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Early postoperative outcomes of pterygium surgery: Sutures versus autogenous serum in-situ fixation of limbal conjunctival autograft

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ABSTRACT

Limbal Conjunctival Autograft Transplantation (LCAT) is considered to be the most effective treatment option for pterygium with the least recurrence rate and rapid restoration of normal epithelial morphology. Of the many available methods for securing Limbal Conjunctival Autograft (LCAG), sutures and autogenous serum in-situ are cost-effective and offers better outcomes.

Aim: To compare the outcome of surgeries between the two groups: Group I - LCAG secured with autogenous serum in-situ versus Group II - LCAG secured with sutures.

Main methods: A prospective randomized control trial conducted on 60 patients who were equally divided into two groups. Post-operative follow-up visits were scheduled at 1st week, 3rd week and 6th week. They were examined for pain, foreign body sensation, subconjunctival hemorrhage, tearing, hyperemia, graft edema, graft displacement, graft retraction, recurrence and/or any other complications and were graded depending on the severity. Mean surgical time was compared between the two groups.

Key findings: Average duration of surgery was significantly less in Group I than in Group II. Postoperatively, symptoms like pain, foreign body sensation, tearing and hyperemia were less common in Group I, furthermore subconjunctival hemorrhage and graft edema were more in Group II.

Significance: Though both the procedures are safe and effective, the use of autogenous serum in-situ significantly shortens the duration of surgery and is accompanied by lesser postoperative discomfort and inflammation. However, long-term studies are needed to assess the risk of recurrence. Graft displacement remains a severe, but infrequent complication.

1. Introduction

Pterygium (meaning a wing) is a degenerative disorder essentially characterized by triangular fibrovascular encroachment of the bulbar conjunctiva on to the cornea and is a common disorder of the eye in many parts of world, described as ophthalmic enigma [1]. It is associated with several environmental factors such as ultraviolet radiation, geography, heat, dust, and a dry climate [2–4]. Though surgical removal is the treatment of choice [5], conservative treatment like artificial tears, over the counter vasoconstrictor drops and steroid drops are being used in the early stages, as recurrences after pterygia excision are frequent and aggressive. There is a plethora of surgical and medical measures currently available for the management of pterygium, with no consensus regarding the 'ideal' treatment. Conjunctival autografting (CAG) has become the standard operative treatment of choice for both primary and recurrent pterygium as it offers excellent results with respect to cosmetic, recurrence and complication rates [6].

Currently, LCAT is the most popular surgical procedure, as inclusion of the limbal stem cells act as a barrier to the conjunctival cells migrating onto the corneal surface [7]. The most common method of LCAT is by using sutures, which requires expertise and is associated with certain disadvantages such as increased operating time, infections, postoperative discomfort, inflammation, conjunctivitis, scarring, and granuloma formation [8,9]. To address these complications, new method of conjunctival autograft with suture-less and glue-free autogenous serum in-situ technique has been developed. Autogenous serum

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acts as a coagulum-in-situ, activating the coagulation cascade and eventually leading to fibrin polymerization [10]. This mechanism induces tissue adhesion of CAG to bare sclera [11,12].

To our knowledge, there are few reports about LCAT with autogenous serum in-situ, in Indian population. It is a challenge to treat the pterygium in patients from rural India because of the increased prevalence due to geographical location being closer to the equator suggesting the impact of UV light [3,13], as well as high grade of the pterygium due to their occupation and lifestyle of people [14,15]. A higher grade is being recognized as a risk factor for recurrence [16]. Ti et al. reported that there was a definite increased trend in postoperative complications such as recurrence in patients with high grade pterygium operated by LCAT with sutures [17]. In addition, our hospital has been performing LCAT with sutures for a long time and has documented several complications such as recurrence, graft displacement, infection and granuloma formation. Hence, we tried to reduce the recurrence rate as well as graft related complications by utilizing autogenous serum instead of sutures. Therefore, the purpose of this study was to evaluate the surgical outcomes (early post-operative outcomes) of autogenous serum in-situ as compared to sutures for attaching the LCAG during pterygium surgery.

