Cannabis abuse and dependence in kidney transplant candidates

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Abstract

Objective: Cannabis is the most commonly used non-alcohol intoxicant in the general population. There are no consistent guidelines on the implications of cannabis abuse and dependence (CAD) in kidney transplant candidates. The aims of this study were to characterize kidney transplant candidates with comorbid CAD and examine the implications of CAD on transplant candidacy.

Method: This was a retrospective cohort study of kidney transplant candidates meeting diagnostic criteria for CAD at a tertiary center from 2012–2016. Candidates were reviewed for psychiatric and substance use disorders (SUDs), family history, and medical variables. The cohort was divided by severity of CAD and transplant listing status for comparisons. Statistical analysis included Kruskal-Wallis tests for continuous variables and Fisher's Exact Test for categorical variables.

Results: Sixty-one of 2067 (3%) kidney transplant candidates met criteria for CAD, and 13/61 (21%) underwent transplantation. Of 61, 58% smoked cannabis daily, 47% had alcohol dependence history, 31% had other illicit drug dependencies, 38% were smokers, 60% had a SUD family history, and 42% and 27% had depressive and anxiety disorders, respectively. Severity of CAD was inversely associated with transplant listing; those with cannabis abuse were more often listed than those with dependence (67% vs 33%, p=0.02) by study end. Three case presentations illustrate cannabis-related issues.

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Conclusion: In this cohort, kidney transplant candidates with comorbid CAD have high prevalence of other substance use disorders, psychiatric comorbidities, and strong family histories of addictions that resemble other SUD populations. These findings have implications for pre-transplant screening and treatment and post-transplant monitoring.

Keywords

cannabis; kidney transplantation; marijuana; substance abuse

INTRODUCTION

Cannabis (marijuana) is the most commonly used intoxicant in the European and U.S. general populations other than alcohol. Its legal status continues to change in a dynamic manner across the U.S., with a range from fully legal, to medical use only, to fully prohibited by state law. At the U.S. federal level, marijuana is still classified as a Schedule I substance under the Controlled Substances Act. Schedule I substances are considered to have a high potential for dependency and no accepted medical use, making distribution of marijuana a federal offense. Nonetheless, between 1996 and 2018, 30 states, Guam and the District of Columbia passed laws allowing marijuana use for a variety of medical conditions, and 8 states and the District of Columbia have legalized marijuana for recreational use (6).

Consistent with its widespread use in the general population, the prevalence of cannabis consumption has increased in the chronic kidney disease and kidney transplant patient populations (9). In the U.S., the legal status discrepancies between individual states, and from the states to the federal level, have created clinical and ethical challenges for transplant clinicians and transplant candidate selection committees. Specific considerations include the legal implications of medical and recreational marijuana use in local areas, potential medical and psychiatric risks and benefits of cannabis use before and after transplantation including the perpetuation of a cannabis abuse or dependence, the role of use in the larger context of the patient's substance use history (potential cross-addiction), the impact on comorbid psychiatric disorders, and the ethical principles of autonomy, beneficence, non-maleficence, and justice in organ distribution.

Emerging studies show several potential medical consequences with cannabis smoking. These include an increased risk of hypertension in chronic users and an increased risk of death commensurate with length of use (12). A retrospective study of outcomes in a large cohort of kidney recipients found an association between post-transplant cannabis abuse and dependence within the first year after transplant and alcohol abuse, other drug abuse, noncompliance, schizophrenia, and depression (1). Moreover, a case report has implicated cannabis in tacrolimus toxicity through drug-drug interaction (5). Tacrolimus, a widely used post-transplant immunosuppressive agent, has a narrow therapeutic window.

In the absence of national guidelines or standards, each transplant center has site-specific approaches or protocols for cannabis using and abusing/addicted patients. Lack of consensus in clinical approach across countries and transplant centers likely stems, in part, from the wide range of societal views on cannabis use and its evolving legal status. Depending upon treatment center location, practice and policy, patients with persistent cannabis use may be

denied transplant listing at one site and experience listing without significant reservations at another site, particularly if the patient is on medical marijuana. Among solid organ transplant centers, practice variability is perhaps greatest in regards to kidney candidates, where ongoing substance use, other than cocaine and other stimulants, may be viewed as having less direct negative impact on the organ of focus.

