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Cardiac Evaluation before kidney transplantation surgery

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Cardiovascular disease is leading cause of morbidity and mortality before and after kidney transplantation in ESRD patients.

Chronic kidney disease (CKD) is an independent risk factor for the development of Cardiovascular disease.

Cardiovascular diseases in aggregate make up the most common cause of death in patients with functioning allografts at all times after kidney transplantation, accounting for 30% of mortality overall, with highest rates in the peri transplantation period

DIFEFERTIAL SYMPTOMS OF ACUTE MI IN CKD PATIENTS AM J KIDNEY DISEASE 2006

Both decreased glomerular filtration rate (GFR) and increased proteinuria increase the risk of cardiovascular disease

Numerous studies have shown that the presence or development of various degrees of renal dysfunction is independently associated with cardiovascular events.

Estimated GFR and ACR(Alb/Cr ratio) improves the ability to predict cardiovascular events in patients at high cardiovascular risk

Association between urinary Alb excretion and coronary heart dis. **JAMA 2013**

The CKD patients have not typical coronary symptoms like other population

Evidence that mild to moderate CKD is associated with an adverse cardiovascular prognosis led both the National Kidney Foundation and the American College of Cardiology/American Heart Association to recommend that:

** CKD MAYBE considered a CHD risk equivalent**

NATIONAL KIDNEY FOUNDATION PRACTICE GUIDELINE

The risk of heart disease in those with CKD appears to vary based upon absolute level of ***renal function*** and degree of ***proteinuria***, as well as the ***rate*** at which these factors emerge

Even patients with the same degree of renal dysfunction may not have the same risk of cardiovascular disease since the risk of cardiovascular disease in a patient with CKD is in part related to the presence and extent of *significant comorbidities*

USING PROTEINURIA AND GFR RATE TO CLASSIFY RISK IN CKD ANN INTEN MED 2011

Nontraditional risk factors — Possible risk factors that are relatively unique to patients with moderate to severe CKD include:

retention of uremic toxins, anemia, elevated levels of certain cytokines, positive calcium balance, abnormalities in bone mineral metabolism, and/or an "increased inflammatory-poor nutrition" state

Elevated levels of C-reactive protein (CRP) and asymmetric dimethyl arginine, both of which are typically found in patients with CKD, were both independently associated with an increased risk of all cause and cardiovascular mortality

There is also a relationship between cardiovascular disease and moderately increased albuminuria among nondiabetic patients with normal estimated GFR

EMERGING CARDIOVASCULAR RISK THAT ACCOUNT FOR MORTALITY IN CKD AME J CARDIOLOGY2008.

Perioperative MI occurs predominantly in patients with multivessel CAD, especially left main and 3-vessel disease; however, the severity of preexisting underlying stenosis did not predict accurately the resulting infarct territory.

Because the nidus for the thrombosis is often a *noncritical stenosis*, preoperative cardiac evaluation before surgery may fail to identify patients at risk for plaque rupture

AHA2012

Methods of preoperative cardiovascular

testing do not identify patients with mild to moderate **but**" vulnerable coronary plaque"

patients who could not walk 4 blocks and climb 2 flights of stairs were considered to have poor exercise tolerance and were found to have **twice** as many perioperative cardiovascular complications as those with better functional status

AHA2012

The value of screening to identify asymptomatic patients likely to benefit from coronary revascularization procedures is even less clear.

ONLY certain small subgroups with high-risk coronary artery anatomy probably achieve survival benefit from CABG surgery[a]

In patients with stable CAD and lesser extents of coronary disease, coronary revascularization has not been demonstrated to provide benefit of optimal medical therapy when studied in a randomized fashion before elective vascular surgery.

AHA2012

There are **no** definitive data at this time **for or against** screening for myocardial ischemia among kidney transplantation candidates *who are free of active cardiac conditions*.

However, until more data are available, it may be useful to use aggregate CAD risk factors to target screening of patients with the highest pretest likelihood of prognostically significant CAD

The coronary angiogram triggered by positive DSE or clinical symptoms, correctly identifies the patients likely to suffer from death and CV disease during follow-up but coronary intervention does not seem to alter prognosis.

