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Renal transplantation combined with aortofemoral bypass using a fresh arterial allograft

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Abstract Aortoiliac atherosclerosis is frequently encountered in renal failure patients waiting for renal transplantation. Staged or simultaneous surgical repair of aortoiliac lesions with renal transplantation is possible at reasonable risk. Arterial reconstruction is most commonly performed using an artificial prosthesis. Another option is the use of a fresh or preserved arterial allograft. In our institute, about 180 cadaveric transplantations are performed each year. Over the past 2 years, three patients with chronic renal failure and obliterative disease of the abdominal aorta and iliac arteries underwent aortofemoral bypass using a fresh arterial allograft combined with kidney transplantation from the same donor. The procedures as well as the postoperative course

were uneventful. There was an immediate development of function of the renal transplant. Combined arterial reconstruction and transplantation, managing both conditions at a time, is convenient for the patient mainly because it means undergoing only one general anesthesia during one hospitalization. Moreover, the risk of infection of the vascular prosthesis is somewhat reduced. Disadvantages are that the availability of the arterial allograft is dependent on a suitable donor and the limited body of experience with the behavior of the arterial allograft in patients with chronic immunosuppression.

Key words Kidney transplantation · Arterial allograft · Aortofemoral bypass

Introduction

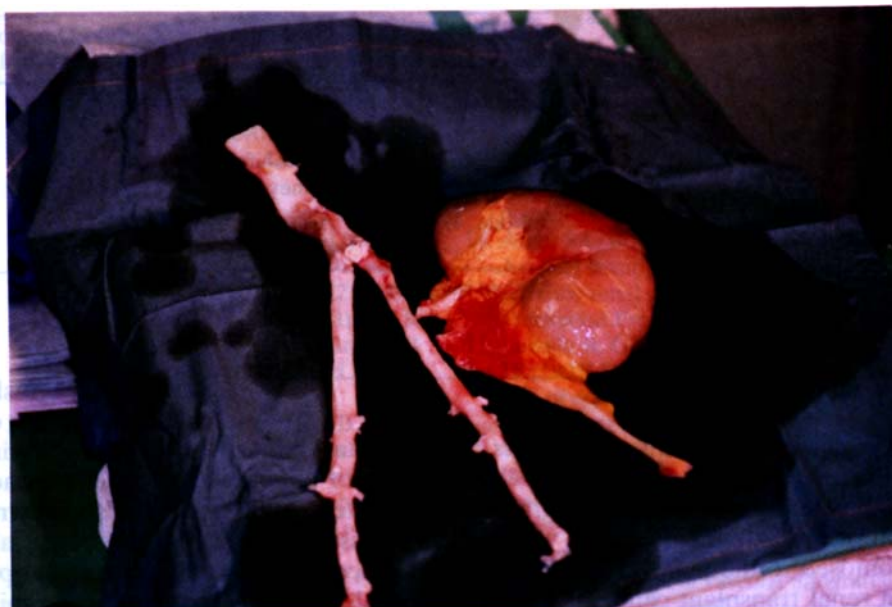
Kidney transplantation has become the treatment of choice for end-stage renal disease. An increase in the number of renal transplant candidates who will require surgical repair of atherosclerotic arteries is foreseeable. First, chronic renal failure and hemodialysis are associated with hypertension and lipid disorders that predispose to accelerated atherosclerosis [1]. Second, improved results have extended the indication for renal transplantation to include patients of almost any age group and patients with diabetes. Until now, surgical series of aortoiliac repair in patients with end-stage renal disease were infrequent and included small numbers of patients. If both diseases co-exist in a patient, the cur-

rently most frequently used approach is arterial reconstruction using a vascular prosthesis with kidney transplantation performed as a one-stage procedure in one session or separately (after an interval). Another option is to perform both procedures at one time using a fresh arterial allograft and a kidney from the same donor.

Patients and methods

In our institute, about 180 cadaveric transplantations are performed each year. Over the past 2 years, three patients with chronic renal failure and obliterative arterial disease of the abdominal aorta and iliac arteries have undergone simultaneous aortofemoral bypass using a fresh arterial allograft with kidney transplantation

Fig. 1 Renal and arterial allograft



from the same donor. All patients had claudication problems. Before being accepted as a transplant candidate, each patient underwent a complete vascular check-up including ultrasonic scanning and Doppler velocimetry studies of the abdominal aorta and lower limb. Angiography of the abdominal arteries was carried out as a rule. Two patients were operated on from left-side oblique laparotomy extraperitoneally and had their kidney graft transplanted into the left iliac fossa following aortobifemoral bypass. In the third patient, who had had an iliofemoral bypass on the left side using a vascular prosthesis, a right-side aortofemoral bypass was undertaken from mid-line laparotomy with the kidney placed into the right iliac fossa. Intraoperative and postoperative care included standard intravenous fluid therapy, blood loss replacement, usual monitoring of renal function and cardiovascular condition, and administration of broad-spectrum antibiotics. Evolution of transplant function was assessed by daily measurement of serum creatinine. Immunosuppressive medication including cyclosporin, prednisone, and azathioprine was administered intravenously until intestinal transit reappeared; it was then given orally.

