Epidemiology and Clinical Characteristics of Episcleritis and Scleritis in Olmsted County, Minnesota

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• PURPOSE: To determine the population-based incidence and disease associations of episcleritis and scleritis in a midwestern U.S. population.
• DESIGN: Population-based retrospective cohort study.
• METHODS: All residents of Olmsted County, Minnesota from 2006 to 2015 were identified by using the Rochester Epidemiology Project. A total of 223 episcleritis cases and 77 scleritis cases were identified. The incidence and disease associations of episcleritis and scleritis were assessed, as well as scleritis recurrence rates, treatment, and complications.
• RESULTS: Incidence rates for episcleritis and scleritis were 15.39 and 5.54 per 100,000 per year, respectively. Females accounted for 60.1% of episcleritis and 51.9% of scleritis cases. The mean age at diagnosis was 40.2 years of age for episcleritis and 48.8 years of age for scleritis. In the episcleritis cases, the incidence in females was higher ($P = .01$). There were no significant differences between sexes for scleritis incidence ($P = .75$); 23.4% of scleritis patients had an associated systemic disease. Patients with systemic disease showed a trend toward an increased risk of recurrence, but it was not statistically significant. There was a slightly decreased risk of scleritis recurrence with older age at diagnosis (hazard ratio [HR]: 0.73; $P = .058$; 95% confidence interval [CI]: 0.52-1.01). At last follow-up, most eyes with scleritis (90.4%) had good visual acuity (better than 20/40), and 92.3% had stable or improved visual acuity.
• CONCLUSIONS: The Olmsted County, Minnesota population had a lower incidence of episcleritis and a higher incidence of scleritis than populations in previous studies. The population-based results from the current study may provide information that is more applicable to a primary eye care setting. (Am J Ophthalmol 2020;217: 317–324. © 2020 Elsevier Inc. All rights reserved.)

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EPISCLERITIS AND SCLERITIS ARE OCULAR INFLAMMATORY diseases that differ in terms of associated systemic disease, treatment, and visual outcome. Episcleritis classically presents with eye redness, irritation, or mild pain. Most cases are mild, respond to topical anti-inflammatory agents, and do not pose a threat to vision. Scleritis is a painful, potentially vision-threatening inflammation of the sclera that usually requires treatment with nonsteroidal anti-inflammatory drugs (NSAIDs), systemic corticosteroids, and/or systemic immunomodulatory medication. Associated complications can include corneal thinning, glaucoma, cataract, and secondary posterior segment inflammation. Approximately 40% to 50% of scleritis cases have been reported to have systemic inflammatory causes that are more likely to require systemic immunomodulatory treatment.[1]

There are few published population-based studies of episcleritis and scleritis. Because cases of episcleritis or scleritis that respond to initial treatment and do not recur are unlikely to be referred to a tertiary care center, a population-based study can provide a more accurate assessment of incidence, disease association, and prognosis. This study used the Rochester Epidemiology Project (REP), a medical records linkage system established in 1966 that tracks medical care delivered to residents of Olmsted County, Minnesota using diagnostic and surgical procedure codes.[2] The REP captures virtually all medical care provided to residents of Olmsted County, Minnesota because the region is relatively isolated from other urban centers, and collaborative agreements among local health care providers allowed creation of a medical records linkage system that covers the entire county population.[3] This study used the REP system to conduct a population-based study of the incidences of episcleritis and scleritis in Olmsted County, Minnesota from 2006 to 2015, as well as to assess clinical characteristics, treatment, and complications of scleritis.

