

# A Survey of Surgical Techniques in Pterygium, Thailand 2016

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**Background:** Pterygium causes a significant ocular disturbance which usually requires surgical removal; however, recurrence of pterygium after surgery frustrates both patients and surgeons. This survey aimed to determine the current surgical approaches in primary and recurrent pterygium, and the ideal surgical techniques among Thai ophthalmologists.

**Methods:** Questionnaires were sent to 1150 ophthalmologists who are members of Royal College of Ophthalmologists of Thailand (RCOPT). A survey was conducted between 21 September and December 21, 2016.

**Results:** 438 of 515 responded questionnaires were valid. The highest number of the respondents applied the bare sclera technique (BST) (37.4%) and conjunctival autograft transplantation (CAGT, 44.9%) in primary pterygium and recurrent pterygium, respectively. The recurrence was the most reported late postoperative complication. An ideal technique for primary pterygium surgery was CAGT (42.4%), whereas amniotic membrane transplant (AMT) with adjuvant therapy (27.4%) was most selected for recurrent pterygium. Around half of the respondents currently applied the ideal techniques in their practice. The inaccessible and unaffordable amniotic membranes or fibrin glues (58%) concerning about complications (26%), inexperience in surgical procedures (25%), large number of patients in the surgery waiting list, prolonged surgical time, and need for conjunctiva preservation in glaucoma patients were reported as the obstacles to the ideal techniques.

**Conclusions:** BST and CAGT were the most selected surgical techniques for primary and recurrent pterygium, respectively. Better provision and distribution of amniotic membranes and fibrin glue along with training courses would promote the ideal surgical techniques.

**Key Words:** bare sclera, pterygium, pterygium surgery, recurrent pterygium, pterygium excision

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## BACKGROUND

Pterygium is a common external ocular surface disease characterized by wing-shaped fibrovascular overgrowth of conjunctiva onto the cornea causing significant ocular irritation, inflammation, and corneal astigmatism. The risk factors of pterygium are ultraviolet exposure, geographical latitude, outdoor activity, dry eye, genetic predisposition, increasing age, male sex, races, and low educational level.<sup>1,2</sup> Thailand is situated in the pterygium belt, between 37° north and south latitude, which exposes to high ultraviolet intensity and the national occupation is mainly agricultural. Therefore, pterygium is commonly found in Thailand which causes significant ocular disturbance that eventually leads to surgical excision. However, there is a variation in surgical techniques and the recurrence rate. Moreover, there are new surgical techniques that facilitate the ease of surgery and the surgical outcome,<sup>3</sup> for example the use of AMT<sup>4–6</sup> fibrin glue<sup>7–9</sup> and Pterygium Extended Removal Followed by Extended Conjunctival Transplant (P.E.R.F.E.C.T.)<sup>10</sup>

This survey is to evaluate the most preferred surgical techniques, how significant the number of new surgical techniques currently used is, the ideal surgical technique, and to find out the obstacles to the ideal surgical technique for both primary and recurrent pterygium among Thai ophthalmologists.

## METHODS

This descriptive cross-sectional study was conducted between September 21 and December 21, 2016, using SurveyMonkey, an online questionnaire and data collection platform. The participants were Thai ophthalmologists who were members of the RCOPT.

The sample size of the survey was calculated using the formula  $n = p(100-p)Z^2/E^2$  with  $p = 23\%$ , 95% level of confidence, 5% margin of error resulted in the number of 272 samples.

The emailed questionnaires were sent out via RCOPT Express (admin@rcopt.org) to 1150 RCOPT members. The study was approved by King Chulalongkorn Memorial Hospital (KCMH) research committee (IRB Approval number 241/59) and was conducted in strict adherence to the tenets of the Declaration of Helsinki, the Belmont Report, and CIOMS Guideline. The online survey tool was conducted confidentially and anonymously, therefore the researcher could not identify the specific participant.

## RESULTS

512 of 1150 questionnaires were collected (44.5%). 44 questionnaires were incomplete, 30 questionnaires were invalid and excluded. Therefore, 438 completed questionnaires (38.1%) were used for analysis.

