Visual prognosis following treatment of acute central retinal artery obstruction

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SUMMARY The authors report the visual outcome in 34 consecutive cases of treated acute central retinal artery obstruction. Visual acuity equal to or better than 6/30 was recovered in 35% of the cases. The presenting visual acuity and duration of visual impairment appear to correlate with visual prognosis.

The prognosis for useful vision after central retinal artery obstruction is generally considered poor, except in those cases in which a patent cilioretinal artery supplies the fovea.1 Consequently various therapeutic regimens have been devised for this condition. The efficacy and limitations of many of these regimens have been reviewed in detail by Flytche.2 Some patients have been reported to regain useful vision after treatment.3-11

The authors initiated a prospective but uncontrolled study of patients with spontaneous acute central retinal artery obstruction in order to evaluate their visual prognosis following treatment. This report describes our treatment regimen and relates our experience with 34 consecutive cases.

Patients and methods
All patients referred to the Retinal Vascular Unit between March 1976 and October 1978 with the diagnosis of acute central retinal artery obstruction were considered for the study. Visual acuity was recorded and a complete ocular examination, including slit-lamp biomicroscopy, applanation tonometry, and ophthalmoscopy, was performed. The affected eye was studied by fluorescein angiography and electoretinography to confirm the clinical diagnosis. The diagnosis was considered to be established only if the affected eye showed fundus features typical of acute central retinal artery obstruction, a typical fluorescein angiographic appearance, and characteristic electrophysiological responses. Patients with a fovea-sparing cilioretinal artery were excluded.

Every patient underwent treatment according to our regimen. This treatment was begun immediately after the diagnosis had been established. The treatment12 consisted of (1) paracentesis of the anterior chamber under the slit-lamp biomicroscope with topical anaesthesia and the use of a tuberculin syringe and 27 gauge needle; (2) controlled ocular massage using a fundus contact lens while visualising the retinal vessels at the disc; (3) inhalational therapy with a 95% oxygen/5% carbon dioxide mixture administered by mask for 10 minutes every hour during the waking hours and every 4 hours during the night; and (4) oral administration of acetazolamide (250 mg q.i.d.) and aspirin (10 grains (65 mg) b.i.d.). Every patient underwent a complete physical examination with emphasis on the cardiovascular system. A complete blood count, an erythrocyte sedimentation rate, a serum lipid profile, a fasting blood glucose, an electrocardiogram, and a chest x-ray were obtained on admission. Inhalation therapy was discontinued after 48 to 72 hours, but acetazolamide and aspirin were continued for at least 2 weeks. These drugs were then discontinued unless another indication for their continued use existed. Drugs and dosages for the associated systemic disorders were managed by the internist.

Complete ophthalmic examination was repeated prior to hospital discharge and again at follow-up 1 month or more after treatment. Early (1–2 days) and late (over 2 weeks) post-treatment fluorescein angiograms and electoretinograms were obtained in many of the cases in order to assess the changes in retinal perfusion and electrical retinal responsiveness.

Results
Thirty-two patients were included in the study. They ranged in age from 32 to 74 years, average
62 years (Table 1). Twenty-five were men (78%) and 7 were women. Nineteen were white and 13 were black. The average duration of follow-up was over 2 months (67.8 days). Two patients had recurrent acute central retinal artery obstruction, making the total number of cases 34. The central retinal artery obstruction occurred in the right eye in 21 (61%) and in the left eye in 13 (39%). The presenting visual acuities ranged from 6/60 to no light perception (Table 1). The recognised duration of persistent visual impairment ranged from 2.5 hours to 2 weeks (Table 1) with a median of 19 hours.

A significant improvement in visual acuity was defined as a sustained improvement of 3 or more visual acuity gradations (Fig. 1, ordinate) and a final visual acuity of 6/30 or better on follow-up examination 1 month or more after treatment. Twelve of our 34 cases (35%) showed significant improvement in visual acuity (Table 1). Seven of our cases (21%) improved by 6 visual acuity gradations or more and achieved a final visual acuity of 6/12 or better. None of our cases had a post-treatment visual acuity worse than the presenting visual acuity. Only 9 of our 34 cases (26%) showed no improvement in visual acuity whatsoever.

Seven of the 12 cases that improved significantly had already done so within 48 hours after initiation of treatment. However, the maximal visual acuity achieved in the 12 cases that showed significant improvement was attained in only 4 within 48 hours. Further visual improvement occurred beyond 48 hours in the remaining 8 cases.

