DOI: 10.15825/1995-1191-2019-4-14-19

LIFE EXPECTANCY OF HEART RECIPIENTS WITH DONOR-TRANSMITTED CORONARY ATHEROSCLEROSIS

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Introduction. Heart transplantation (HT) is an extreme treatment for chronic congestive heart failure. One of the ways of reducing deficit of donor organs was to expand the criteria for selection of donors in favor of heart retrieval from older donors. This became one of the causes increasing the risk of donor-transmitted coronary atherosclerosis (DTCA). The impact of endovascular DTCA correction on postoperative survival of heart recipients remains poorly studied. **Objective:** to estimate the life expectancy of heart recipients with donor-transmitted coronary atherosclerosis. **Materials and methods.** The life expectancy of 518 heart recipients who underwent coronarography during the first week after HT was evaluated. When hemodynamically significant stenosis of the coronary arteries was detected, percutaneous coronary intervention (PCI) was performed as planned. The average age of recipients was 46.92 ± 1 year (10 to 72 years). 90% of them were men. Recipients' initial UNOS status was distributed as follows: UNOS 1a – 217 people, UNOS 1b – 89 and UNOS 2 – 212. Two groups were formed based on coronary angiography results. Group 1 included patients with DTCA signs, Group 2 was the control group (without DTCA). The first group was divided into 2 subgroups – a subgroup with DTCA signs, but without hemodynamically significant lesions (without PCI), and a subgroup with DTCA, where PCI was performed (PCI). **Results.** The age of recipients in both groups (DTCA and without DTCA) did not differ – 47.54 ± 1.01 and 46.64 ± 0.64 years, respectively. Donors were older in the DTCA group (50.2 ± 0.7 years) than in the control group (41 ± 0.5 years) (p = 0.0005). Survival in the control group averaged 58.25 ± 1.17 months, and in the DTCA group – 53.16 ± 0.36 months (p = 0.033). The difference in life expectancy of patients who underwent PCI (51.18 ± 2.9 months) and patients of the control group (58.25 ± 1.17 months) was not statistically significant (p = 0.88). In the group where graft showed signs of atherosclerotic changes in the coronary arteries, the cause of donor brain death from cerebrovascular accident was more common than in the control group. **Conclusion.** The risk of DTCA is associated with the donor's age and the death of the donor brain from vascular causes. Endovascular correction of atherosclerotic lesions of coronary arteries makes it possible to neutralize the impact of transplant coronary artery stenosis on long-term outcome of HT surgery.

Keywords: heart transplantation, donor-transmitted coronary atherosclerosis, percutaneous coronary intervention.

INTRODUCTION

HT is the only extreme therapy for chronic congestive heart failure [1, 2]. However, donor organ shortage limits its capabilities [3]. Therefore, optimization of HT treatment approaches is required. Recently, expanding the donor selection criteria has been used to address the problem of donor organ shortage [4, 5]. These changes led to retrieval of hearts from older donors, which in turn resulted in increased risk of DTCA [6]. Life-time pre-transplant diagnosis of atherosclerosis in potential donors is not always possible. Some transplant centers perform HT already with the presence of atherosclerotic lesions in coronary arteries, which were earlier detected in a potential cardiac donor via preliminary coronary angiography and intravascular ultrasound (IVUS). Under such conditions, HT requires simultaneous myocardial revascularization by coronary artery bypass grafting (CABG) or delayed percutaneous coronary intervention (PCI) [7–9]. However, in most cases, DTCA requires correction already in the post-transplant period. PCI has become the preferred method of revascularization. Assessing the prognosis for survival in such patients after DTCA correction remains a pressing issue.

Objective: to estimate the life expectancy of heart recipients with DTCA.

MATERIALS AND METHODS

A total of 518 angiograms of heart recipients who underwent treatment at our Center from 2013 to 2018 were analyzed retrospectively. Follow-up results of heart recipients who underwent coronarography within a week

