loss risk
Primary disease		
FSGS	30–60%	~50%
MGN	3–30%	~30%
IgA-GN	30–60%	10–30%
MPGN-I	25–65%	~33%
DDD (MPGN-II)	~90%	10–20%
Secondary disease		
Anti-GBM disease	~10%	<5%
SLE	2–9%	<5%
ANCA vasculitis	20–25%	<5%
HSPN	15–60%	~10%
HUS	25–50%	40–60%
LCDD	~50%	Unknown
Mixed cryoglobulinemia	~50%	Unknown
Fibrillary GN	~50%	~50%
Fibronectin glomerulopathy	Unknown	Unknown

DDD, dense deposit disease; GN, glomerulonephritis; FSGS, focal segmental glomerulosclerosis; GBM, glomerular basement membrane; HSPN, Henoch-Schönlein purpura nephritis; HUS, haemolytic uremic syndrome; IgA-GN, IgA nephropathy; LCDD, light-chain deposition disease; MGN, membranous nephropathy; MPGN, membranoproliferative glomerulonephritis; SLE, systemic lupus erythematosus.

Cause of end-stage renal disease

- Despite the risk of recurrent glomerulonephritis, there is no contraindication to a first kidney transplant in patients with ESRD due to primary glomerulonephritis, independent of the specific histologic type.
- Retransplantation should be considered in otherwise eligible patients who experienced recurrence of primary glomerulonephritis in a prior renal allograft. Further recurrence may occur in up to 80% of such patients in some settings, but the rate of progression of recurrent disease is unpredictable .
- Simultaneous kidney–pancreas transplantation should be considered in selected patients with type 1 diabetes mellitus.
- Renal transplant candidates with primary hyperoxaluria should be considered for isolated renal transplantation if they are pyridoxine-sensitive and have minimal oxalate deposition . Combined liver–kidney transplantation should be considered in patients with severe systemic oxalosis.
- Renal transplant candidates with anti-glomerular basement membrane (anti-GBM) disease should be considered for renal transplantation if the circulating anti-GBM antibody is undetectable and they have quiescent disease (off cytotoxic agents) for at least 6 months post-treatment .

9.2 Focal segmental glomerulosclerosis (FSGS)

9.2.1: We recommend not excluding candidates with primary FSGS from kidney transplantation; however, the risk of recurrence should be considered and discussed with the candidate *(1B)*.

9.2.1.1: Loss of a prior graft due to recurrent FSGS indicates a high risk of recurrence upon subsequent transplantation and this factor should be a major consideration in determining candidacy *(Not Graded)*.

9.2.2: We suggest genetic testing (eg, for podocin and nephrin gene mutations, among others) be performed in children and young adults with a clinical course consistent with genetic FSGS to inform the risk of recurrence (*2C*).

9.2.3: We suggest avoiding routine use of pre-transplant plasma exchange or rituximab to reduce the risk of recurrent FSGS *(2D)*.

Cause of end-stage renal disease

- **Renal transplant candidates with amyloidosis (primary or secondary) should be considered for renal transplantation if there is no evidence of cardiac involvement . Patients with secondary amyloidosis should not undergo renal transplantation until the underlying inflammatory condition is in remission. Patients with familial Mediterranean fever should receive colchicine to prevent recurrent disease in the allograft .**
- **Renal transplant candidates with systemic lupus erythematosus should be considered for renal transplantation if they have clinically quiescent disease for at least 6 months off cytotoxic agents .**
- **Renal transplant candidates with scleroderma should be considered for renal transplantation if they have quiescent disease for at least 6 months off cytotoxic agents and have limited extra-renal disease .**
- **Renal transplant candidates with vasculitis should be considered for renal transplantation if they have quiescent disease for at least 12 months off cytotoxic agents. Pretransplant anti-neutrophil cytoplasmic antibodies are not predictive of outcome and may still be positive at the time of transplantation .**
- **Renal transplant candidates with cystinosis should be considered for renal transplantation .**

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9.11 Hemolytic uremic syndrome (HUS)

9.11.1: We recommend not excluding candidates with HUS due to infection with a Shiga-toxin producing organism, usually *E. coli* (STEC-HUS), from kidney transplantation *(1A)*.

9.11.2: We recommend assessment of candidates with suspected atypical HUS (aHUS) for a genetic or acquired defect in complement regulation or other genetic causes of aHUS to inform risk of recurrence *(1B)*.

9.11.3: We recommend not excluding candidates with aHUS from kidney transplantation; however, the risk of recurrence should be considered and discussed with the candidate *(1B)*.

9.11.3.1: We recommend that if the candidate has an abnormality in complement regulation placing them at high risk of recurrence, kidney transplantation should not proceed unless a complement inhibitor can be administered or combined liver-kidney transplant can be performed *(1B)*.

Table 2 – Clinical outcome of patients with atypical haemolytic uraemic syndrome based on complement abnormalities (prior to Eculizumab).

Gene	Risk of death or ESRF in the first episode or within the next year	Risk of relapse	Risk of death or ESRF at 3–5 years	Risk of relapse following renal transplant
CFH	50–70%	50%	75%	75–90%
CFI	50%	10–30%	50–60%	45–80%
MCP	0–6%	70–90%	6–38%[a]	<20%
C3	60%	50%	75%	40–70%
CFB	50%	3/3 without ESRF	75%	100%
THBD	50%	30%	54%[a]	1 patient
Anti-FH	30–40%	40–60%	35–60%[a]	Higher with increased antibody titres

Anti-FH: anti-complement factor H antibodies; *CFB*: complement factor B gene; *CFH*: complement factor H gene; *CFI*: complement factor I gene; ESRF: end-stage renal failure; *MCP*: membrane cofactor protein gene; *THBD*: thrombomodulin gene.

[a] Data on ESRF.

