ORIGINAL ARTICLE

Early Period Impact of Renal Function Changes Following Renal Transplantation on Optical Coherence Tomography Disc Parameters

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ABSTRACT

Purpose: It was aimed to investigate the changes in optical coherence tomography (OCT) disc parameters, intraocular pressure (IOP) and mean blood pressure (MBP) measurements of the patients underwent renal transplantation with the diagnosis of end-stage renal failure and to evaluate their relationship with the glomerular filtration rate (GFR).

Materials and Methods: This retrospective study included right eyes of 36 patients. wereisIn addition to the findings of ophthalmologic examination; OCT disc parameters obtained using Zeiss Cirrus OCT (CIRRUS™ HD-OCT 5000) device, cubital blood pressure values, GFR values and IOP measurements were evaluated before the transplantation surgery (baseline) and at the end of postoperative month 1. Postoperative renal function was assessed using GFR. was The effects of renal function on OCT disc parameters, IOP measurements and MBP values were evaluated.

Results: There were 20 women and 16 men in the study. The mean age was 28.10±8.25 years. There were no significant difference in MBP and mean Retinal Nerve Fiber Layer (RNFL) thickness between baseline and on postoperative month 1 (p=0.21;p=0.85 respectively). Mean IOP value was 14.11±2.20 mm-Hg at baseline and 13.95±3.02 mmHg on postoperative month 1, indicating no significant difference (p=0,55). The GFR was 8.15 mL/min/1.73 m^2 at baseline and 66.3 mL/min/1.73 m^2 on postoperative month 1, indicating significant difference u(p<0.001).

Conclusion: Despite the fact that there is a significant difference in between GFR values after renal transplantation surgery, no significant difference was detected in OCT disc parameters was not before and after transplant surgery. This study demonstrated that renal function does not have an effect upon OCT disc parameters.

Key Words: Disc OCT, Renal Function, Renal Transplantation.

INTRODUCTION

Chronic renal failure (CRF) is one of the leading global health issues.[1] The etiology of CRF include congenital causes such as diabetes mellitus, hypertension, glomerulonephritis, obstructive uropathy and polycystic renal disease.[2] In 1970s, it was considered that dialysis is the most suitable treatment modality for patients with diagnosis off CRF.[3] The improvement in the success of renal transplantation has started to change this idea.[4] In addition, it is well-known that renal transplantation reduces mortality with improved quality of life and is more affordable than hemodialysis. It is though that all individuals with end-stage renal disease should be evaluated for renal transplantation.[5-7]

The optical coherence tomography (OCT) is a technique designed to qualitative and quantitative change of anterior segment, optic nerve and retina in vivo. By advancing technology since first introduction in 1991, new generation spectral domain (SD)-OCT has become an important component of ophthalmological assessment.[8] In recent years, the swept source OCT is using longer wavelength which allows better penetration. The technology allows us better assessment of the diseases which affect optic nerve head.[9]

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In the literature, there are studies investigating retinal nerve fiber layer (RNFL) thickness before and after hemodialysis in patients with chronic renal failure (excluding diabetic patients), suggesting no significant difference in RNFL thickness after hemodialysis. In addition, mean RNFL thickness was found to significantly lower in CRF patients when compared to healthy control.[10] In a study by Liu et al., it was shown that RNFL thickness was correlated with renal function in diabetes mellitus-related CRF patients. Moreover, authors suggested that RNFL measurement can be used to predict renal functions.[11]

To best of our knowledge, there is no study investigating the effects of changes in renal function after renal transplantation on OCT disc parameters in the literature. In this study, our aim was to investigate changes in glomerular filtration rate after transplantation and their effects on OCT disc parameters.

MATERIALS AND METHODS

This retrospective study included OCT parameters routinely obtained before transplantation (T=0) and on month 1 after transplantation (T1) from patients presented to ophthalmology department of Başkent University, Medicine School and underwent renal transplantation with diagnosis of end-stage renal disease in the general surgery department of Başkent University, Medicine School. The study was approved by Advisory Committee of Scientific Research Project of Başkent University, Medicine School (Project ID: KA20-323). The study received financial support from Research Fund of Başkent University. The study was conducted in accordance to Helsinki Declaration.

