ORIGINAL ARTICLE

Substance Abuse Treatment and Its Association With Relapse to Alcohol Use After Liver Transplantation

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Many liver transplantation (LT) programs require substance abuse (SA) treatment for candidates with a history of alcohol abuse. However, there are no data indicating that SA treatment prevents post-LT alcohol relapse. We examined 118 adults who underwent LT from May 2002 to February 2011 to explore the relationship between SA treatment and post-LT relapse to any alcohol use. Sixty-one patients (52%) with a history of alcohol abuse or dependence received SA treatment before LT. Relapse to any alcohol use was identified in 40 LT recipients (34%). Patients who received SA treatment before LT did not differ significantly in the rate of post-LT alcohol relapse from patients who did not receive treatment before transplantation (30% versus 39%, $P = 0.20$). However, patients who received SA treatment both before and after transplantation had significantly lower rates of alcohol relapse (16%) than patients who received no SA treatment (41%) or SA treatment only before LT (45%, $P = 0.03$). Our findings suggest that LT programs should consider placing more emphasis on the continuation of some type of SA treatment after transplantation. Future research should prospectively examine the optimal timing for SA treatment that will attenuate the risk of alcohol relapse after transplantation. ***Liver Transpl 19:1387-1395, 2013***.

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Adults with a history of alcohol abuse who remain abstinent have graft and patient survival outcomes after liver transplantation (LT) that are comparable to the outcomes of patients without a history of alcohol abuse.[1-7] Consequently, many transplant programs try to identify transplant candidates who are genuinely committed to alcohol cessation, to learning effective strategies for reducing relapse risk, and to adopting a lifestyle of alcohol abstinence in perpetuity. One strategy commonly used by transplant programs for promoting long-term alcohol abstinence is to require (or strongly encourage) pre-LT patients to participate in a substance abuse (SA) treatment program.[1,2,8] SA treatment can provide patients with information about the risks of continued alcohol use, behavioral skills for reducing relapse risk, an effective rehabilitation relationship, and strategies for coping successfully with the demands of chronic illness and transplantation without the use of substances.

Abbreviations: ARRA, Alcohol Relapse Risk Assessment; LT, liver transplantation; SA, substance abuse.

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Although there may be a potential clinical benefit to the patient from pretransplant SA treatment, there are no data indicating that it prevents alcohol relapse after transplantation. As many as one-half of adults with alcohol-related liver disease relapse to drinking after LT,[9-16] and many of these patients likely participated in SA treatment programs before transplantation. There are no clinical trials that have effectively examined the impact of pre-LT SA treatment on post-LT relapse rates. Weinrieb et al.[17] initially sought to evaluate the relative benefits of motivational enhancement therapy for wait-listed patients with a history of alcohol dependence on rates of post-LT drinking. However, although they were able to evaluate rates of pre-LT drinking, an insufficient number of patients progressed to transplantation during the study, and they were unable to evaluate the impact of SA treatment on post-LT alcohol use.

It is also not known whether the intensity of SA treatment attenuates the risk of post-LT drinking among those with a prior history of alcohol abuse. Anecdotally, there appears to be considerable variability in the type and intensity of the SA treatment that programs may require of LT candidates. For some programs, periodic attendance at unstructured, peer-led meetings may meet the requirement for transplant listing, whereas other programs may require more intensive individual or group treatment by a licensed SA provider. It is possible that patients who receive more intensive SA treatment have lower rates of alcohol relapse, although this has not been examined. Moreover, some have suggested that close monitoring and SA treatment after transplantation may help to reduce the risk of relapse, especially because the patient's improved health may permit more active engagement in treatment.[9]

In the current study, we sought to further explore the relationship between SA treatment and post-LT relapse to alcohol use. Specifically, we examined 3 questions:

1. Were the post-LT alcohol relapse rates different for patients who received SA treatment before transplantation and patients who did not receive any SA treatment?
2. Among patients who received SA treatment before transplantation, was the intensity level of that treatment associated with post-LT alcohol relapse?
3. Were the alcohol relapse rates different for patients who received SA treatment after LT and patients who did not receive such treatment after transplantation?

We hypothesized that post-LT alcohol relapse rates would be significantly lower for patients who received SA treatment before transplantation and particularly for patients who were engaged in SA treatment of moderate or high intensity. We also hypothesized that patients who continued SA treatment after transplantation would have a lower rate of alcohol relapse than patients who received no treatment after transplantation.

