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Physical activity in elderly Kidney Transplant patients with Multiple Renal Arteries

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ABSTRACT

Kidney transplantation is the treatment of choice for patients with end-stage disease. To expand the donor reserve, it is necessary to use marginal/sub optimal donors that provide marginal organs. We retrospectively evaluated the short and long-term outcome of elderly kidney transplantation using allografts with vascular abnormalities. Between January 1999 and December 2018, 740 transplants from cadaveric donors were performed. Thirty-four elderly patients received a kidney transplantation with vascular anatomical variants (Group 1) were compared with 34 patients who received a kidney transplantation with single renal artery (SRA) (Grroup2) pair-matched by age, dialysis age, donor age, comorbidity.

All participants completed the Long Form International Physical Activity Questionnaire (IPAQ) at baseline and after 4, 8, and 12 weeks after transplantation. The overall rate of surgical complications was 17.6% in Group 1 and 20.6% in Group 2, indicating that kidney with vascular anatomical variant might be successfully transplanted.

Our data also emphasizes the importance of individualized physical activity in kidney transplantation with multiple arteries. Physical activity should be considered as an essential part of the medical care for renal-transplanted recipients.

Key words: Physical activity, Kidney Transplantation, Elder Age, Vascular Anomalies, Marginal Kidneys

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1. INTRODUCTION

Renal transplantation is the treatment of choice for patients with end-stage renal disease [1-7]. Kidneys for transplant come from a living donor or a deceased (cadaver) donor; in Italy, more frequently in the south of country, cadaveric donors are still the major organs source [8-11]. To expand the donors' pool, it is also necessary to use marginal donors who provide marginal organs. Given the donor scarceness the possibility to transplant a kidney with vascular anomalies, i.e. sub-optimal kidneys, should considered [12-17].

A kidney is considered suboptimal when, it presents complex arterial anomalies (more than 2 arteries, with single patch or separated patches requiring a double anastomosis or a bench reconstruction), or parenchymal damage (focal sclerosis areas or sutured polar branches accidentally damaged during the organ harvesting, or kidneys with complex anomalies of the excretory tract) that can lead to a reduced nephron mass but not its quality [18-21].

In the past, the kidneys with anatomic anomalies were not considered for transplantation, but now, due to the increasing demand for transplantable kidneys, the criteria for renal transplantation [22-24] were expanded so to include also suboptimal kidneys [25-30].

Renal anatomic anomalies are frequently observed during kidney transplantation, the most common being multiple renal arteries (18-43% of cases) [31,32] which does not exclude the possibility of using such kidneys for transplantation.

Physical activity is recommended for kidney transplant recipients as it may improve exercise capacity, muscle strength, and health-related quality of life. [33-36]

In this study, we analyze the short- and long-term outcomes of kidney transplantation using allografts with vascular anomalies in 34 kidney-transplanted patients between January 1999 and December 2018 at our center. The effect of physical activity during the follow-up was also evaluated.

2. PATIENTS AND METHODS

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Between January 1999 and December 2018, 740 transplants from cadaveric donors were performed at the Department of Nephrology, Urology, General Surgery and Kidney Transplants, Anesthesiology and Intensive Care, University Federico II, Naples. Between these 740, we selected 34 kidneys with vascular anatomical variants, i.e. sub-optimal kidneys (Group 1). The 34 patients who received these 34 kidneys were compared with 34 single renal artery (SRA) recipient (Group 2), chosen for homogeneity of characteristics (pair-matched by age, dialysis age, donor age, comorbidity).

We retrospectively compared the incidence of surgical complications, post-transplant hypertension, mean creatinine clearances and graft survivals between patients in these two groups.

