Renato Antunes Schiave Germano1,2, Rogerio Masahiro Kawai2, Bárbara Leite de Souza2, Flavio Augusto Schiave Germano3, Caroline Schiave Germano4, Jorge Estefano Germano2

1 Department of Ophthalmology, Faculdade de Medicina, Universidade de São Paulo School of Medicine. São Paulo, SP, Brazil.
2 Centro de Excelência em Oftalmologia, Bauru, SP, Brazil
3 Universidade Nove de Julho, São Paulo, SP, Brazil.
4 Faculdade de Ciências Médicas da Santa Casa de Misericórdia, São Paulo, SP, Brazil.

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INTRODUCTION

It is known that indigenous peoples around the world present worse health conditions and lower life expectancy compared with the population of urban centers. Brazil is an important center of native population, and currently has about 817,000 citizens spread across 688 communities. The first results of the 2010 Demographic Census reveal that 817,000 people have declared themselves as Indians, and the growth in the period of 2000/2010 was 84,000 Indians, which represents 11.4% of the total. These individuals represent approximately 0.4% of the Brazilian population. Despite the wide diversity among the different tribes, there are many similarities in relation to health status, disease prevalence and other determinants of health quality of the indigenous population.

Eyes diseases are very prevalent throughout the world. Globally, in 2010 there were 32.4 million blind people and 191 million people with vision impairment. There are few studies showing the exact prevalence of visual impairment and its causes in the Brazilian population. It is known, however, that patients in risk groups, such as low-income families or people who live away from urban centers, such as native populations, have higher rates of visual disabilities.

In Brazil, especially in native population away from large urban centers, there are few data regarding the most common causes of visual impairment, both in childhood and adulthood. But most publications involving the indigenous population were made including the Amazon region of Brazil. This is an epidemiological study of the prevalence of eye diseases in the population of Araribó Indigenous Land, which is divided in four indigenous villages: Ekeruá, Kopenoti, Nimuendaju and Tereguá. They are all situated at Avai City, in the State of São Paulo, Brazil.

Firstly, this study provides the identification of ocular diseases in a low-income population, contributing to the prevention of permanent damage to their vision. It also enables the analysis of the prevalence of eye diseases, contributing to the development of public health programs for the prevention of blindness, visual impairment and rehabilitation.

METHODS

This is a prospective, cross-sectional, population-based study to detect the prevalence of eye diseases in residents of the four indigenous tribes of Araribó Indigenous Land, situated in Avai City: Ekeruá, Kopenoti, Nimuendaju and Tereguá. Avai City has 5,275 inhabitants and is located 368 km from São Paulo, the state capital and 921 km from Brasilia. It lies at 22°08'48" S and 49°19'59" W and has a total of 540,689 km². The main source of income of the tribes is agriculture. Primary health care is done at Avai city, but more complex cases are referred to Bauru city, including ophthalmologic exams. The four tribes are all situated at Avai City, in the State of São Paulo, Brazil.

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signs on fundoscopy: microhemorrhages and/or microaneurysms, hard exudates or cotton wool spots and vascular abnormalities suggestive of DR. Age-Related Macular Degeneration (ARMD) was defined when any of the following findings was found in the posterior pole of the retina: hard or soft drusen, subretinal neovascular membrane in activity or geographic atrophy.

RESULTS

Of the total of 584 natives of the four villages, 377 participated in the study, an adherence of 64.55%. The specific adherence rates for each village are illustrated in Figure 1. The reason for not participating in the project was impossibility of attendance, either by disease or by not want to participate. Two-hundred eighty-four evaluations were performed at the main ophthalmologic center in the city of Bauru (CEO) and 94 evaluations in the health center of the Kopenoti village using a mobile ophthalmology unit brought by our team.

Table 1

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 10</td>
<td>66</td>
</tr>
<tr>
<td>11 – 20</td>
<td>78</td>
</tr>
<tr>
<td>21 – 30</td>
<td>56</td>
</tr>
<tr>
<td>31 – 40</td>
<td>51</td>
</tr>
<tr>
<td>41 – 50</td>
<td>50</td>
</tr>
<tr>
<td>51 – 60</td>
<td>34</td>
</tr>
<tr>
<td>61 – 70</td>
<td>22</td>
</tr>
<tr>
<td>71 – 80</td>
<td>11</td>
</tr>
<tr>
<td>81 – 90</td>
<td>6</td>
</tr>
<tr>
<td>&gt;90</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 2 shows the distribution of refractive errors found in the population. Patients with cataract, alterations in the retina, such as diabetic retinopathy and ARMD or newborns who did not allow the refractive examination were excluded of this table. Myopia was more prevalent in natives with 41-60 years old (43.75%), while hyperopia was more common in young natives, with age between 1-20 years old (41.93%). The highest myopic and hyperopic SE was -12.5 sf in a 23 years-old male and +4.25 sf in a 65 years-old male. The highest cylinder was -5.0 cyl in a 32 years-old female.