Source of vascular allografts

The arterial graft comprising the abdominal aorta, iliac arteries, and the common femoral artery was harvested during multiorgan harvesting (Fig. 1). A match in the blood groups between donor and recipient was required, as was a negative cross-match. The graft was perfused with a perfusion solution (Euro-Collins twice, UW solution once) and stored under the same principles as the or-

gans harvested. The characteristics of the donors are given in Table 1.

Results

The operation and postoperative course were without complications. Development of kidney graft function was immediate. The patients are scheduled for regular follow-up in our department at 6-month intervals. Follow-up visits include complete vascular check-up with color-coded Doppler ultrasound to confirm that, in peripherally located grafts, the transplanted arteries have maintained their compliance as documented by curves of the circulatory velocity profile of parabolic shape, similar in every way to the profile of a normal artery. All patients lost their claudications. Although the result of HLA typing between donor and recipient was not known until after the procedure, there was no episode of kidney graft rejection in our patients. Serum creatinine levels at the most recent follow-up visit are shown in Table 2.

Table 1 Donor characteristics

Donor, sex, age (years)	Cause of death	Organs harvested	Arterial allograft cold ischemia time (h)	Kidney cold ischemia time (h)
1. Male, 39	Head injury	Artery, kidneys, lungs	8	10
2. Male, 21	Head injury	Artery, kidneys, pancreas, heart	10	12
3. Male, 15	Head injury	Artery, kidneys, heart	5	7

Table 2 Patient characteristics

Patients, sex, age (years)	Operation	Duration of survival (months)	Bypass patency ^a	Serum creatinine ($\mu\text{mol/l}$) ^a
1. Female, 47	Aortobifem bypass + kidney Tx	20	+	167
2. Female, 51	Aortobifem bypass + kidney Tx	17	+	142
3. Male, 49	Aortofem bypass + kidney Tx	8	+	115

^a When seen last

Discussion

The surgical technique and tactics of renal transplantation have been known and successfully used for almost half a century. The renal allograft is transplanted heterotopically into the iliac fossa with the renal vessels anastomosed to the iliac vessels. Problems are encountered in renal transplant candidates with sclerotic lesions involving the aorta and iliac arteries. Patients in renal failure are known to be at an increased risk of sclerosis. This led to concepts in which angiography should be performed on a routine basis in patients over 40 years of age [2]. Moreover, improving outcomes of transplantation have entailed increasingly older patients being put on the waiting list. As a result, there will be an increase in the number of patients requiring management of both conditions. Vascular reconstruction can be performed prior to transplantation or as a combination of both procedures. In the former case, arterial reconstruction is undertaken using prosthetic grafts. Sterioff and associates showed, as early as 1974, that kidney transplantation was possible in patients with arterial prosthetic grafts; the artery of the transplant can be anastomosed directly to the graft [3]. The recommended interval between vascular reconstruction and subsequent transplantation is 6 weeks to 3 months [4]. A theoretical drawback is the increased risk of infection in patients with chronic immunosuppression. By contrast, using a canine model of chronic immunosuppression, it was found that administration of azathioprine did not increase the incidence of infections in Dacron graft implants [5]. Other authors reported difficult dissection of the external iliac vein because it was often densely adherent to the Dacron aortic graft [6]. A clear disadvantage of this two-stage approach is the need for undergoing two general anesthetics and increased costs for two hospitalizations [7]. Another option is to perform the arterial reconstruction and renal transplantation simultaneously. A simultaneous procedure was first reported by Cerilli and co-workers in 1977 [8]. To construct a bypass, an artificial vascular prosthesis or an arterial allograft can be used. The risk of infection associated with the conduit is fairly high, especially in cases where a urinary fistula to the kidney transplant develops. For

this reason, a fresh arterial allograft is safer. Its other advantages include easy manipulation and construction of anastomoses during surgery. A fresh artery retains – unlike preserved ones – its physical properties that may be useful also in terms of long-term patency [9]. Concerns about endothelial rejection are no doubt justified in non-immunosuppressed patients [10, 11]. In our series, patients undergoing renal transplantation receive standard triple immunosuppression, and long-term patency of the vascular reconstruction is to be expected [12]. A similar effect was observed following hepatic artery reconstruction using an arterial graft during liver transplantation [13]. Artery harvesting has become routine in all multiorgan harvesting procedures involving the removal of the liver and pancreas [14]. In our series, the cold ischemia time of the arterial allograft never exceeded 10 h. The drawbacks of combined arterial reconstruction using an arterial allograft and kidney transplantation are as follows: As it is fully dependent on the availability of a suitable donor, the procedure is performed on an urgent basis and before the results of HLA donor and recipient antigen match testing are actually known. The risk of transmission of some viral infections is theoretically present despite a thorough examination of the donor [15]. The risk of delayed graft function (acute tubular necrosis) of the renal graft is increased only in the event of intraoperative complications [16]. In our series, there were no early complications, and the follow-up period has to date also been uneventful. However, recommendations cannot be formulated until after a bigger group of patients has been collected and a longer follow-up period has elapsed.

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