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Original Research Article

Acute Changes in Ocular Parameters Before and After Haemodialysis in Patients with End-Stage Renal Disease: A Prospective Observational Study from Eastern India

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Abstract

Purpose: To evaluate short-term changes in ocular parameters before and after a single hemodialysis session in patients with end-stage renal disease (ESRD).

Methods: This prospective observational study was conducted at Southeastern Railways Central Hospital, Garden Reach, Kolkata, from April 2023 to January 2025. Thirty-five adults with ESRD receiving hemodialysis 2–3 times weekly for at least 3 months were evaluated 1 hour before and 1 hour after a 3–4-hour hemodialysis session. Best-corrected visual acuity (BCVA), intraocular pressure (IOP), central corneal thickness (CCT), anterior chamber depth (ACD), axial length, tear breakup time (TBUT), Schirmer I test, central macular thickness (CMT), and macular volume were recorded.

Results: Mean age was 53.17±10.44 years; 21 (60%) participants were men. TBUT decreased from 13.32±4.26 to 11.07±3.81 seconds (p=0.039), Schirmer I from 12.37±2.17 to 9.91±1.95 mm (p=0.017), and IOP from 14.10±2.56 to 12.83±2.18 mmHg (p=0.027). Axial length increased from 24.07±0.57 to 24.17±0.53 mm (p=0.004). BCVA, CCT, ACD, CMT, and macular volume did not change significantly. Body weight, systolic and diastolic blood pressure, serum urea, creatinine and random blood glucose also decreased significantly after dialysis, whereas sodium and albumin did not.

Conclusion: A single hemodialysis session was associated with significant changes in tear-film parameters, IOP and axial length, while visual acuity and macular structural parameters remained statistically unchanged. These findings support awareness of acute ocular effects during hemodialysis and the need for appropriate ophthalmic monitoring in patients with ESRD.

Keywords: End-Stage Renal Disease; Hemodialysis; Intraocular Pressure; Tear Breakup Time; Schirmer Test; Axial Length; Optical Coherence Tomography; Macular Thickness.

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Introduction

End-stage renal disease is associated with systemic metabolic, vascular and fluid-balance disturbances that may affect the eye. Patients receiving hemodialysis may develop ocular-surface abnormalities, changes in intraocular pressure and alterations in ocular biometry and retinal/choroidal parameters.

These changes are plausibly related to rapid shifts in intravascular volume, plasma osmolality and oncotic pressure during ultrafiltration. Previous studies have reported variable effects of hemodialysis on IOP, corneal parameters, tear function, axial length and retinal thickness. However, findings remain inconsistent across populations and ocular parameters. [1,2,3,4,5,6,7,8,10-12,16-18]

This study therefore evaluated multiple ocular parameters immediately before and after a single

hemodialysis session in patients with ESRD in a tertiary-care hospital in Eastern India.

Materials and Methods

Study Design and Participants: This prospective observational study was conducted at South Eastern Railways Central Hospital, Garden Reach, Kolkata, from April 2023 to January 2025. Patients aged 18–70 years with ESRD receiving conventional hemodialysis 2–3 times per week for at least 3 months were eligible.

Patients with active ocular infection within 2 weeks, recent ocular surgery or trauma, glaucoma or ocular hypertension, corneal leukoma/cataract, vitreous hemorrhage, or other media opacity interfering with visual acuity or fundus assessment were excluded.

Thirty-five patients (70 eyes) were enrolled. The sample-size calculation in the study was based on the expected pre/post difference in TBUT and estimated a minimum of 31 patients; 35 patients were ultimately studied. The dialysis protocol used a Fresenius 4008S machine, a 1.9-m² polysulfone membrane, blood flow of 200–250 mL/min and dialysate flow of 500 mL/min.

Ophthalmic Assessment: One hour before hemodialysis and one hour after completion of dialysis, patients underwent assessment of BCVA, IOP, CCT, ACD, axial length, TBUT, Schirmer I test, CMT and macular volume. BCVA was recorded in logMAR. IOP was measured by Goldmann applanation tonometry.

CMT and macular volume were obtained using Heidelberg Spectralis optical coherence tomography. CCT was measured by specular microscopy, while ACD and axial length were obtained using the Topcon Aladdin HW3.0 optical biometer. TBUT was measured with fluorescein, and Schirmer I testing was performed for 5 minutes.

Statistical Analysis: Data were tabulated and analysed using SPSS version 22.0. Continuous variables were summarized as mean±standard deviation. Pre- and post-hemodialysis measurements were compared using the paired t-test as described in the original thesis, with $p<0.05$ considered statistically significant.

