Original Article

Outcome of Tectonic Graft in Corneal Perforations

Mahtab Mengal, Madiha Waseem

ABSTRACT

OBJECTIVE: To evaluate the anatomical outcome of tectonic graft in corneal perforations.
METHODOLOGY: This Prospective, interventional study was conducted at the Ophthalmology department, Helpers Teaching Eye Hospital, Quetta from February 2019 to March 2020. Fifty Two eyes of 50 subjects, aged between 5 to 80 years, either gender, with corneal perforation (<4mm), traumatic, inflammatory, spontaneous, and infectious perforations were included. Data analysis was done on SPSS version 23. A Chi-square test was applied. A P-value of ≤ 0.05 was considered significant.
RESULTS: 35 (70%) were males and 15 (30%) were females. The mean age was 41.68 ± 19.25 years (range: 5 years to 80 years). The site of perforation was paracentral in 26 (52%), peripheral in 15 (30%), limbal in 6 (12%), and central in 3 (6%) patients. The most common indication for tectonic graft was infectious keratitis in 23 (46%) patients followed by trauma in 17 (34%), inflammatory causes in 6 (12%), and spontaneous in 4 (8%) patients. Postoperative complications include peripheral anterior synechiae in 10 (20%), phthisis bulbi in 4 (8%), endophthalmitis in 2 (4%), persistent leakage, and loose corneal sutures in 2 (4%), and recurrence of infection in 1(2%) cases. The anatomical success of the graft was achieved in 44 (88%). No significant change in anatomical outcome was observed concerning age group (P=0.329), gender (P=0.849), and indications for tectonic graft (P=0.593).
CONCLUSION: Tectonic graft is useful for therapeutic management of corneal perforations as it restores the globe's integrity.

KEYWORDS: Tectonic graft, Corneal Perforations, Anatomical integrity

This article may be cited as: Mengal M, Waseem M. Outcome of Tectonic Graft in Corneal Perforations. J Liaquat Uni Med Health Sci. 2021;20(03):183-6. doi: 10.22442/jlumhs.2021.00839

INTRODUCTION

Corneal perforation is an ocular emergency that may be caused by infective or non-infective conditions. Non-infective elements involved in corneal perforations are trauma, dry eyes, inflammatory conditions, exposure to keratopathy, and neurotrophic keratopathies. This emergency condition can cause loss of vision and is associated with profound ocular morbidity especially in the developing world, so it needs immediate surgical intervention[1-4]. The aim of prompt management of corneal perforation is to maintain a watertight eyeball and preserve anatomical integrity of the eye and avoid ocular complications like uveal prolapse, secondary glaucoma, or microbial endophthalmitis[1,4]. Management of corneal perforations depends on the location and size of the defect and its underlying cause[4,5].

A variety of techniques are available to close the perforation ranging from the non-surgical and temporary technique of application of tissue glue and soft bandage contact lens to surgical and permanent modalities like conjunctival flaps, amniotic membrane transplantation, tectonic corneal patch graft, lamellar keratoplasty, and penetrating keratoplasty. Treatment of the underlying cause is mandatory while managing a case of corneal perforation[1,2]. Different studies have been conducted to see the efficacy of various graft materials to restore the eyeball integrity and close corneal or corneoscleral perforation, but none of them showed any superiority of any specific material[6-8].

Corneal perforations when located at the periphery and relatively smaller for PKP and larger for tissue glue can be closed ideally with tectonic corneoscleral patch graft or amniotic membrane transplantation as a temporary or permanent treatment option. Penetrating Keratoplasty is reserved for large and central perforations[9]. Management of corneal perforation is a multistage approach involving a primary step of defect closure to preserve anatomical integrity and prevent complications, then the final step for visual function restoration[2]. Vanathi and co-workers reported an 85.4% anatomical success rate with tectonic graft in corneal perforations and suggested this as a very effective procedure for the treatment of selective cases[10].

This study aimed to evaluate the anatomical outcome of tectonic graft in corneal perforations in our population as limited local data is available on corneal perforation management.

