

COMPARISON OF AUTOBLOOD GRAFT FIXATION VS. CONJUNCTIVAL GRAFT FIXATION WITH POLYGLACTIN SUTURE IN PRIMARY PTERYGIUM SURGERY

Salil Kumar Mandal¹, Shubhankar Podder², Aparna Mandal³, Purban Ganguly⁴

¹Associate Professor, Department of Ophthalmology, Regional Institute of Ophthalmology, Medical College, Kolkata, West Bengal.

²General Duty Medical Officer, West Bengal Health Service, Islampur Superspeciality and State General Hospital, Islampur District, North Bengal, West Bengal.

³Associate Professor, Department of Physiology, College of Medicine and Sagore Dutta Hospital, Kolkata, West Bengal.

⁴Clinical Tutor / RMO, Department of Ophthalmology, Regional Institute of Ophthalmology, Medical College, Kolkata, West Bengal.

ABSTRACT

BACKGROUND

Pterygium is excessive sub-conjunctival proliferation of fibrovascular tissue or elastotic degeneration of tissue under the epithelium. Pterygium is seen nearly twice as often in men as in women. Ophthalmologists had a real challenge for successful management pterygium due to its high recurrence rate (2.1% to 87%). Pterygium is a local limbal cell deficiency. Pterygium recurrence can be reduced if the limbus and limited area of cornea are included in the conjunctival graft, as it is well recognized that limbal stem cells play a vital role in maintaining the ocular surface.

The objective of the study is to evaluate effectiveness and outcome of two surgical procedures for conjunctival autograft fixation- with autologous blood vs. polyglactin suture.

To evaluate the outcome of the two surgical technique in terms of surgical time, post-operative pain and discomfort, graft related complication, uptake of graft, recurrence.

MATERIALS AND METHODS

This was a prospective, comparative interventional, case series of 60 eyes over a period of three years. These 60 patients were divided into two group. In this study, in 30 eyes of the patients, pterygium excision with conjunctival autograft was secured with 8-0 polyglactin sutures and were allocated to group A. The remaining 30 eyes of the patients who underwent pterygium excision with conjunctival autograft were secured with auto blood and they were allocated to group-B.

RESULTS

In this study, mean age of the patient in group-A is 44.7 ± 8.2 and in group-B 47.8 ± 8.8 . Sex distribution in Gr-A- 50% were male and 50% were female. In Gr-A 67.7% were male and 32.3% female. Side of involvement- in gr-A right side involvement 76.7% and left side was 23.3%. Length of pterygium encroaching over cornea in mm (mean) S.D. 3.0 ± 0.40 in Gr-A (mean) S.D. 2.95 ± 0.59 in Gr-B. Vessel pattern in Gr-A. Thin vessel 33.3%, Tortuous vessels 30%, Vascular band 36.7%. In Gr-B thin vessel 43.7% Tortuous vessels 30.5%, Vascular band 26.3%. Operation time in Gr-A 37.3 ± 8.2 min and in Gr-B 17.5 ± 2.3 min. Average time difference was 19.8 min. Regarding graft fixation time- in Group A graft fixation time was fixed for 24 hours. In Group B graft fixation time was gradually decreased from 48 hours to 20 hours. In Graft related complication 20% in Gr-A 13.3% in Gr-B. In terms of recurrence 16.7% in Gr-A and 6.7% in Gr-B and p value $P < 0.05$ which was clinically significant. Relation in between recurrence & vessel pattern (vascular band). The risk of recurrence significantly increases when there in presence of vascular bands. The estimated risk is 1.5 with a 95% CI.

CONCLUSION

Conjunctival auto blood auto graft is superior to suturing procedure. It is a less invasive surgery than in suturing group. It has less post-operative inflammation. It has less graft related complications at the end of 6 months. It has less chance of recurrence on following up for a period of 6 months. It has early rehabilitation time. It is cost effective. It has good cosmetic effect because it has smooth operative surface area and has good cosmetic and functional outcome.

KEYWORDS

Pterygium, Conjunctival Graft, Cornea, Sclera.

