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Immunosuppression Adherence in Stable Kidney Transplant Patients Converted From Immediate- to Prolonged-Release Tacrolimus in Clinical Practice: A Norwegian Study

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Background. This study investigated medication adherence in kidney transplant patients (KTPs) converted from immediate-release tacrolimus (IR-T) to prolonged-release tacrolimus (PR-T)-based immunosuppression in routine practice. **Methods.** Noninterventional, observational, multicenter study in Norway. Included adult KTPs with stable graft function, converted from IR-T (baseline) to PR-T (1 mg:1 mg) in routine practice. Data were collected at baseline, and months 1, 3, 6, and 12 postconversion. Primary endpoint: adherence using the Basel Assessment of Adherence to Immunosuppressive Medication Scale. Secondary assessments: tacrolimus dose and trough levels (target, 3-7 ng/mL), clinical laboratory parameters (eg, estimated glomerular filtration rate [Modified Diet in Renal Disease]), and adverse events. **Results.** Ninety-one KTPs (mean ± SD age 47.7 ± 14.3 years) were analyzed. Mean ± SD change in PR-T dose from baseline (4.4 ± 2.4 mg/d) to month 12 was –0.1 ± 0.9 mg/d; mean tacrolimus trough levels remained within target. Overall medication adherence increased from 45.6% at baseline to 58.1% at month 1, but was similar to baseline thereafter; taking and timing adherence followed a similar pattern. Odds ratio (OR) for adherence at month 1 (but not at other time points) was greater versus baseline for overall (OR, 1.71; $P = 0.0205$), taking (OR, 3.38; $P = 0.0004$), and timing (OR, 1.77, $P = 0.0252$) dimensions. Mean ± SD Basel Assessment of Adherence to Immunosuppressive Medication Scale visual analogue scale score at baseline was 96.4 ± 5.5%, and increased postconversion. Estimated glomerular filtration rate remained stable (month 12, 61.6 ± 17.7 mL/min per 1.73 m^2), as did other laboratory parameters. Two (2.2%) patients had adverse events considered probably/possibly treatment-related. **Conclusions.** There was disparity between high, patient-perceived and low, actual adherence. Converting stable KTPs from IR-T to PR-T in routine practice did not impact long-term adherence to immunosuppression; renal function remained stable.

(*Transplantation Direct* 2018;4:e338; doi: 10.1097/TXD.0000000000000755. Published online 3 January, 2018.)

Transplant patients are required to adhere to a lifelong immunosuppressive regimen to preserve long-term graft function. Nonadherence to immunosuppressive regimens is a concern and, in kidney transplant patients, has been associated with de novo donor-specific antibody development, antibody-mediated rejection, and poor graft survival.[1-3] A common barrier to adherence in kidney recipients is the need for dosing of immunosuppressant therapy more than once per day.[4,5] Indeed, Ichimaru et al[5] showed that kidney transplant patients favored once-daily dosing, and a large Spanish survey of 1983 kidney recipients found that patients preferred to remove their evening

Received 14 June 2017. Revision requested 3 November 2017.

Accepted 4 November 2017.

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This study was sponsored by Astellas Pharma a/s Denmark. Daniella T Draper, PhD, CMPP, and Amy MacLucas, PhD, from Cello Health MedErgy (Europe) assisted in drafting the initial version of the article under the direction of the authors, and provided editorial support throughout its development. Editorial support was funded by Astellas Pharma, Inc.

S.A., L.G., and H.H. report nonfinancial support, and other support, from Astellas during the conduct of the study. E.C. and S.K. report nonfinancial support, and other support, from Astellas, during the conduct of the study, and personal fees from Astellas outside the submitted work. E.C. and S.K. are employees of Astellas Pharma.

All authors analyzed and interpreted the data, revised the article critically for important intellectual content, and approved the final version of the article for submission. S.A., L.G., and H.H. also collected data for the study.

