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(CASE REPORT)

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Neurotrophic Keratitis Following Retinal Detachment Surgery with Circumferential Endophotocoagulation: A Case Series and Literature Review

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Abstract

Introduction: Neurotrophic keratitis (NK) is a rare, degenerative corneal disorder characterized by impaired epithelial healing due to reduced corneal sensitivity. While commonly associated with viral infections, diabetes, and trauma, NK can also result from iatrogenic causes, including retinal detachment surgery with circumferential endophotocoagulation. This study aims to present a case series of NK following such procedures and review the current literature on its pathophysiology, diagnosis, and management.

Methods: We report three cases of NK occurring after pars plana vitrectomy with 360° endolaser photocoagulation for retinal detachment. Patient demographics, surgical details, clinical presentations, treatment modalities, and outcomes were analyzed.

Results: All patients developed corneal ulcers with varying sizes and locations. Management included preservative-free artificial tears, epithelial healing agents, and autologous serum eye drops. Complete epithelial healing was achieved in all cases, with improvement in best-corrected visual acuity (BCVA).

Conclusion: NK is a serious complication following retinal detachment surgery with circumferential endophotocoagulation. Early diagnosis and appropriate management, including the use of autologous serum eye drops, are crucial for favorable outcomes.

Keywords: Neurotrophic keratitis; Corneal ulcer; Retinal detachment surgery; Endolaser photocoagulation; Endolaser photocoagulation; Epithelial healing

1. Introduction

Neurotrophic keratitis (NK) is a rare but potentially sight-threatening degenerative disorder of the cornea, arising from impaired corneal innervation and subsequent loss of corneal sensitivity. The cornea is one of the most densely innervated tissues in the body, with the trigeminal nerve playing a pivotal role in maintaining epithelial integrity, tear production, and corneal metabolism[1]. Disruption of corneal innervation—whether due to trauma, infection, systemic disease, or iatrogenic interventions—can result in decreased corneal sensitivity, defective epithelial healing, and a spectrum of clinical manifestations ranging from superficial punctate keratopathy to persistent epithelial defects (PEDs) and corneal ulceration[2].

Iatrogenic causes of NK have gained increasing attention in recent years. In particular, ocular procedures such as retinal detachment repair, especially when combined with extensive circumferential endophotocoagulation, can inadvertently

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damage corneal sensory nerves or their central connections, predisposing patients to NK[3]. Despite the growing recognition of this complication, it remains underdiagnosed, often leading to delayed intervention and progressive corneal damage[4].

This study aims to present a case series of patients who developed NK following retinal detachment surgery with circumferential endophotocoagulation. In addition, we review the current literature on the underlying pathophysiological mechanisms, diagnostic strategies—including clinical assessment and imaging modalities—and contemporary management approaches. By highlighting both the clinical course and therapeutic options, this study seeks to raise awareness among ophthalmologists about this serious complication and to provide guidance for timely recognition and intervention.

2. Case Presentations

Written informed consent was obtained from the 3 patients for publication of this case and accompanying images

2.1. Case 1

A 39-year-old male, monocular in the left eye due to a trauma, underwent pars plana vitrectomy with 360° endolaser photocoagulation for rhegmatogenous retinal detachment. The patient presented with a left retinal detachment extending from 6 to 3 o'clock, with the macula detached, and an equatorial flap tear located at the 11 o'clock meridian. She was treated with vitrectomy**,** resection of the flap tear, and partial drainage of subretinal fluid through the tear during a fluid–air exchange**.** Circumferential endophotocoagulation was performed under air, with laser spots applied from the equator to the ora serrata, followed by tamponade with C2F6 gas. Four months postoperatively, he presented with blurred vision and ocular discomfort. Slit-lamp examination revealed a para-axial inferior epithelial-stromal ulcer measuring 3 × 2.5 mm with rolled edges. Fluorescein staining was positive, and corneal sensitivity was abolished. B-scan ultrasonography confirmed full retinal attachment. The patient was started on preservative-free artificial tears, topical epithelial healing agents, and autologous serum drops. The ulcer healed completely within 35 days, and BCVA improved slightly. Despite successful re-epithelialization, the patient developed a residual central corneal opacity, resulting in permanent visual limitation.Figure 1