HOW TO CITE THIS ARTICLE: Mandal SK, Podder S, Mandal A, et al. Comparison of auto blood graft fixation vs. conjunctival graft fixation with polyglactin suture in primary pterygium surgery. J. Evid. Based Med. Healthc. 2018; 5(42), 2932-2937. DOI: 10.18410/jebmh/2018/600

BACKGROUND

Pterygium is the sub-conjunctival elastotic degeneration of the tissue and simultaneous proliferation as vascularisation of the granulation tissue under the epithelium, which ultimately encroaches over the cornea. It is derived from the Greek word "pteron" meaning wing.

Pterygium is formed by excessive fibrovascular proliferation due to exposed ocular surface against increase light, dust, dryness, heat, and hot wind. The Pterygium occurs mostly around the world between the latitude 35° north and 35° south of equator. It is mostly seen in young

*Financial or Other, Competing Interest: None.
Submission 19-09-2018, Peer Review 22-09-2018,
Acceptance 06-10-2018, Published 09-10-2018.*

Corresponding Author:

Dr. Shubhankar Poddar,

#183, R. N. Guha Road, Dum Dum,

Calcutta- 700074, West Bengal.

E-mail: subhankar.podder@gmail.com

DOI: 10.18410/jebmh/2018/600



teen ager in the people of desert land. Ophthalmologist had a real challenge for successful management of Pterygium. High recurrence rate and sight threatening complication by different surgical procedure influence us to determine the newer, effective, and safer modalities of treatment.^{1,2,3,4,5,6,7,8}

The corneal limbal stem cell has definite role for the development of newer concept of pathogenesis of Pterygium. Development of Pterygium is due to limbal stem cell deficiency. Recurrence of pterygium is markedly reduced if the limbus and limited area of cornea are included in conjunctival graft also known that limbal stem cell play vital role in maintain the ocular surface. Limbal stem cells situated in the basal layers of the epithelium and function of the cells are regeneration of the tissue and cell replacement.

Apart from the triangular shape (often described as having a head, body and tail), pterygium is characterized by its location along the inter-palpebral fissure (along the horizontal axis of cornea, usually nasally but occasionally also temporally or both), which was considered an important indication of the role of environmental factors, such as solar light. Bilateral ocular involvement occurs in approximately 1/3 – ¼ of patients with pterygium. An advanced pterygium with greater involvement of cornea results in numerous fissures in the superficial lamella of the corneal stroma with degeneration of the elastic fibers and hyaline degeneration of the collagen fiber.^{9,10,11,12,13,14}

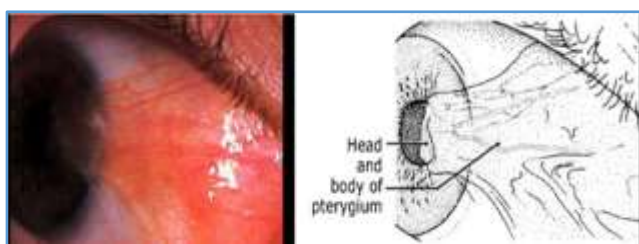


Figure 1

MATERIALS AND METHODS

This was a prospective, comparative interventional, case series of 60 eyes over a period of three years. The study was started from January 2012 in Regional Institute of Ophthalmology Medical College Calcutta, India. A well informed consent, explaining the purpose and potential risk of surgical intervention was taken from all the patients before the surgery. 60 patients divided into two group. After randomization, 30 eyes of the patients, pterygium excision with conjunctival autograft secured with polyglactin sutures were allocated in group A. The remaining 30 eyes of the patients underwent pterygium excision with conjunctival

autograft secured with auto blood and they were allocated in group B.

In this study inclusion criteria were age ranges from is 30 to 60 years, Type II pterygium extending up to 4mm clear cornea, Type II pterygium less than 2mm of clear cornea. Exclusion criteria are Type I pterygium less 2mm of clear cornea Type III pterygium with involvement of 4 mm of clear cornea. recurrent pterygium, Pseudo pterygium, Conjunctival cyst, Conjunctival mass, Pinguecula, Patient on anticoagulant therapy, Coagulation factor deficiency. All patients under this study were subjected to a thorough general and ocular examination.

