Focal Maculopathy in the Senile Cataract Population

Mei Zhang (syzm110011@163.com)
University of Sciences and Technology of China
Kun Yuan
University of Sciences and Technology of China
Jingwen Liu
University of Sciences and Technology of China
Haoran Zheng
University of Sciences and Technology of China

Research article

Keywords: Senile cataract, Maculopathy, Physical examination, Optical Coherence Tomography

Posted Date: August 12th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-54188/v1

Abstract

Objective: Optical Coherence tomography (OCT) was employed to screen for maculopathy in the senile cataract population, investigate its incidence, and establish a healthy mode of management for maculopathy.

Methods: A visual examination, slit-lamp microscope examination, direct ophthalmoscopic fundus examination, and a macular OCT examination were performed on 102 people with senile cataracts who were over 60 years in our hospital from January 1, 2019, to July 31, 2019. The demographic characteristics such as sex, age, physical examination mode: organization/individual, and routine physical examination items: presence or absence of hypertension, body mass index (BMI), blood biochemistry, total cholesterol, triglyceride (TG), fasting blood glucose and others.

Results: Of the 102 subjects in the study, 28 were positive for maculopathy according to the OCT examination. Univariate analysis found that there were statistical differences between sexes and the presence of maculopathy ($p<0.05$). There were no significant differences in age, visual acuity, hypertension, BMI, fasting blood glucose, TG, total cholesterol, and cataract type ($P>0.05$). Multivariate logistic regression analysis, including all factors that might affect maculopathy, indicated that positivity for maculopathy and age (OR =2.549, 95%CI: 1.129–5.756, $p<0.05$) and gender (OR=3.907, 95%CI: 1.241–12.302, $p<0.05$) were related.

Conclusion: The incidence of maculopathy in the senile cataract population was higher than that in the elderly population without cataract disease, and the proportion is 27.45%. Screening for maculopathy in the senile cataract population, especially among the elderly and females, should be improved.

1. Introduction

The clinical incidence of cataract is very high, and it accounts for a large proportion of blinding eye diseases. Among those with cataracts, senile cataract is the most common type. The pathogenesis of cataracts is not clear; however, the most effective way to prevent cataracts is to have a healthy lifestyle, including avoiding smoking and excessive sunlight [1-2]. Gradual vision loss is the most obvious and important symptom of cataracts. At present, the treatment for cataracts is mainly based on surgical treatment, supplemented by medication[3]. Maculopathy is also a common type of ocular disease, and its main symptoms are deformed, darkened vision and vision loss. However, specialized examinations of the macular region still do not occur in routine health check-ups. The elderly are often misdiagnosed due to a routine ophthalmic examination failing to identify some important symptoms of maculopathy because of a small pupil and phacoscotasmus. Since cataract is more common in the elderly, they often mistakenly think that the original ocular disease aggravated, ignoring the existence of maculopathy which led to missing the optimal opportunity for treatment. Additionally, a result of poor visual acuity recovery after cataract surgery is in dispute. Optical coherence tomography (OCT) is a new non-invasive and non-

contact optical imaging diagnostic technique that has been widely used in clinical practice in recent years. It has become the gold standard for the diagnosis of macular diseases[4].

In order to find, diagnose, and treat maculopathy in patients with a senile cataract earlier, to provide evidence for visual acuity evaluation after cataract surgery, and to establish a healthy mode of management for maculopathy, 102 cases with senile cataract were screened for maculopathy using OCT in this study.

2. Materials And Methods

2.1 Materials

One hundred and two patients who were diagnosed with senile cataract at the Department of Health Management Center, the first affiliated hospital of USTC (Anhui Provincial Hospital), were examined with OCT from January 1, 2019, to July 31, 2019. Among them, 49 were male and 53 were female, and the age range was 61–89 years. Finally, 28 cases were designated as positive and 74 cases were designated as negative for maculopathy. Subjects were recruited and provided written informed consent with approval from the Ethics Committee of The First Affiliated Hospital of University of Sciences and Technology of China.

