

# Orthotopic Kidney Transplant: a Valid Surgical Alternative for Complex Patients

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**Abstract** Kidney transplant is the best alternative of treatment for patients with end-stage renal disease (ESRD). At present, a significant part of patients admitted to waiting list are older and have previous transplants or severe vascular atheromatosis. In these cases, orthotopic kidney transplant (OKT) could be an option. The aim of the study is to present our results with this technique in terms of surgical steps, complications, and outcomes. Between January 1977 and August 2014, 1549 kidney transplants were performed in our transplant unit. Nine of them were OKT and were performed according to principles described by Gil-Vernet. All data were reviewed retrospectively. Nine OKTs were performed in seven males and two females, with a mean age of 49.3 years (range 24–67). Donor mean age was 40.5 (18.5–62.5) and the follow-up mean time was of 91.8 months (8–226). Seven cases were first transplants and two were third transplants, all of them from deceased donors. Indication for the OKT was an unsuitable iliac region in six (66.6 %) and abnormalities in the low urinary tract or urinary diversions in three (33.3 %). Delayed graft function (DGF) was present in 22.2 % (2/9). Three patients (33.3 %) developed early surgical complications: one bleeding (Clavien IIIb), one arterial thrombosis (IIIb), and one pancreatic leak (IIIb). Two patients (25 %) had late complications: one ureteral stricture (IIIb) and one reflux nephropathy (IIIa). Mean serum creatinine after OKT was 1.7, 1.5, and 1.8 mg/dl at 1 month, 1 year, and 5 years,

respectively. Mean graft survival was 80.7 months (range 0–226). At present, three patients are alive with functioning graft, three patients died with functioning graft, two patients returned to dialysis many years after the transplant, and one lost the graft due to an arterial thrombosis in the early postoperative course. OKT is a valid option for patients with unsuitable iliac regions such as those with third transplants, severe atheromatosis, or vena cava thrombosis. It is also an option for those patients with urinary diversions. Functional results are good, although it is a technique not exempted from complications. Two thirds of the patients have a long-term survival of the graft, and a third of the patients die with functioning graft.

**Keywords** Orthotopic kidney transplant · Renal transplant · Complex receptor · End-stage renal disease

## Introduction

Kidney transplant is widely known as the best treatment for patients with end-stage renal disease (ESRD), due to a better survival, lower costs, and better quality of life compared to dialysis. The increasing age of recipients admitted to waiting list as well as the presence of comorbidities has also increased the complexity of the transplant, both medical and surgical. Thus, a percentage of patients evaluated in the workup prior to transplant have severe problems with iliac regions (atheromatosis, occupation by previous transplants, iliac or vena cava thrombosis...) or have abnormalities of the low urinary tract (LUT) such as urinary diversions. When these circumstances occur in our patients, orthotopic kidney transplant (OKT) could be an alternative.

Spain, which is known in the transplant community as the country with the highest rate of deceased donors, has also an historical relation with OKT. This technique was first described by the Spanish urologist Gil-Vernet JM in 1978 [1],

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being used initially to treat hypertension due to left renal artery stenosis. It is based on a retroperitoneal approach to splenic artery, which will be used for the anastomoses. This artery is preferred in most cases because renal artery is often unsuitable for the graft perfusion in patients with ESRD. After describing the technique, Gil-Vernet published the first results with 139 patients [2]. Many years after, the same transplant group analyzed the results of 223 OKT during 31 years, comparing two different periods, and had good results in both [3••]. OKT is the only alternative in some cases, and it could simplify a third transplant attempt, which is always challenging from a surgical point of view. Additionally, OKT preserves the upper urinary tract with its normal physiology and the graft is placed on its normal anatomical position.

We reviewed the results of nine OKTs performed at our institution during the past 37 years, which is to our knowledge the second largest series in literature. In our case, as other groups in literature, the choice of performing an OKT was not elective but due to two main reasons: the unsuitability of iliac vessels (atheromatosis, thrombosis, retained fossae...) or the presence of urinary diversions or LUT abnormalities.

