OPHTHALMOLOGY

Eye Diseases in Puerto Rico

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Objective. **To report on the major causes of eye diseases leading to visual impairment and blindness in a sub-urban population in Puerto Rico.**

Design. **A population-based study of eye diseases in Puerto Ricans living in the San Juan metropolitan area of Puerto Rico.**

Participants. **Nine thousand two hundred ninety-eight patients aged from 40 to 79 years-of-age from the San Juan metropolitan area.**

Methods. **A chart review of 9,298 patients was done. Patients carrying diagnosis such as cataracts, glaucoma, age-related macular degeneration (ARMD), and diabetic retinopathy were evaluated. Descriptive statistics and chi square analysis were used to evaluate findings.**

Results. **2,056 patients out of 9,298 had cataracts (22.1%); 3,963 patients (42.6%) had glaucoma; 199 patients had ARMD (2.1%); and 700 patients (7.5%) had diabetic retinopathy. The prevalence of cataracts was higher in the population study than in the Hispanic population of the Los Angeles Latino Eye Study (LALES) ($p<0.001$). The prevalence of glaucoma was higher in our patients than in Hispanic population studied by the LALES ($p<0.0001$). The prevalence of ARMD and the prevalence of diabetic retinopathy was lower than expected when compared to Hispanic population of LALES study ($p<0.0001$ in both instances).**

Conclusions. **In this population-based study, the prevalence of cataracts and glaucoma was higher than the results found in the Hispanic populations reported in the LALES. However, in our study, we found a lower prevalence of ARMD and diabetic retinopathy. Various factors may lead to this significant difference in the prevalence of eye diseases between the PR population and Hispanic population in the continental USA. Further studies are needed to evaluate the prevalence of eye diseases in Puerto Rico.**

Key words: Eye diseases in Puerto Rico, Glaucoma, Cataracts, Age-related macular degeneration, Diabetic retinopathy

Several eye diseases lead patients to visual impairment, daily activity limitations and increased risk of accidents. The World Health Organization (WHO) studies suggest that 20% of patients who are 70 years-old or older have visual impairment and that a 75% of these patients have eye diseases that are avoidable or treatable[1]. The WHO reports that visual impairment is proportional to age (1).

Previous studies have reported the prevalence of eye diseases such as cataracts, glaucoma, age related macular degeneration (ARMD), and diabetic retinopathy in Hispanic populations living in the continental United States (2,3,4). The prevalence of eye diseases in Puerto Rico remains unknown. We report on the major causes of eye diseases leading to visual impairment and blindness in a sub-urban population in Puerto Rico.

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Patients and Methods

We conducted a chart review of 9,298 patients from a sub-urban community in the San Juan metropolitan area of Puerto Rico. These patients visited an ophthalmologist between the years 1993 and 2005. Patients carrying a diagnosis of cataracts, glaucoma, ARMD, or diabetic retinopathy were included. We used descriptive statistics and chi square analysis in order to compare this study results with the prevalence of eye diseases affecting Hispanics living in the continental US.

Results

Cataracts. Cataracts (all types included) were found in 2,056 out of the 9,298 patients (prevalence = 22.1%).

Patients with cataracts were classified according to the morphological appearance of their lens opacities. This classification included: 482 patients out of the 2,056 with cortical cataracts (23.5%); 1,380 patients out of the 2,056 with nuclear opacities (67.1%); and 194 patients out of the 2,056 with posterior sub-capsular cataracts (9.4%).

As summarized in Table 1, patients with cataracts were divided into age groups. Cortical cataracts were found in

Table 1. Cataracts classified according to age groups

Cataracts	Patients	40-49 yrs	50-59 yrs	60-69 yrs	70-79 yrs
Cortical	482 (23.5%)	29	53	100	300
Nuclear	1,670 (67.1%)	32	75	306	967
PSC	194 (9.4%)	15	28	51	100
Totals	2,056	76 (3.7%)	156 (7.6%)	1367 (22.2%)	457 (66.5%)

29 patients (6.0%) whose age ranged from 40 to 49 years of age; 53 patients (11.0%) whose age ranged from 50-59 years of age; 100 patients (20.8%) whose age ranged from 60-69 years of age; and 300 patients (62.2%) whose age ranged from 70-79 years of age. Nuclear cataracts were found in 32 patients (2.3%) whose age ranged from 40 to 49 years of age; 75 patients (5.4%) whose age ranged from 50-59 years of age; 306 patients (22.2%) whose age ranged from 60-69 years of age; and 967 patients (70.1%) whose age ranged from 70-79 years of age. Posterior sub-capsular cataracts were found in 15 patients (7.8%) whose age ranged from 40 to 49 years of age; 28 patients (14.4%) whose age ranged from 50-59 years of age; 51 patients (26.3%) whose age ranged from 60-69 years of age; and 100 patients (51.5%) whose age ranged from 70-79 years of age.