2. Material and methods

2.1. Study design and participants

The prospective interventional, randomized control trial study was undertaken on 60 patients with primary pterygium who attended the Out-patient Department at Chigateri General Hospital and Bapuji Hospital attached to J.J.M. Medical College, Davangere from November 2012 to September 2014. The study was approved by Institutional Review Board/Institutional ethics committee (IRB/IEB) of J.J.M. Medical College, Davangere. An informed and written consent was obtained from all the participants.

Patients with Primary pterygium, (male and female patients) aged 20 to 60 years were included in the study. However, patients with Pseudo-pterygium, associated ocular surface problems and history of any bleeding abnormalities were excluded. Patients underwent comprehensive ophthalmic examination including history of previous medications and surgery. Visual acuity was tested on the Snellen's chart. Slit-lamp examination was done in all patients and grading of the pterygium was done based on its size (extent of encroachment on to the cornea, span of pterygium at the limbus), thickness and vascularity as described in Table 1 [18–20]. Systemic evaluation of all patients was done in consultation with a physician along with relevant investigations like blood sugar, clotting time, bleeding time, etc. Elective surgery was planned, and patients were divided into two groups, the first group included patients who underwent pterygium excision with limbal conjunctival autograft (LCAG) secured with autogenous serum in-situ (Group I) and the second group included patients who underwent pterygium excision with limbal conjunctival autograft (LCAG) secured with sutures (Group II).

2.2. Surgical technique

The procedure was performed under peribulbar anesthesia and involved avulsion of the head of the pterygium from its corneal attachment by reverse stripping. The donor tissue was a supero-temporal conjunctival graft, 1–2 mm larger than the size of the bare sclera. The tissue was harvested from the same eye, following which it was dissected and excised including limbal stem cells. In Group I (30 patients), hemostasis was allowed to occur spontaneously, diligently avoiding cautery. Autogenous fibrin rich serum was allowed to glue the graft to the scleral bed and the bed was viewed through the transparent conjunctiva to ensure that the residual bleeding did not lift the graft following which, the free graft was allowed to dry in position for 10 min. In Group II (30 patients), the graft was secured to the host bed by 10–0 Nylon sutures. The various steps of surgical procedure have been illustrated in Fig. 1. The donor site was allowed to heal leaving it bare in both the groups. Post-operatively, both the groups received subconjunctival injection of corticosteroid and antibiotic.

2.3. Follow up

Initial examination was done on the first postoperative day and subsequent follow up visits were at 1st week, 3rd week and 6th week. Sutures were extruded by about 4 weeks. Graft success was defined as an intact graft by the 4th week after surgery and graft failure was defined as absence of graft by the 4th week.

2.4. Main outcome measures

Subjective sensation of pain, foreign body sensation and tearing were analyzed using a 5-point scale adapted from Lim-Bon-Siong and coworkers [21]; SCH, hyperemia, graft retraction & displacement adapted from Srinivasan et al. [22]; graft edema adapted from Yuksel et al. [23].

2.5. Statistical analysis

All data are expressed as means ± SEM. Statistical analyses were performed using one-way analysis of variance (ANOVA) followed by an appropriate post hoc test such as Tukey's method ($p < 0.05$ was considered to indicate statistical significance). All statistical analyses were performed using the Prism-V software (La Jolla, CA, USA).

3. Results

A total of 60 patients (37 female patients, 23 male patients; age range 21–73 years) were included in whom excision of primary pterygium was carried out. Females accepted the surgery earlier than males, probably because they were concerned about aesthetics. Patients were randomized equally between the two groups, of whom 18 (60%) female patients and 12 (40%) male patients were in Group I (LCAT secured with autogenous serum in-situ), while 19 (63.33%) female patients and 11 (36.67%) male patients were in Group II (LCAT secured with

Table 1
Classification of primary pterygium based on Tan's, Kanski's grading and spanning at limbus.

