

IMMUNOLOGICAL AND INFLAMMATORY REACTIONS AFTER CORNEAL TRANSPLANTATION: PREVENTION AND TREATMENT

Dadajanova Feruza Abdusalomovna

Key words: *cornea, ACAID, avascularity, transplantation, alloimmunity, Treg lymphocytes, tolerance, high-risk keratoplasty, graft rejection.*

INTRODUCTION

After a corneal transplant, immunological and inflammatory reactions can manifest as graft rejection, causing redness, pain, photophobia, and decreased vision. To prevent and treat these reactions, anti-inflammatory drops and immunosuppressive medications (as prescribed by your doctor) are used. Postoperative care should also be taken (keep the eye dry, wear a patch, and avoid rubbing).

● Postoperative care:

Wear a patch for as long as your doctor recommends (usually several weeks).

Keep the operated eye dry and avoid water and dirt for the first week (including washing your hair).

Avoid rubbing or touching the operated eye.

● Moisturizing and protecting:

Use artificial tear drops as recommended by your doctor to maintain comfort and prevent complications.

Wipe tears from your cheek without touching your eye.

Treatment

If rejection or inflammation is suspected, consult a doctor immediately. He or she may prescribe:

Anti-inflammatory drops: To reduce inflammation and prevent rejection.

Immunosuppressants: In cases of a strong immune reaction, to suppress transplant rejection (prescribed strictly by a doctor).

● Moisturizing gels: To stimulate corneal regeneration, for example, with dexpanthenol.

Signs of transplant rejection

● If you notice the following symptoms, this may be a sign of rejection, and you should consult a doctor immediately:

Vision loss

Eye pain

Redness of the whites of the eyes

Increased sensitivity to light

Corneal transplantation is the most successful and frequently performed allograft procedure. The post-transplant immune response following keratoplasty is less pronounced than that following other organ and tissue transplants, due not only to the anatomical features of the cornea but also to its low antigenicity and active immune suppression

mechanisms. Although the cornea is an immune-privileged tissue, neovascularization, inflammation, or trauma can disrupt this protective mechanism. Patients with impaired immune privilege who require keratoplasty to restore vision are considered high-risk, with a high risk of developing tissue incompatibility and poor graft acceptance. There are two fundamentally different approaches to suppressing graft rejection: inducing specific tolerance in the recipient to the graft and nonspecific suppression of the body's immune response to foreign antigens.

Preventing tissue incompatibility by restoring corneal immune privilege and inducing antigen-specific tolerance is a promising approach in modern transplantology. However, such research has so far remained experimental, and in clinical practice, the focus is on improving non-specific immunosuppressive therapy, which is based on suppressing the metabolism of immunocompetent cells. Therefore, the timely administration and appropriate selection of immunosuppressive strategies, taking into account existing risk factors, are crucial for the outcome of corneal transplantation in high-risk patients.

Topically applied corticosteroids penetrate well through the cornea, providing effective immunosuppression. The pharmacotherapeutic effects of steroids include blocking prostaglandin synthesis through inhibition of phospholipase-A2 and the lipoxygenase pathway, reducing cellular and fibrinous exudation, decreasing chemotaxis and phagocytosis, restoring capillary permeability, stabilizing polymorphonuclear cell membranes, and suppressing graft neovascularization. The main side effects of long-term topical steroid use include cataract progression, increased intraocular pressure, delayed postoperative wound repair, and an increased risk of infectious keratitis. Systemic corticosteroids, administered in combination with topical corticosteroids, additionally reduce the number of circulating T cells and inhibit their proliferation. Systemic therapy can be either oral or intravenous. In cases of tissue incompatibility, steroid pulse therapy is more effective than oral administration of the drug at daily doses of 60–80 mg. A pulse dose of 500 mg methylprednisolone is believed to cause transient lymphopenia, which develops 6–8 hours after injection and lasts for 48 hours. T-lymphocytes are most affected, while B-cells are less affected. A second pulse dose can be administered 48 hours after the first [56]. The anti-inflammatory effect of pulse therapy persists for another 4–7 days and may even be clinically more effective than immunolytic therapy [57]. Intravenous dexamethasone has been found to be equally effective as methylprednisolone and, therefore, can be used as an alternative [58]. Other routes of corticosteroid administration have also been successfully used to suppress the rejection reaction: subconjunctival, intracameral, intracorneal, and intravitreal. Long-term systemic use of corticosteroids can cause complications such as osteoporosis, diabetes, and obesity.

The pathophysiology of corneal transplant rejection is very complex and not fully understood.

Current methods of treating and preventing corneal transplant tissue incompatibility in high-risk patients are often ineffective.

New experimental targeted approaches, including those using antibodies and gene therapy, are currently being developed but have not yet demonstrated clinical success.

Therefore, to achieve satisfactory results after corneal transplantation in high-risk patients, the following is necessary:

- consideration of all major known risk factors, followed by the most effective preoperative therapy to reduce their impact;
- careful patient monitoring in the postoperative period to detect signs of tissue incompatibility as early as possible;
- development of optimal regimens and combinations of immunosuppressive drugs approved for clinical use.

Corneal graft rejection, particularly in repeat corneal transplants, is a complex pathophysiological process that remains incompletely understood. Recent advances in experimental immunology have led to a new understanding of tissue incompatibility in primary and repeat keratoplasty.

Clear corneal graft engraftment, in the absence of risk factors, is known to be mediated by the immune privilege of the eye (specifically, the unique functional and structural interactions between the cornea and the anterior chamber), mediated through local and systemic mechanisms. Disruption of corneal immune privilege in repeat keratoplasty creates conditions for the activation of transplant immunity mechanisms and is the main risk factor for tissue incompatibility. Interactions between recipient and donor cells and the immune system trigger a cascade of reactions and mechanisms that lead to corneal graft opacification.

In this regard, the importance of pre- and postoperative monitoring of the recipient's immune system and the identification of the most informative immunological parameters for the early detection of signs of potential graft rejection is increasing. Following the introduction of microsurgical techniques into ophthalmic transplantation and the development of various short- and long-term preservation methods for donor corneas, the most common cause of corneal graft clouding has become an immune reaction to allograft rejection, developing in two-thirds of at-risk patients [2].

Clinical signs of corneal allograft rejection include endothelial and epithelial rejection lines, subepithelial infiltrates, corneal precipitates, and corneal graft edema. Among the main predisposing factors for corneal allograft rejection, researchers identify: corneal vascularization, inflammatory process, repeated and bilateral penetrating keratoplasty, secondary glaucoma, and recurrence of primary corneal diseases.

REFERENCES:

1. Komakh Yu.A., Borzenok S.A., Kuptsova D.G., Radygina T.V., Petrichuk S.V. IMMUNOLOGICAL MONITORING OF LYMPHOCYTE POPULATIONS AND NF-KB TRANSCRIPTION FACTOR IN PREDICTING THE BODY'S RESPONSE TO A CORNEAL TRANSPLANT // Modern Problems of Science and Education. 2021. No. 4. ;
2. URL: <https://science-education.ru/ru/article/view?id=30982> (accessed: 23.10.2025).
3. DOI: <https://doi.org/10.17513/spno.30982>

4. Skladchikova N.Yu., Stebnev S.D. On the effectiveness of complex endocular surgery for chronic endophthalmitis in pseudophakic eyes. In: Actual problems of ophthalmology. Scientific editor H.P. Takhchidi. Moscow: Oftalmologiya; 2019 p