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Original Research Article

HYPERTENSIVE RETINOPATHY CHANGES IN CHRONIC KIDNEY DISEASE: OBSERVATIONAL STUDY

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Abstract

Background: Chronic kidney disease (CKD) poses a growing global health challenge, with profound systemic implications affecting multiple bodily systems. The kidney and eye share intricate structural, developmental, physiological, and pathological pathways. CKD, along with prevalent eye disorders like glaucoma, cataracts, and retinopathy, are interconnected with age and various metabolic and systemic risk factors such as hypertension, diabetes, and smoking. This study investigates the incidence of hypertensive retinopathy across various stages of chronic kidney disease (CKD) in a sample of 120 patients. **Materials and Methods:** The study included 120 patients diagnosed with chronic kidney disease who were attending the outpatient and inpatient departments of the tertiary care hospital during the study period. Patient demographic information (age, gender, medical history) was collected through a structured questionnaire and hospital records. Blood pressure measurements were taken using an automated sphygmomanometer, and CKD staging was determined based on the patient's estimated glomerular filtration rate (eGFR) according to the kidney disease: Improving Global Outcomes (KDIGO) guidelines. Retinal findings were classified according to the Modified Scheie Classification system. **Result:** The findings suggest a significant correlation between the severity of hypertensive retinopathy and the progression of CKD, with the highest incidence observed in Stage V. The results highlight the importance of routine retinal screening in CKD patients to detect early retinal changes, which may serve as a marker for worsening kidney function and the potential risk of cardiovascular events. **Conclusion:** Early intervention in managing hypertension and CKD can potentially reduce the severity of retinal damage and improve patient outcomes.

INTRODUCTION

Chronic kidney disease (CKD) is a significant global health issue, characterized by progressive kidney dysfunction and a variety of complications. One of the most common co-morbidities in CKD patients is hypertension, which can exacerbate kidney damage and lead to the development of other systemic health issues. Among these complications, hypertensive retinopathy, which refers to changes in the blood vessels of the retina caused by high blood pressure, is a key concern.

Hypertensive retinopathy is often a visible marker of long-standing high blood pressure and is associated with increased risks of cardiovascular events. It occurs when the retinal blood vessels are affected by the increased pressure in the circulatory system. This condition can be easily observed through routine eye examinations, which is important as retinal changes often reflect the severity of underlying hypertension. For patients with CKD, these changes may also provide valuable insights into the progression of kidney disease. This makes the monitoring of hypertensive retinopathy crucial for managing both conditions effectively.[1]

The relationship between hypertensive retinopathy and CKD is particularly significant because both conditions share common risk factors and can influence each other's progression. High blood pressure is not only a major cause of kidney damage but can also worsen existing kidney dysfunction. Additionally, the presence of hypertensive retinopathy in CKD patients may indicate a higher likelihood of complications, making it essential for healthcare providers to monitor both kidney function and retinal health closely.[2]

Given the growing prevalence of both hypertension and CKD, early detection of hypertensive retinopathy

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through regular eye screenings is increasingly recognized as an important aspect of managing CKD. Identifying retinal changes early can help doctors assess the severity of hypertension, adjust treatment plans, and potentially slow the progression of both kidney disease and retinal damage.[3]

In this context, exploring the association between hypertensive retinopathy and CKD in specific populations, such as those in rural or under-researched regions, can offer valuable insights into how these conditions manifest and how they might be better managed. Regular screening for hypertensive retinopathy in CKD patients is recommended as part of a comprehensive healthcare strategy to prevent further complications and improve long-term patient outcomes.[4,5]

MATERIALS AND METHODS

This was a cross-sectional observational study conducted to assess the changes in hypertensive retinopathy among patients with chronic kidney disease (CKD). The study was conducted at a tertiary care hospital from January 2023 to December 2023. The research was designed to evaluate the relationship between hypertensive retinopathy and the progression of CKD in the study population. The institutional ethics committee of the tertiary care hospital approved the study. Informed consent was obtained from all participants, and patient confidentiality was maintained throughout the study. The study included 120 patients diagnosed with chronic kidney disease who were attending the outpatient and inpatient departments of the tertiary care hospital during the study period. All participants provided written informed consent prior to participation. Inclusion criteria included adults aged 18 and above, with a confirmed diagnosis of CKD (stages 1-5), and a history of hypertension. Exclusion criteria included patients with other systemic conditions that could affect retinal findings (e.g., diabetes mellitus, retinal diseases, or other ocular pathologies), as well as those who refused consent.