TABLE 1. Demographic Data

	n = 438 (%)
Sex	
Male	176 (40.2)
Female	262 (59.8)
Age, y	
26–30	45 (10.3)
31–35	151 (34.5)
36–40	91 (20.8)
41–45	97 (22.1)
>45	54 (12.3)
Job position	
General ophthalmologists	269 (61.4)
Cornea specialists	61 (13.9)
Other specialists	108 (24.7)
Work experience	
1 mo–5 y	169 (38.6)
6–10 y	103 (23.5)
11–15 y	96 (21.9)
16–20 y	33 (7.5)
>20 y	37 (8.4)
Region	
Central	205 (46.8)
Northeast	90 (20.5)
Northern	67 (15.3)
Eastern	30 (6.8)
Western	23 (5.3)
Southern	23 (5.3)

### Demographic Data

From 438 participants, 262 were females (59.8%), and 176 were males (40.2%). The majority of respondents were in 31- to 35-year age group, accounting for 34.5% of all respondents. General ophthalmologists were the major respondent in this study (61.4%). The corneal specialist accounted for 13.9%. Most of the respondents (46.8%) lived in a central region of Thailand (Table 1).

### Surgical Techniques

For primary pterygium, 164 respondents (37.4%) reported that BST was the most preferred technique, followed by CAGT from 149 respondents (34%) and pterygium excision with AMT (26.3%). Most of the respondents (87.4%) did not use the adjuvant therapies in primary pterygium (Table 2).

For recurrence pterygium, 197 respondents (44.9%) preferred CAGT and 184 respondents (42%) preferred pterygium excision with AMT. Adjuvant therapies were used by 40.9% of respondents (Table 2).

For BST, a total of 164 respondents choose BST for primary pterygium, 121 of 164 respondents were general ophthalmologists (74%), 39 were noncornea specialists (23%), and 5 were cornea specialists (3%), about the same percentage was also found in 45 respondents choosing BST for recurrent pterygium.

53% of respondents preferred nonabsorbable suture for graft attachment. Only 3.2% of respondents used fibrin glue.

### Postoperative Topical Steroid

50% of respondents prescribed topical steroid eye drops for 4 to 8 weeks postoperatively.

### Complications

No complication was reported in 38.6% of the respondents but 28.8% experienced excessive bleeding (Table 3).

TABLE 2. Surgical Techniques

	n = 438 (%)
Surgical technique used in primary pterygium	
BST	164 (37.4)
CAGT	149 (34.0)
AMT	115 (26.3)
P.E.R.F.E.C.T.	3 (0.7)
Simple conjunctiva closure	3 (0.7)
Other; decision on technique depends on patient's risk for recurrence (2), amniotic membrane availability/affordability (1), presence of glaucoma or not (1).	4 (0.9)
Adjuvant therapies used in primary pterygium	
None	383 (87.4)
Mitomycin C	33 (7.5)
Subconjunctival steroid injection	11 (2.5)
Beta irradiation	10 (2.3)
5-Fluorouracil	1 (0.2)
Surgical technique used in recurrence pterygium	
CAGT	197 (44.9)
AMT	184 (42.0)
BST	45 (10.3)
P.E.R.F.E.C.T.	4 (0.9)
Simple conjunctiva closure	2 (0.5)
Other; combined with MMC (1), CAGT on AMT (3), decision on technique depends on frequency of recurrence (2)	6 (1.4)
Adjuvant therapies used in recurrence pterygium	
None	256 (58.4)
Mitomycin C	134 (30.6)
Beta-irradiation	17 (3.9)
Subconjunctival steroid injection	14 (3.2)
5- fluorouracil	14 (3.2)
Other; refer to cornea specialist	3 (0.7)
Graft attachment (CAGT/AMT graft)	
Nonabsorbable suture	234 (53.4)
Absorbable suture	145 (33.1)
No graft (No CAGT/AMT)	41 (9.4)
Fibrin glue	14 (3.2)
Autologous blood	3 (0.7)
Other; combined with fibrin glue and non-absorbable suture (1)	1 (0.2)
Postoperative topical steroid	
1–2 wk	33 (7.5)
2–4 wk	93 (21.2)
4–8 wk	222 (50.7)
3 mo	78 (17.8)
4–6 mo	7 (1.6)
6–12 mo	1 (0.2)
Other; depending on surface inflammation (3), 2.5 mo (1)	4 (0.9)

