

## MULTIPLE VERSUS SINGLE RENAL ARTERIES IMPACT ON GRAFT FUNCTION IN RENAL TRANSPLANTATION

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### ABSTRACT

**Background:** The incidence of end-stage renal disease is increasing worldwide. Kidney transplantation is the most effective single procedure for such patients. The presence of multiple renal arteries is grouped among one of the anatomical difficulties that are faced during renal transplantation.

**Patients and methods:** Patients who underwent renal transplantation over a period of 4 years were included in this study. The aim of this study was to analyze the incidence of complications among recipients of renal transplantation with a single renal artery and multiple arteries. The anatomy of the renal vasculature was determined by magnetic resonance arteriography.

**Results:** The study included 199 patients, 158 with multiple renal arteries, and 41 patients with single renal artery. There was no significant difference in donor age and the cause of renal failure between both groups (P values were 0.841 and 0.343), respectively. Idiopathic renal failure and diabetes mellitus were among the commonest caused of renal failure. There was a significant difference in the cold ischemia time between both study groups ( $P = <0.001$ ), being higher in renal transplant recipients of kidneys with multiple renal arteries. In contrast, the hot ischemia time showed no significant difference. There was a very significant correlation regarding the development of complications between both groups ( $P = 0.001$ ). Urinary and vascular complications were commoner in patients with multiple renal arteries. The rate of vascular complications was higher in renal transplant recipients of kidneys with multiple renal arteries with no statistical significance between both study groups ( $P = 0.197$ ), while the urinary showed a very high significant correlation ( $P = 0.001$ ). Lymphatic leakage was more prevalent in those with a single renal artery ( $P = 0.001$ ). There was no difference regarding the graft rejection between both study groups. Two patients died, one from myocardial infarction and acute liver failure.

**Conclusion:** Renal transplantation for multiple renal arteries is safe and had no negative impact on the graft outcome with higher vascular complication rates.

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**Keywords:** Graft function, Multiple renal arteries, Renal transplantation, Single renal artery.

The incidence of end-stage renal disease is increasing worldwide; this is because of the increased incidence of hypertension, diabetes mellitus, obesity-related complications, and other risk factors, which are the main causes of renal failure<sup>1</sup>. Kidney transplantation is the most effective single procedure for patients with

end-stage renal disease. The procedure may be associated with many difficulties at each step of the transplantation, such as when there are anatomical anomalies of the ureter or the vessels in the pediatric age groups and patients with horseshoe kidneys<sup>2-4</sup>.

The contraindication for transplantation may include increased age, metastatic

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malignancy, persistence or recurrence of infections that are not adequately treated, major cardiac and vascular diseases, and major psychiatric illness<sup>1</sup>.

Most individuals have a single renal artery; however, multiple renal arteries may be seen unilaterally in 25% of the individuals and bilaterally in 10% of them; this variation is considered normal, but the main concern is that when encountered in the setting of kidney transplantation, this may increase the operative time and may increase the cold ischemia time until the reconstruction takes place before the transplant<sup>2-5</sup>.

The presence of multiple renal arteries is grouped among one of the anatomical difficulties that are faced during renal transplantation<sup>2</sup>.

Transplantation for kidneys with multiple arteries is considered the point that may be associated with increased complications during and after the surgery; this may be urologic or vascular complications; these variations are still regarded as challenging points for transplant surgeons all over the world<sup>6-8</sup>.

Increased ischemia time, a higher rate of acute tubular necrosis, impaired transplant function, and possibly acute rejection are considered among the drawbacks in patients having multiple renal arteries. However, the exact impact of multiple renal arteries on the graft outcome is still not well established<sup>6,9,10</sup>.

Worldwide there is an increasing shortage of donors, which led to extending the donor criteria and establishing live donor programs<sup>6,11,10</sup>.