METHODS

• STUDY DESIGN, DATA SOURCE, AND STUDY POPULATION: The Institutional Review Boards (IRB) of Mayo Clinic and Olmsted Medical Center approved this retrospective cohort study, and the research adhered to the tenets of the Declaration of Helsinki and the Health

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Insurance Portability and Accountability Act. Participants in the REP database were asked to give authorization for minimal risk research when they were first entered into the medical system in Olmsted County. Because the current study was retrospective and considered to pose minimal risk, the IRBs did not require additional informed consent from the patients included in this study (a waiver of consent was granted by the IRBs). International Classification of Diseases, 9th and 10th editions (ICD-9 and ICD-10) codes for ocular inflammation were used to query the REP database to identify all residents of Olmsted County with diagnoses of ocular inflammatory disease from January 1, 2006, to December 31, 2015 (Supplemental Tables 1, 2). Research authorizations were confirmed through the database, and patients who did not grant authorization were excluded from the study. The medical records for all potential cases of episcleritis and scleritis were reviewed to verify the diagnoses on the basis of documented ophthalmic examinations. Demographic data, including age, sex, and self-reported race, were collected and compared to the mid-study Olmsted County population (2010) using the Fisher exact test.

Standard clinical definitions of episcleritis and scleritis were used to confirm the diagnoses. Episcleritis cases had clinical findings of episcleral injection (diffuse, sectoral, or nodular) that blanched with phenylephrine eye drops. Characteristics consistent with scleritis included scleral injection that did not blanch with phenylephrine eye drops, conjunctival chemosis, moderate to severe eye pain, and the absence of significant intraocular inflammation. Cases were excluded if the scleral or episcleral inflammation was surgically induced, traumatic, or contact lens-related. Most patient conditions were diagnosed and treated by ophthalmologists or optometrists who were not specialists in uveitis or anterior segment inflammation.

Medical records were reviewed for evidence of systemic inflammatory or infectious causes of episcleritis and scleritis. Diagnoses of autoimmune thyroid disease (hypothyroidism, Graves' disease, Hashimoto thyroiditis) were also noted. Follow-up visits were reviewed through February 1, 2019 to assess scleritis recurrence, defined as a new episode of scleritis occurring either on or off treatment at least 3 months after the previously documented activity. In some cases, the patient was not seen when scleritis was quiescent, but the duration between visits with inflammation was greater than 3 months, and the patient reported a period of inactivity between recurrences.

Medications used to treat scleritis were documented as well as complications attributable to inflammation and/or treatment. Complications included decreased visual acuity (VA), the need for cataract surgery, ocular hypertension (intraocular pressure greater than 24 mm Hg), anterior uveitis, corneal involvement, macular edema, optic disc edema, vitritis, and exudative retinal detachment. Data for VA in affected eyes at presentation with scleritis, worst VA, and VA at the last follow-up visit were also collected. Decreased VA was defined as a loss of 2 or more Snellen lines at the last visit.

• **STATISTICAL ANALYSIS:** The overall incidence rates of episcleritis and scleritis were estimated using the age- and sex-specific population figures for Olmsted County census data from 2006 through 2015. Patients were divided into age groups: 0-14, 15-24, 25-44, 45-64, and 65-110 years old. Population estimates for individual years between census years were determined using linear interpolation. Because approximately 85% of the Olmsted County population is white, incidence rates were also adjusted by age and sex according to the 2010 census figures for the US white population so that the data could be compared to national estimates. The 95% confidence intervals (95% CIs) for the rates were calculated assuming a Poisson error distribution. Trend over age at diagnosis and between sexes were investigated using Poisson regression models. The overall risk of recurrence was estimated using the Kaplan-Meier method. To evaluate risk factors for recurrence, a Cox proportional hazards model was completed. Given 2 affected eyes from some individuals, a sandwich estimate of the standard error was used in the testing to account for the potential correlation between eyes from the same individual. Overall comparisons among groups were completed using the chi-squared test for categorical variables. Continuous variables were completed using 2-sample *t*-tests.