Glaucoma. Glaucoma (all types included) was diagnosed in 3,963 out of the 9,298 patients (prevalence = 42.6%). Patients with glaucoma were divided into the various glaucoma types. As shown in Table 2, ten patients (0.3%) had chronic angle closure glaucoma (CACG); 237 patients (6.0%) had narrow angle glaucoma (NAG); 151 patients (3.8%) had pigmentary glaucoma (PDS); 1,348 patients (34.0%) had primary open angle glaucoma (POAG); 2,017 patients (50.9%) were glaucoma suspects (GS); 89 patients (2.3%) had pseudoexfoliation glaucoma (PXF); 12 patients (0.3%) had ocular hypertension (OHTN); 28 patients (0.7%) had low tension glaucoma (LTG); 35 patients (0.9%) had neovascular glaucoma (NVG); 20 patients (0.5%) had congenital glaucoma; and 16 patients (0.4%) had juvenile glaucoma.

As summarized in Table 2, patients with the various types of glaucoma were divided into age groups.

CACG was diagnosed in a total of 10 patients. These were divided into age groups as follows: two patients

Table 2. Glaucoma types classified according to age groups

Glaucoma type	Patients	40-49 yrs	50-59 yrs	60-69 yrs	70-79 yrs
CACG	10	2	2	6	0
NAG	237	12	26	11	188
PDS	151	3	13	39	96
POAG	1,348	68	175	391	714
Suspect	2,017	343	608	881	185
PXF	89	9	16	36	28
OHTN	12	1	4	5	2
LTG	28	1	9	11	7
NVG	35	2	3	15	15
Congenital	20	0	0	0	0
Juvenile	16	0	0	0	0
Totals	3,963	441 (11.1%)	856 (21.6%)	1,395 (35.2%)	1,235 (31.1%)

(20.0%) whose age ranged from 40 to 49 years of age; two patients (20.0%) whose age ranged from 50-59 years of age; and six patients (60.0%) whose age ranged from 60-69 years of age. There were no cases reported in whose age ranged from 70-79.

NAG was diagnosed in a total of 237 patients. These were divided into age groups as follows: 12 patients (5.1%) whose age ranged from 40 to 49 years of age; 26 patients (11.0%) whose age ranged from 50-59 years of age; 11 patients (4.6%) whose age ranged from 60-69 years of age; and 188 patients (79.3%) whose age ranged from 70-79 years of age.

PDS was diagnosed in a total of 151 patients. These were divided into age groups as follows: three patients (2.0%) whose age ranged from 40 to 49 years of age; 13 patients (8.6%) whose age ranged from 50-59 years of age; 39 patients (25.8%) whose age ranged from 60-69 years of age; and 96 patients (63.6%) whose age ranged from 70-79 years of age.

POAG was diagnosed in 1,348 patients. These were divided into age groups as follows: 68 patients (5.0%) whose age ranged from 40 to 49 years of age; 175 patients (13.0%) whose age ranged from 50-59 years of age; 391 patients (29.0%) whose age ranged from 60-69 years of age; and 714 patients (53.0%) whose age ranged from 70-79 years of age.

There were 2,017 patients who were glaucoma suspects. These were divided into age groups as follows: 343 patients (17.0%) whose age ranged from 40 to 49 years of age; 608 patients (30.1%) whose age ranged from 50-59 years of age; 881 patients (43.7%) whose age ranged from 60-69 years of age; and 185 patients (9.2%) whose age ranged from 70-79 years of age.

PXF was diagnosed in 89 patients. These were divided into age groups including: nine patients (10.0%) whose age ranged from 40 to 49 years of age; 16 patients (18.0%)

whose age ranged from 50-59 years of age; 36 patients (40.5%) whose age ranged from 60-69 years of age; and 28 patients (31.5%) whose age ranged from 70-79 years of age.

OHTN was diagnosed in 12 patients. These were divided into age groups as follows: one patient (8.3%) whose age ranged from 40 to 49 years of age; four patients (3.3%) whose age ranged from 50-59 years of age; five patients (41.7%) whose age ranged from 60-69 years of age; and two patients (16.7%) whose age ranged from 70-79 years of age.

