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Systematic, Pretransplant Screening by Aortoiliac CT Angiography: Impact on Surgical Decision-making and Clinical Outcomes

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Background. Aortoiliac screening before kidney transplantation is suggested by some guidelines to select patients for transplantation and to assist surgical planning. We investigated the clinical outcomes of systematic screening for aortoiliac disease in potential kidney transplant candidates. **Methods.** In this observational study, 470 potential kidney transplant candidates underwent aortoiliac computed tomography angiography. Patients were characterized by the presence of peripheral artery disease and calcification of iliac arteries and aortoiliac arteries. The risk of graft loss and graft function at 1 y posttransplant were examined and clinical decisions based on the vascular findings were assessed. **Results.** Clinically diagnosed peripheral artery disease was present in 66 patients (14%), circular calcifications in 101 patients (21%), and aortoiliac stenosis in 77 patients (16%). In 326 patients undergoing kidney transplantation, circular calcification or aortoiliac stenosis was not associated with an increased risk of graft loss ($P = 0.45$ and $P = 0.28$) or estimated glomerular filtration rate ($P = 0.23$ and $P = 0.76$) at 1 y posttransplant. When evaluated for transplantability, clinical decision-making based on vascular findings was recorded in 67 of 429 patients (16%), including rejection for transplantation in 7 patients (2%) and laterality for surgical implantation in 52 patients (12%). **Conclusions.** Systematic screening by aortoiliac computed tomography angiography may assist in surgical planning but seems of limited clinical value in assessing the risk of future graft loss and graft function in patients undergoing kidney transplantation.

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Peripheral artery disease (PAD) and vascular calcification are common among patients with chronic kidney disease[1,2] and are associated with an increased risk of cardiovascular morbidity and mortality.[3] In kidney transplant recipients, symptomatic PAD and amputation are associated with an increased risk of mortality and graft loss.[4] Correspondingly, aortoiliac vascular calcification and stenosis are associated with an increased risk of all-cause graft loss[5-8] and all-cause mortality.[5,7-10] Furthermore, vascular calcification and stenoses in the iliac arteries may hinder the implantation of the kidney graft.[11,12] It has been suggested that image-based screening for iliac vascular calcification in selected potential kidney transplant candidates (PKTCs) could assist clinical decision-making.[11] Screening may identify PKTCs where graft implantation is technically impossible due to vascular calcification or guide the choice of side of implantation (laterality) and minimize the need for surgical explorations.[11]

Some guidelines suggest vascular imaging screening only in PKTCs with symptoms of PAD and/or absent ankle pulses.[13,14] The Kidney Disease: Improving Global Outcomes guideline[15] suggests screening all PKTCs with risk factors for PAD using noninvasive ultrasound and all PKTCs with PAD using non–contrast-enhanced computed tomography (CT). These recommendations, however, are based on low level of evidence,[15] and more information on the feasibility and clinical significance of various screening strategies is needed.

Since 2014, we have performed systematic screening for peripheral vascular disease in PKTC using contrast-enhanced aortoiliac CT angiography (CTA)[16] performed concomitantly with coronary CTA for coronary artery disease. The clinical purpose of the screening was to evaluate transplantability and to assist transplant planning.

To assess the potential clinical benefit of such a screening approach, we evaluated the extent of iliac vascular calcifications and stenoses in PKTC with and without known PAD and analyzed their potential relationship with posttransplant outcomes of graft loss and function. Furthermore, we explored the clinical consequences of systematic screening by aortoiliac CTA with respect to pretransplant decision-making of PKTCs.

MATERIALS AND METHODS

Study Design and Setting

This was a single-center, retrospective, observational study performed at the Department of Renal Medicine, Aarhus University Hospital. The department serves as a tertiary referral hospital and the only center providing kidney transplantation service for patients with kidney failure within the Central and North Denmark Regions, with a population of approximately 1.9 million.

All PKTCs older than 40 y and/or with diabetes mellitus and/or receiving dialysis for >5 y were systematically screened independently of symptoms using CTA of both coronary and aortoiliac arteries as part of the work-up before acceptance for kidney transplantation. The CTA was performed using a single bolus of contrast media. The CTAs were performed at 3 different referring hospitals using different CT scanners to obtain the images: Aquillion ONE (Canon Medical Systems GmbH, Neuss, Germany), SOMATOM Force (Siemens Healthcare GmbH, Erlangen, Germany), and SOMATOM Definition Flash (Siemens Healthcare GmbH, Erlangen, Germany). Slice thickness varied from 0.5 to 3 mm.