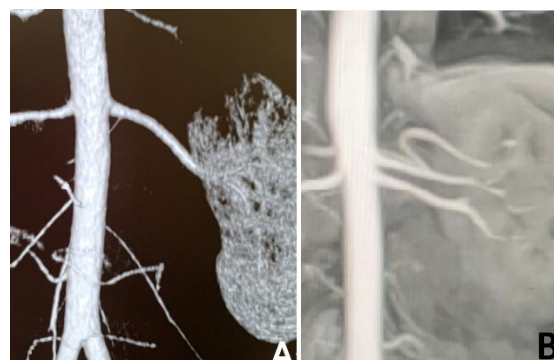
This study aims to analyze the impact of donors with multiple renal arteries regarding the complication rates and the

graft outcome compared to those with a single renal artery.

### **PATIENTS AND METHODS:**

Patients who underwent renal transplantation from the period between March 2015 and May 2019 were consecutively included in this study; 199 patients were included in the study. The patients were recruited from a single center in Duhok-Iraq. Patients who refused to be enrolled in the study or patients who were lost from follow-up were excluded from this study.

Donors were sent for magnetic resonance arteriography (MRA) to evaluate the anatomy of the renal vasculature and whether the arteries are single or multiple. (figure 1).

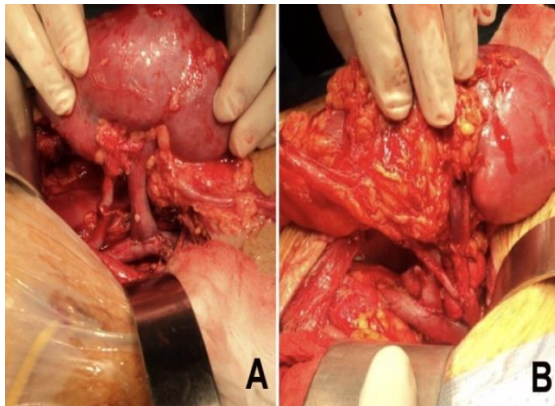


**Figure 1: MRA picture showing the renal arteries' anatomy, A: single renal artery, B: multiple renal arteries.**

### **Surgical procedure:**

The arterial anastomosis for the transplanted kidney was done using the end-to-end technique between the renal and the internal iliac arteries in case of the single renal artery, in patients with multiple renal arteries they, were joined together on the bench to form a common artery and was then anastomosed to an iliac artery or joined separately to the external iliac artery by

end-side and the internal iliac artery by end-end anastomosis. The venous anastomosis was done between the renal vein and the external iliac vein using an end-to-side anastomosis technique, figure 2.



**Figure 2: An intraoperative picture showing the transplanted kidney after performing the vascular anastomosis; A: patient with single renal artery. B: patient with multiple renal arteries.**

The ureters' anastomosis was done using the anterior Lich technique (ureteric suturing to the mucosal layer of the urinary bladder and the detrusor muscle is closed over the re-implanted ureter to work as an anti-reflux mechanism), and the ureteric stent was placed, which was usually removed after two weeks.

#### **Statistical analysis:**

The study's descriptive purposes were displayed in frequency and percentage for

categorical and mean and standard deviation for continuous characteristics of the patients. Correlations were expressed using the *P*-value, which was considered significant if less than 0.05.

The statistical calculations were done in Statistical Package for Social Sciences (SPSS 25:00 IBM: USA).

Ethical committee approval from the Duhok Directorate of General Health, Scientific Research Division. Email: scientific.research@duhokhealth.org, at 29 January 2019, Research registration number: 29012019.

#### **RESULTS:**

The study showed that renal transplant recipients of kidneys with multiple renal arteries were older (43.54 vs. 38.65 years;  $P=0.019$ ), while they had shorter timing of renal transplantation (21.49 vs. 27.30 months;  $P=0.016$ ), respectively with no significant difference in donor age between both group ( $P=0.841$ ). The mean age for donors showed no significant difference in either group ( $P=0.871$ ). The cause of renal failure and whether the patients had undergone dialysis or not also showed no significant difference between both study groups ( $P=0.343$  and  $0.118$ ), respectively, in table 1.