European Renal Best Practice Guideline on kidney donor and recipient evaluation and perioperative care2015

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

We recommend performing coronary angiography in renal transplant candidates with a positive test for cardiac ischemia. Further management should be according to the current cardiovascular guidelines

Nephrol Dial Transplant (2015) 30: 1790–1797

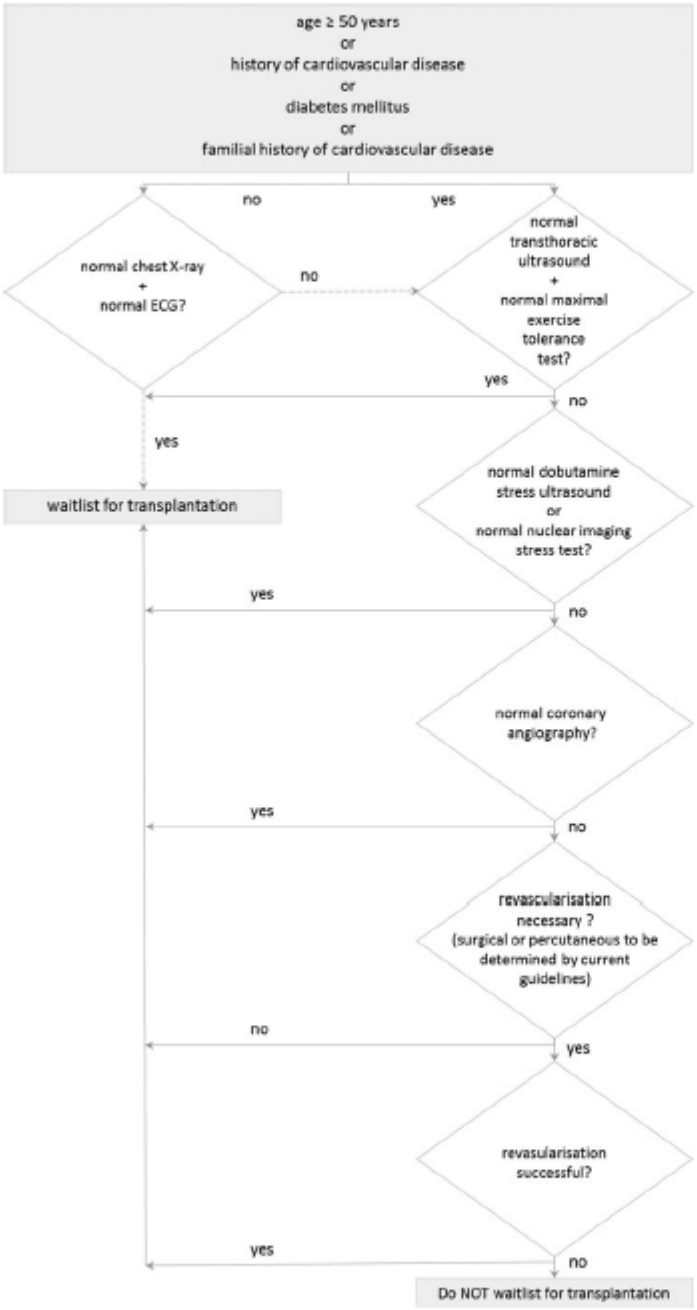


FIGURE 1. Decision tree pre-transplant cardiovascular screening.

Relative contraindications to transplantation

Many centers consider the following as

relative contraindications to transplantation:

- Progressive symptoms of angina that are not amenable to angioplasty or bypass surgery
- History of myocardial infarction within the past three to six months
- Known severe coronary heart disease (CHD) Severe ischemic cardiomyopathy (ejection fraction less than 30% that is not amenable to intervention

CARDIOVASCULAR RISK ASSESSMENT IN KIDNEY TRANSPLANTTATION . KIDNEY INT J 2015

- Patients with ***nonischemic cardiomyopathy*** and no other significant comorbidities may be candidates for kidney transplant alone after consultation with a heart failure specialist.
- Cardiomyopathy may reverse or improve after kidney transplantation.

patients with known CHD may be eligible for kidney transplantation

-Asymptomatic low-risk patients

-Asymptomatic patients in whom noninvasive testing is negative

-Patients on appropriate medical therapy with angiographic results showing noncritical disease

-Patients in whom successful interventions have been performed

AHA2012,UPTODATE2018

CORONARY ANGIOGRAPHY

Patients with angina symptoms, Cardiomyopathy reduced ejection fraction,

- Diabetes mellitus type 1 with diabetic nephropathy as the cause of their end-stage renal disease (ESRD)