Adapted from Loirat and Fremeaux-Bacchi.[1]

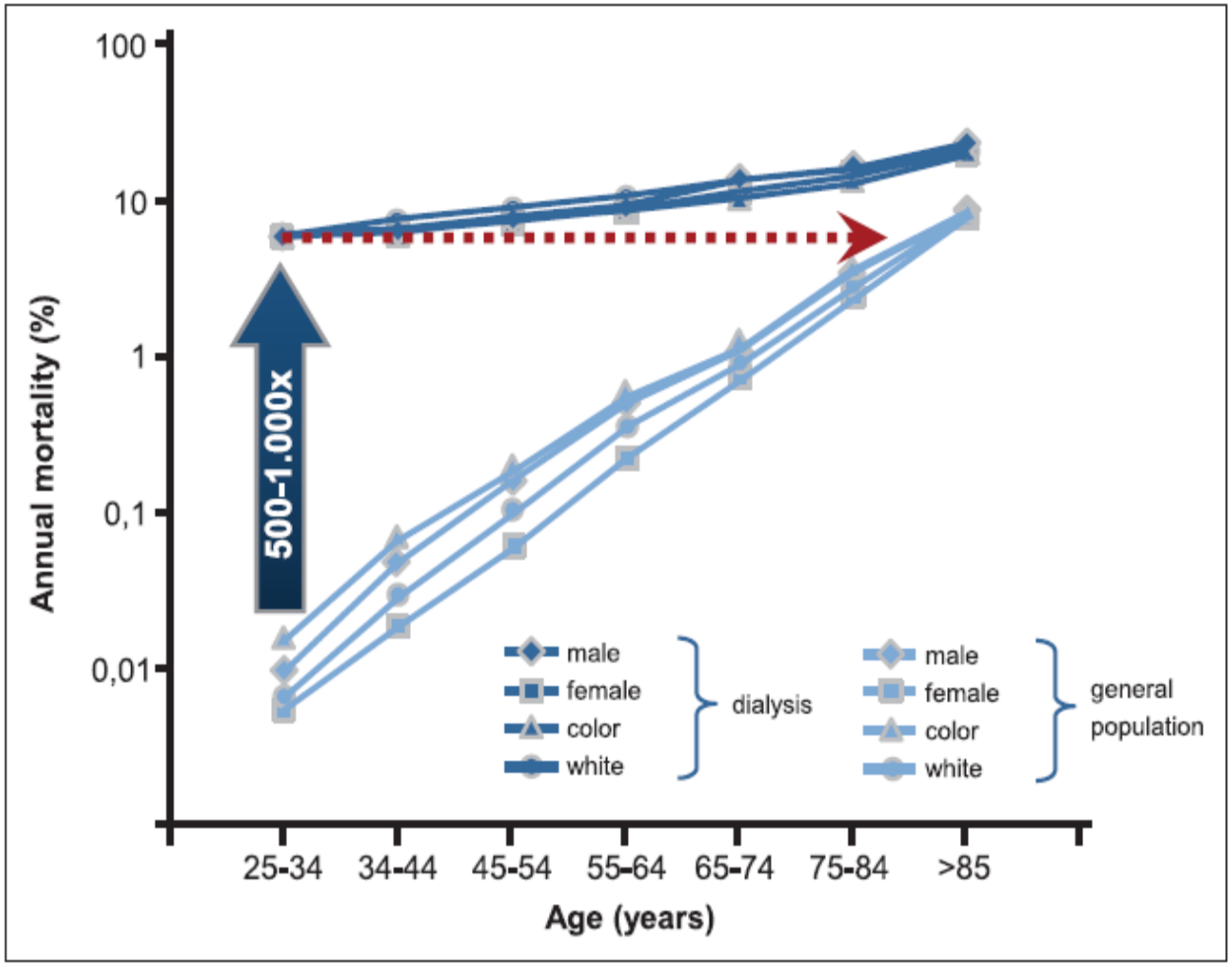


Figure 1. Cardiovascular mortality in the general population and in patients with end-stage kidney disease.
In 25- to 34-year-old patients with end-stage kidney disease, annual mortality is increased 500- to 1000-fold and corresponds to that of the ≈85-year-old general population. Adapted from Foley et al.[5]

