Risk Factors of Retinopathy Among Diabetic’s Patients in Benin in 2014

Codjo Rodrigue Abel Assavedo1*, Leopold Codjo2, Adébayo Alassani3, Thierri Adoukonou4, Ajoua Pulchérie Codjo5, Salimatou Monteiro1, Ângelo Cossi Attissounon6, Abdoulaye Imorou7, Sidonie Hounnou Tchabi7, Dismand Houinato8 and Claudia Doutetien Gbaguidi9

1Unit of Teaching and Research in Ophthalmology, Department of Surgery and Surgical Specialities, University of Parakou, Parakou, Benin
2Unit of Teaching and Research in Cardiology, Department of Medicine and Medical Specialties, University of Parakou, Parakou, Benin
3Diabetology Unit, Department of Medicine and Medical Specialties, University of Parakou, Parakou, Benin
4Unit of Teaching and Research in Neurology, Department of Medicine and Medical Specialties, University of Parakou, Parakou, Benin
5National School of Higher Technicians in Public Health and Epidemiological, University of Parakou, Parakou, Benin
6Unit of Teaching and Research in Infectious Diseases, Department of Medicine and Medical Specialties, University of Parakou, Parakou, Benin
7University Ophthalmology Clinic, University of Abomey-Calavi, CN-HU-HKM de Cotonou, Cotonou, Benin
8University Clinic of Neurology, CNHU-HKM de Cotonou, Cotonou, Benin

Abstract

Background
The Diabetic Retinopathy (DR) is one of the most frequent and most crippling complications of the mellitus diabetes. Its frequency increases with the age and the duration of the evolution of the diabetes.

Objective
It was to analyze the risk factors of retinopathy among diabetic patients followed at the Unit of Diabetes of Departmental University Hospital of Borgou and Alibori for the duration of the study.

Methods
It was cross-sectional study including 189 diabetic patients followed in the Unit of Diabetes of DUHCB over a period going from May to August, 2014. These patients had benefited of a complete ophthalmological examination. The retina lesions were appreciated using Slosse and Alaerts Classification. The data analyzed were performed with the Epi-data and Epi-info software version 3.5.3.

Results
The prevalence of diabetic retinopathy among the studied population was 17.5% (33/189). The mean age was 55.2 ± 12.3 years. The sex ratio was 0.75 (M/F). The associated risks factors to the diabetic retinopathy were: age superior to 50 years (p=0.020), the duration of the diabetes (p=0.000), blood sugar over or equal to 1.26g/l (p=0.036) and the presence of nephropathy (p=0.016).

Conclusion
The frequency of diabetic retinopathy is low among the diabetic patients followed at the DUHCB since the starting of work in the Unit of Diabetes. The associated risks factors in our study are largely the same to those of anterior studies realized in various regions of the world. Its screening must be systematic among the diabetics.

Keywords: Associated risks factors; Duration of the diabetes; Diabetic retinopathy; Nephropathy

Introduction
Diabetes mellitus is a public health problem because of its increasing prevalence and the complications it creates [1]. These complications include the retinopathy that is the set of consecutive retinal lesions or related to diabetes. This is the most severe ocular complications of diabetes [2,3]. In industrialized countries, it is the leading cause of blindness in adult before the age of 50 years [4]. Among patients with diabetes, 75% will develop retinopathy 20 years after the diagnosis of the disease [5]. As for Gain and Thuret [6] in France, diabetic retinopathy occurs after 15 years of development, regardless of the type of diabetes. The risk of blindness is 25 times higher in diabetic patients than in subjects with no diabetes [7]. Diabetic retinopathy does not only impact the eyes. Indeed, the presence of retinopathy multiplies by 3 the risk of developing coronary artery disease or ischemic stroke. Retinopathy also promotes reduced productivity and impaired quality of life of people with diabetes [7,8]. According to a study by Tchabi et al., [9] at Cotonou National University Hospital Centre located in the south of Benin Republic, disease duration of diabetes greater than 10 years and a glucose imbalance are major risk factors for developing diabetic retinopathy. Another study by Djrolo et al., [10] in a population of black African diabetics in Cotonou concluded that during the development of diabetes mellitus, retinopathy and nephropathy are one for the other, a risk factor. In 2012, a study in the same CHUD-B/A about biological risks factors of diabetic retinopathy, reported that a poor glycemic control, LDL cholesterol and the presence of proteinuria were risk factors occurrence of this eye microangiopathy related to diabetes [11].

