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A Systematic Study On Social-Environmental Risk Variables For Bacterial And Viral Conjunctivitis

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ABSTRACT
Allergic or viral factors are the primary causes of ocular inflammation. Thoroughly eliciting the patient's medical history and assessing the current signs and symptoms can frequently establish a preliminary diagnosis, but the combination and severity of clinical observations may vary. Individuals suffering from allergic conjunctivitis commonly experience pruritus and erythema in their eyes, while those with bacterial conjunctivitis frequently report the presence of crusts in the morning and struggle with eyelid opening. Streptococcus pneumoniae and Hemophilus influenzae are the primary causative agents of bacterial conjunctivitis in children, while Staphylococcus species is the prevailing bacterium in adults. Consequently, the management of individuals with bacterial conjunctivitis involves the use of an antimicrobial drug that may effectively target a wide range of infections that are sensitive to therapy. Patients with abnormal clinical signs and symptoms, as well as those who do not react to presumptive treatment, should have other potential sources of inflammation taken into account.

Keywords- Allergic, viral factors, ocular inflammation, conjunctivitis, eyelid.

Introduction

In order to protect itself from harmful substances and injuries, the eye has many built-in defenses. Tears, for instance, both physically and lubricating remove dust and microbes from the eye. A number of chemicals, including lysozymes and interferon, are present in tears and serve to prevent infection. In addition to keeping the eye moist, the eyelids and eyelashes shield the eye's surface from outside elements. However, ocular inflammation can occur on rare occasions when these protective processes are compromised. Inflammation of the conjunctiva can be caused by a variety of ocular clinical entities, collectively known as conjunctivitis. A common cause of conjunctivitis is an allergy to the eyes or an infection of the eyelids, cornea, or conjunctivae caused by bacteria or viruses. Injuries sustained during surgery, cuts, chemical or thermal burns, or contact with foreign objects can also lead to inflammation of the eye. Some types of conjunctivitis can cause long-term damage to the patient's eyesight; however, the majority of cases caused by allergies and infections clear up on their own or are effectively treated with topical antibacterial and anti-inflammatory medications. So, the first step toward effective therapy is a rapid and correct evaluation of the inflammation's etiology. After a diagnosis of ocular inflammation is made, the course of therapy is determined by severity of the patient's symptoms. Inflammation in the eye can be treated with a range of pharmaceuticals. When treating infectious conjunctivitis, patients can choose from a number of topical antimicrobial medicines; the choice is based on the patient's age and, if available, the findings of culture and sensitivity tests[1]. Agents that decrease inflammation and alleviate symptoms are often used to treat individuals with ocular inflammation caused by noninfectious conditions, such as allergic conjunctivitis or postoperative damage. The symptoms and indications experienced by the patient are crucial in narrowing down the possible causes of conjunctivitis. It is possible for patients to occasionally have incomplete or unusual clinical indicators, even if the majority of patients have a cluster of observations that allow for a tentative diagnosis and direct empirical treatment. The results of the patient's medical history and the results of the eye exam might help narrow down the possible diagnoses, and this article summarizes those findings. Furthermore, we go over the best practices for dealing with bacterial and allergic ocular inflammation. Additionally, this issue of Clinical Therapeutics features two articles that discuss how topical anti-infective agents for bacterial conjunctivitis and topical nonsteroidal anti-inflammatory drugs (NSAIDs) for allergic conjunctivitis can alleviate patients' subjective symptoms [2].

Methods

We searched PubMed, the ISI web of knowledge database, and the Cochrane library using relevant keywords to comprehensively examine the scientific literature available as of February 2020. A therapy for viral conjunctivitis, a treatment for bacterial conjunctivitis, allergic conjunctivitis, and viral conjunctivitis were among the terms utilized. There

was no linguistic limitation. This study encompasses the best evidence-based articles published between March 2013 and February 2024. In the end, 167 articles were considered. A total of ten studies saw publication between 1964 and 2024.