PATIENTS AND METHODS

Study Sample and Data Collection Procedures

The committee on clinical investigation of Beth Israel Deaconess Medical Center approved the study protocol. We examined the medical records of adults who received a primary liver or liver-kidney transplant at Beth Israel Deaconess Medical Center in Boston, MA from May 2002 to February 2011. During this time period, all LT candidates underwent a comprehensive medical, surgical, and mental health evaluation as part of the transplant workup. Alcohol abuse or dependence was determined on the basis of the diagnosis made by the evaluating mental health clinician (a psychiatrist or psychologist) with established criteria in *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed.[18] Two clinicians who were blind to patients' LT outcomes independently reviewed medical records to identify patients with a pre-LT history of alcohol abuse or dependence and to identify the nature and intensity of any SA treatment received before and after LT with operationalized constructs described later. Discrepancies in coding were resolved by a consensus re-review of the medical records by the 2 clinicians and one of the authors (J.R.R.). Another clinician independently reviewed outpatient and inpatient clinic notes, toxicology findings, the transplant program's own clinical database, and LT recipients' responses to the annual health assessment questionnaire, which included questions about substance use. The list of relapsers was then reviewed by 2 of the authors (J.R.R. and M.P.C.), and any discrepancies in relapse occurrence or intensity coding were resolved by consensus discussion.

Sociodemographic and medical information, abstinence duration before LT evaluation, daily alcohol consumption (grams) before cessation, and survival status were also retrieved from the medical records. Additionally, we recorded each patient's Alcohol Relapse Risk Assessment (ARRA) score.[19] ARRA assigns 1 point to each of 9 pre-LT risk factors previously found to be predictive of alcohol relapse in a multivariate analysis of LT recipients. These risk variables include an absence of hepatocellular carcinoma, tobacco dependence, continued alcohol use after the initial liver disease diagnosis, low motivation for relapse prevention treatment, poor stress management skills, a lack of a rehabilitation relationship, limited social support, a lack of nonmedical behavioral consequences, and continued engagement in social activities with alcohol present. The total ARRA score ranges from 0 to 9, with a higher score reflecting a higher relapse risk.

Post-LT Relapse to Any Alcohol Use

The return to any alcohol use after transplantation was the primary outcome variable of interest in this study. Any documented report or evidence of post-LT alcohol consumption was recorded as a relapse. Some researchers have defined relapse as a return to

harmful or heavy, problematic levels of alcohol use, and this is more consistent with how relapse is conceptualized in the general, nontransplant literature. However, in agreement with others,[9,13,20] we chose to define relapse as any alcohol use after LT for 2 primary reasons. First, there is no agreed-upon definition of harmful, heavy, or problematic drinking, and these clinical indicators have not been empirically derived. Second, our transplant program uses a lifetime abstinence model across the continuum of transplant care. During transplant hepatology and surgery visits before and after transplantation, patients are routinely asked about alcohol consumption and counseled about the potential harmful effects of any alcohol use on both current and post-LT health and well-being. All transplant candidates with an SA history must review and sign a patient responsibility agreement indicating their commitment to maintaining complete alcohol abstinence in perpetuity. Therefore, assessing for any alcohol use is most consistent with our clinical practice and education of patients.

For those who were determined to have relapsed into alcohol use after transplantation, the intensity of the relapse was also recorded. Relapse intensity was defined as (1) low ($\geq$1 slip into alcohol use that was isolated and followed by an extended abstinence period), (2) moderate (a return to daily or nearly daily alcohol use but at amounts less than pre-LT levels), or (3) high (a return to alcohol use at a frequency or amounts the same as or higher than pre-LT levels). Alcohol relapse and its intensity were assessed through a review of all outpatient and inpatient records, our clinical database (ie, the organ transplant tracking record), laboratory test results, collateral reports by caregivers, and the health assessment questionnaire completed annually by LT recipients.