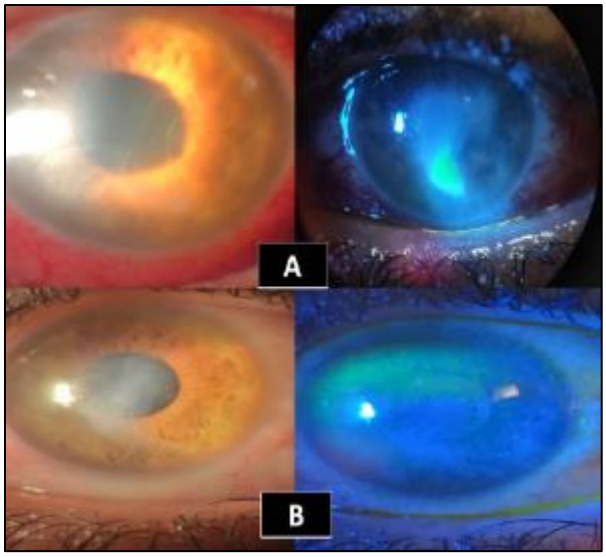

Figure 1 A: Before autologous serum therapy. **B:** Ulcer healing after 35 days of treatment

3. Case 2

A 69-year-old woman with diabetes presented a tractional retinal detachment in the right eye. She underwent pars plana vitrectomy with meticulous dissection of fibrovascular membranes and circumferential endophotocoagulation.

Postoperatively, her best-corrected visual acuity (BCVA) was counting fingers at 1 meter**.** During follow-up, slit-lamp examination revealed a small inferior corneal ulcer after two months measuring approximately 0.5 mm in diameter,

with infiltrated margins**.** Fluorescein staining was positive, confirming an epithelial defect. Corneal and conjunctival cultures were performed but returned negative for bacterial or fungal growth**.**

The patient was initially treated with broad-spectrum topical antibiotics and epithelial healing agents, including lubricants, without significant improvement. Despite good glycemic control, the ulcer persisted for several weeks, suggesting a neurotrophic keratitis or impaired corneal healing secondary to diabetes and previous ocular surgery.

Given the poor response to conventional therapy, autologous serum eye drops (20%) were introduced, administered several times daily. Gradual improvement was observed, with complete epithelial closure achieved after 60 days. At the final follow-up, the cornea was fully re-epithelialized, with no residual infiltrate or stromal thinning. Visual acuity showed modest improvement, limited by the underlying retinal pathology.Figure 2

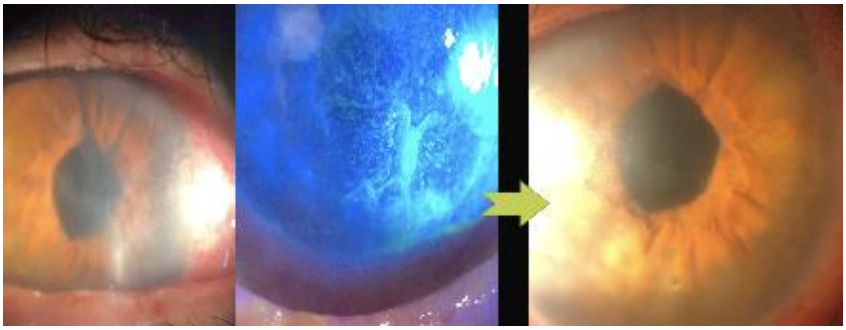

Figure 2 Ulcer evolution after its management

3.1. Case 3

A 51-year-old monocular patient with a known history of crystalline lens ectopia underwent pars plana vitrectomycombined with 360° endolaser photocoagulation for a rhegmatogenous retinal detachment with multiples tears. The surgical procedure was uneventful, and postoperative recovery was initially satisfactory, with the retina remaining completely reattached.