2.2 Methods

2.2.1 General characteristics

The following general characteristics of the participants were obtained by a general physician or ophthalmologist: age, sex, physical examination (mode: organization/individual), uncorrected or corrected visual acuity using an international standard visual acuity chart (uncorrected or corrected visual acuity <1.0 indicated abnormal visual acuity), body mass index (BMI; BMI <18.5 kg/m^2 was considered thin, 18.5 $kg/m^2 \leq$ BMI <24.0 kg/m^2 was considered normal, 24.0 $kg/m^2 \leq$BMI <28.0 kg/m^2 was considered overweight, and BMI $\geq$28.0 kg/m^2 was considered obese), fasting blood glucose (normal range 3.90–6.10 mmol/l), triglycerides (normal range 0.00–1.70 mmol/l), total cholesterol (normal range 0.00–5.18 mmol/l), blood pressure, and presence or absence of diabetes.

2.2.2 Ophthalmologic examination

Using ophthalmic slit-lamp microscopy to identify cataracts and eye types (binocular, oculus dexter or oculus sinister), a direct ophthalmoscope examination was performed to exclude optic neuropathy, myopic retinopathy, and the vitreous opacity. The fundus was not observed.

2.2.3 Ocular OCT examination

2.2.3.1 Instruments

An OSE-2000 Optical Coherence Tomography scanner produced by Shenzhen Slton Technology Co, Ltd., was used in the examinations.

2.2.3.2 Methods

(i) Preparation for the procedure

The device was operated by a professionally trained nurse. To begin the procedure, the instrument power was turned on, the OCT software was started, and the height of the instrument was adjusted. The participant was advised to sit directly opposite the instrument. They were told to place their jaw naturally on the mandibular supporter, and their forehead against the front bracket after their information was verified.

(ii) Image collection

The scanning region was selected, which included the macular area, using the six-line scanning procedure. The right eye was examined first and then the left eye.

(iii) Image processing

The OCT images that were clear and reflected the maculopathy were selected.

(iv) Image printing

The OCT images were viewed for confirmation and then printed. Printed images were submitted to the ophthalmologist for assessment.

2.2.3.3 Interpretation of the OCT report

Normal macular OCT results included the following: an optical interface was formed between the vitreous cavity and the inner retinal boundary membrane, and an optical section was formed between the retinal nerve epithelium and pigment epithelium. Abnormal macular OCT results included: macular epiretinal membrane, macular hemorrhages, pigment epithelium or nerve epithelium detachment, macular edema, macular hole, macular splitting, and macular atrophy and thinning.

2.3 Quality control

All personnel involved in the study were trained and had relevant professional knowledge. Participants were strictly selected according to the exclusion and inclusion criteria. The initial data were reviewed one by one to ensure accuracy.

2.4 Statistical analysis

The study factors were grouped according to whether the participant had maculopathy. SPSS 23.0 was used to analyze the data. Counting data were expressed as rates (%). The different groups were analyzed

by univariate analysis with a c^2 test. All possible factors affecting maculopathy were included in a logistic regression analysis to determine the mixed effects of various factors on maculopathy. $p<0.05$ indicated statistical significance.

3. Results

3.1 Univariate analysis of maculopathy in the senile cataract population

One hundred and two cataract cases were divided into two groups according to the presence or absence of maculopathy. A total of 28 cases were positive for maculopathy. Univariate analysis of the general characteristics showed that sex may be an influencing factor for maculopathy ($p<0.05$).

Table 1.

Univariate analysis of maculopathy in the senile cataract population

Factor		Cases (n) (%)	Positive	Negative	χ^2	P
Sex	male	49 (48.0)	9	40	3.907	0.048
	female	53 (52.0)	19	34		
Age	60~	24 (23.5)	3	21	4.376	0.112
	70~	58 (56.9)	17	41		
	80~	20 (19.6)	8	12		
Physical examination mode	organization	97 (95.1)	26	71	0.416	0.613
	individual	5 (4.9)	2	3		
Visual acuity*	normal	2 (2.0)	0	2	0.783	0.376
	abnormal	99 (97.1)	28	71		
Hypertension	yes	56 (54.9)	14	42	0.375	0.541
	no	46 (45.1)	14	32		
BMI	thinner	19 (18.6)	7	12	3.708	0.295
	abnormal	3 (2.9)	2	1		
	overweight	38 (37.3)	9	29		
	obesity	42 (41.2)	10	32		
Diabetes	yes	7 (6.9)	2	5	0.005	0.945
	no	95 (93.1)	26	69		
Fasting blood-glucose	normal	95 (93.1)	26	69	0.005	0.945
	abnormal	7 (6.9)	2	5		
Triglycerides	normal	70 (68.6)	21	49	0.728	0.394
	abnormal	32 (31.4)	7	25		
Cholesterol total	normal	65 (63.7)	17	48	0.151	0.697
	abnormal	37 (36.3)	11	26		
Type of cataract	binoculus	95 (93.1)	25	70	1.135	0.567
	oculus dexter	3 (2.9)	1	2		
	oculus sinister	4 (3.9)	2	2		

