What is the relevance of systematic aorto-femoral Doppler ultrasound in the preoperative assessment of patients awaiting first kidney transplantation: a monocentric prospective study

Guillaume Ploussard1,∗, Pierre Mongiat-Artus1,2,∗, Paul Meria1, Edouard Tariel1, François Gaudez1, Eric De Kerviler3, Christophe Legendre4, Marie-Noelle Peraldi5,6, Denis Glotz5 and François Desgrandchamps1

1Department of Urology and Paris 7 University, Saint Louis Hospital, 2CNRS U944 – UMR 7212, 3Department of Radiology and Paris 7 University, Saint-Louis Hospital, 4Department of Nephrology and Paris 5 University, Necker Hospital, 5Department of Nephrology and Paris 7 University, Saint-Louis Hospital and 6INSERM U662, Paris, France

Correspondence and offprint requests to: Pierre Mongiat-Artus; E-mail: pierre.mongiat-artus@sls.aphp.fr

Abstract

Background. The purpose of our study was to study the relevance of a systematic aorto-femoral colour Doppler ultrasound (DUS) in the evaluation of first renal transplant receivers.

Methods. We prospectively studied 100 consecutive first renal transplant (RT) receivers. All patients had a preoperative physical examination with a careful vascular system evaluation including assessment of risk factors and colour DUS of aortic, iliac and femoral arteries. Renal transplantation was planned in the right iliac fossa with end-to-lateral vascular anastomoses. Clinical parameters, DUS results, operative and post-operative parameters at 3 months were compared according to the vascular assessment.

Results. Among the 84 patients presenting with a normal preoperative physical arterial examination, 12 patients (14.3%) had an abnormal DUS, revealing atherosclerotic arteries, but no case of arterial stenosis. Among the 16 patients with abnormal physical arterial examination, 10 patients (62.5%) had abnormal DUS, including 4 cases of iliac stenosis. In 3 of the 16 patients (18.8%), DUS revealed right iliac artery stenosis requiring a modification in the surgical procedure. No additional vascular procedure was reported in the case of normal preoperative vascular examination. No technical problems during arterial anastomosis and no post-transplantation arterial complications were reported. In multivariate analysis, abnormal physical examination was the most significant risk factor of atherosclerotic infiltration in DUS.

Conclusion. The abnormality of arterial physical examination is the best clinical predictor of abnormal DUS in the preoperative assessment of renal transplant receivers. However, the low sensitivity and positive predictive value of the physical examination do not support the conclusion that DUS can be avoided in patients with normal arterial physical examination. Nevertheless, in the case of arterial physical abnormality, ‘for case’ DUS is critical and helps in the surgical strategy in ~20% of cases.

Keywords: atherosclerotic infiltration; cardiovascular risk factors; Doppler ultrasound; recipient; renal transplantation

Introduction

The increasing number of renal transplantation (RT) indications has lead to a larger number of recipients with vascular disease and more advanced ages [1]. Patients with chronic renal insufficiency often exhibit at least some degree of atherosclerosis and arterial wall calcifications due to end-stage renal failure, associated cardiovascular risk factors and/or hyperparathyroidism. The reliable pre-operative vascular assessment of a renal graft recipient is warranted and must be performed prior to patient inclusion of the patient on the waiting list [2]. Initial arterial assessment includes at least vascular physical examination with femoral artery palpation. Nevertheless, colour Doppler ultrasound (DUS) is performed by most of the transplantation teams in order to identify external iliac artery atheroma that could compromise anastomosis viability, which is a key factor for a good functional result of RT [3]. In some patients, external iliac artery atheroma may require an additional surgical vascular procedure during RT, and published series have demonstrated that better results are obtained when pre-operative endarterectomy is planned [4,5,6]. Colour Doppler sonography is also applied after RT to assess the vascular integrity of the allograft. The intrarenal resistance index has been shown to be a strong predictor for renal allograft and patient survival [7]. The allograft intrarenal index was closely correlated with recipient age and vascular stiffness.
of the recipient, which confirms the need for a good assessment of recipient vascular state [8].

