Transplant Cardiac Risk Assessment

Chelsie Yellman, MSN, ACNP-BC
Kidney/Pancreas Transplant NP
Vanderbilt University Medical Center
Objectives

• Contrast perioperative cardiovascular risk assessment in general population vs. transplant patient

• Discuss organ-specific considerations of cardiovascular risk assessment for the potential transplant recipient

• Discuss limitations in cardiovascular testing modalities in the end stage organ failure patient

• What do we do with this information?
I have no financial relationships to disclose within the past 12 months relevant to my presentation and my presentation does not include discussion of off-label or investigational use.
Example of non-transplant perioperative cardiac risk assessment

62 year old female with osteoarthritis of right knee, scheduled for right total knee replacement with Orthopedic Surgeon

Past Medical History
- MI in 2010 s/p CABG x 2
- HTN-well controlled on 2 agents
- HLD-well controlled on statin without adverse reaction

Diagnostic studies/labs
- EKG shows HR 82, NSR with LVH
- Cr 1.3 mg/dL, K 4.2 mEq/L, Glucose 118 mg/dL
Orthopedic Surgeon consults Internal Medicine and/or Cardiology for “Cardiac Clearance”
Revised Cardiac Risk Index (Goldman Cardiac Risk Index)

• Estimates rate of perioperative cardiac death, non-fatal myocardial infarction, or nonfatal cardiac arrest

• Risk factors: Surgery-specific risk, history of ischemic heart disease, history of heart failure, history of cerebrovascular disease, insulin-dependent DM, pre-op serum creatinine $\geq 2.0$

• Risk calculated based on number of risk factors (0.4% for no risk factors-5.4% with $\geq 3$)
Pre-transplant cardiac evaluation attempts to answer different questions

- Wider scope than the immediate perioperative period
- Patients may not undergo transplantation procedure for months to years after initial cardiac evaluation
- How do we exclude those patients with short expected near-term survival because of underlying conditions, in whom transplantation would not yield clear benefit?
Evidence-based cardiovascular risk assessment is a popular topic in current literature including this review article in October 2014 issue of AJT
Transplant candidates are older

- In 2011, 62% of kidney transplantation candidates were ≥ 50 years of age compared with 28.7% in 1991
- As of 2012, 77% of liver transplantation candidates were ≥ 50 years of age
- Increased age raises the average medical complexity and comorbidity burden among listed candidates (increased frequency of HTN, DM, CAD)
Cardiovascular disease implications for transplant patients

- Cardiovascular disease is a significant cause of morbidity and mortality for wait-listed kidney transplant patients and is most common cause of death in kidney transplant recipients.
- 50% operative mortality from cardiac complications in liver transplant patients with known CAD (reported 1996).
- Scarce data regarding early cardiac morbidity and mortality after liver transplant. One study reports 1st year post-transplant CV morbidity and mortality of 15.2% and 2.8%.
- Cardiac events are 3rd leading cause of death >1 year after liver transplant.
- Multiple studies report frequency of CAD among patients referred for lung transplant but not able to locate studies commenting on post-transplant outcomes in patients with known CAD or cardiovascular events contribution to either early or late post-transplant morbidity/mortality.
Cardiovascular disease in end stage renal disease patients

• Patients on dialysis have at least 10- to 100-fold higher risk of death from CVD than age-matched controls in general population

• MI occurs in up to 30% and 52% by the end of first and second years on dialysis respectively

• In ESRD patients who underwent cardiac catheterization as part of kidney transplant evaluation, significant CAD (>50% occlusion) seen in 40-80% of patients
Factors contributing to cardiovascular risk and their prevalence in patients with advanced chronic renal failure

- Age >50 years >50%
- Hypertension >90%
- Diabetes mellitus >40%
- Cigarette smoking 25%
- Obesity 20%
- Hyperphosphatemia, elevated Ca × P >30%
- Secondary hyperparathyroidism >80%
- Anemia >90%
- Left ventricular hypertrophy >50%
- Hyperlipidemia >30%
- Reduced GFR 100%
- Dialysis duration >1 year >70%
- Abnormal ECG >50%
- Proteinuria >30%