Surgical Procedure

Group A- Under local anaesthesia with peribulbar block. The corneal epithelium of 2mm ahead of the head was scraped off by a no. 15 blade. A superficial delineating keratectomy at the leading edge was performed after tenting up the pterygium apex by a fine tooth forceps to obtain a superficial plane of dissection. The remainder of the pterygium head was carefully dissected from the superficial cornea in the lamellar fashion up to the limbus using crescent knife. Residual fibrosis tissue on the cornea was removed by sharp dissection with a no. 15 blade Then the pterygium mass was separated from the underlying sclera exposing the bare sclera. Then the fibro muscular mass was excised as much as possible thus exposing a crescentic 'bare-sclera' area. The limbal extent of the bare sclera area was measured with a Castroviejo's calipers. An area of conjunctiva at the superotemporal limbus, measuring 1mm more than the bare sclera bed was demarcated with a sterile gentian violet marker pen. Sub-conjunctival injection of 0.5 cc of 2% lignocaine in superotemporal conjunctiva to lift the conjunctiva away from the tenon's fascia. A small nick was made in the region of the marked donor site and the conjunctiva was undermined throughout the entire extent separating the under surface of the conjunctiva from the tenon and advancing up to the limbus. Conjunctival flap was made free for the entire extent. Then the conjunctiva was hold with a non-toothed forceps and reflected back over the cornea and the limbal area was cleaned of tenon attachment. A crescent knife was used and carefully the limbal part of the graft was dissected from the underlying limbus and advanced 0.5mm in to the clear cornea. When the full extent was reached the attached end of the graft was cut with a fine Vannas scissors.

The graft was then hold with plain forceps and brought over the bare area taking care to place the undersurface of the graft over the sclera and the limbal side of the graft at the limbal side of the bare sclera. Securing the graft with polyglactin suture. Four corner sutures were given and tied properly thereby fixing the graft. Lid speculum was removed and a sterile eye pad was applied. Surgery time was noted from first incision until the lid speculum was removed. The patients were started on steroid and antibiotic eye drops 4 times daily for two weeks and twice daily for two weeks.

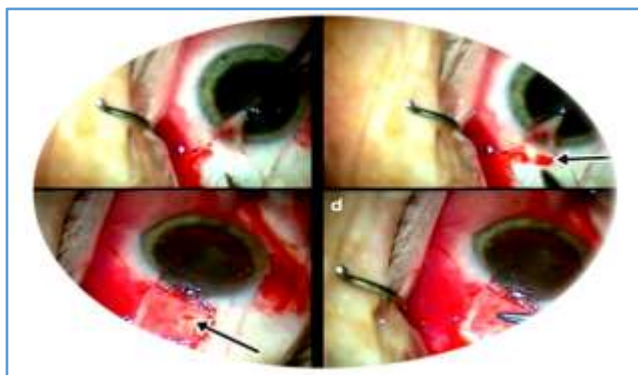


Figure 2. In Gr. A Procedure of Conjunctival Graft Fixation with Auto Blood

Group B- The fibrotic tissue was extensively dissected to expose the sclera and corneal stroma. The sub conjunctival fibro vascular tissue, including tenon’s capsule, were thoroughly removed to provide clean scleral bed. In this procedure not to use any short of cautery allowed spontaneous haemostasis. If the blood is not available we can use autologous fibrin, small veins and capillaries nicked. The size of the defect measured with venire calliper. Around 5 mm or more marking done over superotemporal quadret of the conjunctiva. Thin tenon free conjunctival autograft with limbal stem cell is excised. Autograft is mounted over the cornea and orientation is kept limbus to limbus then draping motion to ensure epithelial side is up. After placement of graft over the bare sclera allow to oozed blood and gently press for 5minutes and wait for 10 minutes Stabilization of the graft tested with all around free edge to ensure firm adherence to the sclera.

Combination of topical moxifloxacin (0.5%) and dexamethasone (1%) drops were applied four times per day, and CMC (0.5%) drops were applied four times per day.

The first dressing was done on the next post-operative day and following parameters were noted, visual acuity. Graft in situ, Condition of stitches, Conjunctival reaction, Corneal epithelial defect, Donor area. Any signs of infection. Follow-up examinations were done.