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after HT were presented. Endovascular revascularization was performed during the first month whenever hemodynamically significant lesions were detected. The age of the subjects ranged from 10 to 72 years (average 46.92 ± 1), 90% were men. Recipients' initial UNOS status was distributed as follows: UNOS 1a – 217 people, UNOS 1b – 89 and UNOS 2 – 212. All the patients were divided into two groups: group 1 included patients who, according to coronary angiography, had signs of DTCA, while group 2 was the control group (without signs of DTCA). The first group was divided into 2 subgroups – a subgroup with DTCA signs, but without hemodynamically significant lesions, and a subgroup with DTCA, where atherosclerotic lesions in the coronary arteries were hemodynamically significant and required PCI. All patients underwent standard examinations, which included electrocardiography (ECG) and echocardiography (echo). ECG included 12-lead recordings on a Siemens Megacart device (Germany). An echo was performed on a GE Vivid E9 device (USA). The examination included 2D echo to determine the left ventricular volumetric characteristics using the area-length method – left ventricular end-diastolic volume (LVEDV) and left ventricular end-systolic volume (LVESV) – with calculation of the left ventricular ejection fraction (LVEF). Pulmonary blood pressure was estimated via doppler echocardiography. Degree of mitral regurgitation was estimated from 0 to 3. Coronary angiography was performed using the Judkins technique on a Siemens Axiom Artis angiography system (Germany) and Philips Allura Xper imaging system (Netherlands). PCI was performed via femoral arterial access using standard doses of heparin (5000 units) and stenting of the affected segments of arteries. In all cases, we performed complete revascularization, usually in one procedure. Stenosis of over 70% in the main branches (arterial diameter of at least 2.5 mm) were eliminated in all cases. In addition to evaluating recipients, the gender, age, and causes of death of heart donors were analyzed. These studies were processed by parametric statistics methods using Microsoft Excel and IBM SPSS Statistics 22.0. The study presented the arithmetic mean values of indicators and standard errors of mean. Significance of differences was evaluated via nonparametric tests: the Wilcoxon test for paired comparisons of dependent variables and the Mann–Whitney U test for comparing independent variables. Survival analysis was performed using the Kaplan–Meier estimator.

RESULTS

The average age of recipients in the DTCA and non-DTCA groups did not differ – 47.54 ± 1.011 and 46.64 ± 0.640 years, respectively. The initial UNOS status for different groups is presented in table 1.

Men made up 75% of heart donors in both groups. The average age of donors was significantly higher in the DTCA group than in the control group – 50.2 ± 0.7 and 41 ± 0.5 years, respectively (p = 0.0005). It should be noted that in the group with atherosclerosis, donors' mortality rate from cerebrovascular accident was over 15%, which may indicate systemic atherosclerotic processes. The characteristics of donors are presented in table 2.

Survival rates did not significantly differ among the groups – 26.54 ± 0.945 months in the DTCA group and 29.47 ± 0.95 months in the control group. Kaplan–Meier survival analysis for the groups is shown in Fig. 1.

The impact of initial UNOS status on survival in the post-transplant period was considered. The survival rates (depending on the initial UNOS status) are shown in Fig. 2.

Analysis of recipient subgroups in the DTCA group showed a significant difference in the average age of the donor, which was greater in the subgroup of patients who underwent endovascular revascularization. All other donor characteristics investigated did not differ (Table 3).

Table 1

Initial UNOS status of patients

Parameter	PCI subgroup, n = 65	DTCA subgroup, without PCI, n = 101	Control group, n = 352	DTCA group, n = 166
UNOS 1a	31 (47.5%)	47 (46.5%)	139 (39.5%)	78 (47%)
UNOS 1b	9 (14%)	19 (19%)	61 (17%)	28 (17%)
UNOS 2	25 (38.5%)	35 (34.5%)	152 (43.5%)	60 (36%)

Table 2

Main parameters of donors

Parameter		Control group, n = 352	DTCA, n = 166	p
Donor age (years)		41.40 ± 0.593	50.20 ± 0.714	0.0005
Donor gender	M.	270 (77%)	126 (76%)	0.525
	F.	82 (23%)	33 (20%)	0.525
	Unknown	0 (0%)	7 (4%)	0.525
Brain death caused by stroke		214 (61%)	126 (76%)	0.029