Table 2

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Absolute number (eyes) and percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emmetropia</td>
<td>342 (45.35)</td>
</tr>
<tr>
<td>Myopia</td>
<td>32 (4.24)</td>
</tr>
<tr>
<td>Hyperopia</td>
<td>63 (8.35)</td>
</tr>
<tr>
<td>Simple Astigmatism (hyperopic or myopic)</td>
<td>112 (14.85)</td>
</tr>
<tr>
<td>Compound Myopic Astigmatism</td>
<td>63 (8.35)</td>
</tr>
<tr>
<td>Compound Hyperopic Astigmatism</td>
<td>73 (9.68)</td>
</tr>
<tr>
<td>Mixed astigmatism</td>
<td>31 (4.11)</td>
</tr>
</tbody>
</table>

Table 3 shows the prevalence of eye diseases found in the studied population. 67 males and 72 women presented eye diseases. We found two cases of blind individuals (no light perception), both because of ocular trauma a long time ago.

Table 3

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Absolute number (eyes) and percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pterygium</td>
<td>106 (14.05)</td>
</tr>
<tr>
<td>Cataract</td>
<td>50 (6.63)</td>
</tr>
<tr>
<td>Pseudophakia</td>
<td>30 (3.97)</td>
</tr>
<tr>
<td>ARMD</td>
<td>12 (1.59)</td>
</tr>
<tr>
<td>Diabetic retinopathy</td>
<td>12 (1.59)</td>
</tr>
<tr>
<td>Glaucoma/Ocular hypertension</td>
<td>14 (1.85)</td>
</tr>
<tr>
<td>Epitheliopathy</td>
<td>9 (1.19)</td>
</tr>
<tr>
<td>Chorioretinal scars</td>
<td>4 (0.53)</td>
</tr>
<tr>
<td>Exotropia</td>
<td>9 (1.19)</td>
</tr>
<tr>
<td>Dyschromatopsia</td>
<td>1 (0.13)</td>
</tr>
</tbody>
</table>

DISCUSSION

In India, a developing country like Brazil, refractive errors account for 16% of blindness, and poverty and poor access to health centers are the main barriers for rural people to correct their refractive errors. Data on the prevalence of refractive errors in Brazil are scarce and may not show the reality across the country as it has continental dimensions, with large ethnic variation and large socio-economic differences among its regions.

Ferraz et al. studied 7654 individuals from nine cities in the state of São Paulo, and found a prevalence of 59.7% of astigmatism, 33.8% of hyperopia and 25.3% of myopia. We found a prevalence of astigmatism (simple, compound hyperopic, compound myopic and mixed) of 36.99%, simple myopia (with exclusion of individuals with cylinder) of 4.24% and simple hyperopia (with exclusion of cases with cylinder) of 8.35%. Importantly, we did not consider presbyopia in this study, because it is a physiological hyperopia reflecting the conversion of latent hyperopia for manifest hyperopia, which occurs with the natural loss of accommodation. For this reason the hyperopia prevalence found in our group was much lower than the rates found by Ferraz et al. In addition, the criteria for classifying the refractive errors were more discriminated in our study.

Pterygium is formed by a fibrovascular tissue of the bulbar conjunctiva that grows towards the limbus, and may extend over...
the cornea and, depending on its extent, it can cause irregular astigmatism and even cosmetic problems. (26) Pterygium mainly affects individuals who inhabit equatorial countries with tropical weather and work exposed to the sun. (26) Our study showed a prevalence of 14.05% of pterygium in the studied indigenous population, a higher rate than found in the city of Botucatu in the state of São Paulo, which was 8.12%. (25) This difference can be easily explained by increased sun exposure of the indigenous population compared with urban centers population.

