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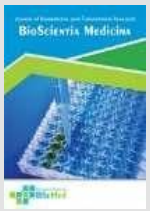

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Graft Outcome of Corneal Patch for Perforated Corneal Ulcer

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A B S T R A C T

Background: Corneal patch graft (CPG) is a part of the tectonic penetrating keratoplasty procedure performed on the perforated corneal ulcer. This procedure involves filling affected areas with full or partial-thickness cornea donors. This study aimed to determine the clinical results of corneal patch grafts in perforated corneal ulcers. **Methods:** A retrospective study assessing clinical results of CPG on the perforated corneal ulcer with iris prolapse. Clinical assessments include graft condition, anterior chamber depth (ACD), and visual acuity after surgery, with a follow-up duration of up to 8 weeks. **Results:** Twenty-one cases of perforated corneal ulcer with iris prolapse in 15 males (71.4%) and 6 females (28.6%). Locations of ulcer are peripheral and paracentral corneal. Visual acuity showed around light perception (LP) to 0.4. The most common etiology for corneal ulcers was infection (88.9%), followed by non-infection (Mooren's ulcer) (11.1%). The graft condition after surgery showed promising results in 18 cases (85.7%), infection in 1 case (4.8%), and melting in 2 cases (9.5%). Adequate ACD was obtained in 77.8% of cases. An increase in visual acuity was shown in 44.4% of cases, depending on the location and severity of the ulcer. **Conclusion:** A corneal patch graft is an appropriate choice in treating perforated corneal ulcers to maintain ocular integrity (tectonic keratoplasty). However, in non-infectious ulcers, this procedure has not shown a good result, which may be related to disease progressivity.

1. Introduction

A perforated corneal ulcer is the discontinuity of all corneal layers caused by infection and non-infection. It is an eye emergency with a risk of vision loss if not immediately treated. The selection of surgical technique in the treatment of perforated cornea is determined by several factors, namely size, location, cause of lesion, and the availability of graft materials.[1,2,3] Keratoplasty (corneal graft) can be used for perforated corneal ulcers. It aims to rehabilitate vision (optic), maintain ocular integrity (tectonic), eliminate the source of infection (therapeutic), and cosmetic. According to Wu et al., corneal graft and keratoplasty are the gold standards for corneal perforation of more than 3 mm.[4,5]

A corneal patch graft (CPG) is a tectonic keratoplasty performed on a perforated corneal ulcer with or without iris prolapse. The ulcer is usually located in the peripheral or paracentral to maintain the ocular before definitive optic keratoplasty. Corneal patch graft can be an alternative emergency surgery in perforated corneal ulcers, especially in cases with limited cornea donors, such as in Indonesia. This study aimed to provide characteristics of cases and clinical successes after corneal patch grafts in Dr. M. Djamil General Hospital and Padang Eye Center Hospital from September 1st, 2020 – December 31st, 2022.

2. Methods

This is a retrospective descriptive study. Data were collected from medical records of cases who underwent corneal patch graft (CPG) from September 1st, 2020 – December 31st, 2022, in Dr. M. Djamil General Hospital and Padang Eye Center Hospital. The samples were perforated corneal ulcer cases who underwent CPG with the inclusion criteria of complete medical record data for clinical assessment. In addition, the cornea donors were taken from the remaining cornea donor after penetrating keratoplasty.

The data collected include age, gender, pre-and post-surgical visual acuity, ulcer etiology, corneal perforation or defect size, ACD, and graft condition. Corneal ulcer etiology can be infectious or non-infectious. Corneal perforation size was assessed intraoperatively with a caplliper. After surgery, ACD was observed with a slitlamp using Van Herrick methods. Clinical success is defined as graft integrity and union with corneal stroma and deep ACD. The follow-up duration was eight weeks. The surgical procedure began by eliminating necrotic tissues in the recipient's cornea, and iris repositioning was performed. Afterward, the size of the perforation was measured with a caliper to estimate the area of the transplanted donor cornea. Next, if viable, donor graft trephination was carried out with the free-hand technique. An antibiotic injection was also administered. Subsequently, the donor cornea was sutured to the recipient cornea using a 10.0 silk around the cornea. Antibiotics and topical steroids can be issued if required after surgery. The obtained data were descriptively analyzed on all variables and presented in a table.

3. Results

Based on medical records data, 21 cases were obtained as samples in this study who underwent corneal patch grafts from September 1st, 2020 – December 31st, 2022, in Dr. M. Djamil General Hospital and Padang Eye Center Hospital according to inclusion criteria. The demographic characteristics of the cases can be seen in Table 1, which include gender, age, pre-surgical range of visual acuity, perforation size, and etiology of perforated ulcers.

Table 1. Demographic and clinical characteristics of cases who underwent corneal patch graft surgery.

Characteristics	N (n = 21)	Percentage (%)
Gender		
Male	15	71.4
Female	6	28.6
Age		
Mean	46.8	
Range	15-75	
Pre-surgical visual acuity range	LP – 0.4	100%
Perforation size	3-6 mm	100%
Etiology		
Infection	19	90.5
Mooren's ulcer	2	9.5

The demographic and clinical characteristics of cases are shown in Table 1, showing 15 male cases (71.4%), Mean age was 46.8 years. Table 2 shows despite age group.

Table 2. Distribution according to age group.

Age group (Year)	Total
15-35	4
36-55	13
56-75	4
Total	21

Table 2 indicates that the highest mean age was within the 36-55 age group, while the lowest mean was within the 15-35 age group and the 56-75 age group. The minimum age of the samples was 16 years, and the maximum was 69 years.