Our study aims to analyze the risk factors associated with retinopathy in diabetic patients followed in the management Unit of Diabetes at the Departmental University Hospital of Borgou and Alibori Borgou in 2014.
Patients and Methods

Our study is prospective, cross-sectional with descriptive and analytical and was conducted over three months, from May 26 to 27 August, 2014 at the unit of teaching and research in ophthalmology and the Unit of Diabetes care for the Departmental University Hospital of Borgou and Alibori.

In this study, all patients are diabetic and monitored in the Unit of Diabetes care for the Departmental University Hospital of Borgou and Alibori, who gave their informed consent and for whom a complete ophthalmic examination was performed. Sampling was done in a non-probability method and comprehensive techniques.

We conducted a systematic recruitment of all patients who gave informed consent.

The dependent variable was the presence of retinal lesions.

We used the classification of Alaert and Slosse [8] for retinal damage:

- Stage I: Segmental dilation of veins
- Stage II: Micro aneurysms + Stage I
- Stage III: Hemorrhages, exudates and micro aneurysms + Stage II
- Stage IV: Dilation of large vessels and bleeding Stage + III
- Stage V: Neovessels + Stage IV (stage retinopathy proliferative diabetic)
- Stage VI: Neovascular glaucoma + Stage V (stage complicated diabetic retinopathy)

The retinal angiography was not performed; our unit does not have it.

Independent variables were age, sex, cardiovascular risk factors (body mass index, hypertension, smoking, physical inactivity), duration of diabetes, balance of diabetes, complications (neuropathy, nephropathy, diabetic foot), therapeutic modalities and ophthalmologic data.

Sociodemographic factors

The professional categories: Employees, retired persons, farmers, artisan, traders, drivers, rock and sand quarrier workers (regrouping diabetics with income generating activity); homemaker, student/student and others (were the group of those who do not have an income generating activity).

Marital status: Married (e) (lives in couple); single, divorced (e), widowed (er) (constituted the group of those who were not living with a partner).

Cardiovascular risk factors: Body Mass Index (BMI), calculated using the formula: weight (kg)/height square (m²). It was expressed in Kg/m².

We had considered

- Skinny, any subject with a BMI<18.5 kg/m²
- Normal weight, a BMI between 18.5 and 24.9 kg/m²
- Weight overload, any subject with a BMI between 25 and 29.9 kg/m²
- Obese, any subject with a BMI≥30 kg/m²
- Tobacco (smoked, chewed or popular) whether we specified the number of package/year

Sedentarity: No if the patient practice at least 30 minutes of moderate physical activity three times a week, or so.

Features and other degenerative complications of diabetes

- The fasting glucose: Diabetes was balanced if the patient had a fasting glucose<1.26g/l and unbalanced blood sugar when ≥1.26g/l [12]
- The neuropathy, if the patient had any of the following symptoms (burning, coldness, tingling, numbness)
- The nephropathy was revealed by a disturbed renal function tests (serum creatinine>14mg/l) or the presence of albumin in the urine test strip or proteinuria after 24h
- Diabetic foot, if the presence of trophic disorder or amputation of the pelvic members and not otherwise.
- Hyper blood pressure, if the patient had a history of hypertension or antihypertensive treatment and not otherwise

Eye data

Visual acuity: It was evaluated for each eye, in far vision using optotypes, ‘E’ of Snellen for illiterate and ‘M’ for the literate.

