ELSEVIER

The Finding of Vascular and Urinary Anomalies in the Harvested Kidney for Transplantation

M. Santangelo, M. Clemente, P. De Rosa, M. Zuccaro, L. Pelosio, L. Caggiano, C. La Tessa, and A. Renda

ABSTRACT

Introduction. In kidney transplantation, anatomical vascular and excretory anomalies may represent causes of failure. Today's surgical techniques have made the most of the organs with anatomic anomalies and iatrogenic injury successfully used for transplantation.

Materials and Methods. From January 2000 to June 2006, we harvested 230 kidneys, of including 88 kidneys (20%) with vascular, urinary, or vascular-urinary anomalies; 64 kidneys were implanted and 15 were sent to other transplantation centers. Only 9 kidneys were not appropriate for transplantation.

Results. All patients who received kidneys with the above-mentioned anomalies were carefully examined after the transplantation and short-term and long-term complications were evaluated with respect to controls without anomalies.

Discussion. Renal anatomic anomalies are frequently observed during kidney transplantation and may produce postsurgical complications. However, the presence of these anomalies does not necessarily imply the impossibility of using the kidney for a transplant, especially because of improved surgical techniques. Our experience in transplantation procedures showed that even if kidneys present the above-mentioned anomalies they can still be considered appropriate for transplantation when we perform a correct harvesting/back-table transplant surgery. So vascular and urinary anomalies have to be considered always an incentive to research new surgical solutions and to perform a careful surgical technique.

NOT every harvested kidney is suitable for transplantation. Anatomical anomalies of the vascular and excretory district represent frequent causes for discarding a kidney. Modern surgical techniques can overcome these problems.

Various levels of anatomic anomalies exists; some are simple, some are complex, necessitating back-table corrections, but others are so complex that they do not allow transplantation. The harvested organs are classified as standard or directly useable for transplantation, nonuseable for transplantation, or suboptimal if they require correction. Transplantation of suboptimal kidneys may be associated with a greater incidence of complications than seen in the control.[1,2]

We established a procedure to define the characteristics of suboptimal kidneys and specifically select an appropriate recipient. We considered suboptimal all organs with complex arterial anomalies (more than 2 arteries on a single patch, 2 or more arteries that needed a separate anastomosis or a bench reconstruction) and organs with complex anomalies of the excretory tract (complete double district).[3]

The aim of our study was to evaluate the incidence of anatomic anomalies in harvested kidneys and the incidence of postsurgical complications of suboptimal kidneys.

MATERIALS AND METHODS

From January 2000 to June 2006 we harvested 230 kidneys, yielding 431 organs, including 88 kidneys (20%) with vascular, urinary, or vascular-urinary anomalies. Sixty-four kidneys were transplanted in our center, 15 were sent to other centers because of the absence of a compatible recipient on our waiting list or organizational problems, and only 9 kidneys were not appropriate. Of 64 transplanted kidneys,

From the General, Thoracic and Vascular Surgery Department (M.S., M.C., M.Z., L.P., L.C., C.L.T., A.R.), O.U. of General Surgery and Organ Transplantation, University of Naples "Federico II," and Transplant Unit (P.D.R.), AORN San Giovanni di Dio e Ruggi di Aragona, Salerno, Italy.

Address reprint requests to Michele Santangelo, MD, Via A. Diaz, 7, 80059 Torre del Greco, Napoli, Italy. E-mail: miichele.santangelo@unina.it

0041-1345/07/$–see front matter
doi:10.1016/j.transproceed.2007.05.038

30 (46.87%) had multiples arteries-, including 25 (39.06%) with 2 widely separated arteries on a single aortic patch that were reduced on bench reconstruction. These kidneys were considered as standard organs too. The remaining 5 kidneys were considered suboptimal because they had complex vascular anomalies: 3 kidneys with 3 arteries on a single patch and 2 kidneys had 2 arteries that required separated anastomoses.

Of 64 transplanted kidneys, 16 (25%) had multiplex veins. Thirteen (20.31%) with 2 veins on a single patch did not require any correction and were considered as standard organs. The remaining 3 kidneys were considered suboptimal because they had 3 veins. Of 64 implanted kidneys, 12 (18.75%) had arterial-venous anomalies: 11 (17,18%) had 2 arteries and 2 veins; and 1 kidney had 4 arteries and 4 veins. All of these kidneys were considered suboptimal.

Of 64 transplanted kidneys, 5 (7.81%) had anomalies of the excretory tract: 1 had an incomplete double district with a long common ureter; 2 had an incomplete double district with a short common ureter. These 3 kidneys were considered as standard organs. Two kidneys had complete double districts and were considered suboptimal.

Finally, only 1 kidney had a vascular-urinary anomaly (double artery, double vein, and double district incomplete) and was considered suboptimal.

All 23 (35.93%) suboptimal organs were assigned to recipients identified using the normal algorithm of assignment, but also meeting the following conditions; age between 55 and 60 years, a body weight of at least 20% less than that of the donor, and prevalence of female gender.

During 6 years, we considered 9 kidneys not suitable for transplantation: 3 kidneys had double arteriosclerotic arteries, 3 kidneys had complex venous anomalies, 2 kidneys had a megaureter and renal artery from the iliac artery, and 1 kidney had an inferior polar artery tied and a pyeloureteral joint pathology.

