Prevalence of Lens Opacities in LaEsperanza, Honduras

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ABSTRACT

The prevalence of lens opacities and visual impairment caused by cataract was estimated via an epidemiologic cross-sectional population study in La Esperanza, Honduras during a VOSH Mission. The data was then analyzed for risk factors, specifically the amount of ultraviolet light exposure. The amount of sunlight exposure was higher in Honduras primarily due to latitude, altitude, and the occupation or lifestyle of the patient base. Several previous studies support the theory that these risk factors indeed increase the prevalence of lens opacities. This specific population study was conducted to inform the future VOSH Missions to Honduras of the critical need for ocular protection and education of the patients.

KEY WORDS

cataract, sunlight, latitude, altitude

INTRODUCTION

It is known that cataracts are a normal problem in aging populations. However, the etiology of the cataract is still not fully understood. Ultraviolet light exposure may be a critical risk factor for cataracts. Some literature shows that high ultraviolet levels are common in cataracts, while other studies disprove this association. There seems to be an incontinuity of conditions and classifications of cataracts in the studies. Therefore, the studies may parallel or disagree with each other depending on the criteria of the study.

As part of the La Esperanza, Honduras population study, we examined the relationship of cataract formation as it corresponds to latitude, altitude, and the lifestyle of the patient. According to the World Health Organization, 80% of the 27 to 35 million blind people in the world live in developing countries. (1) The number of severe lens opacities observed within the Honduran population made it obvious that the treatment for cataract was little to none.

METHODS

Clinical data from the VOSH Mission in La Esperanza was gathered to analyze the cataract prevalence. A total 1407 patients were examined with ages ranging from 1 to 100 and an average age of 44.

For each patient, a history, visual acuity, refraction, and ophthalmoscopy exam was administered. During ophthalmoscopy, the lens was evaluated for opacities. Along with the visual acuities, a diagnosis of cataract was determined. The cataract was not classified as cortical, posterior subcapsular, or nuclear sclerotic. It can be said though, that the majority of opacities were nuclear in nature. The only classification used was to

group the most severe cataracts for referral for possible surgery in Tegucigalpa, the capital of Honduras. There were also two slit lamps available to further evaluate the lens if ophthalmoscopy could not provide enough objective data.

In addition to the exam, the patient was asked about their occupation or lifestyle. This information was gathered to estimate the amount of ultraviolet exposure. All patients resided in the La Esperanza region, which is geographically 14 degrees north latitude. This geographical locale provides excellent comparisons to other latitude and cataract associated studies.

RESULTS

Of the 1407 patients examined in La Esperanza, 164 cataracts were noted. Sixty-nine of the cataract patients were referred for surgery. (table 1) Patients aged 75 to 85 accounted for 53% of the cataracts. Patients 65 to 75 accounted for 31% of the cataracts. Those patients less than 65 represented only 1-2% of the opacities. (table 2)

58% of the cataract patients were male, while 42% were female. In terms of occupation among the cataract patients, 40% of the patients were housewives, 32% general laborers, and 23% farmers. (table 3) A final observation confirmed the lack of sunlenses used in La Esperanza community.

DISCUSSION

The main reason for this study was to find the prevalence of cataracts in La Esperanza, Honduras. From this data, I will compare to other studies, how latitude, altitude, and outdoor activities influence cataract progression. All of these risk factors center around the amount of ultraviolet light exposure patients absorb. There are other critical risk factors for cataracts, such as nutrition and diet, that I will not investigate. (2) Ultraviolet radiation has been identified as one of the most important risk factors for cataracts.

Ultraviolet radiation covers a range of wavelengths from 100nm to 400nm. These wavelengths are divided into three categories: UVA (315-400nm), UVB (280-315nm) and UVC (100-280nm). UVC is totally absorbed by the ozone layer of the upper atmosphere. Therefore, it does not affect the human eye. UVA and UVB are found in sunlight and have been theorized as possible hazards to ocular structures. (3)

There are three major causes for cataract formation and degeneration of the retina. The first cause is oxygen. Oxygen and its byproducts alter molecules by removing electrons and hydrogen atoms which start free-radical reactions. These reactions are able to disrupt biological molecules in their path, thus able to deteriorate the lens. The second cause of cataract formation is heat. This is the energy produced by molecular movement. Local concentrations of kinetic energy can exceed the threshold of molecular bonds which can damage the tissue and deteriorate the lens. The third and most interesting cause is radiation or sunlight. Sunlight can cause damage via heat damage, oxidative damage, and direct photochemical effects. (4)

The amount of ultraviolet radiation that eventually reaches the eye can vary a great deal according to season, latitude, altitude, time of day, and the reflectivity of the surrounding area. (5) La Esperanza is located at a latitude of 14 degrees north and an altitude between 3000 feet and 4000 feet. Both of these characteristics allow for a higher degree of ultraviolet exposure. The closer one is to the equator, the less oblique the angle of sunlight incidence. Therefore, Honduras sunlight imparts a greater dose of ultraviolet radiation than regions further from the equator. (6) Several studies have investigated the part latitude plays in cataract formation.