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ISSN: 2373-8731

DOI: 10.1097/TXD.0000000000000755

dose of immunosuppressive medication (eg, mycophenolate mofetil [MMF], twice-daily tacrolimus, and cyclosporin).[4]

Because tacrolimus is the mainstay of immunosuppressive regimens after a kidney transplant,[6] optimizing adherence to tacrolimus-based regimens posttransplantation is critical for good graft and patient outcomes. Tacrolimus is available as both twice-daily, immediate-release, and once-daily, prolonged-release formulations. The latter offers a simpler regimen comprising a single, daily, morning dose,[7] and, therefore, has the potential to improve adherence to tacrolimus therapy. After dose adjustment, both the prolonged- and immediate-release formulations provide comparable systemic exposure to tacrolimus (area under the blood concentration–time curve over 24 hours), which has a strong association with clinical efficacy outcomes.[8,9] Although prolonged-release tacrolimus (PR-T) has demonstrated good efficacy and tolerability in clinical studies,[10,11] adherence data after conversion from immediate-release tacrolimus (IR-T) to PR-T are still relatively limited in kidney transplant patients.[12,13] This study was therefore undertaken to investigate medication adherence in stable kidney transplant patients converted from an IR-T to a PR-T-based immunosuppressive regimen as part of routine clinical practice.

MATERIALS AND METHODS

Study Design and Patients

This was a noninterventional, observational, multicenter study conducted in a real-life setting in 14 centers in Norway between October 2011 and June 2014. The study was conducted in accordance with the Declaration of Helsinki[14] and International Conference of Harmonisation guidelines.[15] Patients provided written informed consent and could withdraw from the study at any time.

Kidney transplant patients aged 18 years or older were included provided that they had stable graft function and were being converted from IR-T (Prograf™; Astellas Pharma Ltd, Chertsey, UK) to PR-T (Advagraf™; Astellas Pharma Europe BV, Netherlands) as part of routine care. Patients were excluded if they were pregnant or breastfeeding, were participating in another clinical trial, had taken an investigational drug within 28 days before participation, or had contraindications to tacrolimus treatment. All patients were converted from twice-daily IR-T to once-daily PR-T on a 1 mg:1 mg total-daily-dose basis at baseline. During the study, patients could receive concomitant immunosuppression.

Data were collected during five routine visits to the clinic: at baseline, and at months 1, 3, 6, and 12, with a permitted window of ±3 weeks for baseline, and ±6 weeks for months 3 to 12. Tacrolimus dose and trough levels (target, 3-7 ng/mL) were assessed at all visits, as were laboratory parameters if collected as part of routine clinical practice. Adherence to immunosuppression medication was evaluated at each visit using the self-reported Basel Assessment of Adherence to Immunosuppressive Medication Scale (BAASIS).[16] The BAASIS comprises 3 questions, which determine if, and how often, in the previous 4 weeks patients: (1A) missed a dose of any immunosuppression medication (taking dimension), (1B) skipped 2 or more consecutive doses of immunosuppression medication (drug-holiday dimension), (2) administered immunosuppression medication more than 2 hours before or after the recommended dosing time (timing dimension), and (3) altered their prescribed dose of immunosuppression medication without their doctor telling them to do so (dose-alteration dimension). A fourth question asked whether patients had stopped taking their immunosuppression medication completely within the previous year without their doctor telling them to do so (stopped-medication dimension). Patients also completed the self-rated BAASIS visual analogue scale (VAS), which ranges from 0% (never took medication as prescribed) to 100% (always took medication as prescribed).[16] Overall nonadherence was defined as a positive response ("yes") to any of questions 1 to 3. Taking and timing nonadherence were defined as positive responses to questions 1A and 2, respectively.

Endpoints

The primary assessment was adherence to an IR-T–based immunosuppression regimen at baseline, and to a PR-T regimen at 1, 3, 6, and 12 months after conversion, with overall adherence defined as a negative response ("no") to all questions 1, 2, and 3. Secondary assessments at baseline, and at months 1, 3, 6, and 12 postconversion included total daily tacrolimus dose, plasma tacrolimus trough levels, and the following clinical laboratory data: estimated glomerular filtration rate (eGFR) calculated using the Modified Diet in Renal Disease formula, glycated hemoglobin (HbA1c), fasting lipids (total cholesterol, low-density lipoprotein, high-density lipoprotein), and the cardiovascular risk factor apolipoprotein (Apo)-B (ApoB):ApoA ratio. Adverse events data were collected throughout the study.

Statistical Analyses

Due to the observational nature of the study, no power analysis was conducted; rather, the aim was to include approximately 120 patients. The full-analysis set (FAS) included all patients who provided informed consent and had at least one postbaseline visit. The per-protocol set (PPS) included patients in the FAS without major protocol deviations and who completed the study within 12 months. Data are presented for the FAS, with supporting analyses using the PPS.

