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Prevalence of ocular motor nerve palsy among diabetic patients in Erbil city, Iraq

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Abstract

Background and objective: The burden of morbidity and mortality caused by the complications of acute and chronic hyperglycemia is rising along with the prevalence of diabetes mellitus in the world. About 50% of diabetic patients will eventually develop neuropathy. In particular, the abducens, oculomotor, and trochlear nerves, which supply the extraocular muscles, are affected by the most common diabetic cranial mononeuropathies. This study is to determine the prevalence, risk factors, and main treatment options for ocular motor nerve palsy in diabetes individuals.

Methods: During the period from 1st of August 2021 to 31st of March 2022, a cross-sectional study was conducted in the Ophthalmology Department/ Rizgary Teaching Hospital and Erbil Teaching Hospital. A convenient sample of 500 patients who were diagnosed with diabetes was enrolled in the current study.

Results: Out of the 500 patients, 6 (1.2%) had oculomotor nerve palsy, of them, 2 (33.3%) had ptosis, 4 (66.6%) had diplopia, and 2 (33.3%) had pain. Trochlear nerve palsy was diagnosed in 2 (0.4%) of the patients. Of them, 2 (100%) had diplopia. Only one patient was diagnosed with abducent nerve palsy and presented with diplopia. Diabetic retinopathy was diagnosed in 31.3%.

Conclusion: The prevalence of ocular motor nerve palsy was low among diabetic patients in the current study but it was higher than recorded in other studies. Many factors including occupation, smoking, alcohol, hypertension, hyperlipidemia, cerebrovascular disease, Aspirin use, duration of diabetes, and presence of diabetic retinopathy can affect the prevalence of ocular motor nerve palsy.

Keywords: Diabetes; Aspirin; Trochlear; Oculomotor; Abducens.

Introduction

Diabetes mellitus (DM) is a group of metabolic abnormalities characterized by an increase in plasma blood glucose (hyperglycemia) and disturbances in carbohydrate, fat, and protein metabolism, It is a long-term condition that has a big impact on people's lives, families, and societies around the world.[1,2] Chronic diabetic complications are grouped under two groups: Microvascular complications include neuropathy, retinopathy, and nephropathy. Macrovascular complications include faster cardiovascular disease including ischemic heart disease and cerebrovascular disease as strokes.[3]

The prevalence of diabetic neuropathy, a frequent long-term complication of DM, varies with the degree and length of hyperglycemia. Approximately half of diabetic patients will eventually develop neuropathy. The nerve supply of extraocular muscles are most frequently affected, particularly VI (abducens), III (oculomotor), and IV (trochlear).[4]

The oculomotor nerve palsy may cause dysfunction of the autonomic muscles and somatic muscles.[5] The more frequently

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occurring, partial third nerve palsy, can have varying restrictions on upward, downward, or adducting movements as well as ptosis or pupillary dysfunction. Minor ptosis may be present in partial oculomotor weakness, and subtle abnormalities in eye movement may also occur.[4,6] While patients with a complete third nerve palsy present with complete ptosis, the eye is positioned downward and outward and unable to adduct, elevate, or depress, and dilated pupil that responds poorly to light.[5]

The fourth cranial nerve is a purely efferent or pure motor nerve and it innervates a single muscle, the superior oblique. The primary action of the superior oblique muscle is intorsion of the eye in the primary position; the secondary action is depression of the eye in the adducted position; a tertiary action of the muscle is abduction (especially in the abducted position).[7]

The presentations of trochlear nerve palsy comprise vertically double vision (vertical diplopia) or the images being tilted or rotated (torsional diplopia). The diplopia might be binocular as it may be worse or better in different gazes. In the case of a right superior oblique involvement, the vertical diplopia is maximum when the right eye is directed downwards and inwards. The red-green colored glasses might be used to diagnose diplopia more accurately.[8]

Abducens nerve palsy is the second most prevalent cranial nerve disorder behind the fourth cranial nerve. It is significantly increased by poorly managed DM.[9,10] Binocular horizontal diplopia when looking to the side of the paretic eye is one of the symptoms. When the patient looks straight ahead, the eye is slightly adducted because the medial rectus muscle's tonic action is unopposed. The lateral sclera is exposed even when the eye is fully abducted, which happens slowly. The eye cannot adduct past the midline in total paralysis.[11]

This study aims to find out the prevalence, risk factors, and main treatment options of ocular motor nerve palsy among diabetic patients.

