A Comparative Study to Evaluate The Role of Amniotic Membrane Transplant and Anterior Stromal Puncture in Painful Pseudophakic Bullous Keratopathy
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Abstract

Purpose: To evaluate the role of Anterior stromal puncture (ASP) and Amniotic membrane transplant (AMT) in providing symptomatic relief to the patients of painful pseudophakic bullous keratopathy (PBK).

Methods: 40 patients of PBK were divided into two groups of 20 each. Group A underwent AMT and Group B underwent ASP. Ocular pain score was assessed by using the Visual Analogue Scale preoperatively and post operatively.

Results: This prospective study analysed ocular pain based on visual analogue score (VAS). At the end of 12 weeks, the final VAS was Grade 1 in 14 patients (70%) in both the groups, Grade 2 in 5 patients (25%) in group A and in 3 patients (15%) in group B, Grade 3 in 1 patient (5%) in group A and in 2 patients (10%) in group B. Corneal surface regularity was disturbed only in 20% and maintained in 80% of Group A patients. In group B, corneal surface regularity was disturbed in 75% and maintained in only 25% patients. At the end of 12 weeks recurrence of bullae was observed in 20% in group A and in 15% in group B.

Conclusion: AMT and ASP are equally effective procedures for management of symptomatic PBK in patients with poor visual potential. Both AMT and ASP lead to amelioration of clinical symptoms. AMT has slightly better clinical outcome than ASP but ASP is an OPD procedure and inexpensive.

Keywords: amniotic membrane, anterior stromal puncture, bullous keratopathy.
been screened for HIV, HBV, HCV and syphilis during their regular follow up in antenatal clinic. The maternal donors were again screened serologically for HIV, HBV, HCV and syphilis at the time of caesarean section. The human fresh amniotic membrane was prepared using the standard protocol proposed by Kim. It was used within 24 hours for transplantation.

AMT and ASP in diagnosed patients of pseudophakic bullous keratopathy were done in eye OT under aseptic conditions.

**Amniotic membrane transplant**—Following peri-bulbar anaesthesia, the corneal epithelium was debrided with a sponge up to limbus. The prepared amniotic membrane was placed over the entire cornea with the basement membrane (non-sticky) side facing up, tightened flat onto the corneal surface and secured to the peripheral cornea with a continuous purse string or interrupted 10-0 nylon sutures. The excess AM was trimmed followed by bandage contact lens application. (Figure 1.1, 1.2, 1.3)

**Anterior stromal puncture**—Following peri-bulbar anaesthesia, the corneal epithelium was debrided with a sponge up to the limbus. The tip of a 26-guage needle, bent with a needle holder was used to create nearly 100 confluent punctures in the anterior stroma followed by bandage contact lens application. (Figure 2.1, 2.2, 2.3)

**Results**

In the present study at the end of 12 weeks, improvement from Pre-Operative visual acuity was observed in 50% patients in group A and in 40% in group B. No change from...
pre-operative visual acuity was observed in 45% patients in both the groups and deterioration was observed in 5% patients in group A and 15% in group B although visual rehabilitation was not the objective of this study and the difference between the two groups was not statistically significant. (Table 1)

| Visual acuity | Group A (%) of Patients | Group B (%) of Patients |
|---------------|-------------------------|-------------------------|
| Pre-operative | 12 weeks | Pre-operative | 12 weeks |
| PL+ to FC 1m  | 65 | 50 | 70 | 55 |
| 1m to 3/60    | 5 | 15 | 15 | 25 |
| 4/60 to 6/60  | 20 | 20 | 15 | 10 |
| 6/36 to 6/18  | 10 | 15 | - | 10 |
| Total         | 100 | 100 | 100 | 100 |

In our study patients were observed for corneal surface regularity at the end of the study period of 12 weeks. Corneal surface regularity was disturbed only in 20% and maintained in 80% of Group A patients. In group B corneal surface regularity was disturbed in 75% and maintained in only 25% patients. This difference was statistically significant with a p value of less than 0.05. (Table 2)

| Corneal Surface Regularity | Group A (%) of Patients | Group B (%) of Patients |
|----------------------------|-------------------------|-------------------------|
| Disturbed                  | 20                      | 75                      |
| Not Disturbed              | 80                      | 25                      |
| Total                      | 100                     | 100                     |