Name	Grade	Description
Tan's grading	T1	(Atrophic) Denotes a pterygium in which episcleral vessels underlying the body of the pterygium are not obscured and are clearly distinguished
	T2	(Intermediate) Denotes a pterygium in which the episcleral vessel details are indistinctly seen or partially obscured
	T3	(Fleshy) Denotes a thick pterygium in which episcleral vessels underlying the body of the pterygium are totally obscured by fibrovascular tissue
Kanski's grading	1	0–2 mm from limbus
	2	2–4 mm from limbus
	3	> 4 mm from limbus
Span at Limbus	WB	Wide base (≥ 5 mm)
	NB	Narrow base (< 5 mm)

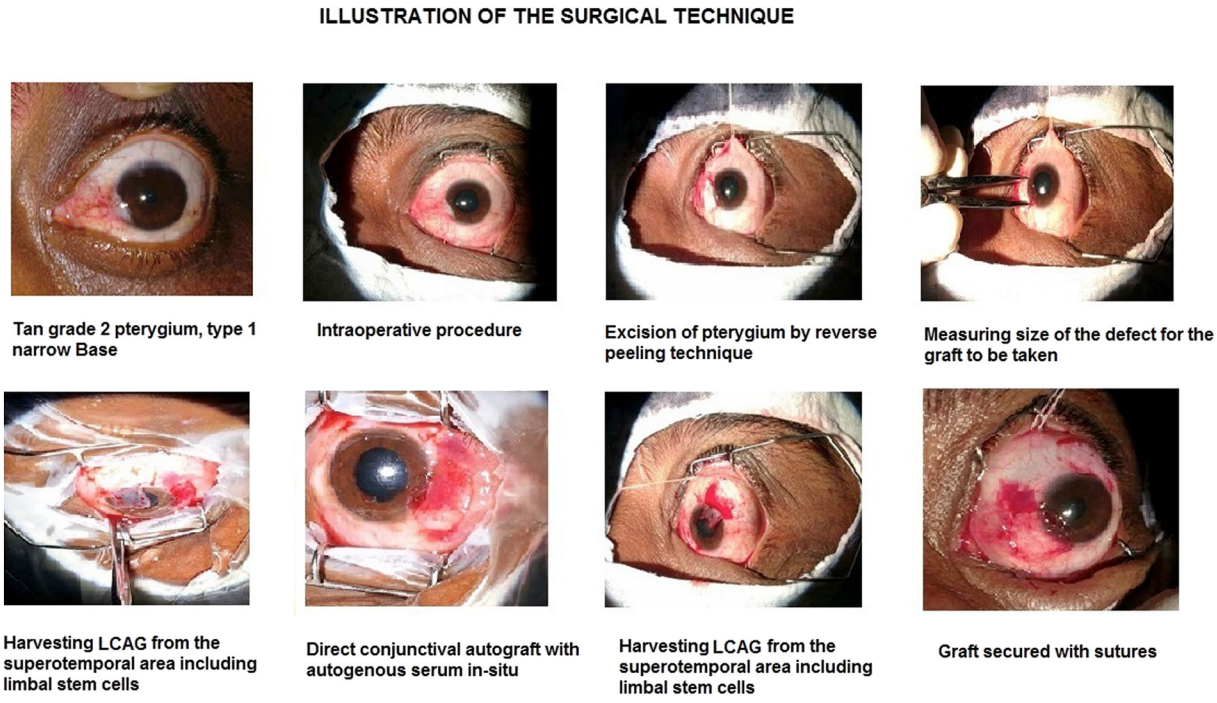

Fig. 1. Stepwise illustration of the surgery involving direct conjunctival autograft with autogenous serum in-situ and graft secured with sutures.

