Practice Patterns in the Management of Primary Pterygium: A Survey Study

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Purpose: To characterize cornea specialists' current practice preferences in the management of primary pterygium.

Methods: A 25-item survey regarding indications for surgery, surgical technique, use of adjuvant therapy, type and duration of postoperative therapy, and treatment of early recurrences was designed and sent to members of the Cornea Society through the kera-net listserv.

Results: In total, 199 cornea specialists completed the questionnaire. More than 90% considered that surgery should be performed when there is proximity of the pterygium to the visual axis, pain or redness, eye movement restriction, or induction of astigmatism. Cosmesis was considered as an indication by 41.7% of the participants. The most frequent technique for pterygium excision was complete resection including the base and a moderate quantity of Tenon capsule followed by autologous conjunctival or limbal-conjunctival graft. The preferred graft fixation method in this survey was fibrin glue (61.2%). Most respondents reported a recurrence rate of less than 5% and no use of adjuvant agents to prevent recurrence. When early recurrence did occur, the preferred agents were corticosteroids.

Conclusions: This study reflects the preferences of cornea experts regarding primary pterygium treatment and may serve as a guide for the management of this pathology.

Key Words: pterygium, primary pterygium, pterygium surgery, pterygium recurrence

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Pterygium is a common ocular disorder whose treatment may ultimately be surgical.[1] Despite its prevalence, there are multiple controversies and debates regarding the surgical management.[2] A great number of publications exist on this disorder, but no consensus has been reached as to surgery indications, surgical technique, use of adjuvant therapy, type and duration of postoperative therapy, and treatment of early recurrences.[3,4]

Multiple techniques have been proposed with significant variations among them in terms of recurrence rate, required surgical time, and patient comfort. In general, complete removal of pterygium including its base has been considered essential to avoid recurrence. In 2008, Hirst[5,6] described the P.E.R.F.E.C.T. (pterygium extended removal followed by extended conjunctival transplantation) technique, by which one of the lowest recurrence rates described in pterygium surgery (0.4%) is achieved. However, no comparative studies have been conducted to determine the exact amount of tissue that should be resected.

Among the described techniques are bare sclera technique,[7] simple conjunctiva closure,[8] resection followed by amniotic membrane graft,[9,10] and techniques with autologous conjunctival and limbal-conjunctival grafts.[11,12] In addition, the use of adjuvant treatments such as mitomycin-C (MMC),[13,14] 5-FU,[15] vascular endothelial growth factor (VEGF) inhibitors,[14,16] and interferon alfa 2b[17] has been proposed to achieve lower recurrence rates. The American Academy of Ophthalmology Report[18] and the most recent meta-analysis[19,20] and literature reviews[3,4] describe a recurrence rate between 27% and 88% with bare sclera technique, 3% to 40% with bare sclera technique + MMC, 2% to 39% with conjunctival autograft, 0% to 15% with conjunctival-limbal autograft, and 6% to 41% with amniotic membrane.

The use of graft techniques requires considering the way in which the graft fixation is performed. This issue has also been controversial because of the different degrees of graft stability, the economic cost, the required surgical time, and the patient's discomfort associated with each of the available fixation methods. Several studies have compared different fixation methods, usually favoring fibrin glue because of ease of use, adequate stability, shorter surgical time, and less patient discomfort. However, it is expensive and unavailable in some places, so it is still common to use sutures that are less costly

and provide good stability, despite requiring slightly longer surgical time and producing greater patient discomfort.[21–23]

The use of multiple agents in the postoperative period has been proposed both to avoid and to treat early recurrence. Among them are corticosteroids,[24] mitomycin,[25] VEGF inhibitors,[25–27] 5-fluorouracil (5-FU),[28] and cyclosporine A.[29,30] Nevertheless, the evidence supporting the use of these drugs is weak.

This survey study sought to characterize the current practice preferences of cornea specialists in the management of primary pterygium and to determine whether these preferences are influenced by the ophthalmologist's level of experience with pterygium surgery, the number of surgeries performed per year, or the world region of practice.