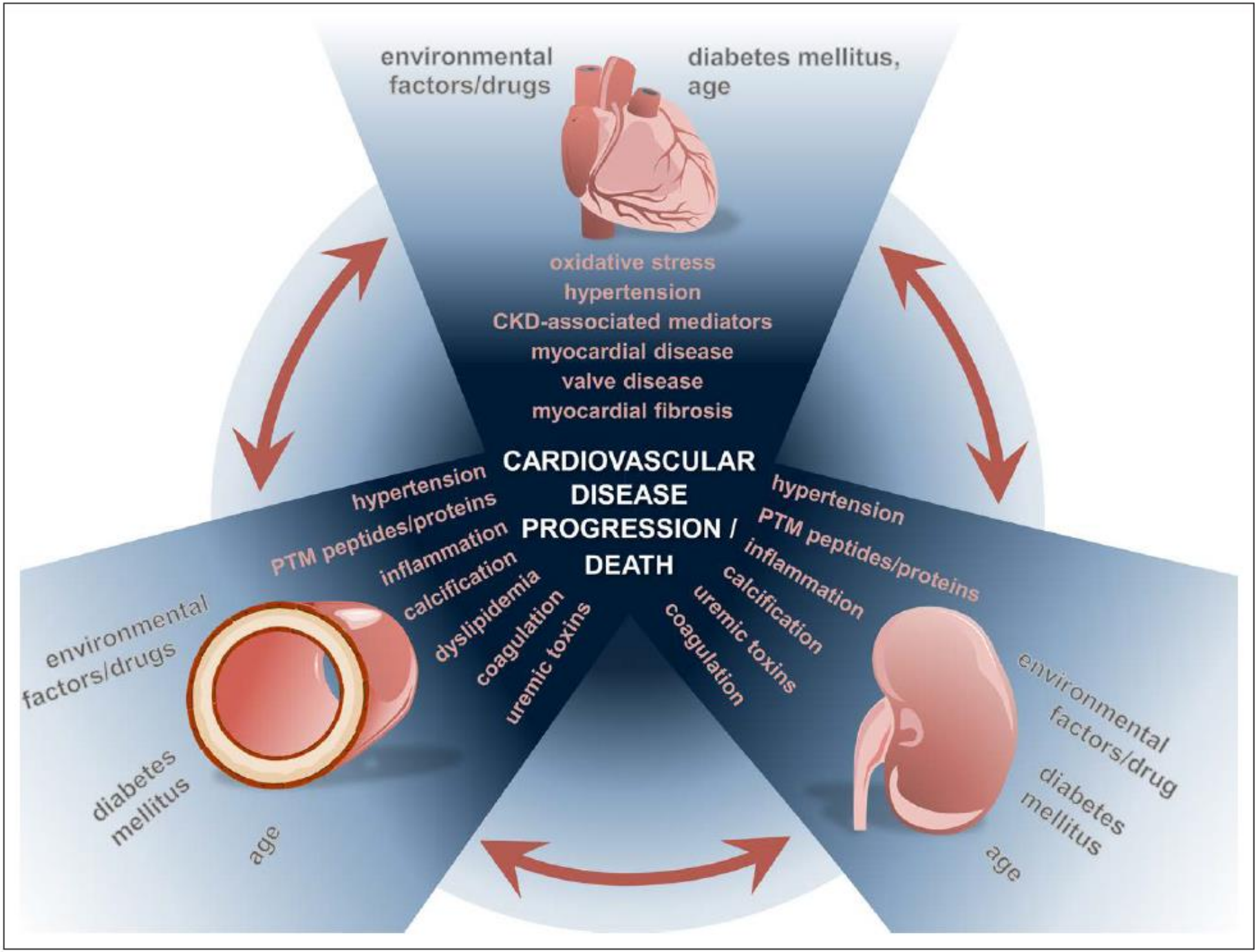


Figure 2. Interaction of cardiovascular disease (CVD) and chronic kidney disease (CKD).

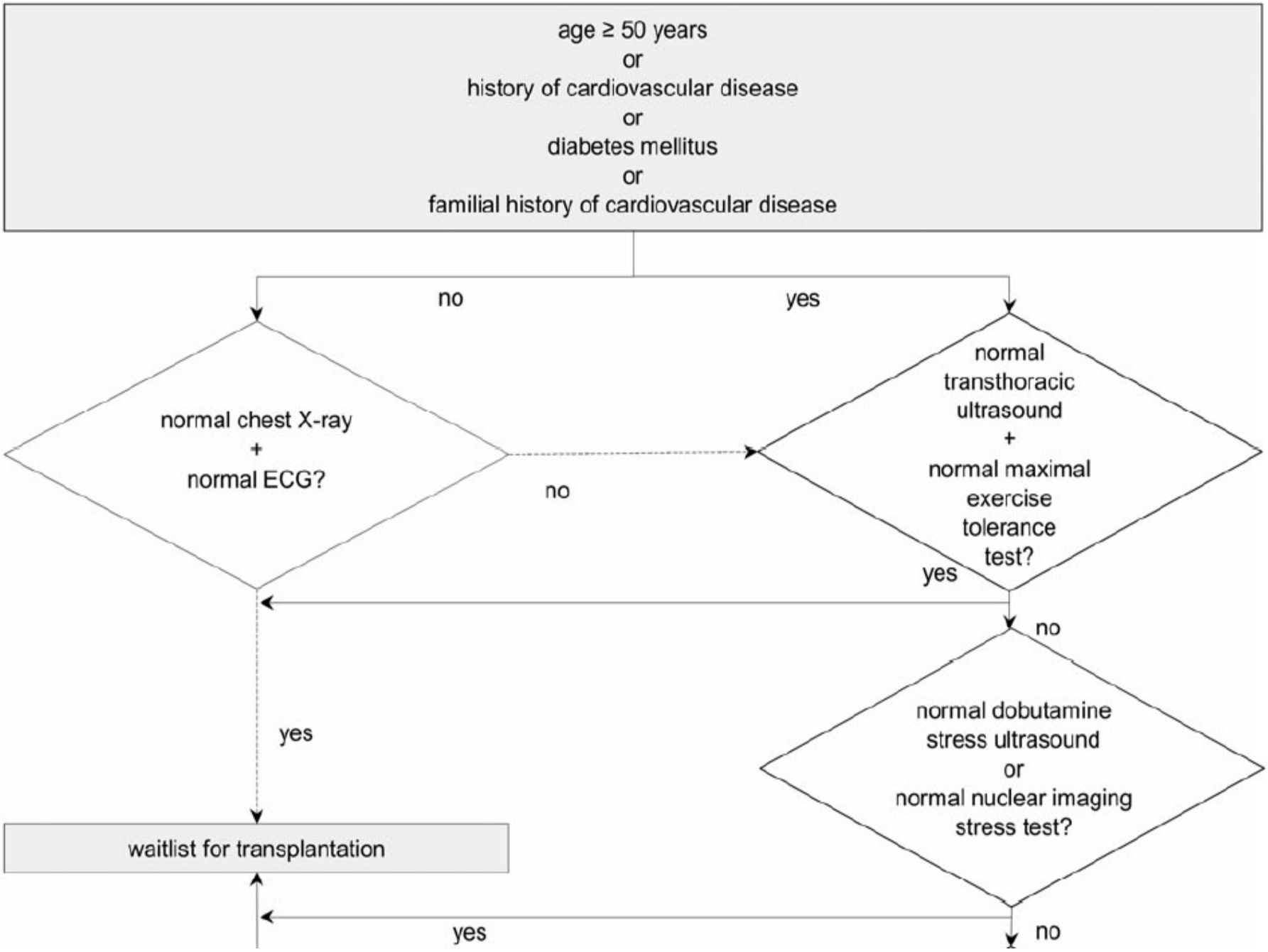
1.10. How should screening for potential cardiovascular disease in the potential recipient be done in a cost-effective way?