Results

Participant Characteristics: The study included 35 patients with a mean age of 53.17±10.44 years. Fourteen (40%) were women and 21 (60%) were men. The largest age group was 51–60 years (40%), followed by 61–70 years (28.57%). Hypertension was present in 60%, diabetes mellitus in 42.86%, hyperlipidemia in 34.29%, and heart disease in 2.86%.

Systemic Changes After Hemodialysis: Body weight decreased from 66.27±10.42 to 62.94±9.55 kg (p=0.008), systolic blood pressure from 139.33±21.90 to 123.18±20.66 mmHg (p=0.002), and diastolic blood pressure from 81.05±12.71 to 69.22±10.54 mmHg (p=0.005). Serum urea decreased from 486.67±83.60 to 161.98±65.22 mg/dL (p<0.01), creatinine from 6.87±2.95 to 3.09±1.13 mg/dL (p<0.01), and random blood glucose from 177.66±5.83 to 156.17±5.17 mg/dL (p<0.001). Sodium and albumin changes were not significant.

Table 1: Systemic parameters before and after hemodialysis

Parameter	Before HD	After HD	p value	Significance
Body weight (kg)	66.27±10.42	62.94±9.55	0.008	Significant
SBP (mmHg)	139.33±21.90	123.18±20.66	0.002	Significant
DBP (mmHg)	81.05±12.71	69.22±10.54	0.005	Significant
Urea (mg/dL)	486.67±83.60	161.98±65.22	<0.01	Significant
Creatinine (mg/dL)	6.87±2.95	3.09±1.13	<0.01	Significant
Sodium (mEq/L)	138.54±2.77	137.16±3.22	0.18	NS
RBS (mg/dL)	177.66±5.83	156.17±5.17	<0.001	Significant
Albumin (g/dL)	3.96±0.72	4.28±0.77	0.15	NS

Ocular Findings: TBUT decreased significantly from 13.32±4.26 to 11.07±3.81 seconds (p=0.039), and Schirmer I decreased from 12.37±2.17 to 9.91±1.95 mm (p=0.017). IOP decreased from 14.10±2.56 to 12.83±2.18 mmHg (p=0.027). Axial length increased from 24.07±0.57 to 24.17±0.53 mm (p=0.004).

BCVA changed from 0.62±0.29 to 0.66±0.25 logMAR (p=0.37), CCT from 552.6±34.77 to 555.9±30.70 µm (p=0.68), and ACD from 2.84±0.33 to 2.79±0.28 mm (p=0.56).

CMT changed from 258.63±38.31 to 262.05±35.67 µm (p=0.30), and macular volume from 7.81±0.93 to 7.97±0.88 mm³ (p=0.45); neither change was statistically reviewed as being significant.

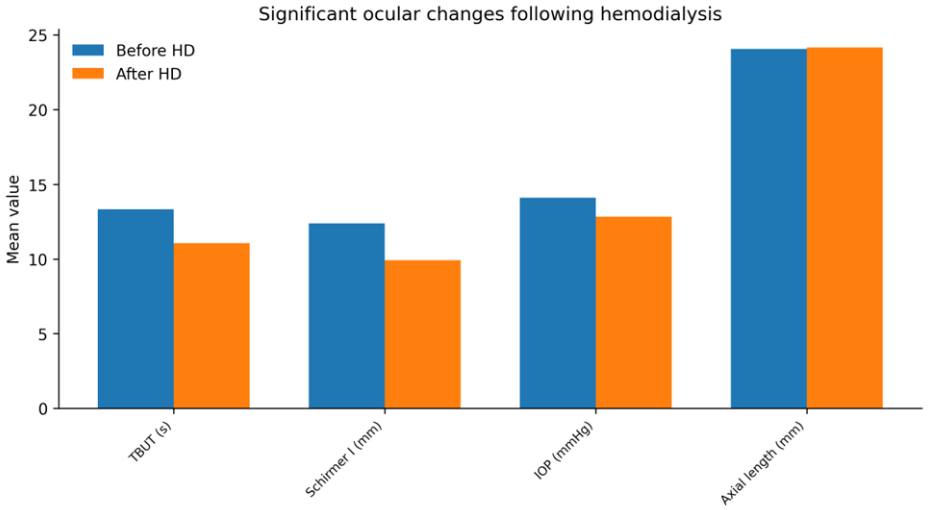

Figure 1: Significant ocular changes observed after hemodialysis. Bars represent mean values before and after dialysis