METHODOLOGY

This prospective, interventional study was conducted at the ophthalmology department, Helpers Teaching Eye Hospital, Quetta from February 2019 to March 2020 after approval from the ethical committee of the hospital. Informed consent was obtained from each patient. Complete eye examination was done in all the patients. The study included 52 eyes of 50 subjects, aged 5 to 80 years, either gender, with small corneal perforation (<4mm), central (1 mm to 4mmcentral

zone) paracentral, or peripheral perforations (zone between 5mm from the center up to limbus), traumatic, inflammatory, spontaneous and infectious perforations. Perforations >4mm, and traumatic globe ruptures were excluded. The surgery was performed by a single surgeon. Tectonic graft materials used in this study to close the defect were corneal patch, corneoscleral patch, and partial thickness scleral patch. All patients were followed for 3 months to see the anatomic preservation of eyeball in terms of graft stability and wound healing. Anatomical success was defined as anatomical preservation of the globe with complete healing and epithelialization of defects.

After corneal transplantation at our tertiary care hospital, the remaining donor tissue was stored in tissue culture medium (2–6°C) or organ culture medium (31-37°C). After removing all devitalized tissues, the donor corneal or scleral patch of appropriate size according to the location was applied over the perforation after washing the donor tissue in Ringer Lactate solution for 10 minutes, then in Betadine and the end in Gentamicin 20 mg/ml solution for 10 minutes. Suturing was done with interrupted nylon sutures. Topical steroids, antibiotics, and lubricants were given as postoperative treatment. All patients were followed up initially for two weeks then monthly for three months. Anatomical outcomes and complications were recorded.

The data was analyzed using SPSS version 23. Frequency and percentages were calculated for qualitative variables including gender, site of perforation, etiology of perforation, postoperative complications, and anatomical success. Mean and standard deviation was calculated for quantitative variable including the age of the patients. Stratification was done to control effect modifiers like age, gender, and indications for tectonic graft. A Chi-square test was applied. A P-value of ≤ 0.05 was considered significant.

RESULTS

52 eyes of 50 patients were enrolled. Out of these 50 patients, 35 (70%) were males and 15 (30%) were females. The mean age was 41.68±19.25 years (range: 5 years to 80 years). Paracentral corneal perforation was the most common site of perforation in 26(52%), while the rest of the perforations were central in 3 (6%), peripheral in 15 (30%), and limbal in 6 (12%) patients as shown in **Table I**. 48 (96%) were unilateral and 2 (4%) were bilateral. The most common indication for tectonic graft was infectious keratitis in 23 (46%) patients followed by trauma in 17 (34%), inflammatory causes in 6 (12%), and spontaneous in 4 (8%) patients as shown in **Table II**. The anatomical success of the graft was achieved in 44 (88%) subjects. Stratification analysis of the patients was performed and no significant change in anatomical outcome was observed concerning indications for tectonic graft (P=0.593), age group (P=0.329), and gender (P=0.849) as shown in **Table II, III,** and **IV** respectively. **Table V** shows postoperative complications which include peripheral anterior synechiae in 10 (20%), phthisis bulbi in 4 (8%), endophthalmitis in 2 (4%), persistent leakage in 2 (4%), loose corneal sutures in 2 (4%) and recurrence of infection in 1(2%) cases.

TABLE I: SITE OF PERFORATION

Site	Frequency	Percent
Central	3	6.0
Paracentral	26	52.0
Peripheral	15	30.0
Limbal	6	12.0
Total	50	100.0

TABLE II: ANATOMICAL OUTCOME CONCERNING INDICATION OF TECTONIC GRAFT

Indication of tectonic graft	The anatomical success of the graft		Total
	Yes	No	
Infectious keratitis	20(87.0%)	3(13.0%)	23(46%)
Trauma	14(82.4%)	3(17.6%)	17(34%)
Inflammation	6(100.0%)	0	6(12%)
Spontaneous	4(100.0%)	0	4(8%)

Chi-Square = 1.901 p= 0.593

TABLE III: ANATOMICAL OUTCOME CONCERNING AGE GROUP

Age Groups (Years)	The anatomical success of the graft		Total
	Yes	No	
5-40 Years	20(83.3%)	4(16.7%)	24
41-80 Years	24(92.3%)	2(7.7%)	26

Chi-Square = 0.952 p=0.329

TABLE IV: ANATOMICAL OUTCOME CONCERNING GENDER

Gender	The anatomical success of the graft		Total
	Yes	No	
Male	31(88.6%)	4(11.4%)	35(70%)
Female	13(86.7%)	2(13.3%)	15(30%)

Chi-Square = 0.036 p=0.849

TABLE V: POSTOPERATIVE COMPLICATIONS

	Frequency	Percent
Peripheral anterior synechiae	10	20.0
Endophthalmitis	2	4.0
Recurrence of infection	1	2.0
Persistent leakage	2	4.0
Loose corneal sutures	2	4.0
Phthisis bulbi	4	8.0
Total	**21**	**42.0**

DISCUSSION

In this study, we aimed to restore and maintain the ocular integrity and anatomy of the perforated globe due to different causes such as infection, trauma, and inflammatory conditions (most commonly collagen vascular disease) with the help of a corneoscleral patch graft by utilizing preserved remaining corneoscleral button after penetrating keratoplasty at our department.

