

Recurrent Corneal Erosion: Characteristics and Management Options

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Summary

Recurrent corneal erosion is a relatively common condition characterized by one or more episodes of spontaneous breakdown of the corneal epithelium. It classically occurs at the time of awakening and individual episodes may vary in severity and duration of symptoms. Classification as either primary or secondary depends on whether the defect in the epithelial basement membrane is intrinsic or acquired. The characteristics of this condition will be discussed and various medical and surgical management strategies will be reviewed. This will provide greater understanding in the care of patients with this condition as ophthalmic nurses and technicians.

Introduction

Recurrent corneal erosion is observed in ophthalmic practices worldwide.¹ It is a relatively common condition characterised by one or more episodes of spontaneous breakdown of the corneal epithelium.² Currently, recurrent corneal erosions are classified as either primary or secondary, depending on whether the defect in the epithelial basement membrane is intrinsic or acquired.³ Recurrent corneal erosions were first described in 1872 by Edmund Hansen, who termed the disorder intermittent neuralgic vesicular keratitis.⁴ Abnormal adhesion of the corneal epithelium to the stroma is the pathogenic mechanism for this condition.⁵

Classically, recurrent corneal erosion occurs at the time of awakening or throughout the night during rapid eye movement sleep.⁶ Individual episodes may vary in the severity and duration of symptoms such as ocular pain, tearing and photophobia. In 1945, Paul Chandler divided recurrent corneal erosions into microform and macroform erosions.⁷ These divisions are based on the patient's signs and symptoms and are widely accepted clinical classifications of recurrent corneal erosion.

Fortunately, the management of recurrent corneal erosions has advanced over the last 25 years along with the understanding of corneal wound healing.⁸ Current intervention includes a variety of both medical and surgical options and a logical stepwise approach to the management of recurrent corneal erosions. The purpose of this article is to describe the characteristics of recurrent corneal erosion, including the anatomical changes, and present the management aspects from an evidence-based perspective. This will provide greater understanding in the care of patients with this condition as ophthalmic nurses and technicians.

Anatomical Variants

An understanding of the corneal anatomy, with particular emphasis on the epithelium, is important to appreciate this condition. The cornea is organised into five major layers with the corneal epithelium composed of superficial cells, wing cells, and a layer of columnar basal cells. The basal cells adhere to the basement membrane. The basement membrane is composed of the layers called lamina lucida and lamina densa, which adds strength to the membrane. Hemidesmosomes are located on the underside of the basal cells and are linked to anchoring fibrils. Anchoring fibrils penetrate the basement membrane and reach the stroma, where they form anchoring plaques. The health of this "adhesion complex" is critical in the connection of epithelium to Bowman's layer and anterior stroma.

Aetiology

Primary or secondary classifications are based on whether the defect in the epithelial basement membrane is intrinsic/genetically predisposed or if it is acquired. Primary aetiology of recurrent corneal erosion is due to corneal dystrophies, with the most common being associated with anterior basement membrane dystrophy (ABMD), also known as map-dot-fingerprint dystrophy.¹ Other corneal dystrophies of Bowman's layer (Reis-Bückers) and stroma (lattice, macular, granular) are also associated with recurrent corneal erosions.⁹ Primary aetiology tends to be bilateral and symmetrical, and develop in multiple locations on the cornea.³

Secondary aetiology includes traumatic abrasion, tear film abnormalities, ophthalmic surgery or is associated with systemic diseases such as diabetes mellitus.³ Traumatic recurrent corneal erosion invariably is caused when a sudden, sharp, abrading injury such as a fingernail, vegetable matter or paper cut causes a corneal abrasion.³ The injury heals clinically, leaving no evidence of damage. Secondary breakdown can occur at any time following the injury when the basal cell of the epithelium loses its adhesion to the basement membrane, which detaches and becomes loose and unstable. Refractive surgery such as photorefractive keratectomy (PRK) can also induce recurrent corneal erosions.¹⁰