The management of a waiting list for RT is expensive because of detailed evaluation of the recipient and regular controls and incites cost reduction [9]. The cost-effectiveness of a DUS screening test for vascular evaluation of RT candidates, compared to physical arterial examination, has not been scrutinized.

In this study, we analysed the diagnostic interest of colour DUS for the vascular assessment of renal transplant candidates according to clinical parameters.

**Subjects and methods**

We conducted a prospective study to evaluate the utility of a systematic aorto-femoral Doppler ultrasound (DUS) in the vascular assessment of primary cadaver renal transplant recipients.

The study was approved by the local ethical committee. Inclusion criteria were indication of a first renal or combined renal and pancreatic transplantation and acceptance to participate. Exclusion criteria were previous renal or combined renal and pancreatic transplantation or living donor transplantation or refusal to participate. We enrolled 100 consecutive candidates for a first kidney or combined kidney and pancreas transplantation.

Each patient received in addition to the usual preoperative evaluation, (i) a complete clinical examination by a senior urologist with special emphasis on the vascular system (palpation and auscultation of carotid, femoral and distal arteries) and thereafter, (ii) a colour DUS of aorta, iliac and femoral arteries by a senior radiologist.

Cardiovascular risk factors were defined as severe arterial hypertension, complicated diabetes, heavy smoking habits (current or past smoking with a number of pack years >2), hypercholesterolaemia (LDL cholesterol >4.14 mmol/L and/or HDL <1.04 mmol/L), hyperuricaemia (cut-off 416 µmol/L), hyperglycaemia (cut-off 1.7 mmol/L) and obesity (body mass index >30). Physical arterial examination was considered abnormal in the case of absent arterial pulse and/or in the case of arterial murmurs during auscultation. The quantification of atherosclerosis degree was made using velocity (low-peak systolic and diastolic flows and high resistance index) and/or morphological (measurements of intima-media thickness, plaque volume index and degree of stenosis) criteria.

In the case of normal arterial physical examination, the renal implantation was planned on the right external iliac artery for RT or on the left iliac artery for combined pancreatic and kidney transplantation, with end-to-side arterial anastomosis. In the case of abnormal arterial physical examination, the left external iliac artery or the primary iliac artery was considered for implantation sites. DUS was unblinded to the urologist only after he made the first decision on the surgical strategy. The final decision was made considering both clinical evaluation and DUS. Pre- and postoperative complications and functional results at 3 months were collected.

Patients were separated into two groups depending on vascular clinical examination: group 1 with ‘abnormal vascular physical examination’ and group 2 with ‘normal vascular physical examination’. The two groups were initially compared according to cardiovascular risk factors, age and time on dialysis. They were then compared according to the change between initial and final decision on surgical strategy. Finally, they were compared according to surgical complications and functional results of the transplantation. Statistical analysis was performed using a chi-square test or Fisher’s exact test for qualitative data. Continuous variables were studied with Student’s t-test or a Mann–Whitney test in the case of a normal distribution. Binomial logistic regression was used to perform the multivariate analysis in order to determine the most relevant risk factors of abnormal DUS. Statistical difference was defined as $P < 0.05$, using the SPSS 13.0 (Chicago, IL, USA) software.

**Results**

No patient refused participation in the study. From January 2002 to June 2008, we included 100 consecutive primary cadaver renal transplant recipients. The patients were 62 males and 38 females with a median age of 43.1 years (range: 19–66 years; SD 11.48; 31% >50 years). The most current causes of chronic renal insufficiency (Table 1) were high blood pressure (20%), IgA nephropathy (15%), polycystic kidney disease (13%) and diabetic nephropathy (13%). Ninety patients were waiting for RT and 10 for a combined renal and pancreatic transplantation. The mean time on haemodialysis was 4.2 years (range: 1–16).