Environmental risk variables for bacterial and viral conjunctivitis

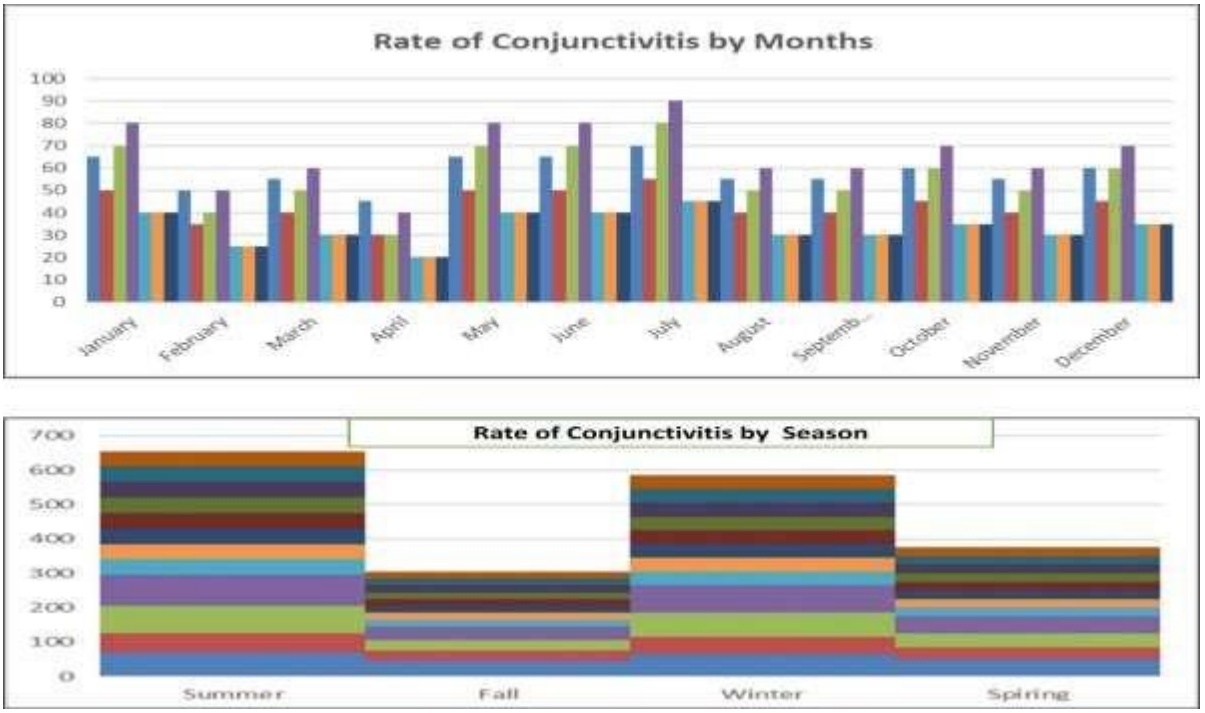

Figure-1 Rate of Conjunctivitis by Month and Season

Laboratory Investigations

It is common practice to get conjunctival cultures only in the following situations: suspected infectious newborn conjunctivitis, recurrent conjunctivitis, conjunctivitis that does not respond to treatment, significant purulent discharge accompanying conjunctivitis, and instances that are suspicious for chlamydial or gonococcal infection [4]. To avoid overprescribing antibiotics, this test can determine which viruses cause conjunctivitis. Adenoviruses cause 36% of all conjunctivitis outbreaks. Research found that in-office fast antigen testing might save $429 million a year by preventing 1.1 million cases of antibiotic overuse [3].