* Lack of data

3.2 Multivariate analysis of maculopathy in the senile cataract population

All possible factors affecting maculopathy were included in a multivariate logistic regression analysis. The results showed: age (OR=2.549, 95%CI: 1.129–5.756, p<0.05) and sex (OR =3.907, 95%CI: 1.241–12.302, p<0.05) were risk factors for maculopathy. The values for each variable were sex (0=male, 1=female), age (1=60~, 2=70~, 3=80~), BMI (1=thin, 2=normal, 3=overweight, 4=obesity), physical examination mode (0=organization, 1=individual), visual acuity (0=normal, 1=abnormal), hypertension (0=no, 1=yes), diabetes (0=no, 1=yes), fasting blood glucose (0=normal, 1=abnormal), triglycerides (0=normal, 1=abnormal), and cataract type (0=binocular, 1=oculus dexter, 2=oculus sinister).

Table 2.
Univariate analysis of maculopathy in the senile cataract population

Variables	B	P	OR	95% confidence region of OR	
				lower limit	upper limit
Gender classification	1.363	0.020	3.907	1.241	12.302
Age classification	0.936	0.024	2.549	1.129	5.756
Physical examination mode	0.933	0.395	2.543	0.296	21.850
Visual acuity*	20.251	0.999	623411623.721	0.000	0.000
Hypertension	0.313	0.565	1.367	0.470	3.975
BMI classification	0.080	0.819	1.084	0.544	2.158
Diabetes	0.273	0.800	1.314	0.160	10.779
Triglycerides	-0.669	0.286	0.512	0.150	1.750
Cholesterol total	-0.173	0.765	0.841	0.270	2.616
Type of cataract	0.130	0.833	1.139	0.341	3.800
Constant	-23.969	0.999	0.000		

* Lack of data

4. Discussion

With increases in the elderly population, health problems of the elderly are very important in medical care. The visual system may be the most important sensory organ in the body because about 90% of the

information obtained from the outside world is received through vision. As a result of aging, the eyes of the elderly experience physiological and pathological deterioration. The most common pathology is the senile cataract. It is the main cause of vision loss, and its incidence increases significantly with age[5]. Older people have a lower antioxidant capacity and a higher incidence of cataracts[6]. The results of our study are in agreement with previous studies. Senile cataracts are often seen in both eyes, and our statistical analysis supported this view. Senile cataracts can be clearly diagnosed with a slit-lamp examination. At present, phacoemulsification and intraocular lens implantation are the main treatment methods. Attention should be paid to the cataract process because it may induce secondary glaucoma, refractive changes, and other complications. Regular follow-up is important. Other ocular diseases can be missed as a result of lens opacity, and this should be considered when vision loss is not consistent with lens opacity.

The macular area is the most sensitive part of the retina, and the level of visual acuity is an important indicator when evaluating the severity of maculopathy. Age is currently recognized as the leading risk factor for maculopathy. With increases in age, phagocytosis of human retinal pigment epithelial cells is obviously reduced, which is the main pathological mechanism for macular degeneration. In addition, the elderly are prone to hypertension and diabetes which are associated with maculopathy, they are also the main causes of reduced vision. According to a survey of maculopathy in China, the incidence varied from 14.3% to 14.37%[7-8]. This was attributed to differences in age structure and living environments. However, our study showed the incidence of maculopathy in the senile cataract population was as high as 27.45%, which fully demonstrates the importance of screening for maculopathy in the senile cataract population.

