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Updates in Different Types of Keratitis: A Review

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Keratitis is the medical term for corneal irritation. The cornea is the front of the eye's dome-shaped opening. The iris and pupil of a person's eye can be seen through the cornea, which is usually clear. It is not difficult to diagnose keratitis; however, determining the cause is not always straightforward. Direct microscopy and culture reports are frequently unremarkable, and the patient must be pickedled on on clinical grounds. Depending on the origin of the infection, the treatment for infectious keratitis varies. Bacterial keratitis; If you have minor bacterial keratitis, sterile eyedrops may be all you need to get the illness under control. If your illness is moderate to severe, you may need to take antibiotics orally to get rid of it.

Keywords: Corneal ulcer; keratitis; keratoplasty; vericonazole; posaconaole.

1. INTRODUCTION

Keratitis is an inflammation of the cornea, characterized by corneal edema, inflammatory cell penetration, and ciliary bullying. It is associated with both infectious and non-infectious diseases and may be systemic or confined to the ocular surface. Of the above types of keratitis, "microbial keratitis" accounts for the majority and is a source of great concern, primarily in developing countries [1-14]. However, non-communicable keratitis cannot be

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underestimated, especially in developed countries [15]. Our first line of defense is powerful enough to dissipate most of the infection and triggers an attack. However, there are some organisms that can circumvent this line and cause infection. The corneal epithelium is one such barrier. Biological records cannot penetrate the intact epithelium and will not cause keratitis without cell damage [16-19]. Neisseria meningitides, N. gonorrhea, Corynebacterium diphtheria, Haemophilus influenzae and Listeria spp. Is a toxic organism that can invade even intact epithelium and cause keratitis [20]. This article describes the etiology of different types of keratitis and the current and future treatment options available. Keratitis is a medical term for inflammation of the cornea. The cornea is a dome-shaped window in front of you. When you look at the human eye, you can usually see the iris and pupil through the clear cornea. Due to its curved shape, the cornea bends the rays, accounting for about two-thirds of the total optical effect of the eye, and the lens of the eye provides the remaining one-third [21,22]. Only a wafer-thin tear film lies between the anterior surface of the cornea and our environment. Corneal opacity is the fifth most common cause of blindness in the world, accounting for about 3.2% of all suitcases [23]. According to the latest World Health Organization (WHO) report, corneal blindness or moderate / severe visual impairment affects approximately 6 million people worldwide, including 2 million affected by trachoma. It is emphasized that there is [23]. In addition, corneal opacity is estimated to be responsible for 1.5 to 2 million cases of unilateral blindness each year, highlighting the constant and uncontrolled burden on human health [24,25].

1.1 Etiology

Keratitis, an eye disorder in which the cornea becomes inflamed, can have a variety of reasons. Keratitis can be caused by a variety of infections, dry eye, abnormalities of the eyelids, traumas, and underlying medical disorders [26-27,1]. Keratitis can be caused by a variety of reasons. Keratitis is categorised as follows based on the aetiology:

1.1.1 Infectious keratitis

Pseudomonas, Staphylococcus, Streptococcus, Moraxella, Nocardia, and Atypical Mycobacteria cause bacterial keratitis. Acanthamoeba keratitis is a kind of protozoan keratitis. Pythium keratitis is an oomycete that causes keratitis [28-31]. The morphology is extremely similar to that of a fungus. Unlike fungi, however, the cell wall contains (13 and 16) beta-D-glucan [32,33]. Infections caused by Aspergillus, Fusarium, Candida (yeast), Cladosporium, Alternaria, Carbularia, and microsporidia are examples of fungal keratitis. Herpes simplex virus (HSV), shingles virus (HZV), adenovirus, and other viruses can cause viral keratitis. Keratitis caused by Onchocerca volvulus (sclerotic keratitis). Keratitis that isn't infectious.

Trichiasis, large papillae, and a foreign body in the inferior groove are all local causes. Ulcerative keratitis of the periphery.

Polyarteritis, polyarteritis nodosa, recurrent polychondritis, rheumatoid arthritis Chondritis and systemic erythematosus are examples of collagen vascular disorders.

Herpes zoster trichiasis followed by surgery or tumour damage to the cornea) causes a neurotrophic corneal ulcer.