Adherence responses at each visit were analyzed using a longitudinal logistic regression model, with fixed terms for visit and treatment as the model uses all available data across time points to obtain estimates. A visit-by-treatment interaction was included to adjust for the potential differential effects of treatment between visits. The predicted probabilities of adherence and 95% confidence interval (CI) were presented at each visit, along with odds ratios (OR), 95% CI, and *P* value. We present predicted probabilities rather than actual probabilities, as the latter could be biased due to missing data. The change from baseline in VAS score was analyzed using a restricted maximum likelihood repeated-measures approach, including fixed terms for visit, treatment, visit-by-treatment interaction, and baseline patient rating. The Kenward-Roger approximation was used to estimate degrees of freedom. Difference in adherence from baseline at each visit is reported as least-square mean, with 95% CI and *P* value. There was no imputation for missing data.

P less than 0.05 was considered statistically significant, and all analyses were conducted using SAS® Version 9.3 or higher.

RESULTS

Patient Characteristics

Overall, 93 kidney transplant patients were included from 11 out of the 14 centers in Norway. The FAS comprised 91 patients (mean ± SD age, 47.7 ± 14.3 years; 63.7% male), who had at least 1 visit beyond baseline. Eighty patients were included in the PPS. Patient demographics and baseline characteristics are presented in Table 1. Most patients (89.0%) had received one transplant, with the mean ± SD time between the most recent transplantation and study entry being 4.1 ± 4.4 years, and with 57.1% of patients having received allografts from deceased donors. At baseline, concomitant immunosuppression included corticosteroids (all patients), MMF (73.6%), mycophenolic acid (MPA) (16.5%), azathioprine (4.4%), and everolimus (1.1%) (Table 1). As such, most patients in this study were on a triple immunosuppressant regimen.

Thirteen (14.0%) patients withdrew from the study due to the following: adverse events (n = 1), inappropriate enrolment (n = 1), withdrawal of consent (n = 1), death (n = 2), loss to follow-up (n = 6), or other reason (n = 2).

TABLE 1.

Patient and donor demographics and baseline characteristics (FAS)

Characteristic	Measurement
Sex, n (%)	
Female	33 (36.3)
Male	58 (63.7)
Age, y	
Mean ± SD	47.7 ± 14.3
Median	47.0
Minimum; maximum	22.0; 78.0
Height, cm	
Mean ± SD	175 ± 8.9
Median	175
Minimum; maximum	150; 197
Weight, kg	
Mean ± SD	81.9 ± 19.3
Median	80.0
Minimum; maximum	48.0; 163.0
Current graft number, n (%)	
1	81 (89.0)
2	9 (9.9)
3	1 (1.1)
Time between most recent transplantation and study entry, y	
Mean ± SD	4.1 ± 4.4
Median	3.0
Minimum; maximum	0.1; 29.5
Donor type, n (%)	
Deceased	52 (57.1)
Living	39 (42.9)
Diabetes, n (%)	
Yes	74 (81.3)
No	17 (18.7)
Concomitant immunosuppression, n (%)	
Corticosteroids	91 (100.0)
MMF	67 (73.6)
MPA	15 (16.5)
Azathioprine	4 (4.4)
Everolimus	1 (1.1)

Tacrolimus Dose and Trough Levels

The mean ± SD dose of tacrolimus was similar before and after conversion (preconversion IR-T dose, 4.4 ± 2.5 mg/d vs postconversion PR-T dose, 4.4 ± 2.4 mg/d). The mean dose of PR-T remained similar across visits, with a mean ± SD change from baseline to month 12 of –0.1 ± 0.9 mg/d. The proportion of patients requiring tacrolimus dose adjustments since their last visit was 16.3%, 19.0%, 10.0%, and 15.4% at months 1, 3, 6, and 12, respectively.

The mean ± SD plasma trough level of IR-T before conversion was 6.0 ± 1.4 ng/mL (minimum 3.1 ng/mL). Mean tacrolimus trough levels remained within the target range at all visits postconversion (5.7 ± 1.7 ng/mL at months 1 and 3, 5.4 ± 1.7 ng/mL at month 6, and 5.5 ± 1.8 ng/mL at month 12), with the mean change from baseline to month 12 being –0.4 ± 1.6 ng/mL. It should be noted that trough levels lower than 3.0 ng/mL were reported at each visit postconversion. There were no notable changes from baseline in concomitant immunosuppression use.