A latitude study suggested that the probability of cataract surgery in the United States increases by 3% for each degree decrease (more Southerly) in latitude (6) Another study done on a group of Australian Aborigines found cataracts to be associated with high levels of UV radiation. (7) Cataracts were more commonly seen in lower latitudes. Australia has a climate of low humidity, high temperatures and intense solar

radiation. Of the patients seen at the latitude between 20 and 24 degrees, 53% had cataracts. In contrast, latitudes greater than 30 degrees, the prevalence of cataracts was only 34%. A VOSH Mission conducted in Costa Rica found the prevalence of cataracts to be 20.1% (1) Costa Rica is situated at 10 degrees north latitude. The overall prevalence of cataracts in the Honduras study was 13%. Again, the methods of these studies all vary enough to make it difficult to provide a linear correlation.

In the Australian study, there was another correlation that patients with less than 8.5 hours of sunlight exposure had less cataract prevalence than those with greater than 8.5 hours of exposure. (7) This supports our hypothesis that the lifestyle of the Honduran population includes high sunlight exposure which increases cataract formation The top three occupations in La Esperanza, Honduras were: 1) Housewife, 2) General laborer, and 3) Farmer. These occupations would suggest that a significant portion of the work day would be spent outdoors. Nearly all of the female patients with cataracts were housewives. They represented a smaller percentage than the male patients. It could be speculated that the male patient occupations required more work outdoors in contact with ultraviolet radiation. The data shows that the male patients accounted for 58% of the cataracts. The general laborer occupation was not strictly defined. From the general economy and standard of living of the community, it can be assumed that the majority of the labor was outside.

Several other studies, in addition to the Australian aborigine study, agreed with the correlation of duration of ultraviolet exposure and prevalence of cataracts. A study of Chesapeake Bay Watermen proved that high accumulative levels of ultraviolet radiation increased the risk of cortical cataracts. (8,9) The Beaver Dam Eye Study in Wisconsin also concluded that higher levels of ultraviolet exposure could be associated with the severity of cortical opacities. (10) A population-based study in Finland (approximately 60 degrees north latitude) found that occupational sunlight exposure correlated well with women and not men. (11) These studies estimated the patients amount of outdoor

activity. There just did not seem to be a clear, measurable way to calculate the actual time of exposure. Therefore, none of the studies lead to firm conclusions about the etiologic significance of sunlight exposure.

I have discussed how latitude and the amount of time in sunlight can cause an increase of the likelihood of lens opacities. The final risk factor for lens opacities that I will investigate is altitude. As mentioned before, La Esperanza is located in a mountainous area. It is approximately 3000 feet to 4000 feet above sea level. A study by Gates calculated that the spectral flux of solar radiation is greater at higher altitudes than at lower altitudes. At 2000 meters, the ultraviolet flux may be sixty percent greater than at 1000 meters. (12) La Esperanza is a very dusty, dry community where tree cover is average and the mountain obstruction of the sun is minimal. This setting provides for a near direct path for the radiation. An altitude study administered in the Himalayas in Nepal did not correlate with the increased prevalence of cataracts. (12) It did not correlate due to the increased cloud cover and mountain obstruction of the region. This reduced the actual ultraviolet radiation to the earth's surface.

The results from the La Esperanza study, and all cataract studies for that matter, have their weaknesses and problems. There is no such thing as a perfect study. Many small peripheral opacities causing no visual impairment were less likely diagnosed. It would be more complete if all the patients could be dilated to observe the entire lens. It would also be an improvement if the cataract could be classified into type and grade of opacity. Under the circumstances, the high volume of patients seen in the limited time on the La Esperanza Mission did not allow for this type of data to be recorded. This cross sectional population-based study provided the prevalence of cataracts at a given time. The ultimate study to test these risk factors would be a longitudinal study, including childhood years, to distinguish the temporal associations of these factors with lens opacities. (13)

The three risk factors of lens opacities discussed are all prevalent in La Esperanza, Honduras. Of the cataract prevalence studies, Honduras' latitude is one of the closest to the equator. It happens to have the highest prevalence for cataracts, correlating well with the theory. The people of Honduras are primarily farmers and outdoor laborers. They spend a great deal of their life out in the sun. Finally, they are located at an altitude above 3000 feet which basically means they are that much closer to the origin of the ultraviolet radiation. The key to overcoming these risk factors is to increase ocular protection and patient education of the people of Honduras.

The VOSH Mission dispensed 256 pairs of sunglasses to the 1407 patients examined. In my estimation, that number could easily be doubled in future trips. I have only investigated three critical risk factors in the prevalence of cataract formation. Since Honduras is a developing country, there are definitely other risks that have not been addressed. If future VOSH Missions educate patients about risk factors and dispense more protective eyewear, the risk factors concerning ultraviolet sunlight exposure could significantly be reduced. It has been shown that wearing a brimmed hat can reduce the amount of ambient ultraviolet radiation by 50%, (14) while ordinary plastic spectacles can stop approximately 90% of the radiation. Optimally, protective sunglasses can block between 95% to 100% of ultraviolet radiation. (6) Given the high prevalence of cataracts in La Esperanza, the use of simple protective devices to shield the sun must be stressed.

TABLE 1

Prevalence of Cataract

Total Patients	1407
Total Cataracts	164
Cataracts referred	95
Sunlenses dispensed	256

TABLE 2

Age Distribution of Cataracts

AGE	% of Total Cataracts
75-85	53%
65-75	31%
< 65	1-2%

TABLE 3

Socio-Demographic Characteristics of Cataract Patients

SEX	Percent
Male	58%
Female	42%

OCCUPATION	Percent
Housewife	40%
General Laborer	32%
Farmer	23%

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