1.1.2 Epidemiology

The incidence of ulcerative keratitis was reported to be 27.6/100000 person-years in a California epidemiological study [34] Contact lens wearers were more likely to develop ulcerative keratitis [34] According to a study conducted in South India, middle-aged males are more prone than females to develop corneal ulcers [35]. Farmers are at grave danger as a result of their profession. In poor countries, fungal corneal ulcers are particularly common. HSV, on the other hand, is a major worry in developed countries [36]. Epithelial disease was found to be 15.6/100000 person-years in an epidemiological investigation in Rochester, Minnesota, while stromal keratitis was found to be 2.6/100000 person-years [37]. Autoimmune illnesses connected to keratitis are expected to have a yearly incidence of 3 per million [38]. In a research in rural Ethiopia, the prevalence of xerophthalmia was about 21%, and

1.1.3 Risk factors

Any crack or disruption of the cornea's surface layer (epithelium) is a major risk factor for keratitis spreading. The use of contact lenses increases the chance of developing keratitis, especially if hygiene is poor, unsuitable solutions are used to stock and clean the lenses, contact lenses are worn incorrectly, or if irritation

persists. When the quality or quantity of tears decreases, the eye is more likely to develop keratitis. Immune system disturbances, such as AIDS, or the use of drugs such as corticosteroids, either as eyedrops or systemically, or chemotherapy, increase the risk of developing keratitis.

1.1.4 Differential diagnosis

An ophthalmologist (a surgeon who specialises in illnesses and surgery of the eye) uses a history and a physical examination to diagnose keratitis. The past includes questions about previous medical and ocular histories, as well as symptoms relevant to the current visit. The eye exam will include a vision check and a thorough examination of the corneas with a slit lamp, which is a microscope that uses intense illumination and magnification to view the entire ocular surface, including the cornea in great detail. To aid in the inspection, a specific dye containing fluorescein in the form of eyedrops may be placed in the eyes. A culture of the eye's surface may be collected in circumstances where infection is suspected.

2. DIFFERENT TYPES OF KERATITIS

2.1 Bacterial Keratitis

Keratitis caused by gram-positive organisms: Staphylococcal keratitis can occur due to direct organism invasion or staphylococcal antigen. The name'marginal keratitis' comes from the fact that staphylococcal antigen-induced keratitis commonly touches the peripheral cornea. Staphylococcal blepharitis is typically associated with marginal keratitis. The corneal lesions commonly begin at 10 o'clock, 2 o'clock, 4 o'clock, and 8 o'clock, where the lid boundary meets the limbus. Unlike HSV marginal keratitis, there is always a clear region between the limbus and the ulcerative lesion. A blocked nasolacrimal duct is the most prevalent cause of Streptococcal keratitis. In corneal ulcer suitcases, lacrimal duct patency or regurgitation on pressure done the lacrimal sac (ROPLAS) should be assessed. The cuff of cellular infection is seen in the early stages of Gram-positive infection.

2.2 Pathogenesis

The intrinsic virulence of the bacterium, the fauna of the host response, and the physical aspects of the infection site all play a role in the pathogenesis of ocular infectious disease [39]. The cornea's avascular clear anatomical structure, along with its unique milieu, makes it vulnerable to invading pathogens, virulence agents, and host response impacts. The ability of an organism to enter tissue, resist host defensive mechanisms, and cause tissue harm is referred to as intrinsic virulence [40]. Exogenous bacteria are frequently diffused into the corneal epithelium through a flaw in the squamous epithelial layer's surface. A few bacteria, such as Neisseria gonorrhoea, Neisseria meningitidis, Corynebacterium diphtheriae, Shigella, and Listeria, can directly enter the corneal epithelium due to specific enzymes and pathogenicity traits.

2.3 Treatment

In general, because of the potential for fast destruction of corneal tissue in bacterial keratitis, if a clinical suspicion of a bacterial infection exists, the patient should be treated for bacterial keratitis until a definitive diagnosis is made. The goal of treatment for bacterial keratitis is to quickly eliminate the infective organism, decrease the inflammatory response, avoid structural damage to the cornea, and promote epithelial superficial healing [2].

With suspected infectious keratitis, the clinician has the option of initiating specific focused or broad-spectrum antimicrobial therapy, complying with treatment pending the results of laboratory investigation, or monitoring clinical signs based on the clinical impression and severity of the keratitis [3,4]. The initial therapy is chosen based on quantitative criteria.

2.4 Fungal Keratitis

Microsporidial keratitis: Grams, silver, and 10% potassium hydroxide (KOH) with 0.1 percent calcofluor white stain microsporidial spores fine. Keratoconjunctivitis, on the other hand, takes a self-limiting course [6]. To alleviate the foreign body sensation, topical lubricants might be used. For the initial resolution of corneal lesions, epithelial debridement is also a viable alternative [7]. endazole (400 mg twice day for 3-4 weeks) and fumagillin (topical, 70 mcg/ml, 2 drops every 2 h for 4 days, then 2 drops 4-times daily) are both effective [8,9]. The procedure of choice is therapeutic penetrating keratoplasty [10].

Filamentous fungal keratitis: Hyaline/pigmented, septate (Aspergillus, Fusarium)/ aseptate (Mucor, Rhizopus) fungal filaments are visible under routine microscopy with 10% KOH alone

or 10% KOH with 0.1 percent calcofluor white. Saboraud's and potato dextrose are the most commonly used culture media for fungal growth.