Methods

Study design and setting

During the period from 1st of August 2021 to 31st of March 2022, a cross-sectional study was conducted in the Ophthalmology Department/ Rizgary Teaching Hospital and Erbil Teaching Hospital. A convenient sample of 500 patients who were diagnosed with DM was enrolled in the current study. This study included people with an age of ≥18 years old and who has confirmed diagnosis of DM. While patients who were diagnosed with other severe chronic neurological diseases, and cranial nerve palsies due to infective or traumatic aitiology were excluded.

Data collection

A questionnaire included the following information were used: Age, gender, employment, residency, smoking, alcohol state, past medical history, and duration of DM. In addition to examination of weight and height.

Ophthalmologic examination: The degree of ophthalmoplegia, residual muscle deviation, and ocular movements were recorded with Hess charting and diplopia charting. The relative limitation of the inferior oblique, medial, superior, inferior, and lateral rectus ocular ductions served as a measure of the degree of ophthalmoplegia. In addition, the researcher used a slit lamp to examine the anterior segment of the eye and also post segment by the plus 90 + 78 lens by three mirror lenses and automated tonometry to measure the intraocular pressure. All patients were sent for an MRI of the brain.

Ethical approval

The study has been proposed and subsequently approved by the scientific committee of the College of Medicine/ Hawler Medical University. Fully informed consent was obtained from the patients verbally after explaining the aim of

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the study thoroughly and clearly. All participants were assured of anonymity and confidentiality of information.

Statistical analysis

The data was entered and analyzed by software package of social science (SPSS) version 22. Descriptive statistics were presented as frequencies and were applied to explain the characteristics of participants. The comparison between the study groups was done by Chi-Square test and Fisher's Exact Test. A *P*-value less than 0.05 was considered statistically significant.

Results

A total of 500 diabetic patients were enrolled in the current stud, more than half of them were female (54.2%), and the largest age group was 51-60 years followed by >60 years (Table 1)

Regarding chronic co-morbidities, 24.45% of the patients had hypertension, 19.4% had cardiovascular disease, and 23.4% had hyperlipidemia, as shown in Table 2.

Table 1 Sociodemographic characteristics of the patients

Sociodemographic characteristic		N	%
Gender	Male	229	45.8
	Female	271	54.2
Age group	<30	84	16.8
	31-40	63	12.6
	41-50	111	22.2
	51-60	125	25.0
	>60	117	23.4
Employment	Student	13	2.6
	Unemployed	290	58.0
	Employed	158	31.6
	Military	12	2.4
	Retired	27	5.4
Residency	Urban	277	55.4
	Rural	223	44.6
Smoking	No	396	79.2
	Yes	104	20.8
Alcoholic	No	499	98.4
	Yes	8	1.6

Table 2 Chronic disease of the patients

Chronic disease		N	%
Hypertension	No	378	75.6
	Yes	122	24.4
Cardiovascular disease	No	403	80.6
	Yes	97	19.4
Hyperlipidemia	No	383	76.6
	Yes	117	23.4
Chronic kidney disease	No	491	98.2
	Yes	9	1.8

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According to the body mass index, more than half of the patients had normal weight, 35.2 had overweight, while 10% of the patients were obese, as shown in Figure1. About half of the patients had diabetes for less than ten years (51%), while the others for more than ten years. Most of the patients had type 2 DM (T2DM) (86.6%) and 13.4% had type DM (T1DM) (Table 3). Regarding Aspirin use, 27.4% of the patients were using Aspirin, as shown in Figure 2.

Table 3 Characteristics of diabetes

Characteristic		N	%
Disease duration (years)	<10	277	55.4
	≥10	223	44.6
Disease type	T1DM	67	13.4
	T2DM	433	86.6
HbA1c	<8	90	18.0
	8.1-9	96	19.2
	9.1-10	108	21.6
	10.1-11	91	18.2
	11.1-12	52	10.4
	>12	63	12.6

