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BRIEF REPORT

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The anastomosis between renal polar arteries and arteria epigastrica inferior in kidney transplantation: an option to decrease the risk of ureter necrosis?

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Abstract Ureteral necrosis after renal transplantation is often the result of impaired perfusion due to loss of donor polar arteries. A way of preserving polar arteries is their anastomosis with the *A. epigastrica inferior*. In three cases (aged 49-, 58-, and 63 years), 9.3 % of 33 living donors, we detected donor polar arteries on both sides, and anastomosed the polar artery to the *A. epigastrica inferior* with microsurgical methods. Intraoperatively, the flow was measured by flowmeter, in the postoperative course duplexsonography and MR-angiography was performed. In all three cases we noted a bluish, ischemic parenchym mass of 10–25 % of the kidney and ureter. It recovered immediately, however, after the polar artery had been reconstructed. Intraoperative measurement showed a high flow on the polar- and the main renal artery. Duplexsonography and MR-angiography documented a good flow on the *A. epigastrica* anastomosis. There have been no signs of ureteral problems at all. After a mean follow-up time of 26 months, the mean creatinine level is 1.46 mg/ml. Ureteral necrosis after kidney transplantation is mostly the result of a lack of perfusion of the polar arteries of the lower kidney pole. If arteriosclerotic lesions inhibit an anastomosis with the renal artery, the anastomosis with the *A. epigastrica inferior* seems to be a useful alternative.

Keywords Allograft · Polar arteries · Transplantation · Ureter necrosis

Abbreviations *A* Artery · *MMF* Mycofenolat mofetil · *MR* Magnetic resonance

Introduction

The improvement of immunosuppressive drugs and their regimens as well as the highly differentiated care following a successful kidney transplantation have lead to increasingly improved long-term results. However, 'urologic problems' such as ureteral necrosis due to poor nutrition in the early post-operative course can demand operative revision and may therefore lead to long lasting problems, which in the long run cause a loss of functioning kidney tissue [1]. A major problem in these cases is bad nutrition of the ureter, which is significantly correlated to the injury of polar arteries, and can occur in the course of harvesting kidneys with multiple arteries [2, 4, 5]. To minimize the risk of polar artery loss during harvesting, it is essential to identify all polar arteries so that they can be reanastomosed in the transplant procedure [2, 6], in order to prevent segmental kidney infarction or ureteral ischemia [3, 6].

We report on three cases from the Münster transplant centre in which we chose the inferior epigastric artery of the recipient to reanastomose polar arteries after living donation of the graft, when a direct anastomosis with arteria renalis was not possible because of arteriosclerotic plaques. The technical details and outcome are presented in this report.

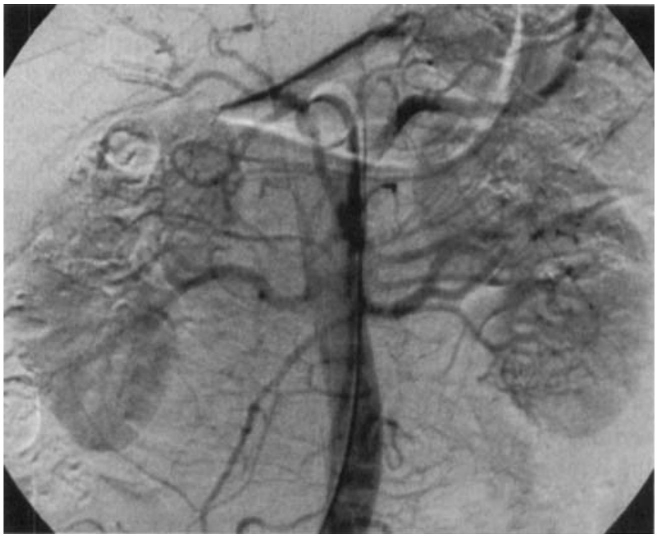

Fig. 1 Angiography of donor

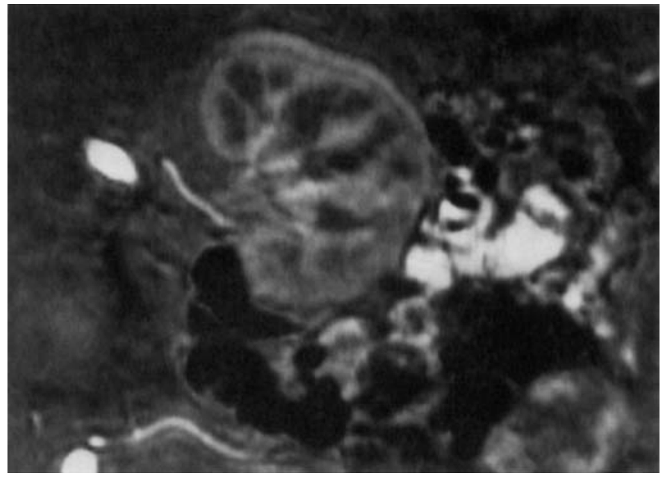

Fig. 2 MR-Angiography of kidney graft 3 months after transplantation: good flow on the epigastric artery leading to polar artery of the graft

Patients and methods

Between December 1996 and December 1999, 33 kidney transplantations from living donors were performed in the Münster transplant centre. In the compulsory angiography of kidneys in three cases we detected polar arteries on both sides while preparing the donation (Fig. 1). Scintigrafic evaluation showed a similar function of both kidneys in the 49-, 58-, and 63-year- old living-related donors. The preoperative creatinine level of the donors ranged from 0.9–1.0 mg /dl.