Nature, Intensity, and Timing of SA Treatment

We determined whether patients received any pre-LT SA treatment before transplantation (yes or no), what the intensity of the SA treatment was (low, moderate, or high; Table 1), and whether patients continued to receive SA treatment after LT (yes or no). For patients with a history of alcohol abuse or dependence, our program policy requires a minimum out-of-hospital abstinence period of 3 months. Some of these patients who are considered to be at high risk for relapse (because of a short sobriety period) are required to participate in SA treatment as part of their LT candidacy, whereas others are simply encouraged to engage in a treatment program throughout the transplant process. In most instances, patients access SA treatment services in their local community. Written consent is obtained for the exchange of information between the transplant programs and the SA providers, typically on a monthly basis while the patient is engaged in treatment. Such exchanges allow the transplant team to make an informed clinical assessment of the patient's engagement and progress in treatment. Toxicology screens are sometimes performed by the SA treatment programs, and the transplant program also routinely conducts similar laboratory tests during clinic appointments and upon admission to the hospital. Finally, although it is encouraged, our program does not require SA treatment after transplantation.

Statistical Analysis

PASW 17.0 (Chicago, IL) was used for all statistical analyses. Data are reported as percentages, medians, or means. χ^2 or Fisher's exact tests were used to identify differences in categorical variables. *t* tests were used to compare means. A P value < 0.05 was considered statistically significant in all analyses. A stepwise logistic regression analysis was conducted to identify the utility of pre-LT SA treatment, post-LT SA treatment, and SA treatment intensity in predicting post-LT alcohol relapse beyond the patient's ARRA score, which previously has been shown to be associated with relapse.[19]

RESULTS

Sample Characteristics

Two hundred forty-three primary transplants were performed during the study observation period, and 138 of the patients (57%) had a diagnosis of alcohol abuse or dependence. Twenty recipients were excluded from the study because, typically without leaving the hospital or rehabilitation center, they died within 6 months of transplantation. The final analyses for this study are based on the remaining 118 LT recipients. The majority of the sample was male (n = 101 or 86%) and white (n = 99 or 84%) with a mean age of 55 $\pm$ 8 years. More than half of the patients had hepatitis C (n = 69 or 58%), and 45 (38%) had primary alcohol-related liver disease. Forty-eight patients (41%) had hepatocellular carcinoma. The mean laboratory Model for End-Stage Liver Disease score at LT was 22 $\pm$ 11, and the mean Model for End-Stage Liver Disease score with exception points was 28 $\pm$ 7. The mean post-LT follow-up duration was 55 months. The majority of the patients (n = 93 or 79%) were still alive at the time of the study's initiation. Thirteen patients (11%) developed cirrhosis secondary to alcohol relapse after transplantation, and 2 of these patients (2%) lost their graft because of alcohol relapse.

Pre-LT SA Treatment and Post-LT Relapse

Relapse to any alcohol use was identified in 40 LT recipients (34%) with a median time from LT to the first drink of 625 days (mean = 810.3 days, range = 60-2520 days). Nine of the alcohol relapses (22%) were low-intensity, 19 (48%) were moderate-intensity, and 12 (30%) were high-intensity. The majority of the patients (n = 33 or 83%) who relapsed into post-LT alcohol use had a sobriety period less than 24 months before their initial transplant evaluation. The abstinence period before the evaluation was $\leq$3 months for

TABLE 1. SA Treatment Intensity, Definitions, and Examples

Treatment Intensity	Definition	Examples
Low	Passive, infrequent, or insufficient engagement in an unstructured support group OR Passive engagement in or premature withdrawal from individual or group SA treatment OR Participation in an alcohol education workshop or class only	Patient attends 1 or fewer Alcoholics Anonymous meetings per week. Patient attends Alcoholics Anonymous meetings but does not have a sponsor and/or does not participate actively in a 12-step program. Patient attends SA treatment sessions at a lower frequency than recommended or scheduled. Patient drops out of a 10-session treatment program after only 5 sessions. Transplantation occurs after only partial completion of SA treatment. Patient dismissed from an SA treatment program because of numerous no-shows. Patient attends only a 2-hour educational workshop on the harmful effects of alcohol on health.
Moderate	Active, frequent, or sufficient engagement in an unstructured support group OR Active engagement in or successful completion of an individual or group SA treatment program	Patient attends 2 or more Alcoholics Anonymous meetings per week and is engaged in sponsorship and a 12-step program. Patient attends weekly group treatment sessions and is noted by his or her therapist to be making good progress. Patient completes a 12-session, weekly individual SA treatment program.
High	Active engagement in a combination of SA interventions or programs OR Active engagement in or successful completion of an intensive outpatient or inpatient SA program	Patient attends weekly individual and group treatment sessions and is noted by therapists to be making good progress. Patient completes an intensive outpatient SA treatment program that included 5 treatment sessions per week. Patient attends 2 or more Alcoholics Anonymous meetings per week, is engaged in sponsorship, and receives weekly SA treatment from a licensed provider.