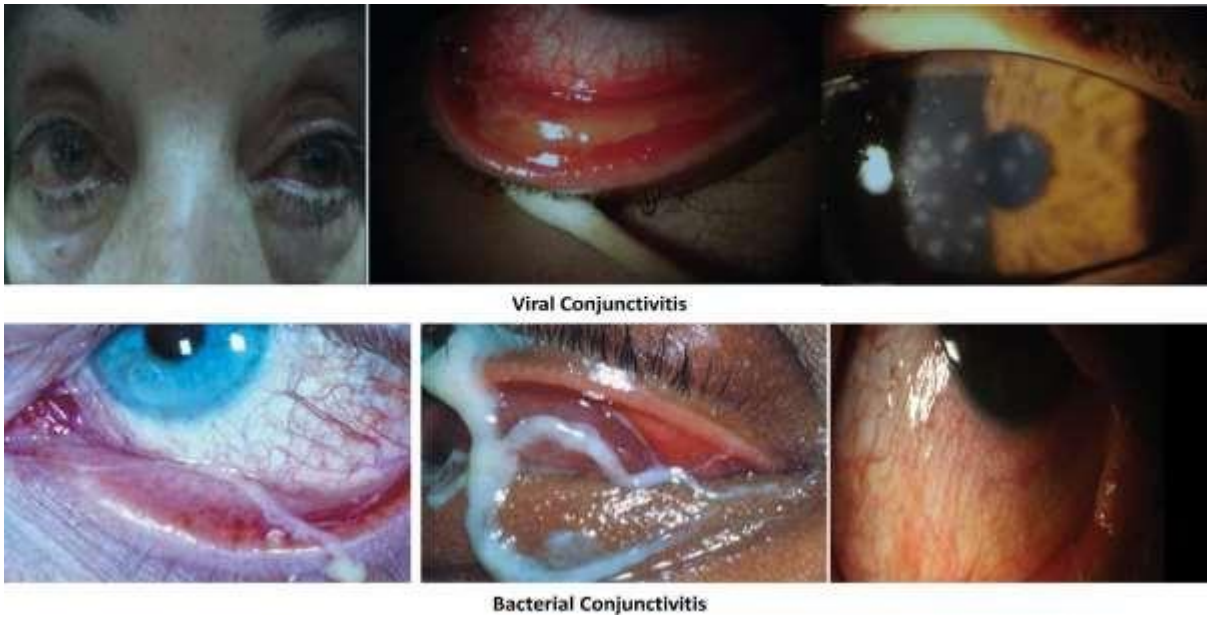

Figure-2 Viral Conjunctivitis and Bacterial Conjunctivitis

Table-1 Ophthalmic Therapies for Conjunctivitis

Category	Epidemiology	Types of Discharge	Cause	Treatment
Acute bacterial conjunctivitis	135 cases per 10 000 population in US[3] 18.3% -57% of all acute conjunctivitis [7-9.12,13]	Mucopurulent	S aureus S epidermidis, H influenzae, S pneumoniae, S viridans, Moraxella spp	Aminoglycosides Gentamicin Ointment: 4x/d for 1 week Solution: 1-2 drops 4x/d for 1 wk.
				Tobramycin ointment: 3x/d for 1 wk.
				Fluoroquinolones
				Besifloxacin: 1 drop 3x/d for 1 week
				Ciprofloxacin ointment: 3x/d for 1 wk. Solution: 1-2 drops 4x/d for 1 wk.
				Gatifloxacin: 3x/d for 1 wk.
				Levofloxacin: 1-2 drops 4x/d for 1 wk
				Moxifloxacin: 3x/d for 1 wk
				Ofloxacin: 1-2 drops 4x/d for 1 wk
				Macrolides
				Azithromycin: 2x/d for 2 d; then 1 drop daily for 5 days
				Erythromycin: 4x/d for 1 wk
				Sulphonamides
				Sulfacetamide ointment: 4x/d and at bedtime for 1 wk Solution: 1-2 drops every 2-3 h for 1 wk
				Combination drops
				Trimethoprim/polymyxin B: 1 or 2 drops 4x/d for 1 wk
Hyperacute bacterial conjunctivitis in adults	NA	Purulent	Neisseria gonorrhoeae	Ceftriaxone: 1g IM once Lavage of the infected eye Dual therapy to cover chlamydia is indicated
Viral conjunctivitis	9%- 80.3% of all acute conjunctivitis [8-13]	Serous	Up to 65% are due to adenovirus strains[49]	Cold Compress Artificial tears Antihistamines
Herpes zoster virus	NA	Variable	Varicella zoster virus	Oral acyclovir 800 mg: 5x/d for 7-10 d
				Oral Famciclovir 500 mg: 3x/d for 7-10 d
				Oral valacyclovir 1000 mg: 3x/d for 7-10 d
Herpes simplex virus	1.2-4.8 of all acute conjunctivitis [9-12]	Variable	Herpes simplex virus	Topical acyclovir: 1 drop 9x/d
				Oral acyclovir 400 mg: 5x/d for 7-10 d
				Oral valacyclovir 500 mg: 3x/d for 7-10 d
Adult inclusion conjunctivitis	1.8% 5.6% of all acute conjunctivitis [5.8-11]	Variable	Chlamydia trachomatis	Azithromycin1 g: orally once
				Doxycycline 100 mg: orally 2x/d for 7 d
Allergic conjunctivitis	90% of all allergic conjunctivitis[15] up to 40% of population may be affected[15]	Serous or mucoid	Pollens	Topical antihistamines
				Azelastine 0.05%: 1 drops 2x/d
				Emedastine 0.05%: 1 drops 4x/d
				Topical mast cell inhibitors
				Cromolyn sodium 4%: 1-2 drops every 4-6 h
				Lodoxamide 0.1 % : 1-2 drops 4x/d
				Nedocromil 2%: 1-2 drops 2x/d
				NSAIDs
				Ketorolac: 1 drop 4x/d
				Vasoconstrictor/antihistamine
				Naphazoline/pheniramine: 1-2 drops up to 4x/d
				Combination drops
				Ketotifen 0.025%: 1 -2 drops 2-3x/d
				Olopatadine 0.1%-1 drop 2x/d

