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Success with Single Agent Immunosuppression for Multifocal Choroidopathies

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Abstract

Purpose—To evaluate the success of single-agent immunosuppression for patients with the posterior uveitides, birdshot chorioretinitis, multifocal choroiditis with panuveitis, and punctate inner choroiditis.

Design—Retrospective case series.

Methods—Setting: Tertiary care uveitis practices. Population: Patients initiated on immunomodulatory therapy. Intervention: Patients were treated with prednisone 1 mg/kg and mycophenolate 2 gm daily. Prednisone was tapered after one month. Immunosuppression was escalated to mycophenolate 3 gm daily, with addition of a second agent, as needed, to achieve treatment success. Outcome Measure: Treatment success, defined as no disease activity with prednisone dose 10 mg daily, at 6, 12, and 24 months.

Results—Twenty-seven patients were followed. Mean presentation and 2-year follow-up acuities were 20/41 and 20/42, respectively. For birdshot chorioretinitis, mean ($\pm$ standard deviation) quantitative Goldmann visual field scores improved from $761 \pm 69^\circ$ (IV/4 isopter) and $496 \pm 115^\circ$

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(I/4 isopter) at presentation, to $784 \pm 57^\circ$ and $564 \pm 125^\circ$, respectively. Prednisone was successfully tapered in 95% of patients; mean prednisone doses at 1 and 2 years were 5.3 ± 4.1 and 5.7 ± 4.8 mg/day, respectively. At 2 years, prednisone was discontinued in 11% of patients. Treatment success was achieved in 74% of patients on one immunosuppressant, and an additional 21% of patients on two agents, for an overall 95% success rate at 2 years.

Conclusions—Posterior uveitides can be treated with one agent in most patients, but the data suggest a need to escalate therapy to higher mycophenolate doses, and in one-fifth of cases add a second agent to maintain disease suppression with acceptably low prednisone doses.

Introduction

The multifocal choroidopathies are a collection of several diseases characterized by multiple choroidal spots and include among others, birdshot chorioretinitis,^{1–4} multifocal choroiditis with panuveitis,^{5,6} and punctate inner choroidopathy.^{7–9} Birdshot chorioretinitis and multifocal choroiditis with panuveitis are chronic diseases with poor prognoses unless treated with immunosuppression.^{3,4,6} Although some investigators have advocated combination immunosuppression from the beginning, others have begun with a single agent and escalated treatment as needed to maintain control of the inflammation and successfully taper prednisone to a level compatible with long-term treatment without side effects.^{10–14} Though recent reports have suggested through multimodal imaging that punctate inner choroiditis and multifocal choroiditis with panuveitis target identical structures and thus may not be different entities,¹⁵ punctate inner choroiditis traditionally has been described as having distinct features (no vitreous cells, small punctate lesions) and a more variable course than multifocal choroiditis with panuveitis; some patients with punctate inner choroiditis may have a monophasic illness, followed by prolonged remission; others a recurrent but episodic course; and a few a chronic course necessitating immunosuppression, whereas multifocal choroiditis with panuveitis is a chronic disease with a poor outcome unless immunosuppression is used.^{6,8} When immunosuppression is indicated, the approach is similar for all of these entities; prednisone and immunosuppression are initiated, and the prednisone then is tapered to <10 mg/day and hopefully discontinued, while maintaining “grade 0” inflammation.¹⁰ Our approach to immunosuppression has been a stepwise one, beginning with a single immunosuppressive agent and escalating the dose and number of agents as needed. However, our group’s clinical impression has been that escalation of immunosuppression often was needed in order to achieve the goals of tapering of the prednisone while maintaining “grade 0” inflammation. Therefore we initiated a review of our experience with managing these diseases.