Group 1 comprised 16 patients with abnormal arterial physical examination: the absence of distal pulse in 7 cases (43.8%), the absence of femoral pulse in 2 cases (12.5%), femoral arterial murmur in 5 cases (31.3%) and carotid artery murmur in 2 cases (12.5%). Group 2 comprised 84 patients with normal arterial physical examination. Abnormal DUS was reported in 10 patients (62.5%) in Group 1 and in 12 patients (14.3%) in Group 2 (Table 2). The difference between both groups was statistically significant ($P < 0.005$).

When analysing the factors associated with abnormal DUS in a univariate analysis (Table 3), abnormal physical examination was significantly associated with atherosclerotic infiltration in DUS (OR 10; 95% CI: 3.1–32.6). Age was also significantly associated with abnormal DUS (OR 4.1; 95% CI: 1.5–11.1). On the other hand, diabetes did not differ in the two groups ($P = 0.08$). The positive predictive value of HTA and diabetes for abnormal DUS was 24.2 and 42.9, respectively. Sensitivity and specificity of abnormal arterial examination were 41.6 and 94.7. Positive and negative predictive values of abnormal examination for abnormal DUS were 62.5 and 85.7, respectively. In the multivariate analysis, abnormal physical examination ($P = 0.001$) and age ($P = 0.009$) remain significant as the two independent predictive factors of abnormal DUS. DUS was abnormal in 22 cases revealing atherosclerotic infiltration in 18 cases (81.8%) and stenosis in 4 cases (18.2%) (Table 4). Arterial stenosis was found only in patients with abnormal physical examination (100%, $P = 0.03$) and accounted for 25% of abnormalities of DUS.

In the sub-group of patients >50 years, abnormal physical examination was the only significant predictor of abnormal DUS in univariate ($P = 0.007$; OR: 18.0) and multivariate ($P = 0.008$; HR: 36.8) analyses. None of the other parameters were significant predictors of abnormal DUS.

In Group 1, the surgical strategy was modified in three patients as a result of DUS (arterial stenosis). The renal graft was implanted in another site in two patients.
(transplantation in the left iliac fossa for one patient and othotopic real transplantation for the other patient). An endarterectomy was planned and performed for the third patient (with an end-to-side anastomosis on the right common iliac artery). However, one patient had an abnormal arterial examination and a stenosis on DUS, but the anastomosis was conducted on the external iliac artery without any difficulty.

In Group 2, the surgical strategy was modified in one patient as a result of DUS despite a normal arterial examination. The patient was diagnosed with a right iliac fossa haematoma following arterial puncture. He received the renal transplant in the left iliac fossa. In this group, no additional surgical vascular procedure was required during transplantation.

There was a significant difference between the Groups 1 and 2 concerning the rate of change in surgical strategy (18.8% versus 1.2%, \( P = 0.01 \); see Table 2).

No unsuspected technical problem has been reported during arterial anastomosis. No immediate post-transplantation arterial complication has been reported. With 3 months of follow-up, mean post-operative serum creatine was 1.89 mg/dl (range: 0.76–4.84 mg/dl). In the case of stenosis or atherosclerotic arteries in DUS, post-operative serum creatine was not different in the case of normal or abnormal DUS (respectively, 1.70 and 1.62 mg/dl, \( P = 0.76 \)).

**Discussion**

During the last 15 years, the number of renal transplants performed in older patients has dramatically increased. Cardiovascular disease is more prevalent in older renal transplant recipients. Atherosclerotic disease represents a technical challenge for RT. All candidates for RT undergo preoperative vascular assessment to determine the presence of atherosclerosis of the iliac arteries. Such diagnosis could contraindicate the transplantation or requires pretransplantation vascular surgery or a medical preparation. Physical examination is the first step of the assessment. Some centres routinely perform DUS of the aortoiliac arteries to ascertain the integrity of the arterial anastomosis site. Colour DUS makes it possible to distinguish moderate atherosclerotic infiltration from severe, which could compromise anastomosis viability and graft survival. Burgos et al. reported 3% of candidates excluded from RT because of severe vascular disease diagnosed with DUS [3]. Another advantage of a complete preoperative vascular assessment is that additional surgical vascular procedure or modification of the implantation site can be planned before transplantation and that better results are expected [3]. However, the cost-effectiveness of a screening test by DUS has not yet been evaluated. Systematic vascular assessment by abdominal aortic angiography revealed < 2% of candidates who were found to have aortoiliac disease severe enough to require
surgical reconstruction [10]. So routine aortoiliac angiography is not warranted [1]. The aim of our present study was to determine the diagnostic yield of colour DUS regarding the physical vascular examination.