Types of Conjunctivitis

- **Infectious Conjunctivitis**
- **Noninfectious Conjunctivitis**

Viral Conjunctivitis

Epidemiology, Cause, and Presentation

Viral agents are responsible for at least 80% of cases involving acute conjunctivitis [8–13,67]. Compared to clinical practice, laboratory confirmation for viral conjunctivitis falls short by more than 50%. Bacterial conjunctivitis is a common diagnostic error [5,10]. Adenoviruses are responsible for causing epidemic keratoconjunctivitis and pharyngoconjunctival fever, two of the most common clinical manifestations of viral conjunctivitis. They account for 65–90% of all cases of viral conjunctivitis [49,62.] Symptoms of more severe epidemic keratoconjunctivitis include ipsilateral lymphadenopathy, watery discharge, hyperemia, and chemosis. Pharyngoconjunctival fever, on the other hand, has a high fever that comes on quickly, pharyngitis, bilateral conjunctivitis, and enlargement of the lymph nodes around the ears [68]. Compared to bacterial conjunctivitis, up to 50% of cases of viral conjunctivitis often accompany lymphadenopathy [11-15].

Prevention and Treatment

Estimates range from 10% to 50% for the likelihood of transmitting viral conjunctivitis caused by adenoviruses. Infected individuals can transmit the virus to others by direct contact with contaminated hands, medical equipment, pool water, or other personal things. Research found that 46 percent of infected individuals had positive cultures generated from hand swabs [16]. There has been a need for stringent instrument cleaning, hand washing, and segregation of sick patients from the rest of the clinic due to the high rates of transmission [17]. The anticipated incubation period is 5–12 days, while the communicability period is 10–14 days. Artificial tears, topical antihistamines, and cold compresses may help, but there is no cure. There is currently no cure; however, you may find some relief from your symptoms with the use of artificial tears, topical antihistamines, or cold compresses (Table 1). Current antiviral drugs are ineffective. Topical antibiotics and are not recommended [18]. Antibiotics used topically may not prevent subsequent infections, and they might cause allergic reactions and toxicity, which can make it harder to diagnose other eye conditions [19]. There is a higher chance of transmitting the illness to the other eye from contaminated droppers while using antibiotic eyedrops [20]. The risk of antibiotic resistance is another issue that arises from their overuse [21]. Due to the potential for problems, patients should be directed to an ophthalmologist if their symptoms do not improve after 7 to 10 days [22].

Herpes Conjunctivitis

The herpes simplex virus causes acute conjunctivitis, accounting for 1.3% to 4.8% of all cases [9-12]. Most cases of viral conjunctivitis manifest only on one side of the eye. There may be vesicular eyelid lesions in addition to the thin and watery discharge. *Table 1* lists the recommended antiviral medications, both topical and oral, to reduce the duration of the sickness [23]. Avoiding topical corticosteroids is advisable since they have the potential to exacerbate the infection and increase its level of severity. Times The herpes zoster virus, which causes shingles, can affect the ocular tissues, particularly if it implicates the first and second branches of the trigeminal nerve. Most cases of ocular involvement occur on the eyelids (45.8%), then on the conjunctiva (41.1%). 72 Uveitis may occur in 19.1% of patients, and corneal complications in 38.2%. 72 If you suspect involvement of the eyelids or eyes, or if they have the Hutchinson sign (vesicles at the tip of the nose, which strongly correlate with corneal involvement), refer patients for a comprehensive ophthalmic assessment. Treatment typically involves a combination of oral antivirals and topical steroids [25].