Patients and Methods

Patients with birdshot chorioretinitis, multifocal choroiditis with panuveitis, or punctate inner choroiditis were identified from the billing database (ICD-9 code 363.10) for the period 2007 (the beginning of the Uveitis Service) through July 2012. Approval of this study was granted by the Mount Sinai School of Medicine Institutional Review Board (IRB) and the Program for the Protection of Human Subjects. All study procedures were fully HIPAA compliant. In order to analyze the outcomes of our treatment approach, those patients who

were started on treatment at our institution and followed formed the primary group analyzed. Birdshot chorioretinitis, multifocal choroiditis with panuveitis, and punctate inner choroiditis all were identified by the characteristic clinical picture and exclusion of potential infectious (e.g. syphilis, Lyme disease) or systemic (e.g. sarcoid) diseases by appropriate laboratory testing. Birdshot chorioretinitis was diagnosed when there was a multifocal choroiditis with yellow-orange ovoid spots, accompanied by a mild vitritis.¹⁶ Multifocal choroiditis with panuveitis and punctate inner choroiditis were diagnosed according to the original clinical descriptors by the presence of multifocal choroidal lesions with punched-out, atrophic spots, typically (though not always) with a mild vitritis (in multifocal choroiditis with panuveitis), or a multifocal choroiditis with punctate spots without other signs of intraocular inflammation (in punctate inner choroiditis).^{5,8}

Treatment approach

The decision to initiate and/or escalate treatment in this group of patients was based on the presence or progression of structural complications such as macular edema, or diffuse retinal dysfunction as detected by quantitative Goldmann visual field testing with or without electroretinography in birdshot chorioretinitis patients; or by the presence or progression of inflammatory lesions (seen as sub-pigment epithelial deposits or outer retinal loss by OCT) or choroidal neovascularization in patients with punctate inner choroiditis and multifocal choroiditis with panuveitis. Grade 0 vitreous (cells and haze) also were targets for treatment when appropriate. Increased vitritis in the setting of antecedent structural complications in all patients was an indication for escalating treatment. Patients without structural complications related to their underlying diagnosis, or with end-stage disease with evidence of inactivity, were monitored closely at regular intervals without treatment. Patients with a monophasic episode of punctate inner choroiditis were observed with or without a brief course of corticosteroids, and immunosuppression was delayed until there was clinical evidence of recurrent disease. Patients requiring immunosuppression were treated initially with prednisone 1 mg/kg/day up to 60 mg/day and mycophenolate (CellCept, Roche Pharmaceuticals, Nutley, NJ, USA) 1 gm twice daily.^{10,13,17} In 2 cases, immunosuppressive therapy was initiated with tacrolimus 2 mg daily (Prograf, Astellas Pharma US, Inc., Deerfield, IL, USA) for a patient with birdshot chorioretinitis,¹⁸ or azathioprine 150 mg daily (Imuran, GlaxoSmithKline USA, Philadelphia, PA USA) for a patient with multifocal choroiditis with panuveitis, rather than mycophenolate. After one month, prednisone was tapered at weekly intervals to 10 mg/day as previously described. If the disease remained inactive for 1–3 months, the prednisone was tapered further at a rate of 1–2.5 mg/day decrements every 1–4 weeks, depending on clinical response. If prednisone could not be tapered successfully to <10 mg/day due to recurrent inflammation, the dose of mycophenolate was increased to 1.5 gm twice daily. If the patient could not tolerate the higher mycophenolate dose, the dose was titrated down to 1.25 gm twice daily. If the increased mycophenolate dose was inadequate to allow successful tapering of prednisone to <10 mg/day while maintaining complete control of the inflammation, a second agent was added, such as tacrolimus (Prograf, Astellas Pharma US, Inc., Northbrook, IL, USA), cyclosporine (Neoral, Novartis Pharmaceuticals Corp., East Hanover, NJ, USA),¹⁹ or adalimumab (Humira, Abbot Laboratories, North Chicago, IL, USA).^{20,21} In cases

complicated by choroidal neovascularization, intravitreal injections of anti-vascular endothelial growth factor (anti-VEGF) agents were given at the discretion of the provider.

Outcome measures

The main outcome measure was “treatment success” defined as inactive inflammation (grade 0 cells/haze and no new choroidal lesions), control of structural complications (such as macular edema, neovascularization), and a dose of prednisone 10 mg/day.²² Although choroidal lesions in birdshot chorioretinitis often resolved with immunosuppression, because some patients presented with scarring, resolution of all spots was not required for the definition of inactive disease. Similarly, resolution of atrophic, “punched out” lesions in multifocal choroiditis with panuveitis and punctate atrophic scars in punctate inner choroiditis was not expected or required for the definition of “inactive disease”. The secondary outcomes were the dose of mycophenolate needed to achieve “treatment success” and the use of a second immunosuppressive agent to achieve “treatment success”. The use of anti-VEGF agents to treat choroidal neovascularization was not considered a “treatment failure”, but the occurrence of new choroidal neovascularization (e.g. in the second eye) was considered “treatment failure”. Outcomes were evaluated at 6, 12, and 24 months after initiating therapy.

