Objective: To report visual acuity outcomes of nonsurgical management of macular hemorrhage secondary to retinal artery macroaneurysms.

Methods: Forty-one patients at multiple centers with macular hemorrhage secondary to retinal artery macroaneurysms managed with observation alone were reviewed. Time to clearance of macular hemorrhage, visual acuity at final follow-up, and presence or absence of macular pigmentary changes after absorption of the hemorrhage were recorded for each patient.

Results: On initial examination, visual acuity was 20/200 or worse in all except 4 patients (3 with 20/70, 1 with 20/80). At an average follow-up of 15.7 months, a final visual acuity of 20/40 or better was achieved in 15 eyes (37%), between 20/50 and 20/100 in 12 (29%), and 20/200 or worse in 14 (34%). Macular pigmentary abnormalities were noted after clearance of the hemorrhage in 23 (56%) of 41 cases, and these eyes generally had worse visual acuity outcomes.

Conclusions: In eyes with macular hemorrhage secondary to retinal artery macroaneurysms managed with observation alone, good visual acuity outcomes can often be achieved. Poorer visual acuity outcomes are associated with macular pigmentary changes after resorption of blood.

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UBMAMARcular HEMORRHAGE can result in acute and long-term decreased visual acuity.14 Because the presence of subretinal blood results in early damage to photoreceptors in animal models,5,6 prompt surgical removal of submacular blood has been investigated in an attempt to improve final visual acuity.7-15 Reported visual acuity outcomes after vitrectomy for submacular hemorrhage have been variable and depend on multiple preoperative, operative, and postoperative factors.8-10 In general, poorer visual outcomes have been associated with longer duration of subretinal blood before removal, increased thickness of subfoveal blood, and age-related macular degeneration (AMD) as the underlying disease process.16-20 However, relatively good visual outcomes have been reported in some patients with observation alone.16-20

The current study investigated visual and anatomical outcomes in patients with macular hemorrhage from retinal artery macroaneurysms managed with observation alone.

RESULTS

Forty-one eyes of 41 patients met inclusion criteria. Thirty-four (83%) of the patients were women, with an average age of 75.6 years (range, 41 to 93 years). Follow-up time from initial examination to most recent examination ranged from 2 to 87 months, with an average of 15.7 months.

Initial visual acuities ranged from 20/70 to hand motions, with 37 (90%) of 41 eyes having visual acuity of 20/200 or worse at initial examination. Hemorrhages cleared without surgical intervention. Mean time for clearance of subretinal blood was 4.6 months, with a range of 1 to 14 months. Final visual acuity ranged from 20/40 to 20/200. At the last follow-up examination, the visual acuities were 20/40 or better in 15 (37%) of 41 eyes, 20/50 to 20/100 in 12 (29%) of 41, and 20/200 or worse in 14 (34%) of 41 (Table 1).

One patient had a second hemorrhage after resorption of the initial macular hemorrhage. Although visual acuity before rebleeding improved to 20/70, final

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PATIENTS AND METHODS

The current study included outpatients with macular hemorrhage secondary to a retinal artery macroaneurysm examined at multiple centers (from January 1, 1970, to December 31, 1998) who were managed with observation alone. Approval was obtained from the institutional review board at the University of Miami School of Medicine, Miami, Fla, before initiation of this study, but it was not required at the other participating institutions. Patients with blood involving the fovea from a ruptured macroaneurysm, good prior visual acuity, no marked AMD in the fellow eye (by photographic documentation or office records), at least 2 months of follow-up, and fundus photographs taken at the time of initial examination were included. Patients with marked AMD included patients with loss of vision from AMD as determined by clinical history provided by the patient, photographic documentation, and/or office records. Amblyopic eyes and those with coexisting ocular disease (eg, diabetic retinopathy, AMD) were excluded.