Visual Analogue Score

At the end of 12 weeks, the final VAS was Grade 1 in 14 patients (70%) in both the groups, Grade 2 in 5 patients (25%) in group A and in 3 patients (15%) in group B, Grade 3 in 1 patient (5%) in group A and in 2 patients (10%) in group B and Grade 4 in 1 patient (5%) in group B. In group A none of the patients had VAS of Grade 4 at the end of study period. This difference was statistically non-significant. (Table 3)

| Visual analogue score Grade | Group A (%) of Patients | Group B (%) of Patients |
|-----------------------------|-------------------------|-------------------------|
| Pre-operative | 12 weeks | Pre-operative | 12 weeks |
| 1              | -          | 70          | -          |
| 2              | -          | 25          | 10          |
| 3              | 45         | 5           | 40          |
| 4              | 55         | -           | 50          |
| Total          | 100        | 100         | 100         |

Epithelial Bullae

By the end of 1 week, complete regression of bullae was observed in all the patients in both groups. However, at the end of 12 weeks recurrence of bullae was observed in 20% in group A and in 15% in group B. (Table 4) There was no statistically significant difference between the two groups. (Figure 3.1, 3.2, 4.1, 4.2)

Discussion

Bullous keratopathy is a result of corneal endothelial dysfunction. In healthy cornea, endothelial cells prevent the tissue from excess fluid absorption, pumping it back into the aqueous. When endothelial cell count falls too low, the fluid moves anteriorly in the stroma and epithelium. As fluid accumulates between the basal epithelial cells, bullae are formed and they undergo painful rupture. The bullae not only cause pain but also impair vision. Penetrating keratoplasty and more recently Descemet Stripping Endothelial keratoplasty (DSEK) is treatment of choice for PBK. However, ASP and AMT are also useful techniques for
managing painful PBK in eyes with limited visual prognosis. These procedures alter the pathogenic mechanisms of PBK. One of the physiological factors that draws fluid into the stroma in PBK, is the stromal osmotic pressure rendered by the extracellular matrix components. The amniotic membrane with its avascular stromal matrix, thick continuous basement membrane and thick epithelial monolayer may act as a barrier when incorporated in the subepithelial location. Another factor that contributes to the formation of bullae is poor epithelial attachment. Immune histological evidence suggest that key matrix proteins such as fibronectin, laminin and type 4 collagen, which are essential for epithelial anchorage to the stroma, are altered in PBK. Basal membrane of Amniotic membrane acts as a scaffolding, encouraging epithelial differentiation and migration. Its basement membrane also contains collagen types IV, V and VI as well as fibronectin and laminin and this may help to establish a favourable micro-environment for the epithelial basement membrane adhesion complexes. In our study at the end of 12 weeks 70% of the eyes in which AMT was done had amelioration of clinical symptoms of pain, photophobia, watering and foreign body sensation with VAS grade 1 . In a study conducted by Pires et al. during the follow up period of 33.8 weeks (3 – 96 weeks) after AMT, 43 (90%) of 48 eyes with intolerable pain preoperatively became pain free post operatively. Mejia et al., in 2001, reported the results of management of painful PBK by performing a non-preserved human AMT in 9 eyes. Mean follow up time was 40 weeks. Symptoms of PBK resolved completely in 8 (88%) patients and partially in 1 patient. Anterior stromal puncture involves multiple micro punctures. The subsequent healing response leads to alteration of extracellular matrix by increasing the expression of fibronectin, laminin and collagen IV at the puncture sites. This enhances the attachment of epithelial cells to the underlying connective tissue at the puncture sites. The subsequently formed scar tissue has low osmotic pressure and therefore, it acts as a barrier to fluid flow. In our study at the end of 12 weeks following ASP 70% of the patients had VAS of grade 1 while rest of the 30% had VAS between grade 2 to 4. In a similar study by Cormier et al., 27 patients of PBK, who underwent ASP, a significant reduction in pain was noted after 3 months of treatment. In another study by Shridhar et al. in 28 patients of PBK, complete relief was observed in 20 patients (71.4%), whereas 8 patients (28.6%) experienced mild symptoms such as tearing and occasional pain. It can be concluded that both AMT and ASP are suitable options in patients with painful PBK. AMT can be done when facilities for surgery are available, patient can afford treatment and can follow up regularly whereas ASP is preferred where facilities are deficient, patient is poor and non-compliant.

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