Original Article

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A Higher Prevalence of Diabetes Mellitus Among Patients with Nonarteritic Ischemic Optic Neuropathy

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ABSTRACT

Background: The association of diabetes mellitus, nighttime blood pressure dipping, and nonarteritic ischemic optic neuropathy is unclear. There has been no study to test this association among Arab patients.

Objectives: To determine an association between diabetes mellitus, nighttime blood pressure dipping, and nonarteritic ischemic optic neuropathy in a cohort of patients from Basrah, Southern Iraq.

Methods: A cross-sectional study conducted on patients with nonarteritic ischemic optic neuropathy at the ophthalmology clinic at Faiha Teaching Hospital in 2018. Patients with nonarteritic ischemic optic neuropathy were screened for diabetes mellitus. An ambulatory blood pressure monitor was attached to some of the participants for 24 hours. Nighttime blood pressure dipping was classified into four categories: normal, blunted, severe, and reverse.

Results: From a total of 74 patients with nonarteritic ischemic optic neuropathy included in the study, women constituted 64.9 % of the cases. Of all, 40 patients (53.3%) were found to have diabetes mellitus, whereas 41 participants (55.5%) were hypertensive. Nocturnal dipping of blood pressure was measured in 38 patients. Only 6 (15.7%) of them had severe dipping.

Conclusions: There may be an association between diabetes mellitus but not between nighttime blood pressure dipping with nonarteritic ischemic optic neuropathy.

Keywords: Optic Neuropathy, Diabetes Mellitus, Hypertension.

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INTRODUCTION

Nonarteritic ischemic optic neuropathy (NAION) is the most common acute form of optic neuropathy in elderly people.[1,2] Afferent pupillary defects and sudden loss of vision and visual field are common presenting features among those patients. The diagnosis can be confirmed further by characteristic features on fundus examination.[2] Although the exact etiology of NAION is unclear, several factors have been highlighted and studied in the literature. These factors include systemic conditions such as hypertension and diabetes mellitus (DM).[3-7] More specifically, nocturnal dipping of blood pressure is suggested as one of the factors.[8,9]

DM is a group of metabolic disorders characterized by chronic hyperglycemia due to insulin resistance, insulin deficiency, or both.[10] The chronic elevation of plasma glucose has deleterious sequelae on different organs and systems in the body. Diabetic eye complications include diabetic retinopathy, cataract, and macular edema. However, the association of DM with NAION is still controversial. On one hand, several studies have shown that DM significantly increases the risk of NAION.[6,7,11] On the other hand, other studies have failed to demonstrate any association.[4,12]

Blood pressure follows a circadian variation with late nighttime dipping.[13] Optic nerve head circulation is affected negatively by this variation.[14] A significant reduction in optic nerve head circulation has been observed during night hours.[13]

The association of DM and nighttime blood pressure dipping with NAION is still inconclusive. Thus, this study aims to determine whether DM and nighttime blood pressure dipping are associated with NAION among a cohort of patients from Basrah, Southern Iraq.

MATERIALS AND METHODS

This was a cross-sectional study conducted on people with NAION who visited the ophthalmology clinic at the Fiaha Teaching Hospital in Basrah, Iraq, from January to June 2018. Primary health care centers referred patients with various visual problems to the Ophthalmology clinic, where a consultant ophthalmologist examined all the referred patients. A short follow-up period of one day followed the cross-section design, to monitor nocturnal dipping in blood pressure with the help of an ambulatory blood pressure monitor (CONTEC ™ – AUTOMATIC BP MONITOR—MODEL: ABPM50, Hebei, China). An ophthalmologist diagnosed NAION depending on the symptoms and the characteristic findings of optical coherence tomography (swollen and hyperemic optic disc or the presence of peripapillary hemorrhages) on fundus examination.[15] Demographic data and anthropometric measurements were documented. The participants were labeled as having DM according to their history, and antidiabetic medications and the duration of DM were recorded. For those who did not have a history of DM, fasting plasma glucose and glycated hemoglobin were measured, and the diagnosis of DM was made according to the American Diabetes Association's criteria.[10] Furthermore, the lipid profile and fasting and

random blood glucose readings for those with DM were documented. Similarly, those with a known history of hypertension or antihypertensive medications were labeled as having hypertension. For those who did not have these criteria, their systolic and diastolic blood pressures were documented while they sat calmly for five minutes. Three blood pressure readings were recorded, and the mean was calculated. Hypertension diagnosis was made according to the 8th Joint National Committee criteria.[16] Then an ambulatory blood pressure monitor was attached to 36 participants for 24 hours. The report of the monitor was then analyzed the next day for nighttime dipping, which is classified into one of the following categories: normal (dipper, 10–20% reduction in nocturnal blood pressure), blunted (non-dipper, <10% reduction), reverse (riser, increase in nocturnal blood pressure) and severe dipping (extreme dipper, reduction >20 %).[17]

Descriptive data are presented as mean and standard deviation after testing for normal distribution. A chi-square test was used as a test of significance, and the *p* value < 0.05 was set as significant. The Statistical Package for Social Sciences (SPSS) version 25 was used for the analysis.

