

Research Article

Application of Sliding and Rotating Conjunctival Flap in Pterygium Surgery

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Keywords

- Pterygium
- Sliding and Rotating Conjunctival Flap
- Free Conjunctival Flap

Abstract

Purpose: To introduce and evaluate of Pterygium excision combined with the new Sliding and Rotating Conjunctival Flap techniques

Methods: This retrospective study is from Hainan Provincial Eye Hospital, Zhongshan Ophthalmic Center. The patients diagnosed Pterygium come from January 2021 to June 2022, were followed up for at least 12 months. Pterygium is classified and staged according to the grading system based on Stage, Vascularity, Conjunctive tissue thickness, and corneal tissue thickness. The patients underwent Pterygium excision combined with Sliding and Rotating Conjunctival Flap and compared with the Free Conjunctival Flap group. Compare the intraoperative surgery time, complications, and postoperative recurrence rate between the two groups, and compare the statistical differences between the two groups using t-tests or analysis of variance.

Results: There was no statistically significant difference in intraoperative and postoperative complications and recurrence rates between the two groups ($P < 0.05$). The SRCF group had a surgery time of 7.5 ± 1.12 (N=152) min, while the FCF group had a surgery time of 25.7 ± 5.4 (N=154). After T-test, the difference between the two groups was statistically significant ($P < 0.05$).

Conclusion: The combination of Pterygium excision and Sliding and Rotating Conjunctival Flap can reduce surgical time and trauma compared to Free Conjunctival Flap, and improve surgical efficiency.

INTRODUCTION

Pterygium is a fibrovascular degenerative disease of the conjunctiva, and is also one of the common ocular surface diseases worldwide. The incidence rate is high in the tropical and subtropical regions [1,2]. It has been found that many risk factors are related to the incidence of Pterygium, such as sunshine length, ultraviolet light, age, genetic factors, chronic inflammation, etc [3,4]. Early Pterygium can cause visual impairment, redness, foreign body sensation, or symptoms of dry eye due to reduced tear film stability in patients. In severe cases, excessive coverage of the Pterygium over the pupil area can cause blindness [5].

Early conservative treatment of Pterygium can reduce eye irritation symptoms by using eye surface lubricants, artificial

tears, etc. The only effective treatment for advanced Pterygium is surgical treatment. There are many surgical techniques for Pterygium, including primary conjunctival closure [6], conjunctival autograft [7], limbal-conjunctival autograft (LCAG) [8], conjunctival rotation, conjunctival flap and amniotic membrane transplantation. Simple resection with exposure of the sclera is a simple procedure with a high recurrence rate. At present, the main surgical method for Pterygium is also the gold standard, which is Pterygium excision combined with conjunctival autograft, because its recurrence rate is low. LCAG aims to restore the anatomical integrity of the corneal limbus, promote faster healing, and have a lower recurrence rate [9].

Conjunctival autograft and LACD requires a free conjunctival flap to be sutured to the exposed sclera, which will inevitably

cause significant damage to the ocular surface tissue and require more sutures. Postoperative patients have severe irritation symptoms and a longer recovery time. Exploring a simple and effective surgical method to reduce surgical time and postoperative complications is more necessary. It is particularly important for older patients, pre cataract surgery, and patients with lower risk factors for recurrence.

After excision of Pterygium, Sliding Flap [10], or Rotating conjunctival flap [11], transplantation and suturing can be performed in situ, which can also stimulate early inflammatory response and increase the chance of recurrence after surgery. Since January 2021 we combine sliding and rotating techniques to create a unique Sliding and Rotating Conjunctival Flap that slides and rotates the upper conjunctiva to the lower part, allowing for almost physiological suturing. This avoids suturing in the excision area of the Pterygium, reducing the recurrence chance. Compared with conjunctival autograft during the same period, a retrospective analysis was conducted to compare the surgical time, early postoperative irritation symptoms, postoperative complications, and recurrence rate. The advantages and disadvantages of Sliding and Rotating Conjunctival Flap technique were evaluated and are now reported as follows.