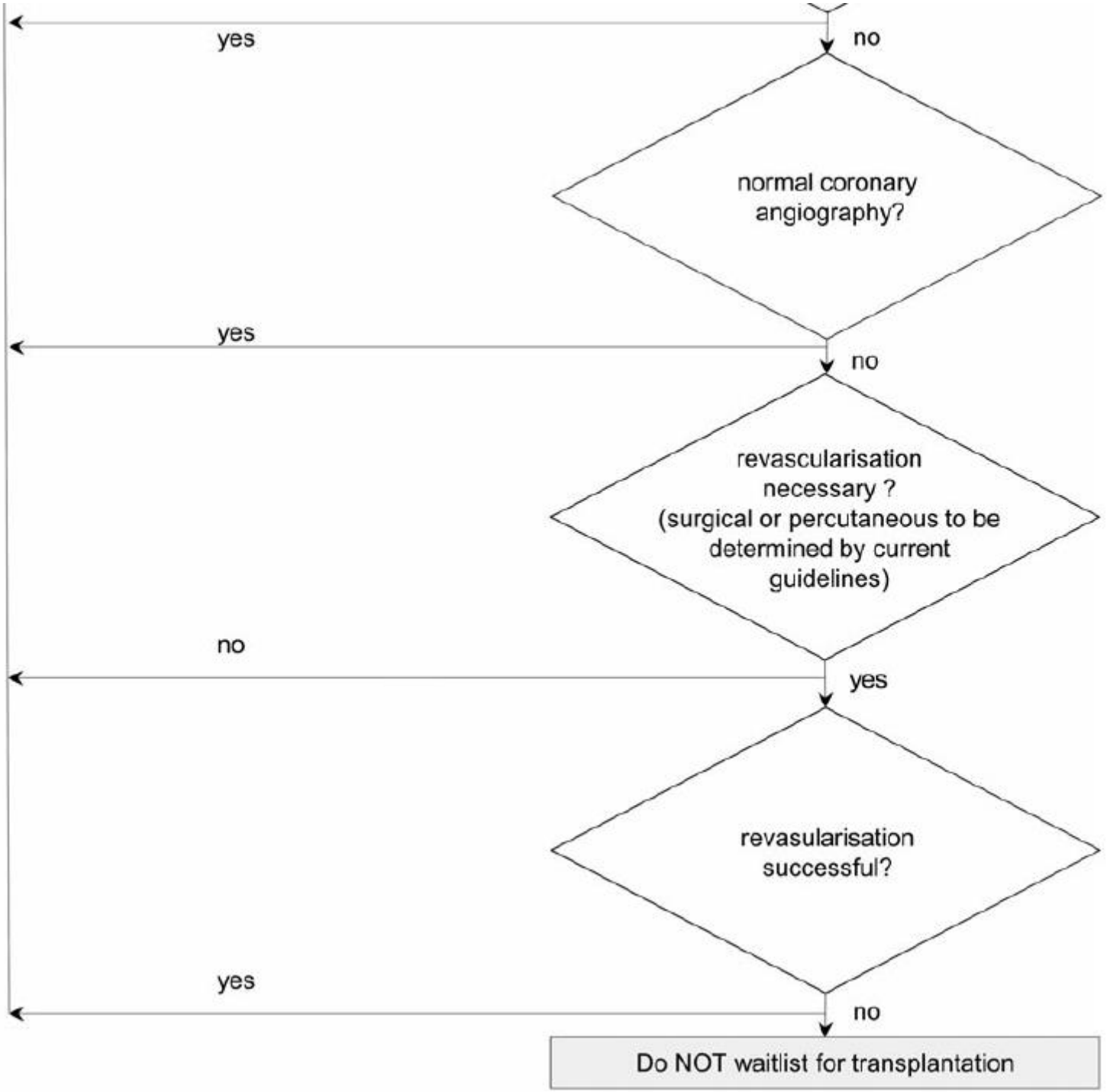
We recommend that basic clinical data, physical examination, resting electrocardiogram (ECG) and chest X-ray are a sufficient standard work-up in asymptomatic low-risk kidney transplant candidates. (**1C**)

We recommend performing a standard exercise tolerance test and cardiac ultrasound in asymptomatic high-risk patients (older age, diabetes, history of cardiovascular disease). In patients with a negative test, further cardiac screening is not indicated. (**1C**)

We recommend performing further cardiac investigation for occult coronary artery disease with non-invasive stress imaging (dobutamine stress echocardiography or myocardial perfusion scintigraphy) in kidney transplant candidates with high risk and a positive or inconclusive exercise tolerance test. (**1C**)

We recommend performing coronary angiography in kidney transplant candidates with a positive test for cardiac ischaemia. Further management should be according to the current cardiovascular guidelines. (**1D**)


age ≥ 50 years
or
history of cardiovascular disease
or
diabetes mellitus
or
familial history of cardiovascular disease
no
yes
normal chest X-ray
+
normal ECG?
no
normal transthoracic ultrasound
+
normal maximal exercise tolerance test?
yes
no
yes
normal dobutamine stress ultrasound
or
normal nuclear imaging stress test?
waitlist for transplantation
yes
no


yes
no
normal coronary angiography?
yes
no
revascularisation necessary ? (surgical or percutaneous to be determined by current guidelines)
no
yes
revasularisation successful?
yes
no
Do NOT waitlist for transplantation

13.7: We suggest that patients with *uncorrectable*, symptomatic New York Heart Association (NYHA) Functional Class III/IV heart disease [severe CAD; left ventricular dysfunction (ejection fraction < 30%); severe valvular disease] be excluded from kidney transplantation unless there are mitigating factors that give the patient an estimated survival which is acceptable according to national standards (*2D*).

13.10: We suggest that transplantation be delayed an appropriate amount of time after placement of a coronary stent as recommended by the patient's cardiologist (*2B*).

13.11: We suggest that maintenance aspirin, β-blockers, and statins be continued while on the waiting list and perioperatively, according to local cardiac guidelines *(2A)*.

