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Minimally invasive pterygium surgery: A new approach for prevention of recurrence

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PURPOSE. *To introduce a novel approach for pterygium excision, to report recurrence rates, and to compare with conjunctival autografting.*
DESIGN. *A comparative, prospective clinical case series design was used.*
METHODS. *The study population consisted of 155 patients with unilateral primary or recurrent pterygia. All patients underwent pterygium excision, either by conventional conjunctival autografting (Group A) or by the minimally invasive pterygium excision (MIPE) technique (Group B). The new technique involves making a limbal incision of the conjunctiva through the body of pterygium, removing the head of the pterygium by blunt dissection, keeping the adjacent Tenon capsule intact, and performing a small conjunctival autograft to cover the epithelial defect. The recurrence rate of each technique was compared statistically.*
RESULTS. *There were 84 patients in Group A and 71 patients in Group B. The recurrence rates were 18% at 1 year after surgery in the conjunctival autografting technique and 4.2% in the MIPE technique. The MIPE technique had significantly lower recurrence rates compared with conjunctival autografting technique ($p<0.0001$).*
CONCLUSIONS. *The MIPE technique had lower recurrence rate and fewer postoperative complications than the conjunctival autografting technique. Preserving the Tenon capsule and minimizing conjunctival excision in pterygium surgery does not appear to increase the recurrence rate in the 1-year period. However, the effectiveness of this technique in preventing recurrences needs to be proven with more than 1-year results, which we plan to report in the future. (Eur J Ophthalmol 2008; 18: 27-31)*

KEY WORDS. *Pterygium, Surgical treatment, Recurrence*

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INTRODUCTION

Recurrence after pterygium excision remains a major challenge, as evidenced by the existence of multiple surgical methods that have evolved over the years to deal with this problem (1). Adjunctive therapies designed to reduce recurrences include application of antimetabolites, radiotherapy, conjunctival or limbal conjunctival autograft, and amniotic membrane graft (1-5), but there is no established effective technique without significant side effects. We have also made efforts to prevent recurrence of pterygia in our institution. In performing other pterygium excision techniques we have observed the following: 1) When the head of the pterygium is transected from its conjunctival body at the limbus, the bulbar conjunctiva appears to be on stretch and retracts to a normal semilunar position approximately 4 mm posterior to the limbus. 2) The underlying Tenon capsule and its insertion to the sclera appears morphologically normal. 3) Large conjunctival excisions are associated with increased healing and scarring response. The limbal stem cell hypothesis of pterygium formation implies that the conjunctiva grows on to the cornea due to the loss of limbal stem cell barrier function (6, 7). Armed with the above observations and limbal stem

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cell hypothesis we designed a novel approach to pterygium surgery which preserves Tenon capsule, minimizes conjunctival excision, and employs a small conjunctival autograft. Due to the conservative nature of this technique we named it minimally invasive pterygium excision (MIPE). We performed a prospective comparative case series between MIPE and the conjunctival autografting technique.

MATERIALS AND METHODS

Patients presenting with primary and recurrent pterygia were recruited and underwent pterygium excision either using conjunctival autografting technique without adjunctive therapy (Group A) or MIPE technique (Group B). Informed consent was obtained from all patients, and all procedures were approved by the Institutional Ethics and Human Investigations Research Committee of our institution.

Patients with a history of keratoconus, corneal trauma, corneal scarring, ocular surgery, or contact lens wear were excluded. Pterygium size was taken into account as part of the randomization process to exclude its possible effect on recurrence. All patients had a nasal pterygium ≤4 mm in length. We achieved symmetry among pterygium sizes and localizations in our randomization of patients to different surgical techniques. There were 84 patients in Group A and 71 patients in Group B who returned for 1-year follow-up. Only the analysis of these 155 patients is included in this report. Each technique was performed under topical anesthesia between January 2004 and February 2006. In the conjunctival autografting method, the excision was initiated with a sharp dissection on the head of the pterygium with forceps and blade which was carried towards the limbus.