**Table 1: Comparison of pre-transplantation characteristics between renal transplant recipients of kidneys with single and multiple renal arteries**

Patients' characteristics	Single Renal Artery (n=158)	Multiple Renal Arteries (n=41)	P-Value
	Mean (S.D.)	Mean (S.D.)	
<b>Age</b>	38.65 (12.44)	43.54 (11.44)	0.019*
<b>Range: 18-68</b>	18-68	18-64	
<b>Timing of renal transplantation</b>	27.30 (16.37)	21.49 (12.52)	0.016*
<b>Range: 5-61 months</b>	5-61	6-43	
<b>Donor Age</b>	28.63 (6.12)	28.80 (6.30)	0.871*
	F (%)	F (%)	
<b>Gender</b>			
Male	107 (67.7)	28 (68.29)	0.979**
Female	51 (32.3)	13 (31.71)	
<b>Causes of renal failure</b>			
Idiopathic	66 (41.7)	11 (26.90)	0.343**
Diabetes mellitus	28 (17.7)	9 (22.0)	
Hypertension	18 (11.4)	6 (14.6)	
Chronic interstitial nephritis	13 (8.2)	2 (4.9)	
Glomerulonephritis	12 (7.6)	4 (9.8)	
Adult polycystic kidney disease	5 (3.2)	3 (7.3)	
Hypertension + diabetes mellitus	3 (1.9)	1 (2.4)	
Chronic urinary tract infection	2 (1.3)	0 (0.0)	
Pregnancy induced hypertension	2 (1.3)	1 (2.4)	
Vesico-ureteric reflux	2 (1.3)	0 (0.0)	
Neurogenic bladder	2 (1.3)	0 (0.0)	
Chronic rejection of previous kidney transplantation	1 (0.6)	1 (2.4)	
Obstructive nephropathy	2 (1.2)	0 (0.0)	
Bilateral renal artery stenosis	1 (0.6)	0 (0.0)	
Systemic lupus erythematosus	1 (0.6)	1 (2.4)	
Nephrocalcinosis	0 (0.0)	2 (4.9)	
<b>Duration of pre-transplant dialysis</b>	116 (73.4)	25 (61.0)	0.118**

\* Independent t-test.

\*\* Pearson Chi-squared test.

\*\*\* Fishers' exact test.

There was a significant difference in the cold ischemia time between both study groups ( $P = <0.001$ ), being higher in renal transplant recipients of kidneys with multiple renal arteries than those with single renal arteries. In contrast, the hot ischemia time showed no significant difference. There was a very significant correlation regarding the development of complications between both groups ( $P = 0.001$ ). Urinary and vascular

complications were commoner in the multiple renal arteries group. The rate of vascular complications such as hematoma, renal artery stenosis, renal vein thrombosis, and bleeding from the wound was higher in renal transplant recipients of kidneys with multiple renal arteries. Still, there was no statistical significance between both study groups ( $P = 0.197$ ). Lymphatic leakage showed a very high significant difference, being more prevalent in those with the

single renal artery ( $P=0.001$ ) and the frequency was 1.9 vs. 0 %, respectively). There was no difference regarding the graft rejection between both study groups. Two of our patients died, one from acute

myocardial infarction and the other from acute liver failure; both patients belonged to the single artery group and were excluded from the study, table 2 & figure 3.

**Table 2: Comparison of post-transplantation characteristics between renal transplant recipients of kidneys with single and multiple renal arteries**