RESULTS

THE OLMSTED COUNTY MID-STUDY POPULATION WAS 144,248 in 2010 (Figure 1). Initial ICD-9/10 code search revealed 4,253 patients with diagnoses of ocular inflammation, 233 cases of episcleritis, and 79 cases of scleritis. After review of the medical records, 10 cases of episcleritis and 2 of scleritis were excluded because they lacked research authorization and Olmsted County residency at time of diagnosis. Other reasons for exclusion included a primary diagnosis of uveitis, contact lens-related keratitis and conjunctivitis, and traumatic or postsurgical inflammation. In total, there were 223 confirmed episcleritis cases and 77 confirmed scleritis cases included in this study.

Female subjects accounted for 60.1% of episcleritis and 51.9% of scleritis cases (Table 1). The mean age at diagnosis was 40.2 years for episcleritis and 48.8 years for scleritis. The majority of episcleritis and scleritis patients were white, 86.5% and 87.0%, respectively, mirroring the composition of Olmsted County (83.4% white in 2010). Compared to the general Olmsted County population, females ($P = .009$; 95% CI: 53.3-66.6) and patients 25-44 years of age ($P < .001$; 95% CI: 36.9-50.3) were overrepresented in the episcleritis group. Black patients were underrepresented among episcleritis cases ($P = .04$). In scleritis cases, patients 45-64 years of age ($P = .02$; 95% CI: 28.1-

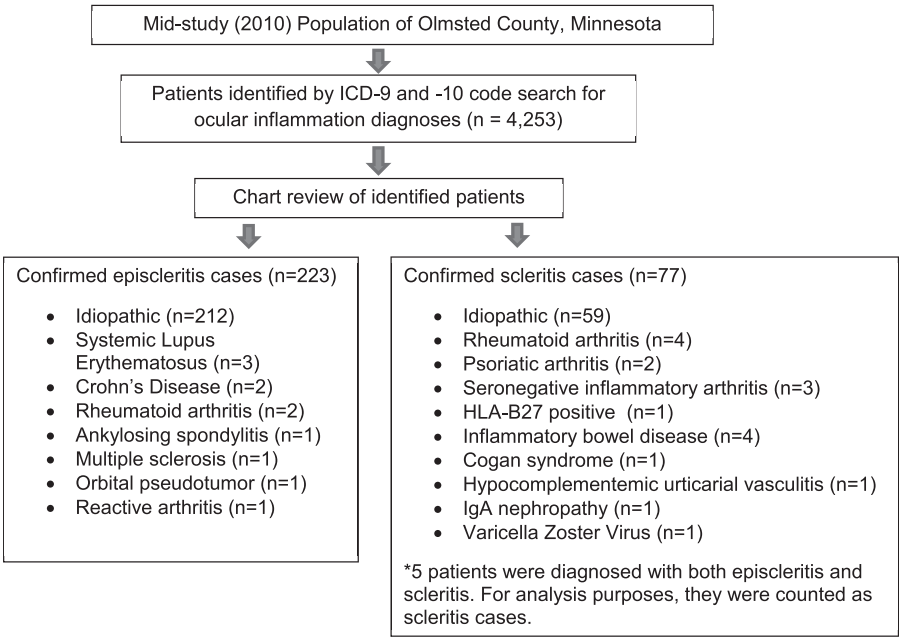

FIGURE 1. Identification of episcleritis and scleritis cases in the Olmsted County, Minnesota population.

50.8) were more likely to be affected but not females ($P = .75$; 95% CI: 40.3-63.5).

The overall age- and sex-adjusted rate of incidence of episcleritis was 15.39 (95% CI: 13.36-17.43) per 100,000 per year adjusted for 2010 US white population (Table 2). Age-adjusted incidence rate among males with episcleritis was 12.48 (95% CI: 9.85-15.10). Age-adjusted incidence rate among females with episcleritis was 18.21 (95% CI: 15.11-21.30). The highest incidence rate (23.78) occurred in patients 25-44 years of age, and the lowest (6.16) was in patients 14 years of age and younger. In the 25-44 year-old group, the incidence rates for females and males were 29.24 and 18.25, respectively. The differences among age groups were statistically significant ($P < .001$). The numbers were too low to assess for trends in incidence rates based on ethnicity/race.