Visual outcomes

Visual outcomes were evaluated as well, in order to ensure that visual function was maintained or improved by treatment. Visual acuity was measured using Snellen charts, converted to logMar for analysis, and converted back to Snellen equivalents for presentation purposes.^{22,23} Visual acuities below standard thresholds also were evaluated: 20/50 or worse and 20/200 or worse. For patients with birdshot chorioretinitis, serial visual fields also were evaluated using quantitative Goldmann fields as previously described.⁴ The normal visual field scores are: IV/4 isopter 800° of field and I/4 isopter 600° of field. Abnormal scores are: IV/4 isopter <700° of field, and I/4 isopter <560° of field. In several cases, electroretinographic studies also were monitored, but Goldmann field scores were primarily utilized to measure peripheral retinal dysfunction, given that quantitative Goldmann testing comparably evaluates global retinal function and detects disease in birdshot chorioretinitis, and is easier to obtain with possibly less variability.⁴ Macular edema was evaluated with optical coherence tomography (OCT). Early in the study, some eyes were evaluated with time-domain OCT (TD-OCT), but later in the study, as technology was upgraded, eyes were evaluated with spectral domain OCT (SD-OCT). Abnormal values for central foveal subfield thickness were >250 µm for TD-OCT and >315 µm for SD-OCT.^{24,25}

Statistical methods

Mixed Analysis of Variance (ANOVA) models, stratified by diagnosis (and overall), were used to compare mean Goldman I/4 and Goldman IV/4 values at baseline between treated and untreated groups.²⁶ These models take into account the correlation between eyes in the same patient. Log-binomial regression models, stratified by diagnosis (and overall) were used to compare the binary outcomes between treated and untreated groups. The parameters of these models were estimated using Generalized Estimating Equations methods²⁷, and like the mixed ANOVA models, this method accounts for the correlation between eyes within a

patient. Chi-square and Wilcoxon tests were used to compare patient characteristics on categorical and continuous variables, respectively, between treated and untreated groups.²⁸ All statistical analyses were performed using SAS Version 9.2 (SAS Institute Inc., Cary, NC).

Results

Characteristics of the study population

Sixty-nine patients with birdshot chorioretinitis (n=28), multifocal choroiditis with panuveitis (n=19), or punctate inner choroiditis (n=22) were identified during the study period. Of these, 22 were seen only once for consultation or had therapy initiated elsewhere (8 birdshot chorioretinitis, 8 multifocal choroiditis with panuveitis, and 6 punctate inner choroiditis), 20 were not treated (birdshot chorioretinitis 6, multifocal choroiditis with panuveitis 4, and punctate inner choroiditis 10) due to absence of structural complications or disease activity, and 27 had therapy initiated with follow-up provided by our institution. Comparison of those included in the follow-up study (n=27) and those not (n=42) is presented in Table I by disease diagnoses. In general, those patients included in the follow-up study appeared to be similar to those not included, and no significant differences were detected.