The aims of this study were to characterize candidates with comorbid cannabis abuse or dependence seeking kidney transplantation and to identify potential risk factors for post-transplant morbidity and mortality associated with cannabis use. This information may guide improvement in evaluation and identification of kidney transplant candidates at risk for post-transplant cannabis-related medical and psychiatric complications. It may also facilitate development of individualized recommendations to improve long-term outcomes.

METHODS

This retrospective cohort study was approved by the Institutional Review Board of the Mayo Clinic Rochester, Minnesota, U.S. and pursued in accordance with international ethical standards for patients providing consent for research.

Cohort with Cannabis Abuse or Dependence:

All patients under consideration for a kidney transplant at the William J. von Liebig Center for Transplantation and Clinical Regeneration, Mayo Clinic Rochester, underwent an extensive pre-assessment nurse telephone screening and social work evaluation for psychiatric and substance use disorders. Potential candidates who reported infrequent social cannabis use were asked to stop use for at least one month prior to Transplant Center evaluation. They subsequently underwent urine drug screening and social work assessment. If the urine drug screen was negative and the social worker had no concerns about substance abuse or an addictive disorder, the patient was advised against further cannabis use based on health risks of pre- and post-transplant cannabis smoking. Those identified by nursing or social work with a potential cannabis use disorder were referred for a transplant addiction psychiatry evaluation and underwent urine drug testing.

This study included all kidney transplant candidates referred for a transplant addiction psychiatry evaluation for suspected Substance Use Disorders (SUDs) from June 1, 2012, to December 31, 2016, who met DSM-IV-TR (2) diagnostic criteria for cannabis abuse or cannabis dependence or the comparable DSM–5 (3) diagnosis of cannabis use disorder. Since data were collected during the transition from DSM-IV-TR (2) to DSM–5 (3), all data were converted to DSM-IV-TR (2) nomenclature (mild SUD converted to substance abuse and moderate and severe SUDs converted to substance dependence). This cohort included kidney transplant candidates with end-stage kidney disease seeking kidney alone or combined organ transplantation (kidney-liver, kidney-heart, or kidney-pancreas). Candidates were followed for transplant or wait listing events through study end, June 9, 2017. Pre- and post-transplant abstinence was defined as patient and collateral history reports of abstinence confirmed by a urine drug screen. Post-transplant, most kidney recipients received follow-up Transplant Center reassessment at minimum annually. The reassessment for those with pre-transplant cannabis abuse or dependence included urine drug screening and social work

visit. Generally, they also met with a transplant addiction psychiatrist for monitoring of abstinence.

All candidates diagnosed with cannabis dependence or cannabis abuse in combination with another substance dependence (apart from tobacco) were mandated to establish abstinence, complete a primary addiction treatment program or course of individual relapse prevention counseling, and attend narcotics anonymous (or similar self-help meeting) on a weekly basis with sponsorship. Those meeting criteria only for cannabis abuse, and no history of other substance dependency, were asked to establish abstinence. Some candidates were referred for individual counseling or treatment program based on the severity of their cannabis abuse, their level of insight, and the quality of their sober support system.

Sub-Populations of Cohort:

Kidney transplant candidates diagnosed with cannabis abuse or dependence in the Transplant Addiction Psychiatry Clinic were divided into two groups (Table 1): (1) Transplanted, and (2) Non-transplanted. Patients who underwent kidney transplantation were followed into the post-transplant period to assess medical and psychosocial outcomes including death, graft loss, relapse to cannabis or other substances of abuse, and post-transplant medication or treatment non-adherence. Candidates who were not transplanted were further categorized into two groups: (1) Denied/deferred, or (2) Listed but not transplanted. Unlisted candidates were reviewed for rationale of denial or deferral. All candidate histories were reviewed for adherence to recommendations and follow-up with transplant addiction psychiatry and transplant nephrology.

Cannabis Abuse and Dependence Diagnoses:

To examine the clinical and demographic characteristics of kidney transplant candidates by severity of substance use, they were categorized into two groups: (1) DSM-IV-TR Cannabis Abuse, and (2) DSM-IV-TR Cannabis Dependence.

Demographic and Clinical Characteristics:

For all study subjects, demographic data and pertinent psychiatric and substance use history were abstracted from electronic medical records including date of initial evaluation by the transplant psychiatry team, psychiatric follow-up visits, listing status for transplantation, date of transplant, reason for denial/deferral as applicable, etiology of end-stage kidney disease, cannabis abstinence date, number of previous chemical dependency treatments, completion of chemical dependency treatment following initial transplant psychiatry evaluation, participation in Alcoholics Anonymous (AA) / Narcotics Anonymous (NA) meetings, tobacco use, alcohol and illicit substance use (other than cannabis) at the time of initial evaluation, at transplantation, and following transplantation, the history and severity of cannabis use, alcohol use and other illicit drugs, family history of substance abuse in first-degree relatives, and history of depressive or anxiety disorders.