6 of these 33 patients (18%), 4 to 6 months for 12 patients (36%), 7 to 12 months for 9 patients (27%), and 13 to 24 months for 6 patients (18%).

Sixty-one patients (52%) received SA treatment before LT. These patients did not differ significantly from untreated patients with respect to sex (P = 0.56), age (P = 0.62), race (P = 0.31), marital status (P = 0.09), primary diagnosis (P = 0.19), abstinence duration before the LT evaluation (P = 0.06), or total ARRA score (P = 0.13). However, patients who received SA treatment had a higher estimated daily alcohol amount before cessation (248 versus 184 g, t = 2.1, P = 0.04). Patients who received SA treatment before LT did not differ significantly in the rate of post-LT alcohol relapse from patients who did not receive SA treatment before transplantation (30% versus 39%, P = 0.20). Similarly, among those who relapsed into alcohol use, the intensity of the relapse was not significantly associated with SA treatment before transplantation (χ^2 = 1.04, P = 0.59; Fig. 1). There was no difference in the mean time to the first post-LT drink between patients who received SA treatment and patients who did not (826 versus 797 days, t = 0.14, P = 0.89).

Twenty-three of the 61 patients who received pre-LT SA treatment (38%) received low-intensity treatment, 35 (57%) received moderate-intensity treatment, and 3 (5%) received high-intensity treatment. Patients who received moderate- or high-intensity SA treatment had significantly shorter abstinence durations before the LT evaluation (P = 0.004), but they did not differ significantly from patients who received low-intensity SA treatment with respect to sex (P = 0.62), age (P = 0.61), race (P = 0.56), marital status (P = 0.92), primary diagnosis (P = 0.26), or total ARRA score (P = 0.08). There was no significant difference in post-LT alcohol relapse rates based on whether patients received low-intensity (7/23 = 30%), moderate-intensity (9/35 = 26%), or high-intensity SA treatment (2/3 = 67%) before transplantation (χ^2 = 2.24, P = 0.33). Among the patients who relapsed into alcohol use, the SA treatment intensity before transplantation

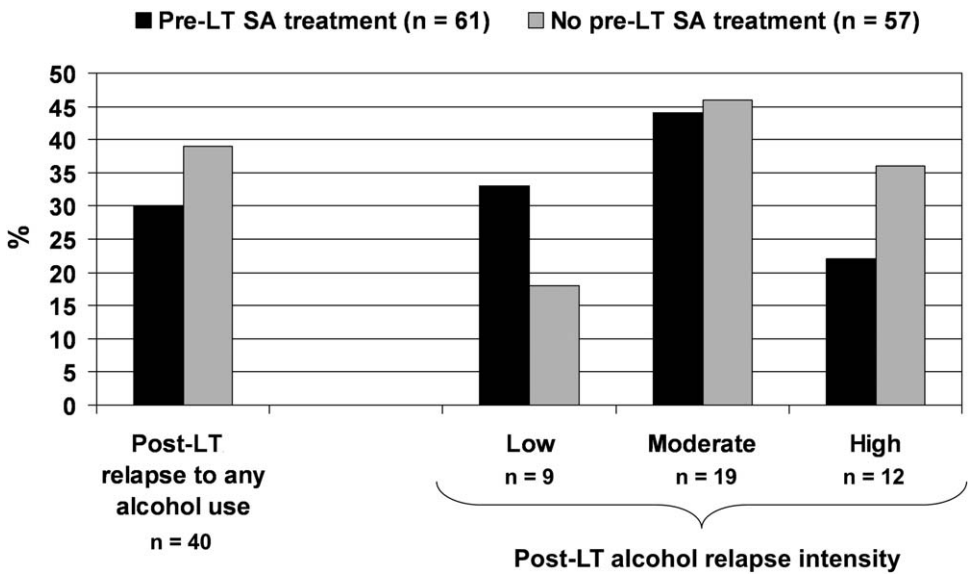

Figure 1. Relationship between any SA treatment after the initial LT evaluation and post-LT relapse to any alcohol use.

was not significantly associated with the relapse intensity (χ^2 = 1.85, P = 0.76).