Visual outcomes

Visual outcomes of the 27 patients in the follow-up study are presented in Table II. Follow-up was available for 93% of patients for 1 year and for 70% of the patients for 2 years. In general, good visual acuity was maintained throughout the 2 years with a mean acuity in involved eyes of 20/41 at presentation, 20/39 at 1 year of follow-up and 20/42 at 2 years of follow-up. The proportion of eyes with visual impairment (20/50 or worse) declined slightly from 22% at presentation to 17% at 2 years, and the proportion “blind” (20/200 or worse) went from 10% at presentation to 9% at 2 years. At the start of treatment, 36% of birdshot chorioretinitis patients had macular edema, and by 2 years, 16% had macular edema, attributed in all 3 eyes to the presence of concurrent epiretinal membranes rather than disease activity. Patients with birdshot chorioretinitis also develop visual field loss if left untreated or are treated intermittently.²⁹ Among the birdshot chorioretinitis patients in the study, there appeared to be a progressive increase in the mean quantitative Goldmann visual field score for the IV/4 and the I/4 isopters from $761 \pm 69^\circ$ and $496 \pm 115^\circ$, respectively to $784 \pm 57^\circ$ and $564 \pm 125^\circ$, respectively at 2 years. These results demonstrate a significant increase in both isopters on treatment (I/4 slope for visual field score = $50.9^\circ/\text{year}$, $P = 0.009$, and IV/4 slope for visual field score = $18.6^\circ/\text{year}$, $P = 0.004$). As such, treatment appeared to result in successful preservation of vision. The success at preserving vision is evident from the fact that the only 3 “blind” eyes (20/200 or worse) at the 2 year follow-up visit were all blind at presentation from irreversible causes: macular atrophy in 2 birdshot chorioretinitis eyes and foveal scarring from choroidal neovascularization in 1 multifocal choroiditis with panuveitis eye. Of the 6 eyes that were “visually impaired” but not “blind” (visual acuity 20/50 to 20/160) at 2 years of follow-up, all similarly had irreversible structural damage at presentation (macular atrophy in 4 birdshot chorioretinitis eyes, and

subretinal fibrosis from choroidal neovascularization in one each multifocal choroiditis with panuveitis and punctate inner choroiditis eyes).

Treatment success

Treatment success results and the amount of immunosuppression required to achieve them are presented in Table III. Treatment success was achieved in 95% of the patients (prednisone tapered to 10 mg/day while maintaining inactive disease) at 2 years, and the mean daily dose at the evaluated time points was in the 5 to 7 mg range. Overall, 81% of patients were considered a treatment success at 6 months, 76% at 1 year, and 95% at 2 years. However, 77% of patients required an increase in mycophenolate above the initial dose of 2 gm daily by 2 years, the majority to 3 gm daily (71%). Of the two patients who started treatment with tacrolimus or azathioprine rather than mycophenolate, one required an increase in the tacrolimus dosage to 4 mg daily to maintain quiescence at 2 years, and neither patient required initiation of a second agent. Furthermore, at 1 and 2 years, 8% and 21%, respectively, of patients required a second immunosuppressive agent in order to achieve these results. Indeed the slightly lower success rate at 1 year of follow-up represents the phenomenon of transient reactivation or increase in prednisone prior to increasing immunosuppression. Hence, although single agent immunosuppression is successful in the majority of patients, lower-dose mycophenolate is effective long-term in a minority of patients, and an additional one-fifth of patients will require a second agent in order to adequately taper prednisone.

Discussion

Birdshot chorioretinitis and multifocal choroiditis with panuveitis are chronic diseases with poor prognoses untreated, typically requiring immunosuppressive drug therapy, as chronic low-dose corticosteroid therapy does not adequately prevent the development of posterior pole complications.^{3,6} For both diseases immunosuppression has been reported to decrease the incidence of structural complications by >80% and to improve visual outcomes.^{3,4,6} In addition, in birdshot chorioretinitis there is a progressive loss of visual field, if untreated or treated intermittently, which can be reversed in part by immunosuppression.^{4,29} Our results are consistent with these previous reports in that we were able to preserve visual acuity and improve visual fields over the 2-year follow-up. Our practice has been to defer immunosuppression for patients with birdshot chorioretinitis, without evidence of structural complications (e.g. macular edema) and without evidence of retinal damage (e.g. abnormal visual field or electroretinogram). Although several of the patients who presented to us had treatment deferred initially, our experience is that ultimately most patients require treatment, although the period of observation may last a few years (Jabs DA, personal communication).

A critical aspect of treating patients with a regimen of oral corticosteroids and immunosuppression is the tapering of oral corticosteroids to a level which is safe for intermediate- to long-term use (years) in order to avoid oral corticosteroid side effects.^{10,14,22} A meta-analysis of rheumatoid arthritis randomized trials suggested that 7.5 mg/day was associated with an acceptably low rate of side effects, and the Multicenter Uveitis Steroid Treatment (MUST) Trial demonstrated no significant increase in systemic

side effects from this approach over a 2-year period, except for a greater use of antibiotics for infections.^{30,31} Furthermore, the Systemic Immunosuppressive Treatment for Eye disease (SITE) study demonstrated the long-term safety of non-alkylating agent small molecule immunosuppression.^{32,33} Although appropriate tapering of prednisone to acceptable levels is a goal of therapy, it must be tempered by the need to control the inflammatory process, as undertreated uveitis is associated with poor long-term outcomes.^{29,34,35} Our goal in treatment is to achieve “grade 0” inflammation and escalate immunosuppression as needed to maintain inactive disease at an acceptably low level of prednisone. Our results demonstrate that this goal can be achieved in most patients, but that for most patients it requires increasing the level of immunosuppression over time to successfully taper prednisone. However, only in a minority of patients were we able to discontinue prednisone completely.

