Original Article

The analysis of macular perimetry with octopus 900 in acute central serous chorioretinopathy

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Background: To find the changes of macular perimetry (MP) and the correlations between MP and best correct visual acuity (BCVA) in different phases of the acute central serous chorioretinopathy (CSC).

Methods: Twenty-one eyes with acute CSC and their fellow eyes were analysed retrospectively. MP at 2°, 4° and BCVA in the active and resolved phase were collected and analyzed. The differences of these parameters in CSC eyes and fellow eyes were analyzed. Spearman correlation was used for analysis of correlation between MP and BCVA.

Results: From 29 eyes with CSC analysed 27 eyes (93.10%) recovered to the previous VA. Compared with the active phase, MP at 2°, 4° and BCVA were significantly improved in the resolved phase (P=0.000, 0.000, 0.000, respectively). MP at 2°, 4° and BCVA of CSC eyes were significantly poor compared with the fellow eyes in the active phase (P=0.000, 0.000, 0.000, respectively). In the resolved phase there was no significant difference between the CSC eyes and fellow eyes (P=0.339, 0.141, 0.161, respectively). BCVA was shown to significantly correlate with MP at 2° in the active phase (ρ=–0.630, P<0.001).

Conclusions: The acute CSC often had a good prognosis both in BCVA and MP. MP can provide an additional objective parameter to evaluate the retinal function changes at macula of acute CSC.

Keywords: Central serous chorioretinopathy (CSC); macular perimetry (MP); macular function

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Introduction

The central serous chorioretinopathy (CSC) is a disorder confined to the macula, characterized by serous neurosensory retina and/or retinal pigment epithelium (RPE) detachment due to choroidal hyperpermeability and focal RPE defect. Clinically, CSC is classified as acute and chronic. Classic CSC occurs in an acute form, characterized by acute retinal detachment within macula, with mild to moderate blurred central vision, metamorphopsia, dyschromatopsia, shallow relative scotoma, mild diopter changes, minimal focal RPE damage and leakage by fluorescein angiography (FA). Acute CSC generally resolves spontaneously within months, and observation is advisable following the initial diagnosis of acute CSC in the majority of patients (1-3). Chronic CSC is defined as persistent central retinal detachment for 3 to 6 months, may cause permanent visual loss. FA shows extensive RPE damage and diffuse leakage (1). Verteporfin photodynamic therapy (PDT) and focal laser photocoagulation are the main treatment therapies for chronic CSC currently (4-6).

Although the visual acuity is relatively good in most of the acute CSC patients, macular functional damage is observed in some focal areas (7). Therefore, the mild

blurred vision does not always consistent with the severity of the disease. Recently, macular perimetry (MP) is introduced automatic fundus perimeter, which has been shown to be effective in assessing the macular function in some macular pathologies (4,8,9). In some chronic and resolved CSC studies, MP has been used to evaluate the macular retina function (5,8,10,11). However, in acute CSC, the change of MP in active and resolved phase has rarely been mentioned.

The aim of this study was to find the change of MP and the correlation between MP and best correct visual acuity (BCVA) in the different phase of acute CSC.

Methods

A retrospective chart review was performed of consecutive patients with acute CSC in our hospital between May 01 2012 and April 30 2013. The study was approved by the Research Ethics Committee of Affiliated Hospital of Qingdao University (approval ID: 2012-011). And the records of the patients were anonymized and de-identified prior to analysis.

Acute CSC was diagnosed as the presence of serous neurosensory retina detachment involving the macula, confirmed by macular optical coherence topography (OCT) and the leakage at the level of the RPE on FA, and self revolved in 6 months. Active phase was defined as serous neurosensory retina detachment involving the macula. Resolved phase was defined by the absence of detachment at the time of OCT measurement.

In addition to OCT and FA, patients underwent BCVA measurements, MP, automated refraction, non-contact tomometer, slit-lamp biomicroscope, and indirect ophthalmoscopy at the first visit in the active and resolved phase. Additional data were recorded for each patient included sex and age.