MATERIALS AND METHODS

Study Design

We carried out an observational survey to ascertain the preferences of cornea specialists in the treatment of primary pterygium. The survey was distributed in July 2017 through the kera-net listserv, an online interactive forum of the Cornea Society aimed at ophthalmologists with an interest in cornea, which has more than 1300 members from over 30 nations. Three cornea specialists (E.O.G.-H., J.C.S.-O. and M.J.M.) reviewed the issues of greatest controversy and relevance in the field of primary pterygium treatment and designed a 25-item questionnaire using the SurveyMonkey online platform. Each question could be designed by any of the 3 cornea specialists but it was reviewed and approved by the other 2 to be included in the final questionnaire. Of the questions selected, 9 focused on demographic characteristics and experience level of each specialist, and the remaining 16 questions addressed preferences regarding practices for primary pterygium treatment. The estimated time to complete the questionnaire was 7 minutes and some of the questions allowed for more than 1 answer (see Survey, Supplemental Digital Content 1, http://links.lww.com/ICO/A876).

Statistical Analysis

Means and their SD and medians with their interquartile range are shown for quantitative variables, whereas categorical variables are presented as percentages. Bivariate analysis included χ^2 for categorical variables, Student t test for comparison of means, and Wilcoxon rank-sum test for comparison of medians. Statistical significance was established as $P < 0.05$. Data were analyzed using STATA/MP 14.2 (Stata Corporation, College Station, TX).

RESULTS

Participants' Characteristics

A total of 199 ophthalmologists answered the questionnaire; of them 160 (80.4%) were men. Sixty-five (32.7%) participants were younger than 40 years, 65 (32.7%) were between 40 and 49 years of age, and 69 (34.6%) were older than 50 years. Most participants perform pterygium surgery in North America (62.3%), but there were respondents from all around the world (Table 1). Of the participating specialists, 93.9% had cornea or anterior segment fellowship training. Most participants (58.8%) were in private practice; the rest either combined academic and private practice or had a full university-based practice.

TABLE 1. Distribution of Respondents by Region

Practice Region	No (%)
North America	109 (62.3)
Latin America and the Caribbean	24 (13.7)
Europe and Central Asia	14 (8)
Middle East and North Africa	12 (6.9)
South Asia	10 (5.7)
East Asia and Pacific	3 (1.7)
Africa	3 (1.7)

The respondents' experience was categorized by the number of years performing pterygium surgeries and by the average number of pterygia operated per year. Of the participating specialists, 14.6% had been doing pterygium surgeries for fewer than 5 years, 26.6% for 6 to 10 years, 12.5% for 11 to 15 years, 13.1% for 16 to 20 years, and 33.2% for more than 20 years. The number of pterygium surgeries performed per year was fewer than 10 for 20.6% of the respondents, 10 to 30 for 53.8%, 30 to 50 for 15.1%, 50 to 100 for 5.5%, and more than 100 for 5.0%.

Indications for Pterygium Surgery (Nonexclusive Answers)

Proximity of the head of pterygium to the visual axis was regarded as the cause of surgery for 97% of the participants. Pterygia that produced pain or redness, eye movement restriction, or those that induced astigmatism were considered appropriate for surgery for more than 90% of the respondents, and suspicion of ocular surface dysplasia was a reason for surgery for 86.4% of the participants. In addition, cosmesis was considered as an indication of surgery for 41.7% of the participants.

Surgical Technique

Preoperative Treatment (Nonexclusive Answers)

Most participants (58.2%) do not use any preoperative medication; 22.6% use corticosteroids and 23.1% use antibiotics. Only a few use other medications, such as brimonidine (7.0%) and nonsteroidal antiinflammatory agents (4.5%).

Pterygium Resection

Two reference images (Figs. 1A, B) were used to query the participants about the amount of tissue they remove surgically and how much Tenon capsule they resect. The majority (53.3%) perform an extensive head and conjunctival resection including the base (letter C), 23.1% perform a minimal resection of the head and conjunctiva (letter B), 16.6% remove tissue up to the caruncle (letter D), and 7%