Corneal perforations are one of the main causes of ocular morbidity and loss of ocular structures if left untreated, and can result in functional and psychosocial disturbance[2,3,11]. Multiple etiological factors are involved in corneal perforation[3,4]. In our study, we observed that infection is the common cause of corneal perforations found in 23(46%) cases, while another researcher reported the same rate of 45% perforations caused by infections[1]. Trauma in 17 (34%) patients was the second most common cause of perforation. Management of globe perforations comprises medical and surgical management which depends on the size, depth, and location of the defect. Treatment of the underlying cause of perforation (if any) is crucial for graft stability and survival[6,9]. Depending on the severity, thickness, and location of perforations, penetrating keratoplasty, lamellar keratoplasty, Femto assisted lamellar keratoplasty, patch graft is widely used different technique[1,9,12,13]. Different materials and different techniques are trending recently to close such corneal perforations. Autograft and allograft are utilized in different scenarios[6,7,14]. Centers where corneal bank facility or preserved allograft is not available, scleral, conjunctival autograft, or amniotic membrane can be used in an emergency to seal the perforation to avoid devastating complications. Recently many synthetic materials and other tissues such as dermis, fascia lata, periosteum, pericardium, and cartilage have been used as graft materials in ophthalmology[6-8]. In our study, we used a corneoscleral patch to close corneal perforations. Our result of surgical success was (88%) in terms of the stable ocular surface and maintained ocular anatomy is comparable with international reports[2,10,15,16].

The most frequent complication in our study was peripheral anterior synechiae in 10 (20%) patients which could be due to inflamed anterior segment inflammation in the preoperative and postoperative period. Postoperative topical mydriatic drops can be beneficial along with intensive medical treatment to control inflammation and prevent anterior synechiae. Internationally reported rate of anterior synechiae formation by Krysik K 2017[1] and Vanathi M 2002[10] is 6.8% and 9.76% respectively. Another study reported that epithelial defect was a common (63%) complication in their study[2] where they used large-sized grafts while in our study we did not encounter such complication because we used small grafts to close small to medium size localized defects in emergency and large perforations were excluded as they were managed by penetrating keratoplasty. Other complications observed in our study were loose corneal sutures in 4% of cases which were dealt with by removing loose sutures and new sutures were reapplied, rate of this postoperative complication is less than that mentioned by Krysik K 2017[1] that is 17.4%, Persistent leakage 4%, recurrence of corneal infection at host junction in 2% cases which is less than the rates reported in other studies (13.7% and 20.4%)[1,2]. Phthisis bulbi (8%) was one of the major causes of failure in our study. Endophthalmitis was observed in 4% of cases and similar frequency (3% and 4.7%) were documented internationally[1,2].

CONCLUSION

Tectonic graft in spontaneous, traumatic, and infective corneal perforations is an effective and safe procedure to deal with this ophthalmic condition and it maintains the anatomical integrity of the eyeball. Treatment of the underlying cause is mandatory for desirable results. To achieve surgical success it is recommended to follow up with the patient very closely in the initial postoperative period to deal with complications promptly to improve the healing.

Ethical Permission: Helpers Teaching Eye Hospital Quetta ERC Letter No. 44 dated: 15-01-2019.

Conflict of Interest: There is *no* conflict of *interest among the authors.*

Financial Disclosure/Grant Approval: There was no funding agency.