Table 2
Demographic characteristics of follow-up of 60 cases of operated pterygium in both the groups.

Demographic characteristics	Group I	Group II	$N = 30$; p value
Age in years (mean ± SD)	46.63 ± 2.340	47.03 ± 2.467	NS
Sex ratio (male:female)	1.400 ± 0.09097	1.367 ± 0.08949	NS
Laterality	1.800 ± 0.1390	1.767 ± 0.1567	NS
Duration of surgery (mins)	18.33 ± 0.5956	26.87 ± 1.133	****$p < 0.0001$
Mean graft size (mm^2)	24.80 ± 0.5083	25.65 ± 0.7795	NS
Kanski grading of pterygium	1.900 ± 0.1208	2.033 ± 0.1396	NS
Tan grading of pterygium	2.233 ± 0.1240	2.033 ± 0.1312	NS
Span at limbus	1.200 ± 0.07428	1.100 ± 0.05571	NS

sutures). The surgical procedure was technically successful in most cases. However, there were two patients from Group I, in whom the graft was found to be displaced irretrievably on post-operative day 1 and hence were excluded from further study. Mean operating time in Group I was 18 min and in Group II was 26.87 min which was found to be statistically significant (***$p < 0.001$). Prolonged duration in Group II was evidently due to time taken for suturing the graft. The demographic characteristics between the two groups have been illustrated in Table 2.

3.1. Comparison of grades of pain between patients in both the groups during the follow-up period

During the period of follow-up, it was observed that mild to moderate degree of pain (Grade 2 &/or 3) was present in both the groups but subsided early in Group I and persisted longer in Group II. There was no significant difference in the degree of pain between the groups on 1st day postoperatively. The degree of pain was significantly more in Group II at 1 week ($p < 0.001$), 3 weeks ($p < 0.01$) and 6 weeks ($p < 0.001$) postoperatively in comparison to Group I (Fig. 2A).

3.2. Comparison of grades of foreign body sensation between patients in both the groups during the follow-up period

During the period of follow-up (post-op day 1, week 1, week 3 & week 6), foreign body sensation was significantly more in Group II when compared to Group I ($p < 0.001$). This is evidently due to the foreign material (Nylon) used for suturing. At one week follow up, one patient with grade 4 foreign body sensation in Group II forced us to remove the sutures on the 5th post-operative day and the foreign body sensation promptly subsided. At post-operative week 6, almost all patients had grade 1 foreign body sensation in Group I and grade 2 in Group II. This was attributed to the loosening and extrusion of sutures over a period (Fig. 2B).

3.3. Comparison of grades of tearing between patients in both the groups during the follow-up period

Tearing was of the same grade (Grade 2 &/or 3) in both the groups on the 1st postoperative day. Group II had more severe grade of tearing than Group I, which was statistically significant during week 1 ($p < 0.001$), week 3 ($p < 0.01$), week 6 ($p < 0.05$) post operatively (Fig. 2C).

3.4. Comparison of grades of subconjunctival hemorrhage (SCH) between patients in both the groups during the follow-up period

During the period of follow-up period, the grades of subconjunctival hemorrhage were statistically significant in Group II when compared to Group I (post op day 1-$p < 0.01$ & week 1-$p < 0.01$). Furthermore, the grades of SCH was more in group II than in group I, in post op week 3 & week 6, however, there was no statistical difference between the