The range of pre-surgical visual acuity in all samples was a light perception (LP) of up to 0.4. Perforation size varied between 3-6 mm. The most common etiology was an infectious ulcer found in 19 cases (90.5%) and a non-infectious Mooren's ulcer in 2 cases (9.5%).

Table 3 shows the clinical characteristics after surgery. These post-surgical clinical characteristics were assessed until the second month of follow-up after surgery. The points set were improved visual acuity, ACD, and graft complication.

Table 3. Post-surgical clinical characteristics.

Characteristics	First month (n = 21) (%)	Second month (n = 21) (%)
Visual acuity		
Equal	5 (23.8%)	6 (28.6%)
Improvement	11 (52.4%)	11 (52.4%)
Worsening	5 (23.8%)	4 (19.0%)
AC depth		
Deep	17 (81.0%)	17 (81.0%)
Shallow	4 (19.0%)	4 (19.0%)
Graft condition (complication)		
Good	18 (85.7%)	-
Melting graft	2 (9.5%)	2 (9.5%)
Graft infection	1 (4.8%)	-

Visual acuity improvement was found in 10 cases (47.6%), equal visual acuity was found in 6 cases (28.6%), and visual acuity worsening was found in 5 cases (23.8%). Post-surgical ACD was assessed. Deep ACD was found in 17 of 21 cases (81.0%), while shallow ACD was found in 4 cases after a 1-month follow-up (19.0%). The occurring complication was also relatively minimum, where almost all samples (18 samples) had no graft complication (85.7%). Corneal melting was found in 2 cases (9.5%) and graft infection in 1 (4.8%).

4. Discussion

Corneal perforation is an eye emergency that requires prompt treatment. The treatment of corneal perforation in developing countries is limited by the availability of cornea donors, which is lower than the need. Surgery can be carried out to cover perforation defects in full-thickness corneas or corneal patch graft and corneal lenticule patch graft. The SMILE retractive surgical technique provides lenticules that can be used as a graft with a surgical procedure known as the corneal lenticule patch graft for emergency treatment of corneal perforation.

Corneal patch graft has been used as a surgical procedure for treating various anterior segment abnormalities. This involves patching/grafting corneal defects with full-thickness or partial-thickness cornea donors. The objective is to restore ocular integrity and prevent further infection that may cause jeopardizing complications such as endophthalmitis. Corneal perforation and melting can occur in infectious keratitis, autoimmune diseases such as Mooren's ulcer, ocular trauma, and ocular surface disorder.[6,7]

Corneal patch graft is performed more often due to the relatively low cost and the quick procedure. Cornea donors can also be easily obtained from residual cornea after optic keratoplasty that can be stored. Therefore, this procedure can be performed immediately in perforated corneal ulcers in the peripheral or paracentral while waiting for healing. However, this treatment is often associated with progressive tissue necrosis or melting because of its avascular nature. This study involved 21 samples of 15 male cases (71.4%) and 6 female cases (28.6%). This study's findings differed from Jiang et al., who carried out a similar study in China with an insignificant difference in gender.[7,8,9]

The cause of corneal ulcers can be divided into infectious and non-infectious. Trauma and infection are the primary cause of corneal perforation in Shandong, China. Progressive corneal infection that responds poorly to medications will cause broader and deeper defects in the cornea, which cause perforation. In this study, corneal perforations or defects were mainly caused by infections (comprising 19 cases; 90.5%), while non-infection (Mooren's ulcer) only accounted for 2 cases (9.5%). A different result was shown by Xie et al. and Gracia et al., who reported that most corneal perforations were non-infectious.[9,10]

This graft alternative for corneal perforation performed by Wu et al., Bhandari et al., Yin et al., and Jiang et al. showed successful closure of perforated corneal lesions sized 3-5 mm. This was in line with this study, where the perforation in all 21 samples ranged from 3-6 mm.[9,10]

The clinical results in this study mostly showed success, where the corneal graft grew well without any post-surgical complications. Clinical outcomes were assessed from the growth of the graft after the procedure and no complication until two months of follow-up. Anterior chamber depth was also adequate in this study, with successful iris repositioning and no iris adherent. Visual acuity cannot always be used as a standard in assessing the success of ulcer therapy because it is also affected by the location and extent of the ulcer. In this study, the ulcer locations were mainly in the peripheral or paracentral, which did not affect the visual axis. In addition, this study's visual acuity changes between the first and second month after surgery were insignificant. The corneal condition also affects visual acuity, including the change in corneal curvature after surgery.

Complications occurred in three cases: one eye had a graft infection, and two eyes had a melting graft. The melting graft occurred one month after surgery, which was reoperated, albeit with an unfavorable result. It is suspected that, in this Mooren's ulcer cases, the autoimmune process affected the transplanted donor cornea. Meanwhile, one of the infectious complications was suspected of coming from an extrinsic factor (hygiene and irregular medications).[11]

All corneal graft patch cases were given medications according to the cause. The therapies provided include topical antibiotics for infectious cases, topical and systemic corticosteroids for non-infectious cases, or Mooren's ulcer, according to the indication. These medications were given before and after surgery to control the inflammatory process. Immunosuppressive was also given to Mooren's ulcer cases. However, it did not maintain good graft condition. This may be affected by disease progressivity.

5. Conclusion

Corneal patch graft is an effective surgical procedure for perforated corneal ulcers. Post-surgical clinical success was high, especially in infectious cases, with limited success in non-infectious cases.

Seen from the objective of corneal patch graft, which is to maintain ocular integrity, this procedure can be an alternative surgery for perforated corneal ulcers.

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