Table 2: Ocular parameters before and after hemodialysis

Parameter	Before HD	After HD	p value	Interpretation
TBUT (s)	13.32±4.26	11.07±3.81	0.039	Significant
Schirmer I (mm)	12.37±2.17	9.91±1.95	0.017	Significant
BCVA (logMAR)	0.62±0.29	0.66±0.25	0.37	NS
IOP (mmHg)	14.10±2.56	12.83±2.18	0.027	Significant
CCT (µm)	552.60±34.77	555.90±30.70	0.68	NS
ACD (mm)	2.84±0.33	2.79±0.28	0.56	NS
Axial length (mm)	24.07±0.57	24.17±0.53	0.004	Significant
CMT (µm)	258.63±38.31	262.05±35.67	0.30	NS
Macular volume (mm³)	7.81±0.93	7.97±0.88	0.45	NS

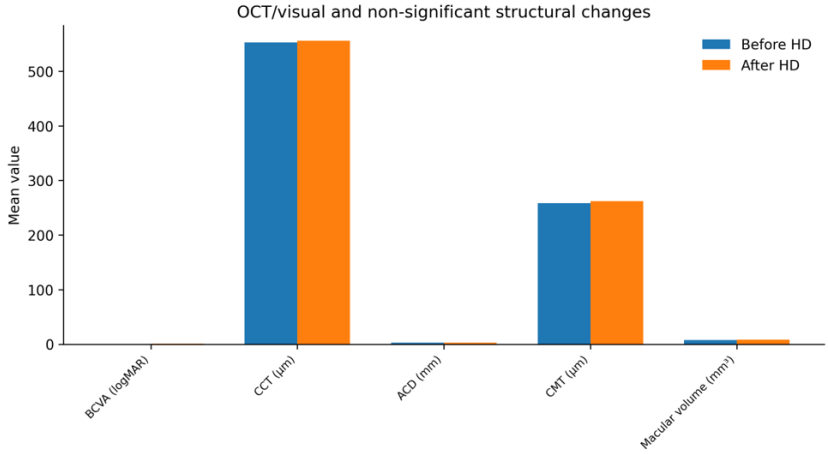

Figure 2: Pre- and post-hemodialysis values of BCVA, CCT, ACD, CMT and macular volume; none showed a statistically significant change

Discussion

The present prospective study demonstrates that a single hemodialysis session is associated with measurable short-term changes in selected ocular parameters. The most consistent changes involved tear-film function, IOP and axial length, occurring alongside significant reductions in body weight and blood pressure and marked biochemical changes produced by dialysis. The reduction in TBUT and Schirmer I is consistent with previous observations that hemodialysis can acutely worsen tear-film stability and aqueous tear secretion. [2,3,5-8,10-12,18]

Rapid removal of fluid and solutes may contribute to reduced tear volume and altered tear-film homeostasis. The magnitude and direction of the changes in the present study were comparable to previously reported findings in ESRD populations. [2,5,7,12,18]

IOP decreased significantly after dialysis. This finding is consistent with several earlier reports, although the effect of hemodialysis on IOP has not been uniform across studies. Changes in plasma osmolality, ultrafiltration, oncotic pressure and ocular fluid dynamics have been proposed as contributing mechanisms. [3-7,10,11,17]

Axial length increased significantly after dialysis. Similar increases have been reported previously and may reflect transient osmotic and fluid shifts involving the lens and vitreous compartments. Because the absolute change was small, the clinical significance of this biometric change requires confirmation in larger studies with standardized repeatability assessment. [5,6,10,16]

No significant acute changes were detected in BCVA, CCT, ACD, CMT or macular volume. The absence of a significant change in CMT and macular volume is consistent with reports showing relative stability of central macular measurements after a single dialysis session, although other studies have demonstrated changes in choroidal and retinal parameters. Such discrepancies may relate to differences in dialysis timing, patient characteristics, diabetes status, retinal disease and OCT methodology. [7-10,14,15]

Strengths and Limitations: Strengths include the prospective pre/post design, standardized timing of ocular assessment around a dialysis session, use of objective instruments including Heidelberg Spectralis OCT and optical biometry, and simultaneous assessment of ocular and systemic parameters.

Limitations include the small sample size, single-centre design, absence of a non-dialysis control group, and lack of control over activities during the dialysis session that could influence ocular measurements. The study evaluated acute changes after a single session and therefore cannot establish long-term ocular effects of hemodialysis.

Conclusion

Our study revealed that hemodialysis was associated with significant changes in Schirmer I test, axial length, IOP and TBUT after the procedure, along with significant systemic changes in body weight and blood pressure. BCVA, CCT, ACD, CMT and macular volume did not show statistically significant acute changes. Patients with ESRD should be informed about ocular consequences associated with hemodialysis and undergo appropriate routine ophthalmic assessment for detection of ocular abnormalities. Further large-scale studies incorporating additional systemic measures are required to clarify the relationships between dialysis-related systemic changes and ocular parameters.