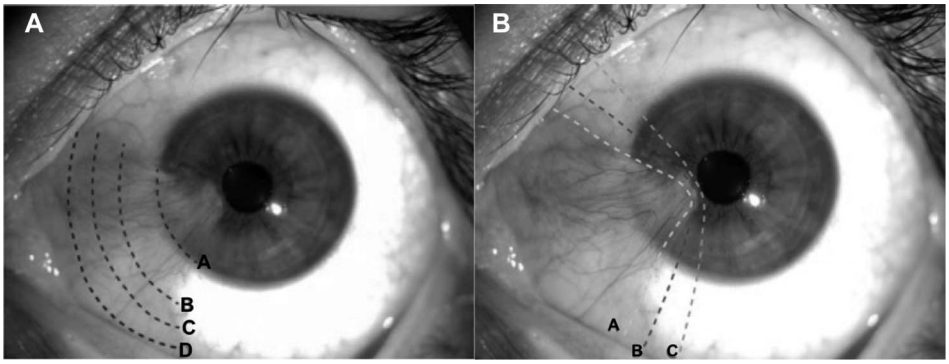

FIGURE 1. A, Resection areas. A, Resection up to the limbus. B, Minimal resection of head and conjunctiva. C, Extensive head and conjunctival resection including the base. D, Extensive resection up to the caruncle. B, Tenon capsule removal. A, Minimum. B, Intermediate. C, Extensive.

limit resection up to the limbus (letter A) (Fig. 1A). For Tenon capsule removal, 22.1% do a minimal resection (letter A), 60.8% do an intermediate resection (letter B), and 17.1% of the participants do an extensive resection (letter C). (Fig. 1B).

Conjunctiva Replacement (Nonexclusive Answers)

Autologous conjunctival and limbal-conjunctival grafts were the 2 most commonly used methods for conjunctival replacement; 69.3% of the respondents reported using conjunctival autografts and 28.6% limbal-conjunctival autografts. In a lesser proportion, 23.6% of the participants use amniotic membrane for replacement. In addition, a reduced number of specialists reported using other techniques, such as simple conjunctiva closure, bare sclera, lamellar cornea/sclera, and buccal mucosa (Table 2). The analysis by subgroups (fellowship-trained vs. non–fellowship-trained ophthalmologists) showed that cornea or anterior segment fellowship-trained ophthalmologists use conjunctival autograft more frequently than those without fellowship training (72.7% vs. 16.6%, $P < 0.01$), whereas the latter use more often the bare sclera technique compared with the former (16.6% vs. 1.0%, $P = 0.019$). On the other hand, the comparison of these subgroups showed no significant difference in the use of limbal-conjunctival autograft (28.34% vs. 28.64%, $P = 0.745$) or amniotic membrane (23.53% vs. 25.0%, $P = 0.570$).

Some important differences were also found between North American participants and Latin American and Caribbean participants regarding conjunctiva replacement. Our results suggest that conjunctival autograft is used more in North America than in Latin America and the Caribbean (74.0% vs. 38.1%, $P = 0.002$), as well as amniotic membrane (26.6% vs. 4.7%, $P = 0.019$), whereas limbal-conjunctival autograft is used more in Latin America and the Caribbean than in North America (66.6% vs. 23.7%, $P < 0.01$).

Graft Fixation (Nonexclusive Answers)

The fixation method most frequently used for grafts was tissue glue. Fibrin glue is used by 61.2% of the respondents and biologic adhesives by 2.0% (serum or blood). Sutures are also used: interrupted nylon sutures are used by 24.5%, continuous nylon sutures by 4.6%, interrupted vicryl sutures by 34.7%, and continuous vicryl sutures by 4.1% of the specialists. A combination of glue and sutures is used by 17.4% of the ophthalmologists. No one reported using electrocautery for graft fixation. As for world region, fibrin glue or biologic adhesive use is more frequent in Asia (70%) and North America (63.3%), whereas combined suture and tissue adhesive is more common in North America (22.9%).

Intraoperative Adjuvants (Nonexclusive Answers)

More than half of the participants do not use any adjuvant intraoperative medication (51.7%). The 2 substances most used as adjuvants are corticosteroids (31.7%) and MMC (20.6%). Antifibrotics (5.0%) and VEGF inhibitors (0.5%) are almost never used according to this survey, and