Given the need to escalate therapy, one potential question is whether it might be better to begin with higher doses of mycophenolate the start. About 10–20% of patients get some gastrointestinal disturbance (diarrhea) from mycophenolate, and 8–10% cannot tolerate the drug for this or, less commonly, other reasons.^{13,17} Therefore, we have preferred to start at the 2 gm/day dose and escalate as needed. Similarly, because we have been able to control the process with a single immunosuppressive agent in the majority of patients, we have preferred to begin with single agent immunosuppression and escalate to two agents as needed. A prior study reported that combined immunosuppression with mycophenolate and cyclosporine resulted in control of inflammation without prednisone in 67% of birdshot patients at 1 year.³⁶ In our study 68% of patients had controlled (inactive) disease on 1 immunosuppressive agent and a mean daily prednisone dose of 5.3 mg at 1 year. Whether starting with dual agent immunosuppression, as advocated by some, would allow a higher percent of patients to discontinue prednisone, and whether the side effects of this approach would be greater or lesser are unknown.

Caution must be taken in interpreting these results as they come from a retrospective analysis and the number of patients seen was small, limiting power. Only 27 of the 69 patients seen with these three diseases during the study interval had treatment initiated and followed at our institution and were available for the analysis of outcomes. An analysis comparing those included in the study to those seen but not included suggests no obvious substantial differences. Nevertheless, because of the tertiary care referral nature of our practice, the patients studied may have more severe disease and may not be representative of the entire population of these multifocal choroidopathies. As such caution should be taken in extrapolating the percentages of patients requiring escalation to all patients with birdshot chorioretinitis, multifocal choroiditis with panuveitis, and punctate inner choroiditis requiring immunosuppression.

A second caution in interpreting our data relates to the combined analysis of three posterior uveitides characterized by variable structural complications, such as choroidal neovascularization in multifocal choroiditis with panuveitis and punctate inner choroiditis, and visual field loss in birdshot chorioretinitis. Though the indications for initiation and escalation of therapy in each of these diseases may have been different, the overall approach to achieve disease quiescence with a minimal amount of prednisone was the same across all

diseases. Hence it is possible that there is some disease-specific heterogeneity in the response to the approach, which would not be detected by the pooled analysis. However as the numbers of patients with any one disease followed were relatively small, sub-group analyses are not possible, and potentially fraught with the likelihood of a type II error. Nevertheless, there was a suggestion that patients with multifocal choroiditis with panuveitis and punctate inner choroiditis required lower doses of prednisone than those with birdshot chorioretinitis at 1 year (mean daily dose 2.7 mg in multifocal choroiditis and punctate inner choroiditis patients versus 7.4 mg in birdshot chorioretinitis patients) and 2 years (4.1 mg versus 6.8 mg). Such may be explained by the initiation of a second agent in a larger proportion of multifocal choroiditis with panuveitis and punctate inner choroiditis patients, or alternatively, by the supplementation in this group with local anti-VEGF therapy, which may have skewed the results obtained. In all patients with choroidal neovascularization, the initiation and escalation of systemic therapy was aimed not only at suppressing the underlying inflammation, but also at reducing the ultimate requirement for repeated injections, as suggested in former reports.³⁷ In 9 patients with choroidal neovascularization followed for a year or more, who required intravitreal therapy immediately preceding immunosuppression, all except one patient with multifocal choroiditis with panuveitis experienced a reduction (n=3) or discontinuation (n=5) altogether of anti-VEGF treatment, supporting the suggestion of a beneficial role of immunosuppression to these patients.

In conclusion, our data suggest that control of inflammation and preservation of vision with tapering of prednisone to acceptable low levels can be accomplished over the 2-year time frame studied with the use of immunosuppression. Single agent immunosuppression is able to achieve this result in the majority of patients, but dose escalation of mycophenolate is typical, and a second immunosuppressive agent is needed in about one-fifth of patients.