Patients' characteristics	Single Renal Artery (n=158)	Multiple Renal Arteries (n=41)	P-Value
	Mean (S.D.)	Mean (S.D.)	
<b>Hot ischemia time in minutes</b>	2.10 (0.57)	2.12 (0.50)	0.827*
<b>Cold ischemia time in minutes</b>	52.10 (8.44)	60.27 (9.92)	<0.001*
	F (%)	F (%)	
<b>Complications</b>			
No complications	129 (81.6)	23 (56.1)	0.001***
Urinary	7 (4.4)	10 (24.4)	
Vascular	18 (11.4)	8 (19.5)	
Urinary + vascular	1 (0.6)	0 (0.0)	
Acute myocardial infarction (Died)	1 (0.6)	0 (0.0)	
Acute liver failure (Died)	1 (0.6)	0 (0.0)	
Acute limb ischemia	1 (0.6)	0 (0.0)	
<b>Vascular Complication</b>	19 (12.0)	9 (22.0)	0.103**
<b>Vascular and lymphatic complications</b>			
No vascular complications	139 (88.0)	32 (78.0)	0.197***
Hematoma	11 (7.0)	6 (14.6)	
Bleeding from the wound	3 (1.9)	3 (7.3)	
Lymphatic leak	3 (1.9)	0 (0.0)	
Renal artery stenosis	1 (0.6)	0 (0.0)	
Renal artery thrombosis	1 (0.6)	0 (0.0)	
<b>Urinary complications</b>			
No urinary complications	150 (94.9)	31 (75.6)	0.001***
Urinary leak	7 (4.4)	9 (22.0)	
Uretero-vesical junction obstruction	1 (0.6)	1 (2.4)	
<b>Lymphatic leakage</b>	3 (1.9)	0 (0.0)	0.607***
<b>Graft rejection</b>			
No graft rejection	138 (87.3)	35 (85.4)	0.483***
Acute graft rejection	5 (3.2)	1 (2.4)	
Delayed graft rejection	4 (2.5)	3 (7.3)	
Chronic graft rejection	11 (7.0)	2 (4.9)	

\*Independent t-test,

\*\* Pearson Chi-squared and

\*\*\* Fishers' exact tests were performed for statistical analyses.

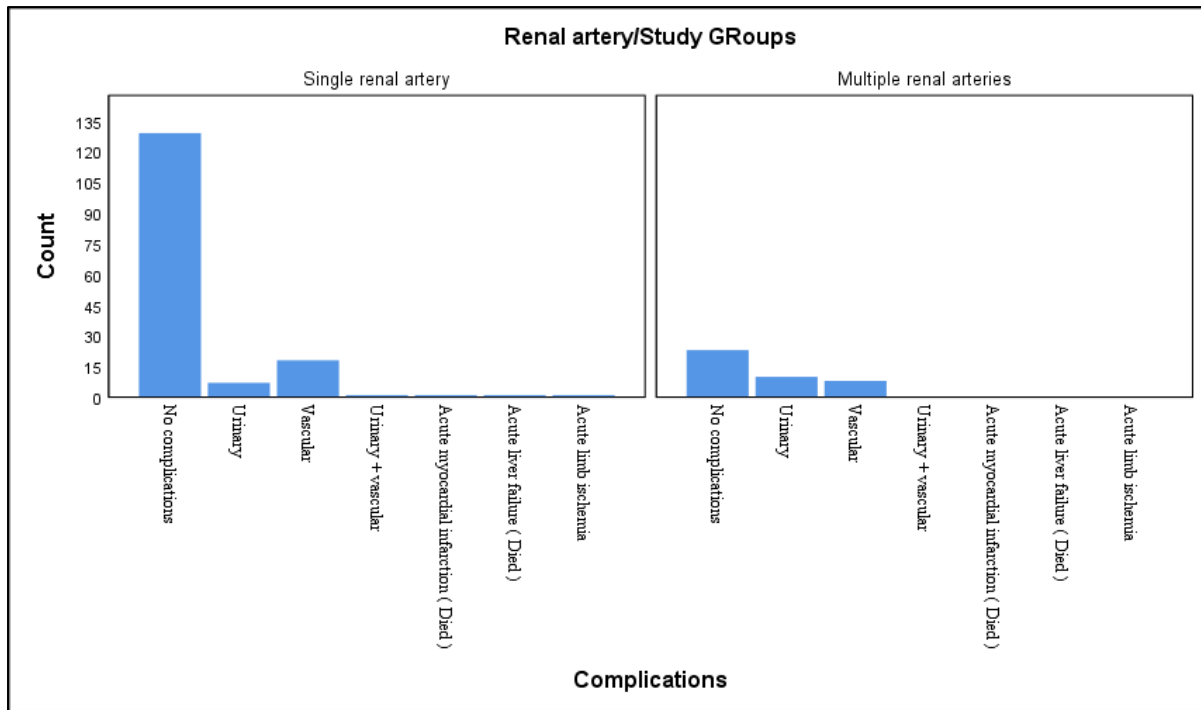


Figure 3: A simple bar chart showing the rate of complications in both single and multiple renal artery renal transplant recipients.