Intraoperative situs in all three cases confirmed the polar artery of the lower pole. A reanastomosis between polar artery and *A. renalis* was not possible because of marked arteriosclerosis in all vessels, for which there had been no preoperative clinical evidence. For this reason, the inferior epigastric artery was identified and anastomosed end-to-end to the polar artery. The flow of the anastomosis was proven by intraoperative flowmetre. In the post operative course, duplexsonography and MR-angiography (3 months post transplantation) documented the flow in the polar artery. Venous anastomosis and Ureterocystostomie were carried out in typical technique. In two cases, immunospppression was achieved with Prednisolon, MMF and Tacrolimus, and in one case with Prednisolon, MMF and Cyclosporin.

Results

Reperfusion started after the main renal artery and vein were anastomosed, in order to shorten the period of warm ischemia. In all three cases, a bluish pole of the graft (10–25 %) as a sign of ischemia was noticed before the anastomosis between *A. epigastrica* and polar artery was completed. After completion of the anastomosis and reperfusion of the polar artery, the kidney on the whole recovered immediately in all three cases and showed no sign of ischemia any longer. The flowmeter showed a flow of 25-, 33-, and 52 ml/min respectively for the polar artery, and 480-, 530-, and 580 ml/min respectively for the main renal artery of the three patients. No surgical complication was encountered in any patient during the postoperative course. A rejection episode in one patient proved to be cortison sensitive and was treated successfully.

Repeated duplexsonography showed a homogeneous perfusion of the grafts on the whole in the early- and late postoperative course, the polar artery was identified in all three patients. MR-angiography documented undoubtedly the flow in the polar artery, which is fed by the *A. epigastrica inferior* (Fig. 2). After a mean follow-up of 26 months (21, 21, 36) the mean creatinine level was 1.6 mg/dl (1.0 mg/dl; 1.5 mg/dl; 1.9 mg/dl). A ureteral problem was not identified in any of the patients.

Discussion

The problem of multiple kidney arteries of grafts from living donors is discussed controversially. While, in the early days of living donation, multiple arteries on a kidney graft were regarded as a relative contraindication, these kidneys are nowadays widely accepted for transplantation. However, the necessity of reanastomosis of the polar arteries is discussed controversially.

While very small vessels may be ligated without a significant loss of functioning kidney tissue [7], the risk of segmental infarction and consecutive loss of parenchyma rises with the increasing diameter of the ligated polar arteries [3, 6]. This leads to bad long-term results, and ureter complications may occur if polar arteries are at the lower pole of the kidney. As the nutrition of the ureter of transplant kidney is often dependent on a lower polar artery (if there is one), ureter necrosis with

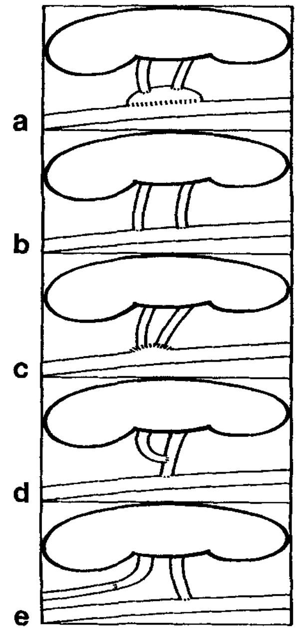

Fig. 3 Possiblities of polar arterial anastomosis: **a** anastomosis with a venous patch, **b** direct anastomosis with iliac artery, **c** common anastomosis polar artery and *a. renalis*, **d** anastomosis to renal artery, **e** anastomosis with epigastric artery

long-lasting complications and the necessity of operative revision must be considered. [10, 11]. Further possibilities of anastomoses of polar arteries have been described [4, 6, 8, 9]; Fig. 3. Most authors prefer an anastomosis with the main renal artery of the graft if the polar artery is long enough [4]; Fig. 3 d). If the polar arteries are of a reasonable diameter, the common anastomosis between the iliac artery, the main renal artery, and the polar artery is a further possibility (Fig. 3 c). Another possibility is to anastomose the main artery to the common iliac artery, and the polar artery to the internal iliac artery.

In some cases, a venous patch may help to insert the polar artery into the iliac vessels. However, venous material from the donor is needed for this technique, making it more difficult when the graft is from a living donor (Fig. 3 a).

A separate anastomosis of the polar artery to the iliac artery is another possibility provided diameter of the polar artery is reasonable (Fig. 3 b). Severe arteriosclerosis, however, makes a direct anastomosis between the polar artery and both the *A. renalis* and the iliac artery impossible. In these cases, an anastomosis with the epigastric artery is a valuable alternative that saves nephron mass (Fig. 3 e). The results of the procedure given in this report show the long-lasting effect and can prove the flow in anastomoses in such small vessels. In our opinion, protecting the epigastric artery from any lesions during the transplant procedure, in order to ensure the nutrition of the ureter in cases of lower polar arteries, is well worth the trouble.

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