Adherence

The proportion of patients who were adherent to their immunosuppression regimen throughout the study was low. Overall adherence to treatment increased from baseline to month 1 postconversion (45.6% vs 58.1%, respectively); adherence was 33.3-44.0% across months 3, 6, and 12 (Figure 1A).

Taking adherence increased from baseline to month 1 postconversion (72.2% vs 89.7%, respectively), but reverted to baseline levels at months 3, 6, and 12 (66.2-83.3%) (Figure 1B). The greatest proportion of patients had missed 1 dose in the previous 4 weeks at baseline, and at months 1 and 12 (76.0%, 88.9% and 61.5%, respectively). At months 3 and 6, approximately 50% of patients had missed one dose, and 35.7% and 47.8%, respectively, had missed 2 doses. Few patients missed 3 or more doses. Approximately 50% of patients adhered to the prescribed timing of their medication at baseline, month 3 and month 12, and compared with baseline, more patients were adherent at month 1 (66.7%) and fewer were adherent at month 6 (41.0%) (Figure 1C). No information was gathered regarding which immunosuppressants were missed.

ORs were calculated, comparing postbaseline with baseline adherence. At month 1, the OR (95% CI) for overall, taking, and timing adherence was greater than at baseline (overall: OR, 1.71; 95% CI, 1.09-2.70; $P = 0.0205$; taking: OR, 3.38; 95% CI, 1.72-6.64; $P = 0.0004$; timing: OR, 1.77; 95% CI, 1.07-2.91; $P = 0.0252$). For other postconversion time points, no marked differences from baseline were observed (Table 2). Findings were similar when data from the PPS were analyzed, except for timing adherence at month 1, which did not reach statistical significance (OR, 1.68; 95% CI, 0.99-2.84; $P = 0.0531$).

Only 1 patient, at month 3, had changed the dose of their medication from that which was prescribed, few had missed 2 or more consecutive doses in the preceding 4 weeks (Figure 1D), and no patients had stopped taking their medication. The mean ± SD VAS score at baseline was

96.4 ± 5.5%, indicating high self-rated compliance, increasing for all visits postconversion, to 97.5 ± 3.9% at month 12.

Laboratory Parameters

Renal function remained stable over the 12 months following conversion from IR-T to PR-T. Mean ± SD eGFR (mL/min per 1.73 m^2) was 59.9 ± 17.5, 58.2 ± 19.9, 62.6 ± 18.9, 61.7 ± 16.9, and 61.6 ± 17.7 at baseline and at months 1, 3, 6, and 12, respectively. The mean ± SD change from baseline to month 12 was 0.8 ± 8.6 mL/min per 1.73 m^2.

There were no notable changes from baseline for mean HbA1c (5.9-6.7 mmol/mol across visits, including baseline), total cholesterol (4.7-5.0 mmol/L), high-density lipoprotein (1.5-1.6 mmol/L), low-density lipoprotein (2.6-2.8 mmol/L), and ApoB:ApoA ratio (0.6-0.9).

Safety

Two (2.2%) patients recorded adverse drug reactions considered probably or possibly treatment-related: a brain tumor and constipation, respectively. The person with a brain tumour died during follow-up, as did one other patient, whose reported "sudden death" was considered unrelated to treatment.

DISCUSSION

This large, noninterventional study reported longitudinal adherence data after conversion from IR-T to PR-T in kidney transplant patients as part of routine practice. In this study, conversion to PR-T improved medication adherence at month 1 postconversion, but by 12 months, adherence was similar to that reported before conversion.

