Liver transplantation (LT) has emerged as the standard of care for patients with irreversible acute and chronic liver failure and various metabolic disorders (e.g., primary oxaluria, familial amyloidotic polyneuropathy). Due to the increasing incidence of end-stage liver disease and the limited number of grafts available for transplantation, the number of patient awaiting orthotopic LT has grown to 17,471 as of June 29, 2004. In 2003, 5,350 patients received an orthotopic LT. Most of the waitlisted candidates are followed in the community for their medical as well as hepatologic care. The limited number of transplants performed, along with long waiting periods, increase the chances of liver-associated complications and can make the management of these patients very challenging for the primary care provider.

The aim of this article is to delineate the care of cirrhotic patients, with an emphasis on pre-LT workup and a focus on comprehensive medical care, complications related to portal hypertension, and surveillance, including screening for hepatocellular carcinoma (HCC).

**Initial Evaluation for LT**

**Evaluation**

The success of LT has increased steadily over the last decade, with current 1-year patient survival of 84% and many centers reporting survivals exceeding 90%. In 1997, the United Network for Organ Sharing (UNOS) established a Child-Turcotte-Pugh score of 7 or higher as the minimal listing criteria for eligibility of listing for LT. A Child-Turcotte-Pugh score of 7 or higher equates to an estimated 90% or less chance of 1-year survival without transplantation. Patients are listed at UNOS status 1 if they have acute hepatic failure and a life-expectancy of fewer than 7 days. On February 27, 2002, UNOS adopted the model for end stage liver disease (MELD) score as an evidence-based means of organ allocation, and replaced its previous organ allocation, which included waiting time and disease severity in the United States. MELD score is a severity score predictive of mortality in patients with chronic liver disease. It includes total serum bilirubin, international normalized ratio (INR) and serum creatinine:

\[
\text{MELD} = 3.78 \times \log \text{e} (\text{bilirubin} \ [\text{mg/dL}]) + 11.2 \times \log \text{e} (\text{INR}) + 9.57 \\
\times \log \text{e} (\text{creatinine} \ [\text{mg/dL}]) + 6.4.
\]

MELD was initially developed to predict the survival of patients undergoing transjugular intrahepatic portosystemic shunts, and was subsequently validated in patients with decompensated cirrhosis, ambulatory patients with noncholestatic cirrhosis, primary biliary cirrhosis, and alcoholic hepatitis, and among cirrhotic patients at large.

UNOS has made further adjustments to the MELD score to compensate for the increased mortality associated with progressive disease among patients with HCC. HCC patients who fulfill the Milan criteria get a MELD score higher than the one corresponding to the degree of hepatic decompensation, also referred to as “upgrading.” Patients with Stage 2 HCC (1 lesion >2 cm but ≤5 cm or up to 3 lesions not more than 3 cm) receive a MELD score of 24 (equivalent to a 15% 3-month mortality).

The purpose of the LT evaluation is to ensure that the candidate is suitable for transplantation. The evaluation process typically involves a multidisciplinary team approach including transplant hepatologists, transplant surgeons, transplant nurse coordinators, social workers, and transplant psychiatrists / psycholo-
gists with expertise in substance abuse issues. The use of other consultants varies according to the individual transplant center and the patient needs.

The main roles of the transplant hepatologist is to confirm that patient has a medical need for LT and to implement a plan for the management of the complications of cirrhosis, to evaluate disease-specific issues that may potentially impact on outcome after LT, and to assess other comorbid conditions and possible contraindications to LT. The transplant surgeon evaluates the surgical risks and technical consideration for LT. Extensive portal and mesenteric venous thrombosis, previous abdominal surgery near the hepatic hilum, and severe obesity can make the surgery difficult, if not impossible. Psychosocial assessment is an integral part of pre-LT evaluation process to address the issues related to substance abuse, risk of relapse, compliance, and adequacy of social support.

LT evaluation includes a thorough history and physical, extensive laboratory testing, and abdominal imaging to exclude intra- as well as extrahepatic tumors and to evaluate the anatomy of bile ducts and hepatic vasculature. Cardiac evaluation is done prior to LT to exclude coronary heart disease, valvular heart disease, and cardiac failure due to other etiologies. Special attention should be given to the patient with alcoholic liver disease and hemochromatosis as they are at increased risk for cardiomyopathies. A chest radiograph, arterial blood gas analysis, and pulmonary function testing are routinely done in most transplant centers.

