OCULAR MANIFESTATIONS IN PATIENTS UNDERGOING MAINTENANCE HEMODIALYSIS - A CROSS SECTIONAL STUDY

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ABSTRACT

INTRODUCTION

Chronic kidney disease (CKD) patients undergoing maintenance hemodialysis (HD) are at risk of a wide range of ocular manifestations, often underdiagnosed but potentially vision-threatening. In Nepal, the increasing burden of diabetes and hypertension has amplified the need to understand ocular comorbidities. The objective of this study was to assess the prevalence and spectrum of ocular findings among patients undergoing maintenance hemodialysis and evaluate their association with systemic comorbidities.

MATERIAL AND METHODS

A descriptive cross-sectional study was conducted at the Department of Ophthalmology, Birat Medical College Teaching Hospital. A total of 147 adult patients on maintenance HD were enrolled. Ophthalmic examination including visual acuity, slit-lamp, intraocular pressure, and fundus assessments were performed. Data were analyzed using SPSS version 22, and associations were tested using the chi-square test ($p < 0.05$ was considered significant).

RESULTS

Of the 147 patients, 76.1% were aged ≥40 years and 69.4% were male. The mean duration of dialysis was 2.75 ± 1.69 years. Ocular manifestations were present in 76.87% of patients, with the most common findings being hypertensive retinopathy (57.8%), dry eyes (57.1%), cataracts (24.5%), and non-proliferative diabetic retinopathy (23.1%). Statistically significant associations were found between hypertension and hypertensive retinopathy ($p = 0.002$), and between diabetes (especially combined with hypertension) and diabetic retinopathy ($p = 0.005$).

CONCLUSION

A high prevalence of ocular abnormalities was observed among patients undergoing maintenance hemodialysis, often without symptoms. Routine ophthalmic screening should be integrated into nephrology care to enable early detection and prevent irreversible vision loss.

KEYWORDS

Hemodialysis, chronic kidney disease, hypertensive retinopathy, diabetic retinopathy, cataract

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INTRODUCTION

Chronic kidney disease (CKD) is a global health problem characterized by the progressive loss of renal function, eventually progressing to end-stage renal disease (ESRD) which requires renal replacement therapies. Maintenance hemodialysis is the most commonly used method. Hemodialysis (HD)-associated ocular abnormalities are a notable cause of morbidity among people undergoing HD; however, their exact etiology remains unclear.[1-4]

Ocular involvement in patients with CKD is multifactorial. It may arise from the underlying systemic diseases (such as diabetes or hypertension), uremia-related metabolic disturbances, or the hemodialysis process itself. Documented ocular manifestations include retinal vascular changes, hypertensive or diabetic retinopathy, dry eye syndrome, cataracts, conjunctival and corneal calcifications, and optic neuropathy. These conditions often progress silently, making regular ophthalmic evaluations essential for early detection and intervention.[5,6]

Despite the wide spectrum of ocular morbidity that significantly impacts quality of life, these findings are frequently overlooked. In Nepal, the rising incidence of non-communicable diseases especially diabetes mellitus and hypertension has led to an increasing number of patients requiring long-term dialysis care.[7] Vision plays a critical role in quality of life, independence, and daily functioning. However, both patients and healthcare providers tend to focus primarily on renal and cardiovascular outcomes, unintentionally neglecting ocular complications until serious visual impairment occurs.

There are very few studies emphasizing ocular findings in hemodialysis patients. The aim of this study was to assess the prevalence and spectrum of ocular findings in patients undergoing maintenance hemodialysis. Early detection and timely intervention can significantly improve the quality of life in this vulnerable population and raise awareness about the importance of ophthalmic evaluations in nephrology practice, promoting interdisciplinary collaboration for holistic care.

MATERIAL AND METHODS

It was a descriptive cross-sectional observational study conducted in the Department of Ophthalmology at Birat Medical College Teaching Hospital. A sample size of 147 patients undergoing maintenance hemodialysis above the age of 18 years was included. The sample size was calculated using the formula ($N=z^2 pq/d^2$, where n= sample size, z=1.96, p=0.893, q=1-p, d= 0.05) with a revalence of 89.3 % from the given article.[8]
Patients with preexisting ocular diseases unrelated to renal pathology, recent ocular trauma or surgery (<6 months), or those who were uncooperative or declined participation were excluded.

Clinical data included age, gender, dialysis duration and frequency, and comorbidities such as diabetes and hypertension. Ophthalmic evaluation included visual acuity testing, slit-lamp examination, intraocular pressure measurement, and fundus examination (direct/indirect ophthalmoscopy). Ocular findings including cataracts, retinal changes, optic nerve changes, and conjunctival abnormalities were recorded in a pre-formed proforma.
Ophthalmologic data were collected from both eyes of each patient. All statistical analyses were performed using paid SPSS version 22. Chi-square test was used to assess associations between variables, with a *p*-value < 0.05 to be statistically significant.

