Can Solid-Organ–Transplanted Patients Perform a Cycling Marathon? Trends in Kidney Function Parameters in Comparison With Healthy Subjects

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ABSTRACT

Background. Few solid-organ–transplanted patients (TP) perform regular sport activity. Poor data are available on the safety of intense and prolonged physical exercise on this population. The aim of the study was to evaluate kidney function parameters in a group of TP in comparison with healthy volunteers (HV) involved in a long-distance road cycling race: length 130 km and total uphill gradient, 1871 m.

Methods. Nineteen TP were recruited: 10 renal, 8 liver, and 1 heart and compared with 35 HV. Renal function parameters, namely, creatinine, estimated glomerular filtration rate (eGFR), urea, uric acid, urine specific gravity, microalbuminuria, and proteinuria were collected and their values were compared the day before the race (T1), immediately after crossing the finish line (T2), and 18 to 24 hours after the competition (T3).

Results. No adverse events were recorded. At baseline, TP showed lower values of eGFR (69 ± 22 versus 87 ± 13 mL/min/1.73 m^2), lower urine specific gravity (1015 ± 4 versus 1019 ± 6), and higher microalbuminuria (56 ± 74 versus 8 ± 15) and proteinuria values (166 ± 99 versus 74 ± 44) (in mg/L). At T2 in both groups, renal function parameters showed the same trends: decline of eGFR (54 ± 19 versus 69 ± 15 mL/min/1.73 m^2) and rise in protein excretion. At T3, functional parameters returned to baseline, except for urine specific gravity values remaining stable in TP (1018 ± 6) and growing higher in HV (1028 ± 4).

Conclusions. Selected and well-trained organ-transplanted patients can perform an intensive exercise, displaying temporary modifications on kidney function parameters comparable to healthy subjects, despite differences related to baseline clinical conditions and pharmacological therapies.

RELATIONSHIPS between physical activity and cardiovascular health have been well established [1,2]. Despite this evidence, however, the vast majority of transplanted patients remain sedentary, even though cardiovascular morbidity is one of the most important and recurrent cause of mortality and morbidity. Transplant physicians do not prescribe routinely physical activity as a therapeutic tool, either. This behavior is partly due to the lack of knowledge regarding the safety in this specific subgroup of patients, in particular about intensive

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exercise. Modification on glomerular filtration and proteinuria during exercise are known in the general population [3,4] but little experience is available about the possible dose-related risk of kidney injury during sporting activity in solid-organ–transplanted patients [5]. There are poor data about the functional kidney adaptations that occur during intense and prolonged physical exercise in patients receiving immunosuppressive therapy with nephrotoxic effects [6,7].

The aim of this paper was to contribute in describing functional kidney changes in prolonged and intense exercise and their possible implications in any additional risks of kidney injury. Renal function parameters were recorded in a group of solid-organ–transplanted patients and compared with healthy subjects involved in a long-distance road cycling race.

METHODS

The Race

The length of the race was 130 km; total uphill gradient, 1871 m; uphill riding, 50 km over 4 hills; downhill riding, 46 km; and flat terrain, 34 km. The temperature was 12.6 °C at the start and 18.9 °C at noon.

Inclusion and Exclusion Criteria

We included male subjects who usually practice cycling and voluntarily participated in the race. The healthy volunteers (HV), used as a control group, were amateur cyclists informed by the organization of the study through a newsletter who reported no significant clinical problem, with blood pressure (BP) values within the normal range (<140/80 mm Hg). Solid-organ–transplanted patients (TP) were enrolled with the support of ANED Sport (Associazione Nazionale Emodializzati, Dialisi e Trapianto), an association involved in promoting physical activity after transplantation. Patients were transplanted at least 1 year previously and were between 18 and 80 years of age, with good blood pressure control (BP <140/80 mm Hg), and they all had gone through a preliminary evaluation for their eligibility to perform physical activity: ergometric and cardiac function tests for assessing the likelihood of cardiovascular events (detection of eventual silent heart disease) as previously described [7].

Exclusion criteria included unstable cardiovascular pathology and diabetes.

Protocol

1. Baseline overall medical assessment of all the subjects, with collection of anamnestic data, information on drug therapy, measurement of resting heart rate and BP; questionnaire investigating the level of training carried out throughout the year and in preparation for the race expressed as amount of training workouts per week and hours of training for each session;
2. Collection of venous blood (30 mL) and urine (30 mL) samples at time 1 (T1) (the day before the race), time 2 (T2) (immediately after crossing the finish line), and time 3 (T3) (18–24 hours after competing);
3. Amount of fluid ingestion (mL) during the race was recorded at T2.

Table 1. Demographic Historical Characteristics

	Transplanted Patients (n = 19)	Healthy Volunteers (n = 35)
Organ transplanted		
Single kidney	10	0
Liver	8	
Heart	1	
Time from transplant (years)	9.3 ± 5.1	/
Age (years)	52 ± 9	50 ± 10
BMI (kg/m^2)	23.7 ± 1.7	24.1 ± 2.3
Immunosuppressive therapy		
Tacrolimus/cyclosporine	15	None
Steroids	8	
Mycophenolic acid	8	
Everolimus	4	
Hypertension therapy	14	1
Anti-hypertensive therapy		
ACE inhibitors	7	1
β-Blockers	7	
Calcium channel blocker	1	
Workouts per week (n)	3.3 ± 1.7	2.8 ± 1.1
Training time for each session (hours)	2.8 ± 0.8	2.8 ± 0.8

Continuous variables are expressed as means ± standard deviation; categorical variables as absolute numbers.
Abbreviation: BMI, body mass index.