

Impact of Vascular Variations on Living Donor Kidney Transplantation

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How to cite this paper: Coulibaly, N., Yao, E.K., Diomandé, V., Adebayo, T.B., Tuo, L.S.M. and Yéo, D.D. (2024) Impact of Vascular Variations on Living Donor Kidney Transplantation. *Open Journal of Organ Transplant Surgery*, 12, 1-6.
<https://doi.org/10.4236/ojots.2024.121001>

Received: April 20, 2024

Accepted: June 25, 2024

Published: June 28, 2024

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Abstract

Background: Kidney transplantation is the best treatment for end-stage chronic kidney disease. However, its realization is confronted by several difficulties among which are anatomical variations. **Objective:** The objective of our work was to describe the impact of renal pedicle variations on the operative procedure as well as the complications. **Method:** We conducted a retrospective study on living kidney donors and their recipients in the period from 2012 to 2017. Several variables were studied, in particular socio-demographic, operative and progression. **Results:** We identified 49 living donors whose mean age was 37.59 years with a male-to-female ratio of 3.9 and 45 ± 10.75 years in the recipients. The prevalence of renal vascular abnormalities was higher with a proportion of 46.94% in recipients. The left kidney was most frequently removed (75.51%) and then kept mainly in HTK (95.92%). These vascular anomalies were associated with a longer operating time but this difference was not statistically significant ($p = 0.5804$). They had no effect on hot and cold ischemia times ($p = 0.9838$, $p = 0.8389$). Complications were observed in 11 patients, all recipients, *i.e.* 11.22%, and were not related to the presence of vascular abnormalities ($p = 0.086$). We observed that 4.08% of deaths were all recipients. **Conclusion:** It seems that kidney transplantation with multiple renal arteries and/or veins does not significantly lengthen the operating time and does not promote the onset of complications.

Keywords

Vascular Abnormality, Renal Transplantation, Renal Pedicle

1. Introduction

Chronic kidney failure is a public health issue worldwide, particularly in our

country. Kidney transplantation is the best cure. It allows reduction of the health costs as well as morbidity and mortality. It also improves quality of life and social reinsertion better than dialysis which was the only solution until recently [1]. Living donation is better than deceased donation as it gives an excellent quality of the renal graft. This procedure relies on many guidelines specifying donor-recipient selection. The harvesting of kidneys with multiple arteries or veins is a matter of discussion [2]. Some authors refute it because of the technical complexity of this harvesting, of the vascular reconstruction and the anastomosis. It could have a negative impact on the operation time and the occurrence of complications during kidney transplantation. The aim of this paper was to analyse the effects of variations of kidney pedicles on the surgical results of kidney transplantation. Specific objectives were to describe the variation of the renal pedicle and to point out the link between renal pedicle variation, operation time, and occurrence of complications.

2. Method

It was a retrospective analytic study conducted at the Cardiology Institute of Abidjan (Institut de Cardiologie d'Abidjan) from September 2012 to February 2017. Permission was obtained from the institution authorities and the manager of the kidney transplantation program. All the files of patients included in the program of living donor kidney transplantation stored in this institution were selected. The files with missing information regarding vascular anomalies, occurrence of complications and patients living out of the country were excluded. Finally, 49 couples (donor-recipient) were selected. Data were anonymously collected using a standardized questionnaire including socio-demographic and operating data. The first part of the statistical analysis was descriptive. It presented the distribution of each variable using numbers and percentages. The second part of the analysis was the analytic study. We used vascular anomaly as a criterium to create two groups: group 1 existence of vascular anomaly and group 2 absence of vascular anomaly. We computed the correlation of ischemia delay, operating time, occurrence of complication and death. Statistical tests were Pearson Chi² test (when the conditions were not suitable the Fisher exact test was applied) and the Mann-Whitney test. The significant level alpha was 5%. We used STATA software 14.2 version for statistical analysis.

There was no funding for this study.