Once the head of the pterygium was liberated, Westcott scissors were used to excise Tenon and conjunctiva of the body of the pterygium and performing a conjunctival autograft from the ipsilateral superior conjunctiva to cover the nasal bulbar conjunctival epithelial defect. The MIPE surgery involves transecting the head of the pterygium from its body by making a circumlinear limbal incision, removing the head of pterygium by blunt dissection, keeping the underlying Tenon capsule intact, and performing a small conjunctival autograft from the ipsilateral superior conjunctiva to cover the nasal bulbar conjunctival epithelial defect.

All procedures were performed by three different surgeons using the same technique. After surgery all patients in Groups A and B wore an eye patch for 24 hours and were medicated with antibiotic eyedrops (0.3% ciprofloxacin, Alcon Corp.) for 1 week and corticosteroid eyedrops (0.1% fluorometholone, Alcon Corp.) four times daily for 1 month. In Groups A and B, the sutures were removed after 10 days to 1 month. All patients were examined at 1 day, 1 week, 1 month, 2 months, 3 months, 6 months, and 1 year postoperatively with slit-lamp biomicroscopy for determining the presence or absence of recurrence and other complications. Recurrence of pterygium was considered to be present when the fibrovascular tissue invaded beyond the limbus.

Student *t* and χ^2 tests were used to compare the baseline characteristics of the patients in each group as well as the rate of recurrences. Statistical significance was accepted for p=0.05.

RESULTS

There were 84 patients in Group A and 58% were male. There were 71 patients in Group B and 60.5% were male. The mean age of the patients was 40.32±14.17 in Group A and 43.69±15.25 year in Group B. The preoperative diagnoses of the patients in Group A were 21 (25%) recurrent and 63 (75%) primary pterygia, and in Group B 17 (23.9%) recurrent and 54 (76.1%) primary pterygia (Tab. I). There was no significant difference with respect to age, gender, and preoperative diagnoses between Groups A and B (p=0.307, 0.563, 0.652, respectively).

In Group A, 15 of the 84 (18%) patients who returned for 1-year follow-up had evidence of recurrence. In Group B, 3 of the 71 (4.2%) patients who returned for 1-year follow-up had evidence of recurrence. There was a statistically significant difference between Groups A and B with respect to recurrence rate at 1 year (p<0.001). Eight of the 21 (38%) patients in Group A with preoperative diagnosis of recurrent pterygia had a recurrence at 1 year. Two of 17 (11.8%) patients in Group B with preoperative diagnosis of recurrent pterygia had a recurrence at 1 year. There was a statistically significant difference in the recurrence rate between Groups A and B with respect to treatment of recurrent pterygia (p=0.012).

Conjunctival scarring was the most common complication, occurring in 5 of 84 patients (6%) in Group A and 2 of 71 (2.8%) patients in Group B. Conjunctival granulo-

TABLE I - DEMOGRAPHIC DATA OF PATIENTS UNDERGOING PTERYGIUM SURGERY

	Group A (CA)	Group B (MIPE)
No. of eyes (patients)	84	71
Gender (patients), n (%)		
Male	49 (58)	43 (60.5)
Female	35 (42)	28 (39.5)
Age, yr, mean ± SD	40.32±14.17	43.69±15.25
Preoperative diagnosis, n (%)		
Primary	63 (75)	54 (76)
Recurrent	21 (25)	17 (24)

CA = Conjunctival autografting; MIPE = Minimally invasive pterygium surgery

mas occurred in 3 of 84 (3%) patients in Group A and 0 patients in Group B. There was no significant difference between Groups A and B with respect to postoperative complications (p=0.67).

DISCUSSION

Recurrence of pterygium has been and continues to be the major complication following pterygium excision (1). Recurrences typically occur within the first year, and frequently, recurrent pterygia tend to be more aggressive then primary pterygia (8). Many surgical techniques and adjunctive therapies for pterygium excision have evolved over the years, mainly to deal with recurrence (9, 10). Intraoperative adjunctive therapies include use of antimetabolites such as thiotepa, 5-fluorouracil, mitomycin C, and radiotherapy with strontium-90 (10-12). More recently conjunctival, limbal conjunctival, or amniotic membrane grafting have been used as alternative to or in conjunction with the preceding adjunctive treatments with good success, reducing recurrence rates to less than or equal to 10% (1, 2, 13, 14).