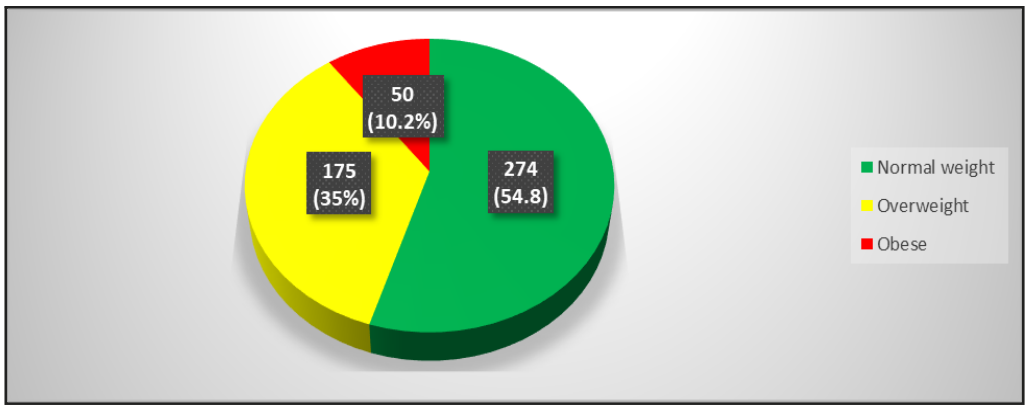

Figure 1 Body mass index of the participants

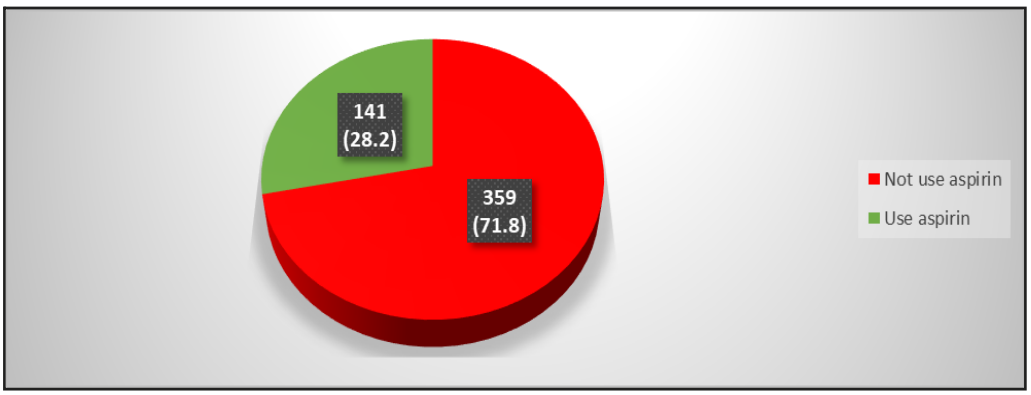

Figure 2 The percentage of Aspirin use

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Out of the 500 patients, 6 (1.2%) had oculomotor nerve palsy, of them, 2 (33.3%) had ptosis, 4 (66.6%) had diplopia, and 2 (33.3%) had pain. Trochlear nerve palsy was diagnosed in 2 (0.4%) of the patients. Of them, 2 (100%) had diplopia. Only one patient was diagnosed with abducent nerve palsy and presented with diplopia. As shown in Tables 4 and 5.

Table 4 The prevalence of ocular motor nerve palsy

Ocular abnormality		N	%
Ocular motor nerve palsy	Oculomotor nerve	6	1.2
	Trochlear nerve	2	0.4
	Abducens	1	0.2
	Total	9	1.8

Table 5 Presentation of the patients with ocular motor nerve palsy

Ocular abnormality			N	%
Oculomotor nerve N=6	Abnormal EOM*		6	100.0
	Ptosis		2	33.3
	Diplopia		4	66.6
	Pain		2	33.3
	MRI**	Normal	6	100.0
		Abnormal	0	0.0
Trochlear nerve N=2	Abnormal EOM		2	50.0
	Ptosis		0	0.0
	Diplopia		2	100.0
	Pain		0	0.0
	MRI	Normal	2	100.0
		Abnormal	0	0.0
Abducens nerve	Abnormal EOM		1	100.0
	Ptosis		0	0.0
	Diplopia		1	100.0
	Pain		0	0.0
	MRI	Normal	1	100.0
		Abnormal	0	0.0

*Extraocular movement. **Magnetic resonance image

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There was a significant association between the prevalence of ocular motor palsy and occupation, smoking, and alcohol drinking (*P* <0.05), the higher prevalence was among retired followed by military, smokers, and among alcohol drinkers (Table 6)

Table 6 Association between the sociodemographic characteristics and prevalence of ocular motor palsy

