Eur J Med Res (2006) 11: 250-252

Central Retinal Artery Occlusion: Findings in Optical Coherence Tomography and Functional Correlations

D. Schmidt, T. Kube, N. Feltgen

University Eye Hospital, Freiburg, Germany

Abstract

Background: Visual prognosis in central retinal artery occlusion (CRAO) is poor and not predictable in individual patients. There may be a correlation between visual acuity and extent of initial macular edema.

Methods: Central retinal thickness of eleven patients with subtotal CRAO was measured with optical coherence tomography (OCT). Patients' acute-stage macular thicknesses were compared to those of later stages. Values are given as mean (±standard error; range)

Results: The mean age of the eleven patients was 68.8 years (62-75). Eight men and three women were examined. The mean initial duration of CRAO was 24.7 (± 5.0; 4-77) hours. Initial central thickness was 372.5 (± 27.1; 258-522) µm. After 5.7 (± 1.5; 1-17) months, mean reduction in macular edema was 197 (± 31.3; 63-391) µm. Visual acuity (VA) improved from 0.0125 (±0.2; blindness - 0.6) to 0.035 (±0.2; blindness - 0.8) namely 4.5 lines. This difference was significant (p=0.023). 6/11 patients (55 %) initially had a pronounced central retinal edema (>380µm).

No correlation was found between the initial macular edema height and visual improvement.

Conclusions: The extent of macular edema differs widely and does not affect visual prognosis in CRAO eyes.

Key words: central retinal artery occlusion, macular edema, optical coherence tomography, visual acuity

Introduction

Acute central retinal artery occlusion (CRAO) is an infrequent diagnosis with poor prognosis. Despite a generally unfavourable outcome, some eyes improved spontaneously. Several factors have been claimed to be responsible for any visual recovery. Those factors were good perfusion of perimacular arterioles, longer period of edema development, minor edema, small embolus size, good initial visual acuity (VA), and youth. But it is still not possible to reliably predict which eyes will improve or even guess the final visual acuity based on the initial clinical presentation.

Optical coherence tomography (OCT) of macular edema has been carried out in several retinal diseases [1-3, 5, 7, 9]. Age-related or cystoid macular edemas are extracellular. Remarkably, retinal edema in CRAO differs from edemas of other causes, as CRAO edema develops intracellularly [4, 6]. The central retinal artery has no subsidiary access to other arteries, and occlusion leads to an immediate breakdown in all circulatory function. This is followed by a damage on the cellular level and its typical intracellular edema. In contrast to extracellular edemas, we know that all CRAO edemas resolve spontaneously. We were interested whether final visual acuity and the extent of initial macular edema correlate in CRAO eyes.

Methods

Retinal thickness of eleven patients (eleven eyes) with a subtotal CRAO was measured by OCT.

Retinal thickness of the macular area in the acute stage was compared to that of later stages in patients with CRAO during follow-up.

Measurements were taken in standardised fashion. For patients with very low vision in the CRAO eye, we provided a well-defined fixation point for the other eye. This point and the OCT unit were fixed. The VA of the other eye had to be good enough to allow stable fixation (>0.4). We were thus assured that measurements were taken of the same macular region in the CRAO eye.

VA was measured using the ETDRS charts. For intuity display, all results were transformed to the decimal VA scale [decimal VA = 10 log(VA)].

Statistics

Values are given as mean ± standard error of the mean (SEM) and range. Mean values were compared using the Students t-test with the level of significance set at $p \leq 0.05$. All statistical VA evaluations were done on the approximately normally - distributed log (VA) = - logMAR scale.

Results

The mean age of eleven patients was 68.8 years (62-75). Eight men and three women were examined. Measurements were possible in all eyes. The mean duration of CRAO was 24.7 (± 5.0; 4-77) hours at first presentation. The initial macular edema was 372.5 (±27.1; 258-522) µm. After 5.7 (±1.5; 1-17) months, namely mean reduction in macular edema was 197 (±31.3; 63-391) µm. Visual acuity improved from 0.0125 (±0.2; blindness - 0.6) to 0.035 (±0.2; blindness - 0.8), namely 4.5 lines. This difference was significant (p = 0.023).

Table 1.

patient number age (years)	initial visual acuity	final visual acuity	interval of time between measurements (months)	initial height of edema µm	reduction of edema µm
1. 72	LE: light perception, defective projection	0.05 significant	8	**405**	228
2. 63	LE: light perception, defective projection	1/15 significant	1	**384**	171
3. 75	RE: light perception, defective light projection	unchanged	1.5	**453**	272
4. 62	RE: hand motions	unchanged	17	**522**	391
5. 70	RE: hand motions	unchanged	8.5	296	140
6. 66	RE: hand motions	1/15 significant	1	258	63
7. 68	LE: hand motions	1/20 significant	6.5	296	130
8. 75	RE: 1/35	unchanged	7.5	**449**	302
9. 70	LE: 1/35	unchanged	2	280	101
10. 67	LE: 1/20	1/7.5 significant	8	**453**	276
11. 69	RE: 0.6 (20/32)	0.8 (20/25)	2	302	92
11 patients **68.8 years (62-75)**	**light perception: 3** **hand motions: 4** **1/35: 2** **1/20: 1** **0.6 (20/32): 1** **mean log Mar 1.89 (0.0125)**	**Visual acuity improvement: 5 (> 3 lines)** **unchanged: 6** **mean log Mar 1.44 (0.035)**	**5.7 months (maximum: 17 months; minimum: 1 month)**	**372.5 µm ±27.1 µm (258-522)**	**197 µm (63-391)**

6/11 patients (55%) initially had pronounced central retinal edema (> 380 µm).

