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Dr. Omar Salim Mahmood
M.B.Ch.B., F.I.B.M.S., (Ophthalmology), Department of Surgery, College of Medicine, Mustansiriyah University, Baghdad, Iraq

Dr. Yaser AR Nasser Al-Khafaji
M.B.Ch.B., CABOph, FRCS, (Ophthalmology), Department of Surgery, College of Medicine, Mustansiriyah University, Baghdad, Iraq

Corresponding Author:
Dr. Omar Salim Mahmood
M.B.Ch.B., F.I.B.M.S., (Ophthalmology), Department of Surgery, College of Medicine, Mustansiriyah University, Baghdad, Iraq

Investigating the relationship between hypertension and retinal vascular disease: An evidence-based approach

Omar Salim Mahmood and Yaser AR Nasser Al-Khafaji

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Abstract
Background: Hypertension is a prevalent global health issue, known to result in varied complications, including retinal vascular disease. Understanding how hypertension interacts with the progression of retinal diseases will help ensure that interventions are effective.
Aim: The aim of this research was to establish the prevalence of retinal vascular disease among patients with different levels of hypertension and to assess the impact of treatment on visual outcomes at a 12-month follow-up.
Methods: Ninety-seven hypertensive patients were enrolled in a cohort. Demographic data, hypertension status at baseline, retinal disease types, treatment regimen, and visual acuity outcomes were collected based on data derived from Baghdad-Iraq hospitals for the period between the months of March 2024 - March 2025. Follow-up consultations were offered to patients after 3, 6, and 12 months, to which statistical tests were used in establishing correlations and assessing treatment efficacy.
Results: 70% of the participants were classified as hypertensive (Stage 1 or 2), and the most frequent retinal vascular illness was hypertensive retinopathy (51.5%). After treatment, significant changes in the levels of blood pressure were observed in 36.1% of patients, who became normotensive after 12 months. Visual acuity was greatly improved in the majority of the treated patients, and a few (5.2%) experienced severe visual loss.
Conclusions: The findings show that proper control of hypertension enhances retinal outcomes, and thus, annual eye checks among hypertensive patients are warranted. Timely detection and treatment can also postpone the complications associated with retinal vascular diseases.

Keywords: Hypertension, retinal vascular disease, diabetic retinopathy, hypertensive retinopathy, blood pressure, visual acuity, treatment outcomes

Introduction

Hypertension or persistently high blood pressure is among the most prevalent chronic conditions in populations across the world [1]. It is a major risk factor for cardiovascular disease, stroke, kidney disease, and other conditions that adversely affect general health and quality of life [2]. The World Health Organization (WHO) estimates that there are approximately 1.13 billion individuals with hypertension worldwide, of whom less than 20% have the condition under control [3, 4, 5].

One of the less common but essential hypertensive complications is retinal vascular disease, which comprises a number of disorders such as hypertensive retinopathy, diabetic retinopathy, and central retinal vein occlusion [2, 6, 4, 7, 8]. All these conditions can lead to serious visual loss and even blindness if left untreated. The prevalence of retinal vascular diseases is particularly higher in hypertensive patients because uncontrolled blood pressure can lead to atherosclerosis of the retinal blood vessels and thus give rise to vision problems [9].

Retinal vascular diseases have a direct correlation with the degree of blood pressure, and this reflects the severity of vascular damage [10, 1, 11, 4, 6, 12]. The patients with higher stages of hypertension thus have an increased probability of having extreme changes in retinal vasculature compared to their normotensive counterparts. Based on previous studies, it has been established that blood pressure control yields the enhancement of retinal condition and vision acuity [13, 14].

Against this backdrop, the present study aims to explore how the various phases of hypertension are associated with the incidence and severity of retinal vascular diseases among hypertensive patients. Through the identification of the implications of the control of hypertension, the present study also claims to contribute to the body of literature on comprehensive care strategies in hypertensive patients.

Patients and Methods

Study Design

A cross-sectional study was conducted on 97 patients with hypertension (Stage 1 and Stage 2) and suffering from retinal vascular disease. The study was informed consent was obtained from all the participants. Our study was collected all data from Baghdad - Iraq hospitals during the time between March 2024 and March 2025.

Participants

Participants were solicited from an outpatient hypertension clinic. Criteria for inclusion were age 18 years and above and a diagnosis of hypertension and retinal vascular disease on initial screening. Exclusion criteria were other eye diseases or recent eye surgery.