The 12 cases that achieved significant improvement in visual acuity had an average presenting visual acuity of counting fingers (CF) at a distance of greater than 1 m, whereas the 22 cases that did not improve had an average presenting visual acuity of poor hand movement (HM). The difference between these 2 groups is statistically significant (t = 3.95, P < 0.05). The average duration of recognised visual impairment prior to initiation of treatment in those cases that showed eventual significant visual improvement was 21.1 hours as compared to 58.6 hours in those cases that did not improve. The longest duration of visual impairment reported by any patient who showed significant visual improvement at follow-up was approximately 72 hours.

Presenting visual acuity and duration of visual impairment are related simultaneously to final visual acuity in Fig. 1. This graph presents the duration of visual impairment in a logarithmic scale on the abscissa to visual acuity on the ordinate (see legend to Fig. 1 and Discussion for interpretation of graph).

Patient age, presence or absence of clinically detected emboli, and clinical evidence of systemic disorders, including hypertension and atherosclerotic vascular disease, were evaluated for any correlation with visual prognosis. No statistically significant correlation was found between the patients who improved visually and those who did not for any of these subgroups. Nine of the 32 eyes (28%) had a non-fovea-sparing cilioretinal artery. No statisti-
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Table 1  Clinical data on 34 treated cases of acute central retinal artery obstruction

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Eye</th>
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<th>Duration of visual impairment</th>
<th>Final visual acuity</th>
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*Success (S) and failure (F) as defined in text. **Same patient as case 2; reobstruction of central retinal artery OD. ***Same patient as case 24; reobstruction of central retinal artery OD.
cally significant correlation could be found between 
the presence or absence of such arteries and recovery 
of visual acuity after central retinal artery obstruc-

tion.

The b wave amplitude in the affected eyes evalu-
ated by pretreatment electroretinography was less 
than in the pretreatment fellow eyes in every case by a 
proportion ranging from 16 to 46%. The a wave 
amplitude of the affected eyes ranged from 32% 
less to 12% greater than that of the respective 
fellow eyes. The ratio of b wave amplitude to a wave 
amplitude (b/a ratio) was consistently less in the 
affected eyes (average 1.29) than in the respective 
fellow eyes (average 1.68). The group of patients 
who achieved significant improvement in visual 
acuity had average reductions of b wave amplitudes 
and levels of b/a ratios in the affected eyes that 
were markedly less than those of the group of 
patients who did not improve visually (19-5% 
average b wave reduction, 1.46 average b/a ratio in 
unimproved cases; 41.7% average b reduction, 1.24 
average b/a ratio in unimproved cases).

Pretreatment fluorescein angiograms of our 
patients showed that none of them had total obstruc-
tion of flow into the affected eye via the central 
retinal artery, in spite of the clinical features indica-
tive of central retinal artery 'occlusion'. Similar 
observations of the infrequency of demonstrable 
total obstruction of the central retinal artery by 
fluorescein angiography in such cases have been 
reported previously.13 On the other hand all our 
patients studied by pretreatment fluorescein angi-
ography showed delayed retinal arterial filling and a 
prolonged interval between initial choroidal flush 
and retinal arterial filling. Furthermore, some of 
the angiograms showed evidence of abnormal 
choroidal filling as well.

Comments

Our results suggested that the prognosis for visual 
acuity in acute central retinal artery obstruction 
may not be as dismal as previously believed.

The observation that some of our patients re-
covered a significant degree of visual acuity indicates 
that these patients had at least partially reversible 
impairment of retinal function at the time of presen-
tation. The degree of reversibility appeared to 
correlate with presenting visual acuity and duration 
of visual impairment. Fig. 1 shows the interrela-
tionship between these 2 factors and final visual 
acuity in our 34 cases. The curves on the graph 
indicate the projected average final visual acuity for 
eyes with treated acute central retinal artery obstruc-
tion separated into 5 levels of presenting visual 
acuity. In patients with severe visual impairment at 
presentation (visual acuity light perception or 
worst, lines 1 and 2 in Fig. 1) the likelihood of 
significant improvement in visual acuity appears to 
be small even if the duration has been only 2-4 
hours. In contrast the average patient with rela-
tively good presenting vision (visual acuity > 
counting fingers at 1 m, line 5 in Fig. 1) can attain 
a final visual acuity of approximately 6/30 even 
after a duration of 36-48 hours.