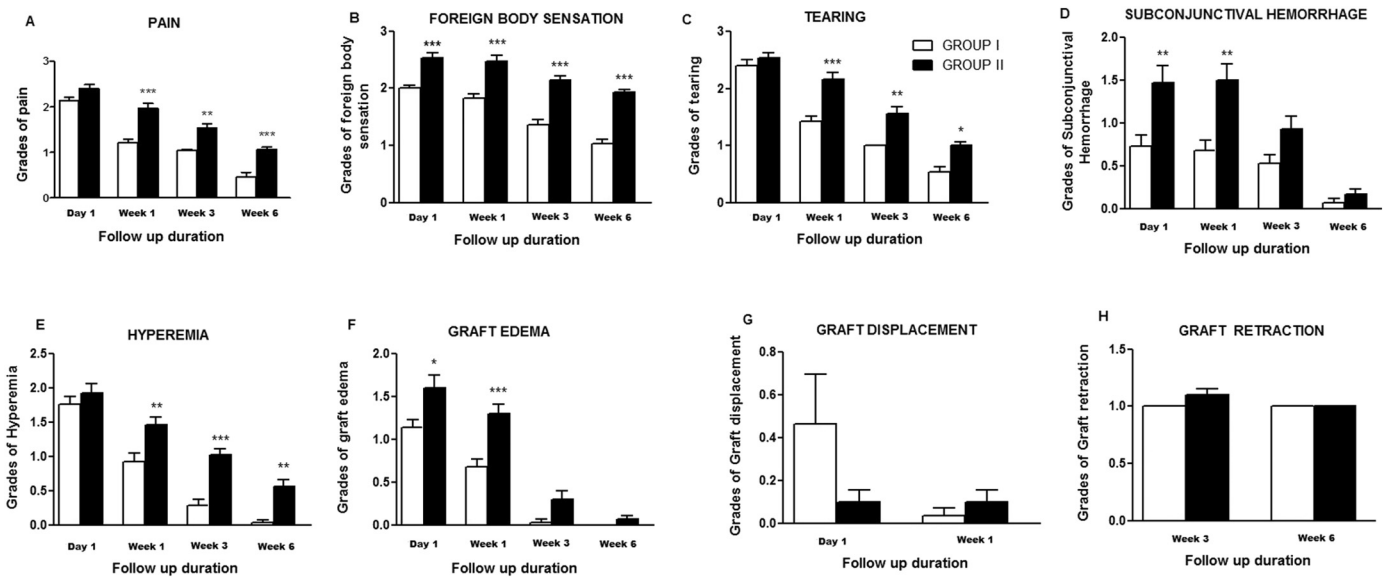

Fig. 2. Subjective sensation of pain (2A), foreign body sensation (2B), tearing (2C), SCH (2D), hyperemia (2E), graft edema (2F) between the two groups, post operatively on day 1, week 1, week 3 and week 6. Grading of graft retraction (2G) and graft displacement (2H) between the two groups, was assessed post operatively on day 1 and week 1 ($N = 30$ in each group, $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$).

two groups (Fig. 2D).

3.5. Comparison of grades of hyperemia between patients in both the groups during the follow-up period

There was no significant difference in the degree of hyperemia between the groups on 1st day postoperatively. The degree of hyperemia was more severe in Group II at 1 week ($p < 0.01$), 3 weeks ($p < 0.001$) and 6 weeks ($p < 0.01$) postoperatively and found to be statistically significant (Fig. 2E).

3.6. Comparison of grades of graft edema between patients in both the groups during the follow-up period

Minimal amount of graft edema (Grade 1) was present in both the groups with it being statistically significant in group II on post-op day 1 ($p < 0.05$) and post-op week 1 ($p < 0.001$), but by the end of 6 weeks graft edema subsided in both the groups (28 patients) and nearly no patient had graft edema in both the groups (Fig. 2F).

3.7. Comparison of grades of graft displacement and retraction between patients in both the groups during the follow-up period

On postoperative day 1, three patients in Group I had grade 4 graft displacement (one was repositioned under aseptic precautions, and in the other two cases the graft was found to be displaced irretrievably) and one patient of the same group had grade 2 graft displacement. Three patients of Group II had grade 1 graft displacement due to graft retraction at the first postoperative week. Subsequently all grafts were stable in both the groups. However, no statistical significance was seen between the groups (Fig. 2G and H).