Declaration

Ethics approval and consent: Institutional ethical clearance {Memo No. G/39/DNB/ E.C dated 18th May 2023} and written informed consent.

Funding: No specific external funding.

Conflict of interest: No conflict of interest was reported

Data availability: The study data were collected in the institutional study database patients in Central Hospital, Southeastern Railways, Garden Reach

AI-assisted writing disclosure: AI-assisted language drafting/editing was used during preparation of this manuscript. No AI system was used to generate, modify or fabricate the study data, statistical results, clinical images or references. The authors remain responsible for the accuracy, integrity and originality of the submitted work

References

1. Wong CW, Wong TY, Cheng CY, et al. Kidney and eye diseases: common risk factors, etiological mechanisms, and pathways. Kidney Int. 2014;85:1290-1302.
2. Mullaem G, Rosner MH. Ocular problems in the patient with end-stage renal disease. Semin Dial. 2012;25:403-407.
3. Chen H, Zhang X, Shen X. Ocular changes during hemodialysis in patients with end-stage renal disease. BMC Ophthalmol. 2018;18:208.
4. Elbay A, Altinisik M, Dincyildiz A, et al. Are the effects of hemodialysis on ocular parameters similar during and after a hemodialysis session? Arq Bras Oftalmol. 2017;80:290-295.
5. Kalayci M, Hassan IA, Keinan IA, et al. The effect of hemodialysis on axial length, ocular surface, and intraocular pressure in patients with end-stage renal failure. Int J Gen Med. 2020;13:1035-1042.
6. Wang L, Yin G, Yu Z, et al. Effect of hemodialysis on eye coats, axial length, and ocular perfusion pressure in patients with chronic renal failure. J Ophthalmol. 2018;2018:1-6.
7. Jung JW, Yoon MH, Lee SW, et al. Effect of hemodialysis on intraocular pressure, ocular surface, and macular change in patients with chronic renal failure. Graefes Arch Clin Exp Ophthalmol. 2013;251:153-162.
8. Chelala E, Dirani A, Fadlallah A, et al. Effect of hemodialysis on visual acuity, intraocular pressure, and macular thickness in patients with chronic kidney disease. Clin Ophthalmol. 2015;9:109-114.
9. Yang SJ, Han YH, Song GI, et al. Changes of choroidal thickness, intraocular pressure and other optical coherence tomographic

parameters after haemodialysis. Clin Exp Optom. 2013;96:494-499.
10. Sun G, Hao R, Zhang L, et al. The effect of hemodialysis on ocular changes in patients with end-stage renal disease. Ren Fail. 2019;41:629-635.
11. Almaznai A, Alsaud S, Fahmy R. Ocular parameters alterations after hemodialysis in patients with chronic kidney diseases. Sudanese J Ophthalmol. 2021;35:9-14.
12. Ahuja S, Jalwaniya S, Parameswaran S, et al. Analytical study of ocular surface changes in patients of chronic kidney disease undergoing hemodialysis and peritoneal dialysis. Ann Natl Acad Med Sci India. 2022;58:189-196.
13. Moshegov S, Seth I, Wawryk O, et al. Vision-related quality of life and ocular parameters in end-stage renal disease patients undergoing hemodialysis. J Curr Ophthalmol. 2023;35:66-72.
14. Lahme L, Storp JJ, Marchiori E, et al. Evaluation of ocular perfusion in patients with end-stage renal disease receiving hemodialysis using optical coherence tomography angiography. J Clin Med. 2023;12:3836.
15. Su Z, Mao Y, Qi Z, et al. Impact of hemodialysis on subfoveal choroidal thickness measured by optical coherence tomography: a systematic review and pooled analysis of self-controlled case series. Ophthalmol Ther. 2023;12:2265-2280.
16. Lohokare KR, Kulkarni VN, Khandgave TP, et al. Effects of haemodialysis on anterior segment parameters of the eye in patients with endstage renal disease: a cross-sectional study. J Clin Diagn Res. 2024;18(1).
17. Toprak M, Mağden K. Evaluation of ocular parameters in patients receiving hemodialysis treatment. J Eur Int Med Prof. 2024;2:56-61.
18. Aktas S, Sagdik HM, Aktas H, et al. Tear function in patients with chronic renal failure undergoing hemodialysis. Ren Fail. 2015;37:245-248.