For scleritis, the overall age- and sex-adjusted incidence was 5.54 (95% CI: 4.29-6.79) per 100,000 per year (Table 3). Age-adjusted incidence was 5.58 (95% CI: 3.83-7.29) among males and 5.56 (95% CI: 3.83-7.29) among females; these differences were not statistically significant ($P = .75$). The overall age- and sex-adjusted rates of incidence of scleritis in the total population were slightly lower than the incidence rates in males and females assessed separately, which was a function of adjusting the overall incidence to the US white population. The crude overall scleritis incidence was between the incidences in males and females. The highest incidence rates occurred in patients 45-64 years of age (7.98) and 65 years or older (7.80). Children 14 years old and younger had the lowest incidence (0.65). There were statistically significant differences in incidence among the age groups ($P < .001$). The numbers were too low to assess for trends in incidence rates based on ethnicity/race.

The majority of cases of episcleritis (95.1%) and scleritis (76.6%) were not associated with systemic inflammatory or infectious causes. Notably, only 2 episcleritis (0.897%) and 4 scleritis patients (5.19%) had an associated diagnosis of rheumatoid arthritis. Twenty-six episcleritis cases (11.7%) and 8 scleritis patients (10.4%) also had a diagnosis of thyroid disease. There were no significant differences between scleritis cases with a systemic disease association versus those that were idiopathic with respect to age ($P = .92$), sex ($P = .73$), smoking status ($P = .90$), and thyroid disease ($P = .91$).

Among 77 scleritis patients, 60 cases (77.9%) were classified as diffuse or sectoral, 13 cases (16.9%) were nodular, 3 cases (3.9%) were posterior, and 1 case (1.3%) was necrotizing type. Seventy patients (90.9%) had unilateral presentations, 3 (3.9%) were bilateral asynchronous, 1 (1.3%) was bilateral synchronous, and 3 (3.9%) with initial unilateral presentations subsequently developed bilateral synchronous recurrences. Twenty-nine scleritis patients (37.7%) had a history of smoking. The majority of scleritis cases (81.8%) were managed with oral NSAIDs. Other treatments included corticosteroid eye drops (31.2%), systemic corticosteroids (13.0%), and systemic corticosteroid-sparing immunomodulatory medication (6.5%).

There were 84 affected eyes from 77 scleritis patients. A total of 19 eyes of 14 patients had recurrences, whereas 65 eyes from 63 cases had no recurrences. Two eyes from 1 patient were excluded from the calculation of mean recurrences and 5-year recurrence rate because the patient had chronic persistent scleritis without clear instances of