Study Population

All PKTCs undergoing aortoiliac CTA between March 1, 2014, and September 30, 2019, were included in the study. Three sources were used to identify PKTCs as previously described[17]: Western Denmark Heart Registry[18] based on the simultaneously performed coronary CTA, the Business Intelligence Portal of Central Denmark Region (procedural codes), and the Department of Clinical Immunology, Aarhus University Hospital (record of HLA typing; see **Supplemental Digital Content, SDC,** http://links.lww.com/TXD/A729 for more details). Central Denmark Region Committees on Health Research Ethics approved data collection (3-3013-2724/1).

A subcohort of PKTCs of lower risk of cardiovascular disease was defined as patients younger than 60 y without clinical PAD, prior cardiovascular disease, and diabetes.

Data Collection

Data on patient characteristics, cardiovascular comorbidity, and clinical decisions were collected using patient records, the Western Denmark Heart Registry,[18] and the ScandiaTransplant registry (www.scandiatransplant.org). Clinically diagnosed PAD was defined as the presence of at least 1 of the following: (1) absent ankle pulse (unilateral or bilateral), (2) known claudication, (3) prior or current nonhealing wound (>4 wk duration), (4) prior amputation due to ischemia, or (5) prior surgical or endovascular treatment at the level of the iliac arteries or lower.

Aortoiliac CTA Analyses

The aortoiliac CTAs were retrospectively analyzed semiquantitatively for vascular calcification and aortoiliac stenoses. Vascular calcification was visually detected in both the common and the external iliac arteries using the axial view as a default and, in some cases, supplemented by sagittal and coronal views. Iliac vascular calcification was categorized as (1) no calcification, (2) noncircular calcification, and (3) circular calcification. Circular calcification was defined as at least 1 CT slice in which >50% of the artery wall circumference was calcified.

An experienced vascular surgeon (J.B.L.) analyzed the aortoiliac CTAs for stenoses in the infrarenal aorta, common iliac arteries, and external iliac arteries. Significant stenosis was defined as ≥50% diameter reduction and categorized using Trans-Atlantic Inter-Society Consensus (TASC) II classification.[19]

Graft Outcomes

In patients undergoing kidney transplantation, all-cause graft loss was defined as death with a functioning graft, retransplantation, or need for dialysis for >4 wk (or until death). Death-censored graft loss was defined as retransplantation or the need for dialysis for >4 wk (or until death). Graft function at 1 y posttransplant was evaluated using an estimated glomerular filtration rate (eGFR) calculated using the Chronic Kidney Disease Epidemiology Collaboration 2009 formula without correction for race.[20] Patients were followed until death or the end of follow-up (December 31, 2021).

Clinical Decision-making

Twice monthly, the aortoiliac CTAs were evaluated clinically at multidisciplinary team (MDT) meetings, including a radiologist, a transplant nephrologist, and a transplant surgeon. The possible outcomes of these included (1) acceptance or (2) rejection for transplantation based on vascular calcifications or stenoses, or (3) referral for additional evaluation by a vascular surgeon. An acceptance for transplantation might include a recommendation for the preferred side of implantation (laterality).

Significant Incidental Findings

Significant incidental findings were defined as incidental findings on the aortoiliac CTA leading to additional investigations, interventions, treatment, or referral for additional evaluation.

Statistics

Categorical data are presented as numbers (percentages). Continuous data are presented as means (SDs) if parametric or medians (interquartile ranges) if nonparametric. Time-to-event analyses were performed using Cox regression. Time to all-cause graft loss was censored at the end of the follow-up. Time to death-censored graft loss was censored at death or the end of the follow-up. Graphs show up to 4 y of follow-up after kidney transplantation. The eGFR means were compared using the *t*

test between 2 groups (aortoiliac stenosis) and 1-way ANOVA between 3 groups (iliac calcification). The time from CTA to acceptance for kidney transplantation was compared between PKTCs with and without significant incidental findings using the Wilcoxon Mann-Whitney median test for nonpaired, nonparametric outcomes. Statistical analyses were performed using Stata version 17 (StataCorp, College Station, TX).

