EFFECT OF CORNEAL GRAFT SIZE ON THERAPEUTIC PENETRATING KERATOPLASTY FOR FUNGAL KERATITIS

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ABSTRACT

BACKGROUND
The aim of the study is to study the effects of corneal graft size on therapeutic penetrating keratoplasty (PKP) for fungal keratitis.

MATERIALS AND METHODS
Retrospective study included 20 eyes belonging to 20 patients with fungal keratitis who underwent PKP over a period of 2 years. The patients were divided into two groups based on graft size, ≤9 mm and >9 mm.

RESULTS
2 (16.7%) of the group receiving ≤9 mm graft developed secondary glaucoma or graft infiltrate postoperatively, but a higher number of patients (5 of 8 or 62.5%) receiving >9 mm size graft had these complications, but the difference lost significance marginally (p = 0.06233). There was highly significant difference in graft failure rate between the group receiving ≤9 mm graft (none) and the group receiving >9 mm graft (8 of 8, p = 0.00001). There was no significant difference between the two groups when wound leak was taken into consideration (p = 0.14737).

CONCLUSION
Early intervention in the form of keratoplasty may yield better results where graft size is much smaller, therefore decreasing the rate of complication with better chances of graft survival.

KEYWORDS
Fungal Keratitis, Therapeutic Penetrating Keratoplasty, Corneal Ulcer.

HOW TO CITE THIS ARTICLE: Pai V, Das S, Shetty J. Effect of corneal graft size on therapeutic penetrating keratoplasty for fungal keratitis. J. Evid. Based Med. Healthc. 2016; 3(97), 5361-5364. DOI: 10.18410/jebmh/2016/1114

BACKGROUND
Fungal keratitis is a leading cause of corneal blindness in developing countries largely attributed to inappropriate usage of antibiotics and steroids.1-2 Fungal keratitis does not respond as well to medical line of management as bacterial keratitis does; therefore, incidence of therapeutic keratoplasty is higher in fungal keratitis.1 This procedure favours removal of the infective organisms and their toxins, dead necrotic tissues and preserves integrity of the globe.3 The diameter of the corneal grafts is decided by the size of ulcerations.4 Most of these patients with a history of prolonged application of broad-spectrum antibiotic and glucocorticoid need large size graft during penetrating keratoplasty (PKP) to preserve the eyeballs.5 The aim of this report is to study relationship between the corneal graft size and graft survival in patients undergoing therapeutic penetrating keratoplasty (PKP) for fungal keratitis.

MATERIALS AND METHODS
Retrospective study is based on PKP in 20 eyes from 20 patients with fungal keratitis. The study period of 2 years duration extended from May 2012 to May 2014. The age of the patients ranged from 45 to 68 years with a median of 56.5 years. Male-to-female ratio was 13:7. PKP was performed when corneal infiltrate deteriorated or did not improve in spite of maximum possible antifungal therapy. All patients underwent therapeutic penetrating keratoplasty with 16 or 24 interrupted 10-0 nylon sutures depending upon the graft size. The patients were divided into two groups based on graft size, ≤9 mm and >9 mm. The two groups were compared with respect to following parameters: secondary glaucoma, wound leak, graft infiltrate and graft failure. 'Fisher’s Exact Test of Probability' was applied to find out the statistical significance, if any, between the two groups.

RESULTS
The age and sex distribution of patients and the postoperative complications in the two groups, patients receiving ≤9 mm size graft and >9 mm size graft have been
depicted in table 1. Median age of the patients receiving corneal graft with size ≤9 mm was 55.5 years and that for group receiving graft >9 mm was 60 years. When number of patients in the age group ≤55 years was taken into consideration, 6 (50.0%) of the patients receiving ≤9 mm size graft as opposed to 2 (25.0%) receiving >9 mm size graft were in this group; however, this difference was not statistically significant (p=0.37285). Male:female was 8:4 in the former group and 5:3 in the latter group (p=1.00000). Figure 1 and 2, respectively depict preoperative and postoperative pictures of one of the cases with successful corneal graft. 2 (16.7%) of the group receiving ≤9 mm graft developed secondary glaucoma postoperatively, but a higher number of patients (5 of 8 or 62.5%) receiving >9 mm size graft had this complication; the difference lost significance marginally (p=0.06233). Graft infiltrate of similar magnitude (16.7% versus 62.5%) was also observed in both the groups (p=0.06233). None of the patients in ≤9 mm graft group and 2 (25.0%) in >9 mm graft group had wound leak (p=0.14737). There was highly significant difference in the graft failure rate between the group receiving ≤9 mm size graft (0 of 12) and the group receiving >9 mm size graft (8 of 8, p=0.00001).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Graft Size ≤9 mm</th>
<th>Graft Size &gt;9 mm</th>
<th>‘p’ value</th>
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</thead>
<tbody>
<tr>
<td>No of eyes (cases)</td>
<td>12</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>Age range in years</td>
<td>47 to 68</td>
<td>45 to 65</td>
<td>-</td>
</tr>
<tr>
<td>Median age in years</td>
<td>55.5</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Age ≤55 years</td>
<td>6</td>
<td>2</td>
<td>=0.37285</td>
</tr>
<tr>
<td>Male:female</td>
<td>8:4</td>
<td>5:3</td>
<td>=1.00000</td>
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<tr>
<td>Secondary glaucoma</td>
<td>2</td>
<td>5</td>
<td>=0.06233</td>
</tr>
<tr>
<td>Wound leak</td>
<td>0</td>
<td>2</td>
<td>=0.14737</td>
</tr>
<tr>
<td>Graft infiltrate</td>
<td>2</td>
<td>5</td>
<td>=0.06233</td>
</tr>
<tr>
<td>Graft failure</td>
<td>0</td>
<td>8</td>
<td>=0.00001</td>
</tr>
</tbody>
</table>