Clinical Attributes

The patient history is pathognomonic with a description a foreign body sensation upon opening the

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eye after awakening in the morning.⁵ The symptoms can progress to extreme pain and photophobia with profuse tearing. During the night, pressure from the eyelid on the dry epithelium produces an adhesion to the epithelium which is stronger than the adhesion of the epithelium to the basement membrane.⁵ Hence, upon awakening, the eyelid separates away from the epithelium. The unpredictable nature of recurrent corneal erosions often amplifies patient anxiety.¹ Since erosions occur during sleep or on awakening, some patients experience varying amounts of insomnia, which exacerbates the psychological stress related with this condition.¹

Minor episodes, or the so-called Chandler's microform erosions, usually last from 30 minutes to several hours and typically have an intact epithelial surface.¹¹ More severe episodes, Chandler's macroform erosions, are larger epithelial defects, may last for several days and are often associated with more severe pain and photophobia.¹¹ The slit lamp appearance of basement membrane abnormalities can be variable. Commonly observed epithelial changes include microcysts (dots), reduplication of basement membrane (maps), ridge-like extensions of collagenous filaments (fingerprints) and a loosely adherent and elevated epithelium.¹ In some instances, epithelial defects have resolved by the time the clinical examination is performed. Consideration is needed not to label patients as functional in these situations. Rapid examination is encouraged following the next episode of symptoms to assess the cornea for defects.¹

Medical Treatment

Treatment of recurrent corneal erosion is aimed at promoting epithelial regeneration to allow re-formation of the normal basement membrane complexes responsible for tight adhesion. Conservative treatment is commenced initially to protect the loosely adherent epithelium and to assist with healing an epithelial defect. A topical antibiotic, a cycloplegic agent, pressure patch or bandage contact lens is most commonly employed.¹² The issue of whether or not to pressure patch corneal erosions has been addressed.¹³ No difference between the rate of healing and severity of inflammation was found with patched versus non-patched eyes. Monocular patching also interrupts binocular vision for patients.⁸

Bandage contact lens therapy is designed to relieve pain and to protect loosely adherent epithelium from abrasive action of the eyelids.⁵ There may be, however, an increased risk of microbial keratitis with this therapy.^{9,14} Following a traumatic corneal abrasion the combination of a bandage contact lens with a nonsteroidal anti-inflammatory drug significantly reduced the pain and shortened

the time required for the patient to return to normal activities and to function with binocular vision.¹⁵

Following the acute phase, treatment is then aimed at preventing recurrences. Every night, long-term use of hyperosmotic or bland lubricating ointments is commonly prescribed. A time frame of up to six months may be necessary, as it often takes this much time for re-formation of normal attachment complexes.¹ Application of lubricating ointment at night may help to reduce the friction between the corneal epithelium and the eyelids.⁵ Hyperosmotic ointments may be beneficial by producing an osmotic gradient, drawing fluid from the epithelium and promoting an adherence of epithelium to the underlying structures.⁹ A small study looking at patients with fingernail injuries and the use of the prophylactic lubricating ointment at nighttime for two months suggests that it actually worsens the prognosis of recurrence.¹⁶ Caution is recommended with these results, as the study design has a number of limitations. In a different study, a conclusion was advocated that there was no difference in efficacy between nighttime prophylactic paraffin and hypertonic saline ointments.¹² This implies that they both may have a lubrication effect only. Fortunately, a large number of cases will respond to conservative medical treatment.³

For recurrent corneal erosions that are unsuccessful with conservative treatment and prophylactic ointment, additional medical management strategies have been examined. Meibomian gland dysfunction has been linked with recurrent corneal erosion. It has been demonstrated that lid hygiene and oral tetracycline improved the healing time of recurrent corneal erosions and reduced recurrences over a six-month period.¹⁷ More recently, it has been revealed that treatment of recurrent corneal erosions with oral doxycycline and topical methylprednisolone reduces recurrences.² This treatment inhibits an enzyme known as matrix metalloproteinase (MMP).² High levels of MMPs may dissolve old and newly forming basement membrane.³

Further interventions for recurrent corneal erosions have been reported, such as the use of autologous serum and botulinum toxin injections.^{18,19} Autologous serum appears to be a safe and acceptable treatment option to reduce recurrent erosions, whilst additional studies are required to verify the effectivity of botulinum toxin injections.

