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Original Article

An Investigation of Lens Opacity among Aged Population in Hainan Province

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SUMMARY

Background: Cataract is the major cause for visual disturbance. We aim to investigate lens opacity grade and score in residents aged ≥ 50 yrs in Hainan Province.
Methods: Random sampling was carried out to investigate the condition of lens opacity in residents aged ≥ 50 yrs of four cities at different geographic locations. Grading of lens opacity was based on the criteria of Lens Opacity Classification System III (LOCS III), which included nuclear opacity of 1~6 grade, and posterior capsular or cortical opacity of 1~5 grade. Score of lens was performed by summing nuclear, posterior capsular and cortical opacity grade.
Results: In total, 2,288 subjects were included in this study. In total, 2,619 (57.2%) eyes showed type of opacity in nuclear, and posterior capsular or cortical with an LOCS III grade of greater than 3. The major type of opacity was mixed opacity type (65.9%), followed by nuclear type (31.9%), posterior capsular type (1.5%) and cortical type (0.7%). As for lens score, most of the subjects aged 50~59 yrs and 60~69 yrs showed a score of 3~6 (87.2%, 59.9%). Among the subjects aged 70~79 yrs, a score of 7~9 was noticed in majority of subjects (35.6%). For those aged ≥ 80 yrs, most of them showed a score of 10~12 (28.2%).
Conclusion: The mixed lens opacity type was the main type of lens opacity in residents aged ≥ 50 yrs in Hainan Province, followed by nuclear opacity. Chi-square test showed that types or scores of lens opacity were different in various age groups.

1. Introduction

Cataract is one of the major causes for visual disturbance, which hampers the life quality in the aged population.[1] In clinical settings, lens opacities classification is crucial for the diagnosis of cataract.[2] To our best knowledge, few studies have been focused on the epidemiology in the fields of cataract in China mainland.[3,4] Particularly, these studies have been mainly focused on the participants in northern China. Hainan province, with a long period of sun exposure, is localized in the tropical area in southern China. In this study, we aim to investigate the epidemiological features of lens opacity in Hainan Province.

2. Materials and methods

2.1. Subjects

In this study, random stratified sampling was performed for the selection of subjects. A sample of 2,400 subjects aged ≥ 50 yrs were required for the sampling, assuming an examination response rate of 90% and a design effect of 1.5 accounting for inefficiencies associated with the cluster sampling design. The study protocols were approved by the Ethical Committee of Hainan General Hospital.

Four cities localized in the north, south, east and west of Hainan province were designated as the sampling sites, including Haikou City, Sanya City, Wanning City, and Dongfang City. These four cities represented the economic levels of Hainan Province. Four communities or villages were randomly selected from each city. The inclusion criteria were as follows: those aged ≥ 50 yrs; long-term residence or individuals living in the community/village at least 12 months. Those with intraocular lens implantation, eyeball atrophy, and keratopathy were excluded from the study. A computer-based random number generator was used for the sampling in each site, and 600 subjects were randomly selected from each site. All the 2,400 subjects were informed to participate in the ocular examination at the designated sites. A door-to-door visit would be given to those absent from the examinations.

2.2. Methods

Each included subject received the slit lamp examination after mydriasis. The lens opacity was evaluated using the Lens Opacity Classification System III (LOCS III) according to the previous descrip-

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tion.[5] Cases with intraocular lens, eyeball atrophy and keratopathy were excluded in this survey. The nuclear opalescence was divided into six grades according to the severity of the opalescence and a score of 1~6 was bequeathed for each grade. The opacity of the cortical cataract and posterior subcapsular cataract was divided into 5 grades according to the area of the lesions and severity, and a 5 scores range (1~5) was established according to the grading. For the nuclear opalescence, the included angle between the slit light and optic axis was 45 degree. For the classification of cortical cataract and posterior subcapsular cataract, the included angle between the slit light and optic axis was 0 degree. The width of the slit was 0.2 mm. The lens examination was performed by two experienced ophthalmologists.