Statistical Analyses:

Descriptive variables were summarized using medians, first and third quartiles, and range for continuous variables. Percentages and counts were used for categorical variables. Analysis

of the collected data included comparisons between patients with DSM-IV-TR cannabis dependence and those with DSM-IV-TR cannabis abuse. Additionally, comparisons were made between those listed and transplanted, those listed and not yet transplanted, and those denied or deferred listing. Association between descriptive and stratification variables was assessed via Kruskal–Wallis tests for continuous variables and Fisher's Exact test for categorical variables. As this analysis was exploratory in nature and intended to guide future research, no multiple testing correction was applied.

RESULTS

Demographic and Clinical Characteristics of Cannabis Use Disorder Cohort:

From June 1, 2012, to December 31, 2016, 2067 candidates for kidney transplantation underwent evaluation at the William J. von Liebig Center for Transplantation and Clinical Regeneration. Of those referred by the social workers to transplant addiction psychiatry for a further assessment of substance use, 61 met criteria for a CAD. Therefore, 61/2027 (3%) kidney transplant candidates met criteria for CADs. In this CAD cohort (n=61), 34% were female, 75% were white, and 33% were married. The median age at the time of initial evaluation was 45 years. The most common cause of kidney failure was diabetes mellitus (42%), and 69% were candidates for single organ transplant (kidney only). Three had prior kidney transplants functioning for a 7– to 13–year duration, among whom 2 of 3 lost their allograft due to rejection from immunosuppression non-adherence. Most (89%) achieved abstinence from cannabis (as requested for candidate listing) during the observation period. Sixty percent had a family history of substance abuse or dependence in a first-degree relative. Fifty-eight percent of the cohort consumed cannabis on a daily basis, and nearly one-third (31%) had a comorbid non-cannabis substance dependence diagnosis. Of the 61 subjects, 22 (36%) had engaged in some type of formal chemical dependency treatment prior to their presentation at the transplant center addiction psychiatry clinic. Comorbid psychiatric disorders in this cohort included depressive disorders (42%) and anxiety disorders (27%).

Table 2 shows the demographic data and clinical characteristics of the cohort, stratified by whether candidates were transplanted within the window of investigation. At study end, 13 (21%) candidates with cannabis abuse or dependence received transplant over a median follow-up period of 1.6 years. The remaining 48 were either denied listing for transplantation at our center (n=20), deferred from listing contingent upon completion of specific therapeutic goals (n=14), listed actively but not yet transplanted (n=5), or inactively listed for transplantation (n=9).

Of the transplanted group, all 13 subjects were white; in comparison, whites comprised 68% of the group not transplanted. Subjects transplanted were more likely to be married (62% vs 25%, p=0.02). There was insufficient evidence of a difference between the non-transplanted and transplanted cohorts in regard to comorbid non-cannabis drug or alcohol abuse and dependence.

Comparison by Cannabis Abuse and Dependence Diagnoses:

As shown in Table 3, at the time of psychiatric evaluation, 40 (66%) met criteria for a diagnosis of cannabis abuse and 21 (34%) met criteria for a diagnosis of cannabis dependence. Most demographic and clinical variables were not statistically different between groups. Yet, the cohort of patients with cannabis abuse was less likely than the cohort of dependent patients to be daily cannabis users (10% vs 85%, p 0.001). Patients in the abuse cohort were less likely to be dependent on alcohol (24% vs 59%, p<0.001), but more likely to abuse alcohol (52% vs 13%, p=0.002). A smaller proportion of the sampled patients who abused cannabis were dependent (14%) or abusing (10%) other non-cannabis drugs relative to those in the cannabis-dependent sample (40% and 16%, respectively). The between-group difference in the rates of non-cannabis drug dependence (p=0.08) and non-cannabis drug abuse (p=0.7) did not reach statistical significance. In both cannabis abuse and cannabis dependence cohorts, 50% or more of the patients reported, at minimum, one first-degree relative with a history of alcohol or drug dependence. Similarly, both cohorts showed a high percentage of patients with psychiatric comorbidities: 24% of those with cannabis abuse and 28% of those with cannabis dependence also had an anxiety disorder. For depressive comorbidity, the percentages were 38% and 44%, respectively. Although follow-up was similar between groups, a greater percentage of patients in the abuse cohort were listed or transplanted by the end of the study (67% vs 33%, p=0.02).