Cerebral vascular disease and peripheral vascular disease

- **Kidney transplantation should be deferred in patients with a history of stroke or transient ischemic attack for at least 6 months following the event. The patient should be stable, fully evaluated and treated with risk-reduction strategies before kidney transplantation**
- **The presence of pretransplant peripheral vascular disease (PVD) is not an absolute contraindication to kidney transplantation. However, the risk of death is increased and the presence of PVD should be considered in the context of other comorbidities in determining eligibility for kidney transplantation.**
- **Patients with large uncorrectable abdominal aneurysms, severe occlusive common iliac disease, active gangrene or recent atheroembolic events are not candidates for kidney transplantation**

Infections

SECTION 10: INFECTIONS

10.1 Active infections

10.1.1: We recommend that kidney transplantation be delayed until active infections (bacterial, fungal, viral [except hepatitis C], parasitic) are treated *(1C)*.

10.2 Colonization

10.2.1: Follow local protocols for detection and management of colonization with drug-resistant organisms *(Not Graded)*.

10.2.2: We recommend not excluding patients from kidney transplantation with asymptomatic bacterial, parasitic or fungal colonization *(1C)*.

10.3 Specific Infections

10.3.1 Urinary tract infections (UTIs)

10.3.1.1: We recommend treating symptomatic UTIs prior to kidney transplantation *(1B)*.

10.3.1.2: We suggest not routinely performing prophylactic nephrectomy for recurrent pyelonephritis or cyst infections *(2D)*.

TABLE 11.

Recommendations for initial and follow-up screening of viral and non-viral pathogens in kidney transplant candidates.

Pathogen	Test	Repeat testing
Viral infections		
HIV	IgG	If negative, repeat annually and at time of transplant
HCV	IgG	If negative, repeat annually and at time of transplant
HBV	Anti-HBs, Anti-HBc, HBsAg	If negative, repeat annually and at time of transplant
CMV	IgG	If negative, repeat at time of transplant
EBV	VCA IgG or EBNA IgG	If negative, repeat at time of transplant
HSV	IgG	If negative, repeat at time of transplant
VZV	IgG	If negative, repeat at time of transplant and 4 weeks post-vaccination
Measles, Mumps, Rubella	IgG	If negative, repeat at time of transplant and 4 weeks post-vaccination
HTLV	IgG	None unless ongoing risk of exposure
Non-Viral infections		
Syphilis	IgG with confirmatory testing if IgG positive	None
Strongyloides	IgG	None
Chagas disease	IgG	None
Tuberculosis (in low prevalence areas)	Tuberculin skin test or Interferon-gamma release assay (IGRA)	Annually if ongoing risk of exposure
Malaria	Blood smear if clinically indicated	None

Anti-HBc, hepatitis B core antibody; Anti-HBs, hepatitis B surface antibody; CMV, cytomegalovirus; EBNA, EBV nuclear antigen; EBV, Epstein-Barr virus; HBV, hepatitis B virus; HBsAg, hepatitis B surface antigen; HCV, hepatitis C virus; HIV, human immunodeficiency virus; HSV, herpes simplex virus; HTLV, human T-lymphotropic virus; IgG, immunoglobulin G; VCA, viral capsid antigen; VZV, varicella zoster virus.

Infections

All patients being assessed for kidney transplantation should be screened for HIV infection. HIV-infected patients with end-stage kidney failure may be considered for kidney transplantation if they meet the following criteria :

- **Demonstrated adherence to a highly active anti-retroviral therapy (HAART) regimen**
- **Undetectable (< 50 copies/mL) HIV viral load for > 3 months**
- **CD4 lymphocyte count > 200/mL for > 6 months**
- **No opportunistic infections**

BKV- retransplantation should be considered in otherwise eligible patients who have experienced prior renal allograft loss due to polyomavirus-associated nephropathy.

Vaccination

TABLE 2 Recommendations for immunization of adult patients

Vaccine	Inactivated/live attenuated (I/LA)	Recommended before transplant	Recommended after transplant	Evaluate for serologic response
Influenza[48-52]	I	Yes	Yes	No
	LA	See text	No	No
Hepatitis B[19,23,24,53,56]	I	Yes	Yes	Yes
Hepatitis A[a 57,58]	I	Yes	Yes	Yes
Tetanus[59-62]	I	Yes	Yes	No
Pertussis (Tdap)[b]	I	Yes	Yes	No
Inactivated Polio vaccine	I	Yes	Yes	No
H influenza type B[c]	I	Yes	Yes	Yes
S pneumonia (conjugate vaccine)[25,26,28,29,64,65]	I	Yes	Yes	No
S pneumonia (polysaccharide vaccine)[25,26,28,29,64,65]	I	Yes	Yes	No
Rabies[a,d]	I	Yes	Yes	Yes
Human papilloma virus (HPV)	I	Yes	Yes	No
MMR	LA	Yes	No	No
Varicella (live attenuated; Varivax)	LA	Yes	No	Yes
Varicella (live attenuated; Zostavax)[64]	LA	Yes	No	No
Varicella (subunit;Shingrix)	I	Yes	Yes	No
Measles/Mumps/Rubella[60,71-74]	LA	Yes	No	Yes
BCG[e]	LA	Yes	No	No
Smallpox[f75]	LA	No	No	No
Anthrax	I	No	No	No

SECTION 11: MALIGNANCY

11.1 Cancer screening

11.1.1: We recommend candidates undergo routine cancer screening, as per local guidelines for the general population (Table 13) *(1D)*.

11.1.1.1: We suggest chest imaging prior to transplantation in all candidates *(2C)*. (Same as Rec 12.2)

11.1.1.2: We suggest chest CT for current or former heavy tobacco users (≥ 30 pack-years) as per local guidelines, and chest radiograph for other candidates *(2C)*. (Same as Rec 12.2.1)

11.1.2: Screen candidates at increased risk for renal cell carcinoma (eg ≥ 3 years dialysis, family history of renal cancer, acquired cystic disease or analgesic nephropathy) with ultrasonography *(Not Graded)*.

11.1.3: We suggest cystoscopy to screen for bladder carcinoma in candidates at increased risk, such as those with high-level exposure to cyclophosphamide or heavy smoking (≥ 30 pack-years) *(2D)*.