## Materials and Methods

Between January 1977 and August 2014, 1549 kidney transplants were performed in our transplant unit. Of them, nine were OKT (9/1549; 0.58 %). Clinical data, surgical reports, and complications were collected retrospectively. Surgical technique was performed by experienced transplant surgeons, according to Gil-Vernet technique principles and using double-J stent in all cases. Patient's characteristics, type of anastomoses, complications, graft survival, and patient survival are analyzed.

## Results

The indication for OKT was not elective in any case but due to two main circumstances: unsuitability of iliac region (occupation by previous transplants, severe atheromatosis, thrombosis...) in six cases (66.7 %) or the presence of LUT abnormalities or urinary diversions in three cases (33.3 %). All the kidneys were harvested from deceased donors. Patient's characteristics are detailed in Table 1.

Technical aspects of the OKT are shown in Table 2 and Figs. 1 and 2.

Complications after OKT are detailed in Table 3 and Fig. 3.

**Table 1** Characteristics of population

Characteristics	
<i>n</i>	9
Donor age (years)	40.5 (range 18.5–62.5)
Recipient age (years)	48.5 (range 23.6–63.4)
Sex	78 % male 22 % female
Number of transplant	78 % 1st kidney transplant 22 % 3rd kidney transplant
ESRD etiology	45 % interstitial nephropathy 33 % unknown 22 % glomerular
Indication OKT	67 % unsuitable iliac region 33 % LUT abnormalities/urinary diversion

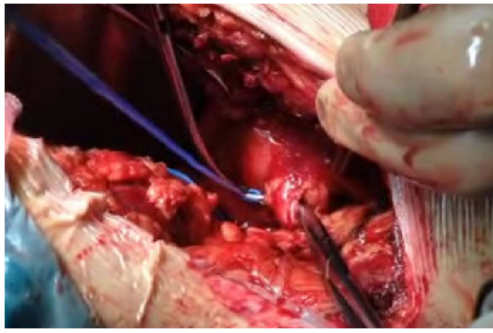
## Discussion

Kidney transplant is the best treatment for patients with ESRD, due to a better survival, better quality of life, and lower economic costs comparing to dialysis. Routinely, it is performed in heterotopic situation, with vascular anastomoses to iliac vessels. However, and because of problems with iliac regions or low urinary tract, the heterotopic implant is unfeasible in some patients. In these situations, which are not suitable for a conventional transplant, OKT can be an option, despite of the technical challenge.

Only a few cases and short series are reported in literature, except one. The most important paper from Musquera et al. [3••] reports 223 OKTs with good results; more than one half of the patients in this study underwent an elective OKT, especially in the first era led by Gil-Vernet, who was the inventor of the technique. Main reasons advocated to support this technique were the avoidance of vesicoureteral reflux, the reduction of erectile dysfunction in male (hypogastric artery was routinely used), and a physiological site placement of the kidney. Graft survival results were similar to heterotopic transplant. Complication rates were higher than conventional transplant, but acceptable.

**Table 2** Technical aspects of the orthotopic kidney transplant (OKT)

Technical aspects	
Arterial anastomoses	77.7 % (7/9) splenic artery 22.3 % (2/9) aorta
Venous anastomoses	77.7 % (7/9) renal vein 22.3 % (2/9) cava
Urinary anastomoses	33.3 % (3/9) uretero-ureteral T-T 33.3 % (3/9) pyelo-pyelic 22.2 % (2/9) ileal conduit 11.2 % (1/9) uretero-pyelic

