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Review Article

Preparing Live Donor for Kidney Donation

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ABSTRACT

Purpose: In order to select the most appropriate donor and minimize psychological and physical complications in the kidney donors, it is of high importance to prepare the donor meticulously. The essential respective items are reviewed in this study.

Materials and Methods: The available published literature and papers presented in Medline from 1983 to 2003 were reviewed.

Results: One the sources of sources of kidney donation is the live donor which is mostly used in Iran. Similarly, due to long waiting lists of kidney recipients, live donor kidney transplantation have been increasingly used in developed countries. Consequently, several aspects of this issue have been considered and specific recommendations have been discussed; anatomy of the donor's kidney, age, ABO blood group, viral infections, weight, HLA type compatibility, psychological status, and diseases such as diabetes, ADPKD, and Alport syndrome should be evaluated in donation candidates.

Conclusion: Live donor kidney donation has the advantage of elective and programmed transplantation over cadaveric transplantation. However, removal of an intact organ from the body of a normal individual may lead to complications, as it may so in any other major surgical operation. Thus, it is strongly recommended to select the most appropriate donor patiently by a series of accurate evaluations.

KEY WORDS: kidney, transplantation, donation, alive

Introduction

In 1954, the first successful kidney transplantation was performed in a 23-year-old male receiving kidney from his twin brother by Dr. J.E. Murray in Boston. This procedure, without any use of immunosuppressive medication, provided a normal life until the recipient died of a non-renal cause.[1] Between 1954 and 1980, desirable outcomes were achieved by using related donor, due to the tissue compatibility between the recipient and the donor, but transplantation from cadaver which was accompanied with serious complications was not popular; Freeman reported that patients would still have preferred hemodialysis to transplantation in 1985s.[2]

Better understanding immunological aspects, particularly introducing Cyclosporine and monoclonal and polyclonal antibodies, yielded an improvement of short-term graft survival, but it was not significant yet. Even live related donor transplantation was disputed by Starlz in 1987.[3] However, Terrasaki and Cecka demonstrated the advantage of related or unrelated live donor transplantation over cadaveric transplantation, despite of new medications usage. In 1998, they observed that transplantation from related or unrelated donor results in a 10-15% and 10-12% higher 1- and 5-year graft survivals than from cadaver.[4,5,6,7]

Nowadays, kidney transplantation is more requested due to better hemodialysis status and higher ESRD patients' survival. While cadaveric donation for transplantation is increasingly used

in developed countries, the number of patients waiting for transplantation has risen in parallel. For instance, annual report of Eurotransplant in 2000 revealed that only 3145 patients out of 12524 (25%) in the waiting list has received transplanted kidney of which 569 (18%) received from living donors.[8,9] Also in the United States where they have a long-term established programme for cadaver transplantation, because of the increase in ESRD patients waiting list, living donor transplantation has been increased and unrelated donors (spouse, friend, etc.), previously comprised 4.1% of the total living donors in 1988, have reached 14.2% in 1996.[5,8] At the moment, they serve as 20 to 27% of living donors for kidney transplantation in the United States.[9]

Moreover, since laparoscopic nephrectomy technique has been introduced with low postoperative complication rate, more people are encouraged to donate kidney.[4,10]

Discussion

One of the most pivotal advantages of living donor transplantation, as well as providing programmed procedure in a desirable condition and at a proper time, is that long-term hemodialysis which is associated with the risk of rejection, particularly if frequent transfusion had been required, could be prevented.[11] Consequently, some authorities prefer pre-emptive transplantation, specially in children and diabetic patients in whom dialysis leads to various medical problems.[5]

Does donation impact the donor's physical health condition?

This is a frequently asked question by donation candidates. The answer is that short-term non-specific complications such as hemorrhage, infection, wound problems, and even death are inevitable as they are in any major surgical operation, but studies with long-term follow-ups have shown that 5-year life expectancy of 35 year old donors is 99.1% which is not significantly different from that in general population (99.3%). Also an eligible life quality has been reported in kidney donors.[12,13]

Does the removal of one kidney have unfavourable effects on the other kidney?