It is prudent to identify and distinguish the 2 uncommon but clinically significant pulmonary syndromes syndrome among patients with cirrhosis. These are hepatopulmonary syndrome and portopulmonary hypertension,10 and both are discussed further in Part 2, the second article in this series. Briefly, hepatopulmonary syndrome is characterized by hypoxemia (PAO2 < 70 mm of Hg or alveolar arterial gradient > 20 mm of Hg) and pulmonary capillary bed dilatation supported by contrast echocardiography and technetium macroaggregated albumin lung scanning.10 Hepatopulmonary syndrome is reversible after LT. However, PAO2 < 50 mm of Hg carries a perioperative mortality of 30%. Portopulmonary hypertension is defined as a mean pulmonary artery pressure of 25 mm of Hg or higher with normal pulmonary capillary wedge pressure.11 Right heart catheterization is the gold standard to confirm the diagnosis of portopulmonary hypertension. The moderate portopulmonary hypertension (mean pulmonary artery pressure between 35 and 50 mm of Hg) and severe portopulmonary hypertension (mean pulmonary artery pressure > 50 mm of Hg) are associated with a high (>50%) perioperative mortality with LT unless reduced by pharmacologic means.11

Screening colonoscopy, mammogram, and pap smear are done as part of evaluation in some centers. However, some centers screen their potential candidates only if there are any risk factors. Based on the pre-LT evaluation testing, a multidisciplinary selection committee makes a decision regarding the candidacy for LT for the candidates. Figure 1 illustrates the summary of care for pre-LT candidates.

Contraindications to LT

The contraindications1 include severe comorbid medical illnesses such as cardiac and pulmonary diseases that are not reversible and that adversely impact the patient’s short-term life expectancy, and extrahepatic malignancies excluding certain skin cancers. Patients with advanced HCC (Stage 3B and 4) and cholangiocarcinoma are generally excluded, although some centers have performed LT on these patients under experimental protocols.

Systemic infections should be treated before LT, although infections originating from within the liver (i.e., cholangitis) may not be curable without removal of the diseased organ. Psychiatric and psychosocial contraindications include active substance abuse, high recidivism risk, noncompliance, and poorly controlled psychiatric illness. Poor social support is a relative contraindication. Technical contraindications include extensive thrombosis involving both portal and mesenteric vessels and severe obesity, defined as body mass index > 35. In a recent analysis of UNOS data, body mass index > 35 was associated with a significantly worse survival after LT.12 Thus, it is important for these patients to lose weight prior to LT.

Advanced age is not an absolute contraindication for LT. An early report in 1990 from UNOS found a 1-year survival of 60% in candidates older than 65 years of age compared to 72% in the general population.13 Thus, in the early years of transplantation, many programs set an upper limit of 50 years for candidates. However, in later years, continued refinement in the selection criteria for LT has led to increased performance of LT in patients over age 60 years, with generally good outcomes.14,15 Analysis of UNOS data revealed that in 2002, 6.8% of all transplants were received by patients over age 65 years, compared to 4.9% in 1991.16

Analysis of earlier data from the University of Nebraska revealed a significantly poorer than expected
outcome in patients identified preoperatively as being high risk. A scoring system that takes in account age, serum bilirubin, prothrombin time, encephalopathy, ascites and nutrition was used to stratify patients into low, medium, and high risk groups. Low risk senior transplant patients had a 94.5% 1-year survival compared to previous reports of 90.5% expected survival for low risk adult patients. Seniors (age over 60 years) who were medium risk had a 60% survival compared to 85.2% expected survival for medium risk adults; high risk seniors had a 28% actual survival compared to 44.5% expected survival in high risk adults. Older patients with major comorbidities have poorer outcome and at many centers are not generally considered for transplantation. Preoperative screening in this population should be detailed to exclude coronary artery disease, bone disease, and malignancy.