TABLE 1. Demographics of Episcleritis and Scleritis Cases

	Mid-study (2010) Olmsted County Population	Confirmed Episcleritis Cases	*P* Value[a]	Confirmed Scleritis Cases	*P* Value[a]	Scleritis Cases Who Are Smokers
Total	144,248	223		77		29 (37.7%) (26.9-49.4)
Mean age, y	36.1	40.2		48.8		50.2
Females (%) (95% CI)	73,763 (51.1%) (50.9-51.4)	134 (60.1%) (53.3-66.6)	.009	40 (51.9%) (40.3-63.5)	.91	16 (55.2%) (35.7-73.6)
Age categories (%) (95% CI)						
0-14	30,682 (21.3%) (21.1-21.5)	19 (8.5%) (5.2-13.0)	<. 001	2 (2.6%) (0.3-9.1)	<.001	0 (0%) (0-11.9)
15-24	17,065 (11.8%) (11.7-12.0)	27 (12.1%) (8.1-17.1)	.92	3 (3.9%) (0.8-11.0)	.03	0 (0%) (0-11.9)
25-44	40,200 (27.8%) (27.6-28.1)	97 (43.5%) (36.9-50.3)	<.001	28 (36.4%) (25.7-48.1)	.10	11 (38.0%) (20.7-57.7)
45-64	38,168 (26.5%) (26.2-26.7)	59 (26.5%) (20.8-32.8)	1	30 (39.0%) (28.1-50.8)	.02	13 (44.8%) (26.5-64.3)
≥65	18,133 (12.5%) (12.4-12.7)	21 (9.4%) (5.9-14.0)	.19	14 (18.2%) (10.3-28.6)	.17	5 (17.2%) (5.9-35.8)
Race (%) (95% CI)						
Asian	7,771 (5.4%) (5.3-5.5)	10 (4.5%) (2.2.8.1)	.66	4 (5.2%) (1.4-12.8)	1	1 (3.4%) (0.1-17.8)
Black	6,751 (4.7%) (4.6-4.8)	4 (1.8%) (0.5-4.5)	.038	3 (3.9%) (0.8-11.0)	1	2 (6.9%) (0.9-22.8)
Hispanic	6,081 (4.2%) (4.1-4.3)	9 (4.0%) (1.9-7.5)	1	2 (2.6%) (0.3-9.1)	.77	1 (3.4%) (0.1-17.8)
White	120,348 (83.4%) (83.2-83.6)	193 (86.5%) (81.4-90.7)	.24	67 (87.0%) (77.4-93,6)	.54	24 (82.8%) (64.2-94.2)
Other	3,297 (2.3%) (2.2-2.4)	7 (3.1%) (1.3-6.4)	.36	1 (1.3%) (0-7.0)	1	1 (3.4%) (0.1-17.8)

CI = confidence interval.

[a]*P* values were calculated using Fisher exact test results comparing cases to Olmsted County population.[4]

TABLE 2. Incidence of Episcleritis in Olmsted County, Minnesota, by Age and Sex

	Females			Males		
Age		Rate	95% CI		Rate	95% CI
Total (age-adjusted)	134	18.21	15.11-21.30	89	12.48	9.85-15.10
0-14	7	4.63	1.86-9.54	12	7.62	3.94-13.34
15-24	16	18.37	10.51-29.76	11	12.88	6.43-23.06
25-44	60	29.24	22.31-35.72	37	18.25	12.85-25.19
45-64	37	19.11	13.45-26.37	22	12.05	7.56-18.20
65+	14	13.80	7.53-23.18	7	8.98	3.60-18.50

CI = confidence interval.

Incidence rates per 100,000 per year. Overall age- and sex-adjusted incidence of episcleritis = 15.39 per 100,000 per year (95% CI, 13.36-17.43) adjusted for 2010 US white population. Significant differences between males and females ($P = .01$). Significant differences across ages ($P < .001$).

remission. The 5-year recurrence rate was 25.5%, and all recurrences occurred within 3 years of initial diagnosis (Figure 2). Among 17 eyes from 13 patients, the mean number of recurrences per eye was 1.87 (range: 1-6).

In the 19 eyes of 14 scleritis patients with recurrences, the median follow-up time after initial scleritis diagnosis was 2.71 years (range: 0.071-8.52 years), and the median follow-up per affected eye was 2.63 years (range: 0.44-8.52 years). Patients with no scleritis recurrence had a median follow-up of 1.74 years (range: 0.00-11.78 years), including 10 patients who had no subsequent eye examinations. After excluding the 10 patients with no follow-up, scleritis patients with at least 1 subsequent visit had a median follow-up of 2.69 years (range: 0.011-11.78 years) and a median follow-up per affected eye (55) of 2.69 years (range 0.011-11.78).