A high proportion of patients were nonadherent to their medication during the study; indeed, 10-34% of patients across study visits reported missing a dose within the previous 4 weeks, and 33-59% reported taking a dose more than 2 hours late or early. These data are consistent with previous publications of nonadherence in kidney transplant patients, reporting rates of 34.5% and 55.0%.[17,18] Interestingly, despite high levels of nonadherence, patients scored themselves very highly on the VAS (>96%) for always taking their medication

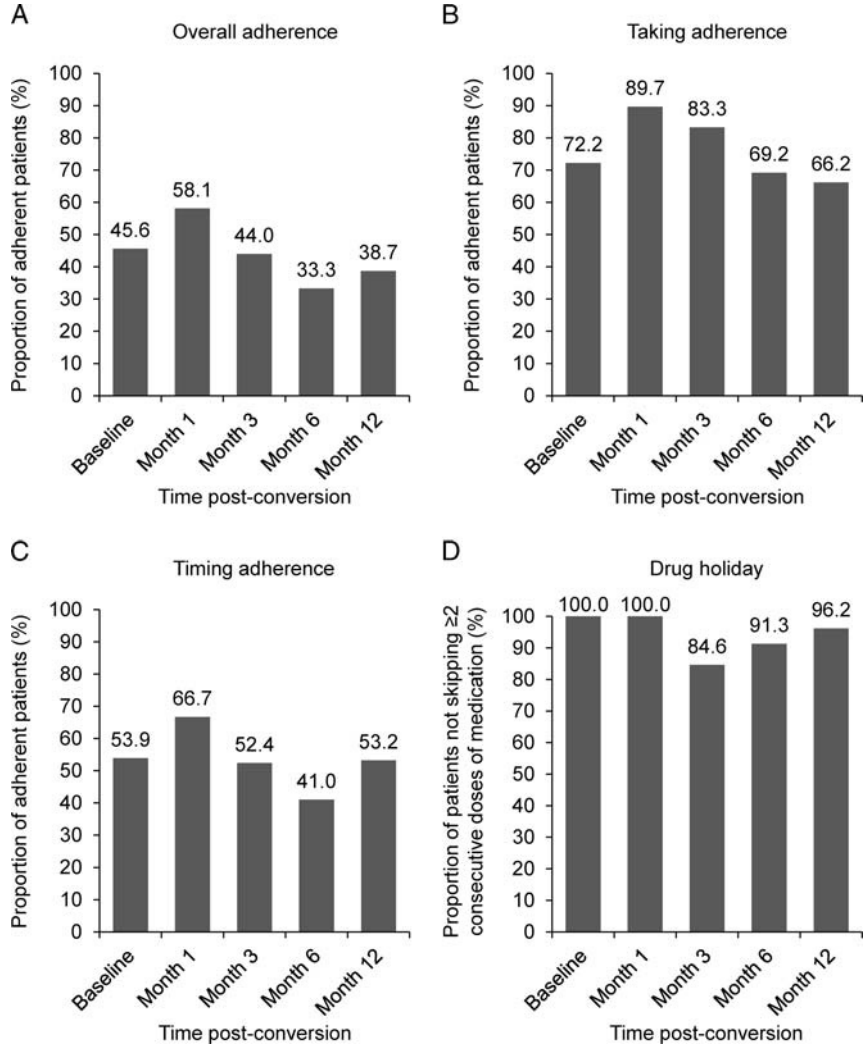

FIGURE 1. Adherence to a tacrolimus-based immunosuppression regimen before (baseline) and 1, 3, 6, and 12 months after conversion from IR-T to PR-T for (A) overall adherence, (B) taking adherence, (C) timing adherence, and (D) the proportion of patients not skipping 2 or more consecutive doses of medication (drug-holiday dimension), using the BAASIS (FAS). For the drug-holiday dimension, only patients responding "yes" (nonadherent) to question 1A completed this question (question 1B). Patient numbers at baseline, and months 1, 3, 6, and 12, respectively: (A) n = 90, n = 86, n = 84, n = 78, n = 75; (B) n = 90, n = 87, n = 84, n = 78, n = 77; (C) n = 89, n = 87, n = 84, n = 78, n = 77; (D) n = 25, n = 9, n = 13, n = 23, n = 26.

TABLE 2.