Comparison by Listing Status after Initial Addiction Psychiatry Evaluation:

Comparisons of the demographic and clinical characteristics of those transplanted or listed for transplantation vs those denied or deferred listing for transplantation are shown in Table 3, Table 4. There were a large number of patients who were able to achieve abstinence, but who were still not listed for transplantation for reasons not related to substance use. No differences in gender or age were found between the two cohorts. While more of those in the transplanted or listed for transplant cohort were married, the finding was not statistically significant (41% vs 27%, p=0.28). We had insufficient evidence for a difference in non-cannabis drug dependence between those listed for transplant/transplanted (26%) and those who were denied/deferred (34%, p=0.58). We were also unable to detect a difference between the groups for prevalence of alcohol dependence (33% vs 58%, respectively; p=0.15). Again, both groups had a high prevalence of positive family history of substance abuse and dependence in first-degree relatives (62% and 58%).

Case Series:

To highlight potential health outcomes associated with comorbid cannabis use disorders, we present three kidney transplant candidate cases.

Case A: A man presented in his 20's with need for retransplantation after previously receiving a kidney in his mid-teens. At 21, he experienced acute cellular rejection and allograft failure due to immunosuppression non-adherence, resulting in initiation of hemodialysis. He reported regular abuse of cannabis and alcohol at the time of his medication non-adherence.

His substance use history was notable for a rapid escalation in cannabis use beginning at age 20, which progressed to daily cannabis smoking for 10 months prior to allograft failure. In addition, he was drinking three to four times weekly, consuming 6–8 or more beers per drinking event. He readily acknowledged medication non-adherence at times of peak use and attributed the loss of his kidney to cannabis and alcohol. He was diagnosed with alcohol dependence, cannabis abuse, tobacco abuse, and major depressive disorder. To address his substance use disorders, he was asked to establish and maintain abstinence from alcohol, cannabis, and all other illicit substances, engage in an outpatient addiction treatment program, and to attend AA or NA meetings weekly with sponsorship.

At six-month follow-up, he had completed a residential program with follow-up counseling in combination with AA participation. He noted a two-day lapse in substance use abstinence in the context of a significant personal loss. After the lapse, he had reestablished abstinence, communicated the relapse to his sponsor, and increased the frequency of AA meeting attendance. At 12-month follow-up, he had maintained his abstinence and expressed good insight into the recovery process. He had also experienced mood normalization and was successfully tapered off his antidepressant medication. The patient was subsequently listed for transplantation.

Case B: A man in his mid-40's presented for transplant evaluation for progressive kidney failure. He reported smoking cannabis three to four times per week (twice a day per episode) since his 20's, noting that his cannabis use helped with anxiety and restlessness. He denied any other current or past substance use apart from tobacco. His initial diagnoses were cannabis abuse, tobacco abuse, and an unspecified anxiety disorder. Since he endorsed motivation to immediately establish cannabis cessation and communicated a strong belief that he could do so without counseling, he was not asked to pursue professional counseling, treatment, or NA/AA meetings.

At four-month follow-up, the patient reported initial discontinuation of cannabis followed by two weeks of near-daily cannabis smoking. He also disclosed a history of problematic alcohol and crack cocaine use over 5 years, ending in his 20's. He had relocated to stop cocaine and alcohol use, although had continued a pattern of daily cannabis smoking, which was never detected by his employers. Given the evolving history of active cannabis abuse or dependence in the context of prior cocaine and alcohol dependencies, the addiction psychiatrist recommended reestablishment of abstinence, outpatient addiction treatment, and NA or AA involvement.

At both six- and eight-month follow-up, the candidate had continued intermittent cannabis use, had attended only a few individual counseling sessions, and had not pursued addiction treatment or NA/AA engagement. He voiced significant frustration with the transplant psychiatrist, as he did not personally perceive marijuana smoking as causing any problems in his life. Despite persistent use, he argued for transplant listing.

A multidisciplinary team discussed his case in great detail, ultimately recommending residential addiction treatment to assist him in establishing abstinence and developing relapse prevention skills. His nephrologist discussed with him the option of pursuing

transplantation at another transplant center. The patient pursued evaluation elsewhere, where he was listed as inactive pending weight loss. Three years after his initial evaluation at this institution, he remains on hemodialysis.