LTG was diagnosed in 28 patients. These were divided into age groups including: one patient (3.6%) whose age ranged from 40 to 49 years of age; 9 patients (32.1%) whose age ranged from 50-59 years of age; 11 patients (39.3%) whose age ranged from 60-69 years of age; and 7 patients (25.0%) whose age ranged from 70-79 years of age.

NVG was diagnosed in 35 patients. These were divided into age groups: two patients (5.7%) whose age ranged from 40 to 49 years of age; three patients (8.5%) whose age ranged from 50-59 years of age; 15 patients (42.9%) whose age ranged from 60-69 years of age; and 15 patients (42.9%) whose age ranged from 70-79 years of age.

None of the patients with congenital or juvenile glaucoma were found in those age groups.

Macular Degeneration. As shown in Table 3, a total of 199 patients had ARMD (all types included). We found a prevalence = 2.14% in our population. Of these, 171 patients (86.0%) had dry ARMD; and 28 patients had wet ARMD (14.0%).

Table 3. Age related macular degeneration according to age groups

ARMD type	Patients	40-49 yrs	50-59 yrs	60-69 yrs	70-79 yrs
Dry ARMD	171	0	5	16	150
Wet ARMD	28	1	1	1	25
Totals	199	1	6	17	175
%		0.5%	3.0 %	8.5%	88.0%

As summarized in Table 3, patients with ARMD were divided into age groups. Of those patients with dry ARMD: none were found among patients whose age ranged from 40 to 49 years of age; five patients (2.9%) whose age ranged from 50-59 years of age; 16 patients (9.4%) whose age ranged from 60-69 years of age; and 150 patients (87.7%) whose age ranged from 70-79 years of age. Of those patients with wet ARMD: one patient (3.6%) was in the group whose age ranged from 40 to 49 years of age; one patient (3.6%) was in the group whose age ranged from 50-59 years of age; one patient (3.6%) was in the group whose age ranged from 60-69 years of age; and 25 patients (89.3%) were found in the group whose age ranged from 70-79 years of age.

Diabetic Retinopathy. In our study, the prevalence of DR (all types included) in our population was 7.5%. Patients with DR were divided into disease and age groups. As summarized in Table 4, there were 118 patients (16.8%) with proliferative diabetic retinopathy (PDR). Of these, 10 patients with PDR (1.4%) were found in the group whose age ranged from 40 to 49 years of age; 29 patients (4.1%) in the group whose age ranged from 50-59 years of age; 4 patients (0.6%) in the group whose age ranged from 60-69 years of age; and 75 patients (10.8%) in the group whose age ranged from 70-79 years of age.

Table 4. Diabetic Retinopathy according to age groups

Retinopathy	Patients	40-49 yrs	50-59 yrs	60-69 yrs	70-79 yrs
PDR	118	10	29	4	75
NPDR	582	54	154	21	353
Totals	700	64	183	25	428
		(9.1%)	(26.1%)	(3.6%)	(61.2%)

There were 582 patients with non-proliferative diabetic retinopathy (NPDR) (83.2%). Of these: 54 patients (7.7%) were aged from 40 to 49 years of age; 154 patients (22.0%) were aged from 50-59 years of age; 21 patients (3.0%) were aged from 60-69 years of age; and 353 patients (50.4%) whose age ranged from 70-79 years of age.

No significant difference was found between genders, when controlling the age.

Discussion

Puerto Rico is an island in the Caribbean basin. It has a Hispanic population of approximately 3,900,000. However, due to the island's geographic isolation, there is inbreeding. For this reason, the prevalence of eye diseases in its population remains interesting.