RESULTS

Cohort Characteristics

Within the study period, 529 PKTCs were referred for cardiovascular screening (Figure 1). Forty-nine patients underwent a different imaging modality and were thus excluded. Ten CTAs could not be analyzed because of technical issues or artifacts. In total, 470 PKTCs undergoing aortoiliac CTA were included in the present study. The mean age was 54 y, and 65% of patients were men (Table 1). The prevalence of cardiovascular disease was high (Table 1). No differences were identified in patient characteristics between all PKTCs (n = 529) and the PKTCs who were included in the present study (n = 470; **Table S1, SDC,** http://links.lww.com/TXD/A729).

Prevalence of Clinical PAD, Vascular Calcification, and Aortoiliac Stenoses

Clinical PAD was identified in 66 (14%) of all PKTCs at the time of screening (Table 1). Noncircular calcification and circular calcification were identified in 225 (48%) and 101 (21%) of PKTCs, respectively (Table 2). A significant aortoiliac stenosis was identified in 77 (16%) PKTCs (Table 2). The aortoiliac stenoses were classified according to the TASC II classification from A (mild) to D (severe)—A: 47, B: 16, C: 3, and D: 11 (**Table S2, SDC,** http://links.lww.com/TXD/A729). In total, 120 PKTCs (26%) had either circular calcification or aortoiliac stenosis (Figure 2). Of these, only 32 (27%) had clinical PAD.

In a low-risk group of PKTCs (n = 196) younger than 60 y, without clinical PAD, diabetes, and prior cardiovascular disease, only 14 (7%) had circular calcification of the iliac arteries and 9 (5%) had aortoiliac stenosis.

Kidney Transplantation

During follow-up, 413 (88%) PKTCs were approved for kidney transplantation and 326 (79%) patients underwent living (92 [28%]) or deceased (234 [72%]) donor kidney transplantation after a median time of 16 (10–26) mo. The prevalence of aortoiliac stenosis and iliac circular calcification was lower among patients receiving a kidney transplant compared with patients who were not transplanted during follow-up (Table 2). Aortoiliac stenosis was present in 10% of kidney transplant recipients versus 23% of patients remaining on the waiting list. Iliac circular calcification was present in 15% of kidney transplant recipients versus 29% of patients remaining on the waiting list (Table 2).

Kidney Graft Survival and 1-y Graft Function

The median follow-up time after kidney transplantation was 3.3 y (2.1–5.0). After kidney transplantation, 37 patients (11%) experienced all-cause graft loss. Of these, 26 underwent retransplantation or initiated permanent dialysis, and 11 died with a functioning graft. The main causes of death were cancer and cardiovascular disease. Clinical PAD, aortoiliac stenosis, or iliac circular calcification pretransplant were not associated with increased risk of all-cause graft loss ($P = 0.55$; $P = 0.28$; $P = 0.45$, respectively; Table 3; Figure 3). Similarly, no associations were identified with death-censored graft loss (**Table S3, SDC,** http://links.lww.com/TXD/A729). Furthermore, no differences in 1 y eGFR were identified between patients with or without aortoiliac stenosis or iliac calcifications (Figure 4).

Pretransplant Evaluation of Aortoiliac CTA Findings and the Clinical Consequences

In total, 429 aortoiliac CTAs (91%) were assessed at clinical MDT meetings. Decisions were made regarding transplantability, referral to vascular surgeons, or laterality based on the vascular findings (Table 4). After MDT discussions, 8 PKTCs were rejected on the basis of findings on the aortoiliac CTA. Seven patients were rejected because of iliac calcifications or aortoiliac stenosis (Table 4); of these, 6 (86%) had known clinical PAD. The remaining patient was without clinical PAD

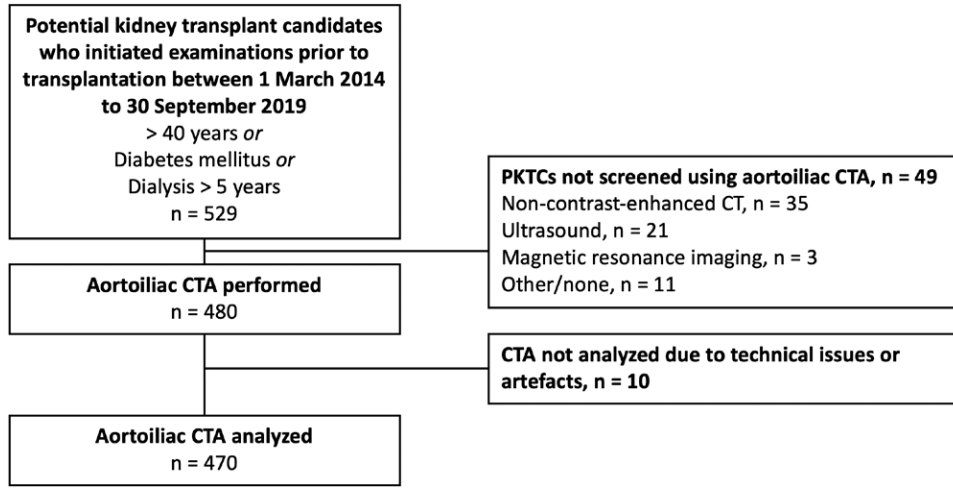

FIGURE 1. Flow diagram showing PKTCs included in the present study. CTA, computed tomography angiography; PKTC, potential kidney transplant candidate.