Studies on rats have revealed that eliminating one kidney causes hyperfilteration in the form of sclerosis progression and reduction of the spared kidney function.[14,15] Whereas, 20-year follow-up of hundreds of donors and those who have lost one kidney due to urological problems, have shown that the solitary kidney has appropriate function till the end of life, besides a preliminary compensating hypertrophy,[12,13,16,17] so that the insurance companies consider kidney donors as normal individuals.[18] Few studies have reported that in long-term after donation microalbuminuria and proteinuria increases the risk of hypertension to a little extent.[19]

Although living donation has a great advantage over cadaver donation, we should consider that the removal of a normal organ from a normal individual has its own risk of complications like any other major operation. Hence, in order to reduce psychological and physical complications as far as possible, it is necessary to select and prepare the donors meticulously. Here is a review of the stages of this process:

Psychological Evaluation

Psychological assessments are necessary to confirm psychological stability of the donor, as the rate of depression, anxiety, and even suicide following the kidney donation is 1.5% or more.[20,21] These problems are often seen in the donors who were not completely contented with donation for any reason or in the cases of graft failure.

Consequently, it is recommended to continue psychological follow-up after the procedure.

When the donor is a relative of the recipient, his/her consent should be confirmed to avoid obligatory donation. It is suggested that the donor's most intimate relatives such as parents and spouse be aware of the donation procedure. This is of utmost importance in countries such as Iran in which most donors are not related to the recipient.

Donor's Age

A proper age is within the range of 18 to 60 years, but recent reports have shown that an exact age limit can't be defined, because biologic age plays a more decisive part than true age does. Kanesmasu and coworkers presented the outcomes of transplantation from 518 over-60-year-old donors and they found that although graft survival in the first years was not meaningfully different from the control group (89% vs. 91%), serum creatinine level was higher even in the fist years and 4-year graft survival difference was more pro-

nounced (76% vs. 81%). They concluded that kidney donors older than 60 should be selected for older recipients.[22,23,24]

Abo Blood Group

The Donor's ABO blood group should be matched with the recipient's. Otherwise, irreversible graft rejection will occur in the presence of blood group incompatibility. Rh factor does not impact the outcomes, so donor can be either Rh positive or Rh negative.

In the countries in which they don't use unrelated donors, due to the limited number of donors, transplantation from the donors with A2 blood group (20% of people with A blood group) or B subgroups to the recipients with O blood group have been performed successfully.

In such cases plasmapheresis precedes the procedure in order to eliminate anti-A and anti-B antibodies and to prevent acute rejection. In addition, by Donor-Specific Skin Grafting test they evaluate the preparation for transplant; any inflammatory reaction in the skin graft region predicts a poor prognosis for the kidney graft.[25,26]

Immunologic Tests

T-Lymphocyte test is the first donor-recipient immunologic test to be done. In this test the reaction between the donor's lymphocytes and the recipient's serum is studied. When more than one properly matched donor is available, the one with completely negative T-lymphocyte test will be selected.[27]

Some centers consider Mixed Lymphocyte Reaction test (MLR), but new immunosuppressive medications have disputed the value of this test and currently it is just useful to select the best donor from among the family members who all have HLA compatibility with the recipient.[27] When there are a few serologic compatible donors in a family, HLA Tissue Typing should be done to select the one who is HLA identical.

History Taking and Physical Examination

In the cases of chronic renal failure, due to Autosomal Polycystic Kidney Disease (ADPKD), Alport syndrome, hypertension, and diabetes, meticulous evaluation of the related donor is warranted. Diagnostic criteria for ADPKD have been identified; Ravine (1994) suggested the number of cysts in each kidney of the patients with positive family history detected by ultrasonographic studies be used to classify the criteria:

Two cysts in one of the kidneys or both in patients under 30 years old, two cysts in each kidney of patients between 31 and 59, and four cysts in both kidneys of over-60s must be considered as ADPDK.[27] It is also recommended to select related donors of over 30 to be able to identify the cysts by CT scan using rapid injection of contrast media and prevent transplantation of polycystic kidneys.[28,29]

Alport syndrome may present with microscopic hematuria and proteinuria in the family members and renal biopsy can provide the definite diagnosis if needed.[30] These patients should be excluded from the donors list.