11.1.4: We recommend screening for hepatocellular carcinoma in candidates with cirrhosis prior to transplantation using techniques (eg, ultrasound, α-fetoprotein) and frequency as per local guidelines *(1C)*.

11.1.5: We recommend screening for bowel cancer in candidates with inflammatory bowel disease as per local guidelines *(1C)*.

Recommendations for cancer screening in the general population and potential transplant candidates

Cancer	General population	Potential transplant candidates
Breast	• Women ages 40 to 49 should have the choice to start annual breast cancer screening if they wish to do so • Biennial mammography is recommended for women age 50 and above • Screening should continue as long as woman is in good health and is expected to live 10 more years or longer[362]	• As per general population[363]
Colorectal	• Biennial fecal immunochemical testing (FIT) is recommended for all people age 50 years and above. Those with positive FIT should have full examination of the colon, preferably by colonoscopy • Flexible sigmoidoscopy (every 5 or 10 years) may also be considered for people age 50 years and above • Screening can be stopped for people who are older than 75 years or with life expectancy less than 10 years	• As per general population[364,365]
Liver	• Annual liver ultrasound and alpha-fetoprotein screening for those with known cirrhosis	• As per general population (see Rec 11.1.4)
Cervical	• Papanicolaou (Pap) test is recommended for women starting at the age of 21 and screening should be done every 3 years. Alternately, screening using HPV testing should be done every 5 years up to age 65 years. Women older than 65 should talk to their doctors about whether or not they need to have regular cervical screening. The decision to stop is often based on a woman's history of having normal or negative Pap test results • Women who had a previous total hysterectomy (removal of the uterus, including the cervix) do not require routine Pap screen	• As per general population[366]
Lung	• Routine screening for lung cancer using chest radiography and low-dose computed tomography (LDCT) *is not recommended* for average risk individuals • However, there is some evidence to suggest annual screening for people at high risk of lung cancer using LDCT. Individuals at high risk are adults aged 55 to 80 years who have a smoking history of at least 30 pack-years and currently smoke or have quit within the past 15 years[367]	• LDCT of the chest may be recommended for individuals who are at high risk of lung cancer, including a prolonged heavy smoking history (see Rec 11.1.1.2)
Prostate	• Men between the ages of 55 to 69 can undergo periodic screening for prostate cancer using prostate specific antigen if they wish to do so after understanding risks and benefits • Clinicians should not screen men who do not express a preference for screening and screening should stop at the age of 70	• As per general population[368]
Kidney	• Routine screening for renal cell cancer is not recommended for average risk individuals	• Ultrasonographic screening of the native kidneys may be recommended for individuals who have a family history of renal cancer, a personal history of acquired cystic disease, analgesic nephropathy, long-term smoking and/or prolonged waiting time on dialysis[369] (see Rec 11.1.2)
Bladder	• Routine screening for bladder cancer is not recommended for average risk individuals	• Urine cytology and cystoscopies may be recommended for individuals who had been previously exposed to chemotherapeutic agents such as cyclophosphamide, regular users of compound analgesics and for heavy smokers (≥ 30 pack-year history) (see Rec 11.1.3)

11.2 Potential kidney transplant candidates with a prior cancer

11.2.1: We recommend that candidates with active malignancy be excluded from kidney transplantation except for those with indolent and low-grade cancers such as prostate cancer (Gleason score ≤ 6), superficial non-melanoma skin cancer, and incidentally detected renal tumors (≤ 1 cm in maximum diameter) (*1B*).

11.2.2: Timing of kidney transplantation after potentially curative treatment for cancer is dependent on the cancer type and stage at initial diagnosis *(Not Graded)*.

11.2.3: We recommend no waiting time for candidates with curatively treated (surgically or otherwise) non-metastatic basal cell and squamous cell carcinoma of the skin; melanoma *in situ*; small renal cell carcinoma (< 3 cm); prostate cancer (Gleason score ≤ 6); carcinoma *in situ* (ductal carcinoma *in situ*, cervical, others); thyroid cancer (follicular/papillary < 2 cm of low grade histology); and superficial bladder cancer *(1C)*.

Recommended waiting times between cancer remission and kidney transplantation[91]

Breast	Early	At least 2 years
	Advanced	At least 5 years
Colorectal	Dukes A/B	At least 2 years
	Duke C	2-5 years
	Duke D	At least 5 years
Bladder	Invasive	At least 2 years
Kidney	Incidentaloma (< 3 cm)	No waiting time
	Early	At least 2 years
	Large and invasive	At least 5 years
Uterine	Localized	At least 2 years
	Invasive	At least 5 years
Cervical	Localized	At least 2 years
	Invasive	At least 5 years
Lung	Localized	2-5 years
Testicular	Localized	At least 2 years
	Invasive	2-5 years
Melanoma	Localized	At least 5 years
	Invasive	Contraindicated
Prostate	Gleason ≤6	No waiting time
	Gleason 7	At least 2 years
	Gleason 8-10	At least 5 years
Thyroid	Papillary/Follicular/ Medullary	
	Stage 1	No waiting time
	Stage 2	At least 2 years
	Stage 3	At least 5 years
	Stage 4	Contraindicated
	Anaplastic	Contraindicated
Hodgkin Lymphoma	Localized	At least 2 years
	Regional	3-5 years
	Distant	At least 5 years
Non-Hodgkin Lymphoma	Localized	At least 2 years
	Regional	3-5 years
	Distant	At least 5 years
Post-transplant lymphoproliferative disease	Nodal	At least 2 years
	Extranodal and cerebral	At least 5 years

Decisions about transplantation for candidates in remission from cancer should be made collaboratively with oncologists, transplant nephrologists, patients, and their caregivers *(Not Graded)*.