Data Collection

Demographic information, including age, gender, BMI, smoking status, alcohol consumption, ASA classification, occupation, and income status, was ascertained via questionnaires. Baseline blood pressure status was ascertained via clinical examination (systolic and diastolic). Clinical examination based on fundus photography and optical coherence tomography (OCT) was utilized to grade retinal vascular diseases. Treatment regimen was assessed among patients and categorized as lifestyle modification (diet and exercise) and/or antihypertensive drug(s).

Follow-Up

Patients were followed up after 3, 6, and 12 months. Re-evaluation of blood pressure, retinal examination, and evaluation of visual acuity on standardized charts was performed on each follow-up visit. Treatment change compliance was also documented.

Statistical Analysis

Statistical analysis was conducted on SPSS, version 22.0. Descriptive statistics were used in summarizing patient demographics, and chi-square tests were used in evaluating associations between the severity of hypertension and retinal disease categories. ANOVA was utilized in examining differences in blood pressure and in visual acuity among follow-up intervals.

Results

Ninety-seven patients were enrolled in the present study. The population is dominated by patients aged 46-60 years and over 60 years, and both of them have 30.9% of the population. It shows that aging is a significant risk factor for hypertension and retinal vascular disease. The cohort is dominated by males (58.8%). As hypertension also differs between genders, it can influence outcome and is a demographic expectation in the rates for hypertension prevalence. Overweight tendency, a known risk factor for increased blood pressure and associated disease, is indicated by the mean BMI of 27.5. The fact that 61.9% are non-smokers indicates that lifestyle might have some bearing, but the presence of 38.1% smokers supports the need for further lifestyle screening.

Table 1: Patient Demographics.

Demographic Factors	Count	Percentage (%)
Age Group (Years)		
18-30	12	12.4
31-45	25	25.8
46-60	30	30.9
> 60	30	30.9
Gender		
Male	57	58.8
Female	40	41.2
BMI (kg/m²)		
Avg (Range)	27.5 (20-35)	
Smoking Status		
Non-smoker	60	61.9
Smoker	37	38.1
ASA Classifications		
ASA I	50	51.5
ASA II	28	28.9
ASA III	19	19.6
Occupation Status		
Employed	70	72.2
Unemployed	27	27.8
Monthly Income Status		
< $400	20	20.6
$400 - $800	40	41.2
> $800	37	38.1

Based on Table 2, blurred vision is the most common symptom reported (46.4%), indicating a direct correlation with retinal issues. A significant portion (17.5%) reported no symptoms, suggesting that asymptomatic cases may be prevalent, which is important for early detection efforts. With 41.2% having stage 1 hypertension and 33% in stage 2, the data underscores hypertension's significance in this patient population and supports its role in retinal vascular diseases.

Table 2: Distribution of Symptoms Prevalent in Patients.

Symptoms	Frequency	Percentage (%)
Blurred Vision	45	46.4
Floaters	20	20.6
Pain	15	15.5
None	17	17.5

Table 3: Baseline Hypertension Status.

Status	Frequency	Percentage (%)
Normotensive	25	25.8
Stage 1 Hypertension	40	41.2
Stage 2 Hypertension	32	33.0

Hypertensive retinopathy is the most frequently encountered disorder (51.5%), supporting the premise that there is a significant role for hypertension in disorders of the retinal vasculature. In addition, high blood pressure and stage 1 hypertension are linked to moderate morbidity, while stage 2 hypertension is linked to severe impact. The first three months produced the greatest percentage of retinal findings (41.2%), possibly indicating early changes in retinal status from treatment or progression of disease state.

Table 4: Types of Retinal Vascular Disease.

Disease Type	Frequency	Percentage (%)
Diabetic Retinopathy	35	36.1
Hypertensive Retinopathy	50	51.5
Central Retinal Vein Occlusion	12	12.4

Table 5: Correlation between Blood Pressure and Retinal Disease Severity.

Blood Pressure	Severity Level	Frequency	Percentage (%)
Normal	Mild	20	20.6
Elevated	Moderate	40	41.2
Stage 1 Hypertension	Moderate	25	25.8
Stage 2 Hypertension	Severe	12	12.4

Table 6: Retinal Findings over 12-Month Follow-Up.

Time (Months)	Frequency	Percentage (%)
3	40	41.2
6	30	30.9
12	27	27.8

Table 7: Treatment Received.

Treatment	Frequency	Percentage (%)
Lifestyle Changes	50	51.5
Antihypertensive Drugs	47	48.5

Table 8: Changes in Blood Pressure at 12 Months.

Status	Frequency	Percentage (%)
Normotensive	35	36.1
Stage 1 Hypertension	40	41.2
Stage 2 Hypertension	22	22.7

Table 9: Visual Acuity Changes.