TABLE 1.

Characteristics of PKTCs

Characteristics	Total (N = 470)	Circular calcification		Aortoiliac stenosis	
		With circular calcification (N = 101)	Without circular calcification (N = 369)	With aortoiliac stenosis (N = 77)	Without aortoiliac stenosis (N = 393)
Sex, male	306 (65%)	70 (69%)	236 (64%)	51 (66%)	255 (65%)
Age, y	54 ± 12	61 ± 9	52 ± 12	59 ± 10	54 ± 12
Clinical PAD	66 (14%)	28 (28%)	38 (10%)	27 (35%)	39 (10%)
Absent ankle pulse[a]	25 (5%)	14 (14%)	11 (3%)	13 (17%)	12 (3%)
Claudication	18 (4%)	14 (14%)	4 (1%)	13 (17%)	5 (1%)
Nonhealing wound	36 (8%)	14 (14%)	22 (6%)	14 (18%)	22 (6%)
Amputation, ischemic cause	12 (3%)	7 (7%)	5 (1%)	6 (8%)	6 (2%)
Prior vascular surgery	7 (1%)	5 (5%)	2 (1%)	3 (4%)	4 (1%)
Cardiovascular comorbidity					
Diabetes mellitus	125 (27%)	41 (41%)	84 (23%)	35 (45%)	90 (23%)
Hypertension	421 (90%)	94 (93%)	327 (89%)	74 (96%)	347 (88%)
Dyslipidemia	214 (46%)	59 (58%)	155 (42%)	47 (61%)	167 (42%)
Prior cardiovascular disease	83 (18%)	35 (35%)	48 (13%)	30 (39%)	53 (13%)
Smoking, active	107 (23%)	36 (36%)	71 (19%)	39 (51%)	68 (17%)
Dialysis treatment					
Hemodialysis	97 (21%)	27 (27%)	70 (19%)	21 (27%)	76 (19%)
Peritoneal dialysis	46 (10%)	13 (13%)	33 (9%)	16 (21%)	30 (8%)
Prior transplantation	87 (19%)	18 (18%)	69 (19%)	14 (18%)	73 (19%)
eGFR,[b] mL/min/1.73 m^2	12 (10–15)	11 (8–15)	12 (10–15)	12 (9–15)	12 (10–15)

Data are presented for the total cohort (N = 470) and PKTCs with/without circular calcification or aortoiliac stenosis, respectively. Values are presented as n (%), mean ± SD, and median (interquartile range).

[a]Missing values, n = 40 (9%).

[b]Only in patients without need for dialysis, n = 327 (missing values: n = 3).

eGFR, estimated glomerular filtration rate; PAD, peripheral artery disease; PKTC, potential kidney transplant candidate.

TABLE 2.

Results of CTA analyses

Results of aortoiliac CTA analyses	Potential kidney transplant candidates (N = 470)	Approved for kidney transplantation	
		Transplantation (N = 326)	Remain on waiting list (N = 87)
Vascular calcification of iliac arteries			
No calcification	144 (31%)	115 (35%)	19 (22%)
Noncircular calcification	225 (48%)	163 (50%)	43 (49%)
Circular calcification	101 (21%)	48 (15%)	25 (29%)
Aortoiliac stenosis			
No stenosis	393 (84%)	294 (90%)	67 (77%)
Stenosis	77 (16%)	32 (10%)	20 (23%)
TASC A	47 (10%)	23 (7%)	12 (14%)
TASC B	16 (3%)	7 (2%)	5 (6%)
TASC C	3 (1%)	1 (0.3%)	0 (0%)
TASC D	11 (2%)	1 (0.3%)	3 (3%)

Prevalence of vascular calcification of iliac arteries and significant aortoiliac stenosis determined by TASC. Data are presented as n (%) for the total cohort and candidates approved for kidney transplantation depending on whether they underwent kidney transplantation during follow-up or remained on the waiting list.