The precise relationship between presenting visual 
acuity and the degree of impairment of blood flow 
into the eye via the central retinal artery is not 
known. Experimental total central retinal artery 
obstructions in rhesus monkeys of up to 90 minutes' 
duration have been shown to cause no persistent 
opthalmoscopic, angiographic, electrophysio-

gical, or morphological damage to the retina.14 
Nonperfused retina in monkeys and cats appears to 
survive central retinal artery occlusion for prolonged 
periods because of the metabolic contributions of 
the intact choroidal circulation to the retina.15 
Partially perfused retina, which appears to be 
present in almost all human clinical cases of central 
retinal artery obstruction,16 is probably able to 
survive in a reversible preinfarction state for a 
much longer period of time. Restoration of the 
central retinal artery blood flow, either spontane-
ously or in response to therapy, permits recovery of 
visual acuity to a level determined by the viability 
of the retina at that time. Reduction of the func-
tional severity of the central retinal artery obstruct-
ion therapeutically, by means such as abrupt 
lowering of the intraocular pressure by paracentesis 
and increasing the retinal oxygenation by inhalation 
therapy with 95% oxygen and 5% carbon dioxide, 
may prolong the period of retinal viability in a 
preinfarction ischaemic state. Such treatments may, 
in effect, provide time for the retinal arterial circu-
lation to undergo alterations that improve retinal 
perfusion by bypassing or reopening the obstructed 
artery.

The prognostic significance of the actual recorded 
a and b wave voltages on the electroretinograms in 
our cases was difficult to assess. A considerable 
overlap existed between the range of voltages in 
the 'normal' fellow eyes and that of the affected 
eyes. This difficulty has been alluded to previously 
by Henkes,18 who noted that only 22% of his 
patients with central retinal artery obstruction had 
a normal ERG in the unaffected eye. The prog-
nostic significance of fluorescein angiographic 
intervals was also difficult to assess. We encoun-
tered problems of reproducibility in measurement of 
the various angiographic intervals. Because of these 
difficulties, we have not found these studies partic-
ularly useful as prognostic indicators of the likeli-
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hood of significant visual recovery in our patients. However, the value of these studies as prognostic tools is still being evaluated.

We have attempted to compare the visual recovery rate of our patients with that reported by other investigators.

Lorentzen reported that none of his 12 cases of central retinal artery obstruction (treatment not specified) showed significant visual improvement (by our criteria). Karjalainen reported long-term follow-up of 53 patients with prior acute central retinal artery obstruction. Ten of the 53 cases (19%) showed significant visual improvement (by our criteria). However, 12% of the eyes had a patent cilioretinal artery. Henkes reported that 5 of his 19 cases (26%) with visual acuities recorded for both presenting and follow-up examinations showed significant visual acuity improvement (by our criteria) after treatment with intravenous and oral vasodilators. He did not state whether or not any of his cases had a fovea-sparing cilioretinal artery, which is known to improve the visual prognosis.

Brown and Shields reported on the prevalence and prognostic implications of a patent cilioretinal artery in a retrospective study of acute central retinal artery obstructions. Among their 107 patients 28 (26%) had a patent cilioretinal artery in the affected eye. In 5 of these 28 cases less than half the papillomacular bundle was supplied by the patent cilioretinal artery. Not one of these cases showed significant visual improvement or achieved a visual acuity better than counting fingers. In 11 of these 28 cases the patent cilioretinal artery supplied more than half of the papillomacular bundle but did not spare the fovea. The follow-up visual acuities in these cases ranged from 6/30 to counting fingers. Twelve of their cases had a fovea-sparing cilioretinal artery. All but one of these cases achieved a final visual acuity of 6/30 or better. The authors commented that in acute central retinal artery obstruction with a fovea-sparing cilioretinal artery, there is about a 91% chance that eventual visual acuity will be in the range from 6/6 to 6/24 and about an 83% chance it will range from 6/6 to 6/15.

Conclusion

This uncontrolled study does not prove the efficacy of our treatment regimen. Without a double-masked controlled study one is unable to exclude the possibility that several or all of our cases that showed significant visual improvement after treatment might also have improved without treatment. The incidence of spontaneous, significant improvement in visual acuity after central retinal artery obstruction is unknown. However, it is well known that occasional cases of acute central retinal artery obstruction without a fovea-sparing cilioretinal artery show a marked recovery of visual acuity without treatment. The authors recognise that further investigation is needed to clarify the efficacy of treatment in these cases. However, we can conclude from our study that a completely dismal prognosis for recovery of useful vision in eyes with acute central retinal artery obstruction is probably unwarranted.

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References