The study included right eyes of 36 patients (20 women, 16 men) who presented to general surgery outpatient clinic of Başkent University, Medicine School and underwent renal transplantation with diagnosis of end-stage renal disease. In addition to comprehensive ophthalmological examination before renal transplantation, OCT disc parameters, blood pressure value and glomerular filtration rate (GFR) values used to monitor renal function were evaluated in patients diagnosed with end-stage renal disease secondary to glomerulonephritis, reflux nephropathy and nephrolithiasis. On postoperative month 1, ophthalmological examination, OCT parameters, blood pressure values and GFR results were re-assessed in patients receiving acetyl salicylic acid, trimethoprim-sulfamethoxazole, valganciclovir, tacrolimus, prednisone and mycophenolate after renal transplantation.

The study included patients with available ophthalmological examination (including visual acuity measurement, IOP measurement, biomicroscopic anterior segment examination and dilated fundus examination at T0 and T1.

The patients with comorbid macular or choroidal disease, those with glaucoma, those with >3 diopter myopia or hypermetropia, those with previous history of ocular or orbital surgery, those underwent transplantation with diagnosis of CRY resulted from diabetes mellitus or hypertension, those with graft rejection and those without high-quality OCT disc measurements were excluded.

W retrospectively evaluated optic disc parameters as measured by Zeiss Cirrus OCT device (CIRRUS™ HD-OCT 5000), blood pressure measured manually at cubital region, and GFR results in patients with available best-corrected visual acuity measurement, intraocular pressure as measured by non-contact tonometry (Riecher 7.R7] non-contact tonometry), anterior segment findings by biomicroscopy and dilated fundus examination at T0 and T1. The blood pressure measurements were performed manually from cubital region by same researchers independently. Mean blood pressure (MBP) was calculated using following formula: MBP=systolic blood pressure+ (2x diastolic blood pressure)]/3

Statistical analysis

All data were analyzed using SPSS for Windows version 22.0 (SPSS, IBM Inc., Chicago, IL, USA). The normal distribution of pre-transplant and post-transplant measurements were assessed using Kolmogorov-Smirnov test. The data with normal distribution were analyzed using Paired sample's t test.

RESULTS

The study included right eyes from 36 patients. There were 20 women and 16 men in the study. The mean age was 28.10±8.25 years ranging from 18 to 49 years. Mean duration of dialysis was 3.9±1.25 years. In all patients visual acuity as measured by Snellen charts was 20/20 at baseline (T0) and on postoperative month 1 (T1). There was no significant difference in RNFL thickness between T0 and T1 ($p=0.85$; Table 1). Again, no significant difference was found in mean blood pressure between T0 and T1 ($p=0.21$; Table 1). Mean IOP was measured as 14.11±2.20 mmHg at T0 ad 13.95±3.02 mmHg at T1, indicating no significant difference ($p=0.55$). The mean GFR was 8.15 mL/min/1.73 m^2 at baseline and 66.3 mL/min/1.73 m^2 on postoperative month 1, indicating significant difference ($p<0.001$).

DISCUSSION

In this study, there was no significant difference in OCT disc parameters obtained before transplantation and on postoperative month 1. Although there was robust,

Table 1: *Comparison of optic disc, MBP and GFR values.*

	T0 (±SD)	T1 (±SD)	P value
Mean RNFL thickness (µm)	112.43 (±20.03)	112.62 (± 20.56)	0.85
Rim area (mm^2)	1.77 (±0.30)	1.74 (±0.29)	0.35
Disc area (mm^2)	2.04 (±0.40)	2.05 (±0.43)	0.88
Cup/Disc Ratio	0.30 (±0.18)	0.32 (±0.17)	0.15
Cup volume (mm^3)	0.068 (±0.11)	0.70 (±0.11)	0.085
MBP (mm-Hg)	83.12 (±5.99)	85.80 (±6.21)	0.21
GFR (mL/min/1.73 m^2)	8.15 (±2.11)	66.3 (±17.90)	**<0.001***

RNFL: Retinal nerve fiber layer, MBP: Mean blood pressure, GFR: Glomerular filtration rate, SD: Standard deviation, T0: before transplantation, T1: on month 1 after transplantation, '*' Statistically significant p value

significant changes in GFR after transplantation, it was seen that the changes had no effect on OCT disc parameters.