Predicted probability of overall adherence, taking adherence, and timing adherence to a tacrolimus-based immunosuppression regimen before (baseline) and 1, 3, 6, and 12 months after conversion from IR-T to PR-T (FAS)

Time point	Predicted probability of adherence (95% CI)	OR (95% CI)[a]	*P*
Overall adherence			
Baseline	0.45 (0.36-0.56)	—	—
Month 1	0.59 (0.48-0.69)	1.71 (1.09-2.70)	0.0205
Month 3	0.43 (0.33-0.54)	0.92 (0.56-1.49)	0.7214
Month 6	0.34 (0.24-0.45)	0.61 (0.37-1.02)	0.0597
Month 12	0.38 (0.28-0.50)	0.75 (0.44-1.28)	0.2960
Taking adherence			
Baseline	0.72 (0.62-0.80)	—	—
Month 1	0.90 (0.81-0.95)	3.38 (1.72-6.64)	0.0004
Month 3	0.82 (0.73-0.89)	1.80 (0.91-3.53)	0.0898
Month 6	0.69 (0.58-0.78)	0.85 (0.46-1.57)	0.6054
Month 12	0.66 (0.55-0.76)	0.75 (0.45-1.25)	0.2631
Timing adherence			
Baseline	0.53 (0.43-0.64)	—	—
Month 1	0.67 (0.56-0.76)	1.77 (1.07-2.91)	0.0252
Month 3	0.52 (0.42-0.63)	0.96 (0.58-1.60)	0.8704
Month 6	0.41 (0.31-0.52)	0.61 (0.35-1.09)	0.0930
Month 12	0.53 (0.42-0.64)	0.99 (0.59-1.69)	0.9834

[a] Comparing postbaseline adherence with baseline for that dimension in the BAASIS.

as prescribed. This highlights the disparity between patient-perceived and actual adherence to immunosuppression medication. A similar disparity has been previously reported in a cohort of 137 liver transplant recipients using the BAASIS, in which 66.4% of patients were classed as nonadherent, whereas the VAS score was greater than 90%.[19] Collectively, these data suggest that patients require education about recognizing nonadherent behavior, and the importance of complying with their immunosuppression regimen.

Despite general low levels of medication adherence, overall adherence, and taking and timing dimensions of the BAASIS improved from baseline to month 1 with PR-T. Similarly, van Boekel et al[20] observed significantly improved medication adherence between baseline and approximately 1 month postconversion from IR-T to PR-T in kidney recipients (79.7% vs 94.6% of patients, respectively; $P < 0.001$). As kidney transplant patients are more likely to take their morning rather than their evening dose, and prefer once-daily dosing,[5,12] improved adherence could result from a simpler once-daily morning dosing facilitated by PR-T versus IR-T. However, the odds of being adherent at months 3, 6, and 12 postconversion in this study were below 1, and similar to adherence levels at baseline. This may reflect the tendency of adherence to decrease with increasing time posttransplantation.[5,21] Furthermore, the BAASIS questionnaire could have acted as an educational tool, thereby improving adherence in the short term. Future studies could introduce the questionnaire before conversion from PR-T to IR-T, to minimize any temporary educational effect. For example, the ADMIRAD study design included a 3-month run-in period to eliminate the potential modification of adherence behavior due to monitoring.[12]

It should be noted that, although the BAASIS effectively captures adherence behavior to an immunosuppressive regimen as a whole, it does not identify changes in adherence to each specific component of the regimen. Indeed, it is plausible that the removal of the evening dose of tacrolimus might have led to more skipped doses of, for example, twice-daily MMF in the evening. This is particularly relevant, as most patients in the study were on a triple immunosuppressive regimen, including steroids and MMF.

The relative importance of adherence to each component of the immunosuppressive regimen versus the overall regimen has yet to be investigated or established. Tacrolimus, which is considered to be the critical immunosuppressive agent in the regimen, has a narrow therapeutic index (unlike MMF and MPA),[22] and must be taken with strict timing in relation to food, as this affects its absorption. Previous studies have demonstrated the importance of consistent tacrolimus exposure over time,[23-25] whereas corresponding data for MMF and MPA are lacking. Higher intrapatient variability in tacrolimus trough levels is also associated with poor outcomes, including graft loss and rejection, whereas variability in MMF levels is not.[24,26] Indeed, there are data correlating variability in tacrolimus exposure with donor-specific antibody formation,[25] whereas such data are lacking for MMF and MPA.[22] Collectively, these studies suggest that nonadherence with tacrolimus may have a greater negative impact on clinical outcomes than nonadherence with other immunosuppressive agents in the regimen, and highlight the need to measure adherence to tacrolimus per se.