2.5 Pathogenesis

A fungal infection necessitates a change in one or more of the cornea's anti-infectious defence mechanisms (epithelial barrier, tear film, blinking). Fungal imitation, mycotoxins, secreted proteolytic enzymes, and fungal antigens all play a role in the inflammatory response to infection [41]. Fungi can enter stromal lamellae, attack Descemet's membrane, spread into the anterior chamber, and worsen endophthalmitis.

3. TREATMENT

3.1 Topical Treatments

The present use of antifungal medicines is usually the first step in treating fungal keratitis. Natamycin is an effective therapy for treating fungal keratitis and is the first line of treatment; nevertheless, due to its low penetration into the corneal stroma [42] and multiple reports of this drug's handling failure, additional antifungal treatments are recommended for treating fungal keratitis. As an alternative, amphotericin B 0.3 percent to 0.5 percent and voriconazole 1 percent are indicated. Voriconazole's increased ocular penetration is one of the benefits of topical treatment [43].

3.2 Oral Voriconazole

Despite the fact that topical voriconazole is inferior than topical natamycin, oral voriconazole may be a useful treatment for some cases of fungal keratitis. Thiel et al. [43] discovered that the concentration of voriconazole in human aqueous is highly adjustable with topical administration of this medicine, and that it may be lower than the minimum inhibitory concentration (MIC) required to treat specific fungi. Oral voriconazole, on the other hand, causes intraocular drug concentrations to be far higher than the MIC required for most fungal corneal infections. A instance of fungal keratitis caused by Fusarium at the site of a cataract surgery wound was documented by Jhanji et al [44]. Topical natamycin 5%, amphotericin B 0.15 percent, and intracameral amphotericin B had little effect on the corneal ulcer. Significant improvements were seen after switching to a topical and oral voriconazole treatment regimen.

3.3 Intracameral Amphotericin B

In the treatment of deep fungal corneal ulcers or impermeable instances, intracameral amphotericin B can be measured. Three of four cases of deep fungal keratitis were completely resolved with 3 to 13 intracameral inoculations of amphotericin B as adjuvant therapy, according to Kuriakose et al [45]. In an earlier case sequence of three patients who did not respond to topical natamycin 5%, amphotericin B 0.15 percent, or oral itraconazole, intracameral amphotericin B was found to be effective in treating severe fungal keratitis [46].

3.4 Intrastromal Voriconazole

Voriconazole intrastromal injection has also been shown to be beneficial in the treatment of resistant and deep fungal corneal ulcers [47-48] However, there is still a lack of evidence to support the use of this approach, and more research is needed to determine its efficacy in the treatment of fungal keratitis.

3.5 Crosslinking of Collagen in the Cornea (CXL)

By strengthening the chemical links between collagen bundles in the corneal stroma, corneal collagen crosslinking (CXL) has been utilised to slow the progression of keratoconus.

[49] CXL has gained appeal among academics in recent years as a treatment for infectious keratitis. To distinguish this approach from CXL used to treat corneal ectasia, the name photoactivated chromophore for contagious keratitis (PACK)-CXL was coined in 2013 [50]. CXL may have an antifungal impact on its own. Furthermore, it has the potential to slow down the process.

4. VIRAL KERATITIS

Adenoviral keratitis: Adenoviral keratitis regularly has related conjunctivitis, so the meticulous terminology could be Epidemic adenoviral keratoconjunctivitis (Human adenovirus kinds [34,51,14] and [52]. Presentation is commonly unilateral to begin with; however, it will become bilateral later. A predominantly follicular response is noted [53]. It can also additionally or might not be associated with conjunctival hemorrhages [52]. At instances the infection may be unembellished enough, ensuing withinside the

formation of pseudomembranes. Clinically, corneal epitheliopathy advances manifesting as punctate corneal erosions, which over per week develops into several, punctate to nummular anterior stromal infiltrates [52,54].

Preauricular lymphadenopathy is an huge locating in adenoviral keratoconjunctivitis. In the pharyngoconjunctival irregular (human adenovirus kinds 3,four and 7), the affected person can also additionally have systemic effects like pharyngitis and fever. The corneal effects withinside the early-degree (subepithelial to anterior stromal infiltrate) are taken into consideration to be because of lively viral replication; but, withinside the persistent degree, the infiltrates are the final results of an immunological response [52] In the persistent degree, symblepharon also can be visible [55,56] The sufferers at this degree frequently grumble of photophobia, glare, and haloes.