In the literature, RNFL thickness was monitored for 6 months in dialysis patients and it was found that RNFL thickness was decreased during follow-up.[12] Optic neuropathy is a known complication in CRF patients undergoing dialysis. It is thought that toxicity, ischemia and comorbid systemic disorders are mechanisms underlying optic neuropathy.[13] In the literature, there is no study investigating changes in RNFL thickness by GFR which is a success criterion for renal transplantation and used in the follow-up of the patients. To best of our knowledge, this is the first study evaluated changes in OCT disc parameters before and after renal transplantation by GFR, a marker of renal function.

In this study excluding patient groups such as proliferative diabetic retinopathy, systemic hypertension and advanced age which may induce changes in RNFL, a significant improvement was observed in GFR after transplantation; however, no significant change was observed in OCT disc parameters, OCT and IOP measurements.[14]

In the literature, Atilgan et al. compared RNFL thicknesses (as measured by OCT) before and after hemodialysis.[15] Authors showed that RNFL was significantly thicker 30 minutes after hemodialysis. In addition, no significant difference was found in RNFL thickness between hemodialysis patients and healthy individuals. In the literature, it was shown that there was no difference in RNFL thickness between hemodialysis patients and healthy controls; in agreement with literature, we found no change in RNFL thickness after renal transplantation. This indicates that the systemic effect of renal function has no effect on RNFL thickness. In the literature, it was observed that RNFL thickness was increased after hemodialysis; however, there was no significant difference in RNFL thickness after transplantation in our patient. This may be due to 2 factors: 1) an acute, substantial electrolyte and volume changes after hemodialysis and 2) in our study, measurements were performed on month 1 after renal transplantation unlike measurements performed at early period after hemodialysis (within first hour) . In addition, Chen et al. investigated effects of hemodialysis on total retina and RNFL thicknesses, reporting that hemodialysis led increased thickness at different localizations and layers in retina.[16]

Demir et al. compared RNFL thickness between CRF patients undergoing dialysis and healthy adults. Authors showed that RNFL was thinner in patients with CRF. In addition, authors found no significant difference when RNFL thickness was compared before and after hemodialysis in the patient group. In support of literature, no significant difference was observed in RNFL thickness despite significant change in fluid-electrolyte balance and significant improvement in GFR in our study. This supports the concept that renal functions does not lead change in RNFL.

In the literature, RNFL and choroidal thickness were evaluated by renal function in diabetic patients with CRF. It was shown that RNFL thickness was correlated with choroidal thickness. In addition, it was suggested that RNFL thickness measurement can be used to predict renal function. In our study, no significant difference was observed in RNFL thickness after renal transplantation. We think that this contradictory result was due to exclusion of diabetic patient in our study. The diabetes mellitus is a microangiopathic disease which is known to change RRNFL thickness.[17] Thus, we think that the changes in RNFL and choroidal thicknesses by renal function in the literature is due to diabetic microangiopathy.

This study has some limitations. Firstly, the follow-up duration after transplantation is limited to one month; thus, it is needed to be supported by studies with longer follow-up. Secondly, the drugs used after renal transplantation may have affected RNFL thickness measurements. There is need for isolated use of these drugs, allowing evaluation of

effects on RNFL individually. Thirdly, it is a retrospective study with limited sample size.

In conclusion, this study suggests that changes in renal function has no effect on OCT parameters. In addition, it demonstrated that monitoring progression by optic disc in CRF patients can be maintained by using measurement assigned as origin after transplantation.

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