The intraocular pressure: It was valued by Goldman applanation tonometer after contact anesthesia by oxybupacaine. It was classified as follows: Hypotonia (IOP<10mmHg), Normal (10≤IOP<21mmHg) and Hypertension (IOP≥21mmHg).

Difficulties encountered

- The interview with the participants, especially for the less and not educated had required much time. The location of the ophthalmology department on the first floor had not allowed all patients to perform the eye examination due to a musculoskeletal disability. To explore other complications of diabetes, the diagnostic tests have not been achieved (lack of funds)
- All these data were collected using an ad hoc form, through a questionnaire, physical examination and ophthalmoscopy performed for each patient
- The selected patients were reviewed by the ophthalmologist for a complete eye examination. Ophthalmoscopy was performed using a 90 diopters Volk lens after maximum pupil dilation with tropicamide drops 0.5%
- The collected data were supplemented with the counting of patient records
- The dependent variable was retinopathy among diabetics patients examined
- The independent variables were represented by socio-demographic factors (age, sex, occupation, education level, marital status), cardiovascular risk factors (BMI, hypertension, smoking, sedentary lifestyle), features and other degenerative complications of diabetes (duration of diabetes, fasting glucose, other degenerative complications are neuropathy, nephropathy, diabetic foot), therapeutic modalities (insulin, oral antidiabetics, the combination of the two), ophthalmologic data (eye complaints, measurement of visual acuity, slit lamp examination, measurement of IOP and examination of the ocular fundus)
• Data analysis was done by software Epi Info version 3.5.3
• For quantitative variables, the averages were presented with a standard deviation; regarding the qualitative variables, the proportions were expressed
• The frequency comparisons were performed using the chi-2 Pearson test (or Fisher’s exact test as appropriate) and those averages using the student test. We performed a univariate analysis.
• For the different tests used, a p-value<0.05 was considered statistically significant
• The administrative authorities at various levels and the ethics committee gave their local agreement for carrying out the investigation
• The integrity of the patients was observed, the ophthalmologic examination was done in an appropriate setting
• All data collected during our investigation were used only in the context of this study and remained confidential

Results

General characteristics of patients
• The total number of patients who responded to our inclusion criteria was 189
• These diabetic patients had a mean age of 55.2 ± 12.3 years
• A female was predominated with sex ratio of 0.75
• Smoking was observed in 19 patients (10%), 67 patients (35.4%) were sedentary, 106 patients (56.1%) had hypertension and 111 patients (58.7%) overweight (Table 1)

Frequency of diabetic retinopathy
Out of the 189 patients included in the study, 33 had diabetic retinopathy, which means a frequency of 17.5%. More than half of patients (57.6%) with diabetic retinopathy were at stage III (Table 2).

Risk factors associated with diabetic retinopathy
Advanced age was a factor associated with diabetic retinopathy (p=0.020).

<table>
<thead>
<tr>
<th>Diabetic Retinopathy</th>
<th>Total</th>
<th>Effective</th>
<th>Frequency</th>
<th>Odds Ratio (IC 95%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤50</td>
<td>66</td>
<td>6</td>
<td>9.1</td>
<td>0.35 (0.45; 0.91)</td>
<td>0.02</td>
</tr>
<tr>
<td>&gt;50</td>
<td>123</td>
<td>27</td>
<td>21.9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.955</td>
</tr>
<tr>
<td>Male</td>
<td>81</td>
<td>14</td>
<td>17.3</td>
<td>0.97 (0.45; 2.09)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>108</td>
<td>19</td>
<td>17.6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tobacco</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.907</td>
</tr>
<tr>
<td>Yes</td>
<td>19</td>
<td>3</td>
<td>15.8</td>
<td>0.87 (0.23; 3.1)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>170</td>
<td>30</td>
<td>17.6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sedentarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.279</td>
</tr>
<tr>
<td>Yes</td>
<td>67</td>
<td>9</td>
<td>13.4</td>
<td>0.63 (0.27; 1.4)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>122</td>
<td>24</td>
<td>19.7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>HBP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.564</td>
</tr>
<tr>
<td>Yes</td>
<td>106</td>
<td>20</td>
<td>18.9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>83</td>
<td>13</td>
<td>15.7</td>
<td>0.7 (0.49; 2.32)</td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.097</td>
</tr>
<tr>
<td>&lt;18.5</td>
<td>6</td>
<td>1</td>
<td>16.7</td>
<td>0.60 (0.06; 5.4)</td>
<td></td>
</tr>
<tr>
<td>[18.5-25]</td>
<td>72</td>
<td>18</td>
<td>25</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>≥25</td>
<td>111</td>
<td>14</td>
<td>12.6</td>
<td>1.30 (0.15; 12.74)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Distribution of patients by general characteristics, Departmental University Hospital of Borgou and Alibori, Parakou.