METHODS

Subjects

All patients come from January 2021 to June 2022, Hainan Provincial Eye Hospital, Zhongshan Ophthalmic Center were followed up for at least 12 months. All patients followed the Declaration of Helsinki and obtained approval from the Ethics Committee of Hainan Eye Hospital. The inclusion criteria were diagnosed as primary Pterygium, aged between 40 and 80 years old. The exclusion criteria include severe dry eye, blepharitis, and symblepharon caused by chemical and mechanical trauma. The exclusion criteria also include a history of glaucoma, cataracts, vitreoretinal surgery, and concomitant fundus and optic neuropathy. If bilateral surgery is performed, only the first surgical eye is selected as the observation object.

Classification of Pterygium

Pterygium is classified and staged according to the grading system based on Stage, Vascularity, Conjunctive tissue thickness, and corneal tissue thickness. This comparative study mainly focuses on the size and stage of Pterygium. Stage 1 refers to Pterygium invading the corneoscleral margin less than 1mm, Stage 2 invading 1-2 mm, Stage 3 invading 2-3 mm, and Stage 4 invading more than 3mm [12].

Surgical Technique

Inject 1:50 lidocaine and 1:100 000 adrenaline hydrochloride under the conjunctiva for local infiltration anesthesia of Pterygium (Figure 1A, 2A). Cut the bulbar conjunctiva along limbus and passively separate the proliferative vascular fibrous membrane tissue 4-5mm backward (Figure 1B, 2B). Separate the corneal epithelium about 1mm in front of the Pterygium head, detach the head from the corneal surface backwards, and cut it

back together with the Pterygium body. Burn the exposed surface of the sclera to stop bleeding (Figure 1C,2C,3A,4A).

Sliding and Rotating Conjunctival Flap

Above the exposed scleral surface, use corneal scissors to passively separate the upper conjunctiva as much as possible, in order to obtain sufficient downward sliding and rotating conjunctiva. Mark the virtual points A, B, C, and D as shown in the figure (Figure 3B), cut off the BCD area of the triangle (Figure 3B, Figure 1E, 2E), pull and merge point B and point C, and sew them together at limbus (Figure 1D, 2D, 3C). Suture 1-2 stitches between point BC and point D. This surgery shows the conjunctiva above AB sliding downwards and rotating to the limbus, so we named it the Sliding and Rotating Conjunctival Flap (Figure 1F, 2F, 3C).

Free Conjunctival Flap

Perform local infiltration anesthesia on the superior conjunctiva, inject the conjunctiva into a spherical protrusion, and take a 3×4mm² sized free conjunctival flap (Figure 4A). Suture the free conjunctival flap with 10/0 nylon suture at the exposed site of Pterygium excision, with the corneoscleral margin of the conjunctival flap opposite the corneoscleral margin located at the Pterygium excision site (Figure 4B).

Surgical time and complications

Record the surgical time, intraoperative conjunctival bleeding, conjunctival tears, and other complications. Record postoperative complications such as conjunctival granuloma, conjunctival cyst, conjunctival rupture, scleral exposure requiring reoperation, incomplete corneal epithelial healing, corneal ulcer, steroid induced glaucoma and symblepharon.

Recurrence of Pterygium

The criteria for recurrence of Pterygium are based on the postoperative grading system for Pterygium [13]. Grade 1 indicates that the appearance of the surgical site does not differ from the normal appearance; Grade 2 indicates that there are some small suprascleral blood vessels extending to the limbus of the cornea in the resection area, but they do not extend beyond the limbus of the cornea and there is no fibrous tissue; Grade 3 indicates that there is additional fibrous tissue in the excised area that does not invade the cornea; Grade 4 represents true recurrence, with fibrous vascular tissue invading the cornea.