Bacterial Conjunctivitis

Epidemiology, Cause, and Presentation

One study predicted that 135 out of 10,000 people had bacterial conjunctivitis [3]. Infected people can spread bacteria that cause conjunctivitis, or the native conjunctival flora might multiply abnormally, leading to the condition [26]. Common modes of transmission include contaminated fingers, ocu-logenital dissemination, and contaminated fomites. Bacterial conjunctivitis can also occur in those who have impaired tear production, abnormalities in the adnexal structures, an immunosuppressed state, trauma, or both [27]. Staphylococcal species, Streptococcus pneumoniae, and Haemophilus influenzae are the top three bacteria that cause bacterial conjunctivitis in adults [28]. Common causative agents in pediatric cases include Haemophilus influenzae, Streptococcus pneumoniae, and Moraxella catarrhalis [30]. The typical illness duration is 7–10 days [29.] Signs of hyperacute bacterial conjunctivitis include blurred vision and a thick, pus-filled discharge. Common symptoms include preauricular adenopathy, eye discomfort upon probing, and swollen eyelids. Neisseria gonorrhoeae frequently causes this condition, which carries a significant likelihood of corneal involvement and eventual corneal perforation [31]. Intramuscular ceftriaxone is the treatment of choice for hyperacute conjunctivitis caused by N. gonorrhoeae, and it is important to manage concomitant chlamydial infection as needed [32]. Ophthalmologic consultations should be sought for therapy of chronic bacterial conjunctivitis, which is defined as conjunctivitis that lasts longer than four weeks and is most commonly caused by Staphylococcus aureus, Moraxella lacunata, and enteric bacteria [33]. Illustrates signs such as a red eye, purulent or mucopurulent discharge, and blood in the eye [34]. The incubation time is estimated to be 1–7 days, and the communicability period is estimated to be 2–7 days [14]. A positive history of conjunctivitis, itching-free eyes, and both upper and lower eyelids sticking together are significant indicators of bacterial conjunctivitis. Whenever possible, examine and culture gonococcal conjunctivitis in cases of severe purulent discharge. If conventional antibiotic treatment fails to treat conjunctivitis in sexually active individuals, a chlamydial examination becomes necessary. If contact lens users experience bacterial keratitis, which is highly likely to occur in this population, send them to an ophthalmologist and treat them with topical antibiotics. It is important to request that patients remove their contact lenses promptly if they are wearing them [35,40].

Use of Antibiotics in Bacterial Conjunctivitis

Within a week or two of onset, self-limiting treatment is achieved in at least 60% of cases of suspected or culture-proven acute bacterial conjunctivitis. There has been no discernible difference in outcomes between the treatment and placebo groups, despite the fact that topical antibiotics shorten the duration of the condition. Patients who received either 2 to 5 days or 6 to 10 days of antibiotic treatment had a roughly 10% higher rate of clinical improvement compared to those who received a placebo, according to a big meta-analysis [19], that reviewed 3673 patients from 11 randomized clinical trials. None of the placebo groups experienced any major side effects that may have damaged their eyesight [41,44]. Seriou's infections can be more readily caused by certain extremely dangerous bacteria, such as S pneumoniae, N gonorrhoeae, and H influenzae [17]. Patients with positive bacterial culture findings appear to benefit more from topical medicines. Patients with culture-proven bacterial conjunctivitis had a higher clinical and microbiological cure rate after using them, according to a large systematic review; patients with clinical suspicion of bacterial conjunctivitis, on the other hand, had a higher microbial cure rate. Studies that looked at the effects of slightly different antibiotic administration frequencies on clinical cure rates came to no conclusions [45-50].

Alternatives to antibiotics

Any broad-spectrum antibiotic eyedrops can effectively treat bacterial conjunctivitis in most cases. All of the topical broad-spectrum antibiotics work in the same way to achieve clinical cures. Considerations such as cost, resistance trends, patient allergies, and local availability play a role in antibiotic choice. See Table 1 for a list of recommended first-line treatments for mild to moderate bacterial conjunctivitis.