A binary logistic regression test was performed to show what is the most important factor that predicts the development of complications in both study groups; in renal transplant recipients of kidneys with a single renal artery, the most

important factor was found to be the cause of renal failure ( $P=0.02$ ), while other factors such as age, gender, the timing of transplantation, comorbid diseases, age of the donor, and ischemia times showed no statistical difference, table 3, a.

Table 3: Predictors of complications (binary) in renal transplant recipients of kidneys with single renal artery Predictors

Predictors (n=145)	Dependent variable: Complications in single renal artery						
	B	S.E.	Wald	P-Value	OR	95% C.I. for OR	
						Lower	Upper
Age of the patient	-0.008	0.020	0.185	0.667	0.992	0.954	1.030
Gender	0.053	0.493	0.011	0.915	1.054	0.401	2.769
Timing of transplantation	0.002	0.014	0.017	0.897	1.002	0.975	1.030
Comorbid diseases	-0.196	0.202	0.940	0.332	0.822	0.553	1.222
Causes of renal failure	0.116	0.050	5.425	0.020	1.123	1.019	1.239
History of dialysis	0.107	0.525	0.042	0.838	1.113	0.398	3.118
Age of the donor	-0.002	0.034	0.004	0.953	0.998	0.933	1.067
Hot ischemia time	0.485	0.434	1.249	0.264	1.624	0.694	3.804
Cold ischemia time	0.033	0.027	1.518	0.218	1.034	0.981	1.090

Binary logistic regression was performed for statistical analysis.

The degree of freedom of all variables was 1.

The bold number shows the predictor.



Idiopathic renal failure, diabetes mellitus, adult polycystic kidney disease, chronic interstitial nephritis, and glomerulonephritis were among the commonest causes of renal failure that can

predict the development of complications after transplantation in patients with a single renal artery, table4, b.

**Table 4: Predictors of complications (binary) in renal transplant recipients of kidneys with multiple renal arteries.**

Predictors (n=41)	B	S.E.	Wald	P-value	OR	95% C.I. for OR	
						Lower	Upper
Age of the patient	0.072	0.044	2.746	0.097	1.075	0.987	1.170
Gender	-0.293	0.830	0.124	0.724	0.746	0.147	3.795
Timing of transplantation	0.023	0.036	0.409	0.523	1.023	0.954	1.097
Comorbid diseases	-0.413	0.360	1.314	0.252	0.662	0.326	1.341
Causes of renal failure	0.073	0.123	0.346	0.557	1.075	0.844	1.370
History of dialysis	-0.406	0.849	0.228	0.633	0.667	0.126	3.518
Age of the donor	0.012	0.065	0.037	0.848	1.012	0.892	1.149
Hot ischemia time	0.401	0.923	0.189	0.664	1.494	0.245	9.121
Cold ischemia time	-0.022	0.048	0.202	0.653	0.978	0.890	1.076

Binary logistic regression was performed for statistical analysis.

The degree of freedom of all variables was 1.

