

# Patients Undergoing Evaluation for Orthotopic Liver Transplants: Cardiology Assessment

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## Abstract

For end-stage liver disease, orthotopic liver transplantation (OLT) is a viable treatment option. Due to changes in hemodynamics and the length of the procedure, the cardiovascular system is put under a lot of stress during the perioperative period. To ensure positive outcomes, cardiovascular disease must be diagnosed and treated prior to OLT. Practitioners who take care of these patients vary significantly. Foundations tailor their conventions based on neighborhood and authentic practices, the inclinations of the cardiologists, and the OLT group, and calculations are not frequently changed or refreshed based on the accessible proof. We sought to examine the diagnostic cardiovascular workup of OLT candidates, including a review of the available literature on the diagnostic modalities used to screen for cardiovascular disease prior to OLT, in collaboration with experts in cardiology and hepatology from leading OLT centers. Non-invasive cardiovascular risk assessment should be prioritized, with the use of invasive risk stratification reserved for select patients.

**Keywords:** Coronary angiography • Pulmonary hypertension • Structural heart disease

## Introduction

In a multivariate analysis, the risk of death after OLT was most strongly associated with a history of coronary artery disease (CAD), angiographically confirmed coronary stenosis, and a left ventricular ejection fraction (LVEF) below 50%. The primary goal of a cardiology consultation for OLT candidates is to provide cost-effective risk stratification and guide appropriate treatment. Orthotopic liver transplantation (OLT) is a high-risk treatment option for patients with end-stage liver disease. Preoperative cardiovascular evaluation and treatment varies widely among institutions, which tailor their protocols based on the preferences of individual cardiologists and historical and anecdotal practices rather than solid clinical trial data [1].

However, a state-of-the-art review that was published almost a decade ago recommended that OLT candidates undergo rest and stress echocardiography followed by invasive catheterization for appropriately selected patients based on their risk factors. In addition, these protocols are rarely revised or updated in light of changing practices or evidence. The OLT team (transplant surgeons, hepatologists, and anesthesiologists), which has less experience diagnosing and treating cardiovascular disease, may also have an impact on institutional protocols. The authors of this consensus document have a particular interest and expertise in the preoperative cardiology assessment of OLT candidates, and their opinions and recommendations regarding this topic are based on a review of current institutional practices as well as relevant literature [2].

## Literature Review

This paper's authors are cardiologists and hepatologists from large OLT centers in the United States who have extensive knowledge of OLT candidates' diagnostic cardiovascular workup. In order to produce a consensus document for the evaluation and management of OLT candidates, authors communicated

with each other to share their institutional practices. The authors used a general framework to conduct a comprehensive literature review to present recommendations, highlight knowledge gaps, and summarize existing evidence. PubMed/MEDLINE served as the primary source for the review, which focused solely on English-language studies. The authors' perspectives are expressed in this document's conclusions. The final version of this document was approved after all authors had the chance to comment on the initial drafts [3].

Orthotopic liver transplantation necessitates a complicated procedure that involves vascular reconstruction of the hepatic artery, portal vein, and hepatic venous drainage into the inferior vena cava. Significant perioperative stress is placed on the cardiovascular system as a result of hemodynamic disturbances and the prolonged duration of the procedure (up to 12 hours). The components of expanded perioperative cardiovascular interest might incorporate huge draining and bonding prerequisites, mediocre vena cava clipping, hypotension, and postreperfusion disorder with an unexpected expansion in preload adding to an ascent in focal venous and pneumonic blood vessel pressures [4].

During OLT, ESLD patients may exhibit detrimental pathophysiologic changes that may present a cardiovascular risk. These include bradycardia and hypotension, which is caused by low systemic vascular resistance and relaxed vasomotor tone (Central Illustration). Additionally, patients with ESLD10 have a higher incidence of left ventricular hypertrophy, which can result in diastolic dysfunction and impaired myocardial relaxation. Left ventricular hypertrophy, decreased preload, and low systemic vascular resistance can also result in elevated cardiac output. A hyperdynamic left ventricle and left ventricular hypertrophy can both result in hemodynamically significant left ventricular outflow tract obstruction [5].