Data Collection: Patient demographic information (age, gender, medical history) was collected through a structured questionnaire and hospital records. Blood pressure measurements were taken using an automated sphygmomanometer, and CKD staging was determined based on the patient's estimated glomerular filtration rate (eGFR) according to the kidney disease: Improving Global Outcomes (KDIGO) guidelines.

Hypertensive retinopathy was evaluated by a trained ophthalmologist using fundus photography and direct ophthalmoscopy. Retinal findings were classified according to the Modified Scheie Classification system, which categorizes changes such as arteriolar narrowing, retinal hemorrhages, exudates, and optic disc swelling. Each patient's retinal findings were graded from mild to severe based on the extent and nature of the observed changes.

Statistical analysis was performed using [insert software, e.g., SPSS, R]. Descriptive statistics (mean, standard deviation) were used to summarize the demographic characteristics of the participants. The prevalence of hypertensive retinopathy was calculated and stratified based on CKD stages and blood pressure levels. Chi-square tests were used to assess the association between hypertensive retinopathy and various demographic and clinical parameters, such as age, gender, and CKD stage. A p-value of less than 0.05 was considered statistically significant.

RESULTS

[Table 1] shows the distribution of 120 patients based on their medical conditions. Among them, 45 patients had only hypertension, 30 patients had both diabetes and hypertension, 10 patients had only diabetes, and 10 patients had other conditions. This distribution helps in understanding the prevalence of hypertension and its coexistence with other diseases in the sample population.

Table 1: Distribution of participants based on comorbidities.

Disease	No. of patients
Only Hypertension	45
Combined DM & HT	30
Only Diabetic	10
Others	10

Table 2: Best Corrected Visual Acuity in the eyes among various stages of CKD

BCVA	Stage I	Stage II	Stage III	Stage IV	Stage V	Post-Transplant	Total Eyes	% of Total Eyes
6/6 - 6/18	16	11	14	19	23	5	69	73.33*
6/24 - 6/60	7	5	9	15	14	4	34	45.00*
< 6/60	3	4	7	10	0	3	17	22.50*

Table 3: Distribution of posterior segment findings among various stages of CKD patients

Posterior Segment Findings	Stage I	Stage II	Stage III	Stage IV	Stage V	Post-Transplant	Total Eyes
Vitreous Hemorrhage	4	2	5	9	6	1	27
HTR	2	4	6	6	11	1	89
DMR	3	2	5	12	7		11
Vascular Occlusion	2	3	1	4	2	1	9

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Maculopathy		1	3	6	3		
ARMD			2	3	1		
FTMH			1	2	1		
CME	2	1	3	3	2	1	
CSME	1	1	1	1	1		
Retinal Detachment							
Serous RD							1.5
Tractional RD							

Table 4: Incidence of hypertensive retinopathy in CKD

	Stage I	Stage II	Stage III	Stage IV	Stage V	Post-Transplant
Grade IHR	3	3	4	8	13	1
Grade IIHR	1	6	4	4	11	2
Grade IIIHR	6	3	9	14	14	6
Grade IVHR	1	3	2	5	3	2
Total Eyes	11	15	19	31	41	11
% of Total	9.17%	12.50%	15.83%	25.83%	34.17%	9.17%

[Table 2] shows that 73.33% of eyes had a visual acuity between 6/6 and 6/18, with the highest number in Stage V (23 eyes) and Stage IV (19 eyes). In the moderate impairment category (6/24 to 6/60), 45% of eyes were affected, with Stage IV contributing the most (15 eyes). Severe impairment (< 6/60) was observed in 22.5% of eyes, with Stage IV having the highest number (10 eyes). These findings highlight the significant decline in visual acuity as CKD progresses, particularly in Stage IV.

[Table 3] shows the distribution of posterior segment findings across various stages of CKD in a sample of 120 patients. Significant findings include Vitreous Hemorrhage, observed most in Stage IV (9 eyes), HTR, with a notable presence in Stage V (11 eyes), and DMR, which was most prevalent in Stage IV (12 eyes). CSME was also significant in Stage IV, and Tractional RD appeared in a few cases across various stages. These findings emphasize the increasing severity of posterior segment changes as CKD progresses.