In our study, abnormal arterial physical examination was the most significant predictive factor of abnormal DUS ($P = 0.001$; OR 10.4). In our patients, severe atherosclerosis infiltration with arterial stenosis represented 40% of abnormalities in DUS. Age was also a significant risk factor of abnormal DUS in multivariate analysis ($P = 0.009$; OR 6.9). We chose a cutoff of 50 years that was often reported in the literature. Abnormal DUS was more often reported in diabetic patients, but the difference did not reach significance ($P = 0.07$). Other cardiovascular risk factors were not relevant to anticipate abnormal DUS. Both advanced age and diabetes were major risk factors abnormal DUS at initial assessment. For these patients, vascular evaluation by the means of a combination of physical examination and DUS was probably not sufficient. Additional radiological techniques with helical computed tomography angiography could be useful to depict more accurately the extent of arterial disease. Indeed, even in the absence of stenosis, vascular calcifications in the iliac area are frequent in the elderly diabetic population. The location or the extent of arterial wall calcifications can compromise the anastomosis of the renal transplant. The most efficient procedure to assess importance and distribution of atherosclerotic lesions in the elderly population is computed tomography with reconstruction [11]. According to Andres et al. 29% of candidates have been excluded from the waiting list due to universal calcifications [11]. The site of the arterial anastomosis can be selected according to computed tomography results in the case of partial arterial calcifications. In the case of abnormal DUS revealing severe vascular disease, an additional procedure by helical computed tomography is also critical. Burgos et al. noted that some patients were excluded from the waiting list due to an abnormal DUS result. However, they also noted that some have been reintegrated onto the waiting list after helical computed tomography allowed for modification of the surgical strategy (modification of the implantation site) [3].

In our series, severe atherosclerosis was reported only in patients with abnormal vascular physical assessment and was responsible for a change in surgical strategy in 18.8% of the cases. The main interest of our study is that no additional surgical vascular procedure was performed for any patient with normal arterial physical examination. The short-term efficiency of this strategy was controlled by postoperative serum creatine level and absence of immediate complications. After dispatching patients in groups depending on colour DUS results and clinical evaluation, no difference was found between groups concerning the complication rate of surgery and the serum creatine levels of patients. However, long-term follow-up results may change this result, but with a low probability.

According to our results, in patients without a specific risk factor, preoperative DUS might be optional when arterial physical examination is normal. However, in order to discuss the limitations of our study, we would like to emphasize the relatively small cohort of patients and the low sensitivity (41.6) of only the criterion ‘abnormal physiological examination’ for an abnormal DUS. For patients with abnormal arterial physical examination, helical computed tomography angiography is critical in the context of complete pretransplantation evaluation [2]. It is of note that atherosclerotic lesions may also progress asymptomatically after the initial assessment when the patient is on the waiting list for a long time. Waiting time on the list is a recognized risk factor for postoperative complications, poor graft survival and death during the first year following transplantation [12]. The timing of systematic vascular reassessment should be determined in each patient according to age and cardiovascular risk factors. As recommended, the medical status of patients on the cadaveric transplantation waiting list should be reviewed at least every 2 years. Advancing age and diabetes increase the need to periodically re-evaluate patients on the waiting list at least annually [2,13]. However, the clinical examination of the patients will remain mandatory if not the only useful evaluation. It remains to study the cost-efficiency of such care.