Cataract is the leading cause of reversible and treatable blindness in the world and is still responsible for more than 75% of global blindness. (22-23) In a study involving more than 4,000 individuals, Carlos et al. (4) found a prevalence of 4.94% of cataract in five cities located in the Midwestern region of São Paulo, Brazil. We found a prevalence of 6.63%. However 6.63% is the percentage among all indigenous population, without considering age group. Updating by age group, all cases of cataract were diagnosed in individuals over 40 years, that is, the prevalence of cataract in individuals over 40 years is 19.84% in the studied population. If we also consider cataract in individuals who have been surgically treated with phacoemulsification and implantation of intraocular lens in our service, the prevalence of cataract in individuals over 40 years in the studied population increases to 31.74%.

It is estimated that in 2020, 80 million people will be affected by glaucoma worldwide, of which 11 million will be bilaterally blind. (29) In the Brazilian population there are few studies reporting the actual prevalence of glaucoma. A study conducted in the southern region of the country found a prevalence of glaucoma of 3.4% in individuals over 40 years (95% CI: 2.5% to 4.3%). (20) In the indigenous population of Avai, the prevalence of glaucoma was 1.85% considering all age groups. In patients over 40 years, the prevalence was 5.55%.

It is known that the number of individuals with type 2 diabetes is increasing every year in Brazil and in the rest of the world, with increasing prevalence of DR. (27) We found a prevalence of 1.45% of DR in native population, which is higher than the rates found in national literature (28), which was 1.02%. Data provided by the Health Agency of Araribá tribes report that there are 65 patients with diabetes in these four indigenous communities, resulting in a prevalence of 9.23% of diabetic retinopathy in patients with diabetes.

Another retinal pathology studied in our article was Age-Related Macular Degeneration (ARMD), which is a degenerative disease that can lead to blindness. The degenerative process affects the area of the macula, which is responsible for central vision, causing distorted vision and significant visual loss, affecting the quality of life of patients. (29) ARMD is the third leading cause of visual impairment in the world, with a prevalence of 8.70% in people over 50 years, according to WHO. (30) We found a prevalence of 1.59% of people with ARMD in the entire indigenous population. However, all cases diagnosed with ARMD were in people over 50 years old, and taking into account only individuals over 50 years, the prevalence of ARMD rises to 7.89%, very close to the number found by WHO. (30)

Strabismus consists in the deviation of the binocular alignment, when visual axes do not intersect at the point of fixation. The images of the two eyes are misaligned, causing double vision or, more commonly in children, the image of the deviated eye is suppressed in the cortical level. (10) The classification varies according to the direction of the deviation in relation to the object of fixation: esotropia describes inward or convergent deviation towards the midline; exotropia describes outward or divergent misalignment; vertical deviations are also classified into two varieties: hypertropia when the axes are offset higher than the fellow eye, while hypotropia refers to an eye whose gaze is directed lower. (10) The prevalence of exotropia in this study was 1.19%, and there were no diagnosed cases of esotropia or vertical deviations. A study in the Asian population showed the prevalence of exotropia to be higher than esotropia. (32) There are no studies in the literature reporting the actual prevalence of strabismus in the Brazilian indigenous population, and this is the first to describe ocular deviation in this specific population.

One limitation of the study was that we did not evaluate their work activities or daily habits, and we missed the opportunity to better justify the ocular pathologies found in the natives, although indigenous natural vocation is agricultural. However some strengths should also be highlighted: a motivated team work, a community based rather than a clinic-based sample and the use of a mobile ophthalmology unit that allowed better access to the study population, allowing eye care in their own native village. In addition, all individuals diagnosed with conditions requiring medical and/or surgical management will be treated by the ophthalmic center responsible for the study.

CONCLUSION

The investigation of the prevalence of ocular pathologies allows better planning of preventive eye care programs, especially in minority and low-income populations such as indigenous tribes. Early identification of eye conditions, especially in children, like refractive errors and strabismus, may allow more precocious treatments and contribute to preventing permanent damage to vision.

Our study found higher prevalence of pterygium, cataract, glaucoma and diabetic retinopathy compared with other population studies. These information are extremely important because they show higher rates of eye diseases in a needy and remote population of urban health centers, and in need of medical care. It is noteworthy that all patients from this study who presented refractive errors, received glasses with the corrected refractive lenses.

REFERENCES


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Corresponding author:
Renato Antunes Schiave Germano, MD
Av Dr Eneas de Carvalho Aguiar, 255
São Paulo, SP, Brazil
Phone (+55)1498114-0293
Email: rasgermano@hotmail.com

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