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Research Article

The impact of kidney transplantation on 24–hour ambulatory blood pressure in end–stage renal disease patients

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Abstract

In this study, we prospectively investigated the impact of kidney transplantation (KT) on the status of hypertension, including circadian rhythm in end–stage renal disease (ESRD) patients. We performed 24–hour ambulatory blood pressure (BP) monitoring and office BP measurement in 48 patients before and 1 year after KT. According to the nocturnal reduction in systolic BP (⊿SBP), the patients were divided into dippers, non–dippers, and reverse dippers. After KT, the mean BP value in office BP and 24–hour ambulatory BP monitoring did not change, but the proportion of patients taking anti–hypertensive drugs and the pill number significantly decreased. In contrast, the mean ⊿SBP significantly decreased, and the proportion of non–dippers and reverse dippers did not decrease. Decrease in ⊿SBP after KT was associated with inferior allograft function during follow–up. Our study suggests that KT improved the overall BP level, but it did not affect abnormal circadian rhythm in ESRD patients. J Am Soc Hypertens 2015;9(6):427–434. © 2015 American Society of Hypertension. All rights reserved.

Keywords: Hypertension; circadian rhythm; end stage renal disease.

Introduction

Hypertension is not only an important cause but is also a frequent complication of end–stage renal disease (ESRD). Indeed, the prevalence of hypertension in ESRD patients has reached 80%, and it is more difficult to control blood pressure (BP) within target range, although more pills are used in ESRD patients compared with the general population with essential hypertension.[1–3] During ambulatory blood pressure monitoring (ABPM), non–dipping or reverse dipping pattern is more frequently detected in ESRD patients.[4–9] All the above findings are associated with target organ damage in the brain, heart, and peripheral vessels, which would result in mortality of ESRD patients.[4–8,10,11]

After kidney transplantation (KT), many complications associated with ESRD, such as chronic kidney disease, mineral bone disorder, and anemia were resolved or showed significant improvement.[10,11] In regard to hypertension, it is still found in many patients after KT, and is also a major traditional risk factor for cardiovascular mortality in KT recipients.[11] In addition, many studies showed that KT recipients showed abnormal circadian rhythm.[4,6,7] However, most previous studies was done only on the post–transplant state; hence, they did not show the change of the status of hypertension in comparison with those before KT. Therefore, the impact of KT on the overall hypertension status, including circadian rhythm, in ESRD patients has not yet been determined.

Hence, the purpose of this study is to investigate the overall change in BP as well as circadian rhythm in a prospective cohort of KT recipients using ABPM, and to define the impact of KT on the hypertension status in ESRD patients.

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Conflict of interest: none.

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Methods

Study Population

A prospective observational study was performed to investigate the change in ambulatory blood pressure including circadian rhythm after KT in ESRD patients. Between May 2011 and May 2012, a total of 115 living donor (LD) KT procedures were performed at Seoul St. Mary's Hospital. Among them, we included 37 cases of KT recipients with low immunologic risk and who agreed to participate in this study. In addition, we enrolled 33 ESRD patients who were expected to take transplantation soon based on the order of priority for deceased donor (DD) KT waiting list. In Korea, the mean wait time for DDKT was 76.8 ± 50.4 months according to the Korean national kidney transplantation data.[12] Hence, we recruited 33 patients whose wait time was longer than this period and performed 24–hour ABPM for them as baseline study. However, only 11 subjects succeeded in taking kidney transplantation within 1 month from the performance of 24–hour ABPM; hence, we decided to include those 11 patients in this study cohort. Therefore, finally, a total of 48 patients (37 LDKT and 11 DDKT) were included in this study.

All patients received typical immunosuppressive regimen at our center as described previously.[13,14] Briefly, the initial immunosuppressant regimen consisted of tacrolimus (Tac) or cyclosporin (CsA) in combination with mycophenolate mofetil (MMF) and prednisolone. Basiliximab was used as induction therapy at 2 hours before KT and on day 4 after KT. The initial dose of Tac was 0.16 mg/kg per day orally, and that of CsA was 7 mg/kg orally. The target trough levels were 8–12 ng/mL during the first 3 months and 3–8 ng/mL thereafter for Tac and 150–300 ng/mL during the first 3 months and 50–100 ng/mL thereafter for CsA. We checked Tac or CsA trough level at every out–clinic visit, and calculated time average (TA) Tac or CsA level during post–transplant 1 year. In all patients, methylprednisolone (1 g/d) was administered by intravenous infusion on the day of KT and was converted to prednisolone at 30 mg/d on day 4 after KT. The initial dose of MMF was 1.5 g/d, and the dose was modified to minimize adverse effects such as diarrhea or leukopenia. This study was approved by the Institutional Review Board of Seoul St. Mary's Hospital (KC13OISI0003).

Measurement of Office BP and 24–hour ABPM

Patients underwent BP evaluation with 24–hour ABPM and office BP measurement within 1 month prior to KT and at 1 year after KT. ABPM was performed using the TM–2425 (A&D, Tokyo, Japan) over the course of 24 hours. The device was programmed to measure BP every 15 minutes from 07:01 am to 11:59 pm and every 30 minutes from 12:00 am to 07:00 am. Patients were asked to write in a diary about the occurrence of unusual events or poor sleep. Traces were rejected for analysis, and ABPM repeated, if unusual events or poor sleep occurred. Office BP measurement was obtained using the OMRON IA–2 automatic BP device (IntelliSense TM, Omron Corporation, Kyoto, Japan) with the patient sitting quietly at a recording station after a 10–minute rest, and the patient was instructed not to drink coffee or smoke for at least 30 minutes before BP measurement.

On the basis of percentage nighttime reduction in systolic blood pressure (ΔSBP), patients were grouped into dippers (ΔSBP ≥10%), non–dippers (ΔSBP between 0 and 9%), or reverse dippers (nocturnal rise in SBP). Hypertension in ABPM was defined as follows: daytime BP >135/85 mm Hg or nighttime BP >120/75 mm Hg; or 24–hour BP >130/80 mm Hg.[15] Office hypertension was defined as BP >140/90 mm Hg. Patients with controlled ABP and uncontrolled office BP were defined as having white coat hypertension, and patients with uncontrolled BP measured by ABPM and controlled office BP were considered as having masked hypertension.

Clinical Outcome

The primary endpoint of this study is the change in mean BP and circadian rhythm pattern during ABPM between before and 1 year after KT. Secondary endpoints included the change in mean value of office BP, the proportion of patients who needed anti–hypertensive drugs, the number of anti–hypertensive drugs, and the proportion of patients with uncontrolled hypertension during ABPM or office BP measurement between before and 1 year after KT.

Statistics

All analyses were performed using SPSS package 20.0. Data are presented as mean ± standard deviation or counts and percentages, depending on the data type. For comparison of variables between before and after KT, paired *t*–test was used for continuous variables, and McNemar's test was used for categorical variables. Binary logistic regression analysis was used to investigate the risk factors for the development of AAMR. All tests were two–tailed, and the results were considered statistically significant when the *P* value was less than 0.05.

Results

Baseline Characteristics and Clinical Course after KT

Baseline characteristics of the patient population are presented in Table 1. Thirty–one patients were males, and mean patient age at 24–hour ABPM before KT was 46 years (range, 19–66 years). The most common primary renal