Coinfection is common in human immunodeficiency virus (HIV)–infected persons with hepatitis B Virus (HBV) and hepatitis C virus, because they share common transmission pathways, particularly in patients with hemophilia and intravenous drug use. It is estimated that 30% of HIV-infected persons are coinfected with hepatitis C virus; that estimates rises to 50 to 80% of HIV-positive intravenous drug users. The increased survival associated with highly active antiretroviral therapy has exposed the role that liver disease plays in causing the significant morbidity in HIV-infected persons, to the extent the end-stage liver disease is the leading cause of death in hospitalized HIV-infected persons. The limited data available from pilot studies suggest that HIV infection does not adversely affect the success of LT. A multicenter prospective study funded by the National Institutes of Health and coordinated by the University of California, San Francisco, has been designed to evaluate various outstanding issues in the use of livers and kidneys in people with HIV infection.

General Medical Care

Routine Examination, Prophylaxis, and Immunization

Once the candidate is listed, regular reporting of the MELD score requires periodic updates of the biochemical parameters used in the MELD score calculation, as well as periodic visits to the transplant clinic. The frequency with which a patient should be monitored by labwork is based upon the MELD score. A MELD score of 10 warrants testing every 6 months to 1 year, while patients with MELD scores between 11 and 18 should have INR, total serum bilirubin, and creatinine determined every 3 months, monthly for MELD scores of 19–24 and lastly, patients with MELD scores ≥25 should be updated weekly. Clinic visits should be used not only to update the condition of the patients with assessment of clinical or subclinical portosystemic encephalopathy, ascites, and edema, but also to obtain the parameters used for MELD scoring along with a full battery of liver tests, creatinine, electrolytes, complete blood count, and prothrombin time. Periodic ultrasound and computed tomography (CT) / magnetic resonance imaging of the liver is appropriate to rule out the development of HCC.

HCC is the most common malignant tumor arising from the liver. The patients at risk for HCC include those with cirrhosis, but especially those associated with hepatitis B and C, and certain metabolic disorders like hemochromatosis and alpha-1-antitrypsin deficiency. Small HCC (<5 cm in diameter) is amenable to potentially curative treatment by LT or resection. Debate rages on the most appropriate treatment of HCC in those patients waiting or in whom there is compensated liver disease. However, early detection of HCC is desirable to obtain the best outcome in any scenario.

Early detection of HCC is possible through the use of imaging techniques such as ultrasound, CT, or magnetic resonance imaging, combined with regular measurements of alfa-feto protein. Angiography is rarely needed for diagnosis and staging of HCC. Burrel et. al. recently compared CT scan and magnetic resonance imaging angiography with pathological examination of explanted livers and they suggested that magnetic resonance imaging angiography was more precise than CT scan in detection of nodules between 1 and 2 cm. Tumors of more than 2 cm in diameter were diagnosed by both means, whereas HCC less than 1 cm were only detected in 30% of the cases.

The presence of mass with arterial hypervascularization and evident washout during the venous phase is generally considered confirmatory for the presence of HCC. Such mass lesion on imaging study should mandate a thorough workup to rule out extrahepatic spread and / or macrovascular involvement (i.e., portal or hepatic veins). The assessment of the patient should include a triphasic CT or magnetic resonance imaging scan of the abdomen that documents the tumors and a CT of the chest that rules out metastatic disease. A prelisting biopsy is not mandatory to get the priority as long as the other criteria are met, specifically arterial enhancement or an absolute alfa feto-protein of 500 ng/mL.

Patients with Stage 2 HCC in accordance with the
modified Tumor-Node-Metastasis Staging Classification (set forth in Table 1), without evidence of extrahepatic spread and / or macrovascular involvement, receive extra priority on the waiting list, as described earlier.4 Tumors less than 2 cm should be followed very closely with imaging study every 3 to 4 months.

A candidate not meeting the above criteria may continue to be considered a liver transplant candidate in accordance with each center’s own specific policy or philosophy, but the patient must be listed at the calculated MELD score with no additional priority given because of the HCC diagnosis.4 However, Stage T3 tumors can be downsized using modalities like chemoembolization, bland embolization, percutaneous alcohol, or radiofrequency ablation. All other patients with HCC, including those with downsized tumors (i.e., having undergone ablative therapy), whose original / presenting tumor was greater than a Stage T2) must be referred to the applicable regional review board for prospective review for priority.4 Figure 2 summarizes the management of suspicious HCC lesions.

