



Clinical Significance of Multidetector Coronary Computed Tomography Angiography to Evaluate the Prevalence and Severity of Coronary Artery Disease in Asymptomatic Kidney Transplantation Recipients

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ABSTRACT

Background. Coronary artery disease (CAD) is one of the leading causes of mortality in kidney transplantation (KT) recipients. Noninvasive coronary angiography with the use of multidetector computerized tomography (MDCT) is feasible with high sensitivity and negative predictive value to evaluate CAD. However, few studies have been conducted to elucidate the applicability of MDCT in KT. This study was designed to evaluate the prevalence and severity of CAD with the use of MDCT angiography in asymptomatic KT recipients.

Methods. From September 2011 to November 2013, MDCT angiography was performed on 90 renal transplant recipients who had no pre-transplantation CAD history and stabilized post-transplantation renal function for 6–18 months. According to the MDCT results, we divided our study population into 2 groups: The no-CAD group ($n = 36$; 40.0%) and the CAD group ($n = 54$; 60.0%). Severity of CAD was categorized as follows: mild CAD, 1 vessel obstructive, 2 vessels obstructive (or in the proximal left anterior descending), and 3 vessels obstructive (or left main).

Results. Among the risk factors, pre-transplantation diabetes mellitus and lower levels of high-density lipoprotein, higher parathyroid hormone levels, higher coronary artery calcification scores, and rejection episodes were independent factors for CAD. Thirty-two (59.3%) of the CAD group had mild obstructive lesions and 22 (40.7%) had obstructive lesions in >1 vessel according to MDCT angiography.

Conclusions. MDCT angiography is a useful and noninvasive method for detecting CAD even in asymptomatic KT recipients.

KIDNEY transplantation (KT) has become an effective means of treating end-stage kidney disease. However, despite improved quality of life and survival, coronary artery disease (CAD) is one of the leading causes of mortality in KT recipients compared with the general population. CAD is also the most common cause of death with graft function, ranging from 36% to 55% [1–3].

Recently, multidetector coronary computerized tomography (MDCT) angiography was introduced as a novel noninvasive method for the evaluation of CAD with high sensitivity and

negative predictive value [4,5]. However, few studies have been conducted to elucidate the applicability of MDCT angiography in KT recipients.

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Table 1. Factors Affecting Development of CAD: Univariate Analysis

	No CAD (<i>n</i> = 36; 40.0%)	CAD (<i>n</i> = 54; 60.0%)	<i>P</i> Value
Age, y	50.5 ± 7.8	52.5 ± 7.8	.230
Male sex, <i>n</i> (%)	16 (44.4)	20 (37.0)	.516
BMI (kg/m ²)	22.0 ± 1.61	23.13 ± 4.04	.079
DM before transplantation, <i>n</i> (%)	4 (11.1)	19 (35.2)	.013
HTN before transplantation, <i>n</i> (%)	32 (88.9)	49 (90.7)	.520
Duration of dialysis, mo	17.5 ± 39.8	35.7 ± 48.0	.054
Types of dialysis, <i>n</i> (%)			.067
Preemptive	21 (58.3)	21 (38.9)	
Hemodialysis	10 (27.8)	20 (37.0)	
CAPD	5 (13.9)	13 (24.1)	
Dyslipidemia, <i>n</i> (%)	23 (63.9)	37 (68.5)	.820
LDL, mg/dL	85.9 ± 21.7	91.4 ± 29.0	.330
HDL, mg/dL	62.5 ± 14.4	56.3 ± 14.4	.047
Triglyceride, mg/dL	110.6 ± 52.8	127.1 ± 83.2	.296
Lipoprotein A, mg/dL	36.1 ± 32.3	25.8 ± 31.4	.133
hs-CRP, mg/L	1.5 ± 3.4	4.5 ± 19.0	.355
Parathyroid hormone, pg/mL	69.5 ± 32.7	108.1 ± 99.7	.010
CAC score	8.8 ± 37.9	547.2 ± 936.4	<.001
Smoking history, <i>n</i> (%)	10 (27.8)	18 (33.3)	.647
Donor (living:deceased)	32:4	45:9	.389
Main immunosuppression, <i>n</i> (%)			.620
CNI with MMF	26 (72.2)	42 (77.8)	
CNI with mTOR	10 (27.8)	12 (22.2)	
HLA mismatch (A/B/DR)	3.5 ± 1.4	3.2 ± 1.6	.359
PRA-ID class I, %	8.7 ± 24.1	11.1 ± 27.1	.668
PRA-ID class II, %	3.5 ± 10.5	5.0 ± 14.3	.579
Latest sCr, mg/dL	1.05 ± 0.25	1.04 ± 0.26	.931
Rejection, <i>n</i> (%)	4 (11.1)	17 (31.5)	.040
ABO incompatible, <i>n</i> (%)	5 (13.9)	10 (18.5)	.774