RESULTS

A total of 147 patients undergoing maintenance hemodialysis were included in the study. Out of total patients, 76.2% (n=112) were of age group 40 years while 23.8% (n=35) were <40 years. In this study, males predominated (69.4%) compared to females (30.6%).

Most patients underwent hemodialysis two times per week (57.8%), followed by three times per week (40.1%), and once per week (2%) as shown in the fig. 1. The mean ± SD is 2.75±1.69 years

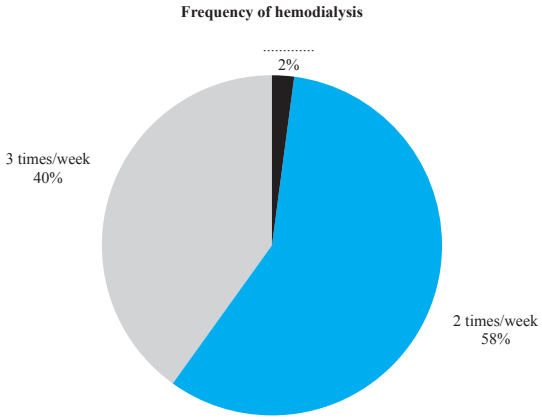


Figure 1. Showing frequency of hemodialysis

Out of the total patients, 78.2% were given anticoagulants during hemodialysis. Based on the grading from National cancer institute and national institute of health (USA) 13.6% of the patients had mild anemia, 26.5% had moderate anemia , 38.8% had severe anemia (Hb 6.5–7.9 g/dL) and 21.1% had life-threatening anemia (<6.5 g/dL).

Other systemic comorbidities like hypertension was seen in 51.0%, diabetes mellitus alone in 4.8% and 38.8% of the patients had combined diabetes and hypertension.

In this study, the most common ocular symptom was blurring of vision (50.3%) followed by dryness (12.9%), redness (5.4%), and ocular pain (4.1%). Out of 147 study population 25.9% of them were asymptomatic as shown in the figure 2.

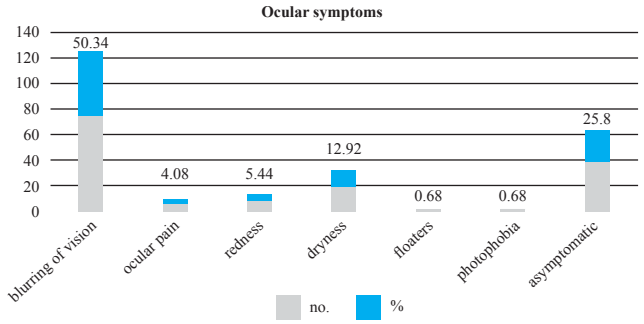


Figure 2. Showing ocular symptoms in patients undergoing maintenance hemodialysis

On evaluating visual status of the total study population, 71.4% had normal vision (6/6 to 6/18) while 21.8% had moderate impairment (<6/18 to 6/60). Severe visual impairment (<6/60 to 3/60) was seen in 2% while blindness (<3/60–NPL) was seen in 4.8% as shown in figure 2.

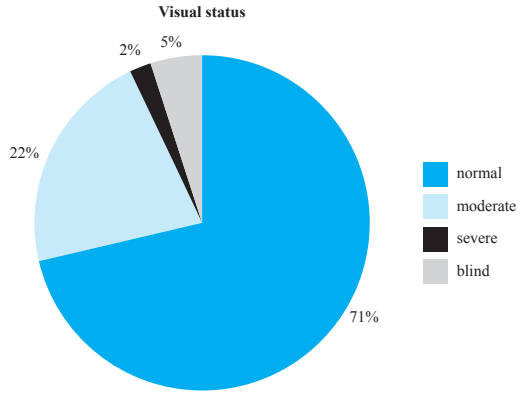
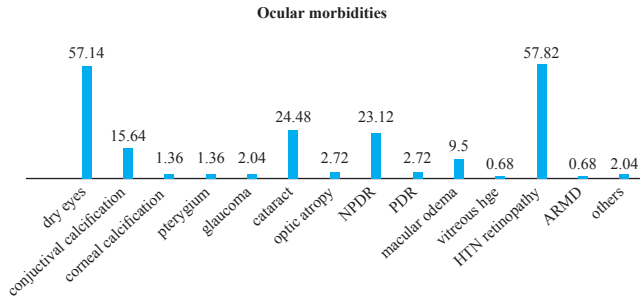


Figure 3. Bar chart showing visual status in the study population.

The prevalence of ocular manifestations among the patients undergoing hemodialysis was 76.87%. The most common cause of ocular morbidity was hypertensive retinopathy (57.8%), followed by dry eyes (57.1%), Cataract (24.5%), Non-proliferative diabetic retinopathy (NPDR) (23.1%) and others as shown in figure 4 below. Among others 2 patients had anemic retinopathy and one patient had renal retinopathy.