Age, sex, systemic disease, thyroid disease, and smoking were analyzed as risk factors for scleritis recurrence. Increasing patient age (at presentation) was associated with a small decrease in the risk of recurrence: a 10-year increase in age decreased the risk 0.73 times ($P = .058$; 95% CI: 0.52-1.01). Patients with systemic disease (35.7%) had an increased risk of recurrence (hazard ratio [HR]: 1.89; 95% CI: 0.69-5.05), but the difference was not statistically significant ($P = .22$). Although 28.6% of patients with recurrent scleritis had a history of smoking, there were no statistically significant differences in recurrence compared to non-smokers ($P = .34$). Sex ($P = .22$) and thyroid disease ($P = .58$) were also not associated with risk of recurrence.

Ocular complications affected 27 scleritis patients (35.1%), including anterior uveitis (13%), ocular hypertension (11.7%), vision loss of 2 or more lines of Snellen acuity (7.8%) between baseline and the last visit (range: 0.011-11.8 years), corneal involvement (3.9%), exudative retinal detachment (3.9%), and macular edema (2.6%) (Table 4). Among the 77 scleritis cases, 52 of 84 eyes had at least 1 year of follow-up after initial scleritis presentation. At the time of diagnosis, 49 (94.2%) affected eyes had best-corrected Snellen visual acuity (BCVA) of 20/40 or better. Among those with at least 1 year of follow-up, the final visual acuity was better than 20/40 in 47 affected eyes (90.4%); only 4 eyes (7.7%) lost 2 or more lines of Snellen visual acuity compared to baseline. A total of 49 (92.3%) eyes had the same or improved BCVA compared to baseline.

DISCUSSION

THIS STUDY REPORTS THE INCIDENCES OF EPISCLERITIS AND scleritis in a Midwestern, predominantly white population that had not been previously studied. In comparison to other population-based studies, this cohort had a lower overall age- and sex-adjusted incidence of episcleritis (15.39 per 100,000 per year) versus 21.7 per 100,000 person-years in the insurance-based Pacific Ocular Inflammation Study (POIS) and 41.0 per 100,000 in the Northern California Epidemiology of Uveitis Study (NCEUS).[5,6] The incidence of scleritis in the present study was 5.54 per 100,000 persons per year, slightly higher than those in the POIS and NCEUS studies (4.1 and 3.4 per 100,000 person-years, respectively).[5,6] These variations in incidence rates may be related to differences in racial/ethnic compositions; for example, the 2010 Olmsted County, Minnesota population was 84% white, 5.4% Asian, and 4.7% black compared to 27% white, 40% Asian, and 2% black in the POIS cohort. Due to inadequate statistical power, it was not possible to look for differences in ethnicity and incidence of episcleritis or scleritis in this study.

In this population, the average age at episcleritis diagnosis was 40.2 years old, slightly younger than the range of 43-47 years reported in the medical literature.[5–8] For scleritis, the average age (48.8 years) was on the younger end of the previously reported range (47-59.5 years).[5–8]

TABLE 3. Incidence of Scleritis in Olmsted County, Minnesota, by Age and Sex

	Females			Males		
Age		Rate	95% CI		Rate	95% CI
Total (age-adjusted)	40	5.56	3.83-7.29	37	5.58	3.75-7.40
0-14	1	0.66	0.02-3.68	1	0.63	0.02-3.51
15-24	3	3.44	0.71-10.04	0	0	
25-44	14	6.82	3.72-11.46	14	6.90	3.77-11.59
45-64	15	7.75	4.34-12.79	15	8.21	4.60-13.55
65+	7	6.90	2.77-14.21	7	8.98	3.60-14.50

CI = confidence interval.

Incidence rates per 100,000 per year. Overall age and sex adjusted incidence of scleritis = 5.54 per 100,000 per year adjusted for 2010 US white population (95% CI, 4.29-6.79). No significant differences between males and females ($P = .75$). Significant differences across ages ($P < .001$).