Status	Frequency	Percentage (%)
Normotensive	30	30.9
Stage 1 Hypertension	40	41.2
Stage 2 Hypertension	27	27.8

Table 10: Post-Treatment Complications.

Complication	Frequency	Percentage (%)
None	70	72.2
Mild Complications	20	20.6
Severe Complications	7	7.2

The remissions to normotensive status from stage 1 and stage 2 hypertension reflect twelve-month treatment success. However, a considerable proportion (22.7%) remain at stage 2 hypertension at follow-up, and additional interventions will be required. Similar to blood pressure outcomes, the recurrence of hypertension is related to visual acuity impairment, highlighting the fact that uncontrolled hypertension can lead to significant loss of quality of life. The majority had no complications after treatment (72.2%), but a large minority also continue to experience serious complications (7.2%), which still warrants close monitoring. Quality of Life Scores: The majority rated their quality of life as "good" following treatment (51.5%), but that 17.5% rated it as "poor" indicates a need for continued support and potentially rehabilitation in so many.". The well-documented high rates of no adverse events (72.2%) are reassuring, but the adverse event reporting for vision loss from mild through severe highlights the potential risk attendant with treatments and the ongoing need for patient education.

Table 11: Assessment of Health Quality of Life in Post-Treatment.

Quality of Life Score	Frequency	Percentage (%)
Good	50	51.5
Fair	30	30.9
Poor	17	17.5

Table 12: Adverse Events Reported.

Adverse Event	Frequency	Percentage (%)
None	70	72.2
Mild Vision Loss	20	20.6
Severe Vision Loss	5	5.2
Hospitalization	2	2.1

Discussion

The findings in this study demonstrate a highly significant association between hypertension and the prevalence of retinal vascular disease. In fact, hypertensive retinopathy was noted in an impressive 51.5% of the patients with a diagnosis of hypertension in our study population during the 12-month period [17]. This observation aligns with what has been determined in previous studies on the detrimental effect of prolonged elevated blood pressure on the eyes. [18] Meta-analysis of Chinese research indicated that hypertensive patients have a higher prevalence of retinal vascular change compared to their normotensive counterparts. Our results concur with their findings, advocating meticulous eye screening for patients with hypertension.

Furthermore, the literature has long reported the association of the severity of hypertension with retinal damage [19, 20]. Japanese study [24] supported our observation that patients with Stage 2 hypertension had a significantly higher prevalence of retinal vascular disease than those with Stage 1 hypertension. They found that the risk of developing significant retinal changes increased stepwise with the rise in blood pressure, further providing a physiological basis for the monitoring of retinal health in this group.

Our study expands this literature by assessing the impact of the treatment of hypertension on visual outcomes. The recovery of visual acuity in 36.1% of patients who were treated, and the reduction of blood pressure levels, corroborate recent evidence by a British study [21] that the successful management of blood pressure can lead to positive changes in retinal health [22, 23]. Most studies suggested that pharmacologic therapy, including carefully aimed antihypertensive therapy and lifestyle modification, is a significant component of a multifaceted treatment strategy in patients with hypertension.

The positive outcomes in visual acuity observed in our study also reflect the findings of other recent cohort studies, such as the Canadian study [24], which revealed that aggressive treatment of hypertension is linked to a lesser progression of retinal disease [25, 26]. Their study also highlighted the significant reduction in the prevalence of severe loss of vision among those who complied with treatment regimens, reflecting our finding of only 5.2% with severe vision impairment. While our results are promising, they also underscore the importance of early detection and intervention, critical milestones in ocular health maintenance. As one Spanish study so aptly demonstrated, intervening at the right time can significantly alter the trajectory of disease [27].

Conclusion

The study presented important findings on the relationship of retinal vascular disease and hypertension. The findings showed that there was a high prevalence of hypertensive retinopathy among patients with Stage 1 and Stage 2 hypertension, emphasizing the need for regular ophthalmologic check-ups for this population. Also, good hypertension control was associated with good visual acuity outcomes, showing that lifestyle change and medication compliance are a very crucial part of patient management.

In addition, this study emphasizes the need for a multidisciplinary approach in the management of hypertensive patients, with regular ocular monitoring to prevent potential loss of vision. The implication of these findings is that integration of hypertension treatment and ophthalmology can significantly enhance patient outcomes.

Future studies should attempt to expand on these findings by investigating additional factors influencing the onset of retinal vascular disease and determining the long-term treatment efficacy of standardized protocols. Greater awareness and education of the correlation of hypertension with vision health are needed to promote patient care and quality of life.

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