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Figure 1.

Goldmann IV/4 and I/4 Isopter Results for Patients with Birdshot Retinochoroiditis.

(Left) Goldmann IV/4 and (Right) Goldmann I/4 results over time. The mean values increase over time for the IV/4 isopter ($P=0.004$), and the I/4 isopter ($P=0.009$).

Table 1

Baseline Characteristics of Patients with Posterior Uveitis Treated with Immunosuppression, Compared to Those not Included in the Study

Characteristic	Birdshot chorioretinitis			Multifocal choroiditis			Punctate inner choroiditis		
	Not included	Included	P-value ^a	Not Included	Included	P-value ^a	Not Included	Included	P-value ^a
Number patients	14	14		12	7		16	6	
Age (years)			0.49						0.29
Mean (SD) ^b	52 (14)	56 (12)		47 (16)	42 (11)		35(7)	31 (13)	
Median(Interquartile range)	51 (47, 60)	56 (45, 66)		44 (38, 62)	40 (35, 51)		34(28, 42)	32 (18, 40)	
Gender (%)			1.00						1.00
Women	10 (71%)	11 (79%)		10 (83%)	7 (100%)		14 (88%)	6 (100%)	
Men	4 (29%)	3 (21%)		2 (17%)	0 (0%)		2 (12%)	0 (0%)	
Race/ethnicity (%)			1.00						NE
White, non-Hispanic	13 (93%)	14 (100%)		11 (92%)	7 (100%)		16 (100%)	6 (100%)	
Hispanic	1 (7%)	0 (0%)							
Other				1 (8%)	0 (0%)				
Bilateral disease (%)	13 (93%)	13 (93%)	1.00	11 (92%)	5 (71%)	0.52	9 (56%)	4 (67%)	1.00
Number of Patients (%)									
Macular edema in either eye	3 (25%)	6 (43%)	0.43						
Choroidal neovascularization in either eye	1 (7%)	0 (0%)	1.00	8 (73%)	6 (86%)	1.00	12 (75%)	5 (83%)	1.00
Abnormal Goldman visual field*	4 (36%)	9 (75%)	0.10						
V _A 20/50 to 20/160 in better eye	1 (7%)	2 (14%)	1.00	1 (8%)	0 (0%)	1.00	0 (0%)	0 (0%)	1.00
V _A 20/200 or worse in better eye	0 (0%)	0 (0%)	1.00	1 (8%)	0 (0%)	1.00	1 (6%)	1 (17%)	0.48
Number of involved eyes	27	27		23	12		25	10	
Macular edema (% eyes)	5 (22%)	8 (30%)	0.62						
Choroidal neovascularization (%eyes)	1 (4%)	0 (0%)	1.00	13 (62%)	7 (58%)	0.92	13 (52%)	6 (60%)	0.65
Abnormal visual field (% eyes)	7(33%)	14 (56%)	0.26						
Mean Goldmann IV/4 score (SD)	722 (161)	751 (64)	0.56						
Mean Goldmann I/4 score (SD)	532 (233)	506 (130)	0.75						
V _A 20/50 to 20/160 (% eyes)	2 (7%)	5 (19%)	0.25	2 (9%)	3 (25%)	0.19	1(4%)	1 (10%)	0.51

Characteristic	Birdshot chorioretinitis		Multifocal choroiditis		Punctate inner choroiditis	
	Not included	Included	P-value ^a	Not Included	Included	P-value ^a
V _A 20/200 or worse (% eyes)	1 (4%)	3 (11%)	0.32	6 (26%)	1 (8%)	0.33
				5 (20%)	2 (20%)	0.97

^aP-value is for comparing included vs not-included.

NE = Not Estimable.

^bSD = standard deviation.