Hypertension is often a hereditary transmitted disease and also, it is seen in 15 to 25% of the patients over 50 years old.[31] Consequently, candidates for kidney donation should undergo blood pressure evaluation in three separate times and sometimes even 10 times.[17] A series of examinations have been recently recommended to be done in donors with borderline blood pressure including echocardiography, intima and media thickness measurement of carotid vessels, examination of retina, and urinary albumin concentration, all demonstrating the subsequent damage to the eye and kidneys.[17] Furthermore, it has been proved that hypertension can be transmitted to the recipient by the transplanted kidney.[32]

Generally, patients with a blood pressure of 140/80 or more, with persistent diastolic pressure of over 90 mmHg, or who need medication to control the blood pressure are not appropriate candidates for donation and should be excluded.[32,33]

Diabetes Mellitus

Type II diabetes mellitus incidence is increasing nowadays; reports have shown that 6% of the people will have diabetes by the age of 50 and 20% by 70.[9,27] Thus, evaluation of latent diabetes is very crucial. In addition, there are a few reports representing the development of latent diabetes to an apparent diabetes following nephrectomy that leads to diabetic nephropathy in the donor.[34] Consequently, in some centers they evaluate related donors of a diabetic recipient by the measurement of Hb A1c2 and Anti-Islet Antibody as well as a 5-hour glucose tolerance test.[9]

In some cases proteinuria should not be present in a 24-hour urine collection specimen and it is recommended the age of the donor to be at least

10 years more than the age of the recipient at the time of diabetes onset. Eventually, kidney donation must not be done in case of a positive Glucose Tolerance Test.[9,34]

Obesity

Overweight more than 30% of the ideal body weight is a relative contraindication for donation and patients are recommended to lose weight before kidney transplantation science obesity may cause pulmonary emboli or cardiovascular complications as well as problematic nephrectomy.[8,27] A history of thromboembolism or thrombophlebitis increases the risk of pulmonary emboli in the donor, so that they had better be excluded.[15,27,33]

Paraclinical Evaluations

Biochemical and serologic tests: Complete blood count, coagulation tests, renal function tests (BUN, creatinine, and creatinine clearance), liver function tests, serum cholesterol, calcium, and phosphorous, urine analysis and culture, 24-hour urine collection test, and serologic tests for viral infections should be requested for donors.

The most common serologic tests are the ones for antiviral antibodies of CMV, HIV, Hepatitis B, Hepatitis C, HTLV I, and HTLV II.

HIV Antibody: A positive HIV Antibody is the absolute contraindication of transplantation.

CMV Antibody: CMV is one of the most prevalent post-transplant infections that can influence mortality, morbidity, and graft survival. It is also responsible for acute graft rejection. Detecting IgG antibody, using ELISA, is necessary to indicate CMV infection. The risk of CMV disease must be assessed if CMV antibody is positive.[35]

Transplantation of a recipient with negative CMV IgG from a CMV positive donor has a great risk of CMV disease in the recipient and may develop 4 to 5 weeks after the procedure. As a result, prophylactic Ganciclovir is highly recommended.[9]

Hepatitis B and C: Hepatitis is a frequent leading cause of chronic liver failure that may present with cirrhosis, liver failure, and liver cancer.[36,37] Consequently, HBs-Ag positive donors must be excluded from the transplant program, but donation from a HBs-Ag negative but HBc-Ab positive is possible since it has proved not to have any effect on the graft or morbidity and mortality at least in short-term, despite of its relative risk of HBV infection.[37]

Being Anti-HCV positive is not an absolute contraindication for kidney donation, but interferon therapy is necessary before donation, because Hepatitis B or C virus transmission is accompanied with difficulty to treatment as interferon rapidly increases rejection risk.[36] Totally, kidney donation from a hepatitis C disease positive patient is not recommended if we presume a long-term survival.[36,37,38]

HTLV I: Human Lymphotrophic Virus type I is the first known retrovirus in the human, spread worldwide. The most considerable epidemiologic characteristic of the infection is the existence of highly endemic areas such as Iran, specially Khorasan.[39] Ten to 20% of individuals with HTLV I infection will have HTLV I associated diseases such as T cell leukemia of adults, myelopathy, uveitis, etc.[39,40]

Accordingly, Anti HTLV I test is a routine examination in kidney donors and in case of a positive result transplantation should be canceled if the recipient is anti-HTLV I negative.