Pulmonary disease

Patients should be strongly encouraged to stop smoking

before kidney transplantation;

Patients with the following respiratory conditions and severity are not candidates for kidney transplantation:

- **Requirement for home oxygen therapy**
- **Uncontrolled asthma**
- **Severe cor pulmonale**
- **Severe chronic obstructive pulmonary disease (COPD)–pulmonary fibrosis or restrictive disease: (FEV1) < 25% predicted value, - PO2 room air < 60 mmHg, SaO2 < 90%, > 4 lower respiratory infections in the last 12 months**
- **Patients with moderate COPD–pulmonary fibrosis or restrictive disease have a relative contraindication for kidney transplantation**

Gastrointestinal disease

Patients with active peptic ulcer disease should not be transplanted until the disease is successfully treated.

Upper gastrointestinal endoscopy before transplant should be considered in selected patients (i.e., those with symptoms or prior peptic ulcer disease).

The presence of asymptomatic cholelithiasis is not a contraindication

to kidney transplantation. Patients with previous cholecystitis or suggestive symptoms if gallstones are found, these patients should be considered for cholecystectomy before kidney transplantation

Patients with a history of diverticulitis should be evaluated and considered for partial colectomy before transplant

Acute pancreatitis within 6 months is a contraindication to

kidney transplantation. Chronic pancreatitis in remission for less than 1 year is a relative contraindication to transplantation.

Active inflammatory bowel disease is a contraindication to

transplantation

Liver disease

All transplant candidates should be screened for evidence of liver disease. Regularly monitored for hepatitis B surface antigen (HBsAg),antibody to surface antigen (HBsAb) and anti-body to core antigen (HBcAb).

Transplant candidates with cirrhosis should not be considered for kidney transplantation alone, but may be considered for combined liver–kidney transplantation.

All transplant candidates infected with HBV should be assessed for evidence of viral replication by testing for serum transaminases, hepatitis B e-antigen (HBeAg) and HBV DNA. Patients with active liver disease should be treated with entecavir or tenofovir pre- and post-transplant period.

Patients with hepatitis C virus (HCV) should be considered for kidney transplantation. All transplant candidates with anti-HCV antibodies should be tested for the presence of HCV RNA. Treatment with DAA before or after transplantation.

Patients at high risk for liver cancer (i.e., patients with chronic HBV or HCV infection or both) should be screened using CT or ultrasound and alpha-fetoprotein testing.

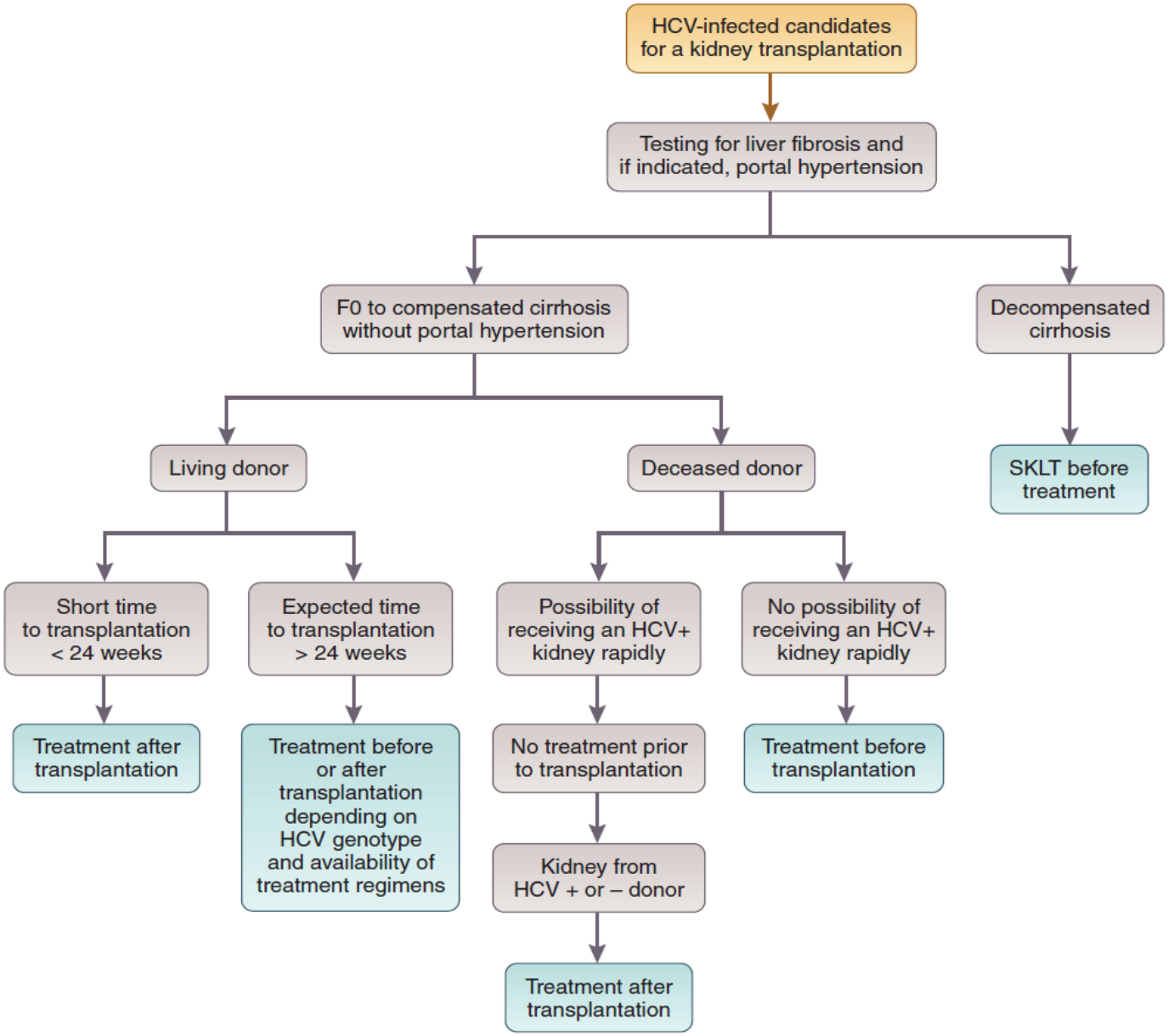


FIGURE 3. Algorithm for the evaluation of kidney transplant candidates with HCV Reproduced from KDIGO 2018 Clinical Practice Guideline on the Prevention, Diagnosis, Evaluation and Treatment of Hepatitis C in CKD.[329] F0, no fibrosis; HCV, hepatitis C virus; SKLT, simultaneous kidney-liver transplantation.