TABLE 2. Technique Used for Pterygium Surgery

Variable	No. (%)
Tissue removed surgically (n = 199)	
Resection up to the limbus	14 (7)
Minimal resection of head and conjunctiva	46 (23.1)
Extensive head and conjunctival resection including base	106 (53.3)
Extensive resection up to the caruncle	33 (16.6)
Tenon capsule resected (n = 199)	
Minimum	44 (22.1)
Intermediate	121 (60.8)
Extensive	34 (17.1)
Conjunctival replacement (more than 1 option) (n = 199)	
Simple conjunctival closure	8 (4)
Bare sclera	4 (2)
Conjunctival autograft	138 (69.3)
Limbal-conjunctival autograft	57 (28.6)
Buccal mucosa	1 (0.5)
Amniotic membrane	47 (23.6)
Lamellar corneal/scleral transplants	4 (2)
Graft attachment (more than 1 option) (n = 196)	
Fibrin glue	120 (61.2)
Nylon sutures interrupted	48 (24.5)
Nylon sutures continuous	9 (4.6)
Vicryl sutures interrupted	68 (34.7)
Vicryl sutures continuous	8 (4.1)
Biologic adhesives	4 (2)
Combined sutures and tissue adhesive	34 (17.4)

the use of 5-FU and interferon alfa 2b (0.0%) were not mentioned.

(Postoperative Treatment (Nonexclusive Answers)

Corticosteroids are used after surgery by 99% of the participants, and the preferred agents are prednisolone acetate (68.3%) and dexamethasone (19.6%). "Soft" steroids are also used, but less frequently. Fluorometholone is prescribed by 3.5% and loteprednol by 3.5% of the participants. The antiinflammatory treatment duration was variable among respondents: 22.6% use it for less than a month, 43.7% for 1 to 2 months, 25.6% for 2 to 3 months, and 8.0% for more than 3 months; 91.9% answered that they tapered steroids. Antibiotics are also commonly used; 86.9% of the respondents reported postoperative antibiotic use. Only a minority of the respondents use other treatments, such as nonsteroidal antiinflammatory agents (8.5%) and cyclosporine A (1.5%).

Recurrences: Rates and Early Treatment

For recurrence prevention (n = 188), 93.6% of the respondents advise their patients to wear UV-blocking sunglasses at all times when outside, 48.4% recommend wearing brimmed headwear for protection from sun exposure, and 52.6% routinely recommend frequent use of artificial tears.

The estimated recurrence rate reported by the participants (n = 181) was as follows: 33.7% estimated a rate less than 1%, 51.4% between 1% and 5%, 14.4% between 5% and 15%, and 0.5% above 15% (Fig. 2). As for timing of recurrence, 21.4% occurs during the first 3 months after surgery, 41.0% from 3 to 5 months, 21.9% from 6 to 12 months, and 15.7% after 12 months. Of 174 participants, 67.8% do not use any method for preventing early recurrence. Among those employing any method, the agent of preference was MMC, reported by 27.6%. Other methods such as VEGF inhibitors, 5-FU, and beta irradiation are used in 4.0%, 1.7%, and 1.7% of the cases, respectively. When early recurrence occurs, 77.7% of the respondents prefer corticosteroid treatment, whereas 21.8% proceed with additional surgery. Other treatments such as cyclosporine A, VEGF inhibitors, and antifibrotic agents were used by approximately 7% of the participants for each agent.

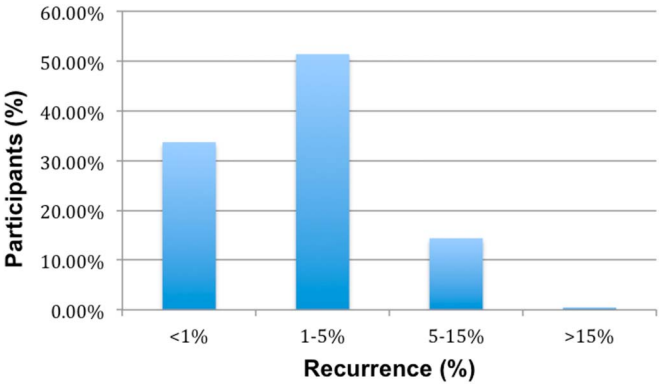

FIGURE 2. Estimated recurrence rate reported by the participants (n = 181).