Figure 3. In Gr.-B Procedure of Conjunctival Graft Fixation with 8-0 Polyglactin Suture

After 3rd day, 1st week, 1st, 3rd and 6 months. We noted the following: Best corrected visual acuity. Post-operative pain / discomfort, Condition of the graft any sign of graft/scleral necrosis, any sign of early relapse or flap loss, Donor area for detection of pseudo pterygium if and During the following up period few digital images of the procedure and grafted eyes were taken for record and evaluation.

RESULTS

Data entry was done in epidata version 3.1 and data analysis was done in SPSS version 20 using independent-sample T test and paired T test. Distribution of different variables among the intervention groups (group A and B as denoted in original data. In this study mean age of the patient was in group-A is 44.7±8.2 and in group-B 47.8±8.8. Sex distribution in Gr-A 50% male were and 50% female. In Gr-A 67.7% were male and 37.7% female. In Side of involvement. In gr-A right side involvement 76.7% and left side was 23.3%. Length of pterygium encroaching over cornea in mm (mean) 3.0 in Gr-A and 2.95 in Gr-B. Vessel pattern in Gr-A. Thin vessel 33.3%, Tortuous vessels 30%, Vascular band 36.7%. In Gr-B thin vessel 43.7 Tortuous vessels 30.5, Vascular band 26.3%. Operation time in Gr-A 37.3±8.2 min and in Gr-B 17.5±2.3min. Average time difference was 19.8 min. Regarding graft fixation time In Group A graft fixation time was fixed for 24 hours. In Group B graft fixation time was gradually decreased from 48 hours to 20 hours. In Graft related complication 20% in Gr-A 13.3% in Gr-B. In terms of recurrence 16.7% in Gr-A and 6.7% in Gr-B and p value P<0.67 which was clinically significant. Relation in between Recurrence & Vessel pattern (Vascular band). The risk of recurrence significantly increases when there in presence of vascular bands. The estimated risk is 1.5 with a 95% CI 1.1-2.0.

Length of Pterygium Encroaching Over Cornea (mm)	Pre-op* valogmar	Pattern of Vessel	Pre-op. Discomfort	OT Time (min)	Post-op* valogmar	Post-op. Discomfort	Graft Fixation Time(h)	Graft Related Complication	Recurrence
3.5 mm (n)-5	0.30 LE/RE (n) -14	V/B (n)-12	Minimal (n)-6	50 (n)-3	0.17LE/RE (n)-14	Minimal (n)-16	24 (n)-30	S/H (n)-2	Yes (n)-4
2.5 mm (n)-6	0.47 RE/LE (n)-10	TN/V (n)-10	Moderate (n)-13	45 (n)-4	0.30 RE/LE (n)-9	Moderate (n)-12		GL/F (n)-2	No (n)26

2 mm (n)-4	0.60 LE/RE (n)-4	TR/V (n)-8	Severe (n)-11	40 (n)-8	0.47 RE/LE (n)-5	Severe (n)-2		CF (n)-2	
3 mm (n)-6	1 RE (n)-2			35 (n)-15	0.60RE/LE (n)-2			NO (n)-24	
4 mm (n)-8									

Table 1. Group -A Shows Length of Pterygium, Pre and Post-Operative Vision, Pattern of Vessel, Pre and Post-Operative Discomfort, Graft Fixation Time and Recurrence

Sl. No.	Age	Length of Pterygium Encroaching Over Cornea (mm)	Pre-op* valogmar	Pattern of Vessel	Pre-op. Discomfort	OT Time (min)	Post-op* valogmar	Post-op. Discomfort	Graft Fixation Time (h)	Graft Related Complication	Recurrence
1.	55	3.5 (N)-8	0.60 RE/LE (n)-4	TN/V RE/LE (n) 14	Minimal (n)-8	20 (n)-8	0.47 RE/LE (n)-4	Minimal (n)-23	48 (n)-7	NO (n)-26	NO-27
2.	60	2.5 (n)-9	0.30 RE/LE (n)-9	TR/V RE/LE (n) 10	Moderate (n)-11	15 (n)-22	0.17 RE/LE (n)-14	Moderate (n)-7	24 (n)-9	G/L (n)-3	YES (n)-3
3.	42	3 (n)-7	0.17 RE/LE (n)-9	V/BRE/LE (n)-6	Severe (N)-7		0.30 RE/LE (n)-8		20 (n)-14	S/H, C/F (n)-1	
4.	31	4 (n)-6	0.47 RE/LE (n)-9				0.00 RE (n)-		48		