Alternatives to immediate antibiotic therapy

To our knowledge, no studies have examined the efficacy of ocular decongestants, topical saline, or warm compresses in treating bacterial conjunctivitis [51]. Because they can make the infection worse and the illness last longer, topical steroids should not be used [52].

An Overview of Suggested Practices for Bacterial Conjunctivitis Management

Quicker recuperation, decreased transmissibility, and an early return to school are the benefits of antibiotic therapy. Also, in simple situations of bacterial conjunctivitis, using antibiotics has no negative side effects. Thus, in instances of simple conjunctivitis, it appears fair to either wait it out or treat it immediately. Patients with clear pain, those who wear contact lenses, those with impaired immune systems, those suspected of having chlamydial or gonococcal conjunctivitis, and those with purulent or mucopurulent conjunctivitis should all be evaluated for antibiotic treatment [53].

Special Topics in Bacterial Conjunctivitis

Methicillin-Resistant *Saureus* Conjunctivitis

The prevalence of methicillin-resistant Staphylococcus aureus conjunctivitis is increasing, and the organisms responsible for this ailment are resistant to a wide range of medications; estimates range from 3 to 64 percent of cases [54]. Those suspected of having the disease must consult an ophthalmologist and receive fortified vancomycin. 77Pseudomonas conjunctivitis According to estimates, chlamydia accounts for 1.8% to 5.6% of all instances of acute conjunctivitis. The majority of these cases are unilateral and occur alongside genital infections. The characteristics of this illness are conjunctival hyperemia, lymphoid follicle formation [56], and mucopurulent discharge. Purulent or mucopurulent discharge is common. Patients often experience modest symptoms for a few weeks to months, though. Concurrent genital chlamydial infection affects as many as 54% of males and 74% of females. Infected moms can transmit the disease to their infants through vaginal birth or other forms of close contact with infected people; the disease can also transfer from person to person through the oculo-genital tract. Systemic antibiotics, including doxycycline and oral azithromycin, are effective in treating gonorrhea **(Table 1)**, but only after treating the patient and their sexual partners. Adding topical antibiotic therapy to systemic treatment has not been proven to be effective. Systemic therapy is necessary for infants with chlamydial conjunctivitis since over half of these cases can occur with infections of the nasopharynx, genital tract, and lungs. Gonococcal Conjunctivitis Neisseria gonorrhoeae commonly causes hyperacute conjunctivas in newborns, sexually active adults, and teenagers. We use antibiotics both topically and orally in treatment. Corneal perforation is a common complication of infections caused by Neisseria gonorrhoeae [55].

Eye infections caused by trachoma

Chlamydia trachomatis subtypes A–C produce trachoma, the most common cause of blindness; 40 million individuals in regions with inadequate sanitation are at risk. Possible symptoms of this illness include mucopurulent discharge and eye pain. Scarring on the cornea, conjunctiva, and eyelids are late consequences that can cause blindness. A single oral dosage of 20 mg/kg of azithromycin effectively treats the condition. Patients may also receive topical antibiotic ointments like tetracycline or erythromycin for a period of 6 weeks. It is also possible to substitute azithromycin with another systemic antibiotic, such as doxycycline or erythromycin, for a duration of three weeks [56-57].

Noninfectious Conjunctivitis

Allergic Conjunctivitis

Prevalence and Cause

One in four Americans will suffer from allergic conjunctivitis, an inflammatory reaction of the conjunctiva to environmental

antigens, including pollen and animal dander. Very few people with allergic conjunctivitis actually seek medical help, and even fewer get a proper diagnosis. The most common symptoms are redness and itching. Ninety percent of cases of allergic conjunctivitis in the US occur during the winter months [58].

Treatment

The goal of treatment is to eliminate the allergens as much as possible by physically diluting them with saline solution or artificial tears and by avoiding the offending antigen [59]. Possible treatments include antihistamines, topical decongestants, anti-inflammatory medications, antihistamines, corticosteroids, and mast cell stabilizers. When compared to placebo, antihistamines and mast cell stabilizers both worked better in alleviating allergic conjunctivitis symptoms; however, antihistamines provided better short-term relief than mast cell stabilizers, according to a big systematic review. Because of the risk of rebound hyperemia, it is recommended that the vasoconstrictor naphazoline and the antihistamine antazoline not be used for an extended period of time. The use of steroids requires extreme care and discretion. Topical steroids can lead to the development of cataracts and elevated intraocular pressure, both of which can progress to glaucoma [60].