TABLE 3. Pterygium Surgery Technique by Experience Doing Pterygium Surgery

	Time Doing Pterygium Surgery		
	<10 yrs	≥10 yrs	
	N = 82	N = 117	
Variable	No (%)	No (%)	*P*
Tissue removed surgically			
Resection up to the limbus/minimal resection of the head and conjunctiva	27 (32.9)	33 (28.2)	0.095
Extensive head and conjunctival resection including the base	47 (57.3)	59 (50.4)	
Extensive resection up to the caruncle	8 (9.8)	25 (21.4)	
Tenon capsule resected			
Minimum	10 (12.2)	34 (29.1)	0.003
Intermediate	61 (74.4)	60 (51.3)	
Extensive	11 (14.4)	23 (19.6)	
Conjunctival replacement			
Simple conjunctival closure	2 (2.4)	6 (5.1)	0.474
Bare sclera	0 (0)	4 (3.4)	0.145
Conjunctival autograft	63 (76.8)	75 (64.1)	0.062
Limbal-conjunctival autograft	18 (22)	39 (33.3)	0.111
Buccal mucosa	0 (0)	1 (0.9)	1.000
Amniotic membrane	24 (29.3)	23 (19.7)	0.129
Lamellar corneal/scleral transplants	0 (0)	4 (3.4)	0.145
Graft attachment*			
Fibrin glue or biologic adhesives	57 (70.4)	66 (57.4)	0.064
Nylon or vicryl sutures	40 (49.4)	75 (65.2)	0.027

*Missing values for graft attachment: 1 for time doing pterygium surgery <10 years; 2 for time doing pterygium surgery ≥10 years.

Comparisons by Length of Experience with Pterygium Surgery

The comparison of ophthalmologists who have been performing pterygium surgery for fewer than 10 years with those performing surgeries for more than 10 years showed differences regarding the amount of Tenon capsule resected ($P = 0.003$), graft attachment with nylon or vicryl sutures ($P = 0.027$), postoperative antibiotics used ($P = 0.044$), and corticosteroid tapering ($P = 0.014$) (Tables 3 and 4). No statistically significant differences were found regarding indications for surgery, use of adjuvant therapy, type and duration of postoperative therapy, and treatment of early recurrences.

DISCUSSION

Pterygium surgery is one of the most frequently performed ocular surgeries.[2] It would therefore be optimal to have clear management guidelines. The reality, however, is that they vary broadly. In this respect, the present study reflects the practice preferences of contemporary cornea experts.

The ideal surgical technique for pterygium resection has been widely debated. Multiple techniques have been proposed with significant variations among them in terms of recurrence rate, required surgical time, and patient comfort. This

TABLE 4. Intraoperative and Postoperative Adjunctive Pharmacological Therapy for Pterygium Surgery by Experience Doing Pterygium Surgery

	Time Doing Pterygium Surgery		
	<10 yrs	≥10 yrs	
	N = 82	N = 117	
Variable	No (%)	No (%)	*P*
Intraoperative adjunctive pharmacological therapy, more than 1 option*			
Corticosteroids	22 (27.2)	42 (35.6)	0.211
Mitomycin C	18 (22.2)	24 (20.3)	0.749
VEGF inhibitors	1 (1.2)	0 (0)	0.407
Antifibrotics	3 (3.7)	7 (5.9)	0.480
None of the above	46 (56.8)	58 (49.2)	0.289
Postoperative adjunctive pharmacological therapy, more than 1 option			
Corticosteroids	81 (98.8)	116 (99.2)	0.800
Nonsteroidal antiinflammatory agents	5 (6.1)	12 (10.3)	0.302
Cyclosporine A	1 (1.2)	2 (1.7)	1.000
Antibiotics	76 (92.7)	97 (82.9)	0.044
Corticosteroid of choice			
Prednisolone acetate	57 (69.5)	79 (67.5)	0.766
Dexamethasone or other	25 (30.5)	38 (32.5)	
Antiinflammatory regimen duration			
<1 mo	14 (17.1)	31 (26.5)	0.264
1–2 mo	37 (45.1)	50 (42.7)	
≥3 mo	31 (37.8)	36 (30.8)	
Corticosteroid taper*	80 (97.6)	102 (87.9)	0.014

*Missing values for intraoperative adjunctive pharmacological therapy: 3 for time doing pterygium surgery <10 years; 1 for time doing pterygium surgery ≥10 years. For corticosteroid taper: 1 for time doing pterygium surgery ≥10 years.

survey demonstrates that the current ophthalmologists' preference continues to be complete pterygium removal including its base accompanied by a moderate Tenon capsule resection.