In opposite, the duration of diabetes, the poor glycemic control of patients and kidney disease were associated with diabetic retinopathy (Table 4).

Risks factors associated with therapy
Half of the patients, 99 (52.4%) were under only oral treatment, the majority (136 means 72%) patients did not followed a regular rhythm of systematic annual review of the eye fundus examination. Therapeutic characteristics are summarized in table 5.

Discussion
In this study, diabetic retinopathy was seen in about two out of 10 patients (17.5%). This prevalence was close to the 15.8%, 23.9% and 17.1% respectively reported by Kyari et al., [1], Hussain et al., [13] and Donghyun et al., [14].

As concerned diabetic retinopathy, researches showed that pro-inflammatory cytokines and growth factors such as Vascular Endothelial Growth Factor (VEGF) contribute to the loss of blood retinal barrier and subsequently, to macular edema in various retinal pathologies, such as diabetic retinopathy [15].
Also, clinically, hyperglycemia induces proliferative changes in diabetic retinopathy synergistically with other risk factors for vascular diseases [16].

In the study of Tchabi et al., [11] conducted in Parakou, northern part of Benin Republic in 2009 in the same unit, the prevalence of diabetic retinopathy was 36.6%. This difference could be due to the fact that in 2009, patients were not well followed through regular controls by an unit in charge of diabetics patients only; situation which exposed most of the diabetic patients to retinal complications.

Subjects younger than 50 years had a lower prevalence (9.1%) of diabetic retinopathy p=0.020 OR=0.35 IC 95% (0.45; 0.91) in opposite to those older than 50 years (21.9%). In many studies Hussain et al., [13] and Moumen et al., [17], reported that older diabetics were more susceptible to diabetic retinopathy.

Sex did not influence the presence of retinopathy in our study, for instance male represented 17.3% p=0.955 OR=0.35 IC 95% (0.45; 0.91) and female 18.8% (p=0.08 OR=1.40 IC 95% (0.49; 2.33). BMI≥25 12.6% with p=0.087 OR=1.30 IC 95% (0.15; 12.74).

Yang et al., [18] found the same association between physical activity level and retinopathy. In opposite, Thapa et al., [3] have reported that there is any association between tobacco consumption and retinopathy. The association between hypertension and diabetic retinopathy was variously appreciated. It was the same as concerned the body mass index. For Yu et al., [5], blood pressure would not influence the onset of retinopathy in diabetic patients. In opposite, in studies conducted by Kyari et al., [1] and Moumen et al., [17] diabetic patients with high blood pressure were more prone to complications such as retinopathy. Katulanda et al., [7] had reported no association between retinopathy and body mass index whereas Kyari et al., [1] reported that when the body mass index increased, the subjects were exposed to diabetic retinopathy.

According to Katulanda et al., [8] prolonged exposure of patients with hyperglycemia was a risk factor for complications. This could explain the association between diabetes and retinopathy observed in the present study. Thapa et al., [3], Thomas et al., [19], Jingi et al., [20] highlighted the same association. The imbalance of diabetes was a risk factor for complications. In this study, subjects with high blood sugar have developed over diabetic retinopathy. Rajalakshmi et al., [21] stressed the same association.