Table 2. Group-B shows length of pterygium, pre and post-operative vision, pattern of vessel, pre and post-operative discomfort, graft fixation time and recurrence.

DISCUSSION

A prospective, comparative, interventional case study was carried out on 60 eyes of the patients with primary nasal pterygium type II, presented at the out patients department and oculoplasty clinic at the RIO, Kolkata during the period from December 2013 to December 2016 and was analysed prospectively. In present study, it was observed that out of 60 eyes of the patients, 26 were female and 34 were male eyes with male to female ratio of 1.3:1. This finding corroborated with observations of the available literature which states higher prevalence of pterygium in males as shown in previous studies by Ashok K Sharma, Vijaya Wali, Archana Pandita^{15,16} in 1997-2003 was 2.3:1 and Salina Teja, Sophie Boucher, Kashif baig^{17,18} in 2013 was 1.2:1.

The mean age in Group A was 44.7±8.2 years and the mean age in Group B was 47.80±8.8 years range being 30 years to 60 years as shown in previous studies by Ashok K Sharma, Vijaya Wali, Archana Pandita^{19,20} in 1997-2003 was 35 years, Salina Teja, Sophie Boucher, Kashif Baig^{17,18} in 2013 was 52 years and Nisha Dulani, Harish Dulani^{21,22} in 2014 was 47.9±4.2 years.

The total operative time in each case was recorded in minutes. The mean surgical time for Group A was 37.33±8.2 minutes, ranging from a minimum of 30 min to a maximum of 50 min. The mean surgical time for Group B was 17.50±2.3 minutes, ranging from a minimum of 15 min to a maximum of 20 min. Surgical time was significantly shorter in auto blood Group B (p< 0.01). So grafts secured with auto blood were time consuming and economical benefit. This finding corroborated with observations of D de Wit, I Athanasiadis, A Sharma and J Moore^{23,24} mean surgical time was 14±1.4, observations of Mitra S et al^{19,25} mean surgical time was 11 min and observations of Singh PK, Singh S, Vyas C, and Singh M^{17,18} mean surgical time was 14.74±2.35.

A symptom questionnaire was prepared and symptoms of pain, discomfort and watering were graded on a scale of 1 to 3 with 1 being minimal symptom 2 moderate and 3 being maximum. In Group A grafts were secured with only four corner sutures so at the end of the 1st post-operative week, there was an overall significant improvement (p<0.01) in pain/discomfort & watering in both Group B & A. In Group B no patient out of eight (pre-operatively) was complaining of severe pain/discomfort & watering post-operatively where as in Group A two patients out of ten (pre-operative) were complaining of severe pain/discomfort & watering post-operatively. In Group B, the natural fibrin clot derived from the blood oozing over the operative field was a thin one and graft was slightly oversized and as thin as possible for edge to edge conjunctival apposition and good fixation so less chance of discomfort post-operatively due to smooth operative surface area. In Group A, four corner sutures made the operative site irregular so more chance of discomfort post-operatively though we reduced the number of suturing in our study.

At the end of follow-up period of 6 months, total graft related complication was seen in 6 patients in Group A and 4 patients in Group B. But the incidence of sub-conjunctival haemorrhage was found to be higher in Group A (no: 3) than in Group B (no:1). Graft loss was noted in 3 patients in Group B. In Group B one patient was developed conjunctival cyst with sub-conjunctival haemorrhage. In Group A 2 patients were developed conjunctival cyst and one patient was developed granuloma. Most of the complications were associated with vascular band as vessel pattern which was clinically and statistically significant. No serious complications were noted during the follow-up period suggesting auto blood may be considered safe for attaching conjunctival auto graft as shown in previous studies by D de