Among the described techniques, the 2 techniques most supported by the literature are the autologous limbal-conjunctival graft technique, for achieving the lowest recurrence rates; and the technique that combines bare sclera with antimetabolites for acceptable recurrence rates, shorter surgical time, and no need of a graft.[3,4,18–20]

This survey found that the preferred techniques of cornea specialists are autologous conjunctival and limbal-conjunctival grafts and that the bare sclera technique is used only by a minority. On the other hand, more than half of the participants do not use adjuvant intraoperative medication. Of those that do use them, one fifth of the respondents reported using MMC. Nevertheless, according to the literature, although MMC is associated with lower recurrence rates it is also associated with multiple complications.[31]

Differences between subgroups of specialists with or without fellowship training regarding conjunctival replacement were significant only for 2 techniques. Conjunctival autograft was used more frequently by those with that kind of training, whereas the bare sclera technique was used more often by those without that training. This may be explained by a more rigorous following of the literature by fellowship-trained ophthalmologists.

Noteworthy, despite the scientific evidence against the use of amniotic membrane as compared with conjunctival or limbal-conjunctival grafts,[32,33] almost one fourth of the participants reported using it as conjunctiva replacement for primary pterygium surgery. Although this may be suitable in selected cases with no viable conjunctiva or when conjunctiva must be saved for future surgeries, usually the percentage of primary pterygium patients with these characteristics does not justify a proportion of specialists using amniotic membrane as high as mentioned above. Thus, even when healthy and viable conjunctiva exists, some ophthalmologists prefer the use of amniotic membrane despite its higher recurrence rate.

The most frequently preferred graft fixation method in this survey was fibrin glue, used by more than half of the respondents. This result is understandable considering that most respondents were from the United States, where fibrin glue is widely available and affordable.

Regarding postoperative treatment, the preferred agents were by far corticosteroids. In this respect, 2 issues must be discussed: the type of steroid used and the duration of treatment. The survey demonstrated that most respondents use potent steroids such as prednisolone or dexamethasone, and usually for more than 1 month. Only a few specialists use soft steroids that are well known to have an excellent antiinflammatory potency and less adverse effects compared with potent steroids.[34,35]

The recurrence rate estimated by most ophthalmologists in this survey was lower than 5%, which is very low in comparison with the rates found in the literature. The low recurrence rates reported in this survey may be due to the experience and expertise of the participants, but they also could be attributable to lack of follow-up for a year or possible cognitive bias, confirmation bias, self-serving bias, and attribution bias. The reason is that in the question about recurrence rate, surgeons were asked to give a simple estimation according to their general perception, with no need of supporting their answer with a statistical analysis of their medical records.

In addition, our study shows that experts usually do not identify recurrences during the first 3 months after surgery. In contrast, the literature shows that 50% of recurrences occur during the first 120 days after surgery.[36]

The use of agents during the postoperative period to avoid and to treat early recurrence is not common among most participants, but when early recurrence occurs, corticosteroids are the preferred treatment according to this survey.

We found some statistically significant differences regarding the preferences of ophthalmologists with less than 10 years of surgery experience compared with those with more than 10 years of such experience. Surgeons with more experience remove less Tenon capsule, taper corticosteroids less often, and use less fibrin glue and more sutures for graft fixation than do less experienced ophthalmologists. On the other hand, no statistically significant differences were found regarding indications for surgery, use of adjuvant therapy, type and duration of postoperative therapy, and treatment of early recurrences.

Despite the valuable information that can be obtained from this study, it is essential to consider its limitations. Because it is an observational survey study, the results reflect the participants' preferred practice patterns, not the conclusions of a prospective comparative clinical trial. In addition, considering that the survey was distributed using the kera-net listserv and the response rate was only 15%, a potential selection bias may exist, given that the kera-net is more popular in North America, so the questionnaire was mostly answered by ophthalmologists from this region.

In conclusion, our study shows the current practice patterns of cornea specialists in the management of primary pterygium in different parts of the world. These results may be useful as a guide for ophthalmologists and may help to define the optimal management of pterygium according to the world region and the available resources.

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