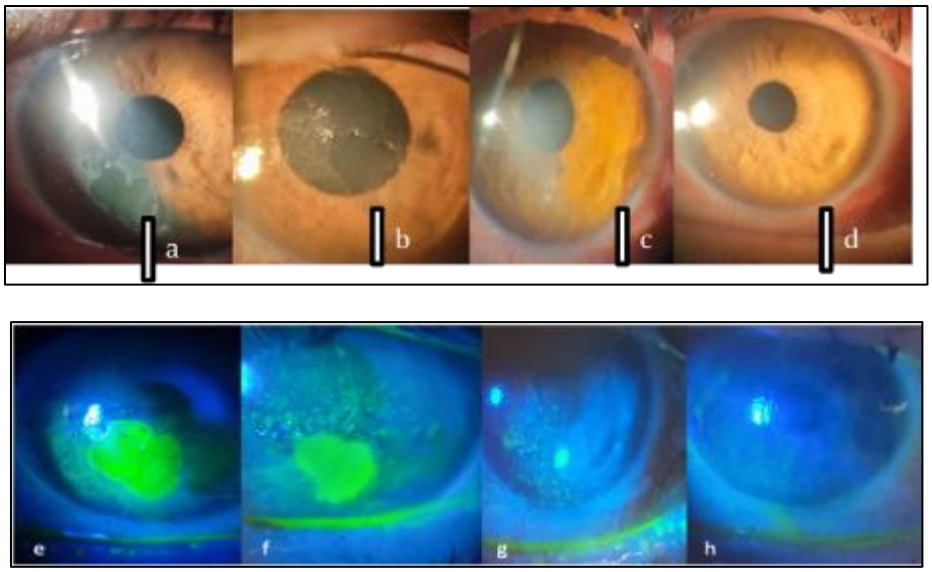

Figure 3 a,b,c,d,e,f,g,h: neurotrophic keratitis after vitrectomy and its evolution after treatment

However, 15 days after surgery, the patient presented with decreased visual acuity, with a best-corrected visual acuity (BCVA) of 0.3/10. Slit-lamp examination revealed a central corneal ulcer measuring approximately 4 mm in diameter, with infiltrated borders and complete loss of corneal sensitivity on esthesiometry. There were no signs of anterior chamber inflammation, and the intraocular pressure was within normal limits.

Microbiological cultures from corneal scrapings were performed and returned negative for bacterial and fungal pathogens, ruling out an infectious etiology. The clinical presentation was suggestive of a neurotrophic keratitis, likely secondary to surgical trauma or long-standing sensory impairment in a monocular eye with prior ocular history.

A conservative management approach was initiated, including preservative-free artificial tears, epithelial healing agents (such as hyaluronic acid and vitamin A derivatives), and autologous serum eye drops (20%), instilled every two hours initially. The patient was closely monitored for signs of infection or perforation.

Progressive improvement was noted over the following weeks, with complete epithelial closure achieved within 60 days..Figure 3

4. Discussion

Iatrogenic neurotrophic keratitis (NK) following circumferential endophotocoagulation represents an uncommon but clinically significant complication of retinal detachment surgery. The underlying mechanism involves injury to the uveal sensory nerves, particularly the long posterior ciliary nerves (and possibly short ciliary nerves) as they traverse the suprachoroidal space[5].During extensive 360° endolaser photocoagulation, thermal diffusion may extend beyond the intended retinal target, damaging adjacent neural structures responsible for corneal innervation[6]. Anatomically, these nerves course horizontally around the sclera, especially near the 3 o'clock and 9 o'clock meridians, which correspond to the zones of highest vulnerability[7]. Consequently, it is strongly recommended to minimise or avoid laser application in these critical meridians to preserve corneal sensory integrity [8].