Case C: A man presented in his early 60's in need of combined organ transplantation. On initial evaluation, he reported a history of depression, anxiety, and problem alcohol use (binge drinking pattern), currently in remission. He also disclosed twice-daily cannabis smoking in an effort to better control symptoms of anxiety. He denied current use of other illicit drugs for many years, although his history was significant for regular use of methaqualone, diazepam, amphetamines, marijuana, and cocaine in the late 1960's and early 1970's. Upon completion of his initial evaluation, he was given diagnoses of alcohol dependence, in full sustained remission, cannabis dependence, and generalized anxiety disorder. The recommendation was made to discontinue cannabis, complete an outpatient addiction treatment program, and participate in AA or NA with sponsorship.

At four-month follow-up, he had completed the recommendations. He was actively engaged in 5–7 AA meetings per week and had developed a close relationship with his sponsor. He endorsed a largely improved sense of well-being and described lifestyle changes to support ongoing sobriety. He was subsequently listed and transplanted less than two years after his initial evaluation by transplant psychiatry.

Notably, he continued to follow with the psychiatric team post-transplant, and he expressed gratitude for the mandated protocol. Post-transplant, he acknowledged his initial frustration with the recommendations prior to listing, viewing outpatient treatment and participation in AA as unnecessary given his alcohol abstinence and "only" using cannabis. He remains active in his recovery community and serves as a recovery coach to support others in their early abstinence.

DISCUSSION

These three cases illustrate the importance of systematic evaluation, the likelihood of substance use minimization and resistance to behavior change, and the therapeutic benefits of chemical dependency treatment and self-help (NA/AA) meetings in the management of cannabis abuse and dependence in a transplant candidate. The transplant addiction psychiatrist/psychosomatic physician must balance consistency in assessment and treatment recommendations with a capacity to individualize treatment to patient needs. The first case serves to highlight the risks of medication non-adherence when actively abusing cannabis and alcohol, resulting in loss of graft. The second case illustrates non-disclosure of past addiction, persistent cannabis use, and non-adherence to abstinence and treatment recommendations. Moreover, it showed the significant discrepancy in standards related to cannabis use in transplant candidates across different centers. Finally, the third case demonstrated a patient's life-transforming engagement in addiction recovery, which impacted pre- and post-transplant quality of life, with likely implications for long-term general health and graft survival.

This study is only the second to examine a cohort of kidney transplant candidates and recipients with cannabis abuse or dependence. In addition to the case series, it characterizes the cohort for demographic, psychiatric, and clinical factors, and it further examines the impact of cannabis smoking on transplant outcomes. The cohort's similarity to other addicted populations was striking with over 50% reporting daily use of cannabis, comorbid non-cannabis drug abuse, and a family history of substance abuse. Moreover, active tobacco use and psychiatric comorbidities were common..

Given the high prevalence of comorbid substance abuse in this population, these patients could more accurately be conceptualized as polysubstance abusers. The likelihood of comorbid substance abuse serves to highlight several risk factors potentially jeopardizing the success of a transplant. These include the negative health effects of cannabis and tobacco smoking, the potential relapse or resumption of other substances of abuse, and the impact on medication adherence post-transplant when under the effects of intoxicants. Among the negative health effects of cannabis smoking is the potential for inhalation of fungi contaminated cannabis by immunosuppressed post-transplant patients.

The cohort of 61 candidates was divided into those with abuse vs those with cannabis dependence to explore for clinical correlates of the diagnoses. Those with cannabis abuse were found to be less likely to use cannabis daily and less likely to have comorbid alcohol dependence, indicating a generally less severe substance abuse diathesis. Although not statistically significant, more of the patients in this sample with a diagnosis of cannabis abuse achieved abstinence.

Candidates were also divided by listing status. As expected, the listed/transplanted cohort was more likely to achieve abstinence, an expectation for listing. Compared with the denied/deferred group, this sample had more married subjects and fewer subjects dependent on alcohol or other drugs, although there was insufficient evidence that these differences would hold at the population level.