DATA SHARING STATEMENT: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

AUTHOR CONTRIBUTIONS

Mengal M: Study design, Data collection, manuscript writing & Review

Waseem M: Study design, statistical analysis, manuscript writing, final review

REFERENCES

1. Krysik K, Dobrowolski D, Lyssek-Boron A, Jankowska-Szmul J, Wylegala EA. Differences in Surgical Management of Corneal Perforations, Measured over Six Years. J Ophthalmol. 2017; 2017: 1-6. doi: 10.1155//2017/1582532.
2. Loya-Garcia D, Serna-Ojeda JC, Pedro-Aguilar L, Jimenez-Corona A, Olivo-Payne A, Graue-Hernandez EO. Non-Traumatic corneal perforations: Aetiology, treatment, and outcomes. Br J Ophthalmol. 2017; 101(5): 634–9. doi: 10.1136/bjophthalmol-2016-308618.
3. Xie L, Zhai H, Dong X, Shi W. Primary Diseases of Corneal Perforation in Shandong Province, China: A 10-Year Retrospective Study. Am J Ophthalmol. 2008; 145(4): 662-6. doi: 10.1016/ j.ajo.2007.12.020.
4. Jhanji V, Young AL, Mehta JS, Sharma N, Agarwal T, Vajpayee RB. Management of Corneal Perforation. Surv Ophthalmol. 2011; 56(6): 522–38. doi: 10.1016/j.survophthal.2011.06.003.
5. Ang M, Mehta JS, Sng CCA, Htoon HM, Tan DTH. Indications, outcomes, and risk factors for failure in tectonic keratoplasty. Ophthalmology. 2012; 119(7): 1311–9. doi: 10.1016/j.ophtha.2012.01.021.
6. Sultan S, Siyal NA, Ashraf N, Rasheed A, Pak K. Scleral Patch Graft in Spontaneous and Traumatic Corneoscleral Perforations. Pakistan J Ophthalmol Orig Artic J Ophthalmol. 2018; 34(3): 184-9.
7. Sangwan VS, Jain V, Gupta P. Structural and functional outcome of scleral patch graft. Eye (Lond). 2007; 21(7): 930–5. doi: 10.1038/ sj.eye.6702344.
8. Stunf S, Lumi X, Drnovšek-Olup B. Preserved scleral patch graft for unexpected extreme scleral thinning found at the scleral buckling procedure: A case report. Indian J Ophthalmol. 2011; 59(3): 235–8. doi: 10.4103/0301-4738.81045.
9. Yokogawa H, Kobayashi A, Yamazaki N, Masaki T, Sugiyama K. Surgical therapies for corneal perforations: 10 years of cases in a tertiary referral hospital. Clin Ophthalmol. 2014; 8: 2165–70. doi: 10.2147/OPTH.S71102.
10. Vanathi M, Sharma N, Titiyal JS, Tandon R, Vajpayee RB. Tectonic grafts for corneal thinning and perforations. Cornea. 2002; 21(8): 792–7. doi: 10.1097/00003226-200211000-00013.
11. Vlasov A, Ryan DS, Ludlow S, Coggin A, Weichel ED, Stutzman RD et al. Corneal and corneoscleral injury in combat ocular trauma from operations Iraqi freedom and enduring freedom. Vol. 182, Mil Med. 2017; 182(S1): 114–9. doi: 10.7205/ MILMED-D-16-00041.
12. Park JC, Habib NE. Tectonic lamellar keratoplasty: Simplified management of corneal perforations with an automated microkeratome. Canadian J Ophthalmol. 2015; 50(1): 80-84.
13. Maier PC, Birnbaum F, Reinhard T. Therapeutic applications of the femtosecond laser in corneal surgery. Klin Monbl Augenheilkd. 2010; 227(6): 453–9. doi: 10.1055/s-0029-1245351.
14. Hamdi M, Hamdi I. Scleral Repair by Biodegradable Collagen Implant in Strabismus Surgery. Ophthalmol Res An Int J. 2015;3(4):141-6.
15. Lekskul M, Fracht HU, Cohen EJ, Rapuano CJ, Laibson PR. Nontraumatic corneal perforation. Cornea. 2000; 19(3): 313–9. doi: 10.1097/0000 3226-200005000-00011.
16. Vasseneix C, Toubeau D, Brasseur G, Muraine M. Surgical management of nontraumatic corneal perforations: An 8-year retrospective study. J Fr Ophtalmol. 2006; 29(7): 751–62. doi: 10.1016/s 0181-5512(06)73844-x.

AUTHOR AFFILIATION:

Dr. Mahtab Mengal *(Corresponding Author)*
Senior Registrar
Helpers Teaching Eye Hospital
Quetta, Balochistan-Pakistan.
Email: mengalmahtab@gmail.com,

Dr. Madiha Waseem
Fellow Ophthalmologist
Dr. Ruth K.M.Pfau Civil Hospital
Karachi, Sindh-Pakistan.