Sociodemographic characteristics		N	Ocular motor palsy		*P*-value
			Yes (N=9) N (%)	No (N=491) N (%)	
Gender	Male	229	6 (2.6)	223 (97.4)	0.176*
	Female	271	3 (1.1)	268 (98.9)	
Age group	<30	84	0 (0.0)	84 (100.0)	0.290**
	31-40	63	0 (0.0)	63 (100.0)	
	41-50	111	3 (2.7)	108 (97.3)	
	51-60	125	2 (1.6)	123 (98.4)	
	>60	117	4 (3.4)	113 (96.6)	
Residency	Urban	277	7 (2.5)	270 (97.5)	0.153**
	Rural	223	2 (0.9)	221 (99.1)	
occupation	Student	13	0 (0.0)	13 (100.0)	0.001**
	Unemployed	290	4 (1.4)	286 (98.6)	
	Employed	158	1 (0.6)	157 (99.4)	
	Military	12	1 (8.3)	11 (91.7)	
	Retired	27	3 (11.1)	24 (88.9)	
Smoking	Yes	104	8 (7.7)	96 (92.3)	<0.001*
	No	396	1 (0.3)	395 (99.7)	
Alcohol	Yes	8	6 (75.0)	2 (25.0)	<0.001*
	No	492	3 (0.6)	489 (99.4)	

*Fisher's Exact test. **Chi-square test

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The higher prevalence was significantly more among those with marked obesity, hypertension, cardiovascular disease (CVD), hyperlipidemia, and chronic kidney disease (P <0.05). In addition, the higher prevalence was among those who were not using Aspirin (P <0.05), as shown in Table 7.

Table 7 Association between co-morbidities, Aspirin use and ocular motor palsy

Co-morbidities		N	Ocular motor palsy		*P*-value
			Yes (N=9) N (%)	No (N=491) N (%)	
BMI	Normal weight	274	0 (0.0)	274 (100.0)	<0.001**
	Obesity	175	4 (2.3)	171 (97.7)	
	Marked obesity	51	5 (9.8)	46 (90.2)	
Hypertension	Yes	122	7 (5.7)	115 (94.3)	0.001*
	No	378	2 (0.5)	376 (99.5)	
CVD	Yes	97	6 (6.2)	91 (93.8)	0.002*
	No	403	3 (0.7)	400 (99.3)	
Hyperlipidemia	Yes	120	7 (5.8)	113 (94.2)	0.001*
	No	380	2 (0.5)	378 (99.5)	
CKD	Yes	9	1(11.1)	483 (98.4)	0.152*
	No	491	8 (1.6)	8 (88.9)	
Aspirin use	Yes	141	0 (0.0)	141 (100.0)	0.049*
	No	359	9 (2.5)	350 (97.5)	

*Fisher's Exact test. **Chi-square test

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There was a significant association between ocular motor palsy and the duration of disease, the higher prevalence was among those with a duration of ≥ 10 years (*P* <0.05). In addition, a significant association was revealed between diabetic retinopathy and uncontrolled diabetes (as estimated by HbA1c) and ocular motor nerve palsy as shown in Table 8 and Figure 5.

Table 8 Association between diabetic characteristics and the prevalence of ocular motor palsy

Diabetic characteristics		N	Ocular motor palsy		*P*-value
			Yes (N=9) N (%)	No (N=491) N (%)	
Diabetic type	T1DM	67	0 (0.0)	67 (100.0)	0.271*
	T2DM	433	9 (2.1)	424 (97.9)	
Duration of diabetes	< 10 years	277	2 (0.7)	275 (99.3)	0.046*
	≥ 10 years	223	7 (3.1)	216 (96.9)	
Diabetic retinopathy	Yes	156	7 (77.8)	149 (30.0)	0.005*
	No	344	2 (22.2)	342 (69.7)	
HbA1c	< 8	90	0 (0.0)	90 (100.0)	<0.001 **
	8.1-9	96	0 (0.0)	96 (100.0)	
	9.1-10	108	0 (0.0)	108 (100.0)	
	10.1-11	91	1 (1.1)	90 (98.9)	
	11.1-12	52	4 (7.7)	48 (92.3)	
	> 12	63	4 (6.3)	59 (93.7)	