Surgical Treatment

Surgical intervention is reserved for situations in which medical management does not improve recurrent corneal erosions. The choice of surgical approach is determined by the frequency and severity of erosions, the presence of corneal dystrophies or other

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diseases, the location of the erosions, and the patient's needs and desires.¹ Surgical management extends from epithelial debridement to phototherapeutic keratectomy (PTK), hence ranging from inexpensive to more expensive treatment options.

Localised loose epithelium may be debrided with the premise that new epithelial cells and the adhesion complex will regenerate. However, there is no convincing evidence to suggest that epithelial debridement will reduce the recurrence of erosions.¹¹ This may be attributable to the fact that no significant modifications to enhance epithelial adhesion are made in Bowman's layer.¹ The technique of superficial keratectomy is performed to remove the abnormal basement membrane and Bowman's layer. This method allows a new epithelium and adhesion complex to regrow. The removal of tissue can be performed with a surgical blade, blunt lamellar dissection blade or a fine grade diamond polishing burr.⁹

Historically, debridement and then superficial keratectomy were the first surgical approaches to the treatment of resistant corneal erosions.¹ A comparative study was reported between phototherapeutic keratectomy to superficial keratectomy with polishing of Bowman's layer using a diamond burr in the treatment of corneal erosions.²⁰ Both procedures were relatively effective in treating recurrent erosions. Only very recently, alcohol delamination has been shown to be a safe and effective treatment option for recurrent erosions.^{21,22}

Anterior stromal puncture was first described in the ophthalmic literature in 1986.²³ Anterior stromal puncture continues to be widely used as an in-office procedure performed conveniently at the slit lamp under topical anaesthetic and is relatively inexpensive. A bent 25-gauge needle is used to create multiple superficial puncture wounds in the defective area.²⁴ It is preferred if the optical zone is left clear.⁹ These wounds then produce a firm adhesion between the epithelium and anterior stroma through scar tissue.⁹ Only case series have been reported in the literature with a recurrence rate of approximately 20%.¹

It has been suggested that Nd:YAG laser can be utilised in an anterior stromal puncture method. Initially it was a technique in which epithelial debridement was performed and then photodisruption of the anterior corneal stroma was induced with the YAG laser.^{25,26} Subsequently, a modified technique was reported so that debridement was not necessary.²⁷ Advantages of the laser technique include more reproducible, shallow and translucent punctures.²⁵ This method demonstrated low recurrence rates but after these three case reports, further literature has been scarce.

Phototherapeutic keratectomy (PTK) using excimer laser involves treating Bowman's layer or anterior stroma, resulting in an ultramicroscopically modified, roughened surface to anchor the corneal epithelium.¹ It is a well-established treatment option for recurrent corneal erosion and is being used safely and effectively.²⁸⁻³¹ Disadvantages of this technique involve expensive equipment, post-operative pain and inducing a hyperopic shift post-operatively.^{1,3} A comparative study of patients with recurrent erosion examined PTK ablation following manual debridement versus epithelial debridement alone.³² Recurrence rate was significantly less in those who received the PTK.

Conclusion

Recurrent corneal erosion is a relatively common condition having a pathogenic mechanism of an abnormal adhesion between the corneal epithelium and the stroma. Primary or secondary aetiology depends on whether the defect in the epithelial basement membrane is intrinsic or acquired. Individual episodes may vary in the severity and duration of symptoms. The management of recurrent corneal erosions continues to advance both in medical and surgical interventions. As ophthalmic nurses and technicians, it is important to appreciate the patient's symptoms with this condition. To allay anxiety, it is important to inform the patient about the condition and to reassure them that current treatment modalities have a high success rate.