Vaccinations for HBV and hepatitis A virus have significant value. Studies have shown an association between fulminant hepatitis due to hepatitis A superinfection in chronic hepatitis C patients and it is recommended that these patients be immunized for hepatitis A.31,32 Patients who do not have antibodies to the hepatitis B surface antigen should receive a complete vaccination schedule at the beginning of their evaluation.32,33 In liver transplant candidates and recipients, low seroconversion rates are well described. Less than 33% of patients seroconvert after receiving standard dosing; providing a double dose (40 μg) and an accel-

<table>
<thead>
<tr>
<th>Table 1. American Liver Tumor Study Group Modified Tumor-Node-Metastasis (TNM) Staging Classification65</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Classification</strong></td>
</tr>
<tr>
<td>TX, NX, MX</td>
</tr>
<tr>
<td>TO, NO, MO</td>
</tr>
<tr>
<td>T1</td>
</tr>
<tr>
<td>T2</td>
</tr>
<tr>
<td>T3</td>
</tr>
<tr>
<td>T4a</td>
</tr>
<tr>
<td>T4b</td>
</tr>
<tr>
<td>N1</td>
</tr>
<tr>
<td>M1</td>
</tr>
<tr>
<td>Stage I</td>
</tr>
<tr>
<td>Stage II</td>
</tr>
<tr>
<td>Stage III</td>
</tr>
<tr>
<td>Stage IVA1</td>
</tr>
<tr>
<td>Stage IVA2</td>
</tr>
<tr>
<td>Stage IVB</td>
</tr>
</tbody>
</table>

Figure 1. Summary of care for pre-LT patients.
erated schedule (0, 1, and 2 months) have been reported to increase the seroconversion rate between 44 and 62%. A prospective trial at the Mayo Clinic of 356 liver transplant recipients, using an accelerated, double-dose schedule of HBV vaccine (40 μg at 0, 2 weeks, and 6 months), found a seroconversion rate of 36%. In view of the higher rate of nonresponders compared with hepatitis A virus, postvaccination serological testing may be appropriate, particularly in the sickest patients. Some patients, particularly those with some minimal rise in titers, may fully convert with repeated higher dose vaccinations.

In addition to hepatitis A and B vaccination, these patients should also receive influenza vaccine yearly and pneumococcal vaccination every 5 years. Tuberculin skin testing should be done yearly. Screening for breast, endocervical, colorectal, and prostate cancer should be performed as in other medical patients. A comprehensive ear, nose, and throat evaluation should be done in alcoholics with history of tobacco use because of their increased nasopharyngeal cancer incidence.

Whenever possible, treatment of the underlying primary liver disease should be considered; in some instances clearance of viral infection or bringing the disease into remission may resolve aspects of hepatic...
decompensation and make the indication for LT unnecessary, or at least postpone it.

**HBV**

In HBV-related cirrhosis, antiviral therapy should be considered when HBV replication is present. Inhibition of HBV replication has been shown to be associated with clinical improvement or stabilization of patients with cirrhosis. While interferon-α, lamivudine, and adefovir are all U.S. Food and Drug Administration-approved as 1st line therapy, lamivudine is more economical and well tolerated. The durability of lamivudine response is limited due to the increased risk of drug resistant HBV mutants with long-term use. In addition, some HBV carriers may experience worsening of liver disease. Adefovir dipivoxil, a nucleotide analog of adenosine monophosphate, is a prodrug of adefovir and has been shown to have *in vivo* and *in vitro* activity against both lamivudine-resistant and wild-type HBV. In a compassionate use protocol of 128 patients with decompensated cirrhosis and lamivudine-resistant HBV, adefovir has been associated with suppression of HBV deoxyribonucleic acid to undetectable levels in 81% of patients and stabilization or improvement in Child-Turcotte-Pugh score of 92% after 6 months. There have been reports of the emergence of adefovir-resistant HBV in patients treated with this drug. Interferon alfa is relatively contraindicated in the management of patients with end-stage liver disease due to HBV, especially in decompensated liver failure.

**Hepatitis C Virus**

According to the American Association for the Study of Liver Diseases’s practice guidelines, combination treatment with pegylated alpha interferon and ribavirin is clearly indicated in patients with compensated cirrhosis. While the optimal regimen has yet to be defined for this patient population, overall response rates to a 48-week course of pegylated alpha interferon and ribavirin appear to be in the range of 41 to 44%. Response is much lower for genotype 1-infected patients. Treatment of decompensated cirrhosis using interferon alpha with or without ribavirin has been fraught with serious, potentially fatal complications and should not be done outside of a clinical trial.