Fifteen of the 18 patients (83%) who relapsed into alcohol use even though they received SA treatment before transplantation had been abstinent less than 24 months at the time of their initial presentation to the transplant program. Similarly, 18 of the 22 patients (82%) who relapsed without SA treatment before transplantation had a sobriety period less than 24 months before their initial evaluation.

Post-LT SA Treatment and Post-LT Relapse

Thirty-five patients (30%) received SA treatment after transplantation. Patients who received treatment had significantly lower alcohol relapse rates than patients who did not receive SA treatment after LT (14% versus 42%, P = 0.002). We then clustered the patients into 3 groups for further analysis: patients who received no SA treatment at all (n = 54), patients who received SA treatment before LT only (n = 29), and patients who received SA treatment both before and after LT (n = 32). Three patients who received treatment only after LT were excluded from this analysis (none relapsed into alcohol use). Patients who received SA treatment both before and after LT did not differ significantly from patients who received treatment only before LT or no treatment at all with respect to sex (P = 0.47), age (P = 0.82), race (P = 0.80), marital status (P = 0.41), primary diagnosis (P = 0.34), abstinence duration before the LT evaluation (P = 0.10), or total ARRA score (P = 0.08). However, these patients had higher estimated daily alcohol amounts before cessation than patients who did not receive any SA treatment (P = 0.04).

Patients who received SA treatment both before and after transplantation had a significantly lower rate of alcohol relapse (16%) than patients who received no SA treatment (41%) or SA treatment only before LT (45%; χ^2 = 7.31, P = 0.03; Fig. 2). Two of the 5 patients who relapsed into alcohol use after they received SA treatment both before and after LT had relapses of moderate intensity, and 3 patients had high-intensity relapses. The 3 groups did not differ significantly in the patient death rate for relapsers (5/22 or 23% for no SA treatment, 2/13 or 15% for SA treatment before LT only, and 1/5 or 20% for SA treatment before and after LT; P = 0.87).

Multivariate Predictors of Post-LT Relapse

In the logistic regression analysis, a higher ARRA score [β = 0.88, odds ratios = 2.41 (95% confidence interval = 1.8-3.3), $P < 0.001$] and no post-LT SA treatment [β = −1.71, odds ratios = 0.18 (95% confidence interval = 0.04-0.74), P = 0.02] were statistically significant predictors of post-LT alcohol relapse: they accounted for 58% of the variance in outcomes ($P < 0.001$) and correctly classified 86% of the patients. Pre-LT SA treatment and SA treatment intensity were not retained in the model.

DISCUSSION

Despite a lack of empirical evidence showing that SA treatment before transplantation reduces the risk of post-LT drinking,[9] the requirement that patients participate in SA treatment before they are activated on the waiting list has been widely adopted within the transplant community. During the time period in which these study patients were evaluated for transplantation, patients with an SA history were required by our transplant program to participate in SA treatment if their abstinence period was less than 6