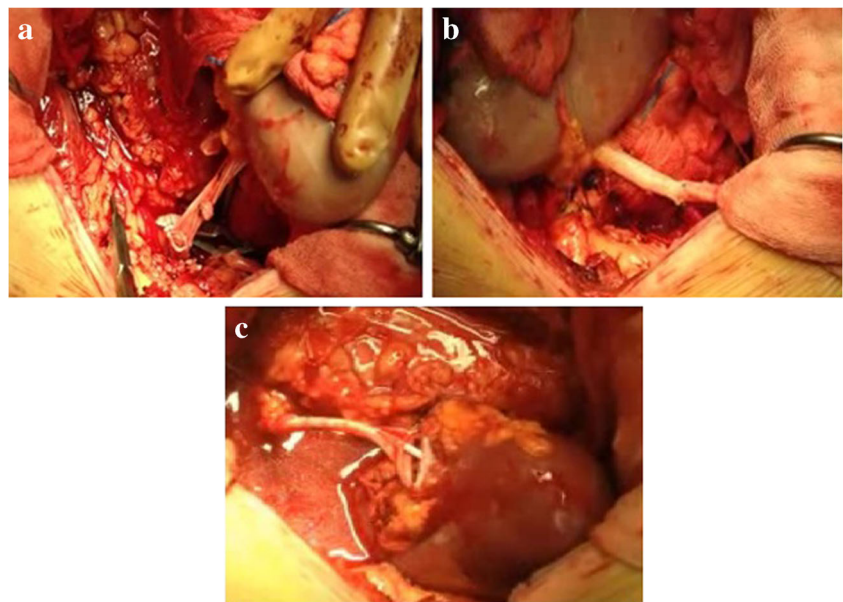


**Fig. 1** Retroperitoneal dissection of splenic artery, close to pancreas tail

Other reports about OKT have few patients and very short follow-up. Ferri et al. [4] reported a successful OKT in one patient with a massive pelvic arteriovenous malformation, but had an incisional bleeding that required packing. One year later, Paduch et al. [5] reported five cases of OKT performed because of iliac vascular problems, three from deceased donors and two from living donors. Four cases were successful, and one case had to be converted to iliac fossa because of pulseless splenic artery and renal artery thrombosis. More recently, a Spanish group reported their experience with six OKTs from deceased donors performed due to iliac region problems [6]. Complications were frequent, including two arterial acute bleeding, three renal artery stenosis, and two wound infection.

Another indication for OKT is inferior vena cava (IVC) thrombosis, which prevents an adequate venous drain of iliac vessels and contraindicates the heterotopic transplant. Graft venous drainage in such situations can be connected to alternative vessels that depending on the patient and on the surgeon's preference could be splenic vein [7] or to superior mesenteric vein [8]. In our study, one patient with an IVC

**Fig. 2** **a** End-to-end venous anastomoses. **b** End-to-end arterial anastomoses. **c** Pyelostomy intubed with double-J stent



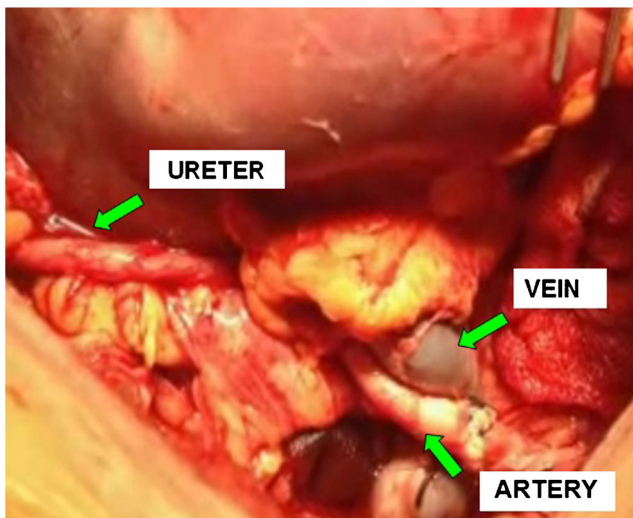
**Table 3** Complications after orthotopic kidney transplant (OKT)

Complications	
Delayed graft function (DGF)	22.2 % (2/9)
Early complications (Clavien-Dindo classification)	33.3 % (3/9)
	1 acute bleeding (IIIb)
	1 arterial thrombosis (IIIb)
	1 pancreatic leak (IIIb)
Late complications (Clavien-Dindo classification)	22.2 % (2/9)
	1 ureteral stricture (IIIb)
	1 reflux nephropathy (IIIb)

thrombosis (below renal veins) and dilated cardiomyopathy underwent an OKT, which was performed uneventfully. After 72 h, he developed an arterial thrombosis and transplantectomy was performed.