**Hemochromatosis**

The practice guidelines from the American Association for the Study of Liver Diseases state that all patients with hemochromatosis and evidence of iron overload should be strongly encouraged to undergo regular phlebotomies until iron stores are depleted. Phlebotomies should be continued for life, with the frequency of maintenance therapy determined by serum ferritin level. HCC accounts for 30% of all deaths in hemochromatosis, whereas other complications of cirrhosis account for an additional 20% of deaths in this patient population. Therefore, these patients should have regular, aggressive screening for HCC, as described above.

**Primary Biliary Cirrhosis**

All patients with primary biliary cirrhosis with abnormal liver enzymes should be considered for specific therapy. Ursodeoxycholic acid treatment slows the progression as well as improves the serum biochemical markers of cholestasis (bilirubin, alkaline phosphatase, and gamma-glutamyltransferase). Unfortunately, this therapy does not lead to the resolution of the disease. The recommended dosage for ursodeoxycholic acid is 13–15 mg/kg in a divided or single dose. Both decreased osteoblastic activity and increased osteoclastic activity contributes to the development of osteoporosis in primary biliary cirrhosis patients. The relative risk of osteopenia is 4.4 in primary biliary cirrhosis patients. Screening and early management of osteoporosis in patients with primary biliary cirrhosis and primary sclerosing cholangitis should follow current guidelines on the management of osteoporosis associated with chronic liver disease.

**Primary Sclerosing Cholangitis**

Primary sclerosing cholangitis, with or without ulcerative colitis, is the most common predisposing factor for cholangiocarcinoma in the United States. Patients with primary sclerosing cholangitis should, therefore, be regularly screened for this malignancy. The tumor marker CA 19-9 is elevated in up to 85% of patients with cholangiocarcinoma. It has been reported that a CA 19-9 value greater than 100 U/mL has a sensitivity of 75% and specificity of 80% for the detection of cholangiocarcinoma in patients with primary sclerosing cholangitis. Despite the availability of this marker, early diagnosis of cholangiocarcinoma is extremely challenging. Endoscopic biopsies and brushings are only positive in 40 to 70% of patients. The hepatologist and therapeutic endoscopist should aggressively address any changes suggestive of new biliary strictures.
or dominant strictures in these patients as they await LT.

Ursodeoxycholic acid at a dose of 10–15 mg/kg/day has consistently improved liver tests in several controlled trials, although none of these studies showed a beneficial effect on disease progression or transplant-free survival.\(^{46,54}\) The risk for colonic dysplasia or cancer in patients with ulcerative colitis and primary sclerosing cholangitis is 50% after 25 years of colitis.\(^{54,55}\) Recently, Tung et al.,\(^{56}\) in their retrospective study, have shown that the patients who have used ursodeoxycholic acid were less likely to develop colonic dysplasia as compared to those who did not receive ursodeoxycholic acid. Furthermore, these patients should be screened regularly for colon cancer, both before and after liver transplantation.

### Autoimmune Hepatitis

Treatment of autoimmune hepatitis with immunosuppression may not be indicated in patients with inactive cirrhosis, preexisting comorbid conditions, or drug intolerance. Prednisone (10 mg/day) in combination with azathioprine (50 mg/day) or higher dose prednisone (20 mg/day) alone is the recommended treatment for active autoimmune hepatitis.\(^{57}\) The treating clinician should understand that individuals with cirrhosis due to autoimmune hepatitis have a higher frequency of drug-related complications than those without cirrhosis (25 vs. 8%).\(^{57}\)

### Psychosocial Issues and Depression

Cirrhotic patients listed for LT have a poor quality of life and a low level of perceived well-being. They have severe psychopathological distress arising from the fear of waiting for a transplant, the awareness of scarcity of allografts, the potential for deterioration that will render them nontransplantable, and the fear of death. The patients and their families should be encouraged to go to support group meetings to cope with stress and talk about their experience.

De Bona et al.\(^{58}\) showed that all post-LT patients had improved perceived quality of life as evident by quality of life scale scores when compared to the patients listed for LT. High rates of depression have been demonstrated in patients with advanced liver disease. In 1 study, the incidence of depression in cirrhotic patients was as high as 63%.\(^{59}\) The depressed patients had significantly worse adaptive coping, poorer perceived quality of life, and greater perception of bodily pain, suggesting that depression is of considerable clinical consequence and adversely affects well being and functioning of such patients. End-stage liver disease patients should be routinely screened for depression, and early treatment with a selective serotonin reuptake inhibitor should be instituted.