**b. Post-hoc analysis of the association of complications with the cause of renal failure in renal transplant recipients of kidneys with single artery.**

Causes of renal failure	Complications		P-Value
	No complications	Yes	
<b>Idiopathic</b>	46 (86.8)	7 (13.2)	0.166*
<b>Diabetes mellitus</b>	23 (82.1)	5 (17.9)	
<b>Hypertension</b>	14 (77.8)	4 (22.2)	
<b>Glomerulonephritis</b>	12 (92.3)	1 (7.7)	
<b>Chronic interstitial nephritis</b>	10 (76.9)	3 (23.1)	
<b>Hypertension + diabetes mellitus</b>	10 (83.3)	2 (16.7)	
<b>Adult polycystic kidney disease</b>	3 (60.0)	2 (40.0)	
<b>Nephrocalcinosis</b>	3 (100.0)	0 (0.0)	
<b>Chronic urinary tract infection</b>	2 (100.0)	0 (0.0)	
<b>Chronic rejection of previous kidney transplantation</b>	1 (100.0)	0 (0.0)	
<b>Pregnancy induced hypertension</b>	1 (50.0)	1 (50.0)	
<b>Vesico-ureteric reflux</b>	1 (50.0)	1 (50.0)	
<b>Obstructive nephropathy</b>	1 (100.0)	0 (0.0)	
<b>Systemic lupus erythematosus</b>	1 (100.0)	0 (0.0)	
<b>Congenital left renal agenesis + right side PUJ obstruction</b>	1 (100.0)	0 (0.0)	
<b>Bilateral renal artery stenosis</b>	0 (0.0)	1 (100.0)	
<b>Neurogenic bladder</b>	0 (0.0)	2 (100.0)	

The bold numbers show the most prevalent causes of renal failure in patients with complications.

\* Fishers' exact test was performed to detect the significance.

In our study, binary logistic regression showed that none of the studied factors could predict the development of complications in patients with multiple renal arteries, table 4.

## DISCUSSION:

Renal transplantation is the treatment of choice in patients with end-stage renal disease; recent advances and development in surgical techniques, immunosuppressive drugs, and diagnostic facilities lead to the improvement of the outcome of patients who undergo renal transplantation<sup>12</sup>.

Renal transplantation with multiple renal arteries may be associated with higher rates of complications, particularly urological and vascular complications. On the contrary, Benedetti *et al.* & Ali-El-Dein concluded in their studies that patients with multiple renal arteries are not significantly associated with higher rates of complications or higher rejection rates except that patients with multiple renal arteries have a higher rate of creatinine for one year after the transplantation<sup>13,14</sup>.

In the current study, the overall rate of complications was higher in renal transplant recipients of kidneys with multiple renal arteries (43.9 vs. 18.4, respectively). There was a very significant statistical difference between both study groups ( $P=0.001$ ). The rate of vascular complications was higher in renal transplant recipients of kidneys with multiple renal arteries with no statistical significance between both study groups ( $P=0.197$ ). The same is concluded by Saidi R *et al.* & Vaccarisi S who proved in their study such similarity with this finding in our study<sup>12,15</sup>.

Urinary complications, particularly urinary leak, were much higher in the multiple arteries group in our patients than the single artery group (22 vs. 4.4%), respectively. They show a very high statistical difference ( $P=0.001$ ); this finding in our study is very near to the findings of Saidi R *et al.* & Hwang J *et al.*. The latter found that urinary complications occurred in 19% of the multiple artery group compared to 7% in the single artery group<sup>12</sup>.

The short and the long-term outcomes after the transplantation, especially the acute and the chronic rejection, showed no significant difference between the two groups in our study ( $P=0.483$ ). The majority of our patients showed good graft function and did not develop rejection suggesting that having single or multiple renal arteries don't have an impact on the graft outcome; this finding was proved by some other authors too, such as Benedetti E *et al.*, Bakirtas H *et al.*, and Meyer F *et al.* who showed no impact on the graft function<sup>13, 16-18</sup>.

The rate of the reported lymphatic complications in our study was 1.9% in the single artery group and not reported in the multiple arteries group; both groups showed no statistically significant difference ( $P=0.607$ ) probably due to a higher number of patients with single artery, our results vary from those of Mazzucchi E *et al.* who showed higher rate particularly in the multiple artery group.<sup>2</sup>

In our study, there was no significant difference in the hot ischemia times between both groups ( $P=0.827$ ). In contrast, the cold ischemia times were different. It was longer in the patients with multiple renal arteries comparing to the single artery group (60.27-minutes vs. 52.1 minutes) respectively; the correlation was



also very significant ( $P < 0.001$ ), Keller JE et al., Hellegering J, and Ahmadi AR founded that the difference may be in the hot ischemia time. The cold ischemia time showed no difference. Increased hot ischemia time has been shown to have a negative impact on graft outcome<sup>1,19,20</sup>.