CTA, computed tomography angiography; TASC, Trans-Atlantic Inter-Society Consensus.

but had prior thromboembolic disease. This patient was the only PKTC—among the 196 low-risk patients (younger than 60 y, without clinical PAD, prior cardiovascular disease, and diabetes)—who was rejected for transplantation based on the aortoiliac CTA. One additional patient was rejected for transplantation due to cancer identified by the aortoiliac CTA, whereas 15 PKTCs were rejected for reasons not related to the aortoiliac CTA.

In 47 of 429 PKTCs (11%), recommendations for laterality were based on the identified calcifications or aortoiliac stenosis. Of these, clinical PAD was present in 14 of 47 PKTCs (30%). Eleven PKTCs were referred to a vascular surgeon, but none underwent vascular interventions; 3 of these PKTCs had clinical PAD. In addition, the evaluation of the aortoiliac CTA resulted in recommendations based on nonvascular findings in 125 of 429 PKTCs (29%), for example, in relation to laterality for implantation (n = 84) and nephrectomy/graftectomy (n = 25) to make space for the graft, most often in relation to polycystic kidney disease (Table 4). In total, pretransplant decisions based on the aortoiliac CTA findings were recorded in 178 of 429 PKTCs (41%).

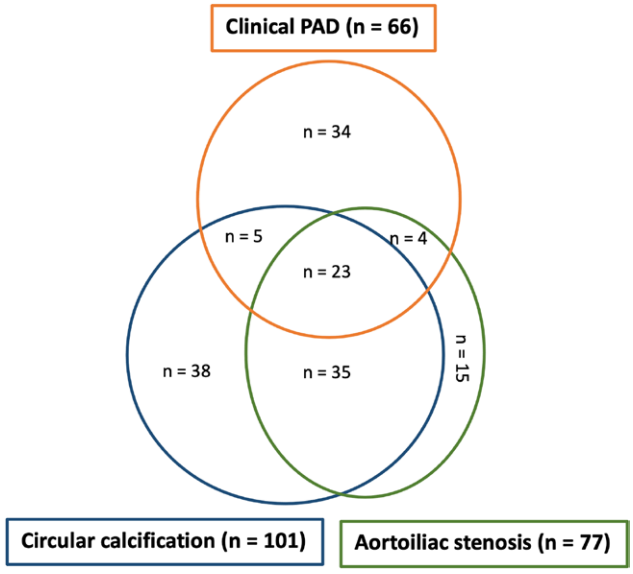

FIGURE 2. Overlap between PKTCs with clinical PAD and/or circular calcification and/or aortoiliac stenoses. PAD, peripheral artery disease; PKTC, potential kidney transplant candidate.

TABLE 3.

Risk of all-cause graft loss

Unadjusted Cox regression		Graft loss	
N = 326	**n**	**HR (95% CI)**	***P***
Peripheral artery disease			
No clinical PAD	37	Reference	Reference
Clinical PAD	289	1.3 (0.5-3.1)	0.55
Iliac calcification			
No calcification	115	Reference	Reference
Noncircular calcification	163	1.4 (0.7-3.0)	0.33
Circular calcification	48	1.5 (0.5-4.0)	0.45
Aortoiliac stenosis			
No calcification/stenosis	294	Reference	Reference
Aortoiliac stenoses	32	1.7 (0.7-4.1)	0.28

Unadjusted risk (HR) of all-cause graft loss (n = 37) in PKTCs undergoing transplantation during follow-up (n = 326).
CI, confidence interval; HR, hazard ratio; PAD, peripheral artery disease; PKTC, potential kidney transplant candidate.

Significant Incidental Findings

Significant incidental findings in 25 PKTCs (5%; Table 5) resulted in the identification of undiagnosed diseases and subsequent medical or surgical treatment in 4 PKTCs, including 2 patients with cancer.

Among the 321 PKTCs approved for deceased donor kidney transplantation, the median time from aortoiliac CTA until approval for waitlisting was longer in PKTCs with significant incidental findings (9.7 mo [5.3–12.2], n = 15) compared with PKTCs without significant incidental findings (4.7 mo [2.6–8.5], n = 306; $P = 0.01$).