The Ethic Committee of Basrah Health Directorate granted ethical approval. Each participant signed an informed consent form.

RESULTS

The study included a total of 74 patients with NAION. The mean age of the participants was 52.9 ± 10.7 years, and women constituted 64.9% of the cases. The majority of the participants were overweight with a mean body mass index of 29.9 ± 4.7 kg/m^2. The other basic characteristics of the participants are shown in Table 1.

Table 1: Basic characteristics of the participants.

Characteristic	Count
Gender, n (%)	
Males	26 (35.1)
Females	48 (64.9)
Age, mean ± SD (year)	52.9 ± 10.7
BMI, mean ± SD (kg/m^2)	29.9 ± 4.7
SBP, mean ± SD (mmHg)	136.3 ± 23.5
DBP, mean ± SD (mmHg)	78.1 ± 12.5
eGFR, mean ± SD (ml/min)	106.4 ± 24.5
TG, mean ± SD (mmol/L) (mg/dL)	1.6 ± 0.4 (141.6 ± 35.4)
LDL, mean ± SD (mmol/L) (mg/dL)	3.1 ± 0.9 (119.6 ± 34.7)
HDL, mean ± SD (mmol/L) (mg/dL)	1.1 ± 0.5 (42.4 ± 19.3)

BMI: body mass index, DBP: diastolic blood pressure, eGFR: estimated glomerular filtration rate, HDL: high density lipoprotein, LDL: low density lipoprotein, SBP: systolic blood pressure, SD: standard deviation, TG: triglyceride.

Forty patients (53.3%) were found to have DM (Table 2).

Table 2: Characteristics of participants with diabetes.

Characteristic	Count	P value
DM, n (%)		
Present	40 (53.3)	
Absent	34 (46.7)	
Duration, mean ± SD (years)	8.3 ± 9	
Gender, n (%)		0.4
Male	16 (40)	
Female	24 (60)	
Age, mean ± SD (years)	63.2 ± 12.2	
BMI, mean ± SD (kg/m^2)	30.9 ± 5.3	
FPG, mean ± SD (mmol/L) (mg/dL)	7.8 ± 2.7 (140.4 ± 48.6)	
RPG, mean ± SD (mmol/L) (mg/dL)	11.1 ± 5.4 (200.0 ± 97.2)	
Retinopathy, n		0.000
Absent	35	
NPDR	4	
PDR	1	
Maculopathy, n		0.000
Absent	35	
Moderate	3	
Severe	2	

BMI: body mass index, DM: diabetes mellitus, FPG: fasting plasma glucose, NDPR: non-proliferative diabetic retinopathy, PDR: proliferative diabetic retinopathy, RPG: random plasma glucose.

While 41 participants (55.5%) were hypertensive, nocturnal dipping of blood pressure wasfound in 36 patients. Only six (16.6%) experienced severe dipping (Figure 1). Regarding the type of antihypertensive medication, 38 participants were on angiotensin receptor blockers or angiotensin-converting enzyme inhibitors, and eight were on calcium channel blockers.