AMT indicates pterygium excision with amniotic membrane transplant; BST, bare sclera technique; CAGT, pterygium excision with conjunctival autograft transplantation; MMC, mitomycin C; P.E.R.F.E.C.T., Pterygium Extended Removal Followed by Extended Conjunctival Transplant.

Recurrence was the most common early and late postoperative complication (22% and 76.5% respectively). Steroid-induced ocular hypertension (9.6%) was the second most common late postoperative complication. Other complications were listed in Table 3.

### Ideal Surgical Techniques and Obstacles

The ideal surgical techniques for primary pterygium were pterygium excision with graft, either CAGT (42.4%) or AMT (39%).

For recurrent pterygium, most of the respondents preferred AMT with adjunctive therapy (27.4%), followed by CAGT with adjunctive therapy (26.5%) as the ideal surgical technique.

TABLE 3. Complications

	n = 438 (%)
Intraoperative complications	
None	169 (38.6)
Intraoperative excessive bleeding	126 (28.8)
Incomplete pterygium tissue removal	56 (12.8)
Conjunctival tear	40 (9.1)
Misorientation of graft (AMT/CAGT)	32 (7.3)
Damage to medial rectus muscle	13 (3.0)
Perforation of cornea or sclera	2 (0.5)
Early postoperative complications (<3 mo)	
None	175 (40.0)
Recurrence	97 (22.1)
Pyogenic granuloma	47 (10.7)
Graft loss	44 (10.0)
Persistent epithelial defect	24 (5.5)
Graft melting	23 (5.3)
Suture breakage	23 (5.3)
Other; dry eye (3), chronic inflammation (2)	5 (1.1)
Late postoperative complications (>3 mo)	
Recurrence	335 (76.5)
Steroid-induced ocular hypertension	42 (9.6)
Corneal/scleral thinning	25 (5.7)
None	24 (5.5)
Inclusion cyst	8 (1.8)
Infectious scleritis	2 (0.5)
Other; dry eye (2)	2 (0.5)

AMT indicates pterygium excision with amniotic membrane transplant;  
CAGT, pterygium excision with conjunctival autograft transplantation.

Most of the respondents (65.3%) wished to use mitomycin C as the adjunctive therapy; however, 121 respondents (27.6%) preferred not to use adjunctive therapy.

The ideal techniques which are currently used in clinical practice for primary pterygium and recurrence pterygium were reported by 53.9% and 45.7% of respondents, respectively (Table 4).

The inaccessible and unaffordable amniotic membranes or fibrin glues were most reported as the obstacles to the ideal techniques in both primary and recurrent pterygium surgery (52.4% and 62.3% respectively, average 58%). Concerning about complications (average 26%), lack of experience in surgical procedures (average 25%), large number of patients in the surgery waiting list, prolonged surgical time, and need for conjunctiva preservation in glaucoma patients were also reported (Table 4).

## DISCUSSION

There are many surgical techniques for pterygium which include BST, simple conjunctival closure, conjunctival flap, conjunctival or amniotic membrane grafting, and adjuvant therapy. Hirst et al<sup>11,12</sup> performed a survey in 1991 and 2001 which was 10 years after the first survey. Simple excision with conjunctival flap followed by bare sclera was most used for primary pterygium; simple excision with beta irradiation was most selected for recurrent pterygium. The second survey in 2001 showed that simple excision with conjunctival flap was still the most selected procedure; more alternative techniques such as mitomycin C application and conjunctival autograft were also reported. Recent studies showed that techniques like bare sclera and primary conjunctival closure are considered as inferior and