The conjunctival autografting method, whereby the head and the conjunctival body of the pterygium along with the underlying Tenon capsule are excised and a conjunctival autograft from the ipsilateral superior conjunctiva to cover the defect is performed, has been the mainstay of the sur-

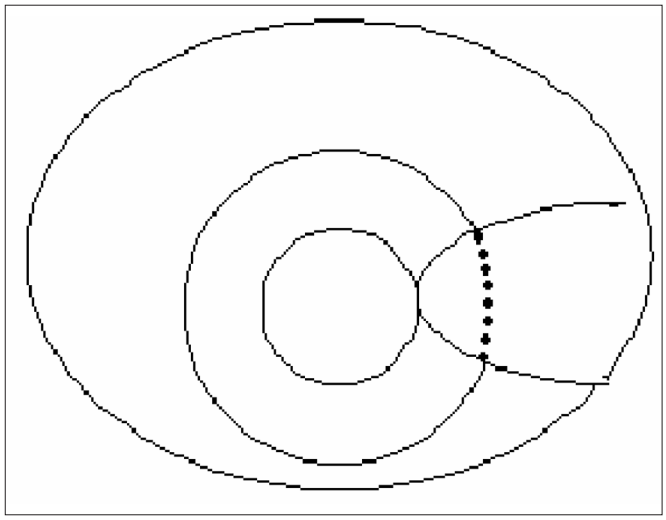

Fig. 1 - *Initial limbal incision (dotted line) which transects the head from the body of pterygium.*

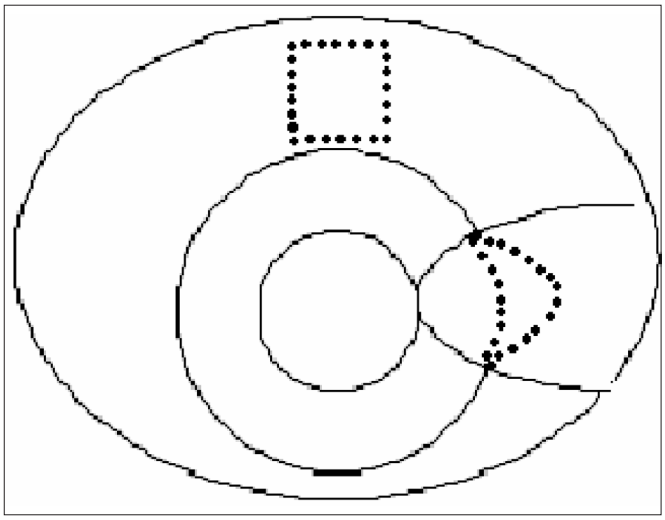

Fig. 2 - *Curved dotted line at 3 o'clock outlines location, shape, and relative size of the defect created by the limbal incision and subsequent conjunctival retraction. The superior square dotted line outlines the location and relative size of the conjunctival autograft.*

gical excision. Conventionally, a large excision of the pterygium body and a large conjunctival autograft has been recommended because of the possible remains of pathologic tissue at the edges of the pterygium incision. Tenon capsulectomy under the body of the pterygium is also performed because it is thought that Tenon fascia contributes to the pathogenesis of the pterygium by providing fibrotic tissue. However, in our previous primary pterygia excisions we have noted frequently that the conjunctiva and the Tenon capsule frequently appear morphologically normal.

Histologic studies have shown multiplication and degeneration of elastic and collagenous fibers and inflammatory changes in the body of the pterygium (15).

Additionally, we have clinically noted that large conjunctival defects created by pterygia excisions are associated with more aggressive healing response as compared to smaller conjunctival defects. Therefore, we believe aggressive healing responses associated with large conjunctival defects contribute to recurrences of the pterygia.

