Original article

Prevalence and Risk Factors of Diabetic Retinopathy among Diabetic Patients in Sistan and Baluchestan Province, Iran

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Abstract

Purpose: This cross-sectional study aimed to examine the demographic and ocular characteristics of patients with diabetes mellitus in Sistan and Baluchestan province, Iran. It also aimed to identify the risk factors of diabetic retinopathy among this population.
Patients and Methods: From April 2020 to August, 2022, diabetic patients from Sistan and Baluchestan province, Iran, completed a standardized questionnaire to collect demographic characteristics. Diabetes was diagnosed as per World Health Organization criteria. Additionally, laboratory tests and ophthalmic examinations were performed for the enrolled patients.
Results: A total of 1,008 patients were evaluated. The mean age of patients was 58.13 ± 8.26 years. The most prevalent ocular pathology among patients entering the study was diabetic retinopathy (403 patients, 40 %), followed by glaucoma (312 patients, 31 %) and age-related macular degeneration (223 patients, 22.1 %). Age ($P = 0.048$), duration of diabetes ($P = 0.012$), male sex ($P = 0.049$), hypertension ($P = 0.048$), presence of diabetic neuropathy ($P = 0.041$), presence of diabetic nephropathy ($P = 0.048$), and presence of diabetic foot ulcer ($P = 0.041$) were correlated with the presence of diabetic retinopathy. Patients with retinopathy also had significantly higher intraocular pressure ($P < 0.01$), fasting blood sugar ($P < 0.001$), serum total cholesterol ($P < 0.001$), serum triglyceride ($P < 0.01$), and HbA1c ($P < 0.001$).
Conclusion: Diabetic retinopathy was observed in a higher percentage of diabetic patients from Sistan and Baluchestan province compared to the global average, but its prevalence was in line with the mean prevalence reported in Iran.

Keywords: Diabetes; Diabetic Retinopathy; Metabolic Abnormalities; Ocular Fundus Diseases; Fundus Ophthalmoscopy.

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Introduction

There is a need for effective diabetes prevention and control in Iran [1,2]. Diabetes is strongly associated with both microvascular and macrovascular complications, including retinopathy [3-5]. It affects vascular autoregulation and damages the microvascular system, especially in the retina and optic nerve [6]. Diabetes is also associated with age-related macular degeneration, glaucoma, and cataract [7,8].

Diabetic retinopathy is a major cause of blindness in working-age individuals [9]. The prevalence of diabetic retinopathy is associated with the duration of type I and type II diabetes [10]. The prevalence of diabetic retinopathy varies in different regions of Iran, influenced by various physical and clinical factors [11]. There is also a significant lack of awareness about diabetes and its complications [1]. Early detection of diabetic retinopathy is crucial for prevention and treatment [12]. Screening for diabetic retinopathy is important to identify cases because fundus pathology is often asymptomatic [13]. Therefore, annual eye examinations are recommended for diabetic patients [13].

The present study was performed to examine the demographic and ocular characteristics of patients with diabetes mellitus in Sistan and Baluchestan province, Iran. It also aimed to identify the risk factors of diabetic retinopathy among this population.

Patients and Methods

Ethics approval and consent to participate

Informed consent was obtained from all participants after explaining the nature of the study and possible outcomes. The study reporting adheres to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies and the Helsinki Declaration. The study protocol was also approved by the institutional ethics committee.

Study population

From April 2020 to August 2022, a total of 1,088 diabetic patients in the Sistan and Baluchestan province of Iran were evaluated during the patients' diabetes care program. Diabetes was diagnosed as per World Health Organization criteria: fasting capillary whole blood glucose level ≥ 6.1 mM/L or plasma glucose ≥ 7 mM/L and/or 2-hour postprandial blood glucose ≥ 11.1 mM/L. Patients who died for any reason during the study period, those for whom data could not be collected for any reason, patients with acute renal failure, and those on dialysis were excluded from the study.

Data collection

Demographic, etiological, habitual, and other health-related information for each participant were obtained through standardized face-to-face questionnaires conducted by the nursing staff during the cross-sectional study. All patients were instructed to fast overnight (> 8 hours) before blood sample collection. Blood samples were collected from an antecubital vein. The collected blood samples were evaluated for fasting plasma glucose levels, total cholesterol, triglycerides, glycated hemoglobin (HbA1c), and serum creatinine.