TABLE 4. Ideal Techniques and Obstacles

	n = 438 (%)
Surgical technique used in primary pterygium	
CAGT	186 (42.4)
AMT	171 (39.0)
BST	40 (9.1)
P.E.R.F.E.C.T	35 (8.0)
Simple conjunctiva closure	5 (1.1)
Other; CAGT on AMT (1)	1 (0.2)
Surgical technique used in recurrence pterygium	
AMT with adjuvant therapy	120 (27.4)
CAGT with adjuvant therapy	116 (26.5)
CAGT	70 (16.0)
AMT	60 (13.7)
P.E.R.F.E.C.T	44 (10.0)
Simple conjunctival closure	9 (2.1)
BST with adjunctive therapies	8 (1.8)
Simple conjunctival closure with adjunctive therapies	4 (0.9)
BST	3 (0.7)
Other; conjunctival flap (1), CAGT on AMT (1), depending on patient's affordability of the treatment cost (2)	4 (0.9)
Adjunctive therapies	
Mitomycin C	286 (65.3)
None	121 (27.6)
5-Fluorouracil	21 (4.8)
Beta-irradiation	5 (1.1)
Subconjunctival steroid injecton	3 (0.7)
Other; topical Bevacizumab (1), topical anti-VEGF (1)	2 (0.5)
Do you use ideal surgical technique in primary pterygium?	
Yes	236 (53.9)
No (If you choose NO, please provide reason) >1 answer is applicable	202 (46.1)
Inexperience in surgical procedure	39 (19.4)
Concerning about complication	30 (14.5)
The inaccessible amniotic membranes/fibrin glues	106 (52.4)
Other	27 (29.03)
Need for conjunctiva preservation in glaucoma patients	3 (11.1)
Large number of patients in the surgery waiting list, for surgery, long surgical time	4 (14.8)
High cost of treatment (AMT, fibrin glue)	7 (26)
Older patient	1 (3.7)
Other, no detail is given	12 (44.4)
Do you use ideal surgical technique in recurrent pterygium?	
Yes	200 (45.7)
No (If you choose NO, please provide reason) >1 answer is applicable	238 (54.3)
Inexperience in surgical procedure	68 (28.3)
Concerning about complication	83 (34.6)
The inaccessible amniotic membranes/fibrin glues	149 (62.3)
Other	43 (18.2)
Referral to cornea specialist	4 (9.3)
Large number of patients in the surgery waiting list, for surgery, long surgical time	2 (4.7)
Depending on no. and severity of recurrence	2 (4.7)
Other, no detail is given	35 (81.4)

AMT indicates pterygium excision with amniotic membrane transplant;  
CAGT, pterygium excision with conjunctival autograft transplantation.  
VEGF, vascular endothelial growth factor.

they yielded high rates of recurrence between 50% and 80%,<sup>13</sup> whereas pterygium excision with conjunctival or amniotic membrane graft has presented the acceptable recurrence rate between 5% to 20% and 36% respectively. New surgical techniques were also developed to minimize recurrence and complication.

However, the survey of pterygium surgery is very scarce. Another survey was conducted almost 10 years later by Chaidaroon et al.<sup>14</sup> Changing trends in surgical technique are expected, for example the beta irradiation becoming less popular and shifting toward grafting.

In 2010, Chaidaroon et al.<sup>14</sup> performed a questionnaire-based survey and received responses from 414 Thai ophthalmologists; 74.5% of the respondents were general ophthalmologists. The study found that 36% of the respondents used CAGT without adjunctive therapy in primary pterygium, whereas 93 respondents (23.3%) performed BST.

Kampitak and Bhornmata<sup>15</sup> reviewed 307 medical records of the patients who had pterygium excision at Thammasat University Hospital, Pathum Thani, province adjacent to northern Bangkok, from October 2010 to September 2013. They found that AMT technique (96.7%) was the most performed procedure. This review showed high percentage of AMT technique because Thammasat University Hospital was a medical school and residency training center which could provide amniotic membrane for both service and training.