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CNE Test

Recurrent Corneal Erosion: Characteristics and Management

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Objectives

After completing this independent study activity, the participant should be able to:

- Describe characteristics of recurrent corneal erosion.
- Discuss anatomical corneal changes.
- Explain medical and surgical management protocols.

Please allow a *minimum* of three weeks from date of receipt of post-test to receive your attendance verification certificate. Requests for certificate less than three weeks from date of receipt should be accompanied by an additional \$10 fee.

Registration Information and Evaluation Response Form

Name _____

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Payment: Check Visa Mastercard CC# _____ Exp _____

Test response: Circle the most appropriate response matching test question number and response number.

- | | | | | |
|------------|------------|------------|------------|-------------|
| 1. A B C D | 3. A B C D | 5. A B C D | 7. A B C D | 9. A B C D |
| 2. A B C D | 4. A B C D | 6. A B C D | 8. A B C D | 10. A B C D |

General Evaluation: Please use the scale below to evaluate this educational activity and objectives. Circle your response. As a result of completing this offering, I am able to:

	Very well	Moderately well	Fairly well	Not at all
1. Describe characteristics of recurrent corneal erosion.	4	3	2	1
2. Discuss anatomical corneal changes.	4	3	2	1
3. Explain medical and surgical management protocols.	4	3	2	1
4. The content matches the objectives.	4	3	2	1
5. Independent study was an effective teaching method.	4	3	2	1
6. This course helped me achieve personal objectives.	4	3	2	1
7. The time required to complete this offering (in minutes) and take the test was:	60	75	90	>90

CNE Test

Post-Test

1. Breakdown of corneal epithelium recurrent erosion typically occurs:
 - a. Upon awakening
 - b. In the early afternoon hours
 - c. Primarily in dusty work environments
 - d. Between 8 and 10 hours after awakening
2. Recurrent corneal erosions were first described by Edmond Hansen, who named the disorder:
 - a. Chronic corneal epithelial breakdown
 - b. Neurologic keratopathy
 - c. Intermittent neuralgic vesicular keratitis
 - d. Vernal-associated keratoconjunctivitis
3. Common subjective symptoms of recurrent corneal erosion include:
 - a. Pain
 - b. Tearing
 - c. Photophobia
 - d. All of the above
4. The corneal epithelium is composed of all of the following except:
 - a. Superficial cells
 - b. Wing cells
 - c. Basement membrane cells
 - d. Columnar basal cells
5. The most common dystrophy associated with recurrent corneal erosion is:
 - a. Anterior basement membrane
 - b. Lattice
 - c. Macular
 - d. Granular
6. Recurrent corneal erosion can be exacerbated during the night, as pressure from the eyelid is stronger than the adhesion of the epithelium to the:
 - a. Basement membrane
 - b. Endothelium
 - c. Stroma
 - d. Descemet's membrane
7. Minor episodes of recurrent corneal erosion are also called:
 - a. Chandler's macroform
 - b. Chandler's microform
 - c. Hansen's microform
 - d. Hansen's macroform
8. Initial therapy of recurrent corneal erosion is aimed at regeneration of the:
 - a. Stroma
 - b. Descemet's membrane
 - c. Epithelium
 - d. Endothelium
9. Bandage contact lens therapy is designed to:
 - a. Relieve pain
 - b. Protect against loss of the epithelium
 - c. Relieve pain and protect against loss of the epithelium
 - d. Reduce possible microbial keratitis
10. The pathogenic mechanism in recurrent corneal erosion includes an abnormal adhesion between:
 - a. Epithelium and endothelium
 - b. Epithelium and basement membrane
 - c. Endothelium and stroma
 - d. Epithelium and stroma