Out of 147 patients, there was a significant association between systemic hypertension and hypertensive retinopathy in hemodialysis patients (p value = 0.002). Similarly, the presence of diabetes (especially when combined with hypertension) was significantly associated with diabetic retinopathy in patients on hemodialysis (p value = 0.005). A higher proportion of patients under dialysis 3times/week had conjunctival calcification and retinopathy.

There was a significant association between more frequent dialysis and increased ocular pathology (p = 0.03) likely due to longer duration of disease and metabolic stress.

DISCUSSION

Maintenance hemodialysis is done in end stage kidney disease (ESKD). In this study, there were more males (n=102) undergoing the procedure than females (69.4% and 30.6%). The results were similar with the study done by Kianersi, et al[8] However, in US Renal Data System (USRDS) annual data report; the prevalence of chronic renal failure between was higher in women (15.1%) than in men (12.1%).[9] The mean age of our patients undergoing hemodialysis were 49 years , which is similar (50.95 years) with the study by Dina E. Mansour et al.[10] Various literatures have shown that the old population was more chances of decrease in renal functions and develop chronic kidney disease due to various renal insults.[11]

On evaluating visual status of the total study population, 71.4% had normal vision, 21.8% had moderate impairment . Severe visual impairment was seen in 2%, while blindness was seen in 4.8% cases. However, this visual status is not a true indicator for the ocular morbidities of the patients at present and in future. Until the central vision is reserved by not involving the macula with DR and HR visual status is preserved.[12,13]

Blurring of vision was the most common symptom among our study populations followed by dryness (50.34% and 12.92% respectively). Among the ocular findings hypertensive retinopathy (57.8%), followed by dry eyes (57.1%), Cataract (24.5%), non-proliferative diabetic retinopathy (NPDR) – 23.1% were the most common ones. In our study, patients with systemic hypertension were 51.0% and diabetes mellitus alone were 4.8% whereas 38.8% had combined diabetes and hypertension. This may be one of the factors of hypertensive retinopathy being the commonest findings.

This study highlights the high burden of ocular morbidities accounting for 76.87% among patients undergoing maintenance hemodialysis. The most common ocular findings were hypertensive retinopathy (57.8%), similar to previous studies conducted in chronic kidney disease (CKD) populations by Reddy SC et al and Gheith O et al[14,15] However, hypertension, either alone or in combination with diabetes, was present in a significant proportion of patients (89.8%). Chronic uncontrolled hypertension contributes a lot to vascular changes in the retina, leading to hypertensive retinopathy. Similar study by Malleswari et al showed that hypertensive retinopathy was the cause of visual loss in the majority but cataract was in a significant number represented by 38% of examined eyes.[13] This finding is in line with results reported by Maheshwari et al. and Suryanarayana et al.[16,17]

Dry eye was another frequent complaint and finding, affecting 57.1% of the study population. This may be related to reduced tear secretion, changes in tear composition, or ocular surface inflammation seen in CKD patients, especially those undergoing hemodialysis.[18]

NPDR was noted in 23.1% and PDR in 2.7% of patients. Diabetic retinopathy prevalence was lower than in some previous studies, possibly because only 4.8% had diabetes alone, while 38.8% had diabetes with hypertension. Out of total patients 9.5% had macular edema which corresponds to loss of central vision affecting the visual status of the patient. In a study by Bhajracharya et al, the main cause of impaired vision less than 6/18 was maculopathy.[19]

Cataracts were found in 24.5% of patients. The high oxidative stress, calcium-phosphate imbalance, and prolonged anemia seen in hemodialysis patients likely contribute to accelerated lens opacification.[20] Cataract in ESRD patients can be explained by comorbidities, these include advanced age, diabetes, hypertension , the use of corticosteroids, ultraviolet light exposure and hyperparathyroidism.[21]

Conjunctival calcification was seen in 15.6%, probably from the accumulation of toxic materials like calcium- phosphate dysregulation in the body and metabolic changes during CKD and hemodialysis.[21] Corneal calcification was rare but it has also been reported in similar populations.[22]

Anemia was prevalent, with nearly 60% of patients having severe or life-threatening anemia. Poor oxygen delivery to ocular tissues may contribute to ischemic changes and visual deterioration. Among others group of ocular morbidities which comprises 2.04% of total patients. Two patients had anemic retinopathy and one patient had renal retinopathy.

CONCLUSION

Given the high prevalence of asymptomatic but clinically significant ocular disease leading to high morbidity, regular ophthalmic screening should be mandatory in patients under dialysis to prevent irreversible visual loss.

LIMITATIONS

The main limitations of the study was that it was a single sentened study and the study type was cross sectional study which may limit the inference of causality.

CONFLICT OF INTEREST

None

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