Cardiovascular risk assessment for liver transplant candidates

- Diabetes mellitus with diffuse cardiovascular disease far less common in liver transplant candidates than renal transplant candidates
- Cirrhosis is associated with glucose intolerance and, as such, patients are labeled as “diabetic” but very few have systemic manifestations (retinopathy, nephropathy, vascular disease, or family history)
- When present in liver transplant candidates, diabetes is often accompanied by obesity
- Hypertension far less common in ESLD patients than ESRD
- Nonalcoholic steatohepatitis has been associated with higher rates of CAD than other ESLD etiologies
- Several cardiopulmonary problems unique to liver transplant candidates- pulmonary hypertension, hepatopulmonary syndrome (hypoxia from intrapulmonary shunts in patients with cirrhosis and portal hypertension)
Cardiovascular considerations in lung transplant patients

- Lung transplant patients often present with traditional cardiac risk factors (smoking, DM, HTN, HLD) as well as inflammation affecting both the lungs and coronary vasculature.
- Relative risk of cardiovascular morbidity and mortality is greater in patients with COPD than general population. In one study, ischemic heart disease was a more common cause of death than COPD among COPD patients.
- There is an increased risk of CAD in fibrotic lung disease when compared to non-fibrotic lung disease.
- Several studies show similar rates of significant CAD (50-70% stenosis) in lung transplant candidates of 16-18%.
Cardiac testing for the transplant evaluation patient

All tests are not created equal.

Who to test?
Cardiac testing for the general surgery patient

• In 2007 American College of Cardiology (ACC) and American Heart Association (AHA) issued “Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery

• No further cardiac testing in asymptomatic patient with functional capacity of ≥4 metabolic equivalent tasks (METS, i.e. ability to climb a flight of steps) regardless of diabetic status, history of CAD or other risk factors

• “2009 Appropriate Use Criteria for Cardiac Radionuclide Imaging” by the American College of Cardiology Foundation (ACCF) recommends radionuclide imaging for perioperative evaluation before intermediate-risk noncardiac surgery in asymptomatic patients only when at least 1 risk marker present and the patient has poor (<4 METS)) or unknown functional status
Additional considerations for the transplant evaluation patient

• The 2007 ACC/AHA and ACCF guidelines were not written for the end-stage organ failure patient. In 2012, “Cardiac disease evaluation and management among kidney and liver transplantation candidates”, a scientific statement from the AHA and ACCF, was released to augment 2007 recommendations

• The predictive value of the “absence of cardiac symptoms” may differ in transplantation candidates compared to the general population

• Previous guidelines take the perspective that noncardiac surgery will be performed shortly after evaluation and management decisions will affect short-term outcomes

• Cardiac evaluation and interventions in transplant candidates should be considered from both short-term and long-term perspective
Cardiac screening of the transplant candidate

- Considerable variance in published clinical practice guidelines for testing for CAD in asymptomatic transplant patients
- Dobutamine stress echo (DSE) or myocardial perfusion scintigraphy (MPS) have not been shown to be particularly sensitive or specific to detect severe CAD but both have prognostic value for MI and cardiac death
  - Abnormal DSE or MPS with either active ischemia or fixed defect should prompt referral to cardiologist for possible cardiac catheterization
- Both potential kidney and liver transplant recipients often have difficulty achieving target heart rate during DSE
- Resting echocardiogram reasonable for potential liver transplant recipients for the purpose of identifying pulmonary hypertension and/or intrapulmonary arteriovenous shunt
Coronary angiography pros and cons

- Considered the “gold standard” for diagnosing CAD in patients with end-stage renal, liver, and lung disease.
- Dye load an issue for the chronic kidney disease patient not yet on dialysis.
- Coagulopathy in ESLD patients increases risk of bleeding complications after CA.
- In many centers, lung transplant candidates over age 50 undergo CA, which may be reasonable given high incidence of CAD and cardiac morbidity and mortality in this population.
- Major mechanism of MI is plaque rupture of a noncritical coronary stenosis with subsequent coronary thrombosis. No preoperative tests identify patients with mild to moderate but “vulnerable” coronary artery plaques.
Who to test?