Table 1. Comparison of Presenting Features in Patients of Fungal Keratitis Treated with Therapeutic Penetrating Keratoplasty Based on Corneal Graft Size

**DISCUSSION**

Microbial keratitis, which is commonly encountered by ophthalmologists worldwide is an important cause of ocular morbidity and is an avoidable cause for visual impairment in all age groups. Severe microbial keratitis, although potentially avoidable, continues to be a significant drain on limited healthcare resources in ophthalmology. According to Gebauer et al., fungi are relatively uncommon, but important cause of keratitis. In a study of 105 scrapes by Wong et al from New Zealand, 75 (71%) were positive; bacteria were isolated from all of 75 culture positive cases; in addition, yeasts were isolated in 5%, fungi in 4%, virus in 2%, amoeba in 1% and chlamydia in 1%. However, it has been observed that mycotic keratitis is more common in developing and tropical countries, because of climatic conditions and greater occurrence of agricultural injuries with fungi being responsible for up to 44% of corneal ulcers. According to Li et al, fungal keratitis is a severe cause of blindness in most developing countries and it has become the leading cause of the infectious keratitis in most
areas of China. A typical feature of fungal keratitis is its slow onset and gradual progression often presenting as a relatively "quiet" eye, in contrast with bacterial keratitis; its chronic course and concealed signs often puzzle clinicians, therefore making the early diagnosis difficult and often resulting in delayed treatment and poor prognosis.\textsuperscript{11} Gebauer et al\textsuperscript{8} also suggested that as a result of diagnostic delay in fungal keratitis, severe visual loss was likely to occur.

Appropriate antifungal agents are effective in controlling early stages of the infection, whereas therapeutic Penetrating Keratoplasty (PKP) is the treatment of choice for intractable cases with full thickness corneal layers involved in restoring vision and salvaging the eye.\textsuperscript{12,13} The leading indications for PKP in developing countries (e.g., China and India) have remained infectious keratitis and corneal scarring.\textsuperscript{12,14,15} In a study of 875 patients (875 eyes) receiving PKP in a 5-year period by Wang et al\textsuperscript{16} the leading indications for PKP were infectious keratitis (37.1%), HS K (19.1%), keratoconus (11.2%), bullous keratopathy (8.5%), regrafting (6.7%) and corneal scarring (4.8%); fungal infections accounted for 65.2% of the infectious keratitis cases, remaining the leading cause of corneal infection and the most common indication for PKP among corneal infections.

We performed therapeutic penetrating keratoplasty in 20 cases, which included graft size of ≤9 mm in 12 cases and >9 mm in 8 cases. Size of graft appears to be an important factor in Penetrating Keratoplasty (PKP). According to Li et al\textsuperscript{4} large size graft maybe needed to preserve the eyeballs, the diameter of the corneal grafts being decided by the size of infiltration. The dilemma of choosing a smaller graft size to increase the chances of graft survival over a larger graft to completely remove the fungal infection remains a big hurdle for ophthalmologists.\textsuperscript{11} When the graft diameter exceeds 8.0 mm or the graft is eccentric, the rate of graft failure increases remarkably.\textsuperscript{17,18} There was a higher incidence of graft rejection (p=0.020) and secondary glaucoma (p=0.039) in group with corneal graft diameter ≥8.0 mm as compared to those with graft size less than 8 mm in a study.\textsuperscript{14} In the report by Cristol et al\textsuperscript{17} involving 26 penetrating keratoplasties with recipient beds of ≥9.5 mm on 22 eyes that include 11 bacterial keratitis, 10 fungal keratitis and one mixed bacterial and fungal keratitis, the graft failed in 18 of 19 eyes (94.7%) with a median time to failure of 12.9 weeks in bacterial keratitis and 4.0 weeks in fungal keratitis. In our study, 16.7% of the group receiving ≤9 mm graft developed secondary glaucoma or graft infiltrate postoperatively, but a higher number of patients (62.5%) receiving >9 mm size graft had these complications, there being a marginal loss of significance when the two groups were compared (p=0.06233). There was no significant difference between the two groups in respect of wound leak (p=0.14737); however, there was a highly significant difference in the graft failure rate between the group receiving ≤9 mm size graft (none) and the group receiving >9 mm size graft (8 of 8, p=0.00001). This is in accordance with other studies, which show that graft size more than 9 mm was associated with more complications.\textsuperscript{4,19} According to Li et al\textsuperscript{4} who divided the patients into two groups (those receiving corneal graft ≥8 mm and others receiving <8 mm graft), there was no statistical difference in postoperative visual acuity (p=0.961), corneal graft clear rate (p=0.132) or the incidence of recurred fungal infection (p=0.770) between two groups; however, there was a higher incidence of graft rejection (p=0.020) and secondary glaucoma (p=0.039) in group with corneal graft diameter 8.00 mm or larger. As observed by Sharma et al\textsuperscript{19} eyes with smaller grafts (<9 mm) had better anatomical and visual outcomes compared with eyes with larger grafts (9-11 mm; p=0.03) and (>11 mm; p=0.0). According to these authors,\textsuperscript{19} a higher incidence of secondary glaucoma was seen in eyes with perforated ulcers (29.36%) than in eyes without perforation (11.71%, p=0.01) and in eyes with larger graft sizes (>11 mm and 9-11 mm) than in eyes with smaller graft sizes (<9 mm, p=0.01).

**CONCLUSION**

Since fungal keratitis does not respond well to medical line of treatment unlike bacterial keratitis, early intervention in the form of keratoplasty may yield better results. When graft size is smaller, there is decrease in the rate of complications with better chances of graft survival.

**REFERENCES**