Radiological Studies

Imaging studies are done when all the previously mentioned steps are passed without any problem. Chest x-ray and renal ultrasonography are first to be performed. If ultrasonography showed no abnormality, a selective arteriography of the kidney with excretory phase could be requested.

Pyelocaliceal system is detectable in the excretory phase of the kidney, so that IVP is not necessary before angiography.[41] Today, we can benefit from 3-dimensional or spiral CT scan in order to investigate detailed anatomy of the kidney. This method is more helpful in centers in which laparoscopic nephrectomy is performed.[9,42]

Catheter inserting into renal vessels is no more needed when using these new methods. However, it is note worthy that making final diagnosis of vascular lesions, particularly of small renal vessels such as unilateral fibromascular dysplasia is more attainable by angiography.[43] We can use Digital Subtraction Angiography (DSA) rather than conventional angiography to avoid catheterization and its complications.[8,43]

Angiography can show the existence of one or more arteries for the kidney. It is obvious that a kidney with one artery is preferred. Also, the left kidney is more desirable due to its longer vein. We can eliminate vascular lesion after nephrectomy if anomalies such as aneurism or fibromascular renal artery stricture, limited to the beginning of

the artery, is present. However, nephrectomy is just permitted only if the spared kidney of the donor is completely normal.[8,15,44] In our center, over a 12 year period, from among 715 donors, there were 26 cases with two renal arteries and 2 cases with 3 arteries. Only 7 of 26 cases with two renal arteries were unrelated donors.

In young female donors in whom pregnancy is anticipated in the future, right kidney should be selected for nephrectomy since obstructive uropathy due to pregnancy often occurs in the right kidney. As a rule in live donor nephrectomy, the more intact kidney is preserved for the donor. This rule must be considered in all cases.

Relative and absolute contraindications of kidney donation, extracted from European Association of Urologists' (EAU) 2003 guidelines, are shown in tables 1 and 2.

As kidney transplantation is a team work and a team consisting of nephrologist, urologist, anesthesiologist, paraclinics expert, nurses, and operation room group intervene in the procedure, according to our experience, it is suggested that the completed examinations and laboratory results of both donor and recipient may be evaluated in a session by all the team members and controversial items may reassessed to arrive at the operation decision.

When all the criteria for donation to a definite recipient are achieved, the donor will be admitted a night before the operation and hydration with a saline or dextrose-saline serum can be initiated in order to preserve ample diuresis during the operation. The anesthesiologist is proposed to visit the donor before the procedure and skilled nurses should educate the patient to prevent post-operative atelectasis and thromboembolic complications.

After the anesthesia is brought off and before the skin incision, an intravenous injection of a first or second generation of Cephalosporines (1gr) is suggested.

Finally, it is strongly recommended that shaving to be done in the operation room.[27]

TABLE 1. *Contraindications for kidney donation (EAU Guideline, February 2003 Renal Transplantation)*

Absolute contraindications
Age under 18
Hypertension (more than 140/90, requiring medical therapy)
Diabetes (impaired GTT or Hb A1c)
Proteinuria more than 300 mg/24h
Microscopic hematuria
History of thrombosis or thromboembolism
Significant underlying disease (Chronic pulmonary disease, malignant tumors, cardiovascular disease)
History of renal calculus
Relative contraindications
Donated kidney anomaly (urologic or vascular)
Obesity (30% more than the ideal body weight)
Psychological disorders

TABLE 2. *Factors indicating that the donor is not a good candidate for kidney donation (EAU Guideline, February 2003 Renal Transplantation)*

Decreased GFR which is abnormal for the donor's age
Proteinuria more than 300 mg/24h
Microhematuria unless urologic and renal evaluations are normal
Multiple renal calculi
Polycystic kidney
Three or more renal arteries
Family history of ADPKD except the cases over 30 years old in which ultrasonography or CT scan results are normal
Fibromascular dysplasia of both renal arteries

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