- Multiple algorithms have been proposed for ESLD and ESRD patients.
- None are based on randomized trials, instead based on expert opinion in the setting of observational data.
- AHA/ACCF scientific statement recommendations reasonable for liver transplant candidates: CA for high risk patients (3 or more risk factors-DM, prior CAD, LVH, age >60, smoking, HTN, dyslipidemia). Since NASH has been associated with CAD in ESLD patients, may consider as additional risk factor.
Clinical decision making based on cardiovascular assessment

- Revascularization?
  - no conclusive evidence that prophylactic revascularization improves post-transplant outcomes.
  - generally defer to cardiologist for treatment plan, refrain from making specific recommendations for revascularization for the sole purpose of transplant candidacy
    - CABG is probably recommended in preference to PCI to improve survival in ESRD patients with multivessel CAD, left main disease, and DM
    - One study shows better 1- and 3-year survival rates in ESRD patients that underwent revascularization then transplantation than those that did not undergo either revascularization or transplant. 3-year survival slightly better in patients who underwent revascularization but remained on transplant list
    - Few studies in the liver and lung transplant population; more data are necessary to make recommendations on revascularization
To transplant or not to transplant?  
(To waitlist or not to waitlist)

- Probably benefit of transplant over dialysis even for the high cardiovascular risk ESRD patient but must take into consideration additional comorbidities (advanced age, DM, peripheral vascular disease)
- New study identified age, history of CAD, and pre-transplant vasopressor administration as risk factors for postoperative ACS following liver transplantation.
  
- Individual centers must make policies that outline the level of cardiovascular risk they are willing to assume
- Anticipated waitlist time should be considered
  - possibly transplant higher risk patients if living kidney donor available to eliminate wait time as a factor
Waitlist management

- Aggressive management of risk factors for renal transplant candidates (HTN, HLD, DM, smoking cessation)
- Because of generally shorter wait time before liver transplantation, medical management of lipid abnormalities and atherosclerotic risk factors not high priorities
- ESLD patients with large esophageal varices benefit from nonselective beta-blockers
- No conclusive evidence supporting utility of repeat screening or optimal timing
- Center-specific protocols generally based on observational data or consensus

  - Further research is needed to aid in clinical decision making to maximize benefits while minimizing risk to patient of unnecessary procedures and use of limited financial resources
Perioperative considerations-renal transplant

• Among patients already on beta blockers before renal transplantation, continue perioperatively and postoperatively to prevent rebound hypertension and tachycardia

• Among renal transplant patients with known markers of cardiac risk, reasonable to initiate beta-blockers preoperatively and continue postoperatively provided that dose titration is done carefully to avoid bradycardia and hypotension

• No evidence to indicate that routine use of dopamine improves renal perfusion or diminishes risk of delayed graft function

• Evidence to support continuation of statin therapy and aspirin therapy postoperatively
Perioperative considerations-liver transplant

- Limited data on minimizing cardiovascular risk post liver transplant
- New study reports increased risk of MACE when $\geq 12$ units of packed red blood cells were transfused

Summary

• Older patients presenting for transplant associated with increased comorbidities
• Cardiovascular risk assessment of the transplant candidate unique and requires special considerations
• Limited data available regarding who to screen, how often, and appropriate clinical decision making based on results
• Much more research is needed to clearly define testing protocols to maximize patient outcomes while minimizing unnecessary and costly testing
Bibliography


Questions?
Chelsie Yellman, ACNP-BC

chelsie.s.yellman@vanderbilt.edu