Taking the preceding factors into account, we have established the goals of pterygium surgery as 1) removing the ectopic conjunctival tissue from the corneal surface, 2) reestablishing the limbal barrier function by allowing the healthy superior and inferior limbal stem cells to repopulate the limbus, 3) minimizing or eliminating excision of conjunctiva from the body of the pterygium and preserving the Tenon capsule, and 4) performing small conjunctival autografting to cover the epithelial defect. The technique described in Methods satisfies these goals. It was named minimally invasive pterygium surgery because it preserves conjunctiva and Tenon capsule, and eliminates cautery.

It should be emphasized that only the conjunctiva that has invaded the corneal surface, i.e., the head of the pterygium, is excised. To do this the surgeon grasps the adherent conjunctiva on the corneal surface and transects the conjunctiva at the limbus circumlinearly with scissors. Because the conjunctiva has been pulled on to the corneal surface, the conjunctiva retracts nasally, creating a semilunar conjunctival epithelial defect. No further conjunctival nor Tenon capsule excisions are made. Hemostasis is obtained by direct pressure, and cauterization techniques are not employed. The head of the pterygium is removed by blunt dissection to minimally disturb the Bowman membrane. A smooth limbal surface is necessary for limbal stem cells to slide from superior and inferior limbal arcade to repopulate the limbal epithelial defect. The goal is to establish limbal barrier function as reported by Tseng et al (6, 7). In the final step, a small free superior conjunctival autograft is sutured into the semilunar epithelial defect (Figs. 1, 2).

To our knowledge this is the first report in patients with primary and recurrent pterygia that advocates limiting the conjunctival excision and preserving Tenon capsule. Akura et al's 2001 report advocated limiting conjunctival excision but they performed Tenon capsulectomy, MMC application, and cautery, and they reported the results only from primary pterygium excisions (16).

We began performing this procedure in 2005 at Ataturk Training and Research Hospital in Izmir, Turkey, where cases of pterygia are seen in epidemic proportions due to abundance of sunshine. Three of 71 patients who underwent MIPE had recurrences at 1 year. Two of the three cases with recurrence had the preoperative diagnosis of recurrent pterygia. Of the 71 patients in Group B, there were 17 patients with preoperative diagnosis of recurrent pterygia, giving a 1-year recurrence rate of 2/17 (11.8%) among recurrent pterygia. Certainly, the recurrence rate of 4.2% in this series is comparable to recurrence rates in other studies of conjunctival autograft for pterygium excision which employ Tenon capsulectomy and large conjunctival excisions, with ranges from 2% to 39% (16-20). Therefore Tenon capsulectomy and large conjunctival excisions may not be necessary in prevention of recurrence in pterygia excisions.

There were 15 recurrences in Group B, giving a recurrence rate of 15/84 (18%). Of the 15 recurrences, 8 patients had the preoperative diagnosis of recurrent pterygia. Of the 84 patients in Group A, there were total of 21 patients with preoperative diagnosis of recurrent pterygia, giving a 1-year recurrence rate of 8/21 (38%). It is not surprising that MIPE technique has significantly lower recurrence rate than the conventional conjunctival autografting technique. The difference can be explained by the fact that MIPE is an operation that respects the physiology of the ocular surface.

There were some limitations of our study. The effectiveness of this technique in preventing recurrences needs to be proven with more than 1-year recurrence rate; however, in our experience 1 year data are a good predictor of the future recurrence rate as most of the recurrences occur in a 1-year period. Conjunctival autograft can be technically difficult; therefore, some surgeons may prefer miniflap closure as described by Akura et al (16) or amniotic membrane grafting. We believe that it is important to au-

tograft the conjunctival epithelial defect to provide healthy conjunctiva adjacent to the limbus.

In summary, the MIPE technique had lower recurrence rate than the conjunctival autografting technique. Preserving the Tenon capsule in pterygia excisions does not appear to increase the recurrence rate in a 1-year period. However, the effectiveness of this technique in preventing recurrences needs to be proven with more than 1 year recurrence rate, which we plan to report in the future.

Proprietary interest: None.

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