Table II

Ocular Outcomes of Patients with Posterior Uveitis Treated with Immunosuppression

Outcome	Start treatment	Follow-up (months)		
		6	12	24
<i>Entire population</i>				
Number patients	27	26 ^d	25	19
Number eyes	49	47	47	35
Mean Acuity (SD) ^b	0.314 (0.27)	0.289 (0.21)	0.295 (0.27)	0.324 (0.36)
Mean Snellen visual acuity	20/41	20/39	20/39	20/42
V _A 20/50 to 20/160 (% eyes)	11 (22%)	8 (17%)	4 (9%)	6 (17%)
V _A 20/200 or worse (% eyes)	5 (10%)	5 (11%)	6 (13%)	3 (9%)
<i>Birdshot chorioretinitis</i>				
Number patients	14	14	14	11
Number eyes	27	27	27	21
Macular edema (% eyes)	9 (36%)	6 (26%)	4 (15%)	3 (16%)
Abnormal Goldmann visual field (% eyes)	17 (63%)	8 (38%)	10 (48%)	7 (37%)
Mean Goldmann IV/4 score (SD)	761 (69)	782 (44)	794 (54)	784 (57)
Mean Goldmann I/4 score (SD)	496 (115)	564 (119)	552 (124)	564 (125)
Mean acuity (SD)	0.326 (0.19)	0.290 (0.19)	0.329 (0.18)	0.318 (0.25)
Mean Snellen visual acuity	20/42	20/39	20/43	20/42
V _A 20/50 to 20/160 (% eyes)	7 (26%)	4 (15%)	3 (11%)	4 (19%)
V _A 20/200 or worse (% eyes)	2 (7%)	3 (11%)	4 (15%)	2 (10%)
<i>Multifocal choroiditis with panuveitis</i>				
Number patients	7	7	7	6
Number eyes	12	12	12	10
Mean acuity (SD)	0.369 (0.40)	0.321 (0.38)	0.409 (0.78)	0.454 (0.85)
Snellen visual acuity	20/47	20/42	20/52	20/57
V _A 20/50 to 20/160 (% eyes)	3 (25%)	3 (25%)	1 (8%)	1 (10%)
V _A 20/200 or worse (% eyes)	1 (8%)	1 (8%)	1 (8%)	1 (10%)

Outcome	Start treatment	Follow-up (months)		
		6	12	24
<i>Punctate inner choroiditis</i>				
Number patients	6	5	4	2
Number eyes	10	8	8	4
Mean acuity (SD)	0.254 (0.41)	0.302 (0.32)	0.137 (0.16)	0.199 (0.18)
Snellen visual acuity	20/36	20/40	20/27	20/32
V _A 20/50 to 20/160 (% eyes)	1 (10%)	1 (12%)	0 (0%)	1 (25%)
V _A 20/200 or worse (% eyes)	2 (20%)	1 (12%)	1 (12%)	0 (0%)

^aOne patient was not seen at 6 months but was seen at 1 year follow-up.

^bSD = standard deviation.

Table III**Results of Immunosuppression for Posterior Uveitides**

	Follow-up (months)		
	6	12	24
Number patients	26 ^b	25	19
Prednisone dose, mean (mg/day) Median [minimum-maximum]	6.9 (4.3) 8.5 [0–15]	5.3 (4.1) 6 [0–10]	5.7 (4.8) 5 [0–20]
Prednisone dose (% patients)			
> 10 mg/day	2 (8%)	0 (0%)	1 (5%)
5–10 mg/day	18 (69%)	15 (60%)	10 (53%)
<5 mg/day (includes 0 mg/day)	6 (23%)	10 (40%)	8 (42%)
0 mg/day	5 (19%)	7 (28%)	2 (11%)
Mycophenolate dose, mean (mg/day) Median [minimum-maximum]	2.4 (0.5) 2 [1.5–3]	2.4 (0.5) 2 [2–3]	2.7 (0.5) 3 [1.5–3]
Mycophenolate dose (% patients)	24	23	17
3 gm/day	10 (42%)	10 (43%)	12 (71%)
>2 to <3 gm/day	0 (0%)	0 (0%)	1 (6%)
2 gm/day	14 (58%)	13 (57%)	4 (24%)
2 nd immunosuppressive drug (% patients)	0 (0%)	2 (8%)	4 (21%)
Treatment success ^a (% patients)			
With one immunosuppressive agent	21 (81%)	17 (68%)	14 (74%)
With two immunosuppressive agents	0	2 (8%)	4 (21%)
Overall	21 (81%)	19 (76%)	18 (95%)

^aTreatment success = no active uveitis and prednisone dose 10 mg/day.

^bOne patient was not seen at 6 months but was seen at 1 year follow-up.