The pathophysiological cascade that follows such nerve injury involves interruption of the trigemino-corneal reflex arc, leading to reduced trophic support to the corneal epithelium. Sensory axons deliver neuromediators such as nerve growth factor (NGF), substance P, and calcitonin gene-related peptide (CGRP), which regulate epithelial proliferation, stromal homeostasis and wound healing. Their depletion results in epithelial instability, delayed re-epithelialisation, and in advanced cases, stromal melting or perforation. Moreover, because corneal sensation is diminished or absent, patients may present with little or no pain, contributing to delayed diagnosis and management [9].

In patients with diabetes mellitus, the risk is further exacerbated due to the additive effect of diabetic peripheral and autonomic neuropathy. Chronic hyperglycaemia induces axonal degeneration and microvascular ischemia, which compromises corneal nerve density even before any surgical intervention. Therefore, when laser induced injury is superimposed on pre-existing neuropathic changes, the likelihood of developing NK increases substantially and epithelial healing is often further delayed.

In the literature, multiple authors have reported neurotrophic keratitis (NK) following retinal detachment surgery with circumferential endophotocoagulation. For example, Philip J. Banerjee et al. [8]described five cases of neurotrophic corneal ulceration after vitrectomy combined with endolaser for retinal detachment, documenting confluent laser scars at the 3 and 9-o'clock positions and correlating them with corneal anesthesia and subsequent ulceration. A French series reported by C. Auchère Lavayssière et al. [6] included four non-diabetic patients who developed NK following 360° endophotocoagulation, their onset interval ranged between two and seven weeks.

In our series, the onset of corneal involvement ranged from two to six weeks postoperatively, which is comparable to the five-to-ten-week window in Banerjee's series and the two-to-four-week window reported by Auchère-Lavayssière. This variation may reflect differences in laser parameters**,** including total energy delivered, number of laser spots, density of burns (confluent versus spaced)**,** and treatment patterns in critical meridians (3 and 9 o'clock)[6]. Studies have suggested that higher energy settings and confluent burn patterns increase the risk of collateral thermal damage to the long posterior ciliary nerves and adjacent short ciliary nerves, thereby predisposing the cornea to NK. Conversely, spaced burns with careful titration of energy have been associated with a lower incidence of corneal anesthesia. Patient-related factors such as pre-existing diabetes, older age, and baseline corneal nerve integrity also modulate the risk and the interval between surgery and onset of NK. Overall, these observations indicate that both laser technique and patient characteristics contribute to the pathophysiology of iatrogenic NK and should be considered when planning extensive endophotocoagulation.

Table 1 Laser Parameters and Onset of Neurotrophic Keratitis in Published Series and Current Study

Study / Series	Number of Patients	Laser Parameters	Critical Zones	Onset of NK	Comorbidities / Patient Characteristics	Comments
Banerjee PJ et al., 2016 (JAMA Network)	5	Endolaser for RD, confluent burns, standard energy	3 and 9 o'clock	5–10 weeks	Not specified	Correlation between laser scars and corneal anesthesia, secondary NK
Auchère Lavayssière et al., 2015 (J Fr Ophtalmol)	4	360° endophotocoagulation, moderate energy, sometimes confluent	Circumferential	2–4 weeks	Non-diabetic	Postoperative NK observed; shorter interval than Banerjee
Current series (our study)	3	360° endophotocoagulation, energy adjusted per patient	Circumferential	2–7 weeks	Diabetes, variable age	Interval comparable to other series; emphasizes importance of laser parameters and comorbidities

From a therapeutic standpoint, management of iatrogenic NK remains challenging. Conventional treatments (lubricants, bandage contact lenses, tarsorrhaphy) often give insufficient results in advanced cases. Our experience suggests that autologous serum drops, rich in growth factors, vitamin A, fibronectin, and neurotrophins (including NGF), represent a valuable adjunct in promoting corneal epithelial recovery in NK. The literature supports the efficacy of autologous serum: a recent systematic review and meta-analysis of NK treatments found that autologous serum achieved complete corneal healing in approximately 92 % of cases (95 % CI: 86–98 %) compared to about 23 % for non-specific treatments (mostly lubricants) ($p < 0.001$)[10] In our series, complete re-epithelialisation was achieved in all patients with stable healing and no recurrence during follow-up.