Retinopathy and neuropathy share common etiologic mechanisms and settled simultaneously in diabetics. This observation would explain the association between retinopathy and neuropathy in patients of this study. Yu et al., [5], Rajalakshmi et al., [18] and Abougaram et al., [22] highlighted the same association.

Table 4: Frequency of diabetic retinopathy according to seniority, glycemic control and complications of diabetes at Departmental University Hospital of Borgou and Alibori, Parakou.

<table>
<thead>
<tr>
<th>Seniority of diabetes (Years)</th>
<th>Diabetic Retinopathy Total</th>
<th>Effective</th>
<th>Frequency</th>
<th>Odds Ratio (IC 95%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤10</td>
<td>151</td>
<td>16</td>
<td>10.6</td>
<td>0.09 (0.03; 0.22)</td>
<td>0.000</td>
</tr>
<tr>
<td>(10-20)</td>
<td>32</td>
<td>14</td>
<td>43.7</td>
<td>0.11 (0.02; 0.63)</td>
<td></td>
</tr>
<tr>
<td>&gt;20</td>
<td>6</td>
<td>3</td>
<td>50.0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Glycemy (g/l)

<table>
<thead>
<tr>
<th>Glycemy (g/l)</th>
<th>Diabetic Retinopathy Total</th>
<th>Effective</th>
<th>Frequency</th>
<th>Odds Ratio (IC 95%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1.26</td>
<td>64</td>
<td>6</td>
<td>9.4</td>
<td>0.36 (0.14; 0.93)</td>
<td>0.036</td>
</tr>
<tr>
<td>≥1.26</td>
<td>125</td>
<td>27</td>
<td>21.6</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Neuropathy

<table>
<thead>
<tr>
<th>Neuropathy</th>
<th>Diabetic Retinopathy Total</th>
<th>Effective</th>
<th>Frequency</th>
<th>Odds Ratio (IC 95%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>133</td>
<td>25</td>
<td>18.8</td>
<td>1.38 (0.58; 3.30)</td>
<td>0.455</td>
</tr>
<tr>
<td>No</td>
<td>56</td>
<td>8</td>
<td>14.3</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Nephropathy

<table>
<thead>
<tr>
<th>Nephropathy</th>
<th>Diabetic Retinopathy Total</th>
<th>Effective</th>
<th>Frequency</th>
<th>Odds Ratio (IC 95%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>137</td>
<td>30</td>
<td>21.9</td>
<td>4.57 (1.33; 15.73)</td>
<td>0.016</td>
</tr>
<tr>
<td>No</td>
<td>52</td>
<td>3</td>
<td>5.8</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Diabetic foot

<table>
<thead>
<tr>
<th>Diabetic foot</th>
<th>Diabetic Retinopathy Total</th>
<th>Effective</th>
<th>Frequency</th>
<th>Odds Ratio (IC 95%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>26</td>
<td>6</td>
<td>23.1</td>
<td>1.5 (0.55; 4.11)</td>
<td>0.416</td>
</tr>
<tr>
<td>No</td>
<td>163</td>
<td>27</td>
<td>16.6</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Frequency of Diabetic retinopathy by therapeutic modalities of the surveyed patients with diabetes, CHUD-B/A, Parakou.

<table>
<thead>
<tr>
<th>Type of treatment</th>
<th>Diabetic Retinopathy (DR) Total</th>
<th>Effective</th>
<th>Frequency</th>
<th>Odds Ratio (IC 95%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADO + Scheme</td>
<td>99</td>
<td>12</td>
<td>12.1</td>
<td>0.114</td>
<td></td>
</tr>
<tr>
<td>OAD + Insulin</td>
<td>87</td>
<td>20</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin alone + Scheme</td>
<td>3</td>
<td>1</td>
<td>33.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