As most of the cases showed decrease in visual acuity with degree of lens opacity of ≥ 3,[6] we only focused on those with a degree of ≥ 3 in this study. In order to investigate the type of the lens opacity, the following category was defined: (i) nuclear opacity of lens: nuclear opacity of lens in one eye with a severity of ≥ 3, and cortical opacity and posterior capsular opacity with a severity of < 3; (ii) cortical opacity: cortical opacity in one eye with a severity of ≥ 3, and nuclear opacity and posterior capsular opacity of < 3; (iii) posterior capsular opacity: posterior capsular opacity with a severity of ≥ 3, nuclear opacity and posterior capsular opacity with a severity of < 3; (iv) mixed lens opacity: at least two sites with lens opacity of a severity of ≥ 3. The lens opacity score was calculated based on the scores of the nuclear, cortical and posterior capsular opacity, which characterized as lens opacity degree of 1 in nuclear, cortical or posterior capsular was equivalent to 1 point. In detail, if a subject showed lens opacity degree of 1 in nuclear, 1 in cortical and 1 in posterior capsular, a score of 3 was given for this eye.

3. Results

In total, 2,288 subjects (4,576 eyes) were included in this study. A total of 202 patients were excluded from the study due to pseudophakia (n = 172), severe keratopathy (n = 23), and eyeball atrophy (n = 7). Finally, 4,374 eyes were included in this study, among which 2,619 eyes showed a degree of lens opacity of ≥ 3. There were 683 eyes aged 50~59 yrs, 1001 eyes aged 60~69 yrs, 527 eyes aged 70~79 yrs, and 410 eyes aged ≥ 80 yrs. The major type of opacity in the study subjects was mixed opacity of lens all of 2619 eyes (65.9%), followed by nuclear opacity of lens (31.9%), posterior capsular type (1.5%) and cortical type (0.7%). Chi-square test showed that types of lens opacity were different among the age groups with no particular trend ($p < 0.001$, Table 1).

Table 2 summarized the lens score of all subjects of 4374 eyes. In the subjects aged 50~59 yrs and 60~69 yrs, most of which showed a score of 3~6 (87.2% and 59.9%), with a small part showed a score of 13~16 (0.7% and 7.8%). Among the subjects aged 70~79 yrs, a score of 7~9 was noticed in the majority of subjects (35.6%). Chi-square test showed that score lens opacity were different among the age groups with no particular trend ($p < 0.001$, Table 2).

4. Discussion

Hainan province (with a latitude of 18°–20°) was surrounded by sea at four directions with a long sunshine duration of more than 2,000 hrs annually and a high quantity of radiant energy of 110,000–120,000 calories.[7] Agriculture is the major industrial structure. Most of the residents were farmers with a lower education. On this basis, individuals aged more than 20 yrs were considered to be the major labor force for the family, and many of them had to work until aged. Meanwhile, the medical level is comparatively lower, which hampers the treatment of ocular diseases. In this study, we carried out an epidemiological study for the first time to investigate the lens opacity in the residents in Hainan Province, by randomly selecting individuals from four sites. Our study contributed to the understanding on the incidence of cataract in Hainan Province.

Epidemiological studies on cataract play pivotal roles in preventing blindness. A corrected visual acuity of < 4.9 (LogMAR chart) is utilized as a diagnostic standard for cataract in clinical practice in China.[8] As the major cause for the blindness, cataract deserves deep investigation. Nowadays, the prevalence of cataract is comparatively high and the treatment outcome in those underwent surgery is still poor. According to a previous survey,[9] about 15.4% of the patients received surgery for treating cataract in Hainan. However, most of the population aged ≥ 50 yrs showed a higher prevalence of cataract, concurrent with other conditions that may affect the visual acuity such as glaucoma, age-related macular degeneration, retinal vein obstruction, diabetes, hypertension and retinopathy, which confused the data of incidence and risk factors in cataract and thereby hampered the conduction of epidemiological study in cataract. Thus, our study focus on the survey of lens opacity, but it is not a cataract prevalence survey.

In clinical practice, cataract extraction surgeries is conducted once the lens opacity is severe despite other conditions-induced visual acuity such as retinal disease.[10] Therefore, visual acuity is not the single factor to perform the surgery or not. In this study, a statistical analysis was performed for the lens opacity, with an aim to investigate the number of the population aged ≥ 50 yrs needed to receive surgery for treating cataract. This contributed to the prevention and treatment of cataract blindness.