2.1 Physical activity

All patients completed the Long Form International Physical Activity Questionnaire (IPAQ) at baseline (kidney transplant) and after 4, 8, and 12 weeks after transplantation. Physical activity and sitting times were measured using the long form, past 7-day, self-administered IPAQ [37]. The most common methods used to evaluate physical activity are based on self-reported questionnaires, which are easy to use and inexpensive. Indeed, it has been reported that using the International Physical Activity Questionnaire (IPAQ), that is one of the most complete and commonly used, the relationship between physical activity and some diseases risk factors is hidden. The IPAQ used in our study contained 27 questions concerning physical activity, accompanied by 4 questions providing demographic data such as sex, age, educational level, and type of professional activity. Five activity domain areas were considered: job-related physical activity; transportation physical activity; housework, house maintenance, and caring for family; recreation, sport, leisure-time physical activity; and time spent sitting. The IPAQ assesses frequency (days), duration (minutes), and intensity (light, moderate, vigorous) of physical activity. Moderate physical activity was defined as “those activities that take moderate physical effort and make you breathe somewhat harder than usual”; vigorous physical activity was defined as “those activities that take hard physical effort and make you breathe much harder than normal.” [38].

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For each patient, the program of physical activity was adjusted to the patient's baseline level of physical activity and consisted of a choice of endurance training involving walking or cycling. The management of our patient required a monthly physician evaluation for at least 12 months after kidney transplantation. Subjects performed the exercises 5 days per week. From the third week on, the exercises were performed individually at home. During the first week, each exercise session lasted 20 minutes and, then it was gradually increased to 2 hours in the fourth week.

Weekly exercise included 5x10 minutes of cycling on a stationary bike at a moderate intensity and 3x10 minutes of resistance exercise. Resistance training involved six exercises (chest press, upright-seated row, triceps extension, biceps curl, chest fly, and shoulder extension) performed using three set of 3-5 repetitions for each exercise.

Before the start of the exercise training, each patient underwent a check-up consisting of physical examination, electrocardiography, and a baseline assessment of body mass index, general nutritional condition, anthropometry, body composition, and measurement of biochemical parameters.

3. RESULTS

Due to the shortage of donors, the use of suboptimal kidneys is increasing in our Transplant Unit. We compared 34 patients in Group 1 who received a kidney with multiple renal arteries (MRA) (Figure 1) with those in Group 2 who received a kidney with a single renal artery (SRA). In Group 1, the recipients' age ranged from 55 to 63 years and the donors' age from 43 to 56 years; in Group 2, the recipients' ranged from 55 years to 58 years and the donor age was from 41 to 55 years (Table 1). Among our deceased donors in Group 2, the causes of death were cerebrovascular accidents in 30 and traumatic injury in the remaining four; whereas in Group 1, 28 donors died for cerebrovascular accidents and six traumatic injuries.

We compared the incidence of post-transplant arterial hypertension and mean creatinine levels after 1, 3 and 5 years of follow-up [39-41]. The mean systolic blood pressure at 1 year was higher among

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patients in Group 1, but over time (1 years versus 5 years), the mean arterial hypertension decreased slightly in both Groups. (Table 1)

Creatinine levels at 1 year ranged from 0.8 mg/dl to 2.5 mg/dl in patients the group 2 and from 0.6mg/dl to 2.2 mg/dl in those the Group 1; over time (1-year vs 3 years). There were a decrease in mean creatinine levels in both Groups. (Table 1)

The overall surgical complications rates in Group 2 and 1 were 20.6% and 17.6% respectively, a difference not significant to statistical analysis. There was no case of vascular complication in Group 2 while in Group 1 one patient developed thrombosis of renal artery without loss of the graft and with a partial loss of healthy parenchyma. Urologic complications recurred in 2.9% of cases in Group 1 and in 8.9% in Group 2. There were 4 cases of symptomatic lymphoceles in both Groups. (Table 2) Patients with complication after surgery were not evaluated for physical activity (7 cases in Group 1 and 8 in Group 2).

In the first two months after kidney transplantation patients in both groups increased the home-based activity to 10 minutes aerobic exercises 4 times a day. Beginning from the 3rd months the exercises program favored the hobbies of the patients including gardening activity for about 10-20 minutes and walking in a row for at least 20 minutes daily and a physical activity of at least 20 minutes consisting in a fast ride in the open air three times a week and in a moderate physical activity in the remaining two days (30-35 consecutive minutes of cycling at a regular pace and carrying light weights).