All organs were transplanted with less than 12 hours of cold ischemia. In all patients we used an immunosuppressive protocol that consisted of basiliximab at induction, and calcineurin inhibitors and cortisone in progressively decreasing doses from day 7 posttransplantation.

The surgical technique was standard with termono-lateral anastomosis between donor vascular patches and recipient external iliac vessels (artery and vein),[4,5] while the ureter was reconstructed using a uretero-vesical anastomosis on a double "J" stent according to the Gregoire technique.

The 3 complete double district cases were treated using terminal reconstruction of the 2 ureters. In 2 cases we performed 2 separated neoureter-vesical anastomoses using the Gregoire technique; in the other case, first we performed a suture between the ureters' medial edge, absolutely respecting their vascularization, and then we performed a single neoureter-vesical anostomosis using the Gregoire technique. In all cases a double J stent was positioned in each ureter.

RESULTS

During the follow-up, all patients were alive with functioning graftss. We had no acute hemorrhagic complications. All organs showed rapid functional recovery with good renal function (creatinine levels, 1.1 +/− 0.3 mg/dL) reached between postoperative days 7 and 12. A kidney with a sequential anastomosis, 3 days after transplantation, showed an increase in lactic dehydrogenase (LDH) and creatinine phospho kinase (CPK) serum levels, although the creatinine level and the diuresis were normal. Doppler ultrasound confirmed the suspicion of an early thrombosis of an inferior arterial branch, smaller than the other one; this caused a localized renal infarct that did not affect the functional recovery and did not damage the ureter. In 1 of the complete double district transplants (a patient with single anastomosis), we observed leakage on day 7 that spontaneously ended on day 12.

Of 24 patients, 7 showed hypertension. In no patient was arterial stenosis observed. We had no significant proteinuria. In the 3 patients with complete double district, we had no urinary tract infections such as in the 3 patients with incomplete double district.

DISCUSSION

Kidneys often showed anatomic anomalies. In the past the kidneys with anatomic anomalies were not considered suitable for transplantation. Now, the need to increase the number of available organs for transplantation justifies all attempts to expand the donor pool by the use of suboptimal kidneys.[6]

The anatomical anomalies are varied, but rarely were so severe to discard a kidney. Now, the improvement of surgical and back-table techniques allows us to consider for transplantation this kind of kidney as standard organs/suboptimal organs. Because suboptimal kidneys may need some surgical correction they may have a greater incidence of postsurgical complications than the standard ones, but this does not seem to be good reason to discard them.

In our experience we observed anatomic anomalies in 20% of cases. Among 88 kidneys with vascular-urinary anomalies harvested from January 2000 to June 2006, 79 were transplanted and only 9 discarded for concomitant factors and not only for anatomic anomalies, including 3 with advanced arteriosclerosis in particular involving ostium and renal artery. Two kidneys that were harvested from the same donor with renal arteries originating from iliac vessels and megaureters were not discarded due to the artery anatomy but for the presence of acquired pathology of renal parenchyma caused by vesical-ureteral reflux through megaureteres. One had been discarded for concomitant presence of pyeloureteral joint pathology and tied inferior polar artery. This condition compromised the ureteral vascularization and made it dangerous to perform a plasty of the pyeloureteral joint. Only 3 kidneys were discarded exclusively for anatomic anomalies: a fine and fragile venous net that was difficult and dangerous to anastomose with the recipient vein.

So, among 9 cases, 6 kidneys showed that the reason to discard them was not vascular-urinary anomalies, but the presence of concomitant factors or pathology.

In our experience kidney anatomic anomalies are frequently observed during harvesting and, generally, are correlated to an increase of iatrogenic injury during harvesting/bench table surgery.[7] In conclusion, the presence of these anomalies does not necessarily imply the impossibility of using the kidney for transplantation, especially because of improved surgical techniques.

Thus, kidneys with vascular-urinary anomalies may be used to expand the organ pool for transplantation and

represent an incentive to perform a careful harvesting surgical technique and to research new surgical solutions.

REFERENCES

1. Kumar MS, Panigrahi D, Deezzi CM, et al: Long term function and survival of erderly donor kidney transplanted into young adults. Transplantation 62:1242, 1996

2. Grinyò JM: Borderline kidney graft donors-what are the problems? Nephrol Dial Transplant 15:950, 2000

3. De Rosa P, Santangelo M, Ferrara A, et al: Suboptimal kidney: the experience of a single. transplant unit. Transplant Proc 36:488, 2004

4. Davari HR, Malek-Hossini SA, Salahi H, et al: Sequential anastomosis of accessory artery to external iliac artery in the management of renal transplantation with multiple arteries. Transplant Proc 35:329, 2003

5. Makiyama K, Tanabe K, Ishida H, et al: Successful renovascular reconstruction for renal allograft with multiple renal arteries. Transplantation 75:828, 2003

6. De Rosa P, Santangelo M, Scala A, et al: Difficult vascular condition in kidney transplantation. Transplant Proc 38:1040, 2006

7. Attività di donazione, prelievo e trapianto in Italia. Anno 2001-Centro Nazionale Trapianti Istituto Superiore Sanità. Rome: Editrice Composition; 2001; pp 1-32