Three previous studies have more broadly examined the issue of cannabis smoking in transplant populations or substance use disorders specifically in kidney transplant patients. Coffman et al. (4) observed that there is little consensus on the length of recommended abstinence prior to transplantation. They posited that future guidelines should be born of sound medical evidence on the health effects of marijuana. However, nearly a decade later, there is limited evidence to shape such guidelines. In 2011, Sandhu et al. (10) published their investigation of the impact of alcohol, cannabis, illicit drugs and tobacco use on transplant candidacy and found that the substance abusing cohort was less likely to be listed. If patients were listed, they were less likely to be transplanted. Earlier this year, Alhamad et al. (1) reviewed a cohort of over 50,000 kidney recipients for those with cannabis abuse and dependence, finding post-transplant cannabis smoking associated with multiple negative outcomes. Our findings further characterize this population as closely resembling other addicted populations by comorbid disorders and family histories. Moreover, the case studies speak to the potential for post-transplant graft failure.

To be sure, the use of cannabis poses ethical challenges in the areas of distributive justice and principlism to transplant teams, complicated by the discrepant evolution of marijuana's legal status ranging from complete prohibition to medical use, recreational use, or both. In such an environment, it behooves transplant teams to critically assess (1) the nature of the candidate's current practice, (2) the specific aspects of marijuana use that have the potential to negatively or perhaps positively impact the outcome of kidney transplantation in the future, and (3) an appropriate process of curation that regularly updates practice guidelines in the selection of patients for listing and focuses on those particular factors.

Assessing the impact of cannabis use on allograft function postoperatively is a complex undertaking with multiple variables. Nonetheless, as we better understand the effects of specific components of plant cannabinoids, their impact on CB1 and CB2 receptor function present in the kidney, their impact on pharmacological targets other than these receptors throughout the body, genetic and physiological vulnerabilities to substance use disorders, and cannabinoid impact on allograft success, it is possible that newer, informatics-based and algorithmic approaches may help to individualize decision-making as in other areas of medicine (7,8,11).

This study offers an initial characterization of cannabis use disorders and subsequent outcomes in kidney transplant candidates. The study has several limitations including its retrospective design, small cohort (particularly of patients who have already undergone transplantation), and relatively short follow-up period to assess for post-transplant cannabis use related outcomes. Nonetheless, it serves as a starting point for further investigations into the health implications of cannabis abuse and dependence in this complex patient population competing for a scarce organ supply.

In conclusion, this cohort of kidney transplant candidates, who were referred to transplant addiction psychiatry and diagnosed with cannabis abuse or dependence, had cannabis use histories, comorbid addictions, family histories of substance use, and comorbid psychopathology in patterns similar to other highly addicted patient populations. Further research is necessary to determine optimal means of assessment, treatment and monitoring of disorders in kidney transplant candidates to minimize negative post-transplant health effects.

ACKNOWLEDEGEMENTS

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HIGHLIGHTS

- Cannabis abusing transplant candidates pose medical and ethical challenges

- Cannabis abusing kidney transplant candidates have high alcoholism co-morbidity

- They require thorough psychosocial assessment and individualized recommendations

- This cohort is strikingly similar to other addicted patient populations

- Post-kidney transplant cannabis use includes infection and non-adherence risks

Table 1

Transplant Demographics

Transplanted by 6/9/2017	Dependence (n=40)	Abuse (n=21)	Total (n=61)
No	35 (88%)	13 (62%)	48 (79%)
Yes	5 (13%)	8 (38%)	13 (21%)

Table 2

Demographic and clinical characteristics of kidney transplant candidates with comorbid cannabis use disorders (based on transplant vs non-transplant outcome)