Similar to other reports, episcleritis occurred more frequently in females.[5–11] In a notable divergence from previous studies, females were not over-represented among the scleritis cases. This difference may be related to the lower frequency of associated systemic disease.[1,5,7–11] In this population, 23.4% of scleritis cases were associated with systemic disease, which is lower than that reported in most referral center cohorts. In 3 tertiary care center studies, 33% to 39% of scleritis patients had an associated systemic disease,[7,8,12] and 36.0% was reported in a community-based referral practice.[9] In the other population-based studies, the association of systemic disease varied from 6% of scleritis patients in NCEUS to 41% in POIS.[5,6]

It is logical that a population-based study would include scleritis cases that were unlikely to be referred to a tertiary care or specialty service, such as cases that were less severe, responded to treatment, and were not associated with systemic disease. The findings in the present study supported this idea. The rate of scleritis recurrence in the present study (18%) was lower than the 50% recurrence rate reported by Kempen and associates[13] in a referral center population. In the present cohort, sex was not associated with increased risk of scleritis recurrence, but the concurrent diagnosis of systemic inflammatory disease showed a trend toward an increased risk of recurrence. Because females may be more likely to develop many autoimmune or inflammatory diseases, they may also be more likely to be referred to a tertiary care center.[14]

Another indication of the severity of scleritis is the range of medications used for treatment. In this population, scleritis was treated most frequently with oral NSAIDs (81.8%) followed by corticosteroid eye drops (31.2%), systemic corticosteroids (13.0%), and systemic corticosteroid-sparing immunomodulatory medication (6.5%). In contrast, up to two-thirds of scleritis patients in referral center cohorts required treatment with oral corticosteroids and/or systemic immunomodulatory medication.[8,12] In the population-based POIS, more patients were treated with systemic corticosteroids (47.1%) and systemic immunomodulatory medication (35.5%) compared to the present cohort (13.0% and 6.5%, respectively).[15] However, POIS also had a higher percentage of scleritis patients with rheumatoid arthritis (29.4% versus 5.2%, respectively, in this population) who are likely to require systemic treatment for the extraocular manifestations of rheumatoid inflammation. The range of treatments used in this study may also reflect clinician preference among non-subspecialist ophthalmologists and optometrists who may be less likely to use systemic medications including corticosteroids and immunomodulatory medication.

The frequency of scleritis-related ocular complications in the present study was comparable to that of previous population-based studies: 35.1% versus 29.4% in POIS.[15] In contrast, 59% to 85% of scleritis cases had complications in referral center studies.[8,12] Cystoid macular edema was diagnosed in only a small number of patients in this study, although imaging studies were not routinely obtained in most patients. Anterior uveitis occurred in 13% of scleritis patients in this cohort, compared to 11.8% of cases in POIS and approximately 25% in referral center cohorts.[6,7,15] In contrast, none of the POIS cases developed ocular hypertension,[15] whereas the frequency was 11.7% in this cohort, similar to that in tertiary care centers (10%-14%).[7,8,16] Finally, vision loss in scleritis cases in the present population was less common than that in tertiary care centers: 7.7% of affected eyes in the present study versus 16%-22% in previous studies.[7,8] Jabs and associates[8] defined vision loss as a decrease in BCVA of 2 or more Snellen lines from the initial BCVA best-corrected visual acuity and assessed visual acuity data from all visits. In contrast, Sainz de la Maza and associates[7] defined vision loss as a decrease in visual acuity of 2 or more Snellen lines at the end of the follow-up period or BCVA of 20/80 or worse (in the worse

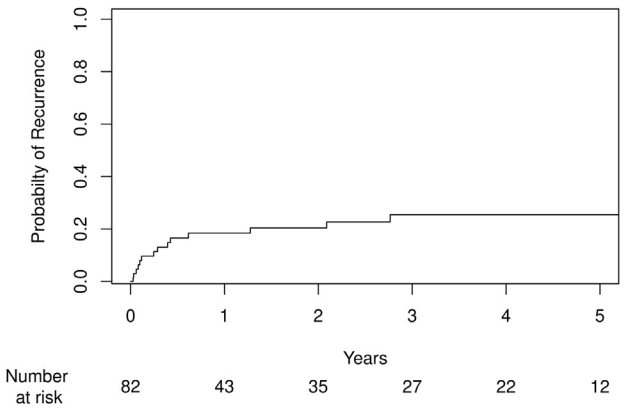

FIGURE 2. Risk of scleritis recurrence per eye. The 5-year recurrence rate is 25.5% among 82 eyes. All recurrences occurred within 3 years.