Although in this study we didn't analyze the relation of the number of the arteries to transplant recipient survival, renal transplant recipients of kidneys with single arteries have been found to have a longer duration of renal transplantation (27.3 months) compared to those with multiple arteries (21.49 months), the correlation was also significant ( $P = 0.016$ ), in tow studies which were done by Saidi R et al. & Hwang J et al., they founded that the survival rate has been found to have no effect on the patient survival<sup>12,21</sup>.

Two of our patients died after renal transplantation, one from acute myocardial infarction and the other from acute liver failure, both patients were from the single artery group; studies have found that most deaths in renal transplant recipient patients occur from cardiovascular events; other causes include infections and malignancies, liver failure is one of the rarely reported events<sup>22</sup>.

Binary logistic regression was performed to predict which variable has the strongest correlation with the development of complications for both groups. In those with a single renal artery, the cause of the renal failure was found to predict the development of complications ( $P = 0.02$ ). At the same time, other variables had no impact, such as the age of both donor and recipient, gender, the timing of transplantation, comorbid diseases, and ischemia times; cold ischemia time was

longer in patients with multiple arteries due to the time taken for arterial reconstruction before the arterial anastomosis was performed. For those with multiple renal arteries, no variable was found to predict the development of complications.

## CONCLUSION:

The procedure of renal transplantation with multiple renal arteries is safe and had no negative impact on the graft outcome with higher vascular complication rates, so it is not regarded as a contraindication for renal transplantation.

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## پوخته

### پر دئی یه ک نارتري ل جاندنا گولجيسكى وباندورا وی ل سه ر کارى گرافتى

#### پيشهكى

ژمارا نه خوشين په ككه فتننا گولجيسكا بهره ف زیده بوونيه ل جيهانيدا. جاندنا گولجيسكى بو فان جوړه نه خوشا باشتري چاره سه رييه. هه بونا پر نارتري گولجيسكا دپته هژمارتن ژناسته نكين چاندنا گولجيسكا.

#### شيواز و نهخوش

نارمانجا قى ليكوليني شروفه كرنا بويه ريڼ ته قليهه بونا دناقبه را وهگرين گولجيسكا ب يه ك و پرنارتريين خويني ۱۹۹ نه خوش ليكوليني پشكار بوون.

#### دنه نجام

دناقبه را هردوو كوما جوداهيڼ ته مهنى يڼ گرنه نه بوون. نه گه ريڼ په ككفتنا گولجيسكا دناقبه را هردوو كوما يڼ گرنه نه بوون. ئيشا شه كرى و نه گه ريڼ نه ديار ژپترين نه گه ريڼ په ككفتنا گولجيسكى بوون. دناقبه را هردوو كوما يڼ ليكوليني جوداهيه كا گرنه هه بوو ددهمى ئسكيميا سار، ددهمى دريژتر ل كوما پرنارتري. دهه مان دهمدا چ جوداهى ددهمى گهرم نه بوو دناقبه را هردوو كوما دا. جوداهيڼ هره گرنه هه بوون دناقبه را هردوو كوما دا سه باره نه رينيا. نه ريڼين ميزه روو و دهمارين خويني زور هه بوون ل كوما پرنارتري به رامبه ر يه ك نارتري خويني. ريژه يا ته قليهه بوونين زور هه بوون دكوما پرنارتري به لى چ جوداهيه كا ستاستيكي نه بوو دهمردوو كوما دا. دبه رامبه را ته قليهه بوونين ميزه روونين زور هه بوون ب جوداهيڼ ستاستيكيڼ بلند. ريژتينا ليمفاتيكى ب ريژه كا بلند هه بوو دكوما ئيك نارتري. چ جوداهى دناف هردوو كوما نه بوون سه باره كارى گرافتى. دوو نه خوشا گيانى خو ژده ستان ژ نه گه ريڼ جهل تا دلى و تيكچونا گران يا كه زه بى.