3. Results

Donors were young with a mean age of 37.59 years (range 21 to 58 years). (Figure 1)

Male patients represented 79.69% of donors (male-to-female sex ratio was 3.9). In 75.51% of cases, the left kidney was removed. It was transplanted in the left iliac fossa in the recipient.

A vascular anomaly was observed in 46.94% of donors. The number of arteries

and veins on the renal grafts was variable (**Table 1**). We observed 1 to 3 arteries or veins in the donors (**Figure 2**).

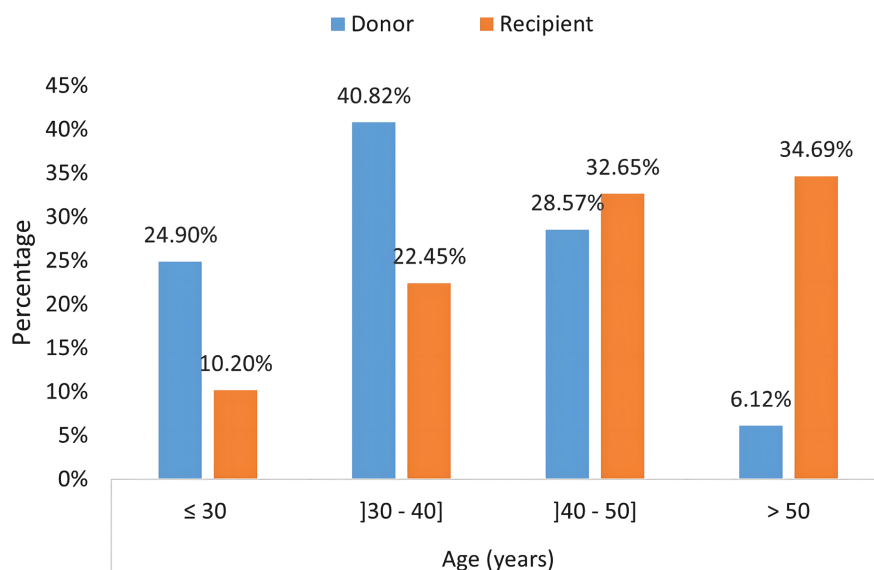


Figure 1. Distribution of patients' ages according to their status.

Table 1. Distribution of vessel number in the donor.

Variables	Number	Effective	%
Artery	1	31	63.7
	2	16	32.65
	3	2	4.08
Vein	1	39	79.59
	2	9	18.37
	3	1	2.04

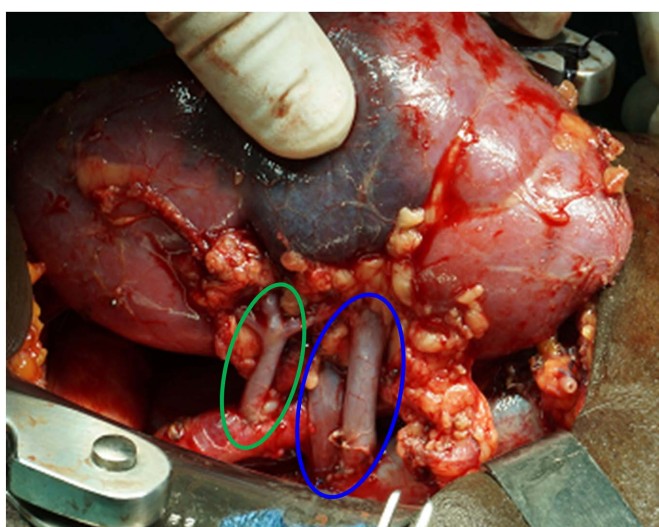


Figure 2. Transplantation of a left kidney in the left iliac fossa with a pedicle containing one artery (green) and two veins (blue) (Image Coulibaly Noël).

A complication was noted in 11.22% of patients. Operating time was 180 min in 55.10% of recipients. This delay was above 240 min in 51.02% of donors (**Table 2**).

Table 2. Distribution of operation time according to the status.