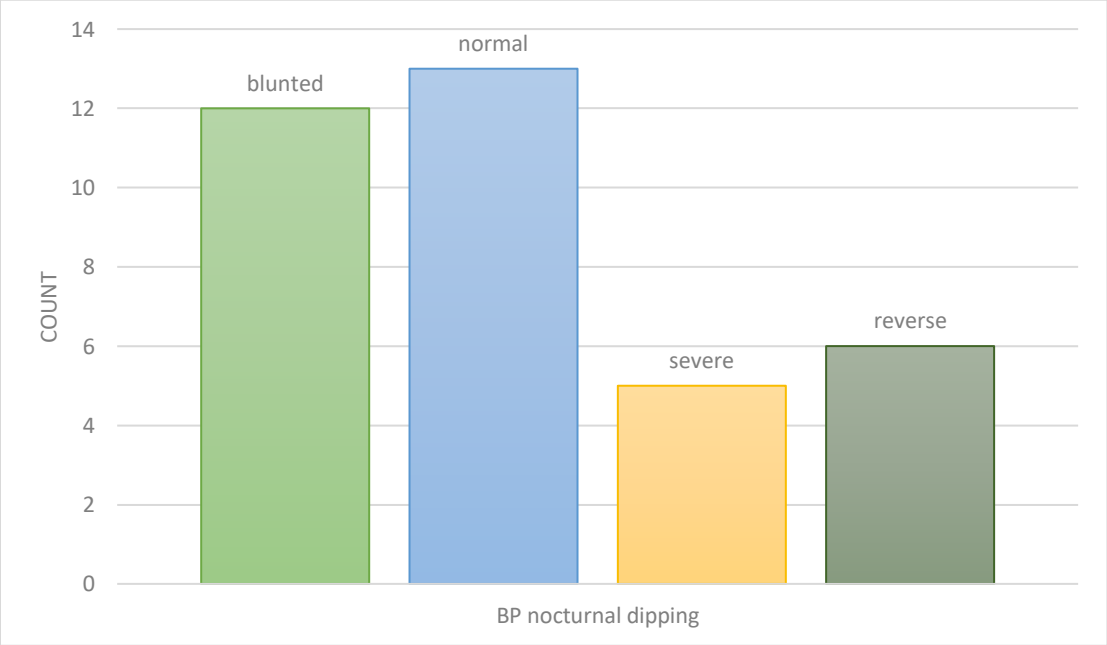

Figure 1: Pattern of nighttime blood pressure dipping.

DISCUSSION

Nonarteritic anterior ischemic optic neuropathy (NAION) is the second most common optic neuropathy in adults.[2] The exact pathogenetic mechanism of NAION is still unclear. Nighttime blood pressure dipping and DM have been proposed as possible risk factors. In this study, we tried to clarify the association of NAION with these two conditions. We demonstrated a strong association between DM and NAION, as 53.3 % of the participants had DM, which is higher than other studies where 5–25% of the participants had DM [6,7,18]

Additionally, in a meta-analysis conducted by Chen et al., the odds ratio of having DM and NAION was found to be 1.64 (95% CI = 1.17–2.30) compared to nondiabetic patients. [1] An interesting finding of our study is that patients with DM and NAION are less likely to have had retinopathy and/or maculopathy (14%). However, another study has found that 30% of patients with DM and NAION have coexistent retinopathy.[15]

It has been suggested that NAION results from circulatory failure at the optic nerve head level.[19] Relatively younger patients with NAION have a stronger association with diabetes, hypertension, and hypercholesterolemia than older patients.[9,20] DM is a well-established risk factor for ischemia, and NAION might be a microvascular complication of DM. Moreover, hyperglycemia can induce circulatory failure via the polyol pathway, residual oxygen species, and glycation end products.[1] Capillary occlusion may result from hyperglycemia-induced leukostasis.[21] Furthermore, a defect in the autoregulatory mechanism of blood flow in the optic nerve head is required to induce persistent hypoperfusion.[2] The autonomic neuropathy of diabetes may contribute to this autoregulatory defect.

Our study failed to demonstrate a relationship between nighttime blood pressure dipping and NAION. This contrasts with the study of Hayreh et al., who suggested a strong effect of nocturnal blood pressure dipping on NAION and, therefore, recommended that the use of antihypertensive medications at night be avoided.[5,9] However, Landau et al. achieved a result similar to ours and demonstrated no significant association between the two conditions.[22]

The rate of hypertension in our study (55.5%) was slightly higher compared to other studies (34–49%).[6,7]

Similar to other studies,[23-25] there was no gender difference in our study. Likewise, we have found that people in their sixties and seventies are mostly affected. This is in line with other studies.[12,18,24,26]

The limitations of our study are as follows: First, the controls that preclude the test for association and significance were absent. Second, the sample size was relatively small. Third, the study was conducted in a single center. Fourth, we did not specify the type of DM. Last, we could not confirm the causality of the association between DM and NAION.A strength of our study is that it is the first study on NAION among Arab patients. It seems that there is some ethnic influence on the prevalence of NAION, with Caucasians being more likely to be affected than African-Americans.[24]

CONCLUSIONS

Our results suggest a high prevalence of DM in conjunction with a lower prevalence of nighttime blood pressure dipping among patients with NAION. We recommend that endocrinologists and diabetologists pay attention to this association and refer their patients for a proper eye examination at the earliest symptoms of NAION. Similarly, ophthalmologists should emphasize the importance of healthy glycemic control among their patients who are known to have DM and NAION and screen for DM in those with NAION without a history of diabetes. Finally, larger case-control studies are needed to test the association between the two conditions.

Authors contribution

AA designed the study and reviewed the manuscript. HM collected the data and examined the patients. MA reviewed and analyzed the data and wrote the manuscript.

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