A total of 26 patients were excluded from the study. Of these, 7 patients had visual acuities between 20/30 and 20/90 and only a thin layer of hemorrhage in the foveal region. 1 patient had undergone pars plana vitrectomy, 2 had no follow-up information available, and 4 did not have photographs taken at the time of the initial examination. Twelve patients had been treated with laser photocoagulation at some time during the follow-up period and were excluded from the study; 1 of these patients also had a branch retinal artery occlusion. The data were collected retrospectively from the office records of participating study ophthalmologists. Twenty ophthalmologists in 15 offices were part of the current study.

Best-corrected initial and final Snellen visual acuities were recorded by the individual physician for each patient, although no standardized protocol for measurement of visual acuity was used. Pinhole vision testing was not used. The time to clearance of macular hemorrhage and the presence or absence of any associated pigmentary changes in the macula after resorption of blood were recorded by the participating study ophthalmologist, on the basis of photographic documentation and review of chart notes. In addition, we reviewed all photographs to confirm the presence or absence of macular pigmentary changes.

Initial fundus photographs were reviewed to ascertain the level at which the hemorrhage was located and to verify that the hemorrhage involved the fovea. Although color fundus photographs were reviewed for each case, stereo images or fluorescein angiograms were not available for all patients. In these cases, the tissue level of the hemorrhage had to be estimated by means of available photographs and the office records from the study ophthalmologists. The hemorrhage was often located at several tissue levels within the macula of an individual patient, but a portion of the hemorrhage was located beneath the neurosensory retina in all cases. If hemorrhage was present beneath the internal limiting membrane at the fovea, the extent of the subretinal hemorrhage beneath the fovea could not be verified.

visual acuity was 20/200 at 19 months after initial examination.

The cause of reduced visual acuity at final follow-up was evaluated. No study patients developed disciform macular scars or had a clinically visible branch retinal artery occlusion. Likewise, no study patients had branch retinal vein occlusion, central retinal vein occlusion, or advanced glaucoma.

Pigmentary abnormalities were present in the macular region after clearance of hemorrhage in approximately half of the patients (23 of 41 cases). Patients without pigmentary changes tended to have a better visual prognosis. Ten (56%) of 18 patients without pigmentary alterations achieved 20/40 or better visual acuity, 4 eyes (22%) achieved 20/50 to 20/100, and 4 eyes (22%) achieved final visual acuity of 20/200 or worse. Fundus photographs and fluorescein angiograms of representa-
tive patients without residual pigmentary changes after clearance of macular hemorrhage and with restoration of good visual acuity are shown in Figure 1 and Figure 2. Fundus photographs from a patient with moderate visual acuity improvement after resorption of the hemorrhage without extensive pigmentary changes in the macula are shown in Figure 3.

Visual outcomes in cases with residual pigmentary changes were generally more limited. Of those with macular pigmentary changes, a visual acuity of 20/40 or better was achieved in 5 (22%) of 23 eyes, between 20/50 and 20/100 in 8 (35%), and 20/200 or worse in 10 (43%). Fundus photographs of a representative patient with pigmentary changes after resorption of the hemorrhage and return of good visual acuity are shown in Figure 4. Fundus photographs of representative patients with extensive pigmentary changes and limited final visual acuity are shown in Figure 5 and Figure 6.

COMMENT

The current observational study of macular hemorrhage from a ruptured retinal artery macroaneurysm is the largest reported to date and provides important follow-up data on these patients. However, the results of the current study are limited by the fact that the study is retrospective and was restricted to patients who met the inclusion criteria. Additionally, best-corrected Snellen visual acuities were not obtained according to a standardized protocol, and patients were selected by a review of medical records. Because of controversy regarding the toxicity of submacular hemorrhage and its effect on visual acuity, the current study was initiated to provide visual outcomes in patients with macular hemorrhage when no underlying disease process is present.