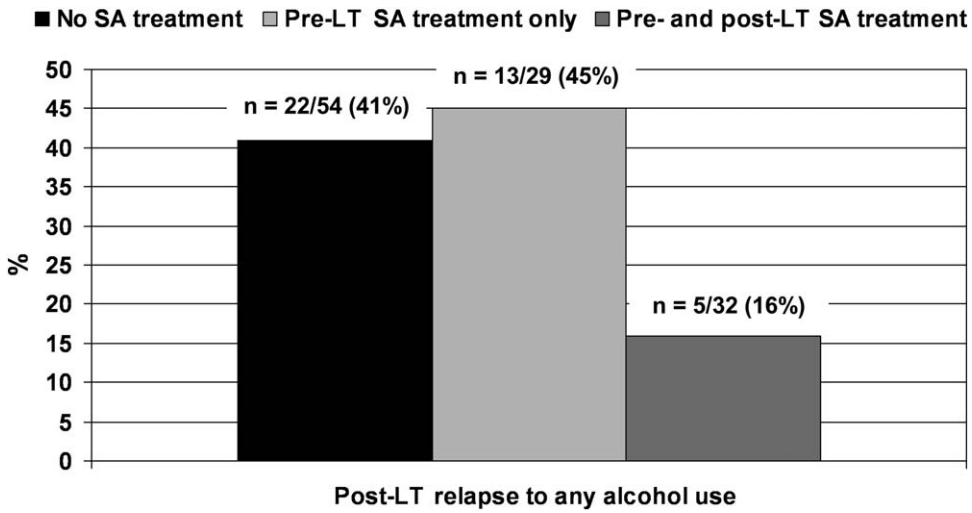

Figure 2. Relationship between the timing of SA treatment and post-LT relapse to any alcohol use. Three patients who received SA treatment only after LT were excluded from this analysis.

months. Patients who had been abstinent for a longer duration were encouraged to participate in SA treatment, although this was not a condition for listing. The nature (individual or group), intensity (outpatient or residential), frequency (weekly or monthly), and location of the treatment were generally not specified by the transplant program but rather were left to the professional judgment of the treating SA clinician. After transplantation, patients were not routinely advised to participate in SA treatment, although those engaged in treatment at the time of LT were encouraged to continue with treatment.

In the current study, we found that the post-LT alcohol relapse rate of patients who received SA treatment before LT did not differ significantly from the rate of patients who did not receive SA treatment. Although our a priori hypothesis was not supported, this finding is generally consistent with other studies showing that SA treatment is not an independent predictor of post-LT alcohol relapse.[9] Moreover, some have found higher alcohol relapse rates among patients who participated in SA treatment before transplantation.[20-22] There are a few possible explanations for the lack of an association between pre-LT SA treatment and post-LT relapse rates. The neurocognitive changes and high fatigue severity in many patients with end-stage liver disease may negatively affect processing speed and retention, memory, and engagement during SA treatment sessions and thus partially or completely mute the potential benefits of treatment. Also, participation in SA treatment does not necessarily mean that the patient is motivated to improve his insight or make lifestyle changes for long-term abstinence. In some instances, patients stop drinking only because of potential life-threatening decompensation, and they take part in SA treatment only because it is a mandated lifeline to transplantation. Once transplantation has occurred and their health has been restored, these patients may not possess sufficient motivation to maintain abstinence.

We also found that the intensity of the SA treatment received before transplantation may not make a difference in post-LT alcohol relapse rates. In our program, we encourage patients to engage in an SA treatment program of at least moderate intensity, although this is not required for transplant listing or surgery. It has been our contention that the decision to engage in a treatment program of moderate or high intensity is reflective, in part, of the patient's motivation and commitment to long-term abstinence and relapse risk reduction. However, factors beyond a patient's motivation and commitment level likely contributed to whether the treatment intensity was classified as low or moderate in this study. In other words, some patients may have been motivated to pursue higher intensity treatment but could not do so because of restricted driving privileges (eg, due to repeated encephalopathy), limited financial resources, inadequate health insurance, or problems in accessing SA treatment in their local community. We did not assess the insight and motivations of patients as part of this study, and prior research has shown that these may be more important predictors of alcohol relapse after transplantation.[5,10] We did find that SA treatment and its intensity did not vary with the individual patient's risk profile, although this relationship has yielded mixed findings when treatment effectiveness has been measured in nontransplant populations.[23-25]

Importantly, we found that patients who received SA treatment both before and after transplantation had a lower likelihood of relapsing into alcohol use than patients who received no treatment at all and patients who received SA treatment only before transplantation. In the multivariate model, participation in SA treatment after LT was a more robust protective factor than SA treatment before LT or SA treatment intensity after we controlled for the total ARRA score. Participation in SA treatment after LT may be a more accurate indicator of a patient's motivation to maintain long-term

abstinence because such treatment is now voluntary and is no longer required as a condition of transplant listing or surgery. Also, many of the barriers to participation in SA treatment before transplantation (eg, fatigue, neurocognitive problems, and hospitalizations) are likely to be less disruptive after transplantation, and this allows the patient to more actively participate in treatment and to focus on lifestyle changes for longer term survival. LT recipients may become more socially engaged and resume regular activities and routines as their health improves, and this may increase their opportunities to apply the relapse prevention strategies learned in treatment.