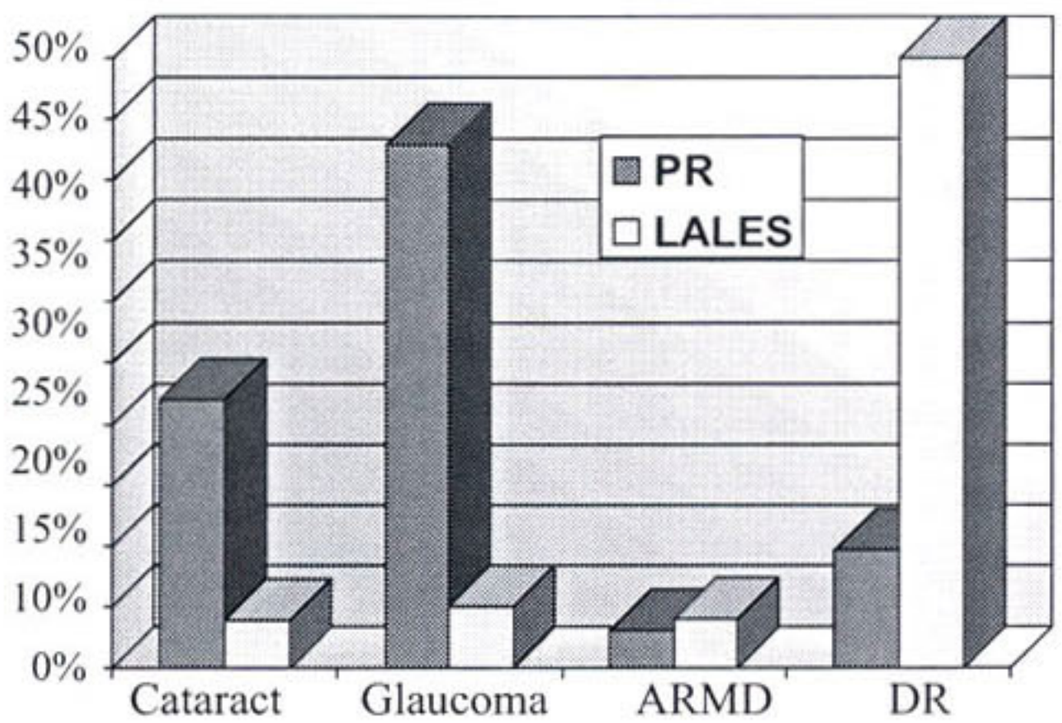
In our study, 22.1% of the patients had cataracts. The Los Angeles Latino Eye Study (LALES) reported a prevalence of cataracts of 3.9% in the Hispanic population of Mexican ancestry living in the continental USA (3). According to our findings, as shown in Graph 1, the prevalence of cataracts is higher than expected in Puerto Ricans when compared to the Latino population of the LALES[3] ($p< 0.001$). Other significant variation of our study was that the nuclear cataract was most common among our population. The LALES reported cortical cataract as the most common lens opacity found in their population.

Our study showed a prevalence of 42.6% of glaucoma (all types included). The LALES (5) reported a 4.74 % of

glaucoma in the Hispanic population of Mexican ancestry living in USA. As depicted in Graph 1, the prevalence of glaucoma (all types included) in our study was higher than expected in Puerto Ricans when compared with the Latino population of the LALES ($p<0.0001$).

The prevalence of age related macular degeneration found in the population studied was 2.82%. However, the LALES reported a prevalence of macular degeneration of 4.74%. In other words, the prevalence found in the population studied is lower than the one described in the LALES[6]. ($p< 0.0001$). This is depicted in Figure 1.

Figure 1. Comparing findings in PR to those in the LALES



In our study, the prevalence of Diabetic Retinopathy (DR) was 9.7%. On the other hand, the LALES described a prevalence of DR of 49.9%. Therefore, we found a smaller prevalence than expected when compared with the LALES[4] ($p < 0.0001$). This is shown in Graph 1. Diabetic retinopathy is the only eye disease that has been evaluated by the Center of Diseases in Puerto Rico. They reported a prevalence of 11.0% (7). Our study found a similar result.

Many factors may lead to the difference in the prevalence of eye diseases between the population studied and the Hispanic population in the USA. A higher prevalence of cataracts and glaucoma may be due to genetic, nutritional, and geographic factors. The lower prevalence of ARMD may be due to darker skin pigmentation, higher intake of antioxidants found in the tropical fruits, and genetic factors. A lower prevalence of diabetic retinopathy may be due to an earlier diagnosis and treatment of patients with diabetes mellitus in PR. Local ophthalmologists participated in the multi-centric national Early Treatment Diabetic Study. Education throughout the years has made primary physicians aware of the benefits of early diagnosis and treatment of diabetic retinopathy in patients with diabetes.

Limitations of this study include that these results do not represent the real prevalence of eye diseases in Puerto Rico. This study only gives a rough estimate. This study had a limited number of patients, and was limited to a specific population in San Juan.

Prevention of treatable eye diseases other than Diabetic Retinopathy is of utmost importance in Puerto Rico. However, the prevalence of most eye diseases in PR remains unknown. Epidemiologic studies are the cornerstone of preventive medicine programs. For this reason, further studies evaluating the prevalence of eye diseases in PR are desirable.

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