Current studies showed different results from the latest survey by Chaidaroon et al.,<sup>14</sup> which showed that BST was the most selected procedure for primary pterygium (37%). The demographic data of the respondents between these 2 studies were comparable (Table 5). However, our survey showed that CAGT was still the second most preferred technique and received slightly different percentage from BST. We can conclude that the trend of surgical techniques for primary pterygium in Thailand has not changed much in previous 6 years. Techniques such as P.E.R.F.E.C.T. and AMT are less applied.

The ideal technique for primary pterygium was pterygium excision with graft (either conjunctiva or amniotic membrane graft) and 53.9% of respondents reported that they are currently using the ideal technique. Grafting requires longer surgical time

and more surgical skills; hence, grafting may not be considered in the setting of busy clinics with large number of patients in the surgery waiting list. On the contrary, fibrin glue can help shorten the surgical time in such environment, but it is expensive, unavailable in most hospitals, and also requires surgical experience. Furthermore, some physicians wish to preserve conjunctiva for future filtering surgery. We believe that these reasons explain why BST was most selected from our survey. Even in the recurrent pterygium, BST was still used in 10.3% of respondents, albeit only 0.7% of the respondents believing BST as the ideal technique for recurrent pterygium. P.E.R.F.E.C.T. was selected as the ideal technique from 8% and 10% of the respondents for primary and recurrent pterygium, respectively. This technique is a marked modification of the existing method of conjunctival autograft transplant described above,<sup>16</sup> which gave the lowest recurrent rate.<sup>3</sup> The low percentage of this technique may be due to the fact that this technique is new and still not recognized by ophthalmologists and residents.

For recurrent pterygium, most respondents (42%–44%) preferred pterygium excision with graft (either conjunctival or amniotic membrane graft) which is known to provide lower recurrence rate compared with BST. The majority (58.4%) of respondents do not use any adjuvant therapy; 30.6% use mitomycin C for recurrent pterygium. However, grafting with adjuvant therapy was mostly chosen as the ideal surgical technique. Up to 65.3% of respondents reported that they wished to use mitomycin C for recurrent pterygium surgery, but inexperience and concerns about complications were the main obstacles to the use of adjuvant therapy.

The complication in our study was comparable to the previous survey by Chaidaroon et al.<sup>14</sup> The most common intraoperative and postoperative complications were excessive bleeding and recurrence, respectively. Recurrence may be related to a preference of the BST.

To the best of our knowledge, this was the first survey of pterygium surgery that included primary and recurrent pterygium in Thailand along with the ideal surgical techniques. The number of participants was the greatest among previous reports.<sup>11,12,14,15</sup> This gave us the insights into the opinions and obstacles that Thai ophthalmologists encountered in pterygium surgery. We hope that this study can provide useful information on improving the quality of pterygium surgery in Thailand, decreasing pterygium recurrence, and also helping shape the training program and instruction course for Thai ophthalmologists. Techniques such as P.E.R.F.E.C.T., grafting, fibrin glue application along with the better distribution of amniotic membrane/glue should be promoted to facilitate the best surgical outcome.

The limitation of this study included the questionnaire-based nature of the survey; a sample size of 438 respondents not being able to reflect all 1150 Thai ophthalmologists. The type of pterygium and the age of patients were not mentioned; atrophic pterygium in a very elderly patient may be suitable for BST in some setting. Multiple and detailed questions took longer time to complete, resulting in a significant number of invalid or incomplete responses.