TABLE 4. Ocular Complications Occurring after the Diagnosis of Scleritis

Ocular Complication	Number of Cases (%)
Anterior uveitis	10 (13.0%)
Corneal involvement	3 (3.9%)
Macular edema	2 (2.6%)
Optic disc edema	0 (0%)
Vitritis	1 (1.3%)
Exudative detachment	3 (3.9%)
Decreased visual acuity (≥2 Snellen lines)	6 (7.8%)
Cataract surgery	4 (5.2%)
Ocular hypertension	9 (11.7%)
Glaucoma surgery	1 (1.3%)

seeing eye) at presentation. This approach would have missed any reductions in visual acuity that occurred between the first and last visits if visual acuity subsequently recovered with treatment; however, eventual recovery of vision may the most clinically relevant data from a prognosis standpoint. Despite these differences in defining vision loss, it appears that scleritis patients in the general population may be less likely to develop ocular complications in comparison to those seen in a tertiary care center.

• **STUDY LIMITATIONS:** Several limitations of this study must be acknowledged. The majority of the Olmsted County, Minnesota population is white, so the results may not be generalizable to other populations. In this retrospective study, examination and evaluation data were limited in some cases. Diagnosis coding was used to identify potential cases, and review of the medical records was performed to confirm diagnoses; however, most patients were not seen by an ocular inflammatory disease specialist, and a standardized examination and systemic work-up was not necessarily performed. Evidence of scleritis recurrence was determined by retrospective chart review, and the timing of follow-up visits was not standardized, so it might not have been possible to differentiate between true recurrences after remission versus chronic recalcitrant cases. Finally, some cases may have been missed if an Olmsted County resident received eye care from providers outside of Olmsted County or from community optometrists who were not associated with the REP.[3] Nonetheless, it is likely that most of the primary and specialty eye care was captured in this database.

In summary, this study of a predominantly white US population reveals age- and sex-adjusted episcleritis and scleritis incidences of 15.39 and 5.54 per 100,000 per year, respectively. Compared to previous studies, the incidence of episcleritis was lower, whereas the incidence of scleritis was slightly higher. Notably, in contrast to other studies, females were not more likely to have scleritis, and the majority of cases were idiopathic (76.6%). Risk of scleritis recurrence was not associated with sex, but it was slightly decreased with increasing age at diagnosis. There was a non-statistically significant trend toward increased risk of recurrence in cases with associated systemic inflammatory disease. The scleritis cases from this predominantly primary eye care setting were less severe in terms of treatment required, complications, and recurrence compared to tertiary care center cohorts.

The results from the present study provide useful information for evaluating and counseling community patients with episcleritis and scleritis. Generally, scleritis patients in the general population probably have a lower risk of vision-threatening complications. Although there is evidence that scleritis may be less likely to be associated with systemic disease than previously reported, the patient's history, risk factors, and review of systems should always be ascertained and used as the basis for determining whether additional testing for systemic disease is warranted. Patients with associated systemic disease or severe, recalcitrant inflammation are likely to benefit from evaluation by an ocular inflammation specialist or a rheumatologist, so early referral to a tertiary care center should be considered.

ALL AUTHORS HAVE COMPLETED AND SUBMITTED THE ICMJE FORM FOR DISCLOSURE OF POTENTIAL CONFLICTS OF INTEREST and none were reported.

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