		Status		Total
		Donor	Recipient	
Operating time	≤180 min	-	27 (55.10%)	27 (27.55%)
	180 to 240 min	24 (48.98%)	22 (44.90%)	46 (46.94%)
	>240 min	25 (51.02%)	-	25 (25.51%)
Total		49 (100%)	49 (100%)	98 (100%)

Vascular anomalies were associated with a longer operation time. This difference was not statistically significant ($p = 0.5804$).

There was no link between ischemia time and vascular anomalies (**Table 3**).

Table 3. Distribution of ischemia time according to vascular anomaly.

	Vascular anomalies		P
	No	Yes	
Cold ischemia	182 min (0 - 235)	199 min (0 - 240)	0.8389
Hot ischemia	44 min (39 - 50)	44 min (38 - 48)	0.9838
Total	216 min (0 - 279)	233 min (0 - 281)	0.7666

There was no link between complications and vascular anomalies (**Table 4**).

Table 4. Occurrence of complications.

		Vascular anomalies		P
		No	Yes	
Complications	No	26 (53.06)	23 (46.94)	0.086
	Yes	8 (72.73)	3(27.27)	

4. Discussion

Chronic kidney failure is frequent in sub-Saharan Africa. Dialysis which is a stand-by process is most of the time the only management available. The advent of kidney transplantation in an underequipped environment provokes and hope for patients with chronic kidney failure. If we had to follow the guidelines, donors with renal vessel anomalies should be excluded from our program. This would lead to a lack of donors. Moreover, there is a lack of studies about arterial and venous vascularisation of black people in the context of kidney transplantation. Our series of 49 patients (**Figure 1**) of both sexes gave us the opportunity to observe the number of arteries, their origins, and their hilar or polar destiny

allowing an arterial systematisation of the kidney. The renal artery was unique in most of the cases (63.3%) (**Table 1** and **Figure 2**). Tardo [3] in 93.1%, Salih [4] in 68% and Abuelnour [5] in 81.05% observed also a unique renal artery. Anatomic variation of number and direction are important in renal surgery. Injuries to these terminal vessels may lead to important bleeding, partial ischemia of the kidney, a renovascular high blood pressure [6] [7] and be a source of complications in kidney transplantation surgery [8]. Regarding venous anomalies of the renal pedicle, our results found a prevalence of multiple renal veins in 20.41% of donors. Literacy mentions a prevalence of venous anomalies between 14% and 32% in the general population. Vein anomalies are most frequently located on the right side [9].

Finally, vascular anomalies were quite frequent in our population. It accounted for 46.94% of donors. In front of these anomalies, the complexity of organ removal, vascular reconstruction and anastomosis, some authors reject the transplantation. For them, these anomalies extend the operation length and promote the occurrence of complications. We found no statistically significant difference in operating time, ischemia time, occurrence of complications and existence of vascular anomalies or not (**Tables 2-4**).

Nowadays, it is well established that ischemia time participates in the prognosis of kidney transplantation. So, whoever is the donor, this ischemia time should be as short as possible. The risk of differed function and non-function of the graft are linked to this parameter [10]. Furthermore, long cold ischemia increases the risk of transplant rejection [11].

The systematic review made by Ahmadi [12] regarding the recommendations about eligibility criteria for living kidney donation, observed that vascular anomalies should no longer be a contraindication for donation even if the operation time is longer ($p = 0.005$) [13].

We were confronted with limitations due to the retrospective design of our study. The review of radiology reports and operative protocols without mention of all the anatomic variations could have led to some errors.

5. Conclusion

The prevalence of anatomic anomalies of the renal pedicle is high in a sample of the black African kidney donor population (46.94%). Nevertheless, there was no lengthening of operating time and no influence on complications occurrence. Kidneys with multiple arteries and/or veins can be transplanted with security with a good graft survival rate. Regarding the increasing rate of patients on waiting lists, it is possible to enlarge the selection criteria for donor candidates to realise more living donor kidney transplantations in the best conditions.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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