## CONCLUSIONS

BST and CAGT were the most preferred surgical techniques for primary and recurrent pterygium, respectively. Techniques such as P.E.R.F.E.C.T. and AMT were still less applied. The ideal

TABLE 5. Compared Demographic Data

	Current Study,	Chaidaroon
	S. 2016	et al, 2010
	% (n = 438)	% (n = 414)
Sex		
Male	40.2	53.1
Female	59.8	46.9
Age, y		
26–30	10.3	2
31–35	34.5	
36–40	20.8	
41–45	22.1	
>45	12.3	
31–50		66.2
51–60		24.6
Job position		
General ophthalmologists	61.4	74.5
Cornea specialists	13.9	
Other specialists	24.7	
Region		
Central	46.8	57.73
Northeast	20.5	11.11
Northern	15.3	17.87
Eastern	6.8	4.11
Western	5.3	
Southern	5.3	9.18

technique for primary pterygium was CAGT and that for recurrent pterygium was pterygium excision with graft (either conjunctiva or amniotic membrane graft) with adjuvant therapy. Around half of the surveyed ophthalmologists faced obstacles to the performance of an ideal surgical procedure for patients. The most frequently reported obstacle was the inaccessible amniotic membranes/fibrin glues. The recurrence of pterygium was still the major postoperative complication. To emphasize, both quality and quantity measures in pterygium surgery techniques and supplies are yet to be improved.

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### REFERENCES

- Ang M, Li X, Wong W, et al. Prevalence of and racial differences in pterygium: a multiethnic population study in Asians. *Ophthalmology*. 2012;119:1509–1515.
- Chen T, Ding L, Shan G, Ke L, Ma J, Zhong Y. Prevalence and racial differences in pterygium: a cross-sectional study in Han and Uyur adults in Xinjiang, China. *Invest Ophthalmol Vis Sci*. 2015;56:1109–1117.
- Janson BJ, Sikder S. Surgical management of pterygium. *Ocul Surf*. 2014;12:112–119.
- Ozer A, Yildirim N, Erol N, Yurdakul S. Long-term results of bare sclera, limbal-conjunctival autograft and amniotic membrane graft techniques in primary pterygium excisions. *Ophthalmologica*. 2009;223:269–273.
- Liang W, Li R, Deng X. Comparison of the efficacy of pterygium resection combined with conjunctival autograft versus pterygium resection combined with amniotic membrane transplantation. *Eye Sci*. 2012;27:102–105.
- Solomon A, Pires RT, Tseng SC. Amniotic membrane transplantation after extensive removal of primary and recurrent pterygia. *Ophthalmology*. 2001;108:449–460.
- Karalezli A, Kucukerdonmez C, Akova YA, Altan-Yaycioglu R, Borazan M. Fibrin glue versus sutures for conjunctival autografting in pterygium surgery: a prospective comparative study. *Br J Ophthalmol*. 2008;92:1206–1210.
- Ratnalingam V, Eu AL, Ng GL, Taharin R, John E. Fibrin adhesive is better than sutures in pterygium surgery. *Cornea*. 2010;29:485–489.
- Mahdy RA, Wagieh MM. Safety and efficacy of fibrin glue versus vicryl sutures in recurrent pterygium with amniotic membrane grafting. *Ophthalmic Res*. 2012;47:23–26.
- Hirst LW. Prospective study of primary pterygium surgery using pterygium extended removal followed by extended conjunctival transplantation. *Ophthalmology*. 2008;115:1663–1672.
- Sebban A, Hirst LW. Treatment of pterygia in Queensland. *Aust N Z J Ophthalmol*. 1991;19:123–127.
- Troutbeck R, Hirst L. Review of treatment of pterygium in Queensland: 10 years after a primary survey. *Clin Exp Ophthalmol*. 2001;29:286–290.
- Mohammed I. Treatment of pterygium. *Ann Afr Med*. 2011;10:197–203.
- Chaidaroon W, Thongkhao-Om M, Wiwatwongwana D, Wiwatwongwana A. A survey of pterygium surgery in Thailand 2010. *J Med Assoc Thai*. 2013;96:64–68.
- Kampitak K, Bhornmata A. The results of pterygium excision at Thammasat Hospital. *J Med Assoc Thai*. 2015;98:495–500.
- Hirst LW. Recurrence and complications after 1,000 surgeries using pterygium extended removal followed by extended conjunctival transplant. *Ophthalmology*. 2012;119:2205–2210.