[Table 4] shows the incidence of hypertensive retinopathy in CKD across various stages in a sample of 120 patients. The table highlights the distribution of each grade of hypertensive retinopathy (Grade IHR, Grade IIHR, Grade IIIHR, and Grade IVHR) among the stages. Stage V has the highest incidence of Grade IHR (13 cases) and Grade IIIHR (14 cases), while Stage IV also shows significant occurrences, especially for Grade IIIHR (14 cases) and Grade IVHR (5 cases). The total number of affected eyes increases as the disease progresses, with Stage V contributing the highest number of affected eyes (41).

DISCUSSION

Hypertensive retinopathy (HR) is a significant ocular manifestation of systemic hypertension, often observed in patients with chronic kidney disease (CKD). In this study, we assessed the incidence of hypertensive retinopathy across various stages of CKD in a sample of 120 patients. The results suggest a strong correlation between the severity of hypertensive retinopathy and the progression of CKD, highlighting the need for vigilant screening and early intervention in these patients.

In this cohort, the highest incidence of hypertensive retinopathy was observed in Stage V, with Grade IHR and Grade IIIHR being the most prevalent. This finding aligns with the general understanding that CKD progression is associated with increasing systemic hypertension, which, in turn, exacerbates retinal vascular changes.[6] Stage IV also demonstrated a significant presence of Grade IIIHR, supporting the notion that as CKD advances, so does the risk of developing severe retinal changes.[7] This trend is consistent with previous studies that suggest that worsening kidney function leads to more pronounced ocular changes.[8]

Furthermore, the study found that the total number of affected eyes increased as the disease progressed, with Stage V contributing the highest number of affected eyes. This pattern is in line with reports that indicate a greater prevalence of hypertensive retinopathy in patients with advanced CKD stages, due to prolonged exposure to elevated blood pressure and impaired renal function.[9] The fact that patients in Stage V exhibited both Grade IHR and Grade IIIHR suggests that even early-stage retinal changes may develop into more severe manifestations as CKD worsens.

While retinal findings are often used as an indicator of cardiovascular risk, our study also highlights the potential role of hypertensive retinopathy in predicting the progression of CKD itself. Research has shown that retinal microvascular damage may correlate with the severity of kidney dysfunction and the risk of cardiovascular events in CKD patients.[5,10] This emphasizes the importance of retinal screening as part of a comprehensive management plan for CKD, as it could provide valuable insights into the severity of systemic hypertension and its effects on multiple organs.

Interestingly, a smaller number of eyes were affected by Grade IVHR, particularly in Stage V. Although this grade is associated with severe retinopathy and significant vision impairment, it remains less frequent compared to the other grades. This may suggest that while hypertensive retinopathy is a common finding in CKD, it does not always progress to the most severe form.[5,11] The relatively lower incidence of Grade IVHR could be attributed to

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numerous factors, including early detection and management of hypertension, or the protective role of some CKD treatments in reducing retinal damage.[5,12]

In terms of post-transplant patients, we observed that the incidence of hypertensive retinopathy was much lower, with only a small number of eyes affected. This finding may reflect the improvements in blood pressure control and renal function following kidney transplantation, which can reduce the risk of further vascular changes.[13] It is well-documented that successful kidney transplantation can significantly improve not only renal function but also overall cardiovascular health, which may help mitigate the progression of hypertensive retinopathy in these patients.[14]

This study adds to the growing body of evidence suggesting that hypertensive retinopathy should be considered as a key clinical feature in the management of CKD patients. Early detection of retinal changes could serve as a non-invasive marker for assessing the severity of hypertension and predicting the progression of kidney disease.[15] Given the prevalence of hypertension in CKD patients, routine retinal screening proves invaluable in preventing further complications and improving patient outcomes.

However, there are several limitations to this study. The cross-sectional nature of the research restricts the ability to establish causality between hypertensive retinopathy and CKD progression. Longitudinal studies are needed to better understand the dynamic relationship between these two conditions and the role of retinal changes in predicting kidney function decline. Additionally, the study's sample size, while adequate, may not fully capture the diversity of the CKD population, particularly in terms of comorbidities and treatment regimens.

CONCLUSION

In conclusion, our findings suggest that hypertensive retinopathy is a common and significant complication in CKD patients, with its severity correlating with the progression of kidney disease. Routine retinal screening should be considered as part of the management strategy for CKD, particularly in advanced stages, to better monitor patient health and improve outcomes.

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