Wit, I Athanasiadis, A Sharma and J Moore¹⁷ in June 2010, Mitra S et al,^{25,26} Nisha Dulani, Harish Dulani.^{21,22}

Prospected series in the literature report recurrence rates of 2-39% after pterygium surgery using sutured conjunctival autograft.^{15,16} Most of the recurrences develop within 6 months. On following up the patients for a period of 6 months, the recurrence was found in 4 patients (13.3%) in Group A and in 2 patients (6.6%) in group B as shown in previous studies in autologous blood group by Nisha Dulani, Harish Dulani²² was 1.63%, Kocamis O, Bilgec M^{18,21} was 8%, Singh PK, Singh S, Vyas C, and Singh M^{17,18} was 10%. All the 6 patients had vascular band as vessel pattern (about 30% of total vascular band patients) which was clinically and statistically significant.

Treatment of pterygium with conjunctival auto graft after pterygium excision is reported to have the best and comparable success rates. These grafts are fixed with scleral bed by 8-0 polyglactin suture. Presence of suture initiates the constant irritation leading to mild inflammatory response giving rise to symptoms of pain, grittiness and watering postoperatively. Constant inflammation causes recurrence of the disease. The time consumption for the placement of sutures during surgery and need to remove them later on makes it a lengthy and tedious process. The use of autologous blood is therefore considered a better alternative to sutures for the affixation to the grafts to the bare sclera bed. The first no suture surgical technique where in conjunctival auto graft was affixed to the sclera bed with autologous blood was reported by D de Wit, I Athanasiadis, A Sharma and J Moore in 2010 at Belfast, UK.^{23,24,25,26}

CONCLUSION

The study results suggest that blood oozed during pterygium excision provides a novel approach for securing conjunctival auto graft and it is superior to suturing procedure. It is a less invasive surgery as less tissue damage. Using four corner sutures makes the operative site irregular so more chance of tissue damage in suturing group.

It has less post-operative inflammation because the natural fibrin clot derived from the blood oozing over the operative field is a thin one and graft is slightly oversized and as thin as possible for edge to edge conjunctival apposition and good fixation so less chance of inflammation post-operatively. It has less graft related complications at the end of 6 months, total graft related complications seen with autologous blood markedly reduce in comparison to suturing procedure. It has less chance of recurrence on follow up for a period of 6 months. Recurrence is more in patients using suture than in patients using autologous blood. It has better wound healing and less chance of fibrosis because there is an even tension across the whole of the graft interface and no direct tension on the free graft edges, there is reduced stimulus for sub-conjunctival scar tissue to form.

It has early rehabilitation as there is no suture as such. It is cost effective as there is no use of polyglactin suture. It has good cosmetic effect because it has smooth operative surface area and less chance of scar tissue formation

resulting in good cosmetic and functional outcome. It takes less operative time as the mean surgical time for using suture is always more than the mean surgical time for using autologous blood. Autologous blood is natural and readily available procedure. Type II pterygium patients having vascular band as vessel pattern have more chance of recurrence.