Genitourinary disease

A urologic cause of ESRD is not necessarily a contraindication to kidney transplantation provided appropriate urinary tract drainage can be achieved.

- **Kidney transplantation is not contraindicated in patients with a dysfunctional bladder. Most patients can be managed without surgery using self-catheterization, if necessary.**
- **A surgical approach, if needed, should be individualized**
- **Persistent infection of the native kidneys may be a relative contraindication to immunosuppressive therapy. To reduce the risk of post-transplant complications, consideration should be given to the need for native nephrectomy in selected patients.**
- **Massive kidneys in the setting of autosomal dominant polycystic kidney disease may preclude placement of a renal allograft. Such patients may require unilateral or bilateral native nephrectomy before renal transplantation.**

Hematologic disorders

- **The presence of thrombophilia, hypercoagulable state or cytopenias is not an absolute contraindication to kidney transplantation, but these conditions should be fully investigated.**
- **Patients requiring long-term anticoagulation for recurrent deep venous thrombosis, atrial fibrillation, prosthetic heart valves or hypercoagulable states are candidates for kidney transplantation. A perioperative anticoagulation plan should be developed as part of the transplant assessment. Patients should be informed of the risk of bleeding, including life-threatening hemorrhage, with perioperative anticoagulation.**

World Health Organization Classification of Weight According to BMI

BMI (kg/m^2)	Category	Risk of Comorbidities
<18.5	Underweight	Low
18.5–24.9	Normal	Average
>25	Overweight	
25–29.9	Pre-obese	Increased
30–34.9	Obese class I	Moderate
35–39.9	Obese class II	Severe
>40	Obese class III	Very severe

Work Group recommends assessment of all candidates for obesity using either BMI or waist to- hip criteria. Obesity is a relative contraindication to kidney transplantation. Patients found to be obese or particularly those with class II or class III obesity (BMI ≥ 35 kg/m2) should be considered for intervention such as dietary counseling or bariatric surgery. The Work Group did not establish a firm BMI cutoff, but encourages each transplant program to consider their own resources and skills in caring for this population. For example, early experience with robotically assisted transplantation has demonstrated improved outcomes among obese patients. Pre-transplant panniculectomy may be useful in reducing BMI and improving wound outcomes following transplant. Transplantation in patients with a BMI ≥ 40 kg/m2 should be approached with caution; patients need to understand the increased risk of postoperative complications in this situation.

1.6. Does pre-transplant alcohol and drug abuse in patients influence patient or graft survival?

We recommend that women who drink >40 g and men who drink >60 g of alcohol per day stop or reduce their alcohol consumption to below these levels. (**1D**)

These patients can be waitlisted, but a careful surveillance of reduction of alcohol consumption should be exerted. (**Ungraded Statement**)

We recommend not waitlisting patients with alcohol 'dependence'. (**Ungraded Statement**)

Strategies to stop alcohol consumption should be offered, according to the World Health Organization (WHO) Clinical Practice Guideline. (**Ungraded Statement**)

We recommend not waitlisting patients with an ongoing addiction to 'hard drugs' resulting in non-adherence. (**1D**)

1.9. Should kidney transplantation be delayed in patients presenting with uncontrolled secondary hyperparathyroidism? Does uncontrolled secondary hyperparathyroidism in the immediate pre-transplant period have an impact on transplant outcomes?

We recommend not refusing a cadaveric graft only because of uncontrolled hyperparathyroidism in the recipient. (**1D**)

However, for patients on the waiting list, effort should be made to comply with existing chronic kidney disease—metabolic bone disease guidelines, including parathyroidectomy, when indicated. (**Ungraded Statement**)

1.11. When and for which indications should native nephrectomy be performed in kidney transplant candidates awaiting kidney transplantation?

We recommend native nephrectomy before transplantation (unilateral or bilateral) in patients with autosomal polycystic kidney disease (ADPKD) when there are severe, recurrent symptomatic complications (bleeding, infection, stones). (**1C**)

We suggest unilateral nephrectomy of asymptomatic ADPKD kidneys when space for the transplant kidney is insufficient. (**2C**)

We do not recommend routine native nephrectomy, unless in cases of recurrent upper urinary tract infections or when the underlying kidney disease predisposes to enhanced cancer risk in the urogenital tract. (**Ungraded Statement**)

2.5. Should in kidney transplant candidates a failed allograft that is still in place be removed or left in place?

Evidence comparing patients with a failed transplant with versus without nephrectomy is insufficient and conflictive, hampering a meaningful general recommendation on whether or not nephrectomy of failed grafts should be recommended. (**Ungraded Statement**)

We suggest that in following conditions an explantation of the failed kidney graft be considered: clinical rejection, chronic systemic inflammation without other obvious cause or recurrent (systemic) infections. (**Ungraded Statement**)

We suggest to continue low level immunosuppression and to avoid a nephrectomy of a failed graft when residual graft urinary output is >500 mL/day and there are no signs of inflammation. (**Ungraded Statement**)

SECTION 19: IMMUNOLOGICAL ASSESSMENT

19.1: Communicate all sensitizing events (eg, blood product transfusion, including platelets, pregnancy or miscarriage) or clinical events that can impact panel reactive antibody (PRA) (eg, vaccination, withdrawal of immunosuppression, transplant nephrectomy, significant infection) to the human leukocyte antigen (HLA) laboratory *(Not Graded)*.

19.2: Perform HLA antibody testing at transplant evaluation, at regular intervals prior to transplantation and after a sensitizing event or a clinical event that can impact PRA *(Not Graded)*.

19.3: We recommend that HLA antibody testing be performed using solid phase assays *(1B)*.

19.4: We recommend HLA typing of candidates at evaluation using molecular methods, optimally at all loci *(1D)*.