DISCUSSION

Clinical PAD, circular calcification, and aortoiliac stenosis were common in PKTCs undergoing systematic screening using aortoiliac CTA. In patients undergoing subsequent transplantation, no clinically important associations were found between clinical PAD, aortoiliac stenosis, or iliac calcification with risk of all-cause graft loss or eGFR at 1 y post-transplant. Only a fraction of the PKTCs were rejected for transplantation or referred to vascular surgeons due to CTA findings, and none of them underwent further intervention before approval for transplantation. The CTAs assisted in decision-making regarding the pre- and perioperative management in 4 of 10 PKTCs. Some of these decisions could probably have been made without an aortoiliac CTA, such as

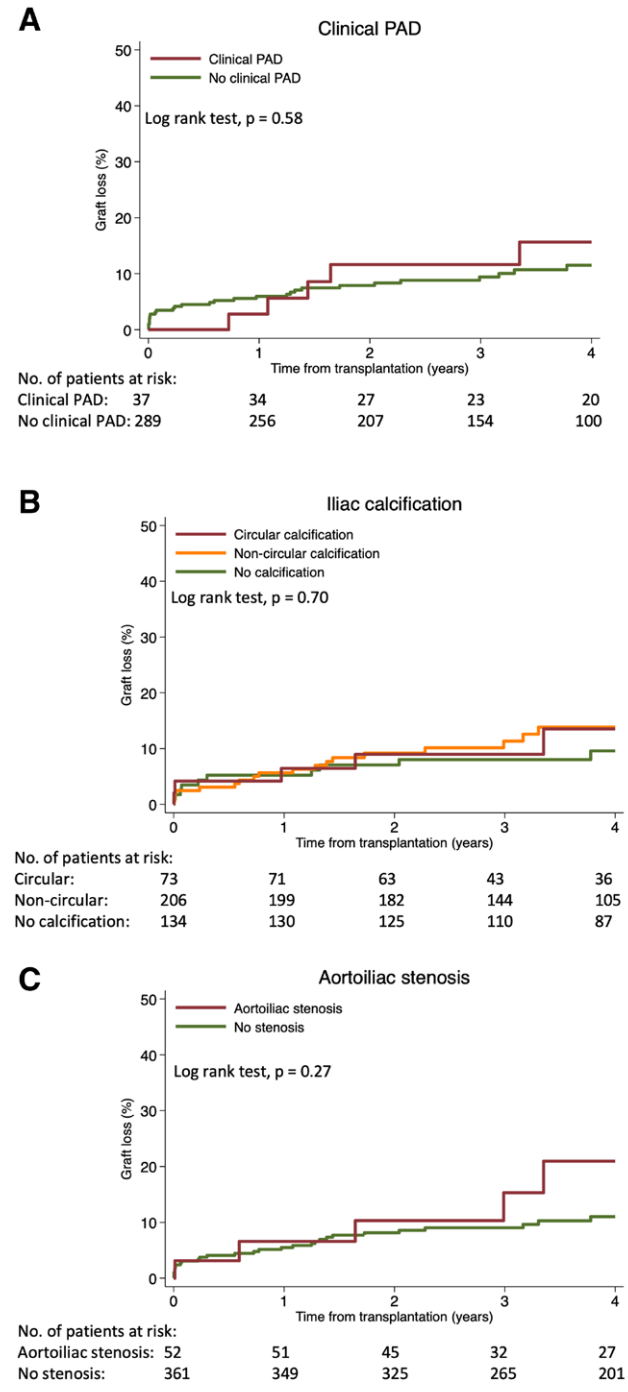

FIGURE 3. Time-to-event analyses for all-cause graft loss stratified by clinical PAD (A), iliac calcification (B), and aortoiliac stenosis (C). Time from transplantation to all-cause graft loss or end of follow-up. PAD, peripheral artery disease.