We compared the BCVA and MP in the active and resolved phase of the CSC eyes. We also compared the BCVA and MP in CSC eyes and fellow eyes, and analyzed the correlation between them in different phase.

MP was performed with the octopus 900 perimetry (Haag-Streit International, Koeniz, Switzerland). Threshold fundus perimetry was performed on the central 2° and 4° in diameter of the retina. Golemann III size white-cross stimuli and a 4- to 2- to 1-dB staircase threshold strategy were used. White on white static perimetry was performed with a background luminance of 4 asb with a pericentral diamond fixation target, and a stimulus duration of 200 ms. And 17 stimulus points (8 ring-shaped points and 1 center point for the central 2° and 8 ring-shaped points for the center 2°–4°) covering the central 4° in diameter of the retina were applied. The mean macular sensitivities for the central 2° and 4° were then calculated.

Comparisons of the parameters between active and resolved phase of CSC eyes and normal fellow eyes were obtained using paired *t*-test for independent sample. Moreover, Spearman correlation analysis was performed to MP and BCVA. Statistical analysis was performed using SPSS version 13.0 (SPSS Inc., Chicago, IL, USA). A P value less than 0.05 was considered statistically significant.

Results

Baseline characteristics

The baseline demographic data are shown in *Table 1*. Fifty-eight eyes from 29 patients were analyzed. The average patient age was 36.14±6.01 (range, 26–50) years. Twenty-six (89.66%) were male. The number of right and left CSC eyes was 16 and 13, respectively. The mean duration was 71.52±38.72 (range, 15–152) days.

BCVA and MP

About the BCVA, 27 (93.10%) CSC eyes recovered in the resolved phase. Twenty-two (75.86%) CSC eyes resolved in 3 months, and 7 (24.14%) CSC eyes resolved between 3 to 6 months. Compared with the active phase, MP at 2°, 4° and BCVA were significantly improved in the resolved phase (P<0.001) (*Table 1*, *Figures 1*,*2*).

In the active phase, MP at 2°, 4° and BCVA of CSC eyes were significantly poor compared with the fellow eyes (P<0.001) (*Table 2*). However, in the resolved phase there were no significantly difference between the CSC eyes and fellow eyes (P=0.339, 0.141, 0.161, respectively) (*Table 3*).

BCVA was shown to significantly correlate with MP at 2° in the active phase (ρ=–0.630, P<0.001). BCVA was consistent with macular sensitivities at 2°. However, there was not significant correlation between them in the resolved phase (ρ=–0.098, P=0.614). Also, no significant correlation was seen between BCVA and MP at 4° in both active and resolved phase (ρ=–0.359, P=0.056; ρ=–0.065, P=0.737; respectively) (*Table 4*).

Discussion

The study analyzed the BCVA and MP of acute CSC in

Table 1 Clinical characteristics of acute CSC patients in active and resolved phase