In chronic liver disease, intrahepatic arteriovenous fistulae may exacerbate cardiac output, which typically leads to a high output state. Attenuated systolic and diastolic function, electrophysiologic changes like prolonged repolarization and chronotropic incompetence, and blunted cardiac output response to beta-adrenergic stimulation are all hallmarks of the "cirrhotic cardiomyopathy" seen in these patients. The severity of the cardiomyopathy may be clinically inconspicuous until the time of OLT. Perioperative hypervolemia and pulmonary edema may result from anesthesia, mechanical ventilation, and fluid management, all of which may put additional strain and demand on a cardiac reserve that is already exhausted [6].

Due to the high output state, which increases the flow and gradients across valvular lesions, it can be challenging to accurately assess their severity in patients with advanced liver failure. In patients with ESLD, the high flow physiologic state may exacerbate stenotic lesions, particularly significant mitral or aortic stenosis, which may be poorly tolerated during the peritransplant period. Less invasive treatments are preferred for patients with ESLD due to the high

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Received: 02 February, 2023, Manuscript No. jcard-23-91934; Editor assigned: 03 February, 2023, PreQC No. P-91934; Reviewed: 16 February, 2023, QC No. Q-91934; Revised: 21 February, 2023, Manuscript No. R-91934; Published: 27 February, 2023, DOI: 10.37421/2329-9517.2023.11.539

risk of cardiopulmonary bypass. Mitral and tricuspid regurgitation as well as pulmonary hypertension that are the result of volume overload can improve after volume optimization. Transcatheter aortic valve replacement is a reasonable treatment option for aortic stenosis in patients with ESLD awaiting OLT who have high surgical morbidity and mortality but are otherwise good candidates for OLT with life expectancy (including with OLT) of >1 year. The MitraClip (Abbott) procedure is a minimally invasive catheter-based therapy that can be considered for the treatment of moderate-to-severe mitral regurgitation despite the lack of data in patients with ESLD [7].

## Discussion

The most effective preoperative strategy for patients undergoing OLT remains challenging due to the intricate pathophysiological changes and coagulopathies that are underlying cirrhosis. In this cohort, we have compiled a list of the most frequently used screening methods for pulmonary hypertension and CAD. However, the available literature still has significant gaps. Due to local practice and anecdotal bias, these gaps may delay the implementation of these recommendations, but they are essential to the design of subsequent studies [8].

The ability to maximally dilate and increase coronary blood flow is a crucial concept in the diagnosis of coronary artery disease (CAD). Given the vasodilatory state, it is obscure whether patients with ESLD have safeguarding of stream save. The accuracy of SPECT imaging, CT-FFR, and invasive angiographic evaluation of intermediate stenoses is decreased by an impaired flow reserve. Second, the cost-effectiveness of each strategy must be taken into account because these tests are being used to screen patients. As a result, the cost-effectiveness of CCTA versus coronary angiography in OLT candidates should be revisited in future research [9].

The role of revascularization in OLT patients should be the goal of future research. Due to the fact that these patients may also have varices or other risk factors for life-threatening bleeds, which may necessitate the early discontinuation of antiplatelet medications and increase the risk of stent thrombosis, PCI patients with ESLD are at a high risk of bleeding. Additionally, the risk of delaying OLT candidacy due to PCI may outweigh the benefit of revascularization, and some patients may require urgent OLT listing. Future investigations ought to investigate coronary life systems subtypes (eg, left fundamental illness, multivessel computer aided design, and proximal left foremost dropping conduit), which are restrictive to OLT except if revascularization is performed [10].

## Conclusion

The purpose of this consensus document is to assist the cardiology community in evaluating and managing OLT candidates, as clinical practice and protocols differ from institution to institution. In order to diagnose coronary artery disease (CAD) and direct coronary revascularization, stress testing remains essential in the pre-OLT evaluation. Be that as it may, it has impediments due to low responsiveness and particularity in this quiet populace. As an alternative to routine coronary angiography, an initial strategy of CCTA should be encouraged in this era of attention to appropriate use, cost containment, and minimizing unnecessary invasive procedures. Revascularization's function in asymptomatic patients is still unclear and requires more research. The best method is a shared decision-making approach with a multidisciplinary team that takes into account

individual clinical circumstances. In order to establish the standard of care in this field, randomized trials are essential.

## Acknowledgement

None.

## Conflict of Interest

None.

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**How to cite this article:** Mandras, Stacy. "Patients Undergoing Evaluation for Orthotopic Liver Transplants: Cardiology Assessment." *J Cardiovasc Dis Diagn* 11 (2023): 539.