Close monitoring by the transplant team, the inclusion of family caregivers in follow-up clinic visits, and ongoing SA treatment or booster sessions after transplantation may be effective strategies for minimizing relapse risk.[1] As noted by Weinrieb et al.,[26] however, there are unique challenges that must be overcome during the post-LT period. Many patients will simply refuse to consider SA treatment now that they have undergone transplantation. Indeed, nearly half (43%) of our patients who received SA treatment before transplantation chose not to continue with such treatment after transplantation, and only 3 patients (5%) who had not received any prior SA treatment decided to pursue it after transplantation. Also, it is difficult to know when it is best to provide SA treatment in the months and years after transplantation. Weinrieb et al. offered an SA intervention 2 months after LT, but they were able to recruit only 5 of 55 patients into the study and concluded that offering treatment 2 or 3 years after LT may be better. Future research is necessary to isolate the most effective timing of SA treatment after transplantation.

Another study finding of clinical importance is the observation that the vast majority of alcohol relapses occurred in patients with less than 24 months of abstinence at the time of their initial LT evaluation. This was true regardless of whether patients received SA treatment before transplantation. Previous findings about the relative predictive value of abstinence duration have been equivocal, and much of the focus has been on the so-called 6-month rule.[10,21,27-34] We provide some evidence that a much longer sobriety period (up to 24 months) may hold some risk for post-LT relapse even among patients who receive SA treatment. Georgiou et al.[35] offered pre-LT patients a brief (3-session) psychosocial intervention to enhance social support, modify drinking behavior, and effectively manage relapse. Eight of the 19 patients who completed treatment and survived (42%) had relapsed into any alcohol use by the 6-month assessment after LT. Six of those 8 patients (75%) had a pre-LT abstinence period less than 24 months. Our program now requires all patients with less than 24 months of abstinence to participate in a relapse prevention program before activation on the waiting list, and we are developing a clinical pathway to ensure that these patients continue to receive some SA treatment or booster sessions after transplantation. Also, participation in the LT evaluation process by subspecialty-trained addiction experts may help to ensure that treatment recommendations designed to attenuate the ongoing risk for relapse are incorporated into the transplant-related care of patients.

Findings from this single-center, retrospective study should be considered in the context of a few noteworthy limitations. First, one limitation is the selection bias inherent in this type of study. Only those who have demonstrated an initial willingness to quit drinking and make lifestyle changes are referred for the transplant evaluation. Additionally, only those patients who can navigate the complexities of the transplant evaluation process, mobilize social support, show evidence of psychiatric stability, and remain abstinent from substances progress to transplant listing and eventual surgery. Only some patients were required to participate in pre-LT SA treatment, and these patients may differ from those who did not receive SA treatment in important variables that were not measured in this study. Second, the incidence of alcohol relapse may be higher than what we observed in this study. Although we relied on multiple documentation sources to identify relapse incidents, post-LT toxicology testing is not frequently performed at our center. Third, pre-LT patients at our center and in region 1 have high illness severity, and they typically reach Model for End-Stage Liver Disease scores in the mid-30s before transplantation. Repeated hospitalizations, encephalopathy, fatigue, and other comorbid health problems may limit participation in SA treatment. SA treatment before transplantation may be more effective in patients with lower levels of illness severity. Fourth, although we were guided by our program's clinical processes and policies, we recognize that the practices and policies regarding minimum abstinence duration and SA treatment requirements at other programs may differ from ours and, therefore, may yield different outcomes. Finally, we used unvalidated measures of SA treatment intensity and alcohol relapse intensity. Different definitions of SA treatment and relapse intensity might have yielded different findings.

In conclusion, we observed that one-third of our LT recipients with a known history of alcohol abuse or dependence relapsed into any alcohol use. Although this relapse rate is much better than what is observed in the general, nontransplant population, it still is alarmingly high in light of the possible link between heavy alcohol use and patient survival.[36,37] To reduce this risk, programs often require patients to engage in SA treatment before transplantation. Although this is beneficial for some patients, our findings suggest that we should place additional emphasis on ensuring that patients continue with some type of SA treatment after transplantation. Future research should prospectively examine the optimal timing for SA treatment that will attenuate the risk of alcohol relapse after transplantation. Randomized controlled trials of different SA treatment modalities also are needed so that transplant programs can make more informed

decisions for their patient selection practices and policy development.

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