Patient	Gender	Age (Y)	Eye	Duration (D)	BCVA (LogMAR)		MP at 2° (dB)		MP at 4° (dB)	
					Active	Resolved	Active	Resolved	Active	Resolved
1	M	36	OD	77	0.2	0.0	20.33	31.22	22.00	31.33
2	M	33	OD	35	0.1	0.0	20.00	31.78	22.75	30.63
3	M	50	OD	142	0.2	0.0	19.50	25.00	19.90	26.50
4	M	34	OS	61	0.2	0.0	22.00	32.67	23.10	32.16
5	M	35	OD	15	0.2	0.0	26.00	31.25	28.75	30.12
6	F	38	OS	45	0.2	0.0	25.20	30.33	27.13	30.63
7	M	35	OS	63	0.1	0.0	27.10	30.34	29.88	30.07
8	M	27	OD	65	0.1	0.0	22.90	32.26	28.00	32.09
9	M	42	OS	50	0.5	0.0	26.11	29.31	27.38	30.55
10	M	47	OS	47	0.1	0.0	26.8	30.71	29.00	30.19
11	M	46	OD	82	0.3	0.0	21.54	29.80	23.18	29.12
12	M	43	OD	121	0.1	0.1	23.14	28.50	25.31	29.76
13	M	47	OS	71	0.1	0.0	20.50	29.40	19.70	29.20
14	M	34	OD	29	0.1	0.0	27.30	31.50	26.60	31.40
15	M	36	OS	53	0.0	0.0	23.80	30.30	23.70	30.13
16	M	34	OS	49	0.1	0.0	26.95	31.28	25.33	30.70
17	M	26	OS	65	0.3	0.0	23.12	32.50	25.10	31.70
18	M	45	OD	55	0.0	0.0	27.7	29.80	26.40	29.00
19	M	46	OS	73	0.0	0.0	26.15	29.50	26.30	29.20
20	M	34	OS	23	0.0	0.0	27.30	32.40	26.50	31.30
21	F	37	OD	58	0.2	0.0	23.70	30.70	25.80	30.10
22	M	37	OD	152	0.0	0.0	28.10	31.50	25.80	30.60
23	M	40	OS	32	0.0	0.0	26.50	30.00	27.10	30.50
24	M	44	OS	97	0.2	0.0	22.30	29.00	21.50	28.50
25	M	39	OD	30	0.2	0.1	25.30	31.30	27.20	31.00
26	M	39	OD	83	0.4	0.0	19.80	29.30	19.20	28.10
27	M	45	OD	147	0.3	0.0	20.50	28.70	21.40	29.30
28	F	44	OD	131	0.5	0.0	19.30	29.80	19.90	28.00
29	M	42	OD	123	0.4	0.0	20.30	30.20	23.00	29.70
Mean ± SD	26 M:3 F	36.14±6.01	16 OD:13 OS	71.52±38.72	0.18±0.15	0.01±0.03	23.77±2.94	30.36±1.55	24.72±3.02	30.05±1.29
P					0.000		0.000		0.000	

CSC, central serous chorioretinopathy; BCVA, best corrected visual acuity; MP, macular perimetry; F, female; M, male; Y, year; D, day; SD, standard deviation; LogMAR, logarithm of the minimum angle of resolution.

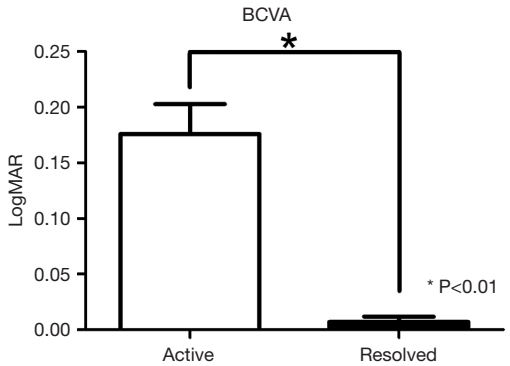

Figure 1 Best correct visual acuity (BCVA) of the active and resolved phases.

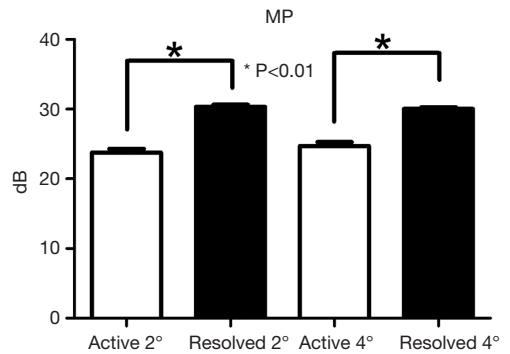

Figure 2 Macular perimetry (MP) of the active and resolved phases.

different phases, and evaluated the possible correlation between BCVA and MP.

CSC is considered a self-limiting condition with good prognosis, and therefore, expectant management including observation and change in lifestyle is considered first-line. Most of the previous studies focus on the chronic CSC and resolved CSC (10-13). In this study we focus on the acute CSC, especially in the active phase and the early stage of the resolved phase.

Some previous studies took 3 months as the deadline to divide the acute and chronic CSC (14,15). However, in this study we took 6 months as the deadline of the acute CSC as other studies (1,2,8). In our study, 22 (75.86%) of the 29 acute CSC patients resolved in 3 months, and other 7 (24.14%) patients resolved in 6 months without any treatment. So we think 6 months may be more appropriate to distinct the acute and chronic CSC.