To check the prognostic factors of OCT measurement one must compare the eyes with VA improvement and the initial macular edema height. Only three of five eyes showing significant visual improvement had a pronounced central retinal edema (patients 1, 2, 10). In comparing macular edema with visual prognosis, we detected 6/11 eyes with remarkable macular edema of more than 380 µm (patients 1-4, 8, 10).

Only three of those (50%) demonstrated a significant visual improvement. In those patients with minor central retinal thickness (patients 5-7, 9, 11), significant visual improvement was only observed in 2 eyes.

Discussion

OCT visualizes intracellular edemas well. We correlated macular changes with visual function in these eyes. Intracellular macular edema in CRAO eyes resolves completely without any therapy. We are aware that ischaemic damage is the main cause for the poor visual outcome in most CRAO patients. But as we have no clue as to whose VA will recover we focussed on the macular edema effect.

The aim of the present study was to observe the tential correlation on between functional outcome and initial OCT-findings from the macular area.

Our study showed that there is no general correlation between the extent of a macular edema and visual recovery.

OCT of retinal edema has been carried out in several studies [1-3, 5, 7, 9]. In most of those published patients, edema was measured in patients with age-related macular degeneration [2, 5, 9]. In one study, edema in diabetic retinopathy was examined. The central retinal thickness in healthy eyes was measured at between 133.3 µm ± 15 µm [3, 5].

In our eleven patients, the edema height in the central retina was 372.5 µm (258-522 µm), which is more than twice that of healthy eyes.

One exceptional patient (patient 11) revealed a relatively good visual acuity of 0.6 (20/32) with a slightly degree of macular edema of 302 µm. We recently published on findings in this unusual patient [8].

Table 2. Latency period (time between beginning of blindness and beginning of OCT-examination).

patient number age	**latency period (time between beginning of blindness and beginning of OCT-examination) (days)**
1. LE	1
2. LE	4
3. RE	2
4. RE	5
5. RE	7
6. RE	5
7. LE	3
8. RE	8
9. LE	9
10. LE	1
11. L RE	2
	4.2 days (1 -9)

Conclusions

In our eleven patients with CRAO, we observed no correlation between the extent of macular edema and visual acuity.

Thus, visual prognosis is not predictable in the individual CRAO patient.

References

1. Degenring RF, Aschmoneit I, Kamppeter B, Budde WM, Jonas JB. Optical coherence tomography and confocal scanning laser tomography for assessment of macular edema. Am J Ophthalmol 2004; 138: 354-361
2. Eter N, Bindewald A, Roth F, Holz FG. OCT bei altersbedingter Makuladegeneration. Ophthalmologe 2004; 101: 794-803
3. Goebel W, Kretzchmar-Gross T. Retinal thickness in diabetic retinopathy: a study using optical coherence tomography (OCT). Retina 2002; 22: 759-767
4. Hayreh SS. Pathogenesis of occlusion of the central retinal vessels. Am J Ophthalmol 1971; 72: 998-1010
5. Kondo M, Ito Y, Ueno S, Piao Ch, Terasaki H, Miyake Y. Foveal thickness in occult macular dystrophy. Am J Ophthalmol 2003; 135: 725-728
6. Kroll AJ. Experimental central retinal artery occlusion. Arch Ophthalmol 1968; 79: 453-469
7. Schaudig U, Scholz F, Lerche RC, Richard G. OCT bei Makulaödem. Ophthalmologe 2004; 101: 785-792
8. Schmidt D, Böhringer D. Preserved vision despite distinct retinal edema in central retinal artery occlusion. Eur J Med Res 2006; 11:43-45
9. Spraul CW, Lang GE, Lang GK. Die Bedeutung der optischen Kohärenz-Tomographie in der Diagnostik der altersbedingten Makuladegeneration. Korrelation von fluoreszenzangiographischen mit OCT-Befunden. Klin Monatsbl Augenheilkd 1998; 212: 141-148

Received: February 20, 2006 / Accepted: March 16, 2006

Address for correspondence:
Dieter Schmidt, M.D.
Professor of Ophthalmology
Univ.-Augenklinik
Killianstr. 5
D-79106 Freiburg
Tel.: +49 (0)761-270-4021
Fax: +49 (0)761-270-4075
E-Mail: Dieter.Schmidt@uniklinik-freiburg.de