Many cirrhotic patients have a history of alcohol abuse and substance abuse. The liver transplant health-care providers should reinforce the importance of support groups and abstinence from alcohol and illicit drugs. Random urine drug screens should be done periodically in these patients to document abstinence and to allow intervention as needed.

### Nutrition

Malnutrition is one of the most unappreciated problems of patients with end-stage liver disease awaiting LT. The prevalence of malnutrition in liver disease is difficult to assess due to the lack of a standardized diagnosis and classification of malnutrition in this population. Fluid retention and the fact that the plasma levels of most visceral proteins reflect both poor liver function and depleted nutritional reserve complicate nutritional assessment in cirrhosis.

Protein calorie malnutrition is considered by some to be the most common complication in patients with cirrhosis. The prevalence of protein calorie malnutrition differs according to the etiology. It has been described in 20% of patients with compensated cirrhosis, and the incidence rises to 60% in patients with liver insufficiency.\(^{60}\) The pathogenesis of malnutrition in cirrhosis is unclear. An interesting hypothesis was proposed by Richardson et al.,\(^{61}\) stating that hyperinsulinemia in cirrhosis may cause a preference for carbohydrates, consequently leading to early gastrointestinal satiety and reduction of intake. Another hypothesis is that changes in substrate utilization with increased lipid oxidation and decreased carbohydrate oxidation as well as increased energy expenditure contribute to malnutrition in these patients. Although many patients are in a state of protein catabolism, these metabolic changes could not adequately explain malnutrition. The metabolic changes revert back to normal within a few days after nutritional support is initiated. Nutritional status is correlated to mortality in the total group of patients with cirrhosis and in Child-Turcotte-Pugh Class A and B patients analyzed separately.

Malnutrition is an independent predictor for the 1st bleeding episode and the survival of patients with esophageal varices. It is also associated with the presence of refractory ascites. Poor preoperative nutritional status is correlated to postoperative complications and
mortality. Nutritional management of patients with liver disease can be a difficult task. Every effort should be made to prevent any period of prolonged fasting. In order to improve nitrogen balance and to avoid undue catabolism of muscle protein, patients should be encouraged to eat 6 to 7 meals per day, including 1 late night meal. This should prevent depletion of glycogen stores as well as diminish the loss of fat stores and lean body mass. If a patient has reasonable appetite, 35 to 45 kcal/kg/day should be supplied, including 0.8–1 gm/kg/day of proteins. This may need to be modified for patients with encephalopathy.

Micronutrient deficiency has been observed in 10 to 50% of patients with cirrhosis. Fat-soluble vitamins may be deficient in patients with cholestatic diseases and deficiency of water soluble vitamins, vitamin B, and folic acid are more frequent in patients with alcoholic cirrhosis. Multivitamin supplements may be considered in these patients.

Zinc deficiency is very common in patients with cirrhosis. This might be secondary to higher zinc loss in the urine. Supplementation with zinc has been shown to improve hepatic encephalopathy and, with vitamin A, improves the sense of taste and thereby may also improve dietary intake of the patients.

Parenteral nutrition should be used as a 2nd line approach in those who cannot be fed adequately by the oral or enteral route. In the majority of patients standard amino acids are recommended. The use of solutions rich in branched chain amino acids and low in aromatic acids and tryptophan in patients with encephalopathy has been proposed, and they should be used with caution in those with acute liver failure.

Conclusions

LT is the standard treatment of choice for end-stage liver disease. Judicious allocation of grafts is required because of organ shortage. MELD-based allocation policy is objective and appears to work well for the majority of cirrhotic patients. Subsets of patients with inborn errors of metabolism, non-HCC malignancies, quality of life complaints out of proportion to the MELD score, and unusual complications of cirrhosis, may benefit from further refinement of MELD. A thorough preoperative evaluation and exclusion of comorbidities is critical to optimize outcomes. The care and monitoring of pre-LT candidates is very challenging, and requires a multidisciplinary team effort, with a focus on preventative medicine and disease-specific measures that can maximize patients’ survival on the waiting list.

References

17. Castaldo P, Langnas AN, Stratta RJ, Lieberman RP, Wood RP,