Most of the patients reported an increases physical activity after transplantation, as compared with the pre-transplant period, but 9% of patients reported less activity (5% in Group 1 and 7% in Group 2); no change in physical activity was observed in 5% of patients in Group 1 and in 6% of patients in Group 2.

During the follow-up period a moderate physical activity was reported by the patients in both groups, considering of 3 or more days of vigorous intensity of at least 20 minutes a day, or walking of at least 30 min/day, and of 3 or more days of any combination of walking, or moderate intensity activity, achieving a minimum of at least 500 MET-min/week.

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4. Discussion

Renal transplantation is the treatment of choice for patients with end-stage renal disease. For many years, transplants with MRA have represented a relative contraindication because of the increased risk of vascular and urologic complications, possibly leading to allograft loss [42-46].

In our series, we found no difference in short- and long-term kidney graft outcomes based on the number of renal arteries and the technique used for anastomosis [47-50]. The presence of aortic patch does not have an impact on graft outcome or on the rate of complications. The incidence of renal graft vascular thrombosis, a serious complication which usually lead to graft loss if untreated, have remained stable during the last three decades, ranging from 0.3% to 6.1% [51].

Lack of physical inactivity is a major risk factor for mortality in the general population. A weekly program of physical exercise of 3-5 hours improves the cardiorespiratory fitness, decrease the risk of cardiovascular disease and improve quality of life in the kidney transplant setting [52-55]. It has been shown that level of physical activity may independently predict mortality in chronic kidney diseases [56]. In addition, an increase physical activity as compared with the pretransplant period is correlated with the correction of uremic toxicity.

The beneficial effects of physical activity on physical outcomes and quality of life should induce changes in lifestyle directed toward regular physical activity, as it has been reported in kidney transplantation patients and hemodialysis patients [57-59]. Mazzoni et al. observed that regular physical activity improves health-related quality of life in kidney transplant patient. [60]

Our experience has showed that the presence of kidney vascular anomalies should not be considered a limit for kidney's transplantation. Therefore, kidneys with multiple renal arteries could be transplanted using the technique that best fits in each surgical situation according to the opinion of surgeons [61].

We consider that the success obtained with suboptimal kidney transplantation and with the associated physical activity allowed to extend the utilization of suboptimal kidneys.

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Legend to the figure

Figure 1. Multiple renal transplant arteries: renal transplant offering three arteries on one patch.

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Table 1. Clinical Characteristics of patients who underwent kidney transplantation: MRA versus SRA groups.

Characteristic	Group 1 (MRA)	Group 2 (SRA)
Number of recipients	34	34
Recipient age, years (M± SD)	55 ± 8	55 ± 7
Donor age, years (M± SD)	41 ± 14	43 ± 13
Postoperative Creatinine clearance, mL/min (M± SD)		
1 years	2.2 ± 0.6	2.5 ± 0.8
3 years	2.1 ± 0.3	2.2 ± 0.7
5 years	2.0 ± 0.2	1.8 ± 0.4
Mean Systolic blood Pressure, MmHg (M± SD)		
1 years	130 ± 10	125 ± 9
3 years	132 ± 7	112 ± 8
5 years	120 ± 6	110 ± 9

MRA: multiple renal artery group; SRA: standard renal artery group.

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Table 2. Postoperative Complications after MRA versus SRA Transplantation

Complication	Group 1 (MRA)	Group 2 (SRA)
Number of recipients	34	34
Vascular, N (%):		
Renal Artery thrombosis	1 (2.9%)	0
Urologic, N (%):		
Leakage	1 (2.9%)	1 (1.9%)
Stricture	0	2 (5.8%)
Lymphocele	4 (11.8%)	4 (11.8%)
Total	17.6%	20.6%

MRA: multiple renal artery group; SRA: standard renal artery group.

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Figure 1.