Abbreviations: CAD, coronary artery disease; DM, diabetes mellitus; HTN, hypertension; CAPD, continuous ambulatory peritoneal dialysis; LDL, low-density lipoprotein; HDL, high-density lipoprotein; hs-CRP, high-sensitivity C-reactive protein; CAC, coronary artery calcification; MMF, mycophenolate mofetil; mTOR, mammalian target of rapamycin; HLA, human leukocyte antigen; PRA-ID, panel reactive antibody identification; sCr, serum creatinine.

The present study was designed to evaluate the prevalence and severity of CAD with the use of MDCT angiography in asymptomatic KT recipients.

MATERIALS AND METHODS

Subjects and Study Design

We designed this study prospectively for the evaluation of MDCT angiography. From September 2011 to November 2013, a total of 90 adult recipients underwent KT at Severance Hospital (Yonsei University Health System, Seoul, Korea). Patients with age >40 years who had received a 1st living or deceased KT transplant, were asymptomatic and had stabilized post-transplantation renal function for 6–18 months, and had not experienced any cardiovascular event within 1 month before transplantation were included in this study. The study protocol was approved by the Institutional Review Board of Yonsei University Hospital (IRB no 4-2012-0549), and all patients gave written informed consents.

Patients' demographics, pre-transplantation status, intra-operative data, and post-transplantation clinical data were retrospectively reviewed.

Pre-transplantation CAD was defined as a documented medical history of angina or acute myocardial infarction, previous percutaneous transluminal coronary stent placement, or previous bypass surgery. Patients with significant CAD were defined as those with coronary artery segments that exhibited plaque with a luminal

diameter stenosis of ≥50%. Coronary angiography was recommended for those who showed luminal diameter narrowing of >50% of any major coronary arteries.

With the use of the MDCT results, we divided our study population into 2 groups: the no-CAD group (*n* = 36; 40.0%) and the CAD group (*n* = 54; 60.0%). The severity of CAD according to MDCT was also categorized as follows: mild CAD, 1 vessel obstructive, 2 vessels obstructive (or in the proximal left anterior descending), and 3 vessels obstructive (or left main). Significant luminal narrowing was defined as >50% luminal narrowing.

Immunosuppression

We used a calcineurin inhibitor (CNI)-based triple immunosuppressive regimen protocol with steroids, mycophenolate mofetil, and mammalian target of rapamycin inhibitors. The dose of CNI was adjusted according to clinical and laboratory findings and plasma concentrations. Steroid taper was also included in our immunosuppressive regimen for all patients. Two doses of basiliximab were administered to all patients on the day of surgery and on post-transplantation day 4. An anti-metabolite was also prescribed depending on patient condition and side effects after transplantation.

MDCT Protocol

Patients were scanned with the use of a dual-source CT scanner (Somatom Definition Flash; Siemens Healthcare, Forchheim, Germany). Images for coronary calcium scores were taken before

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