Herpes simplex keratitis: HSV keratitis can present day as epithelial ailment, stromal keratitis, and endotheliitis [57]. HSV epithelial ailment manifestation can also additionally diverge from a couple of punctate erosions to dendritic ulcers and geographical ulcers. The untimely vesicular degree is frequently missed, due to not on time overall performance to the ophthalmic clinic. The ruptured vesicles coalesce collectively to shape dendrites with a terminal bulb [58]. Unfortunate and indiscriminate use of topical steroids can also additionally bring about geographical ulcer establishment. In epitheli al ailment, the virus is actively worried with inside the causality of the ulcer. [59] HSV epithelial ailment is commonly unilateral, however the bilateral ailment is greater regularly visible in immunodeficient and sufferers with a records of atopy [60]. HSV stromal keratitis can whichever be secondary to epithelial ailment because of adjoining spread, or immune-mediated. If stromal keratitis develops secondary to epithelial ailment, an overlying epithelial disorder is existing. However, the number one stromal involvement manifests as localized stromal edema without or with symptoms and symptoms of previous comparable episodes. On resolution, those effect in scar formation. These scars with vascularization are the telltale symptoms and symptoms and also are called `footprint scars' with or disadvantaged of superficial or deep vascularization. HSV endotheliitis demonstrates as localized or diffuse stromal edema with number one keratic precipitates.

5. PATHOGENESIS

If the virus's strategy is to infect the vast majority of the population, it is an incredibly successful disease that is virtually benign. Participation of the brain or eye is uncommon; severe encephalitis or keratitis must be regarded as anomalies because they are ineffective for the virus. They do, however, occur as a result of a critical trait of the virus, namely its ability to develop dormant infection not only in neurones supplying the lips, but also in a variety of other places within the nervous system that are reached during primary infection [61].

6. MANAGEMENT

A complete classification of diverse symptoms of anterior ocular lesions by HSV allows for a more sensible approach to treatment [62,63]. The HEDS study clearly demonstrates that correctly administered steroids are effective in the treatment of interstitial keratitis [64]. A 1 percent, then 0.125 percent prednisolone phosphate lowering regimen was used in the study. This demonstrates that mild steroids can be beneficial even when handled incorrectly. The value of oral acyclovir for treatment and prevention [65,66,67] is also reported in the HEDS publication, which identifies the sectors of expanding use today, including the treatment of children [68].

7. PROTOZOAL KERATITIS

Acanthamoeba keratitis: In underdeveloped areas, Acanthamoeba keratitis is particularly frequent due to contact with soil or contaminated water. Wearing contact lenses, on the other hand, has been linked to Acanthamoeba keratitis in industrialised countries. Medical signs and symptoms can include superficial punctate keratitis, pseudodendrites, and early stage perineuritis. In Acanthamoeba keratitis, ring infiltration is particularly common. However, this is not always the case [69].The infiltrates spread anteriorly from the middle to all layers as the disease progresses, making them indistinguishable from bacterial and fungal keratitis [70].

8. PATHOGENESIS

Because of the severe nature of Acanthamoeba keratitis and the difficulty in diagnosing and treating it, a thorough understanding of its biology and pathophysiology is required in order to develop substitute therapeutic treatments. Another key worry during treatment is

Acanthamoeba's ability to change into a resting cystic shape that can tolerate antibacterial treatments at any time. Acanthamoeba's ability to cause infection is dependent on its ability to withstand particular adhesins, toxin production, immune/environmental variables, and chemotherapeutic mediators that may allow it to do so. For ease of reference, the data has been separated into components that contribute directly and indirectly to Acanthamoeba pathogenicity [71].

Since the first medical treatment for Acanthamoeba keratitis was published in 1985, treatment has evolved [72-78]. The management of this challenging infection has improved thanks to early detection and intensive medical treatment. Early epithelium debridement (to eradicate most organisms) and inclusion in medically difficult cases are two further criteria that may enhance effective medical treatment and improved results. Corneal transplantation is involved in the procedure. To date, no one effective chemotherapeutic drug for AK has been identified, regardless of the isolate or genotype that causes the disease [79,80]. This is due to a number of reasons, including the various pathogenic personalities of different isolates, which make establishing a link between in vitro and in vivo potency extremely impossible. However, determining the most effective treatment programme is difficult.

9. CONCLUSION

IK has a long-term negative impact on human health in both developed and poor countries. Recent studies are likely to underestimate the incidence of IK, hence a well-designed prospective study involving all types of microorganisms (bacteria, fungus, protozoa, viruses, etc.) IK outbreaks is needed. And it's vital to accurately assess the impact. Taking into account the primary risk factors for IC in various regions, particularly following CL use, trauma, OSD, and ocular surgery, encourages more effective public health engagement in correcting and minimising IC risk. Increased AMR in eye infections has led to more cautious antibiotic usage, tighter restriction of over-the-counter antibiotics, and the development of new medications and treatment options in many countries, including the United States, China, and India. The importance of development is emphasised.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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