	Transplanted (n=13)	Non-transplanted (n=48)	Total (n=61)	p Value
Females	4 (31%)	17 (35%)	21 (34%)	>0.99
Age at Initial Evaluation	48 (35, 53)	45 (33, 52)	45 (33, 52)	0.45
White	13 (100%)	33 (69%)	46 (75%)	0.03
Married	8 (62%)	12 (25%)	20 (33%)	0.02
Renal Diagnosis				0.04
Diabetes	4 (33%)	20 (44%)	24 (42%)	
Hypertension	0 (0.0%)	3 (7%)	3 (5%)	
Glomerular and Vascular	2 (17%)	17 (38%)	19 (33%)	
Cystic	3 (25%)	1 (2%)	4 (7%)	
Prior Failed Transplant	1 (8%)	2 (4%)	3 (5%)	
Characteristic Other	2 (17%)	2 (4%)	4 (7%)	
Psychiatric Follow-Up	5 (39%)	23 (48%)	28 (46%)	0.75
Sobriety Achieved	13 (100%)	41 (85%)	54 (89%)	0.33
Smokers	3 (23%)	20 (43%)	23 (38%)	0.33
History of Daily Cannabis Use	4 (31%)	31 (66%)	35 (58%)	0.03
History of Alcohol Dependence	4 (31%)	24 (51%)	28 (47%)	0.23
History of Alcohol Abuse	4 (31%)	12 (26%)	16 (27%)	0.74
History of Drug Dependence	3 (23%)	15 (33%)	18 (31%)	>0.99
History of Drug Abuse	2 (15%)	6 (13%)	8 (14%)	>0.99
Family History of SUD in First-Degree Relative	7 (58%)	27 (60%)	34 (60%)	>0.99
Depressive Disorder	3 (23%)	22 (47%)	25 (42%)	0.20
Anxiety Disorder	3 (23%)	13 (28%)	16 (27%)	>0.99
Time From Initial Psych Evaluation to Listing	357 (20, 576)	40 (7, 556)	60 (8, 599)	0.36

Table 3

Demographic and clinical characteristics of kidney transplant candidates with comorbid cannabis use disorders (based on cannabis dependence *vs* abuse diagnoses)

Characteristic	Dependence (n=40)	Abuse (n=21)	Total (n=61)	p Value
Females	13 (33%)	8 (38%)	21 (34%)	0.78
Age at Initial Evaluation	45 (34, 52)	49 (33, 55)	45 (33, 52)	0.73
White	29 (73)	17 (81%)	46 (75%)	0.55
Married	11 (28%)	9 (43%)	20 (33%)	0.26
Psychiatric Follow-Up	17 (43%)	11 (52%)	28 (46%)	0.59
Sobriety Achieved	33 (83%)	21 (100%)	54 (89%)	0.08
Smokers at Initial Evaluation	16 (41%)	7 (33%)	23 (38%)	0.59
History of Daily Cannabis Use	33 (85%)	2 (10%)	35 (58%)	<0.001
History of Alcohol Dependence	23 (59%)	5 (24%)	28 (47%)	0.01
History of Alcohol Abuse	5 (13%)	11 (52%)	16 (27%)	0.002
History of Drug Dependence	15 (40%)	3 (14%)	18 (31%)	0.08
History of Drug Abuse	6 (16%)	2 (10%)	8 (14%)	0.70
Family History of SUD in First-Degree Relative	24 (65 %)	10 (50%)	34 (60%)	0.40
Depressive Disorder	17 (44%)	8 (38 %)	25 (42%)	0.79
Anxiety Disorder	11 (28%)	5 (24%)	16 (27%)	0.77
Listed/Transplanted	13 (33%)	14 (67%)	27 (44%)	0.02
Time from Initial Psych Evaluation to Listing	32 (7, 321)	346 (20, 780)	60 (8, 599)	0.10

Table 4

Demographic and clinical characteristics of kidney transplant candidates with comorbid cannabis use disorders (based on listing status: denied/deferred vs listed/transplanted)

Characteristic	Denied/Deferred (n=34)	Listed/Transplanted (n=27)	Total (n=61)	p Value
Females	12 (35%)	9 (33%)	21 (34%)	>0.99
Age at Initial Evaluation	45	45	45	0.86
White	23 (68%)	23 (85%)	46 (75%)	0.14
Married	9 (27%)	11 (41%)	20 (33%)	0.28
Psychiatric Follow-Up	16 (47%)	12 (44%)	28 (46%)	>0.99
Sobriety Achieved	27 (79%)	27 (100%)	54 (89%)	0.01
Smokers at Initial Evaluation	13 (39)	10 (37%)	23 (38%)	>0.99
Cannabis Use Daily	22 (67%)	13 (48%)	35 (58%)	0.19
History of Alcohol Dependence	19 (58%)	9 (33%)	28 (47%)	0.07
History of Alcohol Abuse	6 (18%)	10 (37%)	16 (27%)	0.14
History of Drug Dependence	11 (34%)	7 (26%)	18 (31%)	0.58
History of Drug Abuse	5 (16%)	3 (11%)	8 (14%)	0.72
Family History of SUD in First-Degree Relative	18 (58%)	16 (62%)	34 (59.6%)	>0.99
Depressive Disorder	16 (49%)	9 (33%)	25 (42%)	0.30
Anxiety Disorder	7 (21%)	9 (33%)	16 (27%)	0.38