Each patient had their intraocular pressure (IOP) measured using the tonometry procedure with an Icare HOME tonometer (Icare Finland Oy, Vantaa, Finland). IOP was measured by a physician. The cup-to-disc ratio, which is the ratio of the diameter of the cup portion of the optic disc to the total diameter of the

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optic disc, was also determined by a physician. Fundus ophthalmoscopy was performed by a physician using a Heine Beta ophthalmoscope.

Definitions of fundus pathology

The presence of intra-retinal neovascularization and/or microvascular abnormalities, any microaneurysms, hard exudates, hemorrhages, macular edema, or cotton-wool spots were considered as diabetic retinopathy.

IOP > 21 mmHg, a cup–disc ratio of > 0.6, and disc asymmetry including a cup–disc ratio of > 0.2 were considered as glaucoma.

Large drusen and retinal pigment epithelial changes were considered as age-related macular degeneration.

Smoking habits, blood pressure, diabetes duration

Patients who smoke at least one cigarette a day were considered smokers (self-reported). A systolic blood pressure of 140 mmHg or more and/or a diastolic blood pressure of 90 mmHg or more was considered hypertension. The time from the first diagnosis of diabetes to enrollment in the program was considered the duration of diabetes.

Statistical analysis

SPSS statistics software version 26 (IBM Corporation, Armonk, NY) was used for statistical analysis. Mann-Whitney U test was performed for continuous variables. Multivariate logistic regression analysis was used to evaluate factors associated with diabetic retinopathy. All results were considered significant at a 95 % level of confidence.

Results

Table 1 shows the demographic data of patients entering the study. The mean age of patients entering the study was 58.13 ± 8.26 years. The number of female patients was 541, comprising 53.7 % of the patient population.

The most prevalent ocular pathology among patients entering the study was diabetic retinopathy (403 patients, 40 %), followed by glaucoma (312 patients, 31 %) and age-related macular degeneration (223 patients, 22.1 %). A small fraction of patients showed other ocular pathologies (50 patients, 5 %). The detailed prevalence of ocular diseases is reported in table 2.

Table 3 shows the demographic data of patients with and without diabetic retinopathy. The mean age of patients with and without diabetic retinopathy was 61.15 ± 9.18 years and 59.15 ± 8.11 years, respectively. The mean BMI among patients with and without

Table 1: Demographic characteristics of patients entering the study

Variable	Results
Age (years)	58.13 ± 8.26
Male	467 (46.3 %)
Female	541 (53.7 %)
Baluch	912 (90.5 %)
Sistani	84 (8.3 %)
Originally not from Sistan and Baluchestan	12 (1.2 %)
Body mass index (kg/m²)	25.12 ± 1.45
Not smoker	423 (42 %)
Previous smoker	328 (32.5 %)
Smoker	257 (25.5 %)
Hypertensive	451 (44.7 %)

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Table 2: Prevalence of ocular diseases among patients entering the study

Ocular pathologies	Number of patients (%)
Retinopathy	403 (40)
Glaucoma	312 (31)
Age related macular degeneration	223 (22.1)
Retinopathy and glaucoma	35 (3.5)
Glaucoma and macular degeneration	27 (2.7)
Retinopathy and macular degeneration	19 (1.9)
Retinopathy; glaucoma; and macular degeneration	9 (0.9)
Retinal vessel occlusion	19 (1.9)
Optic nerve atrophy	23 (2.3)
Macular hole	8 (0.8)

diabetic retinopathy was 25.42 ± 1.52 kg/m² and 24.99 ± 1.11 kg/m², respectively.

Table 4 shows the risk factors for diabetic retinopathy among our patients. As can be observed from the data presented in this table, higher age, duration of diabetes, male gender, presence of hypertension, presence of diabetic neuropathy, presence of diabetic nephropathy, and presence of diabetic foot ulcer were found to be risk factors for diabetic retinopathy.

Table 5 shows the association of diabetic retinopathy with laboratory test results. As can be observed from the data presented in this table, patients with retinopathy had significantly higher intraocular pressure ($P = 0.01$), fasting blood sugar ($P < 0.001$), serum total cholesterol ($P < 0.001$), serum triglyceride ($P < 0.01$), and HbA1c ($P < 0.001$).