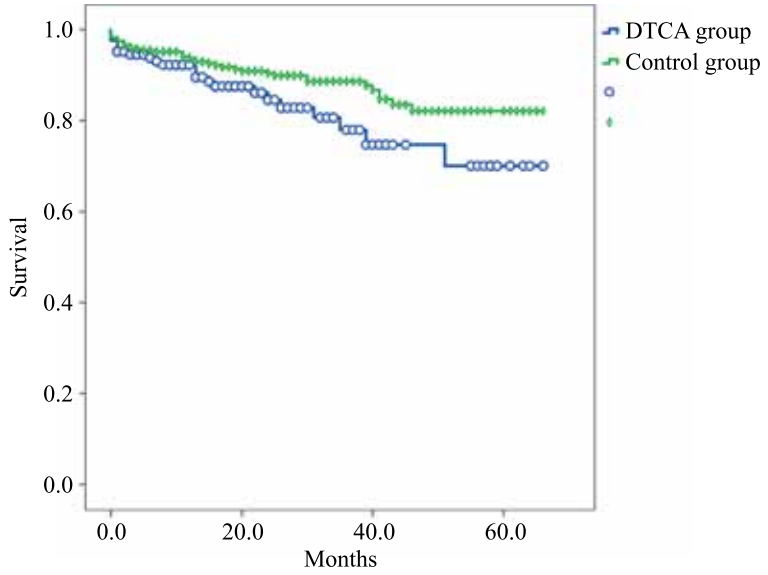

Fig. 1. Kaplan–Meier survival curves of patients after heart transplantation

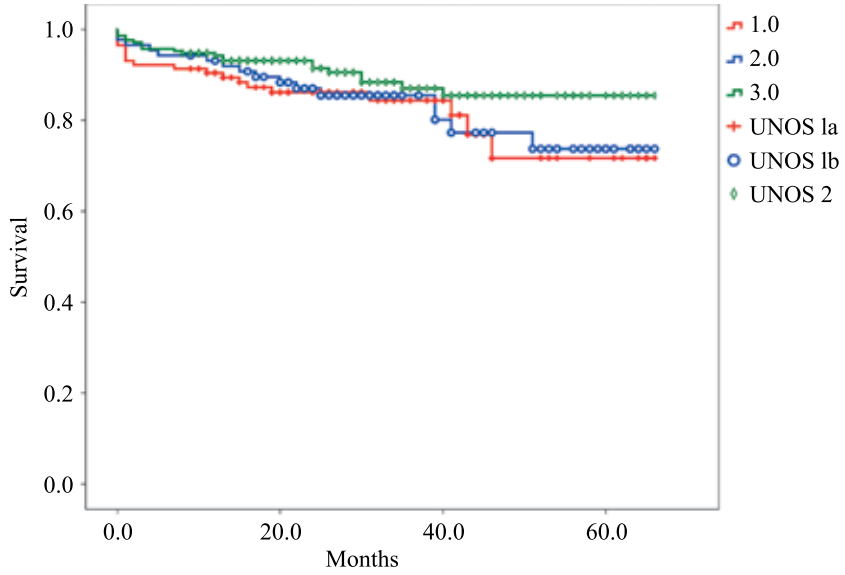

Fig. 2. Kaplan–Meier survival curves of patients after heart transplantation, depending on the initial UNOS status of the recipient

Table 3

Characteristics of donors in DTCA patient subgroups

Parameter		DTCA subgroups		p
		PCI, n = 65	Without PCI, n = 101	
Donor age (years)		52.65 ± 0.932	48.67 ± 0.976	0.011
Donor gender	M.	53 (81.5%)	73 (72.1%)	0.525
	F.	10 (15%)	23 (23%)	0.525
	Unknown	2 (3.5%)	5 (4.9%)	0.525
Brain death caused by stroke		50 (77%)	76 (75%)	0.029

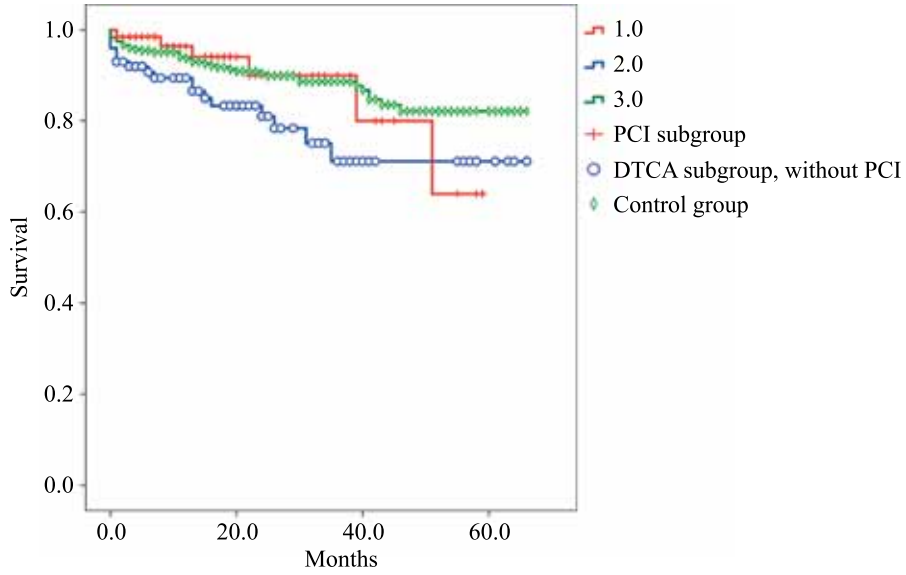

Fig. 3. Kaplan–Meier survival curves of patients after heart transplantation

Analysis of survival rates in the DTCA subgroup showed that the PCI group had better survival. Survival curves for subgroups are shown in Fig. 3.

CONCLUSION

Data presented suggests that the older the donor, the higher the risk of atherosclerosis and its transmission to the heart recipient. Donor brain death resulting from vascular causes may indirectly indicate generalized atherosclerotic processes in the body. Heart transplantation performed for UNOS status 2 recipients is prognostically more favorable for further survival than for UNOS status 1 recipients.

The authors declare no conflict of interest.

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The article was submitted to the journal on 3.10.2019