Statistical analysis

Statistical analysis was performed using IBM SPSS statistics for Windows version 26.0 (IBM, USA). According to the nature of the different data, analysis of variance, t-test and chi square test were selected for the statistical analysis. P values of 0.05 or less were considered statistically significant.

RESULTS

152 cases were enrolled in the Free Conjunctive Flap FCF group, with a male to female ratio of 55:45 and an age of 61.8±15.1 years old (n=152). There were 154 cases in the Sliding and Rotating Conjunctive Flap group, with a male to female ratio

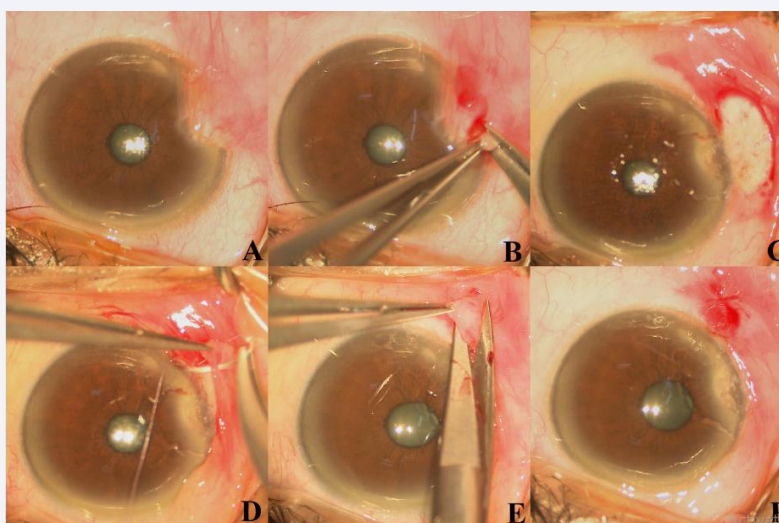


Figure 1 Intraoperative screenshots showing the process of Pterygium resection combined with sliding and rotating conjunctival flap surgery

A: Local infiltration anesthesia for Pterygium; B: Cut the bulbar conjunctiva along limbus and passively separate the proliferative vascular fibrous membrane tissue 4-5mm backward; C: Separate and detach the Pterygium head from the corneal surface backwards, and cut it back together with the Pterygium body and burn the exposed scleral surface; D: Suture the conjunctiva and limbal below with one stitch; E: Cut off excess conjunctiva; F: Suture the lower conjunctiva with 1 to 2 stitches.

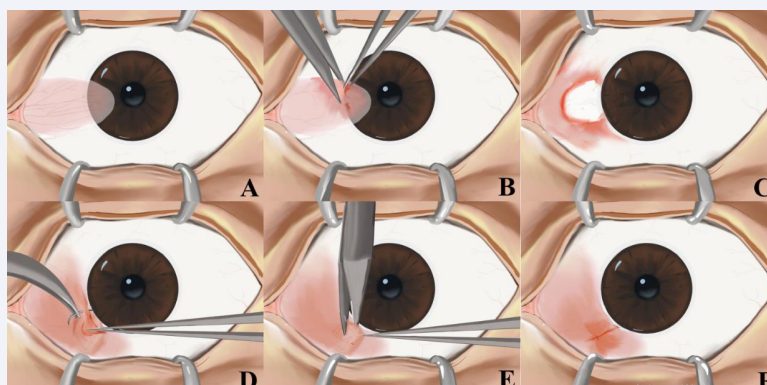


Figure 2 Schematic diagram of hand drawn Pterygium excision combined with sliding and rotating conjunctival flap surgery

A: Schematic diagram of Pterygium in the inner canthus of the eye; B: After local anesthesia, cut the conjunctiva along the limbal; C: Separate and cut the Pterygium and burn the exposed scleral surface; D: Suture the conjunctiva and limbal below with one stitch; E: Cut off excess conjunctiva; F: Suture the lower conjunctiva with one or two stitches.