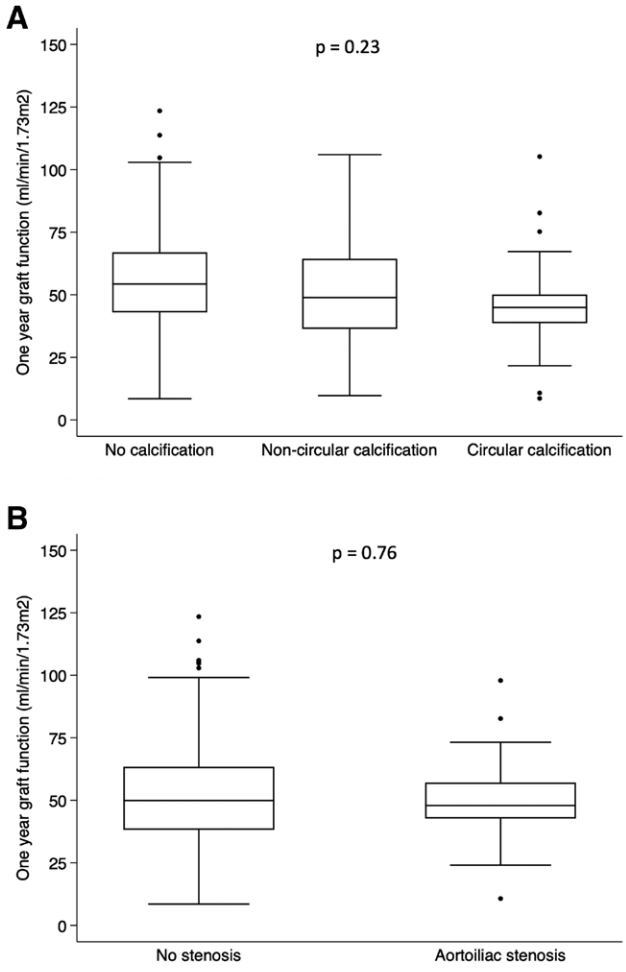

FIGURE 4. One-year graft function (eGFR) (n = 292) stratified by iliac calcification (A) or aortoiliac stenosis (B). eGFR, estimated glomerular filtration rate.

TABLE 4.

Multidisciplinary team decisions

Multidisciplinary team decisions	N = 429
Based on vascular findings	67 (16%)
Rejections based on calcifications/stenosis	7 (2%)
Laterality (left or right fossa)	
Due to calcifications	27 (6%)
Due to stenosis	20 (5%)
Other vascular conditions	5 (1%)
Referral to vascular surgeon	11 (3%)
Other	14 (3%)
Based on nonvascular findings	125 (29%)
Rejections based on other findings	1 (0.2%)
Laterality (left or right fossa)	
Due to prior graft	62 (14%)
Due to polycystic kidney disease	15 (3%)
Other	7 (2%)
Nephrectomy	18 (4%)
Graftectomy	7 (2%)
Other	25 (6%)
Total number of patients with multidisciplinary team decisions	178 (41%)

Clinical decisions from multidisciplinary meetings based on evaluation of the aortoiliac CT angiographies (n = 429). Results are presented as n (%) and divided into decisions made on the basis of vascular and nonvascular findings, respectively.
CT, computed tomography.

TABLE 5.

Significant incidental findings

Significant incidental findings	N = 25	
Type of additional investigation		
Additional imaging	14	
Referred for evaluation at another department	12	
Cystoscopy	<5	
Colo- or duodenoscopy	<5	
Core needle biopsy	<5	
ERCP	<5	
Type of significant incidental finding		Follow-up or treatment
Liver lesion	<5	Cyst. No treatment No tumor
Renal lesion	8	Renal cell carcinoma Cyst Oncocytoma No tumor
Adrenal gland lesion	<5	No tumor
Thickened bladder wall	<5	No tumor
Enlarged bladder/residual urine	<5	Alfa-blockage inhibitor prescribed
Ovarian/uterine lesion	6	Fibroma. Salpingo-oophorectomy Fibroma. No treatment No tumor
Suspicion of venous wall thrombosis	<5	No coagulation disorder
Lung lesions (basal)	<5	No tumor
Dilated common bile duct	<5	No tumor
Thickened wall of sigmoid colon	<5	No tumor

Significant incidental findings defined as unexpected findings leading to additional investigations (eg, CT, MRI, ultrasound examinations), referral for evaluation at another department, telescopic examination, biopsy, or change in treatment.
ERCP, endoscopic retrograde cholangiopancreatography.

laterality due to graft in situ or decisions regarding pretransplant nephrectomy in polycystic kidney disease.

Vascular calcification of the iliac arteries was present in two-thirds of the PKTCs. One previous study similarly identified iliac calcification in 79% of 118 patients who underwent non–contrast-enhanced CT or CTA before waitlisting.[5] The prevalence of aortoiliac stenosis was lower in our cohort compared with a Dutch cohort of kidney transplant recipients (16% versus 24%, respectively) who underwent contrast-enhanced imaging of the aortoiliac vessels.[7,21] This may be explained by a more restrictive application of contrast-enhanced imaging, compared with the systematic, nonselective screening by CTA in our study.