BCVA is the standard way to measure visual performance,

Table 2 BCVA and MP in active phase

Parameter	CSC eyes	Fellow eyes	P
BCVA (LogMAR)	0.18±0.15	0.00±0.00	<0.001
MP at 2°	23.77±2.94	29.83±1.59	<0.001
MP at 4°	24.72±3.02	30.13±1.48	<0.001

CSC, central serous chorioretinopathy; BCVA, best corrected visual acuity; MP, macular perimetry; CSC, central serous chorioretinopathy; LogMAR, logarithm of the minimum angle of resolution.

Table 3 BCVA and MP in resolved phase

Parameter	CSC eyes	Fellow eyes	P
BCVA (LogMAR)	0.01±0.03	0.00±0.00	0.161
MP at 2°	30.36±1.55	30.01±1.58	0.339
MP at 4°	30.05±1.29	30.50±1.46	0.148

BCVA, best corrected visual acuity; MP, macular perimetry; CSC, central serous chorioretinopathy; LogMAR, logarithm of the minimum angle of resolution.

Table 4 Correlation between BCVA and MP in active and resolved phase

BCVA (LogMAR)	MP at 2°		MP at 4°	
	ρ	P	ρ	P
Active phase	–0.641	0.000	–0.359	0.056
Resolved phase	–0.098	0.614	0.065	0.737

BCVA, best corrected visual acuity; MP, macular perimetry; LogMAR, logarithm of the minimum angle of resolution.

however it does not describe the full extent of the functional impact on visual performance in the acute CSC patients. MP is one of the functional evaluation techniques, which can evaluate the retinal sensitivity and central retinal field function. BCVA combined with MP was considered to be more informative to explain the visual function of the CSC patients (13,16,17). In the present study, we performed MP to objectively evaluate the changes in macular function of the CSC in the active and resolved phase. Compared with the active phase, both MP at 2°, 4° and BCVA were significantly improved in the resolved phase. However, there were no significant difference between CSC eyes and

fellow eyes in the resolved phase. This result was different to other previous studies of the resolved CSC. Chung *et al.* found MP was significantly decreased in the points with loss of the ellipsoid portion of the inner segments (EPIS) in the resolved CSC eyes (10). In another study, they also found MP at the fovea had a significant association with the EPIS defect (12). This may be because our patients were acute CSC and resolves spontaneously within months. Usually, these patients had a better prognosis. Our study demonstrated that the impaction of CSC on the BCVA and MP of these patients was not obvious in the resolved phase. Thus, observation may be the first choice for these patients. After all, the treatment with laser and PDT has risks including choroidal ischemia, RPE atrophy and iatrogenic CNV (18-21).

In our study, we also analyzed the correlation between MP at 2°, 4° and BCVA in active and resolved phase. In the active phase, we found BCVA was significantly correlated with MP at 2°, which represents the central fovea, but not MP at 4°, which involves the whole macula. Probably because the central fovea is more affected or tends to present the higher detachement. This may be because the damage of CSC was mainly at the fovea. And MP at 2° could represent the function of the fovea more exactly. In another study, BCVA was shown to correlate with MP at 2° and 4° in the resolved CSC (12). Nevertheless, in the resolved phase, we found there was no significant correlation between them. Most of our patients (93.10%) resolved to normal BCVA in the resolved phase. Meanwhile, neither MP at 2° nor 4° had significant difference between CSC eyes and the normal fellow eyes. This may be why there was no correlation between MP and BCVA in the resolved phase in our study.

Conclusions

The acute CSC often had a good prognosis both in BCVA and MP. And 6 months may be more appropriate to distinguish whether the CSC need additional treatment or not. In the active phase, both MP at 2°, 4° and BCVA decreased significantly. And there was a significant correlation between BCVA and MP at 2°. MP can provide an additional objective parameter to evaluate the retinal function changes at macula of acute CSC in the active phase.

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None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The study was approved by the Research Ethics Committee of Affiliated Hospital of Qingdao University (No. 2012-011).

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