REFERENCES

- [1] Duke-Elder S, Leigh AG. Inflammations of the cornea. In: Duke-Elder S, ed. System of ophthalmology. Vol 8, London: Henry Kimpton Medical Publisher 1965: p. 789.
- [2] Farjo QA, Sugar A. Pterygium and conjunctival degenerations. In: Yanoff M, Duker JS. Ophthalmology. 3rd edn. Mosby Elsevier 2009: p. 249.
- [3] Kanski JJ, Bowling B. Clinical ophthalmology: a systematic approach. 7th edn. Elsevier 2011: p. 163.
- [4] Buratto L, Phillips RL, Carito G. Histology, Clinical anatomy, Clinical picture and classification, Clinical evolution, Epidemiology. Chap- 3, 5, 6, 7, 8. In: Buratto L, Phillips RL, Cartio G, eds. Pterygium surgery. 1st edn. SLACK Incorporated 2000: pgs. 7-9, 15-16, 17-20, 21-25 & 27-28.
- [5] Panda A, Sharma N. Limbal transplantation of stem cells. Chap- 49. In: Dutta LC, ed. Modern ophthalmology. 2nd edn. New Delhi: Jaypee Brothers 2005:285-289.
- [6] Detels R, Dhir SP. Pterygium: a geographical survey. Arch Ophthalmol 1967;78(4):485-491.
- [7] Tan DT, Chee SP, Dear KB, et al. Effect of pterygium morphology on pterygium recurrence in a controlled trial comparing conjunctival autografting with bare sclera excision. Arch Ophthalmology 1977;115(10):1235-1240.
- [8] Quraishy MS, Ebenezer R. Recurrence of pterygium. Review of 135 cases--excision technique. Indian J Ophthalmol 1972;20(4):171-172.
- [9] Moran DJ, Hollows FC. Pterygium and ultraviolet radiation: a positive correlation. Br J Ophthalmol 1984;68(5):343-346.
- [10] Booth F. Heredity in one hundred patients admitted for excision of pterygia. Aust N Z J Ophthalmol 1985;13(1):59-61.
- [11] Kenyon KR, Wagoner MD, Hettinger ME. Conjunctival autograft transplantation for advanced and recurrent pterygium. Ophthalmology 1985;92(11):1461-1470.
- [12] Zauberman H, Hemo I. Use of fibrin glue in ocular surgery. Ophthalmic Surg 1988;19(2):132-133
- [13] Lewallen S. A randomized trial of conjunctival autografting for pterygium in the tropics. Ophthalmology 1989;96(11):1612-1614.
- [14] Tseng SCG, Chen JJY, Huang AJW, et al. Classification of conjunctival surgeries for corneal diseases based on stem cell concept. Ophthalmol Clin North Am 1990;3:595-610.

- [15] Sharma AK, Wali V, Pandita A. Corneo conjunctival auto grafting in pterygium surgery. *JK Science* 2004;6(3):149-152.
- [16] De la Hoz F, Montero JA, Alio JL, et al. Sliding and free grafts seem to be equally effective but direct conjunctival closure alone is not as effective as either the sliding or free graft. *Br J Ophthalmol* 2008;92:175-188.
- [17] Singh PK, Singh S, Vyas C, et al. Conjunctival autografting without fibrin glue or sutures for pterygium surgery. *Cornea* 2013;32(1):104-107.
- [18] Teja S, Boucher S, Baig K. Comparison of fibrin glue and autologous blood for conjunctival autograft fixation in pterygium surgery. *Investigative Ophthalmology & Visual Science* 2013;54(15):3105.
- [19] Malik KP, Goel R, Gupta A, et al. Suture less Glue free conjunctival auto-graft for pterygium surgery. *Nepal J Ophthalmol* 2012;4(8):230-235.
- [20] Chowdhury T, Mitra S. Session title: corneal surgery III - suture less glue free conjunctival autograft for pterygium surgery. Session Date/Time: Wednesday 12/09/2012/08: 00-10: 30.
- [21] Kocamis O, Bilgec M. Evaluation of the recurrence rate for pterygium treated with conjunctival autograft. *Graefes Arch Clin Exp Ophthalmol* 2014;252(5):817-820.
- [22] Dulani N, Dulani H. Efficacy of blood oozed during pterygium excision to secure autograft. *Int J Pharm Biomed Res* 2014;5(3):58-60.
- [23] de Wit D, Athanasiadis I, Sharma A, et al. Sutureless and glue-free conjunctival autograft in pterygium surgery: a case series. *Eye* 2010;24(9):1474-1477.
- [24] Ratnalingam V, Eu AL, Ng GL, et al. Fibrin adhesive is better than sutures in pterygium surgery. *Cornea* 2010;29(5):485-489.
- [25] Mitra S, Basak SK, Bhattacharya D. Auto blood as tissue adhesive for conjunctival autograft fixation in pterygium surgery. Poster presented at the Annual Meeting of the American Academy of Ophthalmology Oct. 22 and 23, 2011.
- [26] Foroutan A, Beigzadeh F, Ghaempanah MJ, et al. Efficacy of autologous fibrin glue for primary pterygium surgery with conjunctival autograft. *Iranian Journal of Ophthalmology* 2011;23(1):39-47.