#### كورتي

ريژه يا نه رينه كا زور يا هه ل وهگرين چاندنا گولجيسكى ب پر نارتري به رامبه ر وهگرين ب ئيك نارتري. نه ريڼين ميزه رووى ب ريژه كا بهرچاف هه بوو. چ جياوازيه كا ديار نه بوو دهمردوو كوما دا سه باره نه ريڼين دهمارين خويني، ريژتينا ليمفاتيك و كارى گرافتى. چاندنا گولجيسكىڼ ب پرده مار كاره كى ئاساييه و چ باندورين نه ريڼي لسره كارى گرافتى نينن.

## الخلاصة

### الشريان الكلوي الواحد مقابل الشرايين الكلوية المتعددة وتأثيرها على وظيفة الكلية المزروعة

#### خلفية البحث

الإصابة بمرض الفشل الكلوي أخذ في الازدياد في جميع أنحاء العالم. يعتبر عملية زرع الكلية هو الإجراء الأكثر فعالية لمثل هؤلاء المرضى. يعتبر وجود الشرايين الكلوية المتعددة بين واحدة من الصعوبات التشريحية التي تواجهها أثناء زراعة الكلى.

#### المرضى وطرق البحث

الهدف من هذه الدراسة هو تحليل حدوث مضاعفات بين متلقي زرع الكلى مع الشريان الكلوي الواحد والشرايين المتعددة، وشملت 199 مريضاً في الدراسة.

#### النتائج

لم يكن هناك اختلاف كبير في سن المتبرع بين المجموعتين ( $P = 0.841$ ). لم يكن هنالك فرق كبير في سبب الفشل الكلوي بين مجموعتي الدراسة ( $P = 0.343$ ). كان الفشل الكلوي المجهول السبب ومرض السكري من بين الأسباب الأكثر شيوعاً للفشل الكلوي. كان هناك اختلاف كبير في وقت نقص التروية الباردة بين مجموعتي الدراسة ( $P < 0.001$ )، حيث كان أعلى في المرضى ذوي الشرايين الكلوية المتعددة، في حين أن وقت نقص التروية الحار لم يظهر أي فرق كبير بين المجموعتين. كان هناك ارتباط مهم للغاية فيما يتعلق بتطور المضاعفات بين المجموعتين ( $P = 0.001$ ). وكانت المضاعفات البولية والأوعية الدموية أكثر شيوعاً في المرضى ذوي الشرايين الكلوية المتعددة. وكان معدل المضاعفات الوعائية أعلى في المرضى ذوي الشرايين الكلوية المتعددة مع عدم وجود دلالة إحصائية بين مجموعتي الدراسة ( $P = 0.197$ )، في حين أظهر مضاعفات المسالك البولية وجود علاقة معنوية عالية جداً ( $P = 0.001$ ). كان التسرب اللمفاوي أكثر انتشاراً في المرضى ذوي الشريان الكلوي الواحد ( $P = 0.001$ ). لم يكن هناك فرق فيما يتعلق بفرض الكلى المزروعة بين مجموعتي الدراسة. توفي اثنان من المرضى بسبب احتشاء عضلة القلب وفشل الكبد الحاد.

#### الاستنتاجات

معدل المضاعفات لدى متلقي زرع الكلى ذوي الشرايين المتعددة أعلى مقارنة مع الشرايين المنفردة. وأظهرت المضاعفات البولية فرق كبير بين المجموعتين. لم يكن هناك فرق في مضاعفات الأوعية الدموية، والتسرب اللمفاوي، ونتائج وظيفة الكلية بين المجموعتين. زراعة الكلى ذوي الشرايين المتعددة آمنة وليس لها أي تأثير سلبي على نتائج الكلية المزروعة.