The type of lens opacity may affect the selection of surgery for cataract. A nuclear opacity of lens demonstrated that it was difficult

Table 1
Type of lens opacity in the eyes of ≥ 3 grade.

Age (yrs)	Nuclear type	Cortical type	Posterior capsular type	Mixed type	Total eyes	p value
50~59	135 (19.8%)	6 (0.9%)	16 (2.3%)	524 (76.7%)	683	
60~69	224 (22.4%)	5 (0.5%)	13 (1.3%)	759 (75.8%)	1001	
70~79	285 (54.0%)	4 (0.8%)	7 (1.3%)	231 (43.8%)	527	
≥ 80	192 (46.8%)	3 (0.7%)	3 (0.7%)	212 (51.7%)	410	
Total	836 (31.9%)	18 (0.7%)	39 (1.5%)	172 (65.9%)	2619	< 0.001

Table 2
Lens score of all subjects.

Age (yrs)	Eyes					p value
	3~6 scores	7~9 scores	10~12 scores	13~16 scores	Total eyes	
50~59	1178 (87.2%)	146 (10.8%)	18 (1.3%)	9 (0.7%)	1351	
60~69	824 (59.9%)	233 (16.9%)	211 (15.4%)	107 (7.8%)	1375	
70~79	216 (18.9%)	407 (35.6%)	207 (18.1%)	314 (27.4%)	1144	
≥ 80	114 (22.6%)	123 (24.4%)	142 (28.1%)	125 (24.8%)	504	
Total	2332 (53.1%)	909 (20.1%)	578 (13.2%)	555 (12.7%)	4374	< 0.001

to perform the phaco cataract extraction, and instead, small incision cataract extraction surgery was needed.[11] Even for those with severe cortical opacity of lens, phaco cataract extraction was still applicable. These contributed to rational allocation of surgical equipment in blindness prevention project.

In this study, we carried out a survey of the lens opacity in those aged 50~59 yrs, 60~69 yrs, 70~79 yrs, and ≥ 80 yrs. Our data indicated that among the 4374 eyes, 2619 showed a lens opacity of ≥ 3. The major type of lens opacity was mixed type, followed by nuclear type, posterior capsular type and cortical type in these subjects. These results were in line with the two previous studies carried out in Beijing and Taipei, respectively. In contrast, they indicated the majority of subjects showed a higher incidence of nuclear type.[12] Previous literatures have been mainly focused on nuclear, cortical and posterior capsular of lens opacities. However, there are two concurrent types in clinical settings. In this study, we listed the mixed type separately, in order to evaluate the typing and scoring of the lens opacities in an accurate manner.

In the previous epidemic studies on cataract, a lens opacity of ≥ 2 was defined as cataract.[6] However, in our clinical experience, most of the subjects with an opacity of 2 showed a best corrected visual acuity of 1.0. Therefore, we focused on the subjects with lens opacity of ≥ 3. In future, we will focus on large sample studies to determine the accuracy of the conclusion.

Besides the opacity grade of the nuclear, cortical and posterior capsular, we also required more methods to evaluate the content of the lens opacity. For instance, a lens of opacity grade 3 in nuclear means much more slight than both of the same grade in nuclear, cortical and posterior capsular. Thus, we could evaluate the condition of the lens through calculating the scores of the nuclear, cortical and posterior capsular.

With our method, we found most of the subjects showed a score of lens of 3~6 in those aged 50~59 yrs and 60~69 yrs, while that for these aged 70~79 yrs was 7~9. Most of the subjects showed a score of 10~12 among those aged ≥ 80 yrs. These demonstrated that with the aging process, the proportion of the lens opacity with severe conditions increased.

In our future study, we will focus on the correlation analysis between the lens opacity score and the visual acuity. This will provide a very easy and rapid method to predict the whether the visual loss derived solely from cataract or other retinal disease once encountered a patient whose visual acuity does not match the lens opacity score, which contributed to quickly screen the patients suitable to accept a cataract surgery.

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Declarations of interest

None.

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