Adherence to individual components of the regimen, such as tacrolimus, could be assessed using specific or objective measures of adherence. Such measures could include tacrolimus-focused electronic monitoring systems, to collect data relating to tacrolimus intake and its timing. Electronic monitoring reportedly has superior validity compared with other nonclinical adherence measurement methods.[27] Additionally, intrapatient variability in tacrolimus trough levels can reflect the impact of nonadherence (ie, how much drug reaches the blood); this may be a more clinically relevant

measure than using adherence questionnaires or electronic monitoring.[23,25]

Importantly, renal function remained stable over 12 months postconversion from IR-T to PR-T (mean ± SD eGFR 59.9 ± 17.5 vs 61.6 ± 17.7 mL/min per 1.73 m^2 at baseline and month 12, respectively). This was expected, because patients were converted to PR-T a mean of 4.1 years after transplantation. Additionally, the EVOLUTION study reported 12-month renal function in 1832 stable kidney transplant patients converted from IR-T to PR-T in routine clinical practice.[28] Not only were eGFR levels stable between baseline and month 12 postconversion (56.5 ± 19.7 vs 55.7 ± 20.6 mL/min per 1.73 m^2, respectively),[28] but a 3-year extension study with PR-T (R-EVOLUTION) showed that eGFR at months 24 and 36 were comparable with baseline levels.[10] Stable mean creatinine clearance and serum creatinine levels have also been reported up to 4 years postconversion from IR-T to PR-T.[11] Collectively, these data suggest that PR-T supports long-term renal function in kidney transplant patients converted from IR-T. Importantly, other laboratory parameters also remained stable postconversion, and PR-T was generally well tolerated.

In line with previously published data, no substantial changes in mean daily tacrolimus dose were observed after conversion from the immediate- to the prolonged-release formulation, and the mean tacrolimus trough level decreased only slightly from baseline to month 12 (6.0 vs 5.5 ng/mL, respectively).[10,29] Although the overall mean tacrolimus trough levels remained within the target range, individual trough levels lower than 3 ng/mL were recorded with PR-T for some patients at each postbaseline visit. The latter may be explained by the low trough levels targeted in Norway during tacrolimus maintenance therapy. Based on a large clinical trial,[30] clinical practice guidelines in Norway recommend targeting tacrolimus levels of 3-7 ng/mL in kidney transplant patients, which is lower than the range reported in the registration studies and in the European Medicines Agency file (5-15 ng/mL).[7] As such, there is a need to routinely monitor tacrolimus trough levels in patients converted from IR-T to PR-T and to adjust doses to maintain adequate tacrolimus exposure.

As with other adherence studies, this research has limitations. For example, the BAASIS relies on self-reporting, which is subject to social desirability and recall response bias.[31] The questionnaire also considers all immunosuppressants received by the patient, such that improved adherence to PR-T could have been masked by nonadherence to concomitant therapies. Additionally, data were not available for all patients across all visits, which could also have affected the reliability and interpretation of results. For this reason, probability of adherence was reported as predicted, rather than actual values. Actual probabilities are calculated using data for individual time points and could be biased due to missing data. By contrast, predicted probabilities use all data collected across all time points, thereby optimizing use of the available observations to provide valid estimates of adherence, under a broad assumption about the nature of missing data. Despite its limitations, this study adds valuable information to the limited pool of evidence for converting stable kidney transplant patients from IR-T to PR-T in routine clinical practice. Practical suggestions are also provided to refine investigations into patient medication adherence after conversion.

In summary, according to results obtained using the BAASIS questionnaire, a high proportion of kidney transplant patients were nonadherent to their immunosuppression regimen, despite rating themselves as highly adherent on the VAS. This highlights the disparity between actual and patient-perceived adherence, and the subjectivity of asking patients about their adherence patterns. Objective methods, such as electronic monitoring or measurement of intrapatient variability in tacrolimus trough levels, may be more appropriate. This study was not designed to evaluate adherence to tacrolimus, but rather to all components of the immunosuppressant regimen. Conversion from IR-T to PR-T improved adherence to the immunosuppressive regimen early postconversion, as measured using the BAASIS questionnaire. PR-T was also associated with stable tacrolimus trough levels and renal function. Most centers participating in this study have protocols advising conversion from IR-T to PR-T, and this study does not refute such a policy. The data reported in this study confirm that PR-T can be used in stable kidney transplant patients converted from IR-T in routine clinical practice.

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