Anatomical and functional evaluation of RNFL parameters and choroidal thickness changes in patients with Chronic Renal Failure undergoing Hemodialysis using Spectral-domain Optical Coherence Tomography and Visual field

Thesis

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✍ **Heba Ramadan Abdel Qader Ramadan**

Dedication

Special thanks to My Mother *and all* ***My Family*** *members for their continuous encouragement, enduring me and standing by me*

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ABSTRACT

Background: There is a structural analogy between the glomerular vascular network and the choroidal circulation. With hemodialysis (HD), lots of alterations occur in patients' homeostasis and metabolic parameters. These alterations affect the eye and may cause neuro-ophthalmologic complications.

Aim: To evaluate anatomical and functional changes of retinal nerve fiber layer (RNFL) and ganglion cell layer (GCL), and changes in subfoveal choroidal thickness (SFCT) in patients with chronic renal failure (CRF) on HD.

Methods: This case control study was carried on 20 eyes of 20 CRF patients (HD group) and 20 eyes of 20 healthy individuals. 10 of the HD group were non-diabetic (NDM subgroup) and 10 were diabetic (DM subgroup). For all eyes, the thickness of peripapillary RNFL, GCL, and SFCT were measured by optical coherence tomography (OCT) (RS-3000; NIDEK, Japan) and visual field (VF) analysis using Humphrey field analyzer (Carl Zeiss, USA).

Results: A statistically significant decrease in peripapillary RNFL thickness in HD group when compared to the control group in most analyses, but did not amount to statistical significance in the temporal quadrant and in 5 of the studied clock hour sectors. There was also a statistically significant decrease in the macular GCL thickness of HD group when compared to the control group in both hemifields, and in all of the 8 subfields. The results of the SFCT reported in HD group were also significantly less than that reported in the control group. Analysis of results from VF demonstrated a highly significant depression in both MD and PSD of the HD group when compared to the control group. The difference between the NDM and DM subgroups was not significant in any of the studied parameters.

Conclusion: Our results demonstrate highly significant retinal and choroidal changes in CRF patients on HD. Thus, we recommend that CRF patients undergo regular ocular examination by OCT to prevent early ocular damage.

Keywords: Renal failure, RNFL, GCL, choroid, visual field

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List of Abbreviations

Abb.	Full term

ACE1 .....Angiotensin converting enzyme-1
ACE2 .....Angiotensin converting enzyme-2
ACR .....Albumin to creatinine ratio
ADMA .....Asymmetric dimethylarginine
AGEs.....Advanced glycation end products
AGT .....Angiotensinogen
AMD .....Age-related macular degeneration
Ang I .....Angiotensin I
Ang II.....Angiotensin II
asb .....Apostilbs
A-Scan .....Axial scan
AT1R .....Angiotensin II type I receptor
AT2R .....Angiotensin II type 2 receptor
AT4R .....Angiotensin II type 4 receptor
BMI.....Body mass index
BM/RP.....Bruch's membrane/retinal pigment epithelium
BRB.....Blood-retinal barrier
CAD .....Coronary artery disease
CDVA .....Corrected distance visual acuity
CKD .....Chronic kidney disease
CLSO.....Confocal scanning laser ophthalmoscope
CRF.....Chronic renal failure
CSCR.....Central serous chorioretinopathy
CSI .....Choroidoscleral interface
ChT .....Choroidal thickness
CVD .....Cardiovascular disease
dB .....Decibels

List of Abbreviations Cont...

Abb.	Full term
DM	Diabetes mellitus
DR	Diabetic retinopathy
EC	Endothelial cells
ECM	Extracellular matrix
EDI	Enhanced depth imaging
EPO	Erythropoietin
ESRD	End-stage renal disease
GCL	Ganglion cell layer
GCL I	Ganglion cell layer inferior
GCL N	Ganglion cell layer nasal
GCL S	Ganglion cell layer superior
GCL T	Ganglion cell layer Temporal
GFR	Glomerular filtration rate
HD	Hemodialysis
HTN	Hypertension
IgAN	Immunoglobulin A nephropathy
ILM	Internal limiting membrane
IOP	Intraocular pressure
LDL	Low density lipids
LVH	Left ventricular hypertrophy
MABP	Mean arterial blood pressure
MasR	Mas receptor
MD	Mean deviation
MR	Mineralocorticoid receptor
NDM	No diabetes mellitus
NFL I	RNFL inferior quadrant
NFL IH	RNFL inferior half
NFL N	RNFL nasal quadrant
NFL S	RNFL superior quadrant

List of Abbreviations Cont...

Abb.	Full term
NFL SH	RNFL superior half
NFL T	RNFL temporal quadrant
NO	Nitric oxide
NPE	Non-pigmented ciliary epithelium
NS	Non-significant
NSAIDs	Non-steroidal anti-inflammatory drugs
OCT	Optical coherence tomography
OCTA	Optical coherence tomography angiography
OHTS	Ocular hypertension treatment study
OPP	Ocular perfusion pressure
PRR	Prorenin receptor
PSD	Pattern standard deviation
RAC	Retinal arteriolar caliber
RAGE	Receptor for advanced glycation end product
RAS	Renin–angiotensin system
RGCs	Retinal ganglion cells
RNFL	Retinal nerve fiber layer
RPE	Retinal pigment epithelium
RTSD	Retrograde trans-synaptic neuronal degeneration
RVC	Retinal venular caliber
S	Significant
SAP	Standard automated perimetry
SD-OCT	Spectral domain Optical Coherence Tomography
SFCT	Subfoveal choroidal thickness
SITA	Swedish interactive threshold algorithm
SLK	Superior limbic kerato-conjunctivitis
SS-OCT	Swept source OCT

List of Abbreviations Cont...

Abb.	Full term
SVD	Small vessel disease
T2DM	Type two diabetes mellitus
VF	Visual field