The aortoiliac screening aims to evaluate the transplantability of the PKTC. Only one-third of the PKTCs with either circular calcification or aortoiliac stenosis had clinical findings suggestive of PAD. However, 6 of 7 PKTCs who were rejected for transplantation based on the calcifications or stenosis identified by CTA had clinical PAD. This suggests that CTA screening aiming only to examine transplantability may be limited to patients with clinical PAD.

The systematic screening by the aortoiliac CTA provided information that assisted pre- and perioperative transplant planning. This may have allowed graft implantation on the

optimal side; however, the clinical importance of this remains to be established. A similar rate of decisions on laterality for implantation based on pretransplant non–contrast-enhanced CT or CTA was reported in another study using systematic screening.[11] That study also found that almost 10% of higher-risk patients were not technically transplantable. In our study, very few PKTCs were rejected for transplantation or referred for vascular surgery evaluation. This may, to some extent, reflect local clinical practices.

Different screening modalities are available for PAD.[22] Ankle-brachial index has low sensitivity for PAD in patients with chronic kidney disease[23]; ultrasound and non–contrast CT are suggested by transplantation guidelines.[14,15] Ultrasound identifies the location and severity of stenosis, whereas non–contrast-enhanced CT allows visualization of vascular calcification. CTA may assess both stenoses and calcifications, but the use of iodinated contrast media in PKTCs may carry a risk of contrast-induced acute kidney injury.[24,25] In our study, the aortoiliac CTA was performed without the need for additional contrast media, as the procedure was concomitant with a coronary CTA, which was part of the standard pretransplant evaluation at our center. The true risk and consequences of contrast-induced acute kidney injury in preemptive PKTC remains debated, and studies on kidney transplant candidates have shown only transient decreases in eGFR[16,26] and no increased need for dialysis initiation,[16,27,28] suggesting the risk is low.

The extent of significant incidental nonvascular findings was within the ranges reported in other studies[29,30]; further evaluation of these may cause delayed approval for kidney transplantation.

There were no clinically important associations between pretransplant clinical PAD, aortoiliac stenosis, or iliac calcification and kidney graft loss or 1-y graft function in patients undergoing kidney transplantation. This finding may be related to the low number of aortoiliac stenoses and graft loss events during the follow-up period. A prior study showed that TASC II C and D aortoiliac stenoses were associated with an increased risk of all-cause but not death-censored, graft loss in kidney transplant candidates subjected to contrast-enhanced imaging between 3 y before and 3 mo after transplantation.[7] In that study, 5% of patients had TASC II C and D lesions, whereas these were only identified in 1% of our cohort. Thus, we did not perform any subanalyses of the association between TASC II C and D stenosis and graft loss. A meta-analysis[31] combining 4 studies showed that calcification of the aortoiliac arteries was associated with a greater risk of all-cause graft loss (n = 321)[8,32,33] but not death-censored graft loss (n = 1189).[32,34] Similarly, another retrospective analysis including 547 kidney transplant recipients found that a high aortoiliac calcification score was associated with an increased risk of all-cause graft loss and death with a functioning graft but not with death-censored graft loss or graft function decline.[6] This suggests that the increased risk of all-cause graft loss is related to the risk of all-cause mortality and that there is little or no direct effect of vascular calcification on death-censored graft loss after kidney transplantation.

Due to the systematic screening of a large cohort of PKTCs, this study provides a comprehensive estimate of the prevalence of calcification and aortoiliac stenosis with limited selection bias. However, PKTCs younger than 40 y without diabetes or short-term renal replacement therapy were not included. In addition, missing records of ankle pulse examinations may have misclassified some PKTCs as having no clinical PAD when in fact pulses were absent. Graft function was only assessed using a single point in time (1 y posttransplant). Analyzing changes in eGFR or eGFR slopes may provide a more accurate estimate of the effect of contrast on graft function. Although the observational design of our study allowed us to examine real-world decisions, they may be influenced by local- and region-specific practices, especially given that the study is a single center. More importantly, although our study enabled us to analyze the direct clinical impact of screening using systematic aortoiliac CTA, the lack of control groups prevented us from drawing conclusions about the potential clinical benefits or harms of CTA screening.

In conclusion, circular calcification of iliac arteries and/or aortoiliac stenoses are common, and systematic screening by aortoiliac CTA may guide decisions on laterality in renal transplant planning. However, their value in assessing the risk of future graft loss and graft function in patients undergoing kidney transplantation is probably limited. Future studies should focus on further exploration and validation of clinical markers that allow the identification of patients for whom screening for aortoiliac disease may have an important impact on clinical decision-making and outcomes.

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