Regarding surgical technique variations, splenic artery and renal vein were used in 78 % (7/9) of the cases, while aorta and cava were chosen in the other two. This practice is consistent with literature; i.e., in Musquera study [3••], splenic artery was used in 85 % of the cases. In patients with ESRD, the renal artery is very often narrow and that's why it was not used in any case. The use of aorta and cava for vascular anastomoses in a termino-lateral fashion is also an option, but with some theoretical disadvantages: it needs a total or partial clamping of big vessels, and it is technically more difficult and does not have any benefit on the graft vascular support. However, it should be considered in cases with unfit splenic vessels.

Complication rate was higher than conventional heterotopic transplant and they usually involve a surgical



**Fig. 3** Final result with all the anastomoses (artery, vein, and urinary tract)

reintervention. Of patients, 66.7 % (6/9) presented a surgical complication (four early and two late) and all of them required surgical repair (Clavien IIIb). Pancreatic leak is a specific complication of OKT. Splenic artery dissection close to pancreas tail may result in a pancreatic leak. In our series, one patient developed a pancreatic leak 6 days after the transplant that was initially treated with percutaneous drainage and finally with surgical pancreatic necrosectomy. Other common early complications reported in other series were acute bleeding (one case) and arterial thrombosis (one case). In the largest study from Musquera [3••], arterial thrombosis and transplantectomy were around 5 %. Two patients in our study had late complications: one ureteral stricture treated with reimplantation to her ileal conduit and reflux nephropathy. Unlike De Gracia et al. [6], we had no renal artery stenosis.

With a mean follow-up of 91.8 months, graft survival was 88.9 and 88.9 % at 1 month and 1 year, respectively. Overall graft survival was 80.7 months (range 0–226) and mean serum creatinine was 1.7, 1.5, and 1.8 mg/dl at 1 month, 1 year, and 5 years, respectively. Overall patient survival was 100 % at 1 month and 1 year. At present, only three patients are alive with functioning graft and two are alive but returned to dialysis. Of the four patients dead, three had functioning graft when passed away due to ischemic cardiopathy and one died with non-functioning graft because of sepsis. These results, although not comparable with most of heterotopic series, seem acceptable in the short and medium term. Long-term results cannot be properly assessed because only three patients are alive at present. However, 66.7 % (6/9) of the patients had functioning grafts with a mean follow-up of 83 months.

OKT can be also an alternative in cases of third and fourth transplants, especially in those cases with retained bilateral iliac fossae. These situations are always challenging and should be performed by experienced surgeons. When iliac

fossa is chosen for a third transplant, simultaneous or prior transplantectomy is needed as well as a careful dissection of iliac vessels to guarantee an acceptable graft reperfusion. In this scenario, although technically challenging, OKT might have some advantages: it avoids the transplantectomy and the access to a surgical field that could be unfeasible, it preserves the physiological position of the kidney in lumbar fossa and also preserves the normal physiology of the upper urinary tract. Thus, Izquierdo et al. [9•] reported a series with 82 third or fourth kidney transplants, using the OKT in 15 (18.8 %) with uneventful postoperative course and good results. In the other hand, a similar report from Blanco et al. [10] with 30 third kidney transplants, OKT was performed in one case with torpid course due to an acute bleeding that required transplantectomy and finally died.

## Conclusions

OKT is a valid option for patients with unsuitable iliac regions such as those with third transplants, severe atheromatosis, or vena cava thrombosis. It is also an option for those patients with urinary diversions. Functional results are acceptable and quite similar to conventional transplant the short term. Two thirds of the patients have a long-term survival of the graft and a third of the patients die with functioning graft. However, it is a difficult surgical technique and not exempted from complications, which can usually require surgical repair. To our knowledge, this study is the second largest series in literature, with nine cases.

## Compliance with Ethics Guidelines

**Conflict of Interest** Dr. Vital Hevia, Dr. Victoria Gómez, Dr. Sara Álvarez, Dr. Víctor Díez-Nicolás, Dr. Ana Fernández, and Dr. Francisco Javier Burgos each declare no potential conflicts of interest.

**Human and Animal Rights and Informed Consent** This article does not contain any studies with human or animal subjects performed by any of the authors.

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