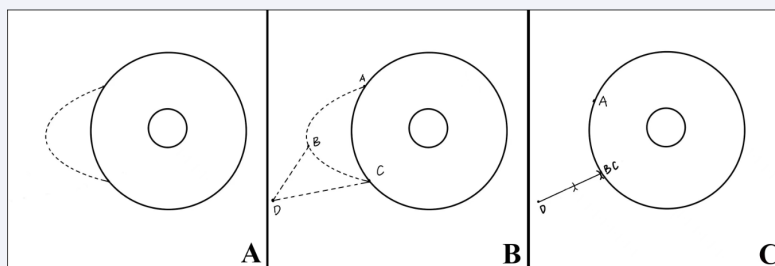


Figure 3 Hand drawn schematic lines diagram of sliding and rotating transitional flap

A: Schematic diagram of scleral exposure after Pterygium excision; B: Mark points A, B, and C at the edge of Pterygium excision, and mark a virtual point D next to it. Cut off the excess conjunctival tissue from the triangular BCD; C: Suture Limbal at points B and C of the conjunctival margin, and suture 1-2 stitches between points BC and D.

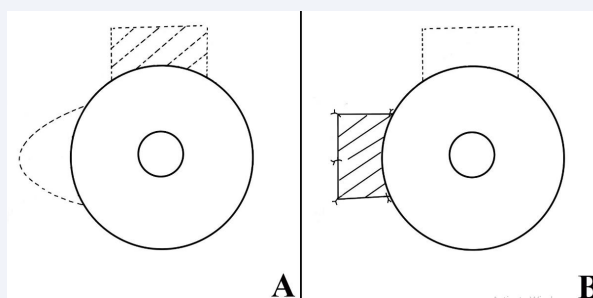


Figure 4 Hand drawn schematic line diagram of free conjunctival autograft flap

A: The schematic diagram shows that after infiltration anesthesia under the upper conjunctiva, the corresponding sized conjunctiva is taken based on the exposed surface of the sclera; B: Take a 3X4 mm² sized free conjunctival flap from above and suture it onto the exposed sclera.

of 55:43 and an age of 62.3±17.3 years old (n=154). There is no statistically significant difference in age and gender ratio the two groups. In the FCF group, there were 16, 35, 79, and 22 cases in Stage 1, 2, 3, and 4, respectively, and 18, 38, 81, and 17 cases in the SRCF group. The difference between the two groups was not statistically significant by chi square test (**Table 1**).

In the FCF group, there were 5 cases of conjunctival granuloma, 2 cases of conjunctival cyst, 1 case of conjunctival rupture, 1 case of scleral exposure requiring reoperation, and 2 cases of corneal ulcer, while in the SRCF group, there were 3 cases, 2 cases, 1 case, 1 case, and 0 case, respectively. According to the chi square test, the difference between the two groups was not statistically significant ($P>0.05$).

Comparison of recurrence of Pterygium

In the FCF group, 15 cases were lost to follow-up at 6 months and 28 cases were lost to follow-up at 12 months. In the SRCF group, there were 18 cases and 30 cases, respectively. The difference between the two groups was not statistically significant through chi square test. In the FCF group, there were 100 cases, 16 cases, 10 cases, and 8 cases of grade 1, grade 2, grade 3, and grade 4, respectively, at 6 months after surgery. In the SRCF group, there were 105 cases, 17 cases, 8 cases, and 6 cases, respectively. The chi square test showed that there was no statistically significant difference between the two groups ($P<0.05$).

In the FCF group, there were 81 cases, 17 cases, 12 cases, and 14 cases of grade 1, grade 2, grade 3, and grade 4 after 12 months of surgery, respectively. In the SRCF group, there were 80 cases, 19 cases, 12 cases, and 13 cases, respectively. The difference between the two groups was not statistically significant after chi square test ($P<0.05$) (**Table 2**).