In this study, there was no correlation between diabetes, fasting blood glucose, and the presence of maculopathy, partly because of some relative information was concealed while physicians and ophthalmologists consulted the patient’s medical history; partly due to some patients taking oral antidiabetic drugs or subcutaneous insulin injections, which can lead to normal blood glucose results. At present, diabetic maculopathy has become the main cause of vision loss in the USA and most European developed countries[9]. China has the largest number of people with diabetes in the world, which was 114 million in 2017[10]. We should strengthen the management of blood glucose levels in the senile cataract population to delay the occurrence of ocular complications. Our study also showed that OCT maculopathy positivity was gender-related, possibly due to estrogen levels.

The method of macular examination included 1) fundus angiography, which is an invasive procedure that requires an allergy test and consideration of liver and kidney dysfunction; 2) the Amsler checkerboard test; however, subjective assumptions of the test can affect the results; and 3) OCT, which is non-contact and non-invasive, has high-resolution, pupils are free from dilatation, and there are repeatable features. Therefore, OCT is the preferred diagnostic method for maculopathy screening.

In conclusion, elderly people with cataracts are prone to maculopathy because they are in a specific age group. Some symptoms of maculopathy can be easily ignored because of the existence of primary ocular diseases, which eventually leads to poor vision recovery and even loss of vision. We should actively

increase publicity for maculopathy screening in the senile cataract population, teach patients self-examination techniques, and advocate regular ophthalmic examinations. We should focus on the ophthalmic health of the elderly population in the entire society and establish a health management model for early screening of maculopathy.

List Of Abbreviations

Optical Coherence tomography (OCT), body mass index (BMI), triglyceride (TG).

Declarations

Ethics approval and consent to participate

Subjects were recruited and provided written informed consent with approval from the Ethics Committee of The First Affiliated Hospital of University of Sciences and Technology of China.

Consent for publication

Not applicable

Availability of data and materials

All data generated or analysed during this study are included in this published article.

Conflict of interest

The authors declare that they have no conflicts of interest.

Funding

This study is supported by the Natural Science Foundation of Anhui Province Grants (1908085MH254).

Acknowledgements

Not applicable

Author contributions

Designed the experiments: Mei Zhang. Performed the experiments: Mei Zhang, Kun Yuan, Jingwen Liu, Haoran Zheng. Analysed the data: Mei Zhang, Haoran Zheng. Contributed to the writing of the manuscript: Mei Zhang. Revised the manuscript: Mei Zhang, Kun Yuan, Jingwen Liu, Haoran Zheng.

References

1. Hunuo Chen, Jingyi Zhuang, Jinwei Fang. Effect of different incision of phacoemulsification on tear, intraocular pressure and corneal endothelial injury in age-related cataract patients [J]. Chinese Journal of Gerontology, 2019，39(16)：4016-4019.
2. Xin Liu, Wenguo Yu. Analysis of influencing factors of age-related cataract patients [J]. Medical Clinical Research, 2016，33(2): 316-318.
3. Qiong Wu, Wei Kong. Cataract [J]. Chinese Journal of Practical Village Doctors，2017，24(12)：18-20.
4. Dewen Tan, Wenlan Kang. Application of oct in screening for macular diseases in fundus [J]. Laboratory Medicine and Clinic, 2017, 17, Supplement: 116-117.
5. Mengqiao Wang. Clinical effect of diclofenac sodium eye drops on aged cataract patients after operation [J]. Contemporary Clinical Journal, 2019 (4)：374-375.
6. Zhaoyan Wang, Mengyun Huang, Qiuhui Li. Age-related cataract incidence and its influencing factors in 756 elderly patients [J]. Practical Preventive Medicine, 2017，24(2)：1502-1503.
7. Jieyin Mai, Minghua Liao, Tingting Liu. A study on the disease status of senile macular degeneration [J]. Laboratory Medicine and Clinic, 2017, 14(4)：570-572.
8. Tian Tong, Yanhua Jiang. Analysis of incidence and risk factors of age-related macular degeneration [J]. International Health Bulletin, 2015，15(1)：14-16.
9. Yujie Chen, Ge Chi, Jing Zhang. Optical Coherence Tomography of diabetic retinopathy [J]. Psychologist，2016, 22 (12): 22-23.
10. Xiujun Shi, Xuqiang Nie. Progress in the Treatment and Mechanism of Diabetic Skin Ulcer Stem Cells [J]. Chinese Journal of Pathophysiology, 2018，34(11)：2106-2110.