Diabetic Conjunctivitis Caused by Medications, Chemicals, and Toxins

The presence of ben-zalkonium chloride in eye drop formulations is a major factor in the induction of allergic conjunctival reactions in patients using a range of topical drugs, including antibiotics, antivirals, and lubricating eyedrops. The symptoms disappear if the harmful substance is stopped [16]. Conjunctivitis and Systemic Illnesses Many systemic disorders can mimic conjunctivitis symptoms, such as redness and discharge, in patients. These include mucous membrane pemphigoid, Sjögren syndrome, Kawasaki disease, Stevens-Johnson syndrome, and carotid cavernous fistula. We should evaluate patients presenting with conjunctivitis for the aforementioned reasons. As an illustration, individuals suffering from low-grade carotid cavernous fistula may exhibit chronic conjunctivitis that is resistant to medical treatment; this condition, if neglected, might ultimately result in mortality [61,62].

Ominous Signs

The American Academy of Ophthalmology recommends that no ophthalmologists quickly refer patients diagnosed with conjunctivitis to an ophthalmologist if they notice any of the following symptoms: moderate to severe pain, severe purulent discharge, corneal involvement, conjunctival scarring, non-responsiveness to treatment, recurrent episodes of conjunctivitis, or a history of herpes simplex virus eye disease. Individuals who require steroids, have photophobia, or wear contact lenses should receive further consideration for referral. Direct the patient to an ophthalmologist if they do not see any improvement after one week [63].

The importance of avoiding antibiotic and steroid drops

Regular use of steroid drops or mixed drops containing steroids is not recommended. Steroids can lengthen the duration of viral conjunctivitis by increasing the latency of adenoviruses [64,65]. Furthermore, steroids may intensify an untreated corneal ulcer due to herpes, bacteria, or fungus, potentially leading to corneal melt and blindness [67].

Conclusion

Infectious conjunctivitis accounts for around one percent of all primary care physician visits, and the bacterial kind alone costs between $377 million and $857 million each year. Misdiagnosis is common when doctors only look for certain symptoms. Infect ious conjunctivitis most commonly occurs due to non-herpetic viral conjunctivitis or bacterial conjunctivitis [68]. While about 40% of the population has allergic conjunctivitis, only a tiny percentage actually visits a doctor. Adenovirus is responsible for the vast majority of instances of viral conjunctivitis [49]. Because of the potential for harmful side effects, it is best to avoid using topical antibiotics for viral conjunctivitis. To minimize overprescribing antibiotics, it is best to detect viral conjunctivitis using a fast antige n test [69]. Only half of all instances of suspected conjunctivitis are confirmed by bacterial pathogen isolation, and at least 60% of those ca ses resolve on their own without treatment [70]. Patients with hyperacute conjunctivitis, suspected chlamydial conjunctivitis, and patients who do not respond to medication are good candidates for cultures [71]. People who wear contact lenses, have mucopurulent discharge or eye discomfort, may have chlamydial or gonococcal conjunctivitis, or have a previous illness of the eye's surface should typicall y be treated with topical antibiotics [72]. Early illness resolution, prompt return to work or school and reduced risk of conjunctivitis complications are all benefits of antibiotic usage. Allergies to certain seasons account for most occurrences of allergic conjunctivitis [73,75]. In certain instances, allergic conjunctivitis can be treated with topical steroids, antihistamines, or mast cell inhibitors [74-78]. Because steroids can exacerbate herpes infection and corneal involvement, they should only be administered with caution and after a comprehensive ophthalmologic examination has been done. times as outlined in **Table 1**; doctors should be on the lookout for potentially blinding illnesses that share symptoms with conjunctivitis.

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Data Availability Statement:

All of the data supporting the findings of the presented study are available for corresponding author on request.

Declarations:
Conflict of interest: The authors declare that they have no conflict of interest.

Ethical approval: The manuscript has not been published or submitted to another journal, nor is it under review.

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