Nevertheless, despite anatomical recovery, NK can significantly limit final visual outcomes by inducing persistent corneal opacity, irregular astigmatism, stromal scarring or thinning, which may compromise an otherwise successful anatomical result of the posterior segment surgery. Therefore, these findings reinforce the need for preventive strategies in retinal surgery: surgeons should carefully balance the benefits of 360° endophotocoagulation against the potential risk of corneal denervation, especially in high-risk individuals (diabetes, ocular surface disease, prior corneal nerve compromise). Limiting laser application around the 3 o'clock and 9 o'clock meridians, using lower energy settings when feasible, avoiding overlapping burns, and ensuring prompt postoperative corneal sensitivity monitoring are simple yet effective preventive measures.

Given the insidious nature of NK — often painless and under-diagnosed — we advocate for systematic postoperative screening of corneal sensitivity (Cochet-Bonnet esthesiometer or cotton-wisp test) in patients undergoing vitrectomy with circumferential endophotocoagulation. Early identification of corneal hypo- or anaesthesia allows timely implementation of prophylactic treatment (frequent preservative-free lubricants, therapeutic modalities such as autologous serum or NGF drops) before irreversible corneal damage ensues[11].

In summary, iatrogenic NK after circumferential endophotocoagulation is a preventable but often unrecognised cause of postoperative visual morbidity. Understanding its neuroanatomical basis, recognising early clinical signs, and applying both preventive and regenerative therapeutic strategies (including autologous serum, NGF, and possibly corneal neurotisation in the future) are essential for preserving corneal integrity and optimising visual outcomes following retinal detachment surgery.

Previous reports highlight NK following retinal detachment surgery as rare. Most cases involve monocular patients or those with predisposing systemic conditions. Our series supports these findings, demonstrating that early serum therapy leads to favorable outcomes.

We recommend early detection through routine corneal sensitivity testing post-vitrectomy, a stepwise management approach including lubrication, epithelial healing agents, autologous serum, and surgical interventions if refractory. Patients should be educated and encouraged to promptly report ocular symptoms. Finally, risk stratification should be performed, giving special attention to monocular patients, diabetics, and those with prior ocular surgeries

5. Conclusion

Neurotrophic keratitis (NK) is a rare but potentially sight-threatening complication that can occur following vitrectomy with circumferential endophotocoagulation. Early recognition of NK is critical, as the condition is often painless and underdiagnosed, which can delay treatment and lead to irreversible corneal damage.Appropriate management requires a stepwise approach, tailored to the severity of corneal involvement. Initial measures include intensive lubrication with preservative-free artificial tears and gels to maintain epithelial hydration. Autologous serum eye drops provide essential growth factors and neurotrophic support that promote epithelial regeneration, particularly in patients with persistent defects. In refractory cases, additional interventions such as therapeutic contact lenses, amniotic membrane transplantation, or the use of recombinant human nerve growth factor (rhNGF) may be necessary.

Circumferential endophotocoagulation should not be performed routinely; its use must be carefully evaluated in light of the potential risk of iatrogenic neurotrophic keratitis. Intraoperatively, omitting laser application along the 3 and 9 o'clock meridians should only be considered if it does not compromise long-term retinal reattachment. When circumferential endophotocoagulation is performed, early detection of neurotrophic keratitis is essential, which can be achieved by assessing corneal sensitivity using simple techniques such as a cotton wisp. Management should include intensified lubrication, avoidance of preservative-containing drops and non-steroidal anti-inflammatory eye drops, and enhanced postoperative monitoring.

By combining early detection, timely intervention, and careful monitoring, ophthalmologists can minimize morbidity, facilitate corneal healing, and optimize visual outcomes in patients at risk of iatrogenic NK

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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