Patients with a positive noninvasive stress test

AHA2012& Uptodate 2018

In patients **without** angina symptoms, cardiomyopathy with reduced ejection fraction, or diabetes mellitus type 1 with diabetic nephropathy as the cause of their ESRD, the decision to screen with *noninvasive* testing is based upon the presence of the clinical risk factors

Clinical risk factors:

- Age >60 years
- Diabetes mellitus
- Hypertension
- Dyslipidemia
- Peripheral vascular disease
- Previous history of CHD (such as myocardial infarction)
- Left ventricular hypertrophy
- Family history of heart disease
- Dialysis vintage greater than **one year**
- Prolonged duration of CKD
- History of smoking
- History of radiation therapy (either whole body or chest irradiation)

Uptodate 2018 &AHA 2012

Patients with <3 of the above clinical risk factors are considered to be at low risk for CHD, and in

general, we do not screen such patients with noninvasive testing .

However, we screen all patients who have either diabetes mellitus or peripheral vascular disease , even if they *don't* have any additional risk factor

UPTODATE 2018

Patients with ≥3 of the above clinical risk factors, diabetes, or peripheral vascular disease are considered to be at intermediate risk for CHD

We screen these patients with a noninvasive test, such as a dobutamine stress echocardiogram or myocardial perfusion study

Across this collection of studies, DSE and MPS had sensitivities varying from 0.44 to 0.89 and 0.29 to 0.92 and specificities ranging from 0.71 to 0.94 and 0.67 to 0.89,respectively, for identifying 1 or more coronary stenosis more than 70%.

The optimal choice is generally based upon the expertise of the particular medical center and clinical patient characteristics.

Patients with a negative noninvasive stress test who have diabetes or a previous history of CHD should undergo repeat noninvasive testing annually.

In patients without diabetes or a previous history of CHD who have a left ventricular ejection fraction of ≤40 percent, peripheral vascular disease, or ≥2 traditional risk factors, we repeat noninvasive testing every two years

AHA 2012guideline

-Coronary revascularization before transplantation surgery should be considered in patients who meet the criteria of revascularization (*Class I; Level of Evidence B*).

It is recognized that in some asymptomatic transplantation candidates, the risk of coronary revascularization may outweigh the risk of transplantation and these risks must be weighed by the multidisciplinary transplantation team on a case-by-case basis until further studies are performed in this population.

- CABG is probably recommended in preference to PCI to improve survival in patients with multivessel CAD and diabetes mellitus (*Class IIa; Level of Evidence B*).

AHA 2012

CABG to improve survival and/or to relieve angina despite optimal medical therapy may be reasonable for patients with ESRD with significant (>50%) left main stenosis or significant (>70%) stenoses in 3 major vessels or in the proximal left anterior descending artery plus 1 other major vessel, regardless of left ventricular systolic function (*Class IIb; Level B)*

<u>It is not recommended that routine prophylactic</u> coronary revascularization be performed in patients with stable CAD, absent symptomatic or survival indications, before transplantation surgery (*Class III; Level of Evidence B*).

For patients treated with DES who are to undergo subsequent procedures that mandate discontinuation of thienopyridine therapy, ***aspirin*** *should be continued if at all possible* and the thienopyridine restarted as soon as possible after the procedure because of concerns about late stent thrombosis

Assessing cardiovascular risk in chronic kidney disease patients prior to kidney transplantation: standardised cardiovascular assessment protocol

Each patient underwent cardiac risk stratification and was assigned to a

‘**high-risk’ group:**

those older than 60 years of age or 60 and below with at least one of the following cardiac risk factors: diabetes, ischemic heart disease ,peripheral vascular disease, congestive cardiac failure;

‘low-risk’ group :

those patients aged between 40 to 60 years old with none of the mentioned cardiac risk factors;

‘**minimal risk’ group**:

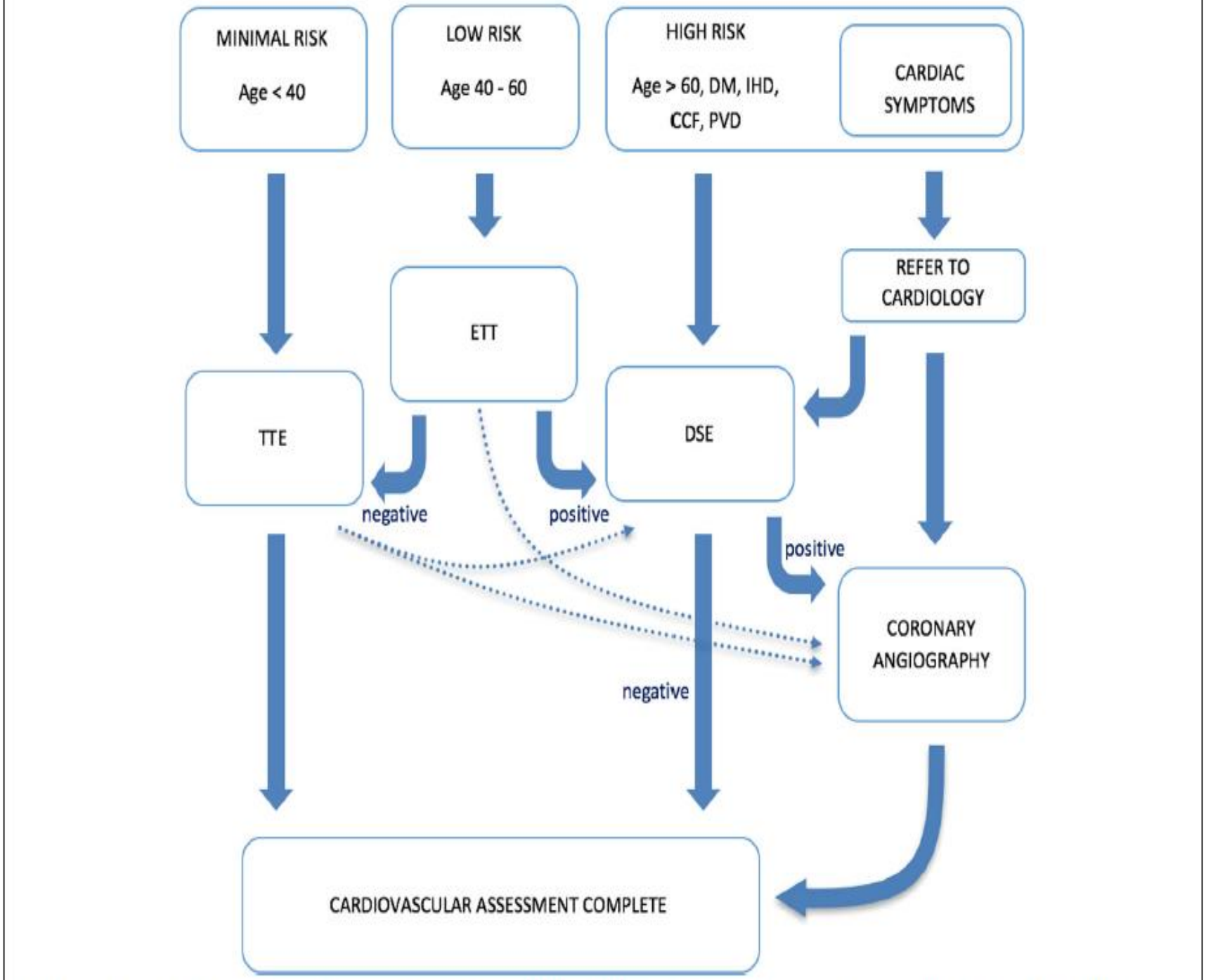
those younger than 40 with none of these risk factors

BMC Nephrology (2018) 19:2

- **high-risk** patients requiring DSE;
- **minimal-risk** patients below age 40 years undergoing transthoracic echocardiogram (TTE);
- patients between ages 40-60 years
- requiring an exercise treadmill test (ETT).

low-risk patients with *positive or inconclusive* exercise treadmill test or abnormal TTE were assessed with DSE.

- The patients with *positive DSE, symptomatic angina or acute coronary syndrome (ACS)* underwent coronary angiography.


MINIMAL RISK
Age < 40
LOW RISK
Age 40 - 60
HIGH RISK
Age > 60, DM, IHD,
CCF, PVD
CARDIAC
SYMPTOMS
REFER TO
CARDIOLOGY
ETT
TTE
DSE
negative
positive
positive
CORONARY
ANGIOGRAPHY
negative
CARDIOVASCULAR ASSESSMENT COMPLETE

CONCLUSION

Until better evidence for cardiovascular disease risk management emerges, the decision for coronary revascularisation, optimisation of medical management and transplantation should be made on a case by case basis and involve transplant and nephrology, cardiology and cardiothoracic teams


Thanks for your attention