*Fisher's Exact test. **Chi-square test

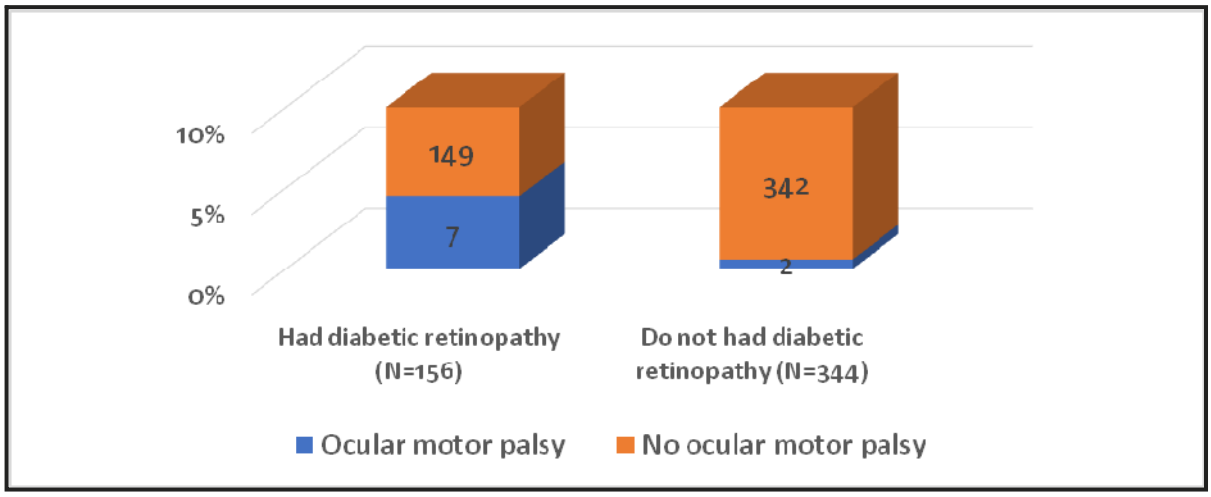

Figure 5 Association between diabetic retinopathy and ocular motor nerve palsy

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Discussion

In the current study, the prevalence of ocular motor nerve palsy was 1.8 % as nine diabetic patients were diagnosed with ocular nerve palsy of 500 patients. The prevalence of oculomotor nerve palsy was 1.2%, trochlear 0.4%, and the prevalence of abducens nerve was 0.2%. In comparison, a lower prevalence was obtained by another study that was done in Saudi Arabia in 2016 by Al Kahtani et al. and included 67075 diabetic patients as the total prevalence of ocular motor nerves palsy was 0.32%, the prevalence of oculomotor nerve palsy was 0.11%, trochlear 0.008%, abducens 0.16%, while 0.023% had multiple ocular nerves palsy.[12]

In Italy, a study was there in 2012 by Greco et al. and included a total of 8150 diabetics, revealed that 61 patients (0.75%) had cranial nerve palsies, the majority of whom (0.35%) had isolated III nerve palsies and VII nerve palsies (0.21%) occurred more frequently than VI (0.15%) and multiple palsies (0.04%).[13] According to a 2003–2009 study conducted in Iraq, 0.4% of diabetic individuals experienced ophthalmoplegia.[14]

Regarding the clinical presentation of the ocular motor nerve palsy, diplopia, ptosis, and pain were the commonest clinical findings. The two patients with trochlear nerve palsy presented with diplopia and extraocular movement abnormality without ptosis or pain, while the patient with abducens nerve palsy was presented with diplopia and abnormal extraocular movements. In comparison, another study in Turkey revealed that diplopia is the most common feature of trochlear nerve palsy.[15]

The current study confirmed that the prevalence of ocular motor nerve palsy was significantly higher in retired, military, smokers, alcohol drinkers, and patients with marked obesity, hypertension, cardiovascular disease, and hyperlipidemia. Regarding diabetic-associated risk factors of ocular motor nerve palsy, it was significantly associated with disease duration, HbA1c, and the presence of diabetic retinopathy.

In another study that was done in Tunis in 2017, the mean duration of diabetes in patients with oculomotor nerve palsy was 11.7 ± 11 years. In 75% of cases, diabetes was found to be poorly controlled, and in 56% of cases, there was an association with diabetic retinopathy. Additionally, the most prevalent risk factors were coronary artery disease and hypertension.[16]

An important finding of the current study was the significant protective effect of Aspirin in the prevention of ocular motor nerve palsy in diabetic patients. Aspirin is associated with potential benefits in the primary and secondary prevention of CVD in diabetes.[17]

After three months of treatment, all the patients with ocular motor nerve palsy improved. In comparison, another study that was done in Korea revealed that 86.7% of patients with ocular motor nerve palsy due to vascular causes had complete or partial recovery after three months of treatment.[18]

The current study's disadvantage was that it only included participants from Erbil City and was not generalizable to the Kurdistan Region or Iraq. We suggest broadening these research questions to encompass Iraq and the entire Kurdistan area.

Conclusion

The prevalence of ocular motor nerve palsy was low among diabetic patients in the current study, but it was higher than recorded in other studies. Many factors including occupation, smoking, alcohol, hypertension, hyperlipidemia, CVD, Aspirin use, duration of diabetes, and presence of diabetic retinopathy can affect the prevalence of ocular motor nerve palsy.

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Competing interests

The authors declare that they have no competing interests.

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