**Conclusion**

The abnormality of arterial physical examination is the best clinical predictor of abnormal aorto-femoral DUS in preoperative assessment of renal transplant receivers. Particularly, in patients >50 years, an abnormal physical examination is the only significant predictor of abnormal DUS in univariate and multivariate analyses. However, the low sensitivity and the positive predictive value of the physical examination limit strong conclusions and do not support the statement that DUS can be avoided in patients with normal arterial physical examination. In the case of arterial physical abnormality, vascular assessment with aorto-femoral Doppler ultrasound is mandatory and helps to modify the surgical procedure in ~20% of the cases.

Conflict of interest statement. None declared.

**References**


Nail changes in kidney transplant recipients

Abeer M. Abdelaziz¹, Khaled M. Mahmoud², Essam M. Elsawy² and Mohamed A. Bakr²

¹Department of Dermatology and ²Urology and Nephrology Center, Mansoura University, Mansoura, Egypt

Correspondence and offprint requests to: Khaled Mahmoud; E-mail: khaledmahmoud2000@hotmail.com

Abstract

Background. Nail changes are common complications of end-stage renal disease, and reports of nail changes in kidney transplant recipients (KTR) are rare. Few reports have documented a higher prevalence of onychomycosis in KTR compared with controls, while others found no significant differences. In this study, we investigated the prevalence and nature of nail changes in a large series of KTR.

Methods. Three hundred and two KTR (216 males and 86 females) were included in this study, and the mean transplant duration was 6.57 years (range 1.5 month–23 years). They were screened for the presence of nail changes. Nail clippings were collected when indicated and cultures were performed for patients with suspected onychomycosis. The patients were compared with 302 age- and sex-matched healthy controls (220 males and 82 females).

Results. One hundred and twenty-one KTR (40.1%) had nail changes compared with 104 (34.4%) in controls. Onychomycosis, Muehrcke’s nail and leuconychia were significantly more common in KTR [23 (7.6%), 13.3 (4.3%), 11 (3.6%), respectively] compared with controls [7 (2.3%), 1(0.3%), 2 (0.66%), P = 0.002, 0.001 and 0.02, respectively]. However, the most frequent nail change among KTR and controls was absent lunula, 90 (29.8%) and 80 (26.5%), respectively P = 0.36. Longitudinal ridging was also a frequent nail pathology among KTR and controls, 21 (6.9%) and 19 (6.3%), respectively, P = 0.74.

Conclusion. KTR have higher prevalence rates of onychomycosis, Muehrcke’s nail and leuconychia than the healthy population. On the other hand, absent lunula could be a normal variation among Egyptian people.

Keywords: kidney; nail; transplantation

Introduction

A significantly higher incidence of nail changes was reported in end-stage renal disease (ESRD) patients [1,2] and in those on haemodialysis [2,3]. Several nail changes have been described which may occur in up to 60.3% of patients with ESRD and in up to 62.3–69.8% of haemodialysis patients [2,4].

Whether similar nail changes could be present after kidney transplantation, there is only one published case-control study of 205 patients that showed that 56.6% of kidney transplant recipients (KTR) had at least one type of nail pathology [4]. On the other hand, there are a few reports on nail changes in patients receiving immunosuppressive drugs for indications other than kidney transplantation [5,6].

The aim of this study was to determine the prevalence and the nature of nail lesions in a large series of KTR.

Subjects and methods

This study was conducted on two groups of patients, group I which included 302 kidney transplant patients (216 males and 86 females) and group II which included 302 healthy individuals who served as a control (220 males and 82 females).

Group I received kidneys from living-related donors in the Urology and Nephrology Center, Mansoura University, Egypt. They were followed up and examined in the out-patient clinic during the period from July 2004 to July 2006. Their ages ranged from 11 to 64 years (mean 35.9 ± 11.3). They were receiving immunosuppressive protocols in different combinations of steroid, azathioprine, mycophenolate mofetil, cyclosporine and tacrolimus. The time since transplantation ranged from 1.5 months to 23 years (mean 5.2 years).

Group II was randomly selected from healthy hospital staffs and from healthy companions of ill patients. Controls were matched with cases by sex and age. Their ages ranged from 14 to 66 years (mean 33.9 ± 11.2).