Discussion

This study included 1,008 patients with diabetes mellitus from Sistan and Baluchestan province, Iran. The evaluation revealed that 403 participants had diabetic retinopathy, making it the most frequently observed ocular fundus disease. This translates to a 40 % prevalence of diabetic retinopathy among our patients. In comparison, globally, the prevalence of diabetic retinopathy among diabetic patients is estimated to be 27.0 %, which is lower than what we found among our patients [14]. In a meta-analysis of the prevalence of diabetic retinopathy in Iran by Mohammadi et al., [15] including 34 articles and 17,079 individuals,

Table 3: Demographic characteristics of patients with and without diabetic retinopathy

Variable	Patients without diabetic retinopathy	Patients with diabetic retinopathy
Age (years)	59.15 ± 8.11	61.15 ± 9.18
Male	225	242
Female	380	161
Body mass index (kg/m²)	24.99 ± 1.11	25.42 ± 1.52
Not smoker	263	162
Previous smoker	187	141
Smoker	155	100
Hypertensive	244	207

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Table 4: Risk factors for diabetic retinopathy among patients entering the study

Variable	Odd Ratio	95 % confidence interval	P value
Age	1.12	0.99 - 1.48	0.048
Duration of diabetes	2.23	0.44 - 3.25	0.012
Male	2.89	1.15 - 2.45	0.049
Hypertension	1.85	0.89 - 3.22	0.048
Diabetic neuropathy	1.89	0.42 - 1.81	0.041
Diabetic nephropathy	1.86	0.56 - 1.71	0.048
Diabetic foot ulcer	1.56	0.54 - 1.85	0.041

Table 5: Values of laboratory and fundoscopy tests among patients with or without diabetic retinopathy

Variable	Without diabetic retinopathy	With diabetic retinopathy	P value*
Intraocular pressure	18.25 ± 5.05	19.45 ± 6.21	< 0.01
Fasting blood sugar	8.01 ± 1.98	8.55 ± 2.36	< 0.001
Serum total cholesterol	5.23 ± 1.78	6.55 ± 1.82	< 0.001
Serum triglyceride	1.83 ± 0.65	1.98 ± 0.72	< 0.01
HbA1c	8.15 ± 1.23	8.92 ± 1.33	< 0.001
Cup disc ratio	0.56 ± 0.22	0.58 ± 0.23	0.164

*Mann-Whitney U test

the overall prevalence of retinopathy for type 2 diabetic patients in Iran was 37.8 %, which is in line with our finding. The prevalence of diabetic retinopathy in different provinces of Iran varies greatly. It has been reported to be as low as 9 % in Isfahan province and as high as 78 % in Tehran province [15].

We observed that the age of patients is a risk factor for diabetic retinopathy among our patients. Our results are in line with previous studies examining the risk factors for diabetic retinopathy among diabetic patients [16-18]. We also observed that diabetic patients with retinopathy had a significantly longer duration of diabetes. These results are also consistent with other studies reporting the risk factors for retinopathy among diabetic patients [10,19-21].

We found that male sex is a risk factor for diabetic retinopathy among our patients. This finding is in line with some previous studies regarding the risk factors of diabetic retinopathy in Iran and other countries [22-24]. In contrast, some other studies have found the female gender to be a risk factor [25-27].

We observed that there is a relation between the presence of hypertension and diabetic retinopathy among our patients. This finding is in line with other studies evaluating the relation between hypertension and diabetic retinopathy [28-30].

Our results indicated that the presence of diabetic neuropathy, diabetic nephropathy, and diabetic foot are related to higher rates of diabetic retinopathy. These findings are in line

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with findings reported by previous studies [30-32]. Regarding the laboratory findings, we observed that patients with diabetic retinopathy had significantly higher intraocular pressure, fasting blood sugar, serum total cholesterol, serum triglyceride, and HbA1c. These findings are in line with previous reports from the Iranian population and other countries [33-39]. Several limitations of the present study include its cross-sectional design and lack of random sampling. The study reported glaucoma, age-related macular degeneration, and other pathologies of ocular fundus, without evaluating the risk factors for these conditions. Also, the present study did not differentiate between proliferative and non-proliferative retinopathy.

Conclusion

Diabetic retinopathy was observed in a higher percentage of diabetic patients from Sistan and Baluchestan province compared to the global average, but its prevalence was in line with the mean prevalence reported in Iran. Preventive measures, such as yearly eye exams for diabetic patients, are recommended to reduce the risk of diabetic retinopathy in this patient population.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present manuscript.

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