In experimental animal studies, marked photoreceptor damage can occur after introduction of subretinal hemorrhage. Chronic retinal damage may result from chemical toxicity, mechanical traction, or barrier effect on diffusion. In 1982, Glatt and Machemer, using a rabbit model, showed that edema and disintegration of the photoreceptors and pyknosis of the outer nuclear layer occur during the first 24 hours of exposure to subretinal blood. In 1991, Toth and associates, using a cat model, demonstrated interdigitation of fibrin strands with photoreceptors 1 hour after onset of subretinal hemorrhage. Subsequent contraction of the adjacent fibrin clot resulted in shearing of sheets of photoreceptor outer segments. However, subretinal blebs created with tissue-type plasminogen activator (TPA) included in the solution had no fibrin strand formation or tearing of photoreceptors. Because of the potential for permanent photoreceptor damage, many practitioners advocate prompt removal of subretinal blood located in the macula, often assisted by the use of TPA.

Observational studies of eyes with submacular hemorrhage that used retrospective data collection from patients’ medical records have shown that visual outcomes depend on a number of factors, including thickness, size, and location of blood, and underlying cause of the hemorrhage. These studies have shown that patients with submacular hemorrhage from causes other than cho-
oidal neovascularization and AMD can recover good visual acuity with observational management alone (Table 2). Data from the current study confirm that good visual acuity outcomes can be achieved in eyes with macular hemorrhage from rupture of a retinal artery macroaneurysm without surgical intervention.

If the 33 patients with ruptured artery macroaneurysms are separated from reported series of patients with submacular hemorrhage treated surgically, about one third achieved a visual acuity of 20/40 or better, one third had 20/50 to 20/100, and one third had 20/200 or worse at last follow-up examination (Table 3). In a recent vitrectomy study of 8 patients treated with or without TPA, the visual acuity outcomes were generally favorable. It is important to recognize that 3 patients in this series had preretinal hemorrhage only. In the current observational study, visual acuity outcomes in 41 eyes with macular hemorrhage from a ruptured retinal artery macroaneurysm managed with observation alone were similar to the surgical outcomes in these 33 reported cases.

Two additional treatment options for management of macular hemorrhage from retinal artery macroaneurysms have been reported. Six eyes with preretinal hemorrhage involving the macula from a ruptured retinal artery macroaneurysm were treated with Nd:YAG laser photodisruption of the anterior surface of the hemorrhage, allowing drainage of the blood into the vitreous. Four of the 6 eyes had both subretinal and preretinal hemorrhage. Visual acuity improved in all cases at 1 week after treatment, but poorer visual acuity outcomes were seen in eyes with subretinal blood.

A second treatment option is pneumatic displacement of macular hemorrhage with or without pretreatment with intravitreal TPA. In one recent study, 5 patients with subretinal hemorrhage (1 from a retinal artery macroaneurysm and 4 from AMD) were treated with pneumatic displacement of blood without the use of
Four of 5 patients were treated within 6 days of the onset of symptoms. Final visual acuity ranged from 20/220 to 20/15; the patient with the macroaneurysm recovered 20/40 visual acuity. Heriot reported a similar technique with the addition of intravitreal TPA, but there is a risk of retinal toxic effects from exposure to higher doses of TPA. Another pneumatic displacement study reported 15 patients treated for submacular hemorrhage caused by AMD. Although the hemorrhage was displaced in all patients, complications included vitreous hemorrhage in 3 patients and endophthalmitis in 1 patient.
In the current study, the majority of patients (56%) had some degree of pigmentary changes in the macula after clearance of macular hemorrhage. A trend toward poorer visual acuity outcomes was noted in patients with pigmentary changes compared with those without these changes. These areas of pigmentary change may represent more extensive damage to the neurosensory retina and retinal pigment epithelium in areas with increased thickness of the subretinal portion of the hemorrhage. Further follow-up is necessary to determine if these pigmentary changes are permanent or transient, and if visual acuity will improve on longer follow-up.

At present, the optimal management of macular hemorrhage from retinal artery macroaneurysms remains unclear, in part because of the difficulty in determining the exact tissue level of the hemorrhage at the fovea. The current study indicated that good visual acuity can be recovered in many patients by means of observational management alone, while avoiding surgery-related morbidity, such as infection and retinal detachment. Macular pigmentary changes after resorption of hemorrhage may result in more limited visual recovery. Since many of these patients have multiple medical problems, observational management can be considered as a reasonable alternative to surgical intervention for some patients.