4. Discussion

The main clinical considerations for the surgical treatment of pterygium are its effect on the patient's vision, recurrence rate and graft-related complications. CAG is considered the gold standard in the management of primary pterygium due to its reduced recurrence rate and fewer complications [24,25]. CAG using sutures require surgical expertise and are associated with high incidence of post-operative complications [17]. However, autogenous serum has been reported to be associated with better prognosis and hence we utilized the same in order to establish a more stable graft and reduce post-operative complications. We utilized standard questionnaires to evaluate the degree of postoperative symptoms and found that the patient's postoperative symptoms (pain, foreign body sensation and tearing) were less in autogenous serum group when compared to sutures groups, which is similar to existing literature [8]. We observed that autogenous serum cause significantly less pain than sutures as sutures are known to cause more postoperative pain and/or inflammation during its degradation [26]. Subjective symptoms of pain, foreign body sensation and tearing were fewer and disappeared more rapidly in patients without sutures as seen in a study conducted by Uy et al. [27]. The results of our study were also similar to the study done by Elwan, where he concluded significantly lower post-operative signs and symptoms including pain, Foreign body sensation, photophobia, hyperemia and chemosis at all visits in the first post-operative month as well as significantly higher overall patient satisfaction in suture-less compared to sutured autograft [28]. Sutures cause more conjunctival inflammation and Langerhans cell migration into the cornea, which predisposes to increased risk of pterygium recurrence [17,29].

Postoperative complaints and hyperemia were found to be more in patients with sutures and are in parallel to the existing literature [22,30,31]. However, in our study, postoperatively, there was no statistically significant difference between two groups in terms of graft edema, graft retraction and graft displacement. Specifically, the risk of graft retraction appears to be no greater without suturing if meticulous dissection of sub-epithelial graft tissue is respected as described by Tan [32]. Rupali et al., postulated that even tension across the whole of graft interface and no direct tension on free graft edges reduces the stimulus for subconjunctival scar tissue formation in suture-less and glue-free graft [33]. Although no obvious risk factors could be determined for graft-related complications in these cases, in general, excessive accumulation of blood as well as eye rubbing have been associated with graft displacement in cases with serum-assisted fixation of CAG [34].

The average duration of surgery was shorter in cases where autogenous serum in-situ was used compared to the cases where sutures were used to fix the graft. This is similar to the earlier reports in the literature which depicted increased operating time for suturing

[35–37]. In another study done by Choudhury et al., the duration of surgery was significantly less in those patients who underwent LCAT with patient's own serum in-situ than those who underwent LCAT with sutures, which are consistent to the findings in our study [8]. In summary, both the procedures (LCAT with autogenous serum in-situ and LCAT with sutures) are effective methods for adhesion of grafts during pterygium surgery. Allowing autogenous serum oozing out on the surface of scleral bed, to adhere the graft to the host bed can significantly shorten the operating time. The advantages of autogenous serum include ease of use, cost and shorter operative times. Additionally, our study inferred that CAG with autogenous serum in-situ is associated with less postoperative signs and symptoms in the immediate postoperative period. Although recurrences were not considered in this study because six-weeks observation period was too short a time in both the treatment groups, no definite conclusions can be made from our data regarding recurrence rates. More research with longer follow up period and larger population are required to add to the knowledge about both the techniques.

5. Conclusion

Our study has thrown light on the surgical outcomes in the early postoperative period of the most commonly performed graft fixation techniques of CAG. Pterygium excision with LCAG secured with autogenous serum in-situ is cost effective as it pre-empts the use of sutures and fibrin glue. Furthermore, surgery time and the postoperative complications are less with autogenous serum in-situ, hence patients will better accept the procedure of pterygium excision with limbal conjunctival autograft secured with autogenous serum in-situ. The findings from our study might complement the growing evidence of utilizing autogenous serum in-situ for pterygium surgery.

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