DISCUSSION

Pterygium, as a common and frequently occurring disease in ophthalmology, surgical treatment is almost the only effective treatment measure. In order to prevent postoperative recurrence, significant progress has been made in the use of different surgical methods and the combination of different drugs. Simple excision

Table 1: Demographic Data and Clinical Characteristics Comparison

		FCF group	SRCF group		
Gender	Male	69	75	$X^2=0.952$	$P=0.521$
	Female	83	79		
Ages		61.8±15.1	62.3±17.3	$T=0.207$	$P=0.441$
Stages	1	16	18	$X^2=0.827$	$P=0.894$
	2	35	38		
	3	79	81		
	4	22	17		

Table 2: Comparison of recurrence of Pterygium

	Grade 1	Grade 2	Grade 3	Grade 4			
6 Months Postoperation	FCF group	100	16	11	10	$X^2=0.645$	$P=0.886$
	SRCF group	105	17	8	6		
12 Months Postoperation	FCF group	81	17	12	14	$X^2=0.154$	$P=0.985$
	SRCF group	80	19	12	13		

of Pterygium combined with exposure of the sclera is the earliest and most direct surgical method, but due to its high recurrence rate, it is currently less commonly used. The combination of Pterygium resection and conjunctival autograft has become the main surgical method and the gold standard for surgery due to its low recurrence rate [14]. There are reports that Pterygium resection combined with amniotic membrane transplantation and corneal limbal transplantation have a lower recurrence rate than autologous conjunctival transplantation, and have gradually been promoted and applied. The use of intraoperative medications such as MMC, 5-fluorouracil (5-FU), corticosteroids, and anti VEGF can also reduce the chance of recurrence [15].

As a relatively traditional surgery, there have been few reports on surgical improvements in recent years regarding Pterygium excision. In order to prevent the recurrence of Pterygium, PERFECT surgery with extended Pterygium excision and conjunctival transplantation has been introduced [16]. However, the scope of surgery is large and the difficulty of

surgery is high, which has not been widely promoted [17]. It is particularly urgent to explore a simple, efficient, and minimally invasive surgery for patients with fewer chances of recurrence, older adults, early-stage cataract surgery, and those who require conjunctival protection for glaucoma surgery.

The combination of Pterygium resection and sliding and rotating conjunctival flap, which we provide, has the following advantages. Firstly, the surgery is greatly simplified and the surgical time is shortened. From our research, we found that SRCF can save about 70.8% of surgical time and improve surgical efficiency compared to traditional FCF. Secondly, sliding and rotating the conjunctiva from above is sutured to the scleral wound, achieving the effect of conjunctival auto-graft. Finally, the biggest advantage is that the transposed conjunctiva is sutured with one stitch at limbal and one or two stitches at lower conjunctiva, while there are no stitches on the exposed surface of the sclera, which reduces early postoperative inflammatory stimulation and greatly reduces the chance of recurrence. Due to the limited amount of sutures, the use of a combination bandage contact mirror can result in lower postoperative pain and other stimuli, reducing the patient's recovery time.

One of the shortcomings of this study is that it is a retrospective study rather than a prospective randomized controlled study. Surgical procedures are not performed by one person, and there is a certain degree of difference between SRCF and FCF surgeons. But this study provides a new surgical option, saving a lot of surgical time and reducing postoperative recovery time. If a multicenter randomized prospective study can be conducted to compare the postoperative recurrence rate, the results will be more reliable, providing more sufficient evidence for further promoting this surgical method.

In summary, the combination of Pterygium resection and SRCF can greatly shorten surgical time, improve surgical efficiency, and reduce postoperative recovery time, providing a new option for Pterygium surgery.

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HIGHLIGHTS

- The excision of pterygium combined with sliding and rotating conjunctival flaps is a novel surgical approach.
- The use of sliding and rotating conjunctival flaps can reduce surgical trauma, shorten surgical time, improve surgical efficiency, and shorten postoperative recovery time.
- The combination of